STRUCTURE PROTECTION PLAN FOR MARK TWAIN NATIONAL FOREST SHELL KNOB AREA

Prepared Date: 08/08/2012

Prepared by: Huron-Manistee Wildland Fire Module

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SECTION I: PURPOSE AND NEED

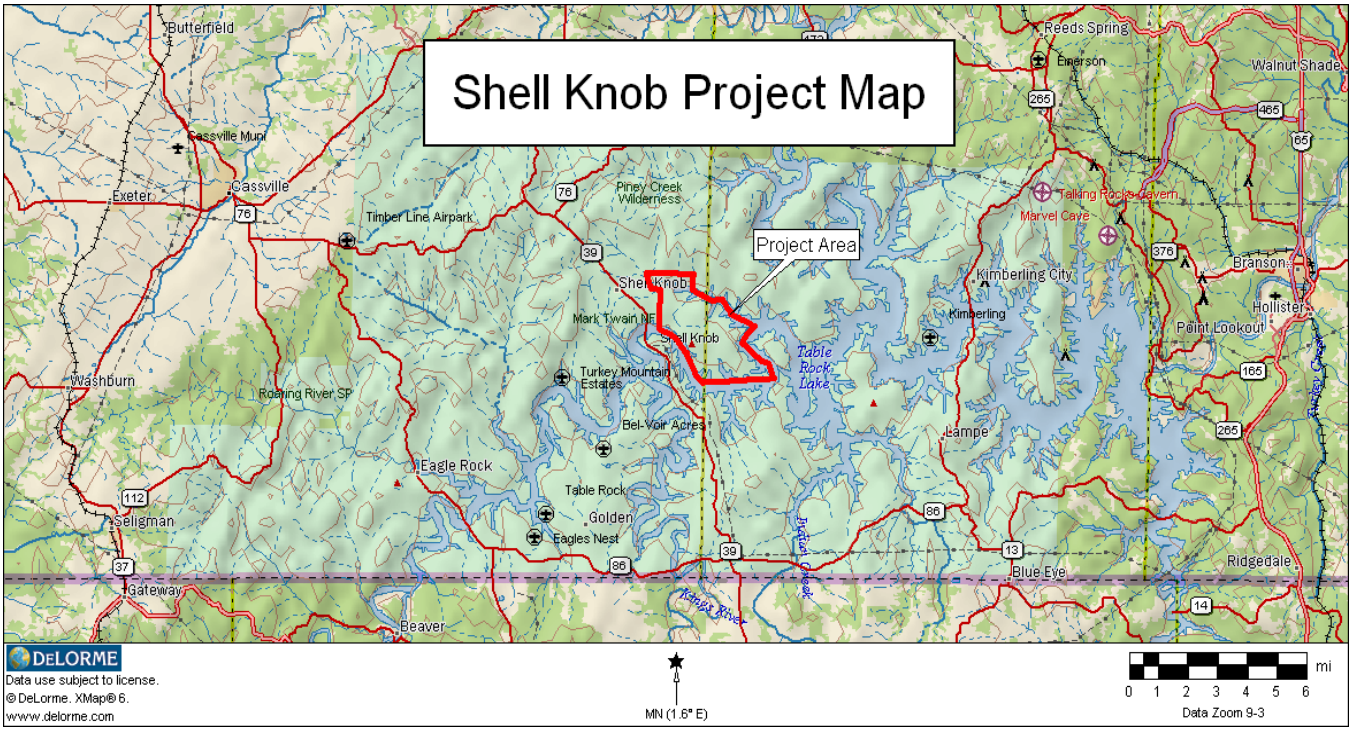
1.1 Introduction

The Shell Knob area has been identified as a community at risk of being impacted by wildfire. The combination of fuel type, fire history, and the lack of access to and from the structures create a condition of concern in the event of a wildfire. This document is a summary of the information collected to better help first responders in the event of a wildfire and makes recommendations to mitigate some of the existing hazards.

1.2 Project Location

The project area (figure 1) includes private land along County Road YY east of the Shell Knob Recreational area of the Mark Twain National Forest. The Shell Knob area is located in Stone and Barry Counties of Missouri. The legal description is: T 22N R 24 & 25 W.

Figure 1. Overview Map



1.3 Objectives:

-Involve homeowners, community leaders, federal, state, and county agencies in the effort to protect people, property, and natural resources from the risk of wildland fire.

-Improve communications between federal, state, and county agencies to maximize the use of current communications infrastructure and improve communications where they are currently inadequate and unsafe.

-The development of evacuation plans and structure protection plans by which urban/interface areas in the Shell Knob area can be safely and timely evacuated and protected in the event of a wildfire disaster.

SECTION II: MANAGEMENT ACTION POINTS

2.1 Implementation

The planning portions of this document should be implemented prior to a wildfire. The planning portion consists of: training with county and state resources, development of an additional ingress/egress route, and a fuels treatment along the private property.

2.2 Trigger Points

A surface fire trigger point would be surface fires within a 1 mile distance, with the potential to impact the communities within the planning area.

2.3 Suggested Action to Protect Structures

The protection of structures begins with the homeowner, and the elements of defensible space and structure construction materials. The required action during a wildfire would consist of evacuations of all homes and the removal of all firefighters during the fire frontal passage. Once the fire front has passed, trained firefighters should return to the structures to protect any that are defendable. Structures can become involved for up to 20 minutes after the fire front passes. A fuels reduction project along the YY road to widen ingress/egress for the homeowner would improve conditions in the event of an evacuation. This would also allow firefighters to move in and out of the subdivision in a safer manner during a pending incident.

2.4 Infrastructure Protection

The gas utilities are located underground along with some natural gas and electricity. A majority of the project area has overhead electrical distribution lines, and a large transmission power line crosses the project area bisecting it from the southwest to the northeast. Water for the dwellings and sewage are both underground.

2.5 Urban Interface Focus Projects

Additional ingress/egress routes should be identified and developed. The use of prescribed burning could be implemented to reduce the potential of a wildfire. It is the responsibility of the property owner to mitigate any potentially hazardous fuels on private land to better protect their property. Annual training with county and state responders would develop better response and improve communications.

2.6 Public Information & Education

The National Fire Protection Association's (NFPA) Firewise Communities program encourages local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and others in the effort to protect people and property from the risk of wildfire. www.firewise.org

2.7 Grants and Finance

The Department of Homeland Security's Office for Domestic Preparedness along with the US Fire Administration offers the Assistance to Firefighters Grant Program. Review the Fire Grant Support page at http://www.firegrantsupport.com/ for full information on the program, including the overall Assistance to Firefighters Grant (AFG) and the Fire Prevention and Safety Grant Program. FEMA Chicago, IL 60605. Christine Stack, (312) 408-5570 or Christine.stack@dhs.gov. Main desk: (312) 408-5320. The Urban Land Institute (www.uli.org) or ULI is a 501(c) (3) nonprofit research and education organization supported by its members. The Public Entity Risk Institute (www.riskinstitute.org) is a not for profit, tax

exempt organization. Its mission is to serve public, private, and nonprofit organizations as a dynamic, forward thinking resource for the practical enhancement of risk management.

