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Prescribed Fire Complexity Rating System Guide

PMS 424 July 2017

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The *Prescribed Fire Complexity Rating System Guide* establishes interagency prescribed fire complexity analysis standards. The analysis provides a focused, subjective assessment by qualified prescribed fire burn bosses that is evaluated and approved by Agency Administrators, and provides insight and improves understanding of the significant risks associated with prescribed fire. The analysis:

- Provides decision support that highlights the risk to values associated with prescribed fire implementation.
- Identifies the technical difficulty (complexity) of managing the risk to values.
- Informs the complexity rating determination of high, moderate, or low for a prescribed fire.
- Identifies prescribed fire plan elements that may pose special problems or concerns.

The *Summary and Final Complexity Worksheet,* PMS 424-1, is supplemental to the *Interagency Prescribed Fire Complexity Rating System Guide,* PMS 424. This worksheet is designed to provide a clear summary of the overall complexity of a prescribed fire. The worksheet is located at: https://www.nwcg.gov/publications/424-1.

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Summary of Changes

Significant changes to the 2017 *Prescribed Fire Complexity Rating System Guide*, PMS 424, include:

- Clear and concise instructions for completing a prescribed fire complexity analysis.
- New spreadsheet analysis format.
- Preparers identify the number and significance of the on-site, off-site and political values associated with a prescribed fire.
- Elimination of '*Consequences*' as a complexity factor.
- Addition of '*Prescribed Fire Duration*' as a complexity element.
- A commonalities table that identifies common links between the complexity analysis and prescribed fire plan.
- Documentation of where and how risks are going to be mitigated per the prescribed fire plan elements.
- A calculated prescribed fire preliminary and summary complexity rating.
- A printable *Prescribed Fire Complexity Summary Rating* that includes a visual pre and post plan rating scheme.

Introduction

Sound risk management is a foundation for all fire management activities. Risks and uncertainties relating to fire management activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity (USDA, USDI, et al, 2009).

> The term complexity is generally used to characterize something with many parts where those parts interact with each other in multiple ways. In the context of the prescribed fire complexity analysis, complexity refers to the interconnectedness and dependence of the individual elements as they relate to the planning and implementation of the prescribed fire.

The complexity analysis process for prescribed fire continues to evolve. Originally, it was designed to assist personnel in determining relative complexity and determination of burn boss qualification. This process has been redesigned as a tool that identifies and characterizes risk to identified values and the technical difficulty or complexity of the 'work' involved to mitigate impacts to them. Assessing the risk a prescribed fire poses to identified values consists of estimating the probability and severity of adverse impacts. The Complexity Analysis process provides help with:

1. Value Identification.
2. Assessment of Risks to the Values.
3. Assessment of Technical Difficulty in mitigating the Risk to Values.
4. A Final Complexity Determination that identifies the minimum required burn boss qualification level.

A preliminary complexity analysis rating is required early in the prescribed fire plan development. The preliminary complexity analysis encourages early line officer engagement in the identification of values and the assessment of prescribed fire implementation risk to those values. It will help identify potential concerns that may be mitigated during the prescribed fire plan preparation. Local knowledge and judgment are important components of the preliminary complexity analysis.

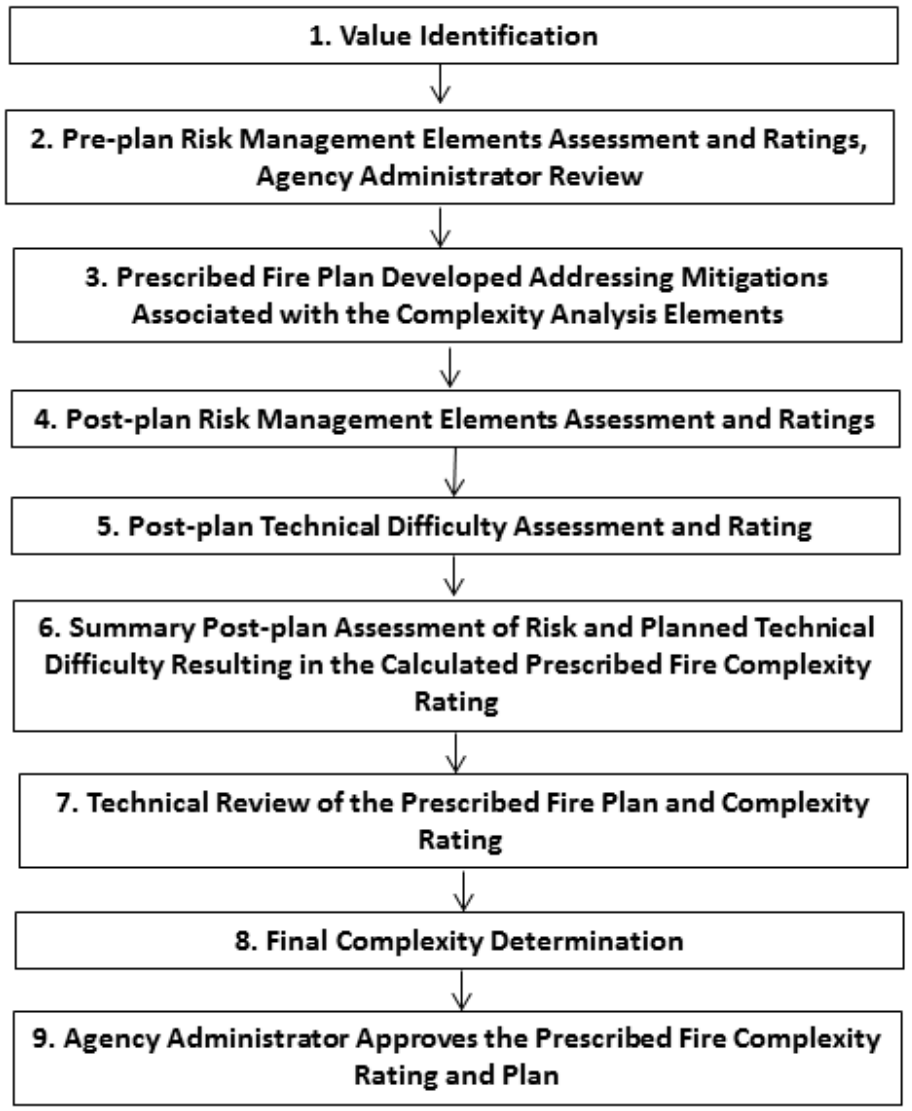
The prescribed fire plan is developed while considering the preliminary risk ratings and incorporating any mitigation actions into the appropriate sections of the prescribed fire plan. Once the prescribed fire plan is near completion, the final complexity analysis and rating is determined. The final complexity

rating, which acknowledges any remaining risk, will be used as the basis for determining the prescribed fire organization and type of prescribed fire burn boss required to successfully implement the prescribed fire plan.

