

Appendix G

Fire Risk Assessment



Mark Twain
National Forest

Cover image: Controlled burn for fuels treatment
Photographer: Paul Nelson, Mark Twain National Forest

Appendix G

Fire Risk Assessment

Introduction

In 2000, the National Fire Plan was created to improve fire preparedness, reduce hazardous fuels, and reduce risks to communities among other objectives. Since its inception, the Mark Twain National Forest has increased its fuels program from less than 1,000 acres of fuel treatment per year to over 10,000 acres annually. Within the next 5 years the program may be treating over 40,000 acres per year. Identifying and prioritizing appropriate projects has required a collaborative effort among fire, fuels, wildlife and ecology staffs, as well as input from other federal, state and private cooperators. Emphasis was given in the development of the Fire Risk Assessment (FRA) to the reduction of hazardous fuels, restoration of fire-adapted ecosystems, and mitigation of potential risks to residents living in and around the Forest.

On the Mark Twain NF a system was needed that would enable managers to identify and prioritize areas for treatment and active management, as well as identify areas of low risk to residents where aggressive suppression activities could be reduced and appropriate suppression responses may be practiced. There was also a need to effectively focus fire prevention and community outreach efforts.

Development of the Fire Risk Assessment (FRA)

The Forest convened a meeting on March 11, 2003 to further refine a risk assessment initiated in 1993 by Mike Schanta and Lyn Carpenter. The original assessment looked at fire occurrence, structure locations, fuels characteristics and potential fire behavior. Attending the March 11, 2003 meeting were Margaret Olson, Marvin Dablemont, Galen Johnson, Bennie Terrell, and Lyn Carpenter. The group discussed the following items:

Fuel Model Flammability (Hazard)

Characteristics of High Hazard

- High flammability
- High potential for crowning
- Great resistance to control
- Continuous fuel bed
- High rates of spread
- High spotting potential

Characteristics of Moderate Hazard

- Fuel Models 5 and 6
- Less available fuels
- Little or no spotting potential
- Little crown fire potential

Structure Density

- Interface is defined as 3 or more structures per acre.
- Intermix is defined as 1 structure per forty acres.

Fire Occurrence Density

- Baseline data will start at 4 fires per square mile.

Point System for Risk Factors

The original idea for the risk assessment came from a model used in Canada. Margaret Olson developed a model for the Forest patterned after the Canadian model. We identified seven risk factors, and then Olson assigned a point system for the risk factors that was compatible to the model.

In order to make the point system as simple as possible, a classification was developed that totaled one hundred points for all risk factors. The following weighting process was developed by dividing up the points so risk factors with the greatest impact on severity of an ignition, have the greatest individual totals.

Table 1 - Wildland Urban Interface (WUI) - 25 Total Points

Risk	Description	Definition	Points
High	Wildland Urban Interface (WUI)	≥ 3 structures / acre	15
Medium	Intermix Moderate	≥ 1 structures / 40 acres	8
Low	Intermix Low	< 1 structures / 40 acres	2

The WUI density range was changed to match those used in the Haight, et al. study for standardization purposes, and ease in conversion of data. Low and very low categories were combined into low.

Table 2 - Historic Ignition Point Densities - 16 Total Points

Risk	Definition	Points
High	10-15/ square mile	10
Medium	2-10/square mile	5
Low	< 2/square mile	1

Table 3 - Fuel Models - 16 Total Points

Risk	Definition	Points
High	FM 1, 2, 11, 12	10
Medium	FM 5, 6	5
Low	FM 8, 9, 10	1

Table 4 - Response Time - 16 Total Points

Risk	Definition	Points
High	> 1 hour	10
Medium	30 min to 1 hour	5
Low	< 30 minutes	1

Table 5 - Potential Ignition Proximity to Interface - 15 Total Points

Risk	Definition	Points
High	< ¼ mile	9
Medium	¼ to 1 mile	5
Low	> 1 mile	1

Table 6 - Potential Ignition Proximity to Infrastructure Developments - 6 Total Points

Risk	Definition	Points
High	< ¼ mile	3
Medium	¼ to 1 mile	2
Low	> 1 mile	1

Table 7 - Potential Ignition Proximity to Threatened and Endangered Species Sites* - 6 Total Points

Risk	Definition	Points
High	< ¼ mile	3
Medium	¼ to 1 mile	2
Low	> 1 mile	1

* T&E sites only considers known gray and Indiana bat caves at this time. Remove green shading

Point Ranges

If a cell received a ‘High’ ranking in all 7 risk factors, the highest possible score is 60 points. A rating of ‘Moderate’ in all 7 risk factors would be 32 possible points. A ‘Low’ rating on all factors would equal 8 possible points, all totaling 100 points.

After the seven grids were applied to each pixel and combined (arithmetic overlay), the total actual points ranged from 2 to 47, out of a possible 100 points.

Determining break points, the point where each class changed to the next class, for high, medium, and low presented a problem. There were no statisticians available to help at this point in the development of the assessment. Olson used the equal interval method of distribution, which generated: 2-17 points for low risk, 18 to 34 points for moderate risk, and 35 to 47 points for high risk. At this point the assessment was sent to Dave Cleland, research ecologist for the Forest Service, with the sole purpose of validating the point system and point distribution of low, medium, and high.

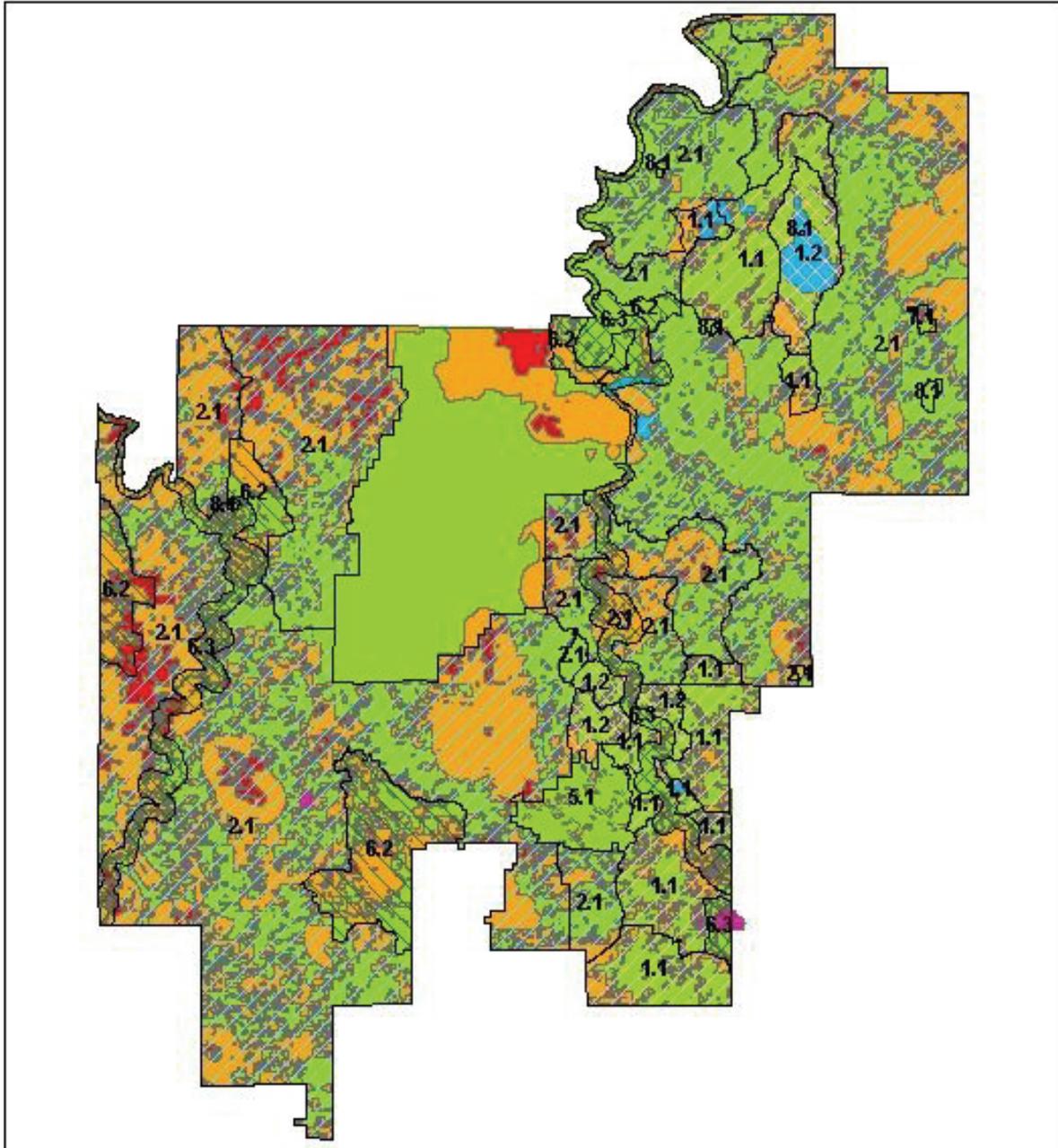
Dave made the following significant statements:

- The point system and overall model is valid.
- It is appropriate to manipulate the point distribution (adjustment of break points).
- The model is considered an expert model, not a mathematical model. (Many criteria decisions made by the Fire Management Advisory Group, such as break points for high, medium, and low for seven risk factors are based on experience or expert opinion.

Adjustments were made to the equal interval point distribution because the initial distribution did not adequately represent “High”, or the risk immediately around structures. Schanta and Carpenter adjusted the distribution, using their professional judgment, until “High” and the area around structures was more accurately represented. The corrected redistribution was 2-15 points for Low risk, 16-25 points for Moderate risk, and 25 to 47 points for High risk.

The following figures show the resulting fire risk to communities and community infrastructure for each of the Mark Twain NF units.

Figure 1 - Houston - Rolla Unit

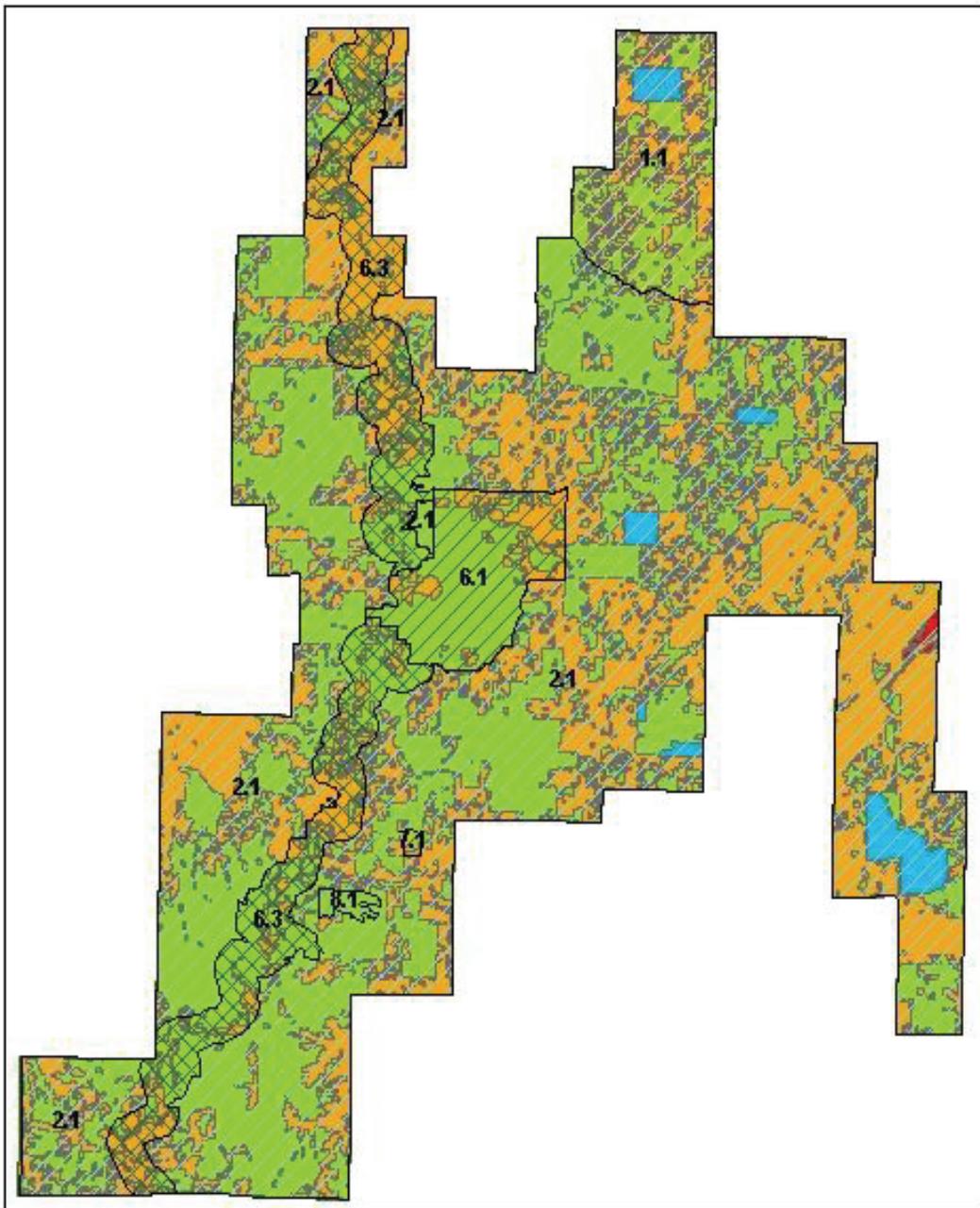


Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Figure 2 - Cedar Creek Unit

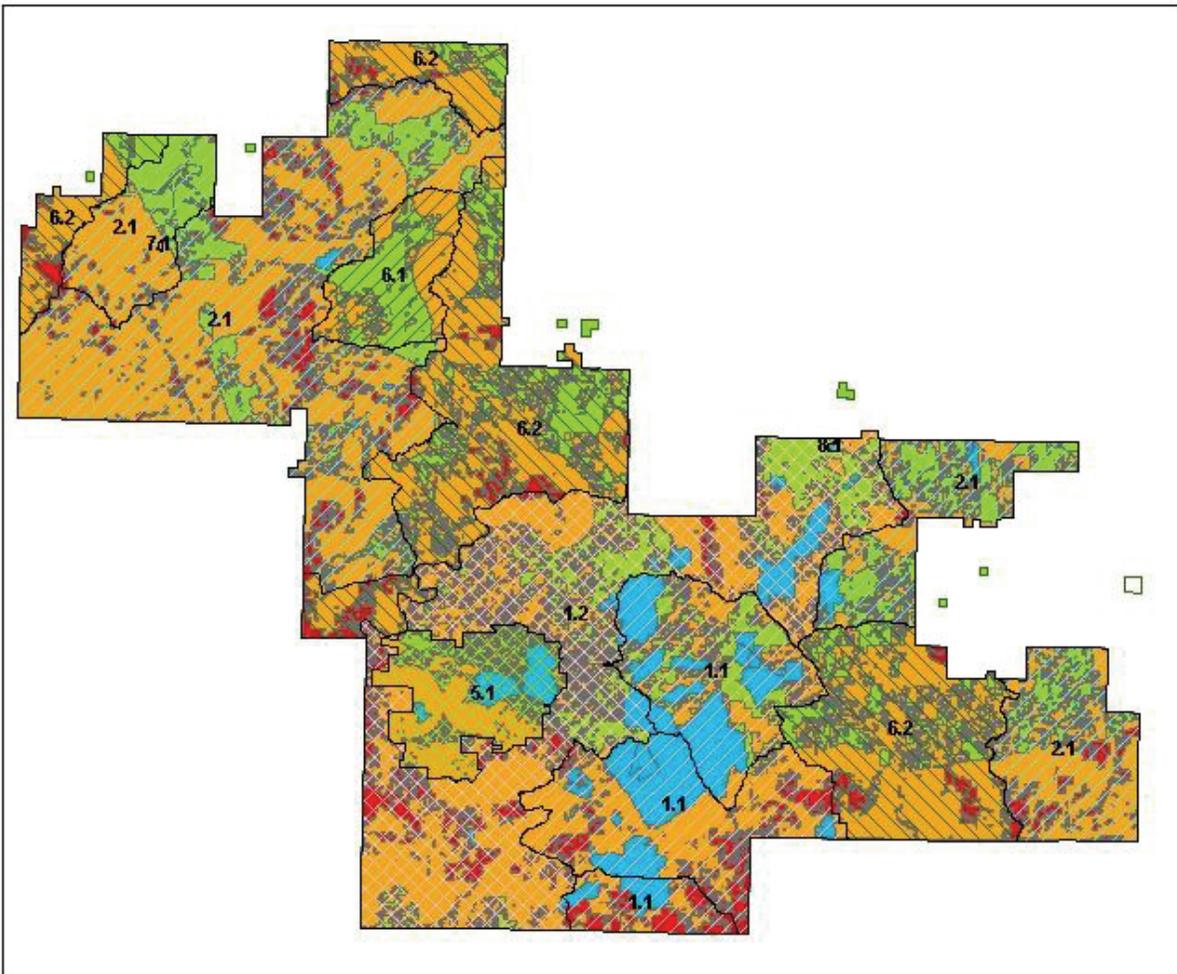


Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Figure 3 - Ava Unit

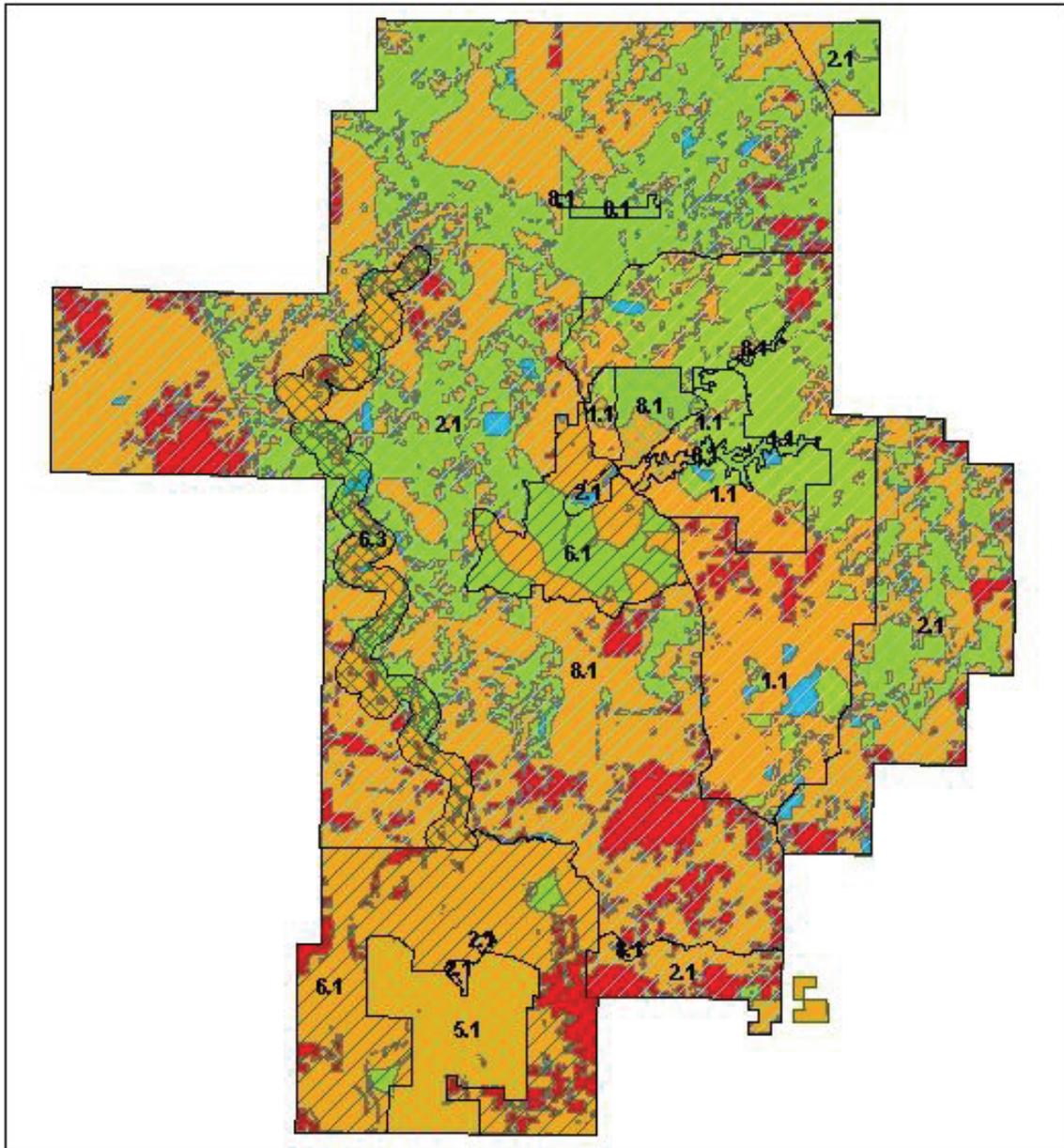


Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Figure 4 - Willow Springs Unit