2.8 Guidelines established in National Fire Protection Association (NFPA) 1144

NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire* is developed as a resource for protecting life and property from wildfire. http://dnrc.mt.gov/forestry/Fire/Prevention/documents/WUIrewrite/NFPA1144.pdf.

SECTION III: MANAGEMENT ACTION PLAN

The management action plan begins with a summary of project area conditions such as weather, fire behavior, fuels, topography, and potential for impact to the community. The Management Action Plan then covers tactical considerations, evacuation plans, water sources, known hazards, and potential locations for staging areas and helispots.

3.1 Weather

Missouri has a continental type of climate marked by strong seasonality. In winter, dry-cold air masses, unchallenged by any topographic barriers, periodically swing south from the northern plains and Canada. If they invade, reasonably humid air, snowfall, and rainfall result. In summer, moist, warm air masses, equally unchallenged by topographic barriers, swing north from the Gulf of Mexico and can produce copious amounts of rain, either by fronts or by convectional processes. In some summers, high pressure can stagnates over Missouri, creating extended drought periods. Spring and fall are transitional seasons when abrupt changes in temperature and precipitation may occur due to successive, fast-moving fronts separating contrasting air masses.

Missouri experiences regional differences in climates, but these differences do not have obvious geographic boundaries. Regional climates grade inconspicuously into each other. Nevertheless, several basic principles help to understand climatic differences in Missouri.

The basic gradient for most climatic characteristics is along a line diagonally crossing the state from northwest to southeast. Both mean annual temperature and precipitation exhibit gradients along this line.

Figure 2. Average Minimum Relative Humidity at Ava Weather Station

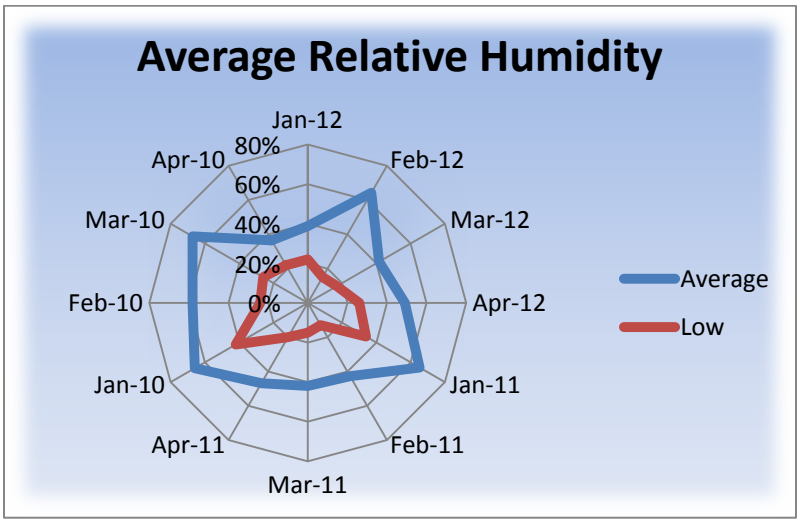


Figure 3. Average Temperature at Ava Weather Station

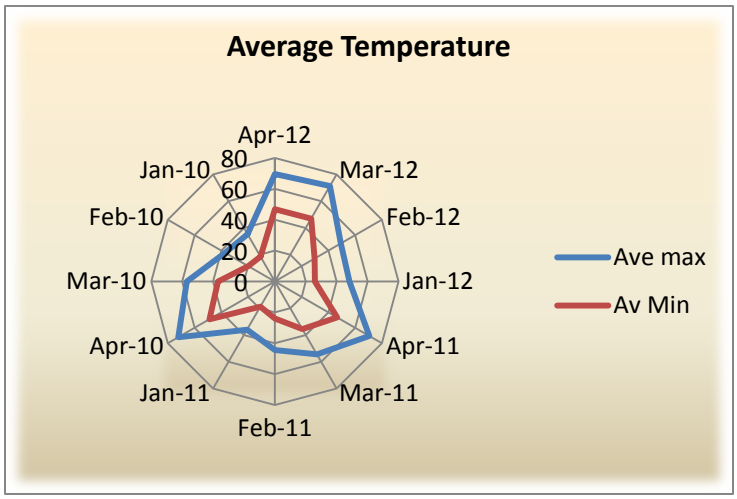
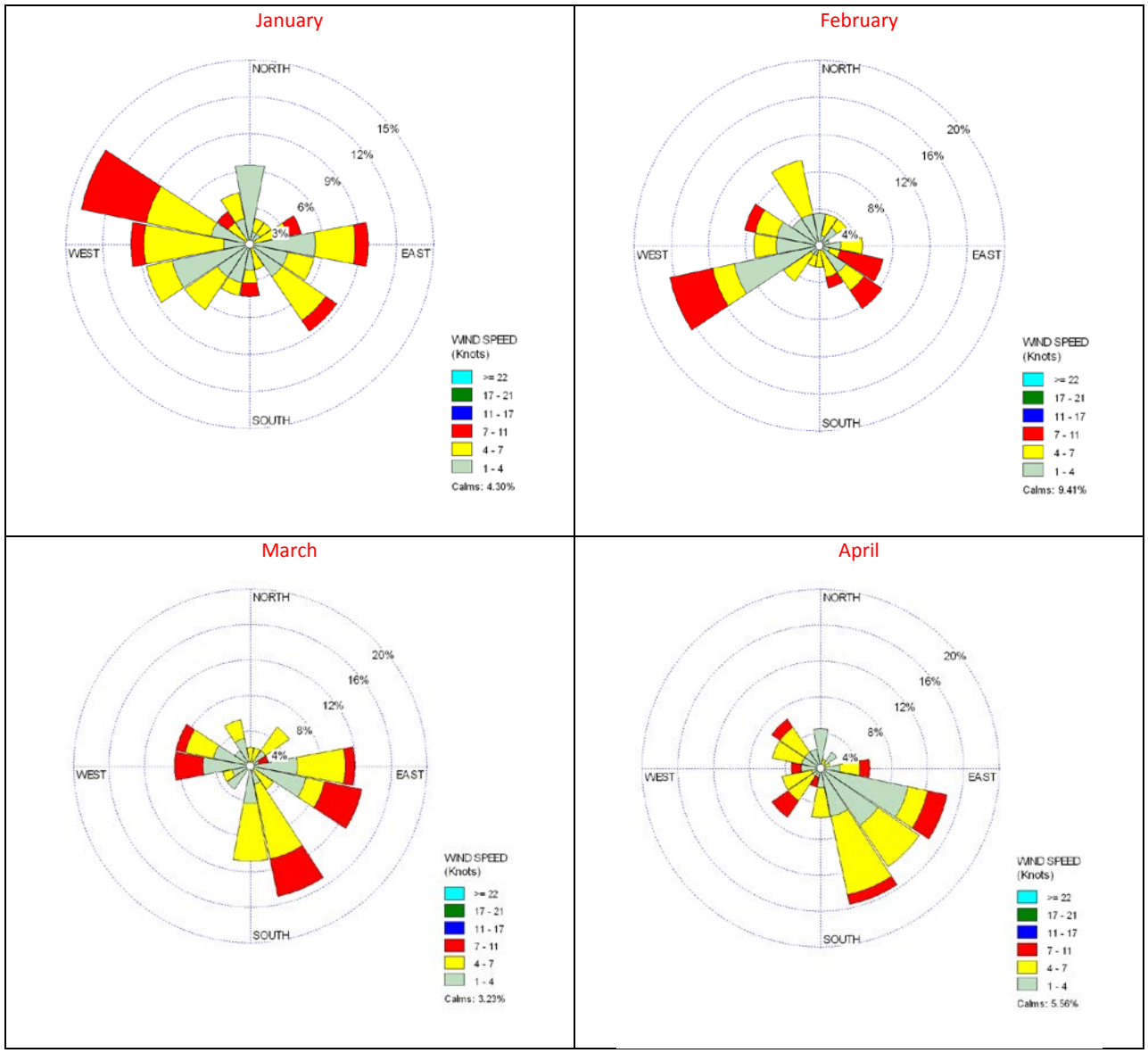


