FL600.0505(D) PURPOSE AND OBJECTIVES

The purpose of this supplement is to provide guidance and specification information for use in the planning and application of prescribed burning in Florida. The information provided in the following sections has been developed to assist the conservation planner in recommending the appropriate conditions to meet the landowner's goals and objectives. The recommendations contained in this supplement do not replace a fire prescription developed from an on-site evaluation of fuel type, fuel load, and other smoke sensitive areas.

FIRE FREQUENCY

Where practical, the season and frequency of prescribed burning should mimic the historic natural occurrence of fire typical of the ecological communities being managed. It is difficult to establish the historic natural occurrence of fire in Florida's ecosystems due to many factors including the lack of historical documentation, land use changes, and rapid decomposition rates of organic matter. However, it is widely accepted that fires were a common occurrence on the Florida landscape due to lightning and human activity. The lack of firebreaks created and high occurrence of fires created and maintained the large extent of flatwoods and herbaceous wetlands that occur in Florida.

These savannas and grasslands are dependent upon fire and hydrology to maintain the structure and diversity of the plant community. Research conducted throughout Florida and the south east U. S. indicates that herbaceous plant communities such as, flatwoods, marshes, and sloughs will transition into woody plant communities if fire is excluded for more than 4 or 5 years. Once these communities have begun the transition it is difficult if not impossible to reverse the transition without the use of herbicides or mechanical equipment.

Table 1 shows the assumed natural fire frequency and type of fire regime. This information was gathered from a variety of local experts and research stations. However, it must be understood that the natural fire frequency fluctuated greatly because of weather and other factors. Other factors, which could affect the fire frequency, include burning by indigenous humans and the effects of herbivores. The following exerpt from the U.S. Forest Service publication "WILDLAND FIRE IN ECOSYSTEMS – Effects on Flora" describes the types of fire regimes.

1. *Understory fire regime* (applies to forests and woodlands) – Fires are generally non-lethal to the dominant vegetation and do not substantially change the structure of the dominant vegetation. Approximately 80 percent or more of the aboveground vegetation survives fires.
2. *Stand-replacement fire regime* (applies to forests, woodlands, shrublands, and grasslands) – Fires kill aboveground parts of dominant vegetation, changing the aboveground structure substantially. Approximately 80 or more of the aboveground dominant vegetation is either consumed or dies as a result of fires.
3. *Mixed severity fire regime* (applies to forests and woodlands) – Severity of fire either causes selective mortality in dominant vegetation, depending on different tree specie's susceptibility to fire, or varies between understory and stand-replacement.
4. *Nonfire regime* – Little or no occurrence of natural fire.

The Longleaf Pine savannas that covered much of the state were adapted to the understory and stand replacement fire regimes. Understory fires were most common; however stand replacement fires could occur on the sites. Other communities such as the Cypress Swamps and Upland Hardwood Hammock would also have a mixed fire regime. The understory fire regime would occur most frequently. However, stand replacement fires would occur ever few centuries.

The grassland and shrubland ecosystems developed under the stand replacement fire regime. Most of these communities would have several stand replacement fires per decade. The interval between stand replacement fires would dictate the type and amount of woody vegetation on site.

Stand replacement fires occurred in forested ecological communities such as the Swamp Hardwood and Mangrove Swamps. These fires were extremely rare, and had a very long interval between fires (>100 years). The major impact of fires on these wetland forests was to limit the extent of the communities into upland areas and create small openings within the community.

Table FL2 – 1 NATURAL FIRE FREQUENCY AND REGIMES FOR FLORIDA ECOSYSTEMS

Ecological Community	Fire Frequency (years)	Dominant Fire Regime
North Florida Coastal Scrub	3 to 10	Mixed
South Florida Coastal Scrub	3 to 10	Mixed
Sand Pine Scrub	6-25 [1],25 - >100 [2]	Stand Replacement
Longleaf Pine -Turkey Oak Hills	6 to 10 [1], 1 to 3 [2]	Understory
Mixed Hardwood and Pine	< 35 [1], 1 to 3 [2]	Understory
South Florida Flatwoods	1 to 5 [1], 1 to 3 [2]	Mixed
North Florida Flatwoods	1 to 4 [1], 1 to 3 [2]	Mixed
Cabbage Palm Flatwoods	1 to 5 [1] , 1 to 3 [2]	Mixed
Everglades Flatwoods	1 to 5 [1]	Mixed
Cutthroat Seeps	1 to 3	Understory
Upland Hardwood Hammocks	10 to <100 [1]	Stand Replacement
Wetland Hardwood Hammocks	35 to >200 [1]	Stand Replacement
Cabbage Palm Hammocks	<35 [1]	Stand Replacement
Tropical Hammocks	10 to <100 [1]	Stand Replacement
Oak Hammocks	10 to 35 [1]	Stand Replacement
Cypress Swamps	35 to <100 [1] , 8 to 100 [2]	Stand Replacement
Scrub Cypress	5 to 20 [1]	Mixed
Salt Marsh	1 to 3 [1]	Stand Replacement
Mangrove Swamp	35 to 200 [1]	Stand Replacement
Bottomland Hardwoods	35 to >200 [1]	Stand Replacement
Swamp Hardwoods	35 to >200 [1]	Stand Replacement
Shrub Bogs-Bay Swamps	20 to 150 [1] , 25 to 100 [2]	Stand Replacement
Pitcher Plant Bogs	3 to 9 [1]	Stand Replacement
Sawgrass Marsh	3 to 5 [1]	Stand Replacement
Freshwater Marsh	2 to 5 [/]	Stand Replacement
Slough	2 to 5 [1]	Stand Replacement

[1] Myers, Ronald, L., Fire in Tropical and Subtropical Ecosystems, 2000
[2] Personal correspondence with Dr. Ronald E. Masters, Director of Research Tall Timbers Research Station and Dr. David Brownlie, Regional Fire Ecologist, U.S. Fish and Wildlife Service.

SEASON OF BURN

The time of year that fires occurred was also very important in the development of the ecological communities. Florida's natural (lightening ignited) fire season begins in mid April and runs through July. This is normally a period where droughty conditions are prevalent and thunderstorms become frequent. On average 1,000 lightening fires will occur each year in Florida. Both the number and size of fires increase during this period. Prescribed fires set during this period will usually behave like wildfires and are harder to control than traditional prescribed burns.

The traditional prescribed burning season runs from December through March. This is a period of predictable wind patterns and cooler, safer burning conditions. Safety is not the only reason that this period was selected for prescribed burns. The winter burn season is believed to be the result of cattlemen burning their range to reduce the amount of old, poor quality forage and stimulate the growth of higher quality forage.

Repeated burning during the same season of the year will produce a distinct plant community. This is because the plants that survive are adapted to burning during that period and have a competitive advantage over the other plants. For example, annual winter burning often increases the number of small diameter sprouts of hardwood shrubs and trees. Annual summer burning has the opposite effect and reduces the number of sprouts. This is because winter burns occur when the plants carbohydrate reserves are fairly high and the plants have a full season to recover from the burn.