The complexity analysis is initially integrated into the prescribed fire plan in the Assessment of Risk to Values phase. The individual prescribed fire plan elements provide the opportunity to address site-specific mitigation measures that will be employed to mitigate the Risk to Values identified. The Technical Difficulty phase evaluates the complexity of implementing the identified mitigation measures.

Process

The complexity of a prescribed fire is determined through a process as depicted in the following chart:



Analysis and Documentation Format

The analysis is completed in the *Summary and Final Complexity Worksheet*, PMS 424-1, to provide a clear, summary of the overall complexity of a prescribed fire. The worksheet can be found at: https://www.nwcg.gov/publications/424-1.

High, Moderate, or Low rating levels for each complexity analysis element are accessed through drop-

down menus within the worksheet. The summarized pre-plan and post-plan complexity ratings are calculated within the worksheet and plotted on a visual graphic for ease of comparison. To ensure worksheet integrity the worksheet should be electronically 'Saved As' (under the name of the prescribed fire) in the electronic file.

Prescribed Fire Complexity Elements Rating Descriptors

Rating descriptors guide the risk and technical difficulty element rating process. High, Moderate, or Low rating levels are assigned for each of the complexity analysis elements. For each complexity element, descriptors are provided to help determine a rating level. The descriptors are broad enough to capture common situations and assist the preparer in determining the best, most appropriate rating for risks and technical difficulties associated with the values identified in and around the project. The descriptors are not exhaustive; local insight, empirical evidence and site-specific information, guidance, and policies should also be used to assist the prescribed fire plan preparer to determine the appropriate rating.

Step 1: Value Identification

Determining the complexity of a prescribed fire starts with understanding the on-site, off-site, and public and political values associated with the prescribed fire. Values are natural resources, humans and their developments, and public and political (including cultural) features that have inherent worth (significance). The National Environmental Protection Act (NEPA) analysis and or land management plans, documents, inventories, site visits and interdisciplinary (ID) team input provide the information necessary to identify valuable features, their significance and susceptibility to negative impacts from the prescribed fire.

Values may not be equal in significance. A project may have one significant value with considerable social and political ramifications if impacted by the prescribed fire. Another project may have many values associated with it with less significance and fewer ramifications if impacted. Identifying the number and significance of values provides the foundation for identifying and mitigating the risks to the values during the planning process.

A review of the risk elements and their associated descriptors prior to a project site visit may assist with verifying the values and subsequently assessing the risk to them. The values typically do not change through the complexity assessment process unless that value is physically removed from the project area or area of impact.

On the Complexity Values Worksheet, identify the quantity and significance of the On-site, Off-site and Public and Political Interest Values associated with the prescribed fire.

- On-Site Values: Valued resources (human, natural, cultural) located within the project area directly affected by implementation of the prescribed fire.
- Off-Site Values: Valued resources (human, natural, cultural) located outside the project area that may be affected by implementation of the prescribed fire.
- Public and Political Interest: The degree of public and political interest in the implementation and outcome of the prescribed fire.

The following are examples of how these values would be identified in a Values Worksheet:

- On-Site Values: The Agency Administrator (AA) and ID Team identified the following as some of the on-site values: Mexican Spotted Owl habitat (listed species), some merchantable timber (20 acres), and the Snotel site in Jones flat. This list is not all-inclusive of the on-site values. The on-site values for this prescribed fire project can be summarized as: Few in Quantity and Low in Significance. The determinations are reflected in the Values Worksheet.

- Off-Site Values: The AA and ID Team have identified the following as some of the off-site values: One mile to the North of the project area is private commercial timber land. There is merchantable timber surrounding the project area along with Mexican Spotted Owl habitat. This list is not all-inclusive of the off-site values. The off-site values for this prescribed fire project can be summarized as: Few in Quantity and Moderate in Significance. The determinations are reflected in the Values Worksheet.
- Public/Political Interest Values: The AA and ID Team have identified the following as some of the Public and Political Interest Values: The public does not frequently visit the project area. Public comments to the NEPA analysis were minimal. Local cooperators (Montana Department of Natural Resource and Conservation) and timber industry are in support of the Project and will likely provide resources. This list is not all-inclusive of the on-site values. The Public and Political Values for this prescribed fire project can be summarized as: Few in Quantity and Few in Significance. The determinations are reflected in the Values Worksheet.

Step 2: Pre-Plan Risk Management Element Assessment and Rating

Step 2a – Pre-Plan Preparation: Risk Management Ratings

On the Complexity Preliminary Risk Worksheet and using the Risk and Technical Difficulty Descriptors as a guide (Appendix A), or by clicking on one of the three ratings in the Preliminary Risk column, rate complexity Elements 1-11 to describe the risk to the values identified in Step 1. Evaluate the elements individually by reading the risk descriptors for each element rating level, and then determine the most appropriate level of risk.

This is the point where local judgment and experience is important to ensure adequate description of risk to the identified values. The descriptors for each level are automatically populated in the associated cell for that element. If a project has unique or site-specific descriptions that affect the Risk to Values, that cannot be evaluated with the rating descriptors provided, they may be identified in the blank cell for each element descriptor in the worksheet.

The following Risk Management elements are analyzed:

- Safety: Hazards to personnel and public from planned prescribed fire activities through all phases of the prescribed fire. Safety is always considered for all elements.
- Fire Behavior: The difficulty of achieving the desired range of fire intensity, rate of spread and flame lengths to meet the prescribed fire objectives.
- Resistance to Containment: The conditions that influence the potential for a prescribed fire to leave the ignition unit or project area and resist containment effort.
- Ignition Procedures/Methods: Number and type of ignition devices, patterns, sequencing and/or timing required to safely ignite the prescribed fire and meet the objectives.
- Prescribed Fire Duration: The length of time (hours, days or weeks) that active ignition, fire spread, and primary holding operations (critical holding points are secure, transitioning to mop-up and patrol, etc.) are expected to occur in order to fully implement the prescribed fire.
- Smoke Management: The actions implemented by prescribed fire personnel directed at reducing the amount of smoke entering populated areas or impacting sensitive sites. Smoke management includes avoiding significant deterioration of air quality and violations of National Ambient Air Quality Standards, and minimizing or eliminating visibility impacts in Class I areas.
- Number and Dependence of Activities: Number and sequence of activities required to safely implement the prescribed fire and meet objectives through all phases of the project, including

logistics, pre and post burn considerations, communication, test fire, ignition and holding operations, contingency actions (if implemented), mop-up and patrol, monitoring, and ensuring firefighter and public safety.