Figure 5. Average Burning Period Winds (12:00-18:00) for the Ava Weather Station.



3.2 Fuel Type

The primary fuel models (FM) are the standard GS1, GR2, TL9, TL7, and TL6 with the main fuel being grasses, sedges, leaf litter, and needle cast. The Timber Litter 9 (TL9) is typically areas of short leaf pine (*pinus echinata*) with needle cast. Areas of heavy mid-story and shrubs are modeled as a GR2. Most of the fuels are best represented as Timber Litter 6 (TL6) and comprised of white oak (*quercus alba*), black oak (*quercus velutina*), and hickory (*carya glabra*) stands. On the tops of most of the ridges are dense stands of red cedar (juniperus virginiana) and some ashe juniper (juniperus ashei). In these areas fire behavior can exhibit group tree torching and crown fire. The primary surface fuels have an average total fuel loading of 8.72 tons/acre. A sampling of the project area was conducted to determine the fuel loading and is illustrated in table 1.

Table 1. Fuel loading

Mixed Oak Fuel Category	Fuel Loading Tons/ Acre
1 hour fuels	0.544
10 hour fuels	0.116
100 hour fuels	0.978
1000 hour fuels	2.662
Litter / Duff	4.424
Total Fuel Loading	**8.724**

Table 2 outlines the basic composition of the average available fuels on Forest Service property within the project area.

Table 2. Fuels Composition

CANOPY - TREES

Input variable	All trees	Trees - overstory	Trees - midstory	Trees - understory
Total percent cover (%)	85.0 (65.00 / 95.00)	60.00 (30.00 / 80.00)	40.00 (20.00 / 55.00)	20.00 (15.00 / 35.00)
Height (ft)		50.0 (20.0 / 100.0)	20.0 (10.0 / 50.0)	10.00 (5.00 / 20.00)
Height to live crown (ft)		20.0 (15.0 / 80.0)	10.0 (5.0 / 20.0)	4.00 (2.50 / 7.00)
Density (#/acre)		35.0 (17.00 / 50.00)	35.0 (15.00 / 75.00)	500.00 (300.00 / 2200.00)
Dbh (in)		15.0 (15.00 / 30.00)	7.0 (3.0 / 15.00)	1.00 (0.80 / 3.00)
Species (relative cover %)		Quercus alba (45.00) Carya glabra (20.00) Quercus rubra (20.00) Quercus velutina (15.00)	Carya spp. (50.00) Acer rubrum (15.00) Quercus alba (25.00) Thuja plicata (10)	Acer spp. (45.00) Cornus florida (25.00) Fraxinus spp. (20.00) Cercis canadensis (10.00)

CANOPY - SNAGS

Input Variable	Snags - class 1 with foliage	Snags - class 1 without foliage	Snags - class 2	Snags - class 3
Height (ft)		15.00 (10.00 / 85.00)	15.00 (10.00 / 80.00)	15.00 (8.00 / 40.00)
Density (#/acre)		30.00 (0.00 / 50.00)	30.00 (0.00 / 90.00)	30.00 (0.00 / 90.00)
Dbh (in)		5.00 (4.00 / 15.00)	5.00 (4.00 / 15.00)	5.00 (4.00 / 15.00)
Species (relative cover %)		Quercus spp. (65.00) Carya spp. (35.00)	Quercus spp. (65.00) Carya spp. (35.00)	Quercus spp. (65.00) Carya spp. (35.00)

CANOPY - TREES

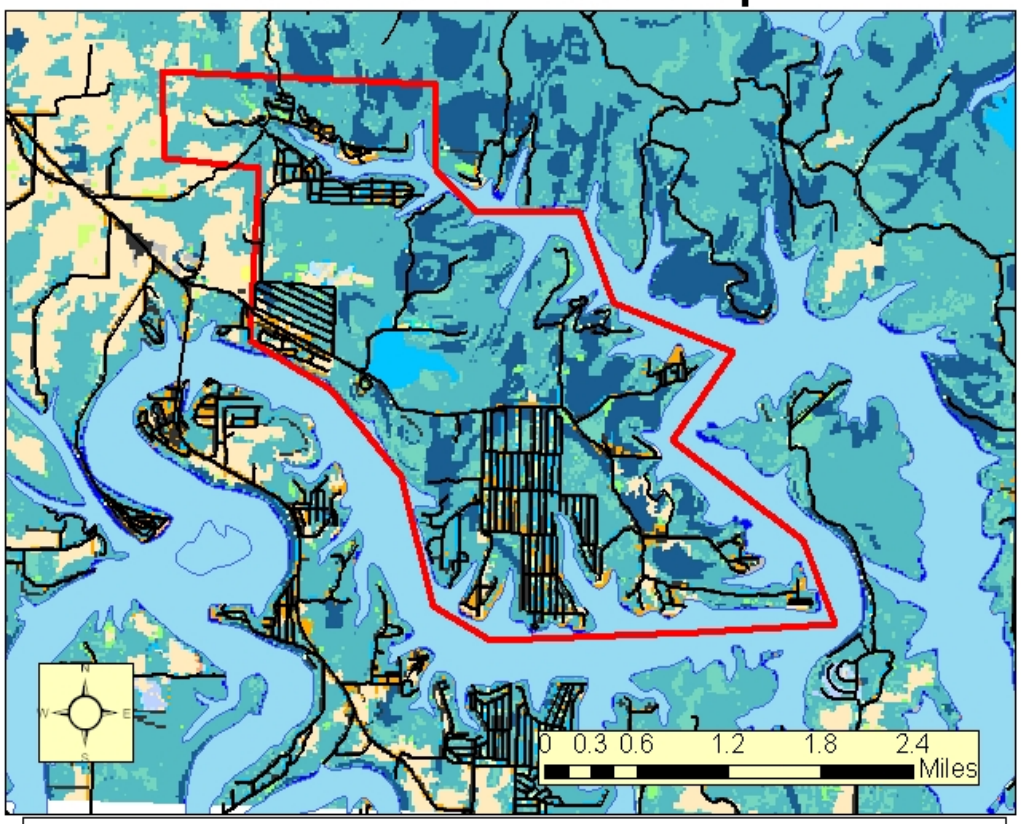
Input variable	All trees	Trees - overstory	Trees - midstory	Trees - understory
Total percent cover (%)	75.0 (25.0 / 85.0)	25.0 (0.00 / 65.0)	65.0 (0.00 / 40.00)	
Height (ft)		20.0 (35.0 / 55.0)	15.0 (25.00 / 40.00)	
Height to live crown (ft)		10.0 (5.00 / 25.0)	0.5 (2.00 / 15.00)	
Density (#/acre)		30.0 (0.0 / 40.0)	175.0 (0.00 / 200.00)	
Dbh (in)		9.0 (6.0 / 12.0)	3.0 (2.0 / 6.00)	
Species (relative cover %)		Juniperus ashei (50.00) Quercus spp. (50.00)	Juniperus ashei (85) Quercus spp. (15)	