The season of burning is also important on the production of grasses and forbs. How burning affects plants varies from species to species. Many warm season grasses and forbs in Florida, show increased flowering following burning during the growing season (March-September). The objective of all prescribed burns must include the effects on key species. The following sources can provide additional information on the effects of fire on plants and plant communities:

Fire Effects Information database at http://www.fs.fed.us/database/feis/

Tall Timbers Research Station at http://www.talltimbers.org/

Wildland Fire in Ecosystems: Effects of Fire on Flora at http://www.fs.fed.us/rm/pubs/rmrs_gtr42_2.htmll

ESTIMATING FUEL LOAD

Fuel loads have a major influence on the intensity, duration of burning, and the effects on vegetation. Therefore it is important to properly estimate the amount of fuel in the planned burning area.

Fuel loads can be estimated using a variety of techniques and fuel models developed by various agencies and organizations, including the USDA - NRCS, USDA – Forest Service (USFS), USDI – Bureau of Land Management (BLM), The Nature Conservancy (TNC), and the Florida Division of Forestry (FDOF). Techniques and fuel models developed and approved for use in the Florida or the Southeast U.S. may be used to estimate fuel loads in Florida.

Destructive Sampling Procedure is the most precise method to estimate the fuel load. However, this method has some distinct disadvantages. The biggest drawback to this method is the time needed to sample, dry and weigh the fuel. The other disadvantage is that it is very difficult to accurately estimate the weight of large fuels such as trees and woody debris.

The Destructive Sampling Procedure is the clipping, sorting by size category, and weighing of all fuel in a representative area. This is an extremely accurate way to collect fuels data but is also time consuming and expensive.

The number of years since the last burn can also be used to estimate the fuel load. This is often referred to as "the age of the rough". This technique is considerably less accurate, however it can greatly reduce the time spent estimating the fuel load and planning the prescribed burn. The USFS technical publication "A Guide for Prescribed Burning in Southern Forests" provides some guidance in estimating the fuel load based on the age of the rough (refer to Table FL2-2). Because this information was developed for a pine plantation in the coastal plain region of the southeast, it should be used with caution in southern Florida.

Table FL2 – 2 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 -16
fireline Intensity	B[1]	8 – 15	12 – 25	20 – 35	25 – 65	30 - 75
(Btu/sec/ft)	H[2]	30 – 60	50 – 90	80 – 145	Outside Rx underburning window	
Flame Length	B	0.5 – 1.5	1 – 2	1.5 – 2.5	2 – 3	2 – 3.5
(feet)	H	1.5 - 2	2 – 2.5	2.5 – 3.5	Outside Rx underburning window	
Scorch height[3]	B	<5	<5 – 5	<5 – 7	5 – 11	6 –12
(feet)	H	6 – 10	9 – 14	13 – 19	Outside Rx underburning window	

"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 the opposite effect except during severe drought."

"[1]B = Backing fire with rate-of-speed of 100 feet per hour and fuel consumption of 60 percent."
"[2]H = Heading fire with rate-of-speed of 660 feet per hour and fuel consumption of 40 percent."
"[3]Ambient temperatures of 50° and windspeed of 2 mph. Lower temperatures and higher windspeeds will decrease scorch height."

Table and footnote from "A Guide for Prescribed Fire in Southern Forests", USDA-Forest Service Technical Publication R8-TP 11, February 1989.

Photographic guides and fuel models can also be used to estimate fuel loads. These guides and models have been developed so individuals can compare photos of specific areas with known fuels loads to the site they are planning. Because these guides do not cover all of the sites or fuel loading conditions that can occur in Florida, individuals should use caution when using these tools.

Two guides which are recommended for use in Florida. The most widely accepted guide is "Aids To Determining Fuel Models For Estimating Fire Behavior", Anderson, H. E., USDA-Forest Service, General Technical Report INT-122, 1981. The other is the publication "Photos for Estimating Fuel Loadings Before and After Prescribed Burning in the Upper Coastal Plain of the Southeast" by E. R. Scholl and T. A. Waldrop. USDA-Forest Service, General Technical Report SRS-26, April 1999. This publication is available online at http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs026.pdf.

Individuals may also estimate fuel load using the following information that was include in "Screening System for Smoke Management" Section of the publication, "A Guide for Prescribed Fire in Southern Forests".

"Generally, the total fuel loading will be less than 10 tons in the fuel types listed below when age of rough is:

A. Grass (with pine overstory), any age. Also wheat fields and other agricultural burns.
B. Light brush, 7 years old or less (10 years if basal area is less than 100 square feet per acre).
C. Loblolly pine with
   1 palmetto-gallberry understory, 7 years or less if basal area is less than 150 square feet per acre.
   2 little or no understory, 15 years or less if basal area is less than 150 square feet per acre.
D. Slash pine with
   1 palmetto-gallberry understory, 5 years or less if basal area is less than 150 square feet per acre.
   2 little or no understory, 8 years or less if basal area is less than 150 square feet per acre."

Other publications such as the "Southern Forestry Smoke management Guidebook", (USDA-FS, provide guidance on estimating fuel loads. This publication can be obtained at http://www.srs.fs.usda.gov/pubs/gtr/gtr_se010.pdf.

SMOKE DISPERSION

Proper dispersion of smoke is a critical aspect of planning and implementing prescribed burning. To avoid unwanted effects of poor smoke dispersion such as impaired visibility on roadways, unwanted odors, and smoke related health problems planners should follow the guidance provided in the Smoke Management Screening Procedure section of this supplement.

The principal factors involved in smoke dispersion include atmospheric stability, wind direction, wind speed, transport winds, mixing height, and the dispersion index. Therefore, individuals planning prescribed burns must understand these factors and how they affect smoke dispersion.

Atmospheric stability is a term used to describe the resistance of the atmosphere to vertical motion or how rapidly air mixes between layers in the atmosphere. The atmosphere is stable when air rises slowly and little mixing takes place. In stable atmosphere, temperatures decrease slowly as altitude increases, therefore air and smoke rises slowly. Air temperatures may occasionally rise as elevation increases resulting in a temperature inversion.

A stable atmosphere generally results in a fire that is predictable and easier to control. However, this slows the dissipation of heat from the fire and can lead to increased crown scorch and increased damage to desirable vegetation. Unstable atmospheric conditions result in more rapid dispersion of smoke due to the increased speed in which air rises. Fires become more unpredictable and harder to control as atmospheric stability decreases.

Generally, the atmosphere is stable at night and becomes unstable during the day. The atmosphere is usually most unstable in the afternoon and will become stable at night as temperatures fall. This usually results in smoke rising very slowly, if at all. It can also create inversions where smoke already in the air settles back to the surface. The inversions can create dangerous conditions on roads and severe health problems for persons with respiratory disorders. Unstable conditions often result in spot fires and erratic fire behavior.