- Management Organization: The organizational capabilities needed to safely achieve objectives specified in the prescribed fire plan. This includes all phases of the prescribed fire until declared out.
- Treatment/Resource Objectives: The degree of difficulty to meet specific, measurable, achievable, realistic, time-sensitive treatment and resource objectives for the prescribed fire.
- Constraints: Conditions or requirements that place sideboards on the prescribed fire plan implementation. Example: Seasonal timing, logistical restrictions, smoke management restrictions, and national preparedness levels four, and five.
- Project Logistics: Facilities, services and supplies required to support all phases of the prescribed fire (includes access complexity).

Step 2b – Preliminary Prescribed Fire Plan Complexity Analysis Review:

The preliminary risk rating is calculated within the spreadsheet and is displayed as an average of the 11 risk elements ratings. On the Final Complexity Worksheet, the preliminary rating is identified on the calculated summary prescribed fire plan complexity slider bar. Values are not included in the calculations. Once the values are determined, the preliminary risk ratings made, the preliminary complexity rating is calculated within the spreadsheet, it is recommended that the AA be briefed to discuss:

- **Identified Values**—this action can provide the AA the opportunity to review and provide feedback on the identified values.
- **Preliminary Risk Ratings to the Identified Values** —this action can provide an opportunity to discuss the preliminary ratings to better understand the risk to values associated with each element.
- **Preliminary Calculated Complexity Rating**—this action can provide the AA an overview of the risks associated with the prescribed fire and provide for feedback on the prescribed fire preliminary complexity rating.

On the Preliminary Risk Worksheet an additional column is provided to help the preparer identify if a briefing was completed with the AA for each element (Yes, No). It is not required that this occur but is recommended that the AA be engaged in the preliminary rating whenever possible.

If a preliminary risk rating indicates a high complexity for the prescribed fire, consider consulting a high complexity burn boss to help in the continued development of the prescribed fire plan.

Step 3: Develop the Prescribed Fire Plan

When developing the prescribed fire plan, identify the constraining and/or mitigating actions that are planned to manage the project's risks to values and determine a final complexity rating.

> The goal of prescribed fire plan development is to define a prescribed fire treatment that meets objectives while mitigating the Risk to Values to an acceptable level, and considering the Technical Difficulty of managing those risks.

Mitigation measures should be developed in the prescribed fire plan that will lower the higher preliminary risk ratings whenever feasible. In some situations, the rating will stay the same. Apply the adaptive management process by using lessons learned or monitoring reports from other projects to

provide input into prescribed fire plan development.

The complexity analysis and prescribed fire plan elements are not independent. Mitigating the risk of a complexity element through the prescribed fire plan may affect other complexity elements and require additional information or activities to be identified in other prescribed fire plan elements. For example, adding more holding resources in the prescribed fire plan to mitigate risk to an off-site value may increase the risk and technical difficulty related to management organization, number and dependence of activities, logistics, and others.

The Complexity Analysis and Prescribed Fire Plan Elements Commonalities Table (Appendix B) provides an example of common linkages between the complexity analysis and the prescribed fire plan elements. The table can be used as a tool to ensure elements rated in the complexity analysis are addressed in the prescribed fire plan.

Step 4: Post-Plan Risk Management Elements Assessment and Ratings

Step 4a – Re-rate the Risk Management Elements

At the completion of the prescribed fire planning phase, the complexity analysis Risk Management elements are again rated on the Complexity Post-Plan Worksheet under the Post-Plan Risk column to identify if risk was mitigated during the preparation of the prescribed fire plan. The Risk Management element descriptors are once again used to guide the decision process. The elements rating may or may not have changed from the initial rating. One element rating could go up or down based on what was learned in the planning process, i.e. fire behavior was overestimated because the actual fuel loading was less than first considered. Those unique project or site-specific descriptions that affect the Risk to Values are carried over from pre-plan risk determination to the associated blank cell in the worksheet.

Step 4b – Identifying Mitigation

An important part of the post-plan analysis is documenting where and how the risk was managed or mitigated by the prescribed fire plan elements. Mitigation actions developed in the plan are identified on the Complexity Post-Plan Risk Worksheet in the Elements and Actions in the Prescribed Fire Plan that Address Risk Mitigation column. Example: The fire behavior prescription has very specific fuel moisture, environmental parameters, and resulting fire behavior that presents potentially high risk. This was mitigated in the plan by adjusting parameters to meet objectives while moderating the fire behavior. Identify Prescribed Fire Plan Element 7 (Prescription) as the element in the prescribed fire plan where this mitigation is reflected and provide a brief description of the steps taken to mitigate the element rating. If no opportunity for mitigation existed, enter “no opportunity for mitigation” in the cell.

Step 5: Post-Plan Technical Difficulty Rating

Technical Difficulty is the level of skill and effort required to implement the mitigation actions for the identified risk for each element in the prescribed fire plan. These mitigation actions are captured when developing the prescribed fire plan elements. The post-plan technical difficulty rating provides a broad picture of the complexities associated with managing the risk to the values when implementing the prescribed fire plan. Use the Risk and Technical Difficulty Descriptors (Appendix A) or by choosing one of the three ratings in the Technical Difficulty Rating column on the Post-Plan Technical Difficulty Worksheet to describe and rate the technical difficulty for each element.

Those unique project or site-specific descriptions that affect the technical difficulty to mitigate the risks are identified in the associated blank cell under the list of descriptors.

Step 6: Final Calculated Prescribed Fire Complexity Rating

On the Summary and Final Complexity Worksheet, the summary complexity assessment combines the Post-Plan Managed Risk and Technical Difficulty ratings into a calculated complexity rating. This is a recommended complexity rating calculated within the worksheet. The graphic slider bar provides a visual representation of the calculated prescribed fire pre and post-plan summary complexity.

Step 7: Technical Review of the Prescribed Fire Plan and Complexity Analysis

The complexity analysis is reviewed as part of the Prescribed Fire Plan Technical Review process. Every prescribed fire plan must receive a technical review prior to the AA approval. The technical review ensures compliant prescribed fire plan content, as well as an evaluation of the risk and complexity analysis to ensure that the prescribed fire goals and objectives can safely and successfully be achieved. The Technical Reviewer provides concurrence with the calculated final complexity determination and may provide the plan preparer and agency administrator with a recommendation for the final complexity determination.