Figure 6. Red Cedar & Ashe Juniper Fuels

Mixed Oak Fuels

Short Leaf Pine / Hardwoods

Shell Knob Fuels Map



Legend bjs 2012

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Value

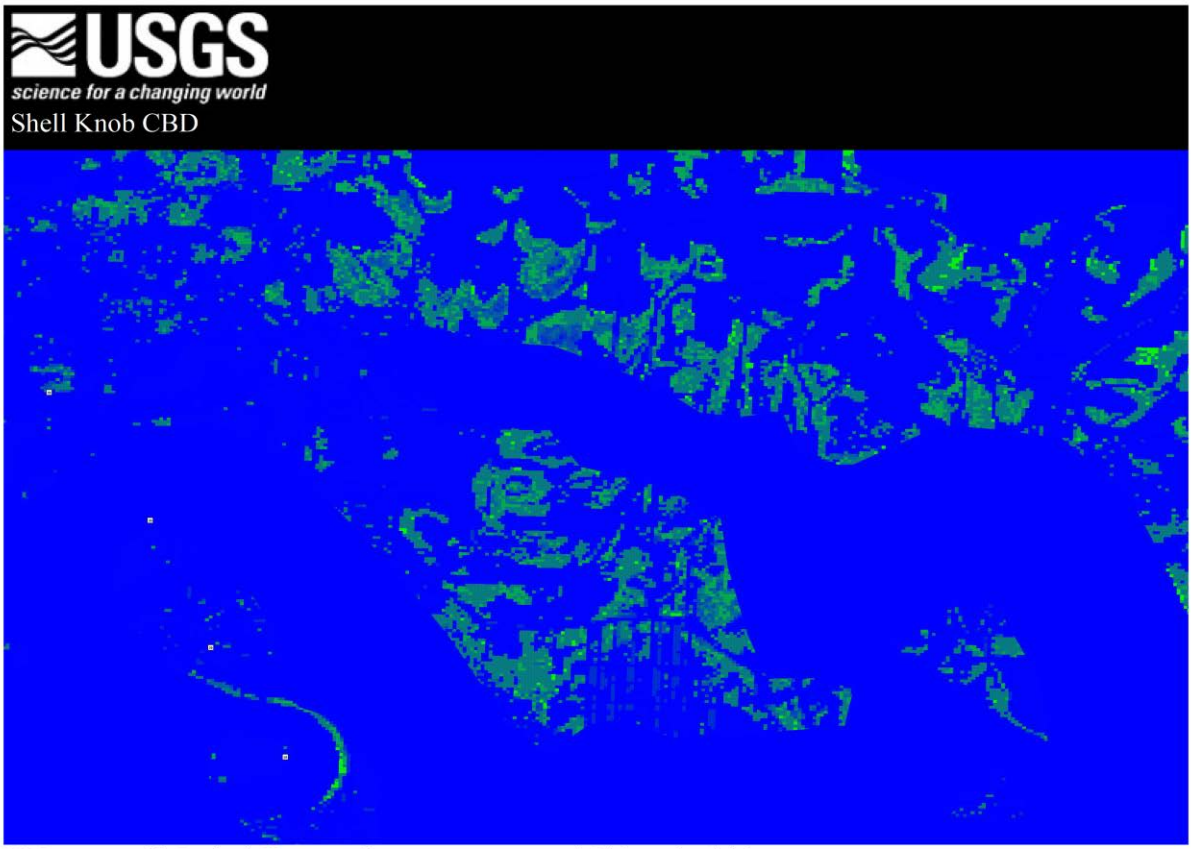
- White Oak - Northern Red Oak Forest
- Green Ash - American Elm Forest
- Eastern Redcedar - Oak / Bluestem Savanna
- Red Maple - Oak - Hickory - Sweetgum Forest
- Loblolly Pine / Bluestem Forest
- Post Oak - Blackjack Oak Forest
- Shortleaf Pine - Post Oak - Black Oak Forest
- Calcareous Glade and Woodland
- Modified or Managed Xeric Grass 1
- Modified or Managed Xeric Grass 2
- Modified or Managed Mesic Grass 1
- Modified or Managed Xeric Grass Shrub 1
- Modified or Managed Xeric Grass Shrub 2
- Modified or Managed Xeric Shrub 1
- Modified or Managed Xeric Shrub 2
- Modified or Managed Xeric Shrub 4
- Modified or Managed Xeric Understory 1
- Modified or Managed Xeric Timber Litter 1
- Modified or Managed Xeric Timber Litter 2
- Modified or Managed Xeric Timber Litter 3
- Modified or Managed Mesic Timber Litter 2
- Modified or Managed Mesic Timber Litter 3
- Open Water
- Developed-Medium Intensity
- Developed-High Intensity
- Developed-Roads
- Barren
- Quarries/Strip Mines/Gravel Pits
- NASS-RowCrop-Close Grown Crop
- NASS-RowCrop
- NASS-Close Grown Crop
- Agriculture-Cultivated Crops and Irrigated Agriculture

3.3 Fire Behavior Summary

Generally, surface fires are observed in the fuels identified within the project area. The modeling for fire behavior for this project was modeled under "red flag" conditions. Spotting from torching conifer species (short leaf pine, red cedar) can be up to 0.3 miles ahead of the fire, using the conditions in this example (20 mph wind).

Table 3. Surface fire behavior output for "red flag" conditions.