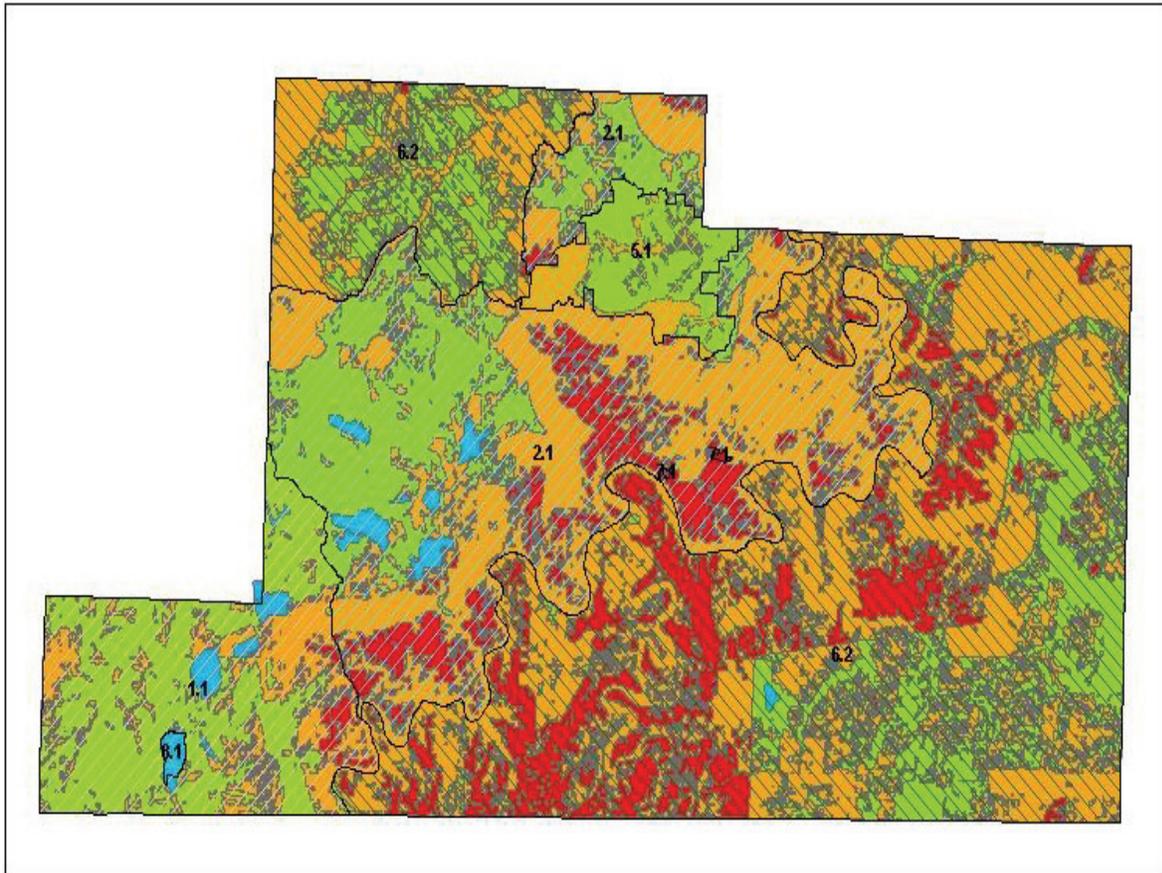


Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Figure 5 - Cassville Unit

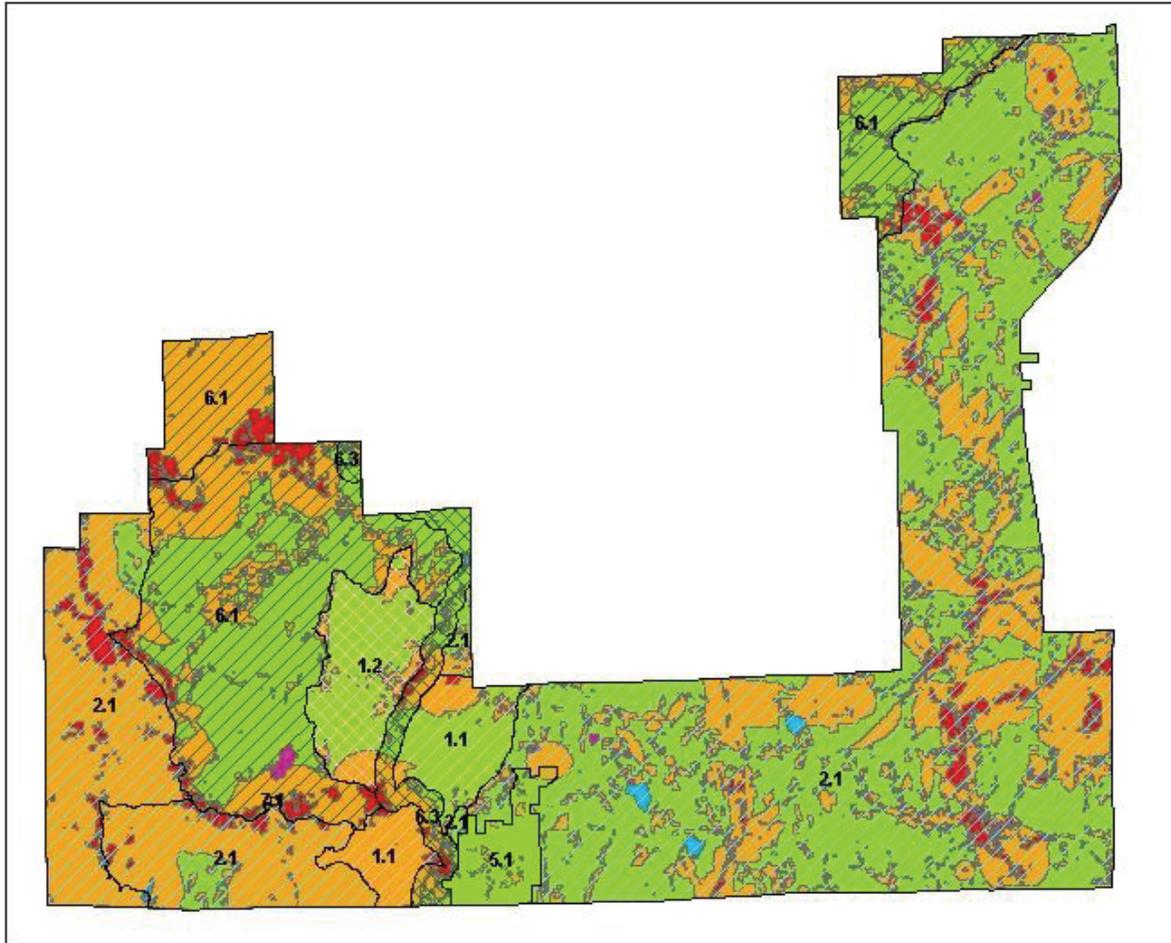


Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Figure 6 - Fredericktown Unit

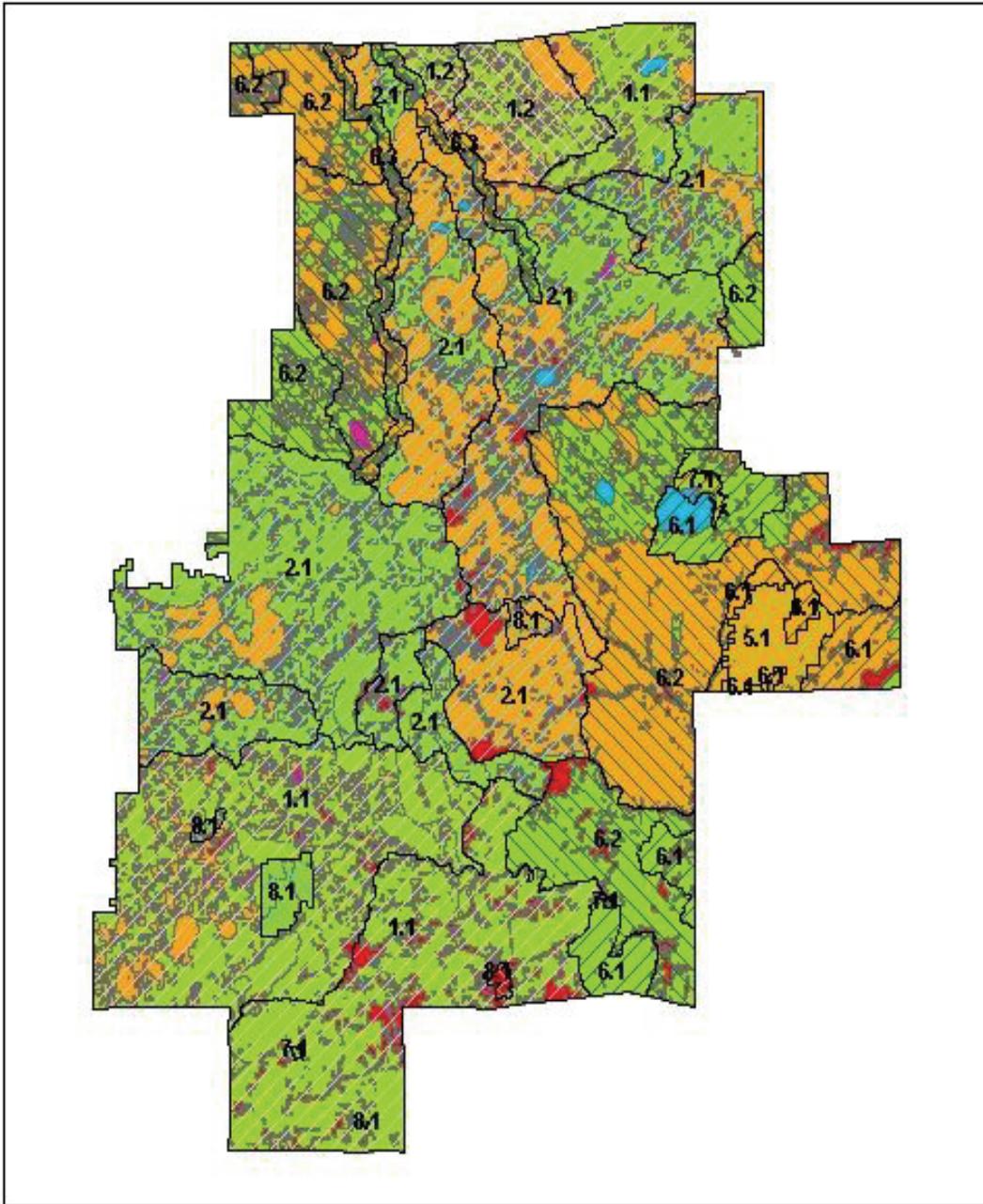


Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Figure 7 - Salem and Potosi Units