When technically reviewing the complexity analysis the reviewer should pay attention to how the risk and technical difficulty elements where mitigated in the plan. The Technical Reviewer should ensure adequate mitigation is provided in the prescribed fire plan to justify the pre and post risk ratings.

The Elements Commonalities Table (Appendix B) can be used as a guide. The Technical Reviewer should also ensure that the Technical Difficulty rating for the identified mitigation is appropriate. For qualifications, roles, and responsibilities of the Technical Reviewer and the technical review process, see the *Interagency Prescribed Fire Planning and Implementation Procedures Guide*, PMS 484.

Step 8: Summary and Final Complexity and Rating

On the Summary and Final Complexity Worksheet the calculated rating for each prescribed fire complexity analysis element is shown. The final prescribed fire complexity is manually identified in the Final Complexity Determination box using the drop-down menu. The determination of complexity should be based on the calculated rating, the technical review and an evaluation of how the prescribed fire plan mitigated pre-plan risks to values considering the technical difficulty (complexity) of the required mitigation. Be sure to re-consider the quantity and significance of values identified earlier and shown in the Values box.

The evaluation should be completed after discussion between the AA, local fire management and the prescribed fire plan preparer. If, as a result of the discussion, the AA feels that a higher or lower rating from what is identified in the calculated summary complexity is appropriate and they understand the risks associated with a modified rating, they may make an adjustment and the rationale for the determination is documented in the Final Complexity Determination Rationale cell. If they accept the calculated complexity rating and technical review the determination is documented in the summary rationale box. The rationale will clearly justify the rating for the prescribed fire. At a minimum, complexity analysis elements rated high that cannot be mitigated in the prescribed fire plan must be discussed in the rationale.

The final determination of prescribed fire complexity will be made per agency policy. In most cases the AA is required to make the final determination.

The final complexity determination of high, moderate, or low identifies the required qualification level of a prescribed fire burn boss needed to implement the prescribed fire.

The Summary and Final Complexity Worksheet must be signed and dated by the prescribed fire plan preparer, the technical reviewer, and AA. The signed Summary and Final Complexity Worksheet is

inserted into the prescribed fire plan as Element 3. On the completed Summary and Final Complexity Worksheet: right click and unprotect worksheet; highlight the entire worksheet area to be copied; right click; click on ‘copy’. On the *Prescribed Fire Plan*, Element 3: delete the directions text; right click; choose ‘picture’ as a paste option; resize as necessary to fit to the page.

An alternate solution is to print the Summary and Final Complexity Worksheet and insert it into the final plan.

The PMS 424-1 Values, Preliminary Risk, Post-Plan Risk, and Post-Plan Technical Difficulty Worksheets are printed and placed as Appendix C in the prescribed fire plan using the same procedures described above.

Retain an electronic copy of the completed worksheet in the electronic file for the project.

Step 9: Agency Administrator Approves the Prescribed Fire Plan

Once the technical review process is complete, the prescribed fire plan preparer and the AA sign the prescribed fire plan per instructions in the *Interagency Prescribed Fire Planning and Implementation Procedures Guide*, PMS 484.

Appendix A. Risk and Technical Difficulty Descriptors

1. Safety

Hazards to personnel and public from planned prescribed fire activities through all phases of the prescribed fire. Safety is always considered for all elements. Safety is also considered in the Risk and Technical Difficulty descriptors of all the elements.

Risk Management

Low	Moderate	High
• Safety issues and hazards are easily identifiable, addressed in briefings, and managed. • Minimal organization produces little exposure of personnel to hazards. • Adverse impacts to public health and safety are unlikely. • Activities are high frequency/low risk. • Fatigue and exposure to hazards are limited. • Standard safety briefings and attention to Lookouts, Communications, Escape Routes, and Safety Zones (LCES) are sufficient.	• Safety issues are pronounced and require detailed briefings, with certain hazards requiring special caution. • A small organization with a single branch results in modest exposure of personnel to hazards. • Adverse impacts to public health and safety are possible. • At least one activity is low frequency/high risk. • Fatigue and extended exposure to hazards are anticipated.	• Complex safety issues and significant hazards exist that require special briefings and cautions. • A large organization with multiple branches results in an increase of hazard exposure to personnel. • Adverse impacts to public health and safety are likely without appropriate mitigation. • Several activities are low frequency/high risk. • Fatigue and prolonged exposure to hazards require major consideration and specific mitigation.

Technical Difficulty — The degree of skill required by prescribed fire personnel and the relative difficulty of implementing mitigation actions identified in the prescribed fire plan that are directed at minimizing hazards to personnel and the public from environmental or prescribed fire activities through all phases of the prescribed fire.

Low	Moderate	High
• No special actions are required to mitigate potential minor accidents or injuries identified in the risk assessment/Job Hazard Analysis (JHA). • Safety concerns can be easily mitigated through LCES. • No preparation work or special project design features are required.	• Potential serious accidents/injuries or multiple accidents/injuries to personnel or public are mitigated by standard safety briefings and identified in existing risk assessments/JHA. • Special emphasis is needed for some elements of LCES. Some standard preparation work and/or project design features are required.	• Potential for serious accidents/injuries or multiple accidents/injuries to personnel or public have to be addressed with specific safety briefings. • Unusual number of JHAs or risk assessment elements is required to be analyzed. • A new risk assessment or JHA is required to be developed. • Careful attention to all elements of LCES is required. • Special or unique mitigation efforts are required. • A Safety Officer is recommended.

2. Fire Behavior

The difficulty of achieving the desired range of fire intensity, rate of spread and flame lengths to meet the prescribed fire objectives.

Risk Management

Low	Moderate	High
• Terrain is mostly flat or the slope and aspect are uniform, leading to a relatively unvarying fire. • Winds, fuel moisture, microclimate, and other fire conditions are relatively uniform and are not conducive to active fire spread. • Fire behavior is highly predictable. • Fire spread beyond the immediate ignition area(s) is not likely to occur or contribute to any control problems.	• Fuels vary within the unit, both in loading and arrangement. • Fire behavior may present control challenges that are easily mitigated. • Medium fuel loadings with some high concentrations are present. • Variable terrain features may significantly affect fire behavior and present moderate ignition and control problems. • Local winds and burning conditions may vary enough to cause shifts in fire behavior that briefly exceed modeled fire behavior and threaten controllability. • Periodic torching can be expected either as isolated points or in limited areas. • Probability of ignition outside of the unit is low and any spotting is expected to be short-range.	• Major variations in the fuel complex are likely to result in more intense fire behavior variations. • Wide variations in fire behavior may present major control challenges. • Terrain encompasses a wide range in slope steepness, abrupt changes in slope, and several directional aspects that lead to widely variable and unpredictable local winds and microclimate differences. • High intensity fire behavior may be expected outside the unit with high rates of spread, torching, possible crown fire runs. • Probability of ignition outside of the unit is high and short and long range spotting can be expected. • Potential fire spread and behavior outside the unit is equal to or greater than inside the unit.