Fuel Model	ROS(max)ch/h	Flame Lgth ft	Spot Dist. miles
tl6	5.5	2.7	0.3
tl9	8.4	4.9	0.3
gs2	30.7	6.3	0.3
Tl 7	1.9	1.7	0.3



Canopy Bulk Density Area	Kg / M³	Lbs/ft³
18	.18	0.0112
23	.23	0.0144
31	.31	0.0194
43	.43	0.0268

Results for: Crown Fire Behavior Run Based on Red Flag Criteria

Canopy Bulk Dens	Critical Surf Int	Trans Ratio	Crown Fire ROS	Critical Crown ROS	Active Ratio	Crown Flame Leng	Power of the Fire
lb/ft3	Btu/ft/s		ch/h	ch/h		ft	ft-lb/s/ft2
0.0112	3	7.14	87.5	49.9	1.75	39.0	21
0.0144	3	7.14	87.5	38.8	2.25	43.8	25
0.0194	3	7.14	87.5	28.8	3.04	50.7	31
0.0268	3	7.14	87.5	20.8	4.20	60.2	41

Results for: Fire Type

20-ft	Surface Flame Length				
Wind	ft				
mi/h	0.2	0.6	1.0	1.4	1.8
0	Surface	Surface	Torching	Torching	Torching
5	Surface	Surface	Torching	Torching	Torching
10	CondCrown	CondCrown	Crowning	Crowning	Crowning
15	CondCrown	CondCrown	Crowning	Crowning	Crowning
20	CondCrown	CondCrown	Crowning	Crowning	Crowning

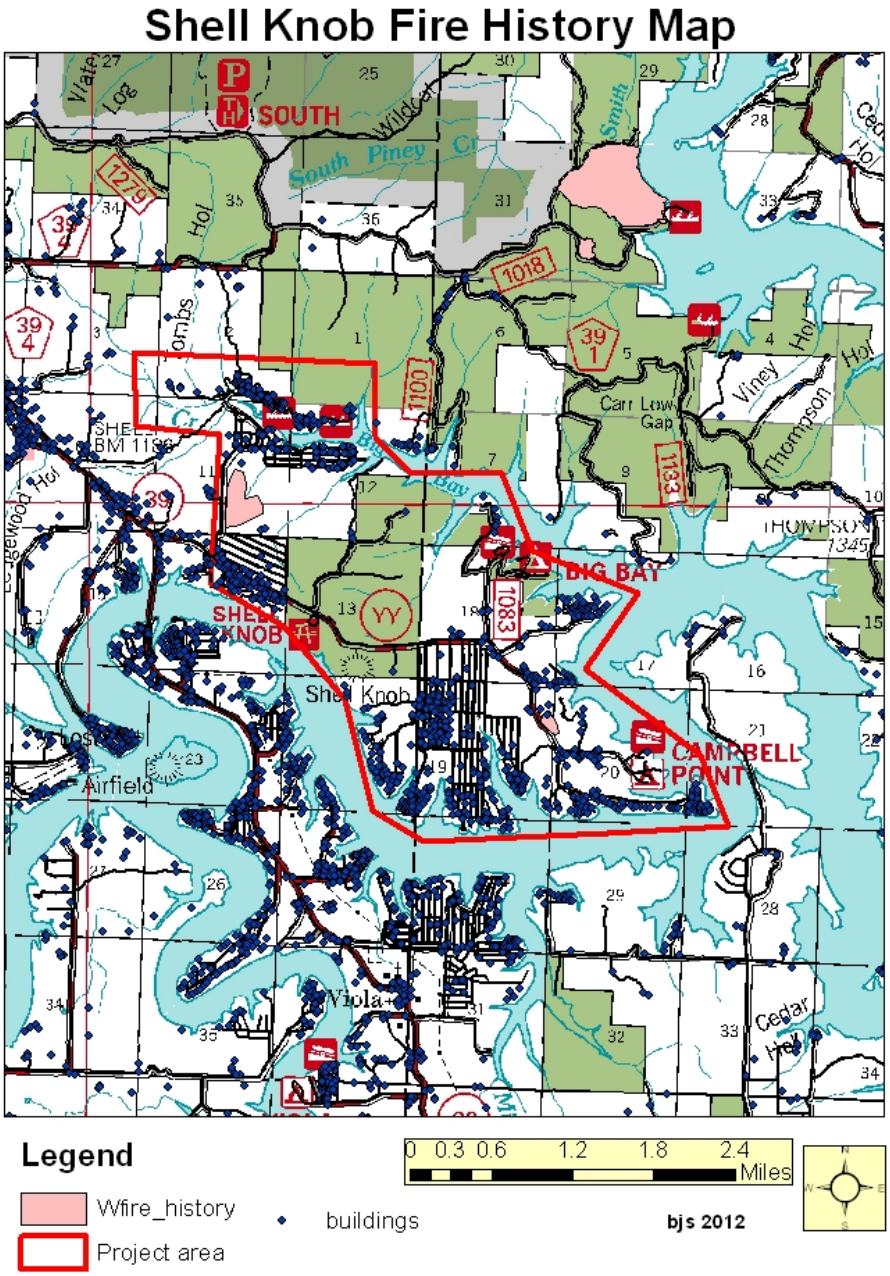
Results for: Crown Flame Length (ft)

20-ft	Surface Flame Length				
Wind	ft				
mi/h	0.2	0.6	1.0	1.4	1.8
0	8.1	8.1	8.1	8.1	8.1
5	19.2	19.2	19.2	19.2	19.2
10	32.8	32.8	32.8	32.8	32.8
15	46.6	46.6	46.6	46.6	46.6
20	60.2	60.2	60.2	60.2	60.2

3.4 Probability of Impact

Wind speed and direction has been averaged for the 4 months that typically exhibit the greatest chance for a wildfire to occur (Figure 5). The data was collected from the Ava weather station approximately 50 miles northeast of the analysis area. The wind graphs give probability of wind direction (%) and wind speed. The historical data for wildfires in the project area is also displayed (Figure 12).

Figure 12. Project Area Historic Fire Locations



3.5 Topography

The topography for the assessment area is rolling hills that make up part of the central plateau region of the Ozark's. Dramatic elevation changes of more than 100' are common. The surface of the area has been eroded into a successive series of ridges and valleys with slopes reaching >30%. These ridges and valleys can make navigation and fire planning in the area difficult. The main drainages that cross through the assessment area are the White River Big Bay and Table Rock.

3.6 Strategic and Tactical Considerations

The community has only 1 form of ingress/egress, and the road widths are approximately 20'. The assessment area has multiple locked gates that further hamper access to structures. All of the areas with limited escape routes and within close proximity of hazardous fuels create a condition that does not allow firefighters to prepare a structure and stay on the scene. Firefighters should be instructed to "prep and leave" - to foam or wet down the structure and retreat to a safe area before the wildfire would impact the community. All of the pre-identified water sources are depicted on the project map. There are numerous underground utilities along most of the roads that could be damaged by dozers or tractor plows. When constructing fireline near any road, the suppression forces would need to employ the use of blade line instead of plow line to reduce the risk of rupturing the underground utilities.

