

Planning the Prescribed Burn

The first step to a successful prescribed burn is a stand-by-stand analysis of your forest lands. Determine the needs of each stand and what actions should be taken to meet these needs. Prescribed fire as well as other alternatives should be addressed here and a decision reached regarding the preferred treatment.

Prescription burning is a highly technical job requiring knowledge of fire behavior, suppression techniques, and environmental effects of fire. Well in advance of the burning season, scout stands that may need a fire treatment and choose those to burn. Overplan the number of acres to be burned by 10 to 25 percent so substitutions can be made if necessary, and so additional areas can be burned if favorable weather continues. The number of suitable burning days varies widely from year to year and the acreage that can be burned on a

given day can be increased dramatically if aerial ignition is used. If you have several blocks to burn, set priorities. Specifically designate any planned burns that require exacting weather conditions. Considerations include heavy fuels, small trees, potential smoke problems, etc. Indicate all blocks to be burned on an administrative map. When the burns are completed, record the dates on the map.

A written prescribed-burning plan prepared by a knowledgeable person is needed for each area to be burned. Complete the plan before the burning season and be prepared to burn when the prescribed weather occurs. Some plans may be quite short and simple while others will be complex. Individual blocks can vary from a few acres to over 1,000, but topography, and amount and type of fuel in a unit should be similar. Your plan can con-

sist of a series of blocks in the same compartment or management unit as long as the same objectives apply and the fuel is similar.

Break large areas into 1-day burning blocks or smaller areas. Use existing barriers such as roads and creeks as possible, but be sure these barriers are effective at the time of the burn.

The Written Plan

A prepared form with space for all needed information is best. The form will serve as a checklist to be sure you have not overlooked some aspect or potential impact. Sample forms for both understory burns and postharvest burns can be found on pages 34, 35, and 36. The "simple" form can be used on small burns within a large landholding that does not contain public roadways. Contents of the written plan should include:

TABLE 3 – Effects of Age of Rough on Some Common Fire Parameters

Parameter	Age of rough (years)					
	1	2	4	8	16	
Litter fuels (tons/ac)	1.5 - 3	2.5 - 4.5	4 - 7.5	5.5 - 12	6.5 - 15	
Fireline intensity (Btu/sec/ft)	B' ¹ H ²	8 - 15 30 - 60	12 - 25 50 - 90	20 - 35 80 - 145	25 - 65 Outside Rx underburning window	30 - 75
Flame length (feet)	B H	0.5 - 1.5 1.5 - 2	1 - 2 2 - 2.5	1.5 - 2.5 2.5 - 3.5	2 - 3 Outside Rx underburning window	2 - 3.5
Scorch height ³ (feet)	B H	<5 6 - 10	<5 - 5 9 - 14	<5 - 7 13 - 19	5 - 11 Outside Rx underburning window	6 - 12

Assume a 20-year-old southern pine plantation on the Coastal Plain with no understory present. Table values will increase as the amount of understory increases. In the Piedmont and mountains, an understory is likely to have an opposite effect except during severe drought.

¹B = Backing fire with rate-of-spread of 100 feet per hour and fuel consumption of 60 percent.

²H = Heading fire with rate-of-spread of 660 feet per hour and fuel consumption of 40 percent.

³Ambient temperature of 50°F and windspeed of 2mph. Lower temperatures and higher windspeeds will decrease scorch height.

Simple Understory Prescribed Burning Unit Plan

Landowner _____ Permit no. _____
 Address _____ Phone No. _____
 S ___ T ___ R ___ County _____ Acres to Burn _____ Previous burn date _____
 Purpose of burn _____
 (Draw map on back or attach)

Stand Description

Overstory type & Size _____ Height to bottom of crown _____
 Understory type & height _____
 Dead fuels: description and amount _____

Preburn Factors

Manpower & equipment needs _____
 List smoke-sensitive areas & locate on map _____
 Special precautions _____

 Estimated no. hours to complete _____ Passed smoke screening system _____
 Adjacent landowners to notify _____

