Fire Use Planning

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The success of a fire use program is in large part dependent on a solid foundation set in clear and concise planning. The planning process results in specific goals and measurable objectives for fire application, provides a means of setting priorities, and establishes a mechanism for evaluating and refining the process to meet the desired future condition. It is an ongoing process, beginning months or even years in advance of actual fire use, with plans becoming increasingly specific as the day of the burn approaches. Although details differ between fire practitioners, the general planning process is essentially the same.

Land and Resource Management Planning

Fire use planning should begin as a component of the overall land and resource management planning for a site. Consideration of the intentional use of fire to achieve stated resource management goals should be an integral part of this process. In deciding whether or not fire use is the best option to accomplish a given objective, an analysis of potential alternative treatments should be completed. This analysis should describe the risks associated with use of a given treatment and include expected negative as well as beneficial outcomes. Care should be exercised to separate statements that are supported by data (preferably local and ecosystem-specific), from those only purported to be true.

Many private landowners do not have written resource management plans, but most have a vision of what natural resource attributes they want to favor and what they want their lands to look like. We recommend they put this vision on paper to provide guidance to themselves and their heirs.

The plans should identify any barriers to implementing a treatment judged best from a resource management standpoint, such as regulations, cost, or insufficient resources. If such a treatment is not recommended because of these barriers, the probable ecological ramifications of this decision should be documented. On sites where fire is selected as the best alternative to accomplish the desired resource management objectives, the next step in fire use planning is to develop a fire management plan.

The Fire Management Plan

The fire management plan addresses fire use at the level of the administrative unit, such as a forest, nature preserve, park, ranch or plantation. It ensures that background information

about the area has been researched, legal constraints reviewed, and a burn program found to be both justified and technically feasible. It proposes how fire will be applied to the landscape, both spatially and temporally. When managing for multiple resources (e.g., range, wildlife, and timber) on a tract, guidance should be provided regarding the allocation of benefits; i.e., should benefits to the same resource always be maximized on given burn units, or should the focus be rotated among benefits on some, or all burn units over time?

Items commonly addressed in the fire management plan are:

- Background information on the area, such as topography, soils, climate and fuels
- Applicable fire laws and regulations, including any legal constraints
- Landowner policy governing fire use on this tract of land
- Fire history of the area, including the natural fire regime, and recent fire occurrence or use
- Justification for fire management
- Fire management goals for the area, including a description of the desired future condition. (Objectives for specific burns are set in the burn unit plan, see below.)
- Fire management scheduling, qualitatively describing how fire will be applied to the site over time to achieve stated resource objectives. (Quantitative descriptions of fireline intensity, fire severity, and season of burn are set in the burn unit plan, see below.)
- Species of special concern, wildlife habitat issues, invasive species issues
- Definition and descriptions of treatment units or burning blocks
- Air quality and smoke management considerations
- Neighbor and community factors
- Maps illustrating fuels distribution, treatment units, smoke sensitive areas, etc.

When complete, this document should enable the resource manager to gain the support (both internal and external) and identify the resources needed to effectively and efficiently use fire as a management tool.

Community involvement in the fire planning process is crucial to public acceptance of fire use. At what stage to involve the public in the process will depend on regional issues, regulations, and organizational policy. In general, the earlier the public is involved, the easier it is to reach agreement on any concerns. Whenever it is done, it is important to remember that public support is key to the long-term success of a fire management program. Unexpected results, including under-achievement and over-achievement of objectives, are bound to occur. A full, honest discussion of the potential for such results, and their ramifications, can defuse negative reaction to the occasional bad outcome, especially if the public was involved early in the planning process.

Further guidance for developing a fire management plan is available from a number of federal sources, including *Wildland and Prescribed Fire Management Policy: Implementation Procedures Reference Guide* (USDI and USDA Forest Service 1998), and from The Nature

Conservancy's *Fire Management Manual* (www.tncfire.org/manual).

The Burn Plan

Once the fire management plan is completed and approved, the next step is implementation—not an easy task. Resource managers are usually faced with numerous constraints, such as budget and staff limitations, equipment availability, timing of good burning conditions, and a lack of information on potential effects. A successful prescribed fire program requires the complete dedication of the fire management staff, full cooperation of all personnel and functional areas involved, and unwavering support and commitment throughout the chain of command.

Although the overall resource management goals for an individual burn unit often remain unchanged for long periods, the specific burn objectives for a given unit will likely vary over time, necessitating modifications to the unit plan for each burn. For example, the use of a heading fire during the growing season to promote biodiversity and flowering of ground layer plants may be the current burn objective, while a backing fire during the dormant season may have been used to reduce hazardous fuels loads the last time the unit was burned.