Atmospheric stability can be assessed using the following indicators:

Indicators of Unstable Conditions

Strong sunshine
Clear or high, puffy clouds
Strong, gusty wind
Dust devils or whirl winds
High smoke columns

Indicators of Stable Conditions

Low clouds or overcast
Fog
Stratus type clouds
Low, steady wind or calm
Poor visibility
Low smoke column

Wind speed affects the behavior of both the fire and the smoke. It basically affects fires by regulating the intensity of the fire, controlling the direction of the fire and the rate that heat is dissipated horizontally.

Windspeed regulates the intensity of the fire in three ways. First it affects the amount of oxygen that is available for the fire. As windspeed increases the amount of oxygen available for combustion also increases. Secondly, wind removes moisture from the fine fuels and increases the rate at which fuels dry out. Thereby, reducing the time needed for preheating the fuels and increasing the amount of fuel that is burning at any one time. Lastly, wind also affects rate at which the fire moves across the landscape. As air pressure from the wind pushes heated air and flames into new fuels the fire is able to spread more rapidly. This is why higher windspeeds are required to carry fire through sparse fuel. Thick fuels do not require as high of a wind to carry the fire through the vegetation. In fact the same winds needed for sparse vegetation can create an inferno that is hard to control in thick vegetation.

When windspeed and wind direction are steady the fire will behave in a more predictable manner. Fires become very unpredictable and dangerous when winds are gusting and changing directions. Therefore, prescribed burns should not be carried out under variable conditions. The maximum windspeed generally occurs in the afternoon following a gradual increase through the daylight hours.

Windspeed is measured ***in the stand*** at eye level. The term ***"In the stand"*** means that the wind speed is measured in the type of vegetation to be burned. This provides a good measure of the windspeed as the vegetation affects it. This is more reliable than fire weather forecasts. Most fire weather forecasts are measured under open conditions at height of 20 feet above the ground. It is important to note that most fire weather forecasts provide the maximum expected and not the average windspeed. Therefore, windspeed should be measured in the stand to best predict fire behavior.

As a rule in the stand windspeeds of 1 to 3 mph are suitable for most situations. Usually it is best to plan burns with 20-foot windspeeds of 6 to 20 mph. As a general rule higher windspeeds are more predictable.

Low windspeeds can have a higher level of crown scorch because of the relatively slow rate of heat dissipation. Higher windspeeds dissipate heat quickly but can become difficult to control.

Wind direction is usually more important than windspeed because of its affect on the direction of the fire and smoke. It is best to burn on days when the wind direction will be steady. Often steady winds occur on days following a cold front in the fall and winter. However, it can be difficult to find days like that in the rest of the year. For that reason, prescribed burning plans for growing season burns should developed to incorporate predictable shifts in wind direction.

Transport winds carry the smoke both vertically and horizontally out of the area. The transport windspeed is the average windspeed throughout the mixing layer. Mixing heights above 1,700 feet and transport windspeeds above 9 mph are desirable for good smoke dispersion.

Mixing height is the base elevation of the mixing layer. This is the height at which smoke loses its buoyancy and stops rising. It will then move off with the prevailing wind direction at that level. As a general rule mixing heights of 1,700 feet to 6.500 feet are desirable. However, increased spot fire activity and erratic fire behavior can occur when the mixing height nears 6,500 feet.

Smoke dispersion index is term used to describe a numerical rating system for how well smoke is dispersed into the atmosphere. Many factors are used in determining the dispersion index such as, atmospheric stability, mixing height, transport wind, angle of sunlight and temperature.

The typical dispersion index used in the southeast rates smoke dispersion on a scale from 0 to 100. Index values greater than 100 may occur. High dispersion index values equate to rapid dispersion of smoke. Conversely, low values indicate slow dispersion, which could create smoke management problems.

Smoke dispersion values can be used to gauge the behavior of a prescribed burn. Figure FL-1 shows the relationship for smoke dispersion index used for the southeast to burning conditions. Prescribed burns on days with low values indicate that the fire behavior will be more predictable than burns when the dispersion index value is high. Smoke dispersion index values above 100 indicate unsafe conditions for a prescribed burn. The FDOF website has an on-line map that can be used to assess the current dispersion index, as well as future index values. The map can be accessed at: http://flame.fl-dof.com/fire_weather/forecasts/mm5/adi.html.

Figure FL-1 from "A Guide for Prescribed Fire in Southern Forests", USFS, Technical Publication R8-TP 11.

Figure FL-1 Relationship of Dispersion Index to on-the-Ground Burning Conditions

Dispersion Index	Burning Conditions
> 100	Very Good – Burning conditions may be so good that fires may be hazardous and present fire control problems. Reassess decision to burn.
61 – 100	Good – Prefferred range for prescribed burns.
41 - 60	Generally OK – Climalogical afternoon vlues in most inland forested areas fall in this range.
21 - 40	Fair – stagnation may be indicated if accompanied by low windspeeds. Reassess decision to burn.
13 – 20	Generally poor – do not burn. Stagnant if persistent, although better than average for a night value.
7 – 12	Poor – Do not burn. Stagnant during the day, but near or above average at night.
1 – 6	Very poor – represents the majority of nights at many locations.

RELATIVE HUMIDITY

Relative humidity is one of the most critical factors influencing whether a burn will meet the desired objective(s). Relative humidity also plays a major role in fire behavior. Fires burn more easily and rapidly when the relative humidity is low and there is relatively little moisture in the atmosphere. Conversely, when the relative humidity is high it is often difficult to get the fire ignited and keep it burning due to the increased amount of moisture in the atmosphere.

The term relative humidity is used to express the amount of moisture in the air compared to the total amount of moisture the air can hold. Air temperatures play a major role in determining the amount of moisture the air can hold at any given time. When temperatures are low the air can hold a small amount of moisture. Conversely, when the temperature is high the air can hold a larger amount of moisture.

The amount of moisture in the air regulates the drying rate and consequently the rate of spread of fires. When the humidity is high, fuels dry slowly. Therefore, the rate of spread will be slow compared to fires when the humidity is low.

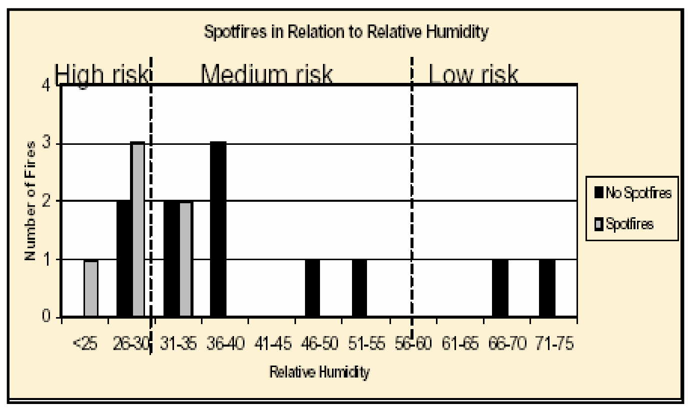
The preferred range of relative humidity for prescribed burning ranges from 30% to 55%. Patchy or mosaic burns for wildlife and range management are best achieved when the humidity is above 55%. Prescribed burns to create blacklines and increase firebreak width should be conducted when the relative humidity is near or above 60%. The preferred range of humidity for brush management and land clearing, where a clean burn is desired, range from 30% to 50%. It is dangerous to conduct prescribed burns when the relative humidity is near or below 30%. Only under special conditions should a prescribed fire be conducted when the relative humidity drops below 30%.