Weather Factors:	Desired Range	Predicted	Actual
Surface winds (speed & dir.)	_____	_____	_____
Transport winds (speed & dir.)	_____	_____	_____
Minimum mixing height	_____	_____	_____
Dispersion/stagnation index	_____	_____	_____
Minimum relative humidity	_____	_____	_____
Maximum temperature	_____	_____	_____
Fine-fuel moisture (%)	_____	_____	_____
Days since rain _____ Amount _____	_____	_____	_____

Fire Behavior:	Desired Range	Actual
Type fire	_____	_____
Best month to burn	_____	Date burned _____
Flame length	_____	_____
Rate of spread	_____	_____
Inches of litter to leave	_____	_____

Evaluation:	Immediate	Future
Any escapes? _____ Acreage _____	_____	Evaluation by _____
Objective met _____	_____	Date _____
Smoke problems _____	_____	Insect/disease dam. _____
% of area with crown discoloration of	_____	Crop tree mortality _____
5-25% ___ 26-50% ___ 51-75% ___ 76%+ _____	_____	% understory kill _____
Live crown consumption _____	_____	Soil movement _____
% understory veg. consumed _____	_____	Other adverse effects _____
Adverse publicity _____	_____	_____
Technique used OK _____	_____	Remarks _____
Remarks _____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Prescription made by _____

Title _____ Date ____ / ____ / ____

Understory Prescribed Burning Unit Plan

Prepared by _____ Signature _____ Date _____ Permit no. _____
 State _____ County _____ District _____ Comp't _____
 Burning unit no. _____ S _____ T _____ R _____ Gross acres _____ Net acres _____
 Landowner _____ Address & phone no. _____
 Person responsible & how to contact day & night _____
 (Draw map on back or attach)

A. **Record of Previous Burning:** Date _____ Fire type _____ Results _____

B. **Description of Stand:**
 1. Overstory: Type, density, size _____ Height to bottom of crown _____
 2. Understory: Type, density, height _____
 3. Dead fuels: Type, density, age, volume _____
 4. Soil type and topography _____

C. **Purpose(s) of Burn:** _____

D. **Specific Objectives:** _____

E. **Preburn Factors:**
 1. Chains to plow (see map): Exterior _____ Interior _____ Total _____
 2. Chains to fire (see map): Exterior _____ Interior _____ Total _____
 3. Crew size: _____ Equip. needs _____
 4. Estimated tons/acre _____ Total tons to be burned _____
 5. Ignition procedure (see map) _____
 6. Passed screening system? _____ Special precautions _____

 7. Notify: _____

 8. Regulations that apply _____
 9. List smoke-sensitive areas & critical targets (see map): _____

F. Weather Factors:	Desired Range	Predicted	Actual
1. Surface wind (speed & dir.)	_____	_____	_____
2. Transport wind (speed & dir.)	_____	_____	_____
3. Stability/stagnation index	_____	_____	_____
4. Minimum mixing height	_____	_____	_____
5. Dispersion index	_____	_____	_____
6. Minimum relative humidity	_____	_____	_____
7. Maximum temperature	_____	_____	_____
8. Fine-fuel moisture	_____	_____	_____
9. Days since rain _____ Amount _____	_____	_____	_____
10. Burning Index _____ Drought Index _____	_____	_____	_____

G. Fire Behavior:	Desired Range	Actual Range
1. Type fire	_____	_____
2. Best month to burn	_____	Date burned _____
3. Time of day to start	_____	Time Set _____
4. No. hours to complete	_____	Completed _____
5. Flame length	_____	_____
6. Rate of spread	_____	_____
7. Fireline intensity	_____	_____
8. Inches of litter to leave	_____	Litter left _____