A written burn plan serves several important purposes:

- It makes the planner think about what he/she wants to achieve, and how it will be accomplished.
- It allows the fire manager to prioritize between burn units based on constraints and objectives.
- It functions as the operational plan that details how a burn will be safely and effectively conducted.
- It serves as the standard by which to evaluate the burn.
- It provides a record for use when planning future burns (which makes it essential to document any changes when the burn is conducted, directly on the plan).
- It becomes a legal record of the intended purpose and execution of the burn project.

There is no standard format for a burn unit plan; numerous examples are available which can be consulted for guidance. Sources include state and federal land management agencies, The Nature Conservancy's internet site (www.tncfire.org), or publications such as *A Guide to Prescribed Fire in Southern Forests* (Wade and Lunsford, 1989), which is available online from the Alabama Private Forest Management Team website (www.pfmt.org/standman/prescrib.htm), and from the Florida Division of Forestry (flame.fl-dof.com/Env/Rx/guide/).

Although formats differ, certain components should be included in all burn plans. They should address at least the following 12 topics:

1. **Assessment and Description of the Burn Unit.** The first step in developing a burn plan is to evaluate and document existing conditions. Factors to include depend on the site itself, as well as the complexity of the planned burn. The information recorded here will serve as the baseline from which success of the burn will be determined, so parameters used in the burn objectives should be assessed and described. Include details on the unit size (broken into single-day burn units); date of the last burn; overstory and under-

story vegetation, density and size; fuel type, density and size; soil type and topography; threatened and endangered species present; invasive species present; and current wildlife use.

2. **Maps.** Good maps of the treatment area are a key component of the burn plan. The map scale should be adequate to show pertinent information in meaningful detail. Be careful not to include too much information on a single map, making it difficult to read. The burn plan should include a series of maps showing the following: unit boundaries; adjacent land ownerships, including contact person and phone numbers; topography and manmade obstacles such as canals, ditches, and erosion gullies that would impede equipment or people; natural and constructed fire control lines; areas to be protected or excluded such as sawdust piles, utility poles and sensitive vegetation areas; firing plan; initial placement of equipment and holding personnel, and; escape routes and safety zones. Every crew member should receive a map with the information essential to personnel safety and burn operations.

3. **Measurable Burning Objectives**. Unit-specific treatment objectives identify the desired changes in affected resources from the present to the future condition. Treatment objectives are prepared within the context and intent of all resource management objectives. They are the measures against which the success of a burn is determined. Burn objectives make clear to everyone involved what is expected - including the burners, cooperators, managers, and the public. The objectives should be detailed statements that describe what the treatment is intended to accomplish, and as such, must be specific and quantifiable.

4. **Weather and Fuel Prescription**. The prescription defines the range of conditions under which a fire is ignited and allowed to burn to obtain given objectives. Fuel moisture (by size class) and weather conditions (temperature, humidity, wind, drought, dispersion index) are key factors in achieving objectives because they in large part determine fire behavior (intensity and severity), which in turn, governs ease of fire control and effects. These same parameters also affect smoke production and transport. Considerable care should therefore be taken in defining the window of conditions under which the projected burn may take place. Although there may be an ideal set of conditions that will maximize a single objective, the likelihood of this set of conditions occurring at the right time is typically extremely low. Therefore, a range of fuel and weather conditions are usually specified in the burn prescription that allow the skilled burner to compensate between various parameters to safely and efficiently conduct a successful burn—a burn which meets both the resource and smoke management objectives.

5. **Season and Time of Day**. The season of burn influences many burn parameters. Typically, acceptable burning conditions are more predictable during certain seasons, making it easier to plan and prepare for burns days in advance, but not all burn objectives may be achievable under those weather and fuel conditions. Regional effects are important in decision-making for this factor. For example, in the southeast, dormant season burns are generally more uniform in effects while growing season burns are more likely to be patchy. Backing fires are much easier to conduct during the dormant season when ground layer herbaceous plants are dead and burn readily, rather than green and succulent

thereby retarding fire spread. In the Pacific Northwest, season of burn can be used to reduce emissions. Broadcast burning of slash in the wet spring has been shown to produce 50% fewer emissions when compared to burning periods in the dry fall (Sandberg and Dost 1990). Selecting the correct season to execute a burn will help maximize the probability of achieving the burn objectives.