The relative humidity will vary greatly during the day depending upon the increase in temperature from daylight to mid afternoon. There is and inverse relationship between air temperature and relative humidity. This relationship can be used to estimate the relative humidity as the temperature changes.

As a rule of thumb, the relative humidity will double for each 20-degree (F) drop in temperature and halve for each 20-degree (F) increase in temperature.

The following example illustrates the rule of thumb. For example, if the temperature in the morning was 60 degrees with a relative humidity of 80% and the temperature rises to 80 degrees the relative humidity will decline to 40%.

The risk of spot fires also increases as relative humidity declines. Figure FL-2 illustrates the effect that humidity has on the number of spot fires. In this study spot fires, caused by fire brands from crowning cedar and pine trees, fire creeping across mowed fire lines, and oak leaves blown across firebreaks increased as the relative humidity decreased. In this study spot fires were related to critical level of relative humidity.



From Weir, 1999. Risk factors have been added to the chart to offer guidelines as to the risk associated with temperature.

AIR TEMPERATURE

Air temperature also has an effect on fire behavior and the success of a prescribed burn. When air temperatures are low, the fire must generate an increased amount of heat to dry the fuel and ignite new materials. Therefore, fires are more controllable when air temperatures are below 60 degrees (F).

Cool fires (<60° f) are less likely to cause mortality in plants than burns conducted at higher temperatures. This is because more heat is required to raise temperatures in foliage and stems to lethal levels. If the objective is to control woody species, it may be preferable to conduct burns when the temperatures are relatively high. Conversely, if the objective is to increase the width of the firebreak it would be preferable to plan the burn for a day when the temperatures are lower.

High temperatures may also increase the potential for spot fires. Figure FL-3 shows the relationship between temperature and the distance that spot fires occurred. Although the research supporting Figure FL-3 was not done under Florida conditions it does illustrate the fact that spot fires occur at increasingly greater distances as temperatures increase.

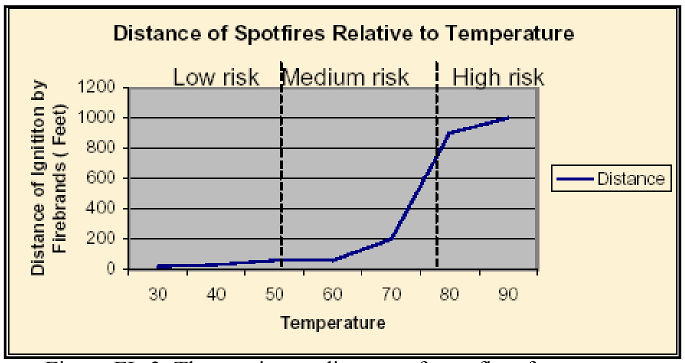


Figure FL-3. The maximum distance of spot fires from prescribed fires in relation to air temperature. Spotfires that started when temperatures were below 60 degrees were primarily by flaming firebrands. Bunting and Wright 1974. Risk factors have been added to the chart to offer guidelines as to the risk associated with temperature.

The increased occurrence of spot fires at greater distances may be due to other in addition to high temperatures such as, reduced atmospheric stability and lower relative humidity. Regardless of the cause, prescribed burners should be alert to the increased potential for spot fires when the temperature exceeds 80 degrees (F).

FINE FUEL MOISTURE

Fine Fuel moisture is another important factor in prescribed burning. Fine fuel moisture is the amount of water contained in the fuel. The amount of water is usually expressed as a percentage of the ovendry weight of the fuel. Fuel moisture is computed by dividing the weight of the water contained in the fuel by the ovendry weight of the fuel.

Dead, fast drying fuels less than ¼ inch in diameter are normally referred to as fine fuels. These are fast drying fuels, which ignite readily and are consumed rapidly. This includes grass, leaves, draped pine needles and small twigs.

The following example demonstrates the procedure for determining fine fuel moisture content.

1. A sample of dead fuel less than ¼ inch in diameter was collected from the planned burn area.
2. The sample was weighed in the field immediately after it was collected to determine the field or wet weight. The sample weighed 100 grams.
3. The sample was placed in a drying oven over night and was weighed again. The ovendried weight of the sample was 82 grams.
4. The amount of moisture was determined by subtracting the ovendried weight from the field (wet) weight. The sample contained 18 grams of water (100 g. – 82 g. = 18 g.).
5. Then the percent moisture was determined by dividing the weight of the water by the ovendry weight and converting the result to a percentage. The result was a fine fuel moisture content of 22% (18 / 82 = 0.22) (0.22 x 100 = 22%).

The desired range of fine fuel moisture is usually between 10% - 30%. Burning when fine fuel moisture is very low (<10%) will often result in unwanted damage to plant roots and possibly the soil. In addition, fires burning under these conditions can be hard to control and therefore dangerous.

When fine fuel moisture conditions approach 30% it can be hard to ignite and sustain a prescribed burn. High fuel moisture conditions often result in patchy burns. With much unburned fuel in the planned burn area. Burning when the fuel moisture is high will also increase the amount of smoke released from the fire and can cause unwanted hazards in smoke sensitive areas.

Some types of vegetation burn more vigorously than others at higher fuel moisture. These species are often referred to as volatile fuels. Consideration should be given to burning areas containing volatile fuels at lower fine fuel moisture levels to prevent escape.

The desired fine fuel moisture should be selected based on the fuel to be burned, and the intended purpose. A prescribed burn with high fine fuel moisture will create a patchy burn that is good for wildlife and range management objectives. A prescribed burn with low fine fuel moisture will be best for purposes, such as brush management and land clearing.

POST-FIRE MANAGEMENT

Management following a prescribed burn is often the critical factor in determining whether or not the fire will meet the land owners objectives. For example, if uncontrolled grazing is allowed following the burn many desirable grasses and forbs will be severely impacted and may be replaced by plants that have lower forage and wildlife habitat values. However, managed grazing following prescribed burns can have a positive effect on the plant community, if the grazing management is based on the requirements of the key plants.

Other treatments to control weeds, soil erosion, or to reestablish native plants should be identified prior to the prescribed burn and included in the overall management plan. This will allow the landowner to begin implementation of the treatments immediately following the burn.

RECOMMENDATIONS TO ACHIEVE A SPECIFIC PURPOSE

The information contained in the following tables has been developed to assist land managers and conservation planners develop a prescribed burn plan that meets the landowner's objectives and can be conducted in a safe manner. The information contained in these tables should not be interpreted as the “natural” season, frequency or conditions that fire occurred on Florida's landscape.