H. Evaluation Immediately After Burn:	Future Evaluation:
1. Acres burned	Evaluation by _____
2. Spotting _____ Distance _____	Date made _____
3. Any escapes	Insect/disease dam. _____
4. Objectives met	_____
5. Smoke problems	Crop tree mortality _____
6. % understory veg. consumed	_____
7. % of area with crown discoloration of 5-25% ___ 26-50% ___ 51-75% ___ 76%+ ___	% Understory kill _____
8. Live crown consumption	Soil movement _____
9. Adverse publicity	Other adverse effects _____
10. Remarks	Remarks _____
_____	_____
_____	_____

Postharvest Prescribed Burning Unit Plan

Prepared by _____ Signature _____ Date _____ Permit no. _____
 State _____ County _____ District _____ Comp't _____
 Burning Unit No. _____ S _____ T _____ R _____ Gross acres _____ Net acres _____
 Landowner _____ Address & phone no. _____
 Person responsible & how to contact day & night _____
 (Draw map on back or attach)

A. Description of Area:

1. Natural stand or plantation _____ Stand age _____ Harvest date _____
2. Clearcut _____ Harvest method _____ Pine basal area removed _____
3. Organic soil _____ Hardwood basal area _____ Hardwoods utilized _____
4. Unmerchantable trees felled _____ Snags felled _____ Debris evenly distributed _____
5. Debris (light, medium or heavy) _____ Brush (light, medium or heavy) _____
6. Herbaceous fuels (light, medium, heavy) _____ Herbaceous fuels continuous _____
7. Herbicide used _____ Date applied _____ / _____ / _____
8. Drum chopped _____ Single or Double Pass _____ Date Completed _____ / _____ / _____
9. Windrowed and/or piled _____ Date piled _____ / _____ / _____ Piled when wet _____
10. Pile or windrow dimensions: Ht. _____ Width (dia.) _____
11. Windrow break interval _____

B. Preburn Factors and Desired Fire Intensity:

1. Areas to exclude: _____
2. Chains to plow (see map): Exterior _____ Interior _____ Total _____
3. Chains to fire (see map): Exterior _____ Interior _____ Total _____
4. Equipment needs _____
5. Crew size _____ Type of fire _____ Type of ignition _____
6. Ignition procedure (see map): _____
7. No. of hours to complete _____ Tons/acre to consume _____ Litter to leave (in.) _____
8. Special precautions: _____
9. Notify: _____
10. Regulations that apply _____
11. Passed screening system? _____ List smoke-sensitive areas, critical targets & locate on map: _____

C. Weather Factors:	Desired Range	Predicted	Actual
1. Surface wind (speed & dir.)	_____	_____	_____
2. Transport wind (speed & dir.)	_____	_____	_____
3. Mixing height	_____	_____	_____
4. Dispersion Index (or comparable)	_____	_____	_____
5. Relative humidity (%)	_____	_____	_____
6. Temperature (oF)	_____	_____	_____
7. Fine-Fuel moisture (%)	_____	_____	_____
8. 10-hr. fuel moisture (%)	_____	_____	_____
9. Days since rain _____ Amount _____	_____	_____	_____
10. Burning Index _____ Drought Index _____	_____	_____	_____
11. Best month to burn _____	_____	Dates burned _____	_____
12. Time of day to start _____	_____	Time set _____	_____

D. Summary of Burn:

1. Type fire & ignition _____
2. All piles, windrows & logging decks ignited _____
3. % of area burned _____ Did area between piles burn? _____
4. Spotting frequency _____ Distance _____ firebrand material _____

E. Evaluation Immediately After Burn:

1. Any escapes: Number _____ Adjacent to burn area? _____ Acres involved _____
2. Hours to burnout: Active flaming _____ Smoldering _____ Total hours _____
3. % understory veg. consumed _____ Depth of litter remaining (in.) _____
4. % material < 3" dia. consumed _____ Did piled debris burn down? _____
5. Objectives met _____
6. Adverse publicity _____
7. Smoke problems _____
8. Remarks _____

F. Future Evaluation (Date, signature and remarks) _____

Required Signatures

Provide spaces for signature(s) of person(s) who prepared the plan. This identifies the people who know the most about the plan.