The timing of ignition determines whether the burn can be completed and mopped up as scheduled during the burning period. Timing is also important when considering factors such as: when solar radiation will break a nighttime inversion or dissipate any dew which formed during the night, when atmospheric conditions will support adequate transport and dissipation of smoke, when surface winds may develop or change speed or direction, or when a sea breeze front may reach the unit. Experienced burners become familiar with the area, and learn how to factor these time-sensitive influences into their burn plans.

6. **Smoke Management**. Planning a fire use project that has the potential to impact areas sensitive to smoke requires assessment of airshed and meteorological conditions that influence both the movement and concentration of smoke. The expected effects of wind speed and direction, air stability, and nighttime inversions should be specifically outlined. Specific regional issues should be addressed, such as mountainous terrain, fog, or sea breeze effects. This information normally will be developed by fire managers using their personal experience and knowledge of fire behavior, smoke transport and dispersion in the area, along with more formal emissions prediction and dispersion modeling.

Sensitive areas downwind of the burn unit should be identified and plotted on a map. Information such as distance and direction from the burn unit, the nature of the sensitivity, and when the area is considered sensitive should be included. Examples of smoke sensitive areas include Class I areas (generally, international parks, and large national parks and national wilderness areas), non-attainment areas, communities or individual residences, airports, highways, and medical facilities. Several procedures for predicting the potential impact of smoke on sensitive areas are discussed in chapter 9.

Smoke dispersion in areas prone to inversions, such as deep, mountainous valleys, is especially problematic in fire use planning. If the smoke remains trapped by the inversion, all of the emissions produced will remain trapped within the airshed.

The following smoke-related questions should be addressed in every plan:

- What quantity of emissions will it take to saturate this airshed?
- Where will the smoke concentrate if it settles under an inversion?
- Do special arrangements need to be made to protect populations impacted by these emissions?
- How many burning projects will it take cumulatively to exceed acceptable levels within this airshed?
- How long will the airshed remain stable and harbor the emissions?

In instances where a burn may affect an area especially sensitive to smoke, the use of air quality monitors may be advisable to ensure that an agreed-upon emission level or limit is not exceeded. Factors to consider in using monitors include placement of the device, personnel to operate the instrument, quality checks, data analysis, and provisions for real-time feedback if data is to be used in making a decision to terminate a burn in progress. Monitors are not commonly accessible and are costly to use, so this option is chiefly available to federal and state agencies. Air quality monitoring for evaluating a fire management program is discussed in Chapter 10.

Smoke impacts to fireline personnel should also be considered in a smoke management plan. The burn planner should consider projected exposure when determining the size of the burn crew and the duration of the work shift. More information on smoke exposure to fireline personnel can be found in Chapter 3.4.

Once an analysis of significant factors is complete, the planner should set specific, measurable smoke management objectives for the burn. These may include, for example, minimum visibility standards for roads or viewsheds, and an emissions limit if air quality monitors are to be used. Objectives provide a common understanding for all individuals involved in or affected by the burn, of what constitutes acceptable smoke impacts. They also provide a tool for the burn boss when deciding whether to terminate a fire because of problematic smoke behavior. If the decision is made to terminate a burn because of smoke problems, it should be remembered that direct suppression often temporarily exacerbates smoke problems. If ignition has been completed, the best strategy may be too let the fire burn out.

The amount of air quality analysis required at all levels of fire planning will be influenced by air quality laws and smoke management regulations. Formal state smoke management programs are becoming increasingly common, but are not yet universal. Some states include only regulatory language regarding "nuisance smoke." Complying with all applicable laws and regulations is a basic tenet of conscientious land stewardship, but responsible fire use and air quality planning include looking beyond the requirements of the law. Communities likely to be impacted by a fire-use program should be involved in determining what their threshold of acceptance is for smoke from wildland fire. Thorough attention to smoke management planning can prevent future problems.

7. **Notification of Local Authorities and the Public**. Early development of a notification plan will assist in the necessary communication with local authorities and the public. A wide variety of methods have proven successful, including distribution of pamphlets or flyers, public meetings, newspaper and radio announcements, and Internet postings. The public should be notified well in advance of the proposed burn day, and again within a few days of executing the burn. Generally, there is a list of individuals to be notified on the actual burn day. This list is often unit-specific, and should be included along with telephone numbers in the burn plan.

8. **Environmental and Legal Constraints**. If constraints to the burn plan have not already been addressed in a fire management plan for the entire site, they should be addressed here because they can limit or determine how a burn is implemented. These may include environmental, economic, operational, administrative, and legal constraints.