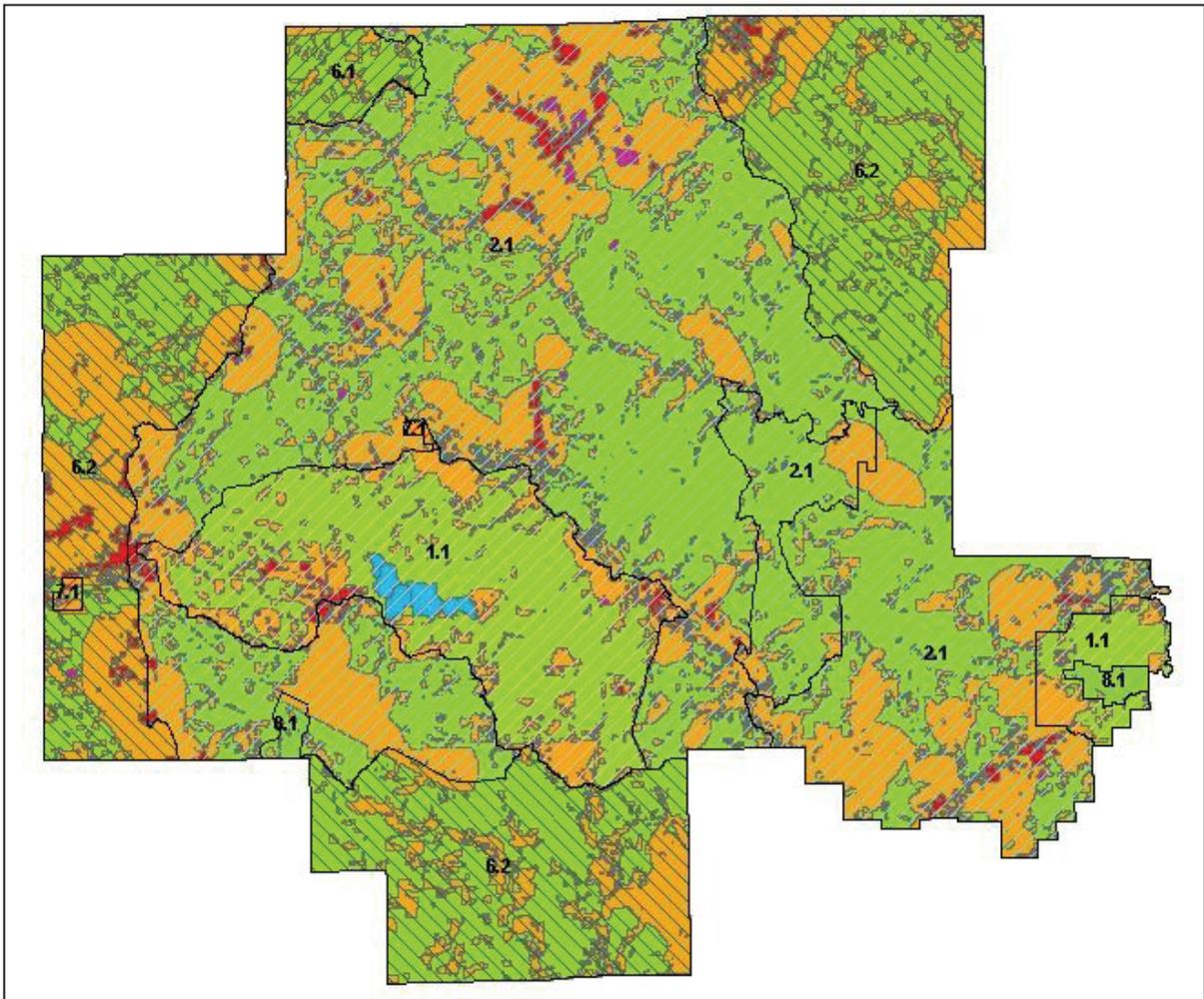


Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Figure 8 - Poplar Bluff

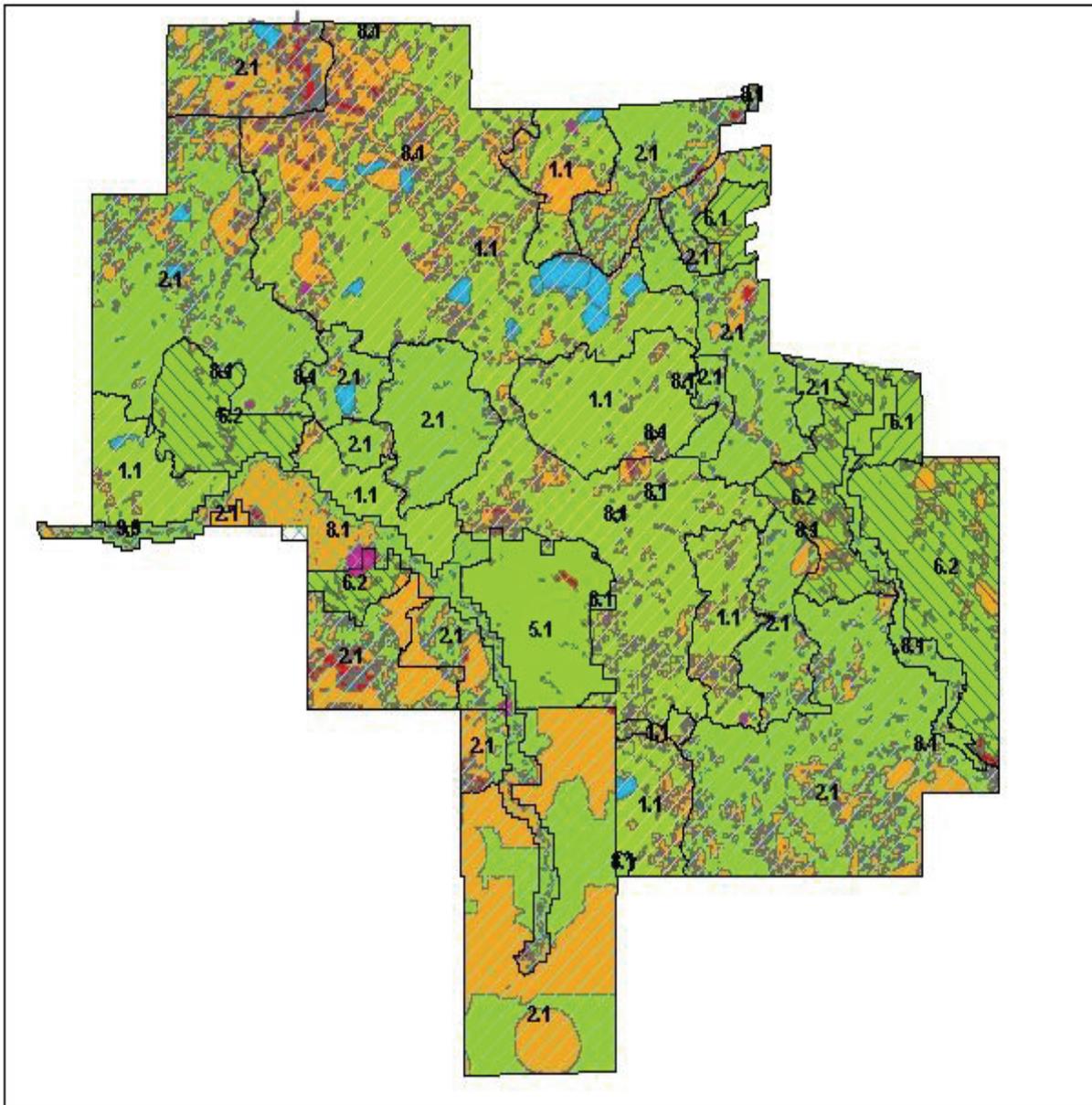


Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Figure 9 Doniphan/Eleven Point Unit



Note: Forest Plan Management Prescriptions for the selected alternative are shown

Legend

High Risk (25 – 47 Points)	
Moderate Risk (16 – 25 Points)	
Low Risk (2 – 15 Points)	
Wildfires 2000 – 2003	
Prescribed Fires 2000 – 2003	

Use of the Risk Assessment

The Fire Risk Assessment (FRA) can be used:

- as a guide to identify where fuels reduction projects are needed.
- to identify projects needed to prevent fire from entering high risk areas,
- to preposition suppression resources for initial attack,
- to determine where modified suppression responses may be best utilized,
- to locate areas best suited for wildland fire use,
- to “target” private landowners and communities for participation in Firewise or other prevention programs.