Purpose and Objective(s)

Include in the written plan the reason(s) for prescribing a fire. Examples include: prepare seedbed, control insects or disease, reduce hazard, improve wildlife habitat, control understory, improve forage, increase accessibility, and enhance aesthetics. In addition, give a specific quantifiable objective. State exactly what the fire is to do – what it should kill or consume, how much litter should be left, etc. Also concisely describe the expected fire behavior, including the desired range in flame length and fireline intensity. In case prescribed weather conditions do not materialize, this description may allow the objective(s) to still be achieved by varying the firing technique. Such information will also be useful in determining success of a burn.

Map of the Burning Unit

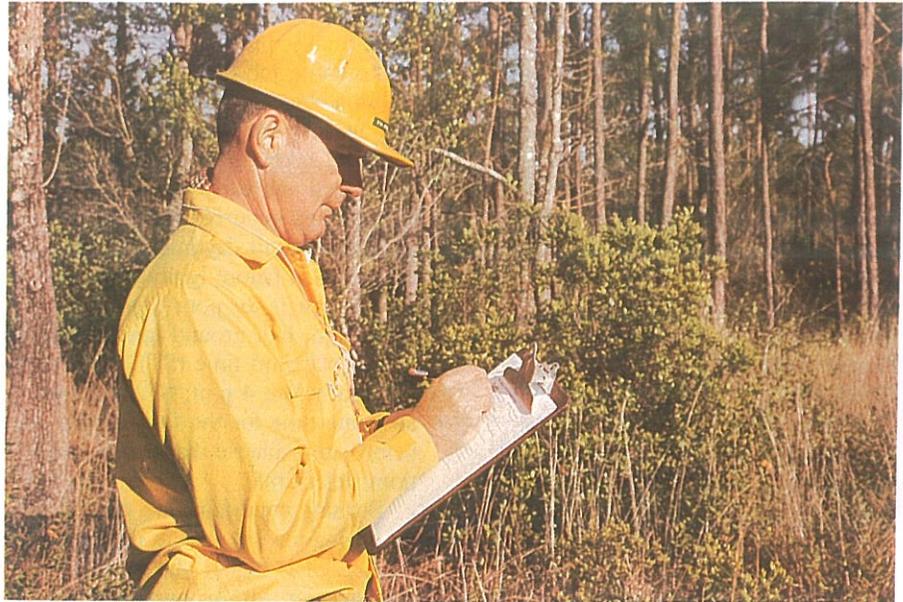
A detailed map of each burning unit is an important part of the burning plan. The map should show the boundaries of the planned burn, adjacent land owners, topography, control lines (both existing and those to construct), anticipated direction of the smoke plume, smoke-sensitive areas, holding details, and other essential information. Plowed control lines are often not necessary. Consider expanding the planned burn to employ existing fire-breaks and natural barriers. For example, use fuel type boundaries such as occur near creek bottoms where the fire will go out as it encounters fuels with a higher moisture content. Show areas that should be excluded or protected such as improvements, young reproduction, sawdust piles, etc. Subdivide each area to be burned into logical, 1-day burning blocks, or smaller areas if smoke management needs dictate.