Table FL2 –2 To improve quality/quantity of forage for livestock, improve livestock distribution, and to stimulate seed production.

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Flatwoods	Dec-May	2-4[1]	10-30	30-50	20-80	5-10
Freshwater Marsh	Dec-Feb	2-5[1]	10-20	20-50	20-80	5-15
Slough	Dec-Feb	2-5[1]	10-20	20-50	20-80	5-15
Salt Marsh	Sept-Dec	2-3	10-30	20-50	20-80	5-15
Longleaf Pine-Turkey Oak Hills	Feb-May	2-4[1]	10-30	30-50	20-80	5-10
Sand Pine Scrub	Feb-May	10-60[1]	10-30	30-50	20-80	5-10
Pasture	Nov-Feb	Variable	10-30	30-50	20-80	5-10

Remarks:

Type of Fire: Not critical, do not ring fire.

Avoid using backing fires on stoloniferous grasses to prevent damage to stolons.

The size of burn is not critical. However, the area will become overgrazed if the burn area is too small. A good recommendation is to split the grazing area and burn an equal portion each year, depending on the fire frequency of the ecological community.

Desirable native grasses are sensitive to grazing pressure following burning. Burned areas must be deferred from grazing during a portion of the growing season. For best results, the deferment period should begin when Wiregrass becomes tough and cattle begin to select other grasses. This usually occurs 6 weeks after the area has been burned.

Burning pastures severely stresses pasture plants and reduces organic matter at the soil surface. Therefore, burned areas must be allowed adequate time to recover following a burn.

To maintain wildlife habitat and reduce impacts to nesting wildlife, limit the size of the burn to no more than 50% of the available habitat in the area.

Individual herbs and grasses respond differently to fire and season of burn, therefore the season and frequency of the fires should be based on site-specific observations.

Avoid burning pastures during dry periods to prevent damage to forage plants.

[1] G.W. Tanner, W.R. Marion, and J.J. Mullahey, Understanding Fire: Nature's Land Management Tool, Circular 1018. University of Florida – Institute of Food and Agricultural Sciences, Gainesville, FL, 1997.

Table FL2 –3 To Prepare Sites for Harvesting, Planting, or Seeding

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Flatwoods	Nov-Feb	NA	5-10	30-50	20-50	2-7
Longleaf Pine-Turkey Oak Hills	Nov-Feb	NA	10-20	30-50	20-50	3-10
Mixed Hardwood and Pine	Nov-Feb	As Needed	10-20	30-50	20-50	2-10
Pasture	Nov-Feb	NA	10-20	30-50	20-50	3-10

Remarks:

Type of Fire: Not critical. Do not ring fire.

Size of Burn (acres): Not critical. However it should be large enough to prevent concentrations of birds and rodents (usually 10 acres of more.)

Natural seeding, summer to early fall prior to seed fall. Use caution to avoid damage to seed trees. If logging debris is present, smoke management may be a problem.

Direct seeding, schedule burns in fall to late winter for spring planting and a late winter to early spring for summer planting.

Planting, schedule burns in the growing season to control hardwoods.

If logging debris is present, smoke management may be a problem.

Use caution to avoid damage to soil or water resources.

To maintain wildlife habitat and reduce impacts to nesting wildlife, limit the size of the burn to no more than 50% of the available habitat in the area.

Table FL2 –4 Improve or maintain Quail habitat

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Flatwoods	Year-round	1-3	10-20	20-50	20-60	5-10
Longleaf Pine-Turkey Oak Hills	Year-round	2-4[1]	10-20	20-50	20-60	5-10
Sand Pine Scrub	Year-round	10-60[1]	10-20	20-50	20-60	5-10
Mixed Hardwood and Pine	Year-round	1-3	10-20	30-50	20-50	2-10
Slough	Year-round	2-5[1]	10-20	20-50	20-60	5-15

Remarks:

Type of Fire: Not critical. Do not ring fire.

Size of Burn (acres): Not critical. However it should be large enough to prevent concentrations of birds & rodents (usually 10 acres of more.)

Avoid early nesting season (April-June) unless sufficient nesting and brood rearing habitat is available adjacent to the planned burn area.

Where possible, burn on a 1-2 year frequency for best results.

Protect 10-50% of the valuable nesting and brood rearing habitat. Leave unburned patches and thickets.

Table FL2 –5 To Improve or Maintain Habitat for Deer and Turkey

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Flatwoods	Year-round	2-4[1]	10-20	30-50	20-60	5-10
Longleaf Pine-Turkey Oak Hills	Year-round	2-4[1]	10-20	30-50	20-60	5-10
Sand Pine Scrub	Year-round	10-60[1]	10-20	30-50	20-60	5-10
Mixed Hardwood and Pine	Year-round	2-4	10-20	30-50	20-50	2-10
Slough	Year-round	2-5[1]	10-20	20-50	20-60	5-15
Freshwater Marsh	Year-round	2-5[1]	10-20	20-50	20-60	5-15

Remarks:

Type of Fire: Backing fire or point source fires.

Size of Burn (acres): Not critical. However it should be large enough to prevent concentrations of birds and rodents (usually 10 acres of more.)

Protect transitional or fringe areas and do not burn stream bottoms.

The objective should be to promote sprouting and keep browse within reach. Repeated summer fires may kill some rootstocks

Protect 10-50% of the valuable nesting and brood rearing habitat.

Leave patches of vegetation unburned within the burned area.

Table FL2 –6 To Improve or Maintain Habitat for Water Fowl

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Freshwater Marsh	Year-round	2-3	10-20	20-50	20-60	5-15
Salt Marsh	Year-round	2-3	10-20	20-50	20-60	5-15

Remarks:

Type of Fire: Not critical. Do not ring fire.

Size of Burn (acres): Not critical. However it should be large enough to prevent concentrations of birds & rodents (usually 10 acres of more.)

Soil profile should be saturated when burning areas with an organic (muck) soil type.

Marshes, which have been invaded by exotic species, may need to be burned on a more frequent basis to reduce vegetative build-up.

To maintain wildlife habitat and reduce impacts to nesting wildlife, limit the size of the burn to no more than 50% of the available habitat in the area.

Table FL2 – 7 To Reduce Wildfire Hazards

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Flatwoods	Nov-Feb	2-4[1]	10-30	30-50	20-80	5-10
Longleaf Pine-Turkey Oak Hills	Nov-Feb	2-4[1]	10-30	30-50	20-80	5-10
Sand Pine Scrub	Nov-Feb	10-60[1]	10-30	30-50	20-80	5-10
Mixed Hardwood and Pine	Nov-Feb	2-4		20-50	20-50	3-10
Slough	Nov-Feb	2-5[1]	10-20	20-50	20-80	5-15
Freshwater Marsh	Nov-Feb	2-5[1]	10-20	20-50	20-80	5-15

Remarks:

Type of Fire: Not critical. Do not ring fire

Size of Burn (acres): Not critical. However it should be large enough to prevent concentrations of birds & rodents (usually 10 acres of more.)

