



PRESCRIBED FIRE COMPLEXITY RATING WORKSHEET **INSTRUCTIONS AND RATING EXAMPLES** DRAFT - 3/2/23

This Prescribed Fire Complexity Worksheet is intended for prescribed fire practitioners to help them assess the complexity of implementing a specific prescribed fire. The Worksheet was adapted from complexity analysis tools used by the Nature Conservancy fire program and the National Wildfire Coordinating Group.

The Worksheet can be useful for:

- Fire practitioners to evaluate their own burn units.
- Burn bosses to assess what types of burns they are qualified to implement and what their limits are.
- Instructors to illustrate to trainees and practitioners how fire complexity varies across the Midwestern landscape.
- Training organizations as a method for stratifying training program complexity, and for identifying the level and types of training that may be necessary.
- Burn plan reviewers seeking to assess escape risk in relation to burn complexity

The Worksheet is designed to assess the inherent characteristics of a burn unit, such as size, shape, topography, etc. Day-of-burn considerations, such as the acceptable range of weather conditions, predicted fire behavior, fuel moisture parameters, etc., should be addressed in the burn plan. Note that conditions such as very dry or windy weather, extremely dry fuel, or drought will significantly increase the complexity of burning a given unit. Conversely, higher humidity, higher fuel moisture, and increased soil moisture can reduce the complexity.

Complexity is not necessarily a function of the amount of equipment being used. Even a relatively small burn using only hand tools can be complex if there are issues with topography, shape of unit, changing fuel types, or long distance to nearest wheeled vehicle access.

Remember that every burn situation is unique and can change quickly. It is not possible for this worksheet to account for everything that might happen between the time the form is filled out and the time the fire is started. The go/no-go decision process should always include an assessment of whether the combination of conditions on the day of the burn will increase the complexity beyond the capabilities of the available personnel. Users should not rely on the complexity analysis to guarantee a safe burn.

The Worksheet contains fifteen Complexity Elements, each of which is assigned a complexity value from 1 (low complexity) to 5 (high complexity). The complexity value for each element is multiplied by the appropriate Weighting Factor to arrive at the Total Points for that element. The sum of all the elements' totals is the overall Complexity Score for the burn unit.

The Evaluation Examples provide guidance for determining the complexity values for each element. Note that examples are given for complexity values of 1, 3, and 5. Values 2 and 4 represent conditions that are intermediate to those described in 1, 3, and 5.

Some of the Complexity Elements include multiple considerations that can be used to arrive at a score for that element. Often, some of these considerations may have lower complexity ratings while others may have higher ratings. The user should use their judgment of the relative ratings of the various considerations to select the score for that element. The following approach could be used to decide on the specific value of 1-5 to be applied to a given element: If two of the bulleted items apply to an element, score it at that level. If many or most of the bulleted items apply, consider raising the value by one unit; for example, from 3 to 4. If only one of the bulleted items applies, consider lowering the value by one unit; for example, from 3 to 2.

Note that the Evaluation Examples are not necessarily comprehensive. There may be other issues not explicitly listed.

Complexity scores can range from a low of 55 to a high of 275, with lower scores expected to be rather simple burns and the highest scores expected to be very complex burns that are rarely seen in Wisconsin. Scores have been divided into only four categories: Low, Moderate, High, and Very High. As a result, you should expect that a burn unit that scores at 85 will be significantly easier to execute than a burn unit that scores at 134, even though both are categorized as "Moderate". The score for a given burn unit will also be somewhat "fuzzy" rather than absolute. Different people scoring the same unit will likely arrive at scores of plus or minus 5 points from each other.

Our expectation is that individuals who have met the requirements to become a Wisconsin Certified Prescribed Fire Burn Boss should have the training and experience to lead a burn with a score of 135 or less.

Every burn boss is always responsible to honestly assess their own capabilities relative to a given burn unit. They should accept leadership responsibility only for those burns that they are qualified to lead. The worksheet is useful for highlighting the interaction among various factors that can combine to make a burn more or less complex.

For example, a burn unit that scores 3 for every single complexity element would have an overall score of 165, which rates as High complexity, just one point away from Very High. This reflects that a large number of moderately complex factors combine to greatly increase the overall complexity.

On the other hand, if a unit has only one or two very complex elements, the overall rating will not be as high. For example, a unit that is very large with complex topography, but with scores of 1 and 2 for the other elements, would score around 118, which rates as Moderate complexity.

Please send your comments on the draft Worksheet to WPFCA Standards Committee Chair Jim Elleson at jim@hickoria.com.