Fuels Reduction Projects

The highest priority for hazardous fuels treatments should be areas that are designated “High” or “Moderate” risk, in Management Areas 1.1 and 1.2. The next priority should be areas that are designated “High” or “Moderate” risk, in all other management areas. Planning hazardous fuels projects in areas designated as “Low” risk may be considered if those projects are imperative to keep fire out of high and moderate risk areas.

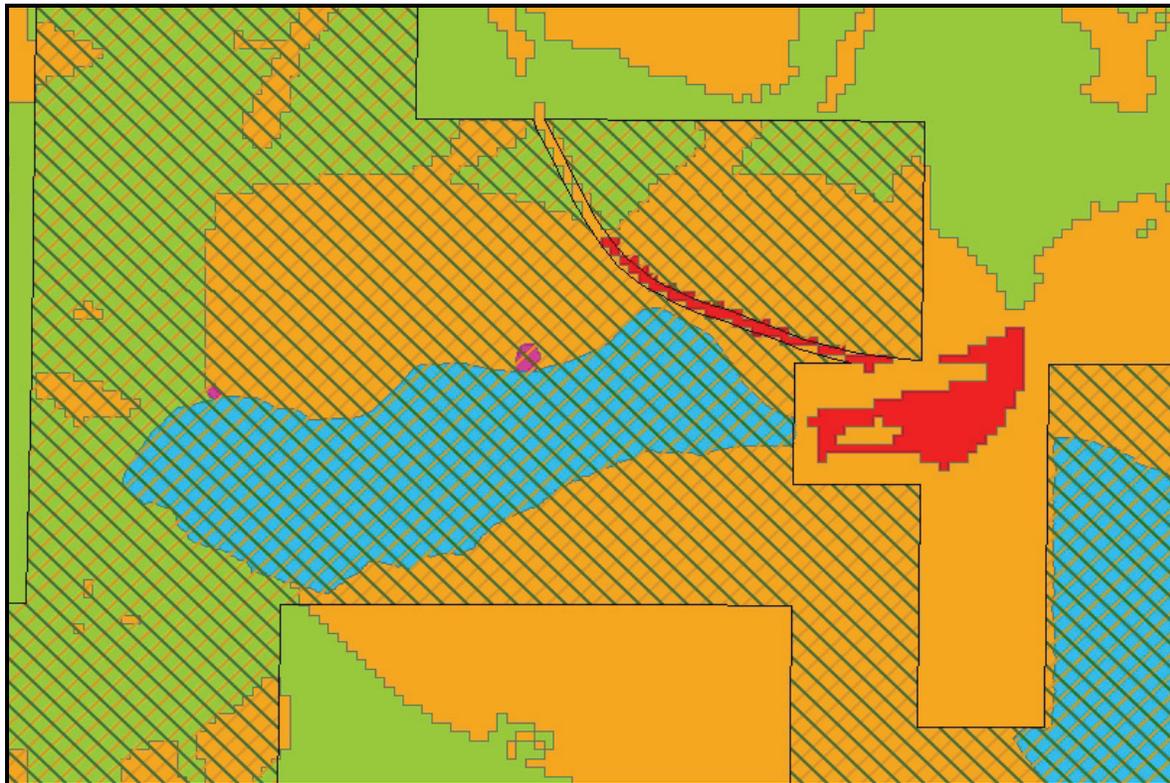
Other examples where low risk areas may be treated:

- Inclusions or fingers of Low risk surrounded by High or Moderate risk,
- an area of Low risk lies between a natural or manmade barrier and an area of High or Moderate risk,
- an area of Low risk is included in an area of High and Moderate risk to make a logical burn unit.

Projects specifically designed to reduce hazardous fuels in low risk areas should not be considered unless they meet one or more of the previous criteria.

To illustrate the appropriate location of projects, the following graphic (Figure 10) was clipped from Management Area 1.1 on the Doniphan/Eleven Point District. Prescribed fires were accomplished in areas of Moderate risk in Forest Service ownership. The graphic displays a history of wildland fire and an area of High risk in the same immediate location, on private land. Low risk was included in the project to make a logical burn boundary. Looking at projects at this resolution leads to the question of why burns were not planned to include more acres or a larger area. There also appears to be an opportunity to do hazardous fuels reduction projects on private land in cooperation with the Missouri Department of Conservation using Stevens/Wyden Act funding.

Figure 10 - Sample Use of Risk Assessment in Project Planning



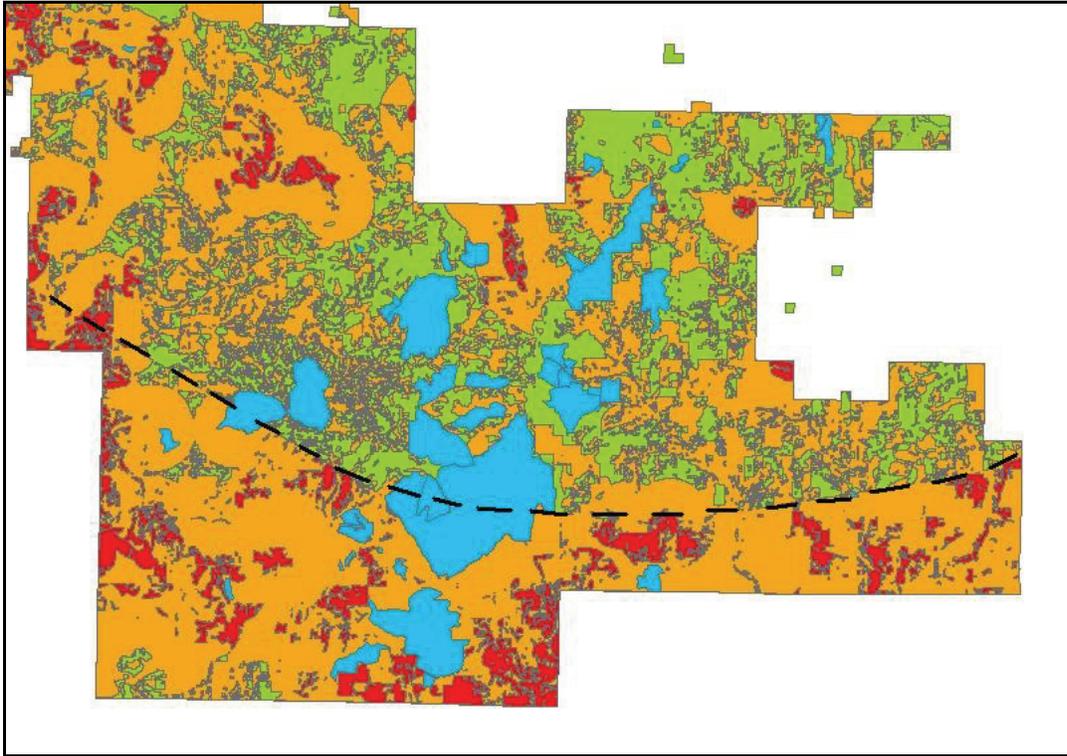
Legend

High Risk	
Moderate Risk	
Low Risk	
Historic Wildfires	
Accomplished Prescribed Fires	
FS Ownership	

Locating Initial Attack Suppression Resources

Two critical elements of the FRA are historic ignition points and response times. A study of these factors can show the need to move traditional standby locations or staging areas to improve response times and reduce risk. A good example is the Ava unit of the Ava/Cassville/Willow Springs Ranger District. There is an arc of Moderate risk running approximately from Hercules Glades east, to south of Thornfield Mo. (See Figure 11). While there are concentrations of structures in this area, much of the risk is generated by the response time from Ava, which is in the far NE corner of the graphic. By locating suppression resources south of Ava, some risk could be reduced. If moving resources south of Ava is not practical, other mitigation measures such as fuel reduction treatments need to be considered.