Technical Difficulty — What degree of skill is required by prescribed fire personnel for predicting, producing, and sustaining the desired range of fire intensity, rate of spread and flame lengths to meet the prescribed fire objectives? What is the difficulty of maintaining containment of the prescribed fire under required fire behaviors to meet objectives? Are there specific skills or equipment needed for special or unusual ignition devises to produce or sustain desired fire behavior(s) i.e. terra / helitorch, PSD?

Low	Moderate	High
• Standard fire safety precautions are adequate to ensure personnel safety. • No fire behavior variations are expected and numerous barriers to fire spread exist. • The number, size or likelihood of spot fires and slopovers is minimal and do not require additional suppression resources. • Fire behavior is such that holding forces can easily control possible spot fires and slopovers using direct attack tactics. • No on-site operational fire behavior specialists are required.	• Some special provisions for safety are needed to protect personnel. • Fire behavior variations are minimal and do not require multiple fuel models to account for the fire behavior. • At least one barrier or containment opportunity exists. • Fire behavior is such that holding resources may need to use indirect tactics to control some spot fires and slopovers. • Occasional on-site fire behavior assessments or calculations may be needed and can be performed as a collateral duty. • Emission Reduction Techniques (ERTs) and Smoke Management Techniques (SMTs) require a close adherence to the prescription in the Rx plan.	• Fire behavior may create unique safety problems or the need for special escape routes or other safety measures. • Fire behavior variations require the use of several fuel models to develop the prescription parameters. • Limited containment opportunities exist. • Fire behavior is such that additional holding resources would be required along with indirect attack tactics. • Systematic fire behavior assessments and calculations are needed by a dedicated skill position. • Fire Behavior Analyst (FBAN) or Long Term Analyst (LTAN) is suggested for short or long duration prescribed fire operations, respectively. • ERTs and SMTs require a strict adherence to the prescription in the Rx plan the extensive contingency planning.

3. Resistance to Containment

The conditions that influence the potential for a prescribed fire to leave the ignition unit or project area and resist containment efforts.

Risk Management

Low	Moderate	High
• Ranges from no potential to a likelihood of few mechanisms such as spot fires, slopovers or fire creeping, each comprising small areas that are readily detected, accessed, and controlled by holding resources available on the prescribed fire. • No ladder fuels or concentrations are near critical holding points. • Ignition procedures do not create intense fire behavior. • Probability of ignition in fuels outside the unit is low. • Local drought and or fire danger indices are expected to be low to moderate.	• Potential for multiple wildfire mechanisms such as spot fires or slopovers that can propagate at moderate rates of spread but can be held by prompt holding actions. • Some fuel concentrations or ladder fuels exist near critical holding points. • Expected fire intensities in the primary fuel type create little potential to challenge standard fire lines. • The probability of ignition in fuels outside of control lines is low to moderate. • Some dependency on natural fuel breaks to hold the prescribed fire. • Local drought and or fire indices are expected to be moderate to high.	• There is a potential for multiple wildfire mechanisms (spot fires, slopovers, fire creeping etc.) that exceeds the capability of the holding force to detect and suppress. • Fuel concentrations near critical holding points include ladder fuels that challenge holding operations. • Expected fire intensities in the primary fuel type creates potential to challenge standard fire lines. • Probability of ignition in fuels outside the unit is moderate to high. • High dependence on natural fuel breaks to hold the prescribed fire. • Local drought and or fire indices are expected to be high to extreme.

Technical Difficulty — The conditions that influence the potential for a prescribed fire to leave the ignition unit or project area and resist containment efforts.

Low	Moderate	High
• Minimal holding resources are involved in the holding operation. • The burn unit and project area is easily accessible to the holding resources identified in the plan. • Minimal line width required to contain expected fire spread. • Minimal site prep is required.	• Several types of resources are involved in the holding operation. • Some portions of the burn unit and project area are not easily accessible to the holding resources. • Expected fire behavior outside the unit may require developing indirect attack options. • Areas outside of the project area have specific suppression action constraints or are on other jurisdictional lands that may limit containment efforts. • Some site prep is required. • Expected fire behavior outside of the unit requires moderate contingency planning.	• Many types of resources are involved in the holding operation. • Several portions of the burn unit and project area are not easily accessible and or some portions are inaccessible to the holding resources. • Expected fire behavior outside the unit requires development of indirect attack plans. • If the prescribed fire leaves the burn unit boundary it will enter a highly restrictive suppression resource area such as wilderness, swamp, unexploded ordinances (UXOs), cultural site that will directly impact on-site holding resource ability to contain the fire. • Extensive site preparation is required. • Expected fire behavior outside of the unit requires extensive contingency planning.

4. Ignition Procedures/Methods

Number and type of ignition devices, patterns, sequencing and/or timing required to safely ignite the prescribed fire and meet project objectives.

Risk Management

Low	Moderate	High
• An unexpected or adverse event is unlikely and coordination of firing sequence, patterns and timing is not critical to meet project objectives. • Specific fire intensities or rate of spread (ROS) are not critical for meeting resource objectives.	• Multiple firing sequences patterns and timing must be coordinated to meet project objectives and reduce the risk of an unexpected or adverse event. • Specific fire intensities or ROS are somewhat critical for meeting resource objectives but are readily attained by placing local skill sets in firing boss positions.	• Multiple firing devices, firing sequences, patterns, coordination and timing are critical to meet project objectives and reduce the risk of an unexpected adverse event. • Specific fire intensities or ROS are critical for meeting resource objectives. The use of experienced skill sets in supervision and lighting is mandatory for meeting objectives.

Technical Difficulty — The skill level(s) of the prescribed fire team to adequately manage the number and type of ignition devices, patterns, sequencing and/or timing required to safely ignite the prescribed fire and meet project objectives.