Complexity Element	Complexity Value Evaluation Examples		
	1	3	5
1. Safety Weighting Factor 5	<ul style="list-style-type: none"> All safety issues have been identified and mitigated. 	<ul style="list-style-type: none"> Significant safety issues exist and some cannot be mitigated except by identifying them (e.g. Rock ledges, animal holes, side slopes on firebreaks, snag trees, burning off roadway, crew smoke exposure) 	<ul style="list-style-type: none"> Complex safety issues exist. Safety officer is assigned.
2. Difficulty of Containment Weighting Factor 5	<ul style="list-style-type: none"> Low threat of escape past unit boundaries. Boundaries naturally defensible or firebreaks easily installed and defended. Secondary control lines strong and easily accessed by vehicles and/or crew. 	<ul style="list-style-type: none"> Moderate threat of escape from unit boundaries. Moderate risk of slop-over or spot fires. Fuel type produces numerous firebrands. Secondary control lines difficult to access or not secure. 	<ul style="list-style-type: none"> High threat of escape from unit boundaries. High risk of slop-over or spot fires. Secondary control lines non-existent or inadequate without significant resource commitment.
3. Fuels and Fire Behavior Weighting Factor 5	<ul style="list-style-type: none"> Low variability in slope & aspect. Surface fuels (grass and/or leaf litter) only. Fuels are uniform. Duff or organic soils thin. Soils are not sandy or peaty. 	<ul style="list-style-type: none"> Moderate variability in slope & aspect. Ladder fuels present and isolated torching/candling possible. Fuel types/loads variable. Dense/tall shrub or forest with dense and combustible mid-story. Up to 4" of duff or organic soils Sandy soils impact fuel moisture. 	<ul style="list-style-type: none"> High variability in slope & aspect. Extreme fire behavior, such as canopy fire, and/or stand replacement fire possible. Fuel types/loads highly variable. Altered fire regime, hazardous fuel, excessive fuel loading, logging slash. Thick layer of duff or organic soils.
4. Infrastructure at Risk Weighting Factor 5	<ul style="list-style-type: none"> No risk to people or property within or adjacent to fire, or values to be protected are easily mitigated. Potential damage from escape low. 	<ul style="list-style-type: none"> Several values to be protected. Mitigation through planning and/or preparation is complex. May require some commitment of specialized resources. Potential damage from escape moderate. 	<ul style="list-style-type: none"> Numerous values and/or high values to be protected. Severe damage likely without significant commitment of specialized resources with appropriate skill levels. Potential damage from escape high.
5. Burn Unit Size Weighting Factor 4	<ul style="list-style-type: none"> < 6 acres 	<ul style="list-style-type: none"> 60 – 150 acres 	<ul style="list-style-type: none"> > 500 acres Unit large enough to force night-burning
6. Burn unit shape Weighting Factor 3	<ul style="list-style-type: none"> Unit is a simple polygon or circle 	<ul style="list-style-type: none"> Unit is a complicated polygon such as long and linear or has breaks that turn abruptly enough to alter fire behavior 	<ul style="list-style-type: none"> Unit has multiple cases of irregular fire break shapes.
7. Burn unit topography Weighting Factor 3	<ul style="list-style-type: none"> Topography does not influence fire or crew behavior 	<ul style="list-style-type: none"> Unit has hills large enough to affect fire or crew behavior 	<ul style="list-style-type: none"> Unit contains multiple slopes and aspects that influence fire behavior