3.7 Suggested Evacuation Plan

The private property that borders concentrations of hazardous fuels will be the primary concern for evacuations and could require a significant amount of resources depending on the area that is impacted by a wildfire. Dwellings east of Shell Knob recreational area have only one evacuation route and should be considered a high priority for evacuations. In the event of evacuations, the county or city emergency management would designate a "shelter" for evacuees to stay. The location of the shelter would be determined by the county Emergency Operations Center (EOC) on a case by case basis. Emergency first responders assisting with evacuations should provide this information to evacuees in addition to the recommended route to take to get to a safe area. Once the evacuation has taken place, the dwelling should be marked with flagging to indicate that it has been evacuated. The first responder should write the time / date / status on the flagging so any other responders would know that the dwelling has been evacuated.

Figure 14. Evacuation Maps

Red lines = 1 form of ingress / egress and or hazardous fuels
Yellow lines = 2 forms of ingress / egress, or 1 form of ingress / egress without hazardous fuels
Green lines = 3 or more forms of ingress / egress

3.8 Command Post and Staging Locations

Incident command post (ICP) and staging area will be determined by the Incident Commander of the fire. One logical location identified on the project map is the Shell Knob on County Road YY.

3.9 Safety Zones

No adequate safety zones have been identified within the project area. Creating a safety zone with mechanical equipment or burning should be considered by the incident commander or responding firefighters.

3.10 Water System & Locations

All of the water sources and draft sites are depicted on the project map. A description of how much draft hose is required, or pump site requirement, are addressed in the project map. One fire hydrant is located within the assessment area near the water tower, but it is behind a fence. If a helicopter is used, the White River, Big Bay and Table Rock Lake may offer possible dip sites. The decision for dip site location is the responsibility of the helicopter manager, and ultimately, the pilot of the aircraft.

3.11 Hazards

Underground utilities, septic tanks, unknown hazardous materials (pesticides, flammable materials, household chemicals) in sheds and garages, domestic animals, and the public are all potential hazards identified for this area.

3.12 Helispot Locations

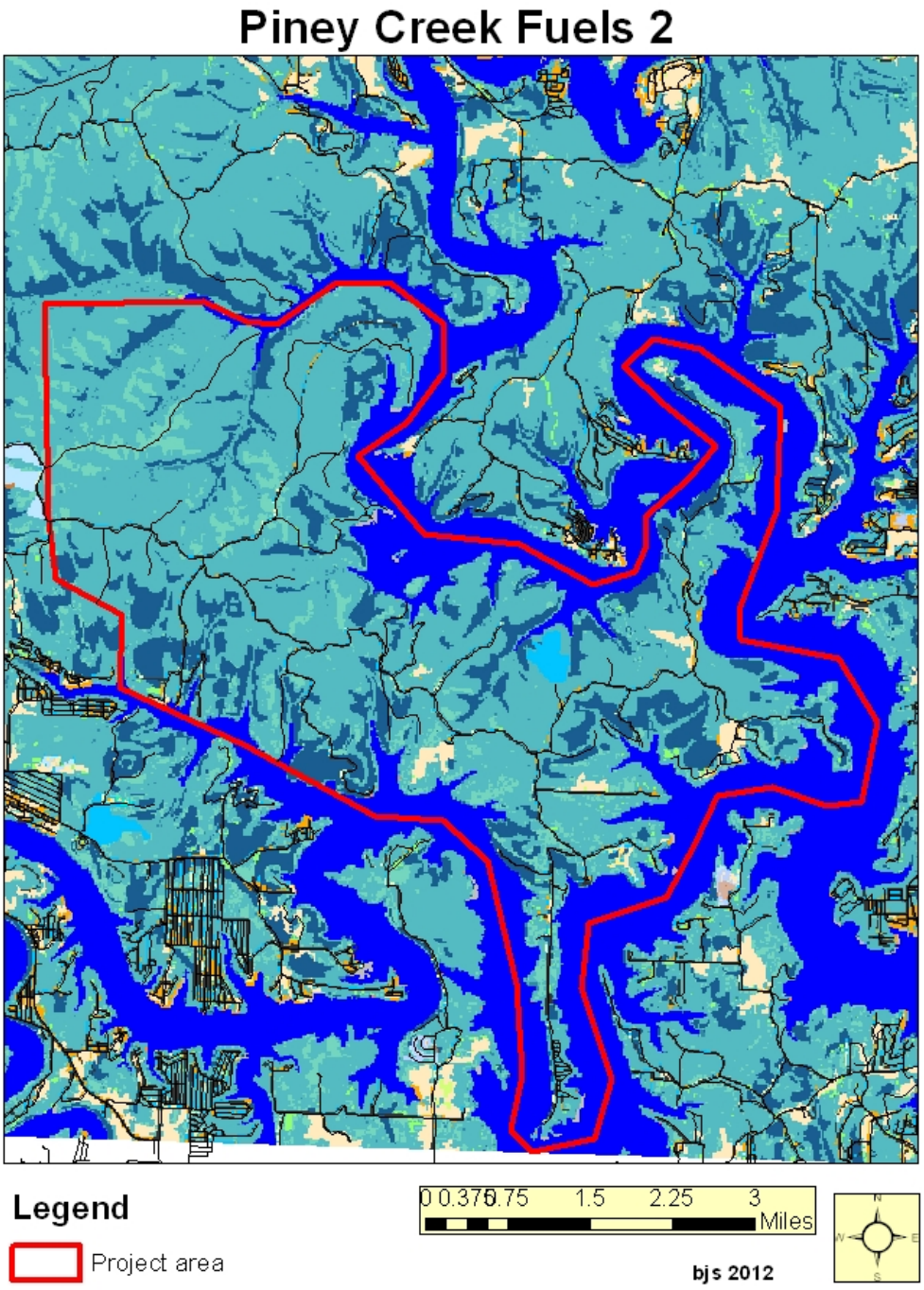
The established helibase for an incident that may impact this area would likely be the Heilipad in the town of Shell Knob. The airport facilities are more than adequate for helitack operations (ie: safety equipment, landing zone, security, and access to ground support). The decision for helispot location will be made by the helicopter manager, and ultimately, the pilot of the aircraft. Other proposed landing areas can be determined on a case by case basis, and are dependent on weather factors, time of day, and FAA and Forest Service regulations regarding flight times.

3.13 Structure Assessments

An assessment was conducted on each structure where access was allowed. Access to all property was not allowed in these instances and assessments were made using the best judgment of the ground personnel, as well as observations from a distance. Each structure was evaluated on the potential to withstand a wildfire and was based on the standard form for assessing structures (NFPA299).

Click on the "Shell knob Structures.klm"or "Shell Knob Haz" to activate the google earth structure map.