Figure 11 - Response Time Arc



Suppression Strategies

- In conducting wildland fire suppression, responsible officials shall give priority to the safety of firefighters, other personnel, and the public. Consistent with this priority, responsible officials shall conduct wildland fire suppression in a timely, effective and efficient manner. (FSM 5130.3)

An important goal of the Fire Risk Assessment is to ensure the intent of FSM 5130 is executed by offering a tool to decrease response time and increase efficiency. As areas of the Forest experience growth of the wildland urban interface, or more commonly the wildland intermix or rural interface, additional measures may need to be taken to protect structures and communities at risk. Aggressive suppression action must be taken in areas of High risk and to a somewhat lesser degree in areas of Moderate risk. As mentioned above, the location of suppression resources needs to be such that response times to areas of High risk are reduced to an acceptable level.

- In making decisions about how to organize and conduct suppression operations, line officers shall minimize both suppression cost and resource loss consistent with the resource management objectives for the values to be protected and shall consider fire behavior, the availability of suppression resources, the values of the natural resources and property at risk, direction in the Forest land and resource management plan, and the potential cost of suppression. (FSM 5130.3)
- The primary criteria for choosing fire suppression strategies and tactics are to ensure the safety of the public and the firefighting resources while minimizing suppression costs, resource loss, environmental damage, and the threat of wildland fire escaping onto non-Federal lands. (FSM 5130.3)

- Unit managers shall ensure that a cost-effective initial attack on any human-caused ignition is conducted. And, under no circumstances are suppression strategies and tactics tailored to achieve resource benefits. (FSM 5130.3)
- The selection of less aggressive containment strategies in areas of minimal potential negative impacts is appropriate if it determined to be the safest and least-cost alternative. (FSM 5130.3)

Based on these manual references, areas identified as Low risk may present opportunity for a reduced or less aggressive suppression strategy based on current and expected fire behavior. In practical terms, it may be more cost effective, and safer, to allow a fire to burn an extra 500 acres allowing the use of natural barriers, as opposed to using personnel, equipment, and time to construct firelines.

Items that must be considered by line officers and fire managers when considering less aggressive strategies include:

- Completion of a Wildland Fire Situation Analysis (WFSA); especially if more than one burning period is expected for control (FSM 5131.10).
- Current and predicted weather conditions
- Current and predicted fire behavior
- Potential for resource damage as a result of 1) the fire and, 2) suppression activities including fireline construction.
- Areas designated High or Moderate risk in the potential path of the fire, and the current Rate of Spread
- Smoke management
- Firefighter and public safety
- Resource Availability
- Firefighter Fatigue
- When a fire is person caused and there is a realistic expectation of billing the individual responsible for starting the fire, overall cost of the fire (suppression plus resource damage) must be a consideration.

Wildland Fire Use

Only natural ignitions are allowed for wildland fire use for resource benefits. Lightning is the only natural ignition that occurs on the Mark Twain National Forest. Over the last ten years, the Forest has had an average of 1.8 lightning fires per year. While the occurrence of lightning fires is infrequent, it does represent an opportunity for ignition. The fire risk assessment is a tool to help identify those areas of low risk where wildland fire use would be an appropriate management response. Possible candidate areas are the seven Wildernesses and other large, remote areas of low risk.

WFU Considerations:

- The Mark Twain National Forest Plan must approve Wildland Fire Use.
- The Fire Management Plan (FMP) must establish Fire Management Units, which would most likely follow Zone boundaries.
- A Maximum Manageable Area (MMA) will need to be established.
- A Wildland Fire Implementation Plan (WFIP) would need to be developed when the go/no-go decision leads to wildland fire use.

The purpose of giving managers the ability to select appropriate management response on every wildland fire is to provide the most responsible decision based on ecological, social and political factors, and the greatest flexibility possible to achieve greater balance in the program. To clarify the full range of options available under appropriate management response, the following figure utilizes four variables to illustrate development of an appropriate management response.

Management Responses to Wildland Fire

Figure 12 - Appropriate Management Response Matrix

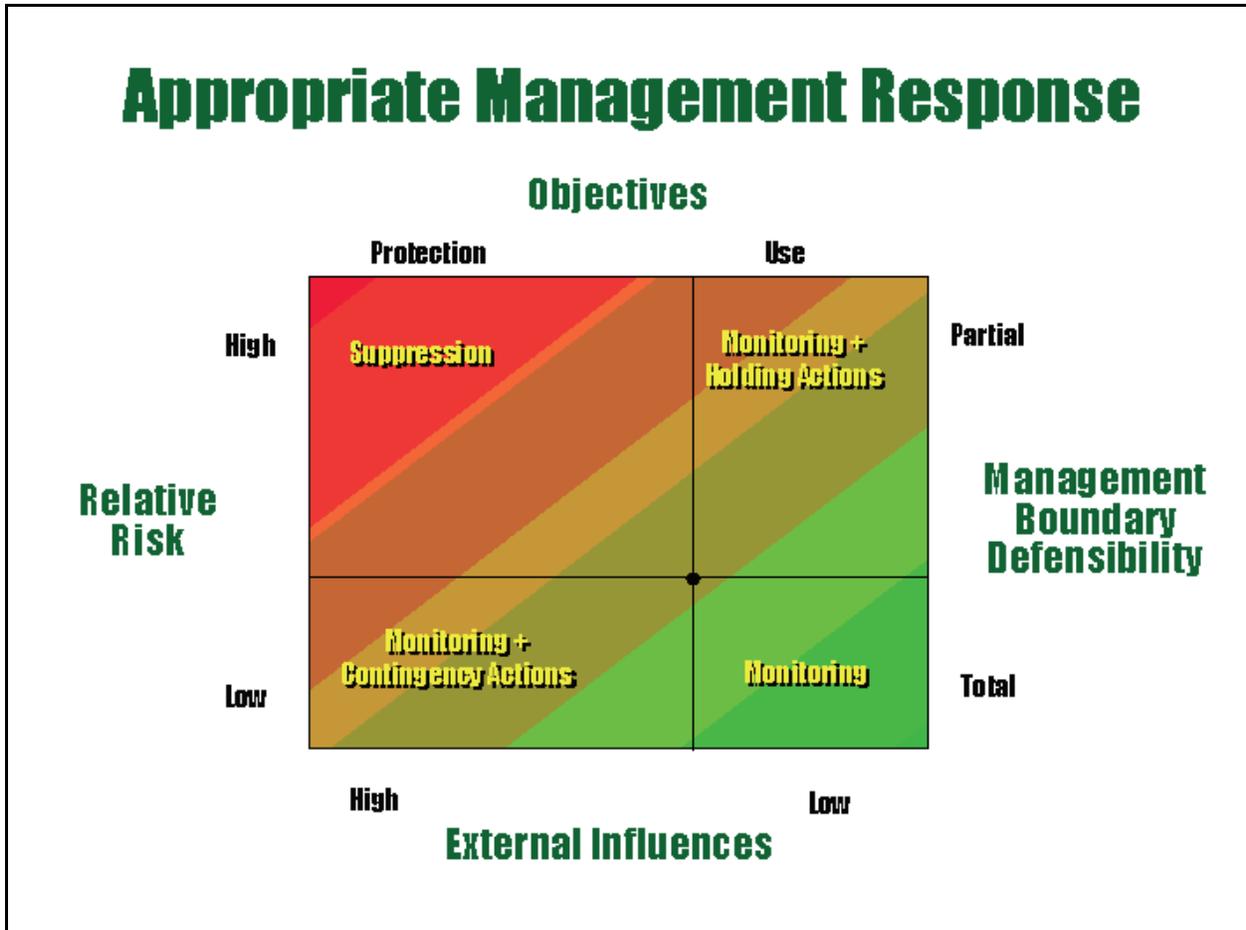
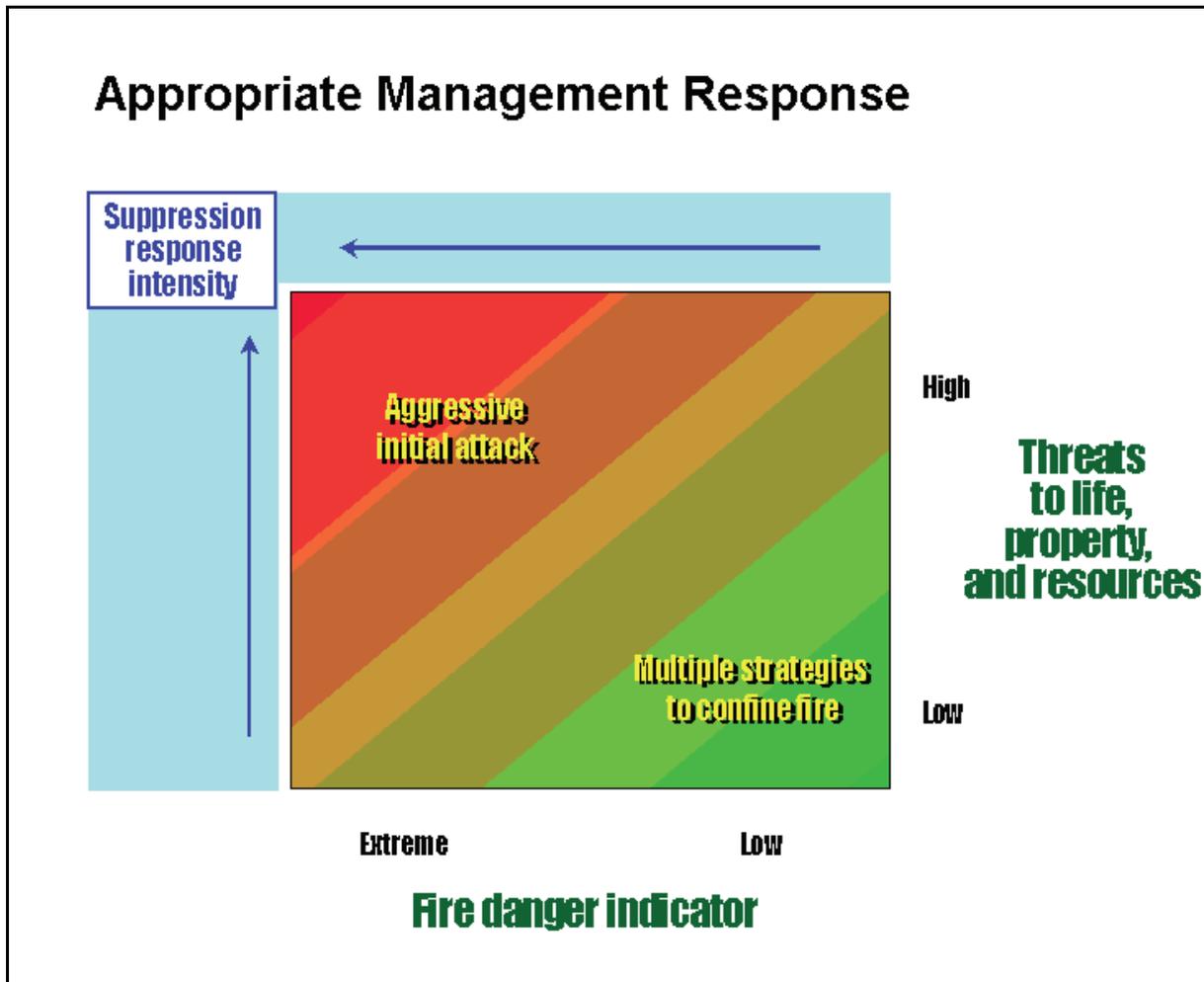