Use care when planning burns on areas with high levels of fuels or where extremely volatile fuels such as palmetto, titi, gallberry, and waxmyrtle as the potential for fire to escape is higher.

Only experienced, certified prescribed burners should plan and implement prescribed burns in areas with very high fuel loads.

Use line-backing fire, or point-source fires under moist conditions for initial burn.

Grid-firing technique excellent for maintenance of burns.

To maintain wildlife habitat and reduce impacts to nesting wildlife, limit the size of the burn to no more than 50% of the available habitat in the area.

Table FL2 – 8 To Control Undesirable Vegetation, and Control Plant Disease

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Flatwoods	Nov-Feb	2-4[1]	10-30	30-50	20-80	5-10
Longleaf Pine-Turkey Oak Hills	Nov-Feb	2-4[1]	10-30	30-50	20-80	5-10
Sand Pine Scrub	Nov-Feb	10-60[1]	10-30	30-50	20-80	5-10
Mixed Hardwood and Pine	Nov-Feb	2-4		20-50	20-50	3-10
Slough	Nov-Feb	2-5[1]	10-20	20-50	20-80	5-15
Freshwater Marsh	Nov-Feb	2-5[1]	10-20	20-50	20-80	5-15
Pasture	Nov-Feb	2-5[1]	10-20	20-50	20-80	5-15

Remarks:

Type of Fire: Not critical. Do not ring fire

Size of Burn (acres): Not critical. However it should be large enough to prevent concentrations of birds & rodents (usually 10 acres of more.)

When burning to reduce understory vegetation in Pine Plantations:

Avoid burning until Pines are at least 3" in diameter at the ground and 10' in height to avoid damage to trees.

Burn only after a strong cold front with rain.

To maintain wildlife habitat and reduce impacts to nesting wildlife, limit the size of the burn to no more than 50% of the available habitat in the area.

Summer burns result in higher rootstock kills and affects larger stems.

Exclude fire from desirable hardwoods in pine-hardwood type.

To control plant disease:

Schedule burning frequency as needed to reduce severity and occurrence of disease.

Burn when humidity is above 50%.

Avoid leaving unburned pockets of infected seedlings within or adjacent to burn.

Table FL2 – 9 To Restore and Maintain Ecological Sites

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Flatwoods	Year-round	2-4[1]	10-30	30-50	20-80	5-10
Longleaf Pine-Turkey Oak Hills	Year-round	2-4[1]	10-30	30-50	20-80	5-10
Sand Pine Scrub	Year-round	10-60[1]	10-30	30-50	20-80	5-10
Slough	Year-round	2-5[1]	10-20	20-50	20-80	5-15
Freshwater Marsh	Year-round	2-5[1]	10-20	20-50	20-80	5-15
Salt Marsh	Year-round	2-5	10-20	20-50	20-60	5-15

Remarks:

Type of Fire: Will vary with fuel conditions and species requirements.

Size of Burn (acres): Not critical. However it should be large enough to prevent concentrations of birds & rodents (usually 10 acres of more.)

Fire intensity, timing and frequency all dictated by species requirements.

Implement a long-term burn plan that mimics the natural fire cycle for the ecological community, if possible.

If possible conduct occasional growing season burns.

To maintain wildlife habitat and reduce impacts to nesting wildlife, limit the size of the burn to no more than 50% of the available habitat in the area.

Table FL2 – 10 To Remove Slash and Debris

Ecological Community	Season	Frequency of Burning (years)	Fine Fuel Moisture (%)	Relative Humidity (%)	Air Temp (deg. F)	Wind Velocity (mph
Flatwoods	Nov-Feb	NA	10-30	30-50	20-80	5-10
Longleaf Pine-Turkey Oak Hills	Nov-Feb	NA	10-30	30-50	20-80	5-10
Sand Pine Scrub	Nov-Feb	NA	10-30	30-50	20-80	5-10
Mixed Hardwood and Pine	Nov-Feb	NA		20-50	20-50	3-10

Remarks:

Type of Fire: Not critical, center firing with helitorch preferred, do not ring fire.

Size of Burn (acres): Not critical. However it should be large enough to prevent concentrations of birds & rodents (usually 10 acres of more.)

Burn small areas to reduce nighttime smoke management problems.

Smoke management is a must!

Use caution to avoid damage to soil or water resources.

If a broadcast burn will not meet objectives, pile - do not windrow debris.

ATTACHMENT 2 – SMOKE MANAGEMENT SCEENING PROCEDURE

The following information is an excerpt from the USDA Forest Service Southern Region Technical Publication, R8-TP 11, **A Guide for Prescribed Burning in Southern Forests**, February 1989. This material along with other useful and important information may be found on the Florida Division of Forestry web site <http://flame.fl-dof.com/Env/fire.html>.

Smoke Management

Prescribed burning helps achieve many desired resource objectives, but it nevertheless pollutes the air. We therefore have an obligation to minimize adverse environmental effects. If this obligation is disregarded, prescribed burners can be held liable for damages from accidents or problems resulting from their actions. Use the following guidelines to reduce the impact from smoke.

A. Define objectives. - Be sure you have clear resource objectives and have considered both on-site and off-site environmental impacts.

B. Obtain and use weather and smoke management forecasts. - Weather information, fire-weather and smoke management forecasts are available to all resource managers through State forestry agencies. Be sure to use them. Such information is needed to predict smoke generation and movement as well as fire behavior. If the forestry weather outlook does not agree reasonably well with the radio/TV forecast, find out why.

C. Don't burn during pollution alerts or stagnant conditions. - Smoke will tend to stay near the ground and will not disperse readily. Many fire-weather forecasters include this in their regular forecasts.

D. Comply with air pollution control regulations. - Know the regulations that apply at the proposed burn site when you make the prescription. Check with your State fire control agency.

E. Burn when conditions are good for rapid dispersion. - Ideally, the atmosphere should be thermally neutral to slightly unstable so smoke will rise and dissipate, but not so unstable as to cause a control problem. Again, your local forestry agency can help. Some states use Category Day based on the ventilation rate, but if the Dispersion Index is calculated for your area, it is a better indicator (see table 1). Reassess a decision to burn when the daytime Dispersion Index value is below 41.

F. Use caution when near or upwind of smoke-sensitive areas. - Burning should be done when wind will carry smoke away from public roads, airports, and populated areas. Do not burn if a smoke-sensitive area is within 1/2 mile downwind of the proposed burn.

G. Use caution when smoke-sensitive areas are down drainage. - Minimize the production of residual smoke. Use aggressive mopup as necessary.

Table 1. – Relationship of Dispersion Index to On-the-Ground Burning Conditions

Dispersion Index	Burning conditions
>100	Very good – Burning conditions may be so good that fires may be hazardous and present fire control problems. Reassess decision to burn.
61 – 100	Good – preferred range for prescription burns.
41 – 60	Generally OK – climatological afternoon values in most inland forested areas fail in this range.
21 – 40	Fair – stagnation may be indicated if accompanied by low windspeeds. Reassess decision to burn.
13 – 20	Generally poor – do not burn. Stagnant if persistent, although better than average for a night value.
7 – 12	Poor - do not burn. Stagnant during the day, but near or above average at night.
1 – 6	Very poor – represents the majority of nights at many locations.