Low	Moderate	High
• There is no need for special firing equipment, techniques, or patterns. • Firing procedures are simple and ignition team is small. • Use of only one type of ignition device is planned. • The ignition pattern requires minimal supervision of the lighters to achieve project objectives and manage safety concerns. • Communications are easily maintained with a single tactical frequency. • The entire project area is readily visible to the Firing/Burn Boss.	• The need for multiple firing devices, sequences, techniques, or patterns has been identified. • Firing procedures are somewhat complex in at least some portions of the project area and a single Firing Boss (FIRB) is used. • Two different types of ignition devices are planned. • The ignition pattern requires direct control of the lighters to achieve project objectives and manage safety concerns. • Communications may require the use of a command (repeater) and at least two tactical frequencies will be used. • The project area is large but can be observed from high points and terrain and/or distance does not contribute to sequence and timing problems.	• The need for multiple special firing equipment or different techniques or firing sequences or patterns has been identified. • Firing procedures are complex and the ignition function may be broken into multiple teams with more than one FIRB is used. • Simultaneous ignitions will occur that require precise timing and communications to insure safety. • Ignition patterns and techniques to manipulate fire behavior are used and require tight control of the lighters to achieve project objectives and manage safety concerns. • Specialized communication equipment and planning (Portable or human repeater) is necessary to direct ignition operations. • More than three tactical frequencies will be used. • Many portions of the project area are not readily visible to the Firing Boss and Burn Boss.

5. Prescribed Fire Duration

The length of time (hours, days or weeks) that active ignition, fire spread and primary holding operations (critical holding points are secure, transitioning to mop- up and patrol etc.) are expected to occur in order to fully implement the prescribed fire.

Risk Management

Low	Moderate	High
• Ignition operations should be accomplished within one operational period. • Burn unit is small in size and residual burning is not expected after primary burn out of the unit. • Decrease in seasonal severity is expected. • Short time frame does not require special logistical support. • Mop-up is minimal or none is anticipated/planned.	• Active ignition, fire spread, and patrol is expected to occur for several operational periods. • Some residual burning (heavy fuel smoldering, stump holes, etc.) is expected to occur for several days after the primary burn out of the unit. • Mop-up and patrol is typical with minimal resource and equipment needs. • Primary holding phase is expected to be completed within reasonably predictable local weather forecasts. • The prescribed fire depends on accurate forecasts through three days.	• Long-term active ignition operations or fire spread is required to meet prescribed fire objectives. • A large amount of residual burning (heavy fuel smoldering, stump holes, etc.) or residual burning over a large area is expected to occur for at least a week after the primary ignition of the unit. • Long term mop-up and patrol with multiple resource types and equipment. • Primary holding phase may exceed reasonably accurate weather predictions. • Prescribed fire depends on accurate weather forecasts beyond over a three-day period.

Technical Difficulty — The length of time (hours, days or weeks) that active ignition, fire spread and primary holding operations (critical holding points are secure, transitioning to mop- up and patrol etc.) are expected to occur in order to fully implement the prescribed fire.

Low	Moderate	High
• Ignition and mop-up operations are usually completed in 1 to 2 operational periods. • Mop-up and patrol is typical with minimal resource and equipment needs. • Standard press release is sufficient for public notification.	• Ignition and mop-up operations are usually completed within 3 - 7 operational periods. • Multiple shifts may need staffing (day/night). • Required staffing may affect resource availability for other prescribed fires. • Additional dispatch support may be required. • Standard press release is sufficient for public notification. • The units Public Affairs Office (PAO) is required to be available to field questions from media and public. • Some fire behavior assessment is necessary to identify potential seasonality fire behavior. • Only a few Management action points (MAPs) are needed to identify how the fire will be managed if unfavorable events occur. • The length of time to complete the project and the size of the organization needed may increase. • ERTs and SMTs require daily attention to ensure that smoke constraints are not exceeded.	• Ignition, mop-up and patrol operations will last longer than 7 days, potentially for weeks. • Management organization will have to be adjusted to account for fire activity. • Multiple resource types and equipment. • Systematic fire behavior assessments and calculations are needed by a dedicated skill position (SOPL, FBAN or LTAN). • Additional dispatch support will be required. • A dedicated PAO will be on-site to field questions from media and public. • MAPs are required that will address how the fire will be managed if unfavorable events occur. • The length of time to complete the project and the size of organization will increase as season progresses. • Close coordination with States Department of Environmental Quality will be needed to ensure that short and long term smoke outputs can be managed and constraints are not exceeded.

6. Smoke Management

The actions implemented by prescribed fire personnel directed at reducing the amount of smoke entering populated areas or impacting sensitive sites. Includes avoiding significant deterioration of air quality and violations of National Ambient Air Quality Standards (NAAQS), and mitigating human-caused visibility impacts in Class I areas. Reference the NWCG Glossary.

Risk Management

Low	Moderate	High
• Smoke concerns are generally few or easily mitigated. • Smoke will be short-lived or inconspicuous. • Exposure to smoke by firefighters and the public will be minimal. • Few concerns exist about smoke from nearby communities.	• Noticeable smoke will be produced creating at least some public concern. • Short-term health or safety concerns related to smoke exposure may occur if actual weather deviates from forecasted. • Nearby communities are highly conscious of smoke from wildland fire. • Some possibility for a NAAQS exceedance violation. • The prescription or ignition portions of the plan need to consider smoke management.	• Conspicuous smoke will be produced creating significant public concern. • The possibility of health and safety issues due to smoke exposure exists. • Strong, widespread social/political concern about smoke is common in the affected area. • High possibility for a NAAQS exceedance violation. • Smoke impacts affect several prescribed fire plan elements.

Technical Difficulty — The degree of skill required by prescribed fire personnel and the relative difficulty of implementing the prescribed fire plan actions directed at minimizing the amount of smoke entering populated areas or impacting sensitive sites, avoiding significant deterioration of air quality and violations of NAAQS, and mitigating human-caused visibility impacts in Class I areas.

Low	Moderate	High
• ERTs and SMTs are simple, routine and straightforward to achieve and will provide desirable smoke management outcomes. • Some limitations may be present in the plan. • Wind and dispersion parameters are not constrained. • No sensitive receptors exist. • Minimal coordination with air quality officials is required.	• ERTs and SMTs require skilled application of the prescribed fire prescription. • Some considerations are needed in the prescription or ignition portions of the plan to employ ERTs, and SMTs. • Wind parameters are constrained but easy to achieve. • Sensitive receptors exist. • Burn window/opportunities are reduced by the required weather/dispersion conditions. • Normal coordination with air quality officials is required. • Some mitigation measures or additional smoke modeling may be needed to address potential concerns with smoke impacts. • Specific smoke monitoring may be required to determine smoke plume heights and directions. • Rotating project personnel out of dense smoke may be necessary but easy to accomplish. • Daily smoke management forecasts are adequate.	• Several considerations are needed in the prescribed fire plan in order to balance ERTs and SMTs against prescribed fire objectives. • Must be implemented under multiple specific constraints (specific wind parameters, season, etc.) to prevent impacts to sensitive smoke receptors. • Burn window/opportunities are limited by the required weather/dispersion conditions. • Special coordination with air quality officials is required. • Accelerated mop-up may be planned to reduce smoke impacts. • Some mitigation measures or additional smoke modeling are required to address potential concerns with smoke impacts. • Specific smoke monitoring is required to determine smoke plume heights and directions. . • Forecasts of long term atmospheric stability are required due to duration of the prescribed fire burn.