Equipment and Personnel

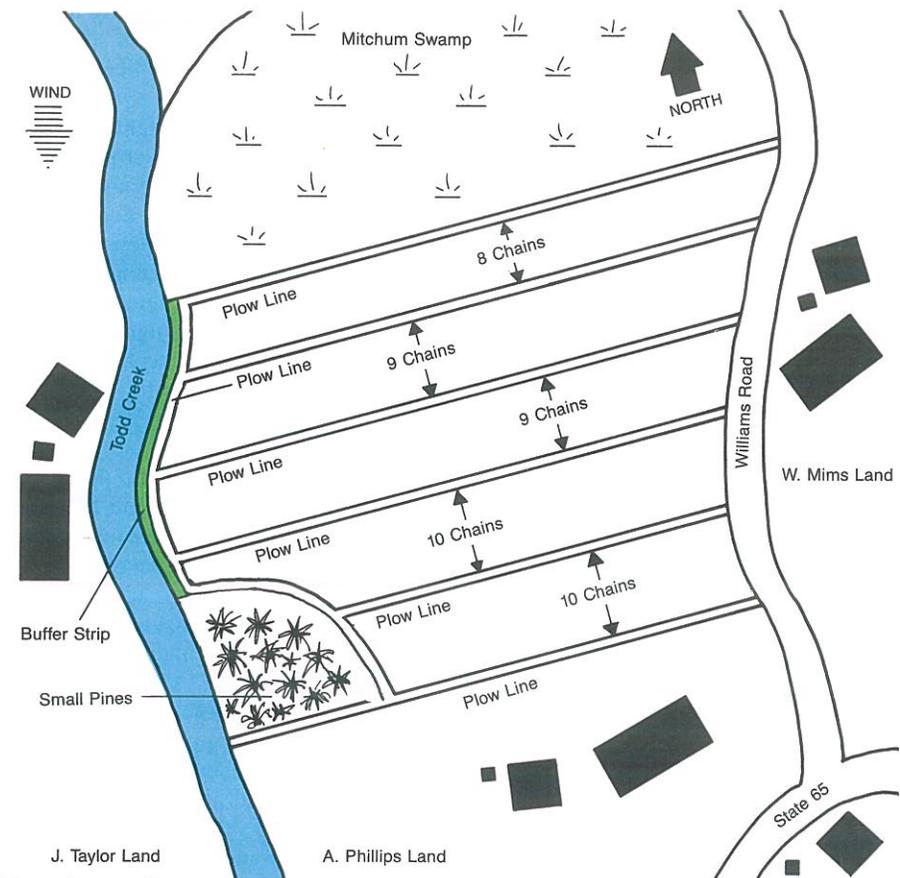
List equipment and personnel needed on site and on standby. Assign duties.

Fire Prescription

The amount of fuel, weather conditions and desired intensity of the burn will determine the firing technique



Make a prescribed fire plan for each area



Burning unit map

and ignition pattern to use. Species involved and height of overstory will determine the maximum intensity that can be tolerated. Where large amounts of fuel are present, cooler burns can be accomplished by burning when humidity and fuel moisture are near the high end of the range so a smaller

fraction of the fuel will burn. Lower temperatures are desirable with more intense fires, especially when understory fuels are tall.

A series of user-friendly computer programs called *BEHAVE* has been developed to predict the behavior of a fire. They are based on a specific set

of fuel data and prescribed weather conditions. These programs will run on a hand-held calculator with a fire behavior CROM (Custom Read Only Memory). You can use them in the field to make instant decisions as burning conditions change. A version called *MICRO BEHAVE*, compatible with IBM PCs, is also available at very low cost from Forest Resources Systems Institute (FORS), Courtview Towers, Suite 24, 201 N. Pine Street, Florence, AL 35630; telephone (205) 767-0250.

Always think about smoke management. Make sure your burning plan passes a smoke management system.

Season

Winter — Most understory burning is done during the winter dormant season. Acceptable relative humidity, temperature, fuel moisture, and steady, persistent winds most often occur then.

Spring — More variable weather and generally higher fire danger dictate smaller burns in the spring. Check with local wildlife specialists to avoid periods when prescribed burning could harm nesting wildlife. Pine buds are more exposed and thus more susceptible to heat damage during elongation.

Summer — Hot weather during the summer means much less heat is needed to raise the temperature of plant tissue to lethal levels. For this reason, summer burns are used to kill undesirable hardwoods — usually a series of burns after an initial winter burn. Care must be taken not to severely scorch overstory crowns. Postharvest burns to dispose of logging debris can be conducted year-round, but conditions are especially good in mid to late summer because the high ambient temperatures help dry out the larger materials.

Fall — Exercise special care when burning in early fall just prior to the dormant season. Both loblolly and slash pines are more likely to die if severely scorched or root damaged at this time.