Prescribed Fire Reduces Air Pollution from Wildfires

H. Estimate the amount and concentration of smoke you expect to generate. – This guideline is especially important near highways and populated areas (see table 2). Smoke management guidelines will help you develop this estimate. Some states tie allowable smoke generation to Category Day.

I. Notify your local fire control office, nearby residents, and adjacent landowners. - Notification is common courtesy and is required in most areas. People need to know that your burn is not a wildfire. In addition, the burner will get advance notice of any adverse public reaction and be made aware of special problems, such as respiratory ailments, washday, etc.

J. Use test fires to confirm smoke behavior. - Set these in or adjacent to the area proposed for burning, away from roads or other edge effects.

K. Use backing fires when possible. - Backing fires consume dead fuels more completely and produce less smoke. Even though slower and more expensive, they produce fewer pollutants and restrict visibility less.

L. Burn during middle of the day when possible. - Atmospheric conditions for dispersion of smoke will be most favorable.

M. Consider burning in small blocks if Dispersion Index is below 61. - The larger the area being burned, the higher the concentration of particulates put into the air, and the longer the duration of the visibility reduction downwind. However, if weather conditions are good for rapid smoke dispersion, e.g., the Dispersion Index is above 60, it is often better to burn the whole area at one time from a smoke management standpoint.

N. Do not ignite organic soils. - It is virtually impossible to put out an organic soil fire without submerging it in water. It will smoke for weeks despite control efforts, creating severe smoke problems for miles around. Such fires can also re-ignite surface fuels, resulting in a wildfire.

O. Be very cautious of nighttime burning. - Smoke drift and visibility are very difficult to predict at night. The wind may lessen or stop completely keeping smoke concentrations high in the vicinity of the burn. Burn at night only when you have a definite forecast of optimum conditions. A nighttime smoke patrol is often necessary.

P. Anticipate down-drainage smoke flow. - Atmospheric conditions tend to become stable at night. Stable conditions tend to keep smoke near the ground. In addition, downslope winds generally prevail at night. Thus, smoke will flow down drainage and concentrate in low areas. When relative humidity rises above 80 percent and smoke is present, the formation of fog becomes increasingly likely as moisture condenses on the smoke particles. There seldom are satisfactory solutions to these problems, so they should be avoided entirely whenever possible.

Q. Mopup along roads. - Start mopup along roads as soon as possible to reduce impact on visibility. Extinguish all stumps, snags and logs. Mopup should be particularly aggressive whenever roads are in areas where smoke could travel downslope or up or down a drainage.

R. Have an emergency plan. - Be prepared to extinguish a prescribed burn if it is not burning according to plan or if weather conditions change. Have warning signs available. If wind direction changes, be prepared to quickly contact the local law enforcement agency and to direct traffic on affected roads until traffic control personnel arrive.

Caution: Check For Down Drainage Smoke Flow At Night!

Screening System for Managing Smoke

Most southern states have either voluntary or mandatory smoke management guidelines that should be followed when planning a prescribed burn. Your local State forestry office can advise you of recommended or required procedures. Many of these guidelines use a term called the ventilation rate or ventilation factor which estimates the atmosphere's capacity to disperse smoke. Another way to estimate this capacity is to use the Dispersion Index (see table 1) developed at the Southern Forest Fire Laboratory. This calculated index is better able to incorporate diurnal changes in the lower atmosphere.

Table 2 - Effect of Smoke Concentration on Visibility

Smoke concentration (micrograms/m3)	Visibility (miles)[1]
125	2.0 - 8
250	1.0 - 4
500	0.5 - 2
1,000	0.25 - 1

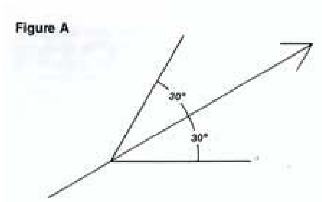
[1] These numbers only valid when relative humidity is below 70 percent

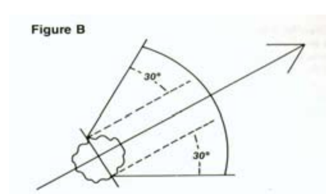
If you will be burning in a state that has not issued guidelines, use the **Southern Forestry Smoke Management Guidebook** (see Suggested Reading section, second listing under U.S. Department of Agriculture). This guidebook tells you how to predict smoke concentrations at any distance downwind. An improved and computerized version, called **PRESMOK**, simplifies use of this prediction system. Copies are available from Southern Forest Fire Laboratory. Use of this smoke screening system does not take precedence over State guidelines. The full system cannot be discussed here, but an updated version of the Initial Screening System based on the Guidebook is presented below. This system has five steps: (1) Plot direction of the smoke plume, (2) Identify smoke-sensitive areas, (3) Identify critical smoke-sensitive areas, (4) Determine fuel type, and (5) Minimize risk.

Step 1. Plot Direction of the Smoke Plume

A. Use maps on which the locations of smoke-sensitive areas can be identified. Plot the anticipated downwind smoke movement a distance of: 5 miles for grass fuels regardless of fire type; 10 miles for palmetto-gall berry fuels when using line-backing fires or spot fires; 20 miles for palmetto/gallberry fuels using line-heading fires; 30 miles for all logging debris fires; 5 miles for line backing fires in all other fuel types; and 10 miles for line-heading fires in all other fuel types, or burns of 250 acres or more. First locate the planned burn area on a map and draw a line representing the centerline of the path of the smoke plume (direction of transport wind) for the distance indicated. If the burn will last 3 or more hours, draw another line showing predicted wind direction at completion of the burn

B. To allow for horizontal dispersion of smoke as well as shifts in wind direction, draw two other lines from the fire at an angle of 30 degrees from the centerline(s) of observed wind direction (45 degrees if forecast wind direction used). If fire is represented as a spot, draw as in figure A. If larger, draw as in figure B. The result is your probable daytime smoke impact area.





C. Now go down-drainage for one-half the distance determined above, but do not spread out except to cover any valleys or bottoms. The result is your probable nighttime impact area, providing the burn will be completed at least 3 hours before sunset, and providing the forecast night winds are light and variable.

Step 2. Identify Smoke-Sensitive Areas

Identify and mark any smoke-sensitive areas (such as airports, highways, communities, recreation areas, schools, hospitals, and factories) within the impact zone plotted in step 1. These areas are potential targets for smoke from your burn.

A. If no potential targets are found, you may burn as prescribed.

B. If the area to be burned contains organic soils that are likely to ignite, do not burn.

C. If any targets are found, continue this screening system.

Step 3. Identify Critical Smoke-Sensitive Areas

A. Critical smoke-sensitive areas are:

1 Those that already have an air pollution-or visibility problem.

2 Those within the probable smoke impact area as determined below. If the distance determined in step 1 was:

a.) 5 miles, any smoke-sensitive area within 1/2 mile is critical, both downwind and down-drainage.
b.) 10 miles, any smoke-sensitive area within 1 mile is critical.
c.) 20 miles, any smoke-sensitive area within 2 miles is critical.
d.) 30 miles, any smoke-sensitive area within 3 miles is critical.