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<p>8. Objectives</p> <p>Weighting Factor 3</p>	<ul style="list-style-type: none"> • Maintenance objectives. • Prescriptions broad. • Easily achieved objectives. 	<ul style="list-style-type: none"> • Reduction of both live and dead fuels. • Moderate to substantial changes in two or more strata of vegetation. • Objectives judged to be moderately hard to achieve. • Objectives may require moderately intense fire behavior. 	<ul style="list-style-type: none"> • Precise treatment of fuels and multiple ecological objectives. • Major change in the structure of 2 or more vegetative strata. • Conflicts between objectives and constraints. • Requires a high intensity fire or a combination of fire intensities that are difficult to achieve.
<p>9. Managing People</p> <p>Weighting Factor 5</p>	<ul style="list-style-type: none"> • Span of control held to 2. • 1-4 person crew • 0-2 equipment resources (ATVs, UTVs, Engines) 	<ul style="list-style-type: none"> • Span of control held to 4. • 8 - 16 person crew • 4 equipment resources (ATVs, UTVs, Engines) • Pre-positioned non-motorized resources (e.g. fuel and water). 	<ul style="list-style-type: none"> • Span of control > 6. • >6 equipment resources • Multiple divisions or groups. • Specialized resources (dozers, aerial support, etc.) needed to accomplish objectives. • Organized management team required (Fire Use or Incident Management).
<p>10. Contingency Planning and Resources</p> <p>Weighting Factor 4</p>	<ul style="list-style-type: none"> • Adequate contingency resources on site. 	<ul style="list-style-type: none"> • Contingency resources limited or have more than a 15 - 30 minutes response time. 	<ul style="list-style-type: none"> • Contingency resources limited or have more than a 60 minutes response time.
<p>11. Natural, Cultural, and Social Values</p> <p>Weighting Factor 3</p>	<ul style="list-style-type: none"> • No risk to natural, cultural, and/or social resources within or adjacent to fire, or mitigation through planning and preparations is adequate. • No fire-sensitive species present (reptiles, insects, others). 	<ul style="list-style-type: none"> • Several values to be protected within unit. • Fire-sensitive species must be accounted for in planning, preparation, or day-of operations. • Mitigation through planning and/or preparations is complex. • May require some commitment of specialized resources. 	<ul style="list-style-type: none"> • Numerous values and/or high values to be protected. • Fire-sensitive species pose significant constraints on burn operations. • Severe damage likely without significant commitment of specialized resources with appropriate skill levels.
<p>12. Air Quality Values</p> <p>Weighting Factor 3</p>	<ul style="list-style-type: none"> • Few smoke sensitive areas near fire. • Smoke produced for less than 1 burning period. • No air quality agencies are involved. 	<ul style="list-style-type: none"> • Multiple smoke sensitive areas, but smoke impact mitigated in plan. • Smoke produced for 2 burning periods. • Air quality alerts are sometimes enacted during the burn season. • Infrequent consultation with air quality agencies is needed. 	<ul style="list-style-type: none"> • Multiple smoke sensitive areas with complex mitigation actions required. • Health or visibility complaints likely. • Smoke produced for greater than 3 burning periods. • Multi-day air quality alerts are often enacted during the burn season. • Smoke sensitive Class I air-sheds. • Frequent consultation with air quality agencies is needed.

Complexity Element	Complexity Value Evaluation Examples		
	1	3	5
<p>13. Logistics</p> <p>Weighting Factor 3</p>	<ul style="list-style-type: none"> • Easy access. • Duration of fire is 1 day (holding or monitoring). • No pre-positioned resources (water, fuel, hose lays, etc) required. 	<ul style="list-style-type: none"> • Difficult access. Portions of burn breaks accessible for hand crew only • Duration of fire support >1 day. • One person dedicated primarily to logistics for duration of burn. • Anticipated difficulty in obtaining resources. • Pre-positioned resources (water, fuel, hose lays, etc) needed to hold lines. 	<ul style="list-style-type: none"> • No vehicle access. • Duration of support is greater than 3 days. • Multiple logistical positions assigned. • Remote camps and support necessary.
<p>14. Rx Fire Implementation</p> <p>Weighting Factor 3</p>	<p>Simple ignition patterns with no one inside the unit. Single ignition method used. Ignition complete within one burning period. Resources (other than simple mop up or monitoring) required for 1 day only. Holding requirements minimal.</p>	<p>Multiple firing methods and/or sequences with two igniters inside the unit at once. Use of specialized ignition techniques (e.g. flank or dot ignition to manage heat near power lines, structures, etc.) Use of ground launched specialized ignition methods (flares (e.g. flares) Ignition continues for two burning periods. Resources required for 2 days. Holding actions to direct or delay fire spread.</p>	<p>Complex firing patterns highly dependent upon local conditions. Simultaneous use of multiple firing methods and/or sequences. Simultaneous ground and aerial ignition. Resources required for over 3 days. Multiple mitigation actions at variable times identified. Aerial support for mitigation actions desirable or necessary.</p>
<p>15. Cooperator Coordination</p> <p>Weighting Factor 1</p>	<p>Cooperators not involved in operations. Single land owner No concerns.</p>	<p>Low potential for scheduling conflicts with cooperators. Simple joint-jurisdiction fires. Some competition for resources. Some concerns. More than two land owners and/or owner(s) place constraints on burn.</p>	<p>High potential for scheduling conflicts with cooperators. Complex multi-jurisdictional fires. High competition for resources. High concerns. Multiple land owners and multiple constraints that limit fire window.</p>