Time of Day

Normally, plan burning operations so the entire job can be completed within a standard workday. Prescribed fires usually are ignited between 10 a.m. and noon, after sunshine has evaporated any early morning dew. If an inversion occurred the previous night, wait until daytime heating eliminates it before igniting the fire. If the forecast is for poor nighttime dispersion, halt ground ignition before 3 p.m. standard time (ST). Halt aerial ignition before 4 p.m. ST, to allow adequate time for the fire to burn out before atmospheric dispersion conditions deteriorate.

Burning conditions are usually better during the day than at night because windspeed is higher and wind direction steadier. Smoke management is also much easier during the day. At night smoke tends to stay close to the ground and collect in depressions. Also, relative humidity usually increases at night, resulting in spotty burning and an increased likelihood that fog will form.

However, on winter nights when a strong cold front moves across an area, winds remain strong and persistent and relative humidity does not rise greatly. These conditions can provide good prescribed burning weather, especially when cooler temperatures are needed. Whenever night burning is done, keep a close check on wind, humidity, and smoke drift.

Firing Plan

Key parts of a successful prescribed burn are plans for firing and holding a burn. This plan should consist of a narrative section and a detailed map. The burning unit map is ideal for this purpose because it already contains much pertinent information. Add the following items:

- Firing technique, ignition pattern, and planned ignition time.
- Manpower and equipment needed, and planned distribution for setting, holding, patrolling, and mopping up the fire and managing the smoke.
- Location and number of reinforcements and equipment that can be mobilized rapidly if fire escapes.
- Instructions for all supervisory personnel, including complete description or illustration of assignment, and forces needed to fire out, hold, and mop up the fire.

Alternative Prescriptions

Consider alternative sets of weather conditions (wind, relative humidity, and/or fuel moisture) and methods of burning that will produce a fire of about the same intensity and accomplish the desired objectives. Two separate burns may be necessary to eliminate heavy volumes of fuel without damage to the overstory.

Preparation Work and Protection of Sensitive Features

Include fire lines to be constructed, snags to be lined or felled, special features to be protected and the installation of any monitoring equipment. Give instructions for the protection of sensitive areas. Consider historical and archeological sites, streams, habitats of threatened and endangered species, and fragile soils.

Notification of Intent to Burn

List the names and telephone numbers of the local State fire protection officer and other officials who should be contacted prior to the burn. Make direct contact with all homes and businesses in the area likely to be impacted by the burn. Offer to evacuate anyone with respiratory problems during the burn. Put them up in a local motel if necessary. Consider written notification explaining the reasons for the burn and encouraging individuals with respiratory ailments to contact you — include a 24 hour telephone number. Establish responsibility for burn-day contacts and how they will be made. Consider a newspaper article describing the reasons for the burn if you expect to produce lots of smoke or anticipate any negative reactions.

*Establish Burn Acreage Goals
But NOT Quotas!*

Impact of Smoke

List any sensitive areas near to, downwind, or down drainage of the burn. Include smoke management strategies of avoidance, emission reduction, dispersal, or all three, to minimize any adverse smoke impacts. Attach the smoke management plan (e.g. screening system calculations) as part of the burning plan.

Legal Requirements

List any legal requirements that might apply, and what the prescribed burner must do to comply. Remember, the person who conducts the prescribed burning operation may not be the one who made the analysis and prepared the prescription. Follow all applicable statutes, regulations, and agency procedures. Needs for a written prescribed burning plan, documentation of deviations from the plan, and good judgment cannot be overemphasized. Erroneous forecasts, unforeseen local influences, and accidents occur despite our best efforts to prevent them. Proper documentation will help establish that the prescribed fire was conducted in a prudent and professional manner. If a prescribed fire results in damage or bodily harm and you cut corners, neglected any mandatory requirements, or acted with disregard to the welfare of others, you are likely to be held responsible, regardless of whether compliance would have changed the outcome. For more information see the summary article, *Legal Implications of Prescribed Burning in the South* by William C. Seigal, listed in the Suggested Reading section.