7. Number and Dependence of Activities

Number and sequence of activities required to safely implement the prescribed fire and meet objectives through all phases of the project, includes logistics, pre and post burn considerations, communication, test fire, ignition and holding operations, contingency actions (if implemented), mop-up and patrol, monitoring, firefighter and public safety.

Risk Management

Low	Moderate	High
• Activities are mostly independent from each other. • Coordination of activities is simple and straightforward. • The project does not involve another land management agency or jurisdiction.	• Several activities depend on achievement of previous or concurrent actions. • Several activities are interactive. • Communication is routine for coordination of activities and project success. • The project involves another land management agency, ownership or jurisdiction but project completion is not dependent on coordinated implementation. • Adjacent ownership supports the implementation of the prescribed fire.	• Numerous highly interactive activities are required for project success. • Numerous activities are complex and highly interactive. • High degree of coordination is required to manage prescribed fire implementation. • The project involves other land management agencies or jurisdictions and project completion is dependent on coordinated implementation. • Adjacent lands are excluded due to the lack of support for the prescribed fire treatment.

Technical Difficulty — The degree of skill required and the relative difficulty of implementing actions directed at managing and coordinating the number and sequence of activities required to safely implement and meet objectives through all phases of the project. This includes logistics, pre and post burn considerations, communication, test fire, ignition and holding operations, contingency actions (if implemented), mop-up and patrol, monitoring, firefighter and public safety.

Low	Moderate	High
• Minimal difficulty in coordinating the required activities. • Holding and lighting are loosely dependent on each other. • Coordination problems or communication failures or issues will not affect the completion of the project. • No to very few pre-burn considerations are required.	• Holding and lighting require close coordination and are dependent on each other to prevent spots or slopovers. • Continuous communication is necessary for successful project completion. • Some pre-burn considerations are required before ignition.	• Requires a highly skilled team to successfully complete the project. • Continuous coordination and communication is critical to the success of the project. • Requires implementation personnel to be familiar with capabilities of the resources used. • Multiple pre-burn considerations are required to take place before ignition.

8. Management Organization

The organizational capabilities needed to safely achieve objectives specified in the prescribed fire plan. This includes all phases of the prescribed fire until declared out.

Risk Management

Low	Moderate	High
• A small number of qualified people are required to implement the prescribed fire. • A single level of supervision is all that is needed (i.e. Burn Boss plus lighters and holders).	• Two levels of supervision are needed (i.e. Burn Boss, Ignition Specialist, and/or Holding Specialist, plus lighters and holders). • Special skills or supervision required for one function (RXB2 is suggested).	• Three levels of supervision may be needed (i.e. Burn Boss, FIRB, Holding Function, plus Squad Leaders and Squads) or multiple teams are needed to cover multiple shifts or a long duration project. • Special skills or supervision required for more than one function (RXB1 suggested). • Large organization increases potential for safety issues. • Considerable pre-burn preparation work is required.

Technical Difficulty — What organizational capabilities are needed to safely achieve objectives specified in the prescribed fire plan? This includes all phases of the prescribed fire until declared out.

Low	Moderate	High
• All team members are available within the local unit and are familiar with local factors affecting project implementation. • Several qualified personnel are available. • The operation is carried out employing a small burn crew. • There is no special pre-burn preparation organization is required.	• At least one primary team member may need to come from outside of the local unit and may not be familiar with local factors. • The numbers of qualified personnel available on the local unit are limited. • Special skills or supervision required for one function (RXB2 suggested). • Some pre-burn preparation work may require special organizational planning and/or coordination. • Protection of resource values requires extra considerations when developing certain elements of the prescribed fire plan. • Few resources are required for mop-up and patrol.	• Numerous and varied resources require a large team of specialized positions. • The prescribed fire has difficult access, complicated logistics, potentially conflicting objectives, unusual fuel complexes, and is proximate to smoke sensitive/non-attainment areas or wildland urban interface, and/or large scale/long duration. • The Burn Boss and/or two or more primary team members may need to be ordered from outside the local unit and may not be familiar with local factors. • Certain skills and qualified personnel are not available on the local unit. • Protection of values requires the development of special ignition **AND** holding plans. • Special skills or supervision required for more than one function. An RXB1 is suggested. • Numerous resources required for mop-up and patrol.

9. Treatment and Resource Objectives

The degree of difficulty to meet specific, measurable, achievable, realistic, time-sensitive prescribed fire treatment and resource objectives for the prescribed fire

Risk Management

Low	Moderate	High
• Few if any issues are present that hamper meeting treatment resource objectives. • Few or no adverse impacts are expected if resource objectives are not met. • No critical holding points.	• Issues are present that hamper or may prevent meeting treatment resource objectives. • Failure to meet objectives could have short-term adverse impacts. • Associated resources could be damaged if the prescribed fire did not meet resource objectives. • Few critical holding points.	• Substantial issues are present that hamper or prevent meeting treatment resource objectives. • Failure to meet objectives may have adverse long term impacts to resources. • Associated resources would be damaged if the prescribed fire did not meet resource objectives. • High intensity fire behavior is required in the unit to meet objectives. • Many critical holding points and considerable pre-burn preparation work is required to meet resource objectives.

Technical Difficulty — The degree of difficulty to meet specific, measurable, achievable, realistic, time-sensitive (S.M.A.R.T) prescribed fire treatment and resource objectives. (How big is the 'just right' window?)