B. If any critical smoke-sensitive areas are located, DO NOT BURN under present prescription!

1 Prescribe a new wind direction that will avoid such targets and return to the beginning of this screening system, or

2 If smoke-sensitive area is in last half of distance criteria, reduce the size of the area to be burned by approximately one half, complete burn at least 3 hours before sunset, and aggressively mopup and monitor, or

3 Use an alternative other than burning.

C. If no critical smoke-sensitive areas are found, or criteria B1 or B2 is met, continue the screening system.

Step 4. Determine Fuel Type

E. The smoke produced may vary greatly by type, amount, and condition of fuel consumed.

F. From the list below, determine which broad type best fits your fuel.

1 Grass (with pine overstory)

2 Light brush

3 Pine needle litter

4 Palmetto-gallberry

5 Windrowed logging debris

6 Scattered logging debris or small dry piles

G. Review fuel categories or combinations.

1 If the fuel type is described by one of the above categories, continue.

2 If your fuel type is not comparable to any of the above, pick the fuel type for which fire behavior and smoke production most nearly compare with yours and proceed with EXTREME CAUTION on the first few burns.

H. If the fuel type is windrowed logging debris, and you have identified smoke-sensitive areas, DO NOT BURN under present prescription. Smoke production is great and can last for weeks.

1 Prescribe a new wind direction to avoid all smoke-sensitive areas and return to the beginning of the system.

2 If you cannot avoid all smoke-sensitive areas, you will need a better procedure than this simple screening system. Refer to the **Southern Forestry Smoke Management Guidebook** or use **PRESMOK**.

I. If the fuel type is scattered logging debris or small, essentially dirt-free, dry piles, the following conditions should be met:

1 Size of area to burn less than 100 acres.

2 No major highways within 5 miles down drainage.

3 No other smoke-sensitive areas within 3 miles down drainage.

4 If relative humidity is predicted to stay below 80 percent and surface winds above 4 m.p.h. all night, the distances in 2 and 3 above can be cut in half.

J. If your comparable fuel type is one listed in 4A above, determine your total per-acre fuel loading. See below or **Southern Forestry Smoke Management Guidebook** for tables to assist you.

1 If less than 10 tons per acre, continue. Generally, the total fuel loading will be less than 10 tons in the fuel types listed below when age of rough is:

a.) Grass (with pine overstory), any age. Also wheat fields and other agricultural burns.
b.) Light brush, 7 years old or less (10 years if basal area is less than 100 square feet per acre).
c.) Loblolly pine with
  a palmetto-gallberry understory, 7 years or less if basal area is less than 150 square feet per acre.
  b little or no understory, 15 years or less if basal area is less than 150 square feet per acre.
d.) Slash pine with
  a palmetto-gallberry understory, 5 years or less if basal area is less than 150 square feet per acre.
  b little or no understory, 8 years or less if basal area is less than 150 square feet per acre.

2 If greater than 10 tons per acre, refer to **the Southern Forestry Smoke Management Guidebook** or double the distance determined in step 1A. Use 1 1/2 times the distance if close to 10 tons.

CAUTION: Be Sure Atmospheric Conditions Are Conducive To Good Dispersion!

Step 5. Minimize Risk

To meet your smoke management obligations when any smoke-sensitive area may be affected by your burn, you must meet all of the following criteria to minimize any possible adverse effects.

- Height of mixing layer (mixing height) is 1,650 feet (500 meters) or greater.
- Transport windspeed is 9 mph (4 meters per second) or greater.
- Background visibility is at least 5 miles within the plotted area.
- If rough is older than 2 years, use a backing fire. If burn can be completed 3 hours before sunset, or if no smoke-sensitive areas are located in the first half of the impact area, other firing techniques can be used.
- Promptly mopup and monitor to minimize smoke hazards.
- If a smoke-sensitive area is in the overlapping trajectory of two smoke plumes, it should be 1 mile from either source (2 miles if one is from logging debris).
- For night burns, backing fires with surface windspeed greater than 4 mph and relative humidity under 80 percent should be prescribed.
- If it appears that stumps, snags, or logs may cause a residual smoke problem, take steps to keep them from burning. If they do ignite, extinguish them.

- Daytime value of the Dispersion Index between 41 and 60 is adequate for small fires and low levels of burning activity. As either size of individual fires or level of burning activity increases, the Dispersion Index value should also increase.

Many variables affect the behavior and resulting smoke from a prescribed burn. The above system works best in fiat terrain and was not designed for use in mountainous country. It does not attempt to consider all the variables: it can only offer broad guidelines. If your prescribed fire complies with all conditions in these five steps, you should be able to safely burn without causing a smoke problem. If you have any marginal answers, areas that are especially sensitive to smoke, heavy fuel loading or wet fuels, use the prediction system mentioned in the Southern Forestry Smoke Management Guidebook. You must make the final judgment.

GLOSSARY

Aerial Ignition
The ignition of fuels by dropping incendiary devices or materials from aircraft.

Area Ignition
Igniting, throughout an area to be burned, a number of individual fires either simultaneously or in rapid succession and so spaced that they soon influence and support each other to produce a hot, fast-spreading fire throughout the area.

Available Fuel
The portion of the total fuel that would actually be consumed under a specific set of burning conditions.

Backing Fire
A fire spreading set to spread into (against) the wind, or downhill. (See Flanking Fire, Heading Fire).

Blackline
A burned are either adjacent to a fireline (control line) or along a roadway. The blackline increases the width of the fireline and provides additional protection against uncontrolled spread of fires.

Burning Boss (Fire Boss)
The person responsible for managing a prescribed fire from ignition through mopup.

Center Firing
A method of broadcast burning in which fires(s) are set in the center of the area to create a convection column with strong surface indrafts. Usually additional fires are then set progressively nearer the outer control lines as the draft builds up, to draw the flames and smoke towards the center of the burn.

Control Line
Comprehensive term for all constructed or natural fire barriers and treated fire edges used to control a fire.

Debris Burning
Any prescribed fire used to dispose of scattered, piled, or windrowed dead woody fuel in the absence of an overstory. Such a burn often accomplishes the objectives of a Site Preparation Burn as well.

Drift Smoke
Smoke that has been transported from its point of origin and in which convective motion no longer dominates.

Drought Index (Keech-Byram Drought Index)
A numerical rating of the net effect of evapotranspiration and precipitation in producing cumulative moisture depletion in deep duff or upper soil layers.

Fine Fuels (Flash Fuels)
Fast drying, dead fuels, which have a timelag constant of 1 hour or less. These fuels ignite readily and are consumed rapidly when dry. Included are grass, leaves, draped pine needles