9. **Operations**. The burn plan must describe in detail how fire will be used. This section of the plan may take any number of formats, but the topics to be addressed include:

   - Safety. What provisions will be made to ensure the safety of the crew?
   - Communications. How will the crew communicate with each other, and with dispatch or emergency support?
   - Equipment and Personnel. What resources are needed to effectively accomplish the burn and how will they be deployed?
   - Fire Lines. What is the width and condition of existing fire lines? How many chains of fireline need to be prepared or cleared? How will this be accomplished?
   - Ignition Pattern and Sequence. How will the burn be ignited? Ignition duration and firing patterns play an important role in production and lofting of emissions. Rapid ignition may reduce consumption, therefore emissions, and be successful in lofting a smoke column high into the atmosphere. Backing fires produce fewer emissions than heading fires. More information on using ignition to manage emissions production can be found in Chapter 8, Techniques to Reduce Emissions and Impacts.
   - Holding. How will the fire be kept within its predetermined boundaries? How will snags be dealt with?
   - Mop-up. How will the burn be extinguished? What standard will be used to consider the burn unit safe to leave?

10. **Contingency Planning**. Contingency plans outline procedures for dealing with a burn gone awry. They are a normal part of a burn plan and should include provisions to deal not only with escaped fire, but also with unexpected smoke intrusions during an otherwise controlled burn. Some of the issues to be addressed include safety of the general public and the fire crew, sources of assistance for fire control and smoke-related problems, deployment of resources, actions to be taken to rectify the problem, notification of authorities and the public, and measures to mitigate smoke on roadways. It should be recognized that in some cases where smoke problems dictate shutting down a burn after ignition has been completed, the most prudent action may be to allow the unit to burn out rather than to immediately extinguish it, which can temporarily exacerbate smoke production.

11. **Preburn Checklist**. Every burn plan should include a checklist to be reviewed immediately prior to ignition. The checklist should include the factors essential to safe execution of the burn project, and a list of points to review with the crew during the preburn briefing. The use of the checklist ensures that some detail does not slip by the burn manager's attention in the busy moments preceding a fire.

12. **Monitoring and Evaluation**. Monitoring and evaluation of the burn are key to learning from the process and making refinements for subsequent burns. Where appropriate and practical, monitoring and post-fire evaluation protocols describing the effects on soil, water, air, vegetation, and wildlife should be included in the burn unit plan. Alternatively, the information can be included in a post-burn evaluation report or form, which is attached to the burn plan after completion.

- Documenting air quality conditions before, during, and after a fire is useful in identifying nuisance smoke thresholds and assuring that air quality standards have not been exceeded. Additionally, monitoring and documenting smoke transport, dilution, or concentrations in each airshed can help develop local knowledge that is the basis of predicting smoke impacts. In addition to environmental effects, the following topics should be addressed: adequacy of preburn treatments, fire behavior, degree to which objectives were achieved, discrepancies between planned fuel and weather components and on site measurements, observations, accidents or near-accidents, slopovers, and recommend changes for future burns. A series of photographs over time at permanent photo points is an excellent inexpensive method to document vegetation changes.

Fire Use Planning for Federal Land Managers

The *Wildland and Prescribed Fire Management Policy: Implementation Procedures Reference Guide* (USDI and USDA Forest Service 1998) represents an effort by Federal wildland fire management agencies to establish standardized procedures to guide implementation of the policy described in the 1995 Federal Wildland Fire Management Policy and Program Review. It uses new terminology and definitions to provide consistency and interpretation to facilitate policy implementation, and describes relationships between planning tiers to fire management objectives, products, and applications.

The federal process generally follows the planning process described above. The flow of information begins with the land and resource management plan, variously called the Forest Management Plan (FS), Integrated Resource Management Plan (BIA), Resource Management Plan (NPS), Comprehensive Conservation Plan (FWS) and the Forest Management Plan (FS). This plan determines the availability of land for resource management, predicts levels of resource use and outputs, and provides for a variety of resource management practices.

The next step is preparation of the Fire Management Plan (FMP). The FMP is the primary tool for translating programmatic direction developed in the land management plan into on-the-ground action. The FMP must satisfy NEPA requirements, or follow direction provided by a Forest Plan that has been developed through the NEPA process. Comparisons between fire use activities and no fire use should be described in the NEPA process. This includes implications of wildland fire and prescribed fire use over extended periods of time.

The most detailed step in the process involves the tactical implementation of strategic objectives for the wildland and prescribed fire management programs. It is at this level where specific plans are prepared to guide implementation of fire-related direction on the ground. This step includes Prescribed Fire Plans, Wildland Fire Implementation Plans, and the Wildland Fire Situation Analysis.

More information on the smoke management requirements and federal planning process is contained in Chapter 4.

Literature Citations

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