Escaped-Fire Plan

Identify potential fire escapes and specify actions to take should such occur. Designate who will be in charge of suppression action and what personnel and equipment will be available.

Control and Mopup

A plan must include necessary safeguards to confine the fire to the prescribed area and reduce smoke impact. Mopup promptly and completely. Emphasize protection of all adjacent land. Consider and make plans for any variation in forecasted weather that may change a prescribed fire into a damaging wildfire, increase the pollution in smoke-sensitive areas, or create visibility problems on adjacent roads.

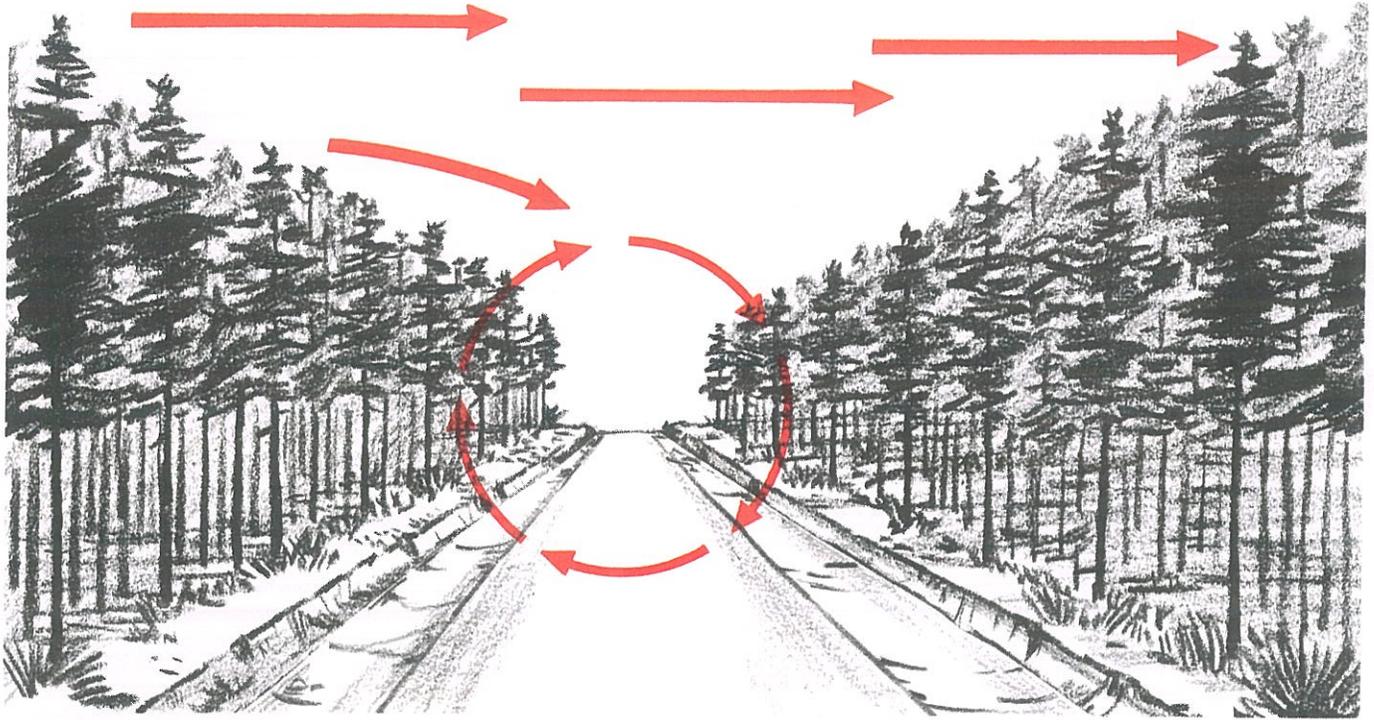
Evaluation

Include space for a written evaluation of the prescribed burn. A record of actual weather conditions, behavior of the fire, and total environmental effects of the burn is essential. This information is used to determine the effectiveness of the prescribed burn and in setting criteria for future burns.

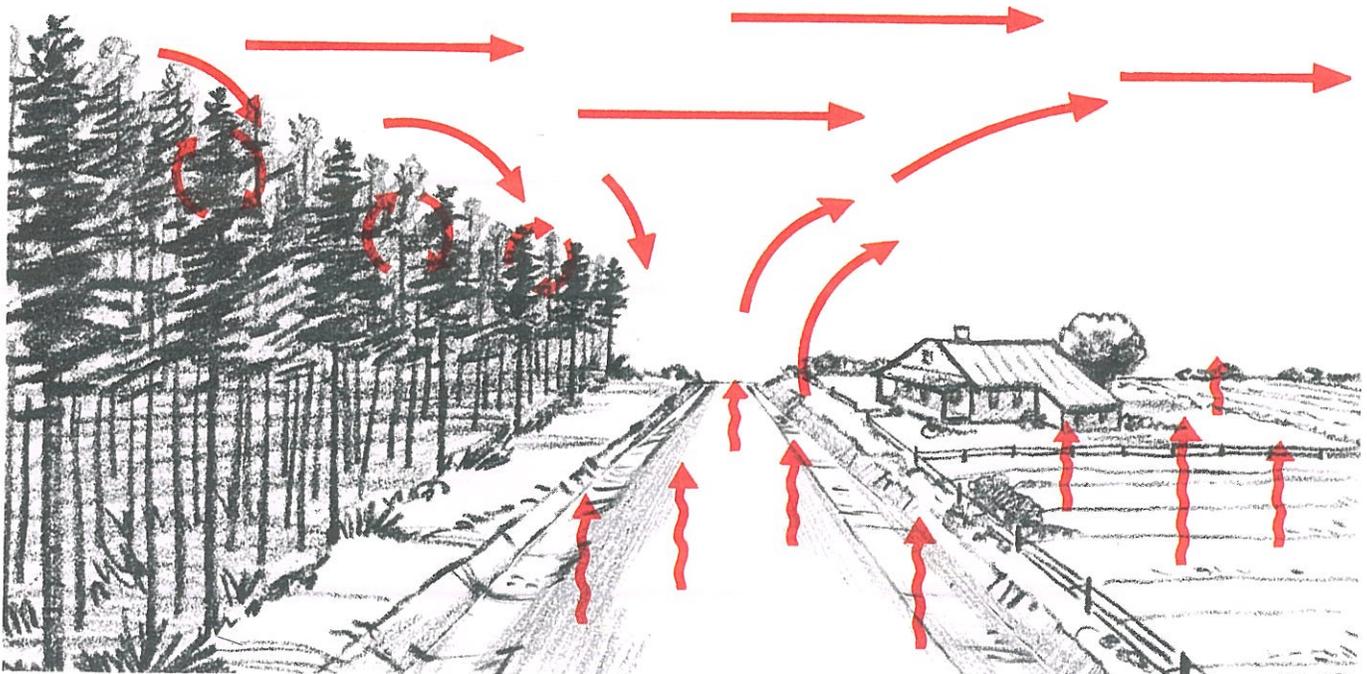
At the beginning of the prescribed burn, record windspeed and direction, fuel moisture, humidity, burning index, temperature, days since and amount of last rain, and dampness of soil and lower litter. Also record fire behavior data such as type of fire used, length of flames, and forward rate of spread. Continue to record applicable weather and fire-behavior parameters at 2- to 3-hour intervals throughout the burn. After the burn, record amount of crown scorch, consumption of brush, litter, and duff, and any other evidence of fire intensity such as unburned areas, exposed mineral soil, and cracks in bark or cupping on the lower bole due to bark consumption. Also include a short narrative on success of the burn.

*Give Prescribed Burning FIRST
Priority When Weather Conditions
Are Favorable*

*Prescribed Fires Often Behave
Erratically At Edges Of Openings*



Eddies caused by forest openings



Convection and eddies for open areas