Appendix A:


Piney Creek Fuels 2
Legend
Project area
0 0.375 0.75 1.5 2.25 3
Miles
bjs 2012

Appendix B:

Author: Brian Stearns

Date/Time: Jul 16 2012 - 03:25 PM

Fuelbed Name: Mark Twain Oak

Fuelbed Number: 123

File Name: C:\FCCS\conf\fuelbeds\user_fuelbeds\Mark Twain Oak.xml

Data quality ranking:

Original Original FBPS fuel model (13)*:9

Standard fuel model (40)*:TL9

Description:Found on dissected hills and valleys from about 600 to 1200 feet in elevation. This fuelbed includes oak -- hickory forests in Missouri. These forests are second growth and fire has been excluded for recent history (up to 50 years).

Moisture Scenarios

Output Variable	Default	User-defined	Optional	Definitions
Moisture scenario name	D2L2C3	CUSTOM		
Moisture scenario description	Dry dead FM, 2/3 cured nonwoody; used in crosswalk to fuel models.	custom		Fuel moisture scenario descriptions (Behave Plus, Andrews 2005)
Reaction Intensity (BTU/ft²/min)	2541	2830		The rate of heat release, per unit area of the flaming front (BTU/ft2/min).
Flame Length (ft)	3.0	3.4		The distance between the flame tip and middle of the flame base (ft).
Rate of Spread (ft/min)	5.8	6.9		Distance per unit of time of the flaming front (feet per minute).
FBPS Fuel Model (13)	9	9		Suggested crosswalk to the original 13 FBPS fuel models (Rothermel 1972, Albini 1976).
Flame length (%)	122	138		Percentage of the flame length predicted by the FBPS fuel model.
Rate of spread (%)	85	101		Percentage of the rate of spread predicted by the FBPS fuel model.
Standard fuel model (40)	TL9	TL9		Suggested crosswalk to the 40 standard fuel models (Scott and Burgan 2005).

FUELBED INPUT REPORT

Author:

Date: Jul 16, 2012

Fuelbed number: 123

File Name:

Data quality ranking:

Description: Found on dissected hills and valleys from about 600 to 1200 feet in elevation. This fuelbed includes oak -- hickory forests in Missouri. These forests are second growth and fire has been excluded for recent history (up to 50 years).

CANOPY - TREES

Input variable	All trees	Trees - overstory	Trees - midstory	Trees - understory
Total percent cover (%)	85.0 (65.00 / 95.00)	60.00 (30.00 / 80.00)	40.00 (20.00 / 55.00)	20.00 (15.00 / 35.00)
Height (ft)		50.0 (20.0 / 100.0)	20.0 (10.0 / 50.0)	10.00 (5.00 / 20.00)
Height to live crown (ft)		20.0 (15.0 / 80.0)	10.0 (5.0 / 20.0)	4.00 (2.50 / 7.00)
Density (#/acre)		35.0 (17.00 / 50.00)	35.0 (15.00 / 75.00)	500.00 (300.00 / 2200.00)
Dbh (in)		15.0 (15.00 / 30.00)	7.0 (3.0 / 15.00)	1.00 (0.80 / 3.00)
Species (relative cover %)		Quercus alba (45.00) Carya glabra (20.00) Quercus rubra (20.00) Quercus velutina (15.00)	Carya spp. (50.00) Acer rubrum (15.00) Quercus alba (25.00) Thuja plicata (10)	Acer spp. (45.00) Cornus florida (25.00) Fraxinus spp. (20.00) Cercis canadensis (10.00)

CANOPY - SNAGS

Input Variable	Snags - class 1 with foliage	Snags - class 1 without foliage	Snags - class 2	Snags - class 3
Height (ft)		15.00 (10.00 / 85.00)	15.00 (10.00 / 80.00)	15.00 (8.00 / 40.00)
Density (#/acre)		30.00 (0.00 / 50.00)	30.00 (0.00 / 90.00)	30.00 (0.00 / 90.00)
Dbh (in)		5.00 (4.00 / 15.00)	5.00 (4.00 / 15.00)	5.00 (4.00 / 15.00)
Species (relative cover %)		Quercus spp. (65.00) Carya spp. (35.00)	Quercus spp. (65.00) Carya spp. (35.00)	Quercus spp. (65.00) Carya spp. (35.00)

FCCS VERSION 2.2 OUTPUT

Author: Brian Stearns

Date/Time: Jul 16 2012 - 03:25 PM

Fuelbed Name: Mark Twain Oak

Fuelbed Number: 123

File Name: C:\FCCS\conf\fuelbeds\user_fuelbeds\Mark Twain Oak.xml

Description: Found on dissected hills and valleys from about 600 to 1200 feet in elevation. This fuelbed includes oak – hickory forests in Missouri. These forests are second growth and fire has been excluded for recent history (up to 50 years).

FCCS Output by Fuelbed - Strata and Categories

Stratum	Category / Subcategory	Percent Cover (%)	Depth - Canopy (ft), others (in)	Loading Total (tons/acre)	Loading Live (tons/acre)	Loading Dead (tons/acre)	Fuel Area Index	Packing Ratio	Density (#/ acre)	Tree Height to Live Crown (ft)	Tree DBH (in)
Canopy		85.0	100.0	20.0925	18.9438	1.1486	86.9	<0.01	0.0	4.0	0.0
	Trees	100.0	66.0	18.9438	18.9438	0	86.9	<0.01	0.0	0	0.0
	Overstory	60.0	40.0	15.6816	15.6816	0	72.0	<0.01	35.0	60.0	25.0
	Midstory	40.0	20.0	2.6415	2.6415	0	12.0	<0.01	35.0	40.0	13.0
	Understory	20.0	6.0	0.6207	0.6207	0	2.8	<0.01	500.0	4.0	1.0
	Snags	.0	15.0	1.1486	0	1.1486	.0	<0.01	0.0	0	0.0
	Class 1 other	.0	0	1.4294	0	1.4294	.0	<0.01	30.0	0	0.0
	Class 2	.0	0	0.5743	0	0.5743	.0	<0.01	30.0	0	0.0
	Class 3	.0	0	0.5743	0	0.5743	.0	<0.01	30.0	0	0.0
	Ladder fuels	.0	0	0	0	0	.0	0	0.0	0.0	0.0
Shrubs		45.0	120.0	1.2541	1.066	0.1881	5.8	<0.01	0.0	0	0.0

Strata & Categories Report

Author: Brian Stearns

Date: Jul 16 2012 - 03:25 PM

Fuelbed Name: Mark Twain Oak

Fuelbed Number: 123

File Name: C:\FCCS\conf\fuelbeds\user_fuelbeds\Mark Twain Oak.xml

Data quality ranking:

Original FBPS fuel model (13)*: 9

Standard fuel model (40)*: TL9

Description: Found on dissected hills and valleys from about 600 to 1200 feet in elevation. This fuelbed includes oak -- hickory forests in Missouri. These forests are second growth and fire has been excluded for recent history (up to 50 years).

Surface Fire Behavior Potential	**5**	Summary surface fire behavior potential, calculated as the maximum of spread potential and flame length potential scaled to an index between 0-9.
Reaction Potential	4.0	Approximates the potential reaction intensity (energy released per unit area and time).
Spread Potential	4.7	Proportional to the no-wind rate of spread in surface fuel (distance per unit time).
Flame Length Potential	3.5	Proportional to fireline intensity or flame length.
Crown Fire Potential	**2**	Weighted average of crown fire subpotentials.
Crown fire initiation potential	2.3	Potential for fire to reach canopy layer.
Crown-to-crown transmissivity potential	9.0	Potential for fire to carry through a canopy.
Crown fire spreading potential	0.5	Relative index of crown fire rate of spread.
Available Fuel Potential	**1**	Sum of fuel loadings in all combustion phases scaled to an index between 0-9.
Flame available fuel potential	0.7	Sum of fuel loadings available for the flaming phase of combustion (in units of 10 tons/acre).
Smoldering available fuel potential	0.2	Sum of fuel loadings available for the smoldering phase of combustion (in units of 10 tons/acre).
Residual Available Fuel	0.3	Sum of fuel loadings available for the residual smoldering phase of combustion (in units of 10 tons/acre).
FCCS Fire Potential Code	**521**	Three-digit code representing the surface fire behavior, crown fire, and available fuel potentials.

*Based on dry fuel conditions (D2L2 moisture scenario) FCCS v 2.2

FUELBED INPUT REPORT

Author:

Date: Aug 5, 2012

Fuelbed number: 450

File Name:

Data quality ranking:

Description: The structure ranges from open to closed canopy over a variable shrub layer with grassy openings. This fuelbed type occurs Limestone ridge tops in southwestern Missouri.

CANOPY - TREES

Input variable	All trees	Trees - overstory	Trees - midstory	Trees - understory
Total percent cover (%)	75.0 (25.0 / 85.0)	25.0 (0.00 / 65.0)	65.0 (0.00 / 40.00)	
Height (ft)		20.0 (35.0 / 55.0)	15.0 (25.00 / 40.00)	
Height to live crown (ft)		10.0 (5.00 / 25.0)	0.5 (2.00 / 15.00)	
Density (#/acre)		30.0 (0.0 / 40.0)	175.0 (0.00 / 200.00)	
Dbh (in)		9.0 (6.0 / 12.0)	3.0 (2.0 / 6.00)	
Species (relative cover %)		Juniperus ashei (50.00) Quercus spp. (50.00)	Juniperus ashei (85) Quercus spp. (15)	

CANOPY - SNAGS

Input Variable	Snags - class 1 with foliage	Snags - class 1 without foliage	Snags - class 2	Snags - class 3
Height (ft)			20.0 (10.00 / 30.0)	15.0 (10.0 / 25.0)
Density (#/acre)			2.0 (0.00 / 5.0)	2.0 (0.00 / 5.0)
Dbh (in)			6.50 (4.00 / 10.0)	6.50 (4.00 / 10.0)
Species (relative cover %)			Juniperus ashei (50) Quercus spp. (50)	Juniperus ashei (50) Quercus spp. (50)

Author: Brian Stearns

Date/Time: Aug 05 2012 - 03:30 PM

Fuelbed Name: Ashe juniper forest

Fuelbed Number: 450

File Name: C:\FCCS\conf\fuelbeds\user_fuelbeds\Mark Twain Cedar.xml

Data quality ranking:

Original Original FBPS fuel model (13)*:8

Standard fuel model (40)*:TL7

Description: The structure ranges from open to closed canopy over a variable shrub layer with grassy openings. This fuelbed type occurs Limestone ridge tops in southwestern Missouri.

Moisture Scenarios

Output Variable	Default	User-defined	Optional	Definitions
Moisture scenario name	D2L2C3	CUSTOM	D1L1C4	
Moisture scenario description	Dry dead FM, 2/3 cured nonwoody; used in crosswalk to fuel models.	custom	Very Dry, fully cured nonwoody	Fuel moisture scenario descriptions (Behave Plus, Andrews 2005)
Reaction Intensity (BTU/ft²/min)	2145	2666	2535	The rate of heat release, per unit area of the flaming front (BTU/ft2/min).
Flame Length (ft)	1.4	1.8	1.7	The distance between the flame tip and middle of the flame base (ft).
Rate of Spread (ft/min)	1.4	2.0	1.9	Distance per unit of time of the flaming front (feet per minute).
FBPS Fuel Model (13)	8	8	8	Suggested crosswalk to the original 13 FBPS fuel models (Rothermel 1972, Albini 1976).
Flame length (%)	139	184	173	Percentage of the flame length predicted by the FBPS fuel model.
Rate of spread (%)	83	120	112	Percentage of the rate of spread predicted by the FBPS fuel model.
Standard fuel model (40)	TL7	TL6	TL8	Suggested crosswalk to the 40 standard fuel models (Scott and Burgan 2005).

Author: Brian Stearns
Date: Aug 05 2012 - 08:03 PM
Fuelbed Name: Red Cedar forest
Fuelbed Number: 450
File Name: C:\FCCS\conf\fuelbeds\user_fuelbeds\Mark Twain Cedar.xml
Data quality ranking:
Original FBPS fuel model (13)*: 8
Standard fuel model (40)*: TL7
Description: The structure ranges from open to closed canopy over a variable shrub layer with grassy openings. This fuelbed type occurs Limestone ridge tops in southwestern Missouri.

Surface Fire Behavior Potential	**2**	Summary surface fire behavior potential, calculated as the maximum of spread potential and flame length potential scaled to an index between 0-9.
Reaction Potential	3.7	Approximates the potential reaction intensity (energy released per unit area and time).
Spread Potential	2.3	Proportional to the no-wind rate of spread in surface fuel (distance per unit time).
Flame Length Potential	2.3	Proportional to fireline intensity or flame length.
Crown Fire Potential	**2**	Weighted average of crown fire subpotentials.
Crown fire initiation potential	0.0	Potential for fire to reach canopy layer.
Crown-to-crown transmissivity potential	8.5	Potential for fire to carry through a canopy.
Crown fire spreading potential	1.5	Relative index of crown fire rate of spread.
Available Fuel Potential	**2**	Sum of fuel loadings in all combustion phases scaled to an index between 0-9.
Flame available fuel potential	1.7	Sum of fuel loadings available for the flaming phase of combustion (in units of 10 tons/acre).
Smoldering available fuel potential	0.6	Sum of fuel loadings available for the smoldering phase of combustion (in units of 10 tons/acre).
Residual Available Fuel	0.1	Sum of fuel loadings available for the residual smoldering phase of combustion (in units of 10 tons/acre).
FCCS Fire Potential Code	**222**	Three-digit code representing the surface fire behavior, crown fire, and available fuel potentials.

*Based on dry fuel conditions (D2L2 moisture scenario) FCCS v 2.2