Figure 12 can be used to estimate appropriate methods to implement desired or necessary strategies. To obtain this estimate, lines must be drawn to connect top and bottom variables and left and right variables. At the intersection of two lines is a potential management response for the defined conditions. For the example in Figure 12 the appropriate management response would be Monitoring and Contingency Actions.

For those situations indicating a suppression response, a range of responses dealing with only suppression actions is available. The following chart illustrates how the range of appropriate suppression management responses can vary.

Figure 13 - Range of Appropriate Suppression-Oriented Responses



Stage I, II, and III, come directly from the Wildland Fire Implementation Plan (WFIP) (FSM 5130). The WFIP is a progressively developed assessment and operational management plan that documents analysis and selection of strategies and describes appropriate management response for a wildland fire. A full WFIP consists of three stages. See Figure 15 below.

Figure 15 - WFIP Implementation Stages, Requirement Status and Completion Timeframes

WFIP Stage	Planning and Assessment Element	Initial Attack	Requirement Status* Other Suppression-oriented appropriate management responses	Fire use actions	Maximum completion timeframe
WFIP Stage I: Initial Fire Assessment	Fire Situation	1	1	1	As soon as possible
	Decision Criteria Checklist (Initial GO-NO-GO Decision)	3	1	1	2 hours after first fire detection
WFIP Stage II: Short-term Implementation Actions	Short-Term Fire Behavior Predictions and Risk Assessment	3	1	1	24 hours after Stage I completion
	Short-term Implementation Actions	2	1	1	
	Complexity Analysis Stage III Need Assessment Chart	3 NA	1 1	1 1	
WFIP Stage III: Long-Term Implementation Actions	MMA Definition	3	4	4	Within 24 hours after Stage II or
	Fire Behavior Predictions	3	4	4	Periodic Fire Assessment
	Long-Term Risk Assessment	3	4	4	indicates need
	Long-term Implementation Actions	3	4	4	
Periodic Fire Assessment	Part 1: Re-validation	NA	1	1	On assigned frequency
	Part 2: Stage III Need Assessment Chart	NA	1	1	
WFSA		5	5	6	Before implementing new strategy

Requirement status key

- 1 = mandatory
- 2 = mandatory, but can be preplanned
- 3 = optional
- 4 = completed if Stage II or Periodic Fire Assessment, Part 2 indicate need.
- 5 = completed if fire exceeds management capabilities
- 6 = completed if Periodic Fire Assessment, Part 1 indicates need

For additional information please refer to “Wildland and Prescribed Fire Management Policy, Implementation Procedure Reference Guide. It can be found at:

http://www.fs.fed.us/fire/fireuse/wildland_fire_use/ref_guide/index.html

Prevention

Historically prevention efforts have been concentrated on schools, parades, and special events. Utilizing the FRA, managers can target prevention efforts in areas of high risk where there are communities and/or individual structures at risk. Materials such as “Living with Wildfire: How to assess your property and decrease the chance of wildfire damage to your home” (MDC), could be distributed to “at risk” areas by bulk mailings or during personal visits. During periods of high fire danger, prevention teams could accomplish site visits and offer evaluations

Community Protection Plans

The idea of community-based fire planning and prioritization is neither novel nor new. However, the incentive for communities to engage in comprehensive fire planning and prioritization was given new and unprecedented impetus with enactment of the Healthy Forests Restoration Act (HFRA) in 2003.

This landmark legislation includes the first meaningful statutory incentives for the US Forest Service (USFS) and the Bureau of Land Management (BLM) to give consideration to priorities of local communities as they develop and implement forest management and hazardous fuel reduction projects.

In order for a community to take full advantage of this new opportunity, it must first prepare a Community Wildfire Protection Plan (CWPP).

The HFRA provides communities with a tremendous opportunity to influence where and how federal agencies implement fuel reduction projects on federal lands and how additional federal funds may be distributed for projects on non-federal lands. A CWPP is the most effective way to take advantage of this opportunity.

The minimum requirements for a Community Wildfire Protection Plan as described in the HFRA are:

- **Collaboration:** In consultation with federal agencies and other interested parties, local and state government representatives must collaboratively develop a CWPP. ..
- **Prioritized Fuel Reduction:** A CWPP must identify and prioritize areas for hazardous fuel reduction treatments and recommend the methods of treatment that will protect one or more at-risk- communities and essential infrastructure. The FRA is the perfect tool to help communities with the identification and prioritization of proposed projects.
- **Treatment of Structural Ignitability:** A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the plan.

Mark Twain National Forest Contributors to Fire Risk Assessment

Mike Schanta	GIS Analyst
Margaret Olson	GIS Model Development, GIS Analyst
Bennie Terrell	Fuels Specialist
Ben Wyatt	Fire Management
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Jody Eberly	Wildlife Program Manager
Marvin Dablemont	Fire Management
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Lyn Carpenter	Fire Management/Assessment Development