Low	Moderate	High
• There are few resource objectives to meet. • Measures to achieve the objectives are easy to complete and there are few or no restrictions on techniques. • There are few or no restrictions on techniques and prescription parameters. • Basic monitoring of fire behavior and weather is needed to determine if prescribed fire objectives are being met. • Many other opportunities will exist to meet objectives in a given year. • Pre-burn site preparation is not required to meet resource objectives.	• There are several resource objectives to meet. • Measures to achieve the objectives are either 1) easy to complete but there are restrictions on the techniques or 2) moderately difficult to complete and there are few or no restrictions on techniques. • Additional monitoring of fire behavior and weather is needed to determine if prescribed fire objectives are being met. • Other opportunities to meet objectives are very limited in a given year.	• There are a high number of resource objectives. • Measures to achieve the objectives are both moderately difficult to highly difficult to achieve and there are restrictions on the techniques. • Extensive monitoring of fire behavior and weather is needed to determine if prescribed fire objectives are being met. • Opportunities to meet objectives are not available every year or may not be achievable without extensive fuels preparation work. • Objectives include changes in several strata of vegetation for ecosystem restoration or hazardous fuels reduction.

10. Constraints

Conditions or requirements that restrict or limit (place sideboards on) prescribed fire implementation. Example: Seasonal timing, logistical restrictions, smoke management, restrictions at national preparedness levels four and five, etc.

Risk Management

Low	Moderate	High
• Constraints exist with little impact on implementing the prescribed fire or achieving objectives.	• Constraints exist with some constraints imposing limits on implementing the prescribed fire or achieving objectives.	• Significant and/or competing constraints exist and impose limits on implementing the prescribed fire or achieving objectives.

Technical Difficulty— Assesses the level of skills required to adequately plan for and safely execute the prescribed fire within identified constraints while still achieving desired objectives.

Low	Moderate	High
• Constraints are easily accommodated and do not increase the difficulty of completing the project or achieving objectives. • Required weather and fuel conditions are locally very common.	• Some constraints are not easily accommodated and increase the difficulty of completing the project or achieving objectives. • Some prescribed fire parameters are dependent upon marginal environmental conditions. • The length of time to complete the project and the size of the organization may need to be increased.	• Constraints are hard to accommodate and significantly increase the difficulty of completing the project or achieving objectives. • Windows of opportunity or conditions within prescribed parameters rarely occur in the project area. • The length of time to complete the project and the size of organization will need to be increased and project feasibility may be in doubt.

11. Project Logistics

Facilities, services and supplies required to support all phases of the prescribed fire (includes access complexity).

Risk Management

Low	Moderate	High
• Minimal logistical support is needed to safely meet prescribed fire objectives. • No special equipment, support or communications needs are required.	• Some phases of the prescribed fire may require logistical support in order to safely meet project objectives. • Limited amount of special equipment or communication equipment requiring more intensive logistical support may be needed to complete the project.	• Extensive dedicated logistical support through most phases of the prescribed fire is required to safely meet project objectives. • Large amount of equipment or a communications network is needed that require intensive logistical support.

Technical Difficulty — The difficulty and skill required to obtain all required facilities, services and supplies to support all phases of the prescribed fire (includes access into and out of project area).

Low	Moderate	High
• No specific logistic function is required and the local unit will handle their own support needs. • Project is nearby and easily accessible. • Local cache can supply the needs of the prescribed fire.	• Project implementation requires a small logistical support operation. • Logistical support may be combined with other functions. • Obtaining some personnel may require additional contacts and advanced scheduling. • Additional support may be needed for out-of-area personnel. • Project duration may require a resupply to ensure successful remote prescribed fire implementation. • Support for meals, sanitation and camping sites may be required to complete the project. • Project is remote with long travel periods.	• Project implementation requires a large logistical support operation. • Separate logistical functions or a logistics team is required. • Obtaining the necessary personnel requires at least some additional contacts and does require careful scheduling. • Additional support will be needed for out-of-area personnel. • Scarce supplies/equipment requires extra lead-time to procure. • Support of meals, sanitation and camping sites are required in order to objectives. • Remote locations difficult to access or inaccessible to vehicles.

Appendix B. Complexity Analysis and Prescribed Fire (RX) Plan Elements Commonalities Example

This crosswalk provides examples of common linkages between the complexity analysis and the prescribed fire plan elements. The crosswalk can be used as a tool to ensure elements rated in the complexity analysis are addressed in the prescribed fire plan. Each individual prescribed fire plan may have slightly different linkages.

RX Fire Plan Elements

Complexity Guide Elements	1 Signature Page	2a AA Ignition Authorization	2b RX Go/No Go	3 Complexity Analysis Summary	4 Description of RX Fire Area	5 Objectives	6 Funding	7 Prescription	8 Scheduling	9 Pre-burn considerations and weather	10 Briefing	11 Organization and Equipment	12 Communication	13 Public and Personnel Safety, medical	14 Test Fire	15 Ignition Plan	16 Holding Plan	17 Contingency Plan	18 Wildfire declaration	19 Smoke Management and Air Quality	20 Monitoring	21 Post Burn Activities
1. Off-Site Values					H	H		M	L	H	H	L		H		M	H	H		M		
2. On-Site Values					H	H		H	M	H	H	L		H		H	H	H			H	
3. Public and Political Interest					H	M		L	L	H		L	H	H		L	H	H		H	L	
4. Safety					L	M		H	M	H	H	H	H	H	L	H	H	H		H	L	
5. Fire Behavior					H	H		H	H	H	H	H	H	H	H	H	H	H	H	M	M	
6. Resistance to Containment					M	L		H	M	L		H	L	M	H	L	H	H	H	L	L	
7. Ignition Procedures/ Methods					L	M		H	L	H	M	H	L	M	L	H	L	L		M	L	
8. Prescribed Fire Duration					L	M		M	L	H		H	M	M	L	L	H	H	H	H	L	
9. Smoke Management					M	L		H	M	H	M	L	M	H	H	H	H	M		H	H	
10. Number and Dependence of Activities					L	L		H	M	H		H	L	L	L	H	H	L		L	L	
11. Management Organization					L	L		H	L	H	M	H	L	L	L	H	H	M		L	L	
12. Treatment/ Resource Objectives					L	H		H	H	M		L	L	L	H	H	L	L		M	H	
13. Constraints					L	H		H	H	H		L	L	L	L	H	H	L		M	M	
14. Logistics					L	L		L	M	H		H	L	L	L	H	H	M		L	L	

* The degree of interaction between the Prescribed Fire Burn Plan and the Complexity Analysis (in most cases) is assessed as Low (L), Moderate (M) or High (H). Blank boxes indicate elements that would generally not require a complexity element rating.

The Prescribed Fire Complexity Rating System Guide is developed and maintained by the Fuels Management Committee, an entity of the National Wildfire Coordinating Group (NWCG).

Previous editions: 2015, 2004, 1995.

While they may still contain current or useful information, previous editions are obsolete. The user of this information is responsible for confirming that they have the most up-to-date version. NWCG is the sole source for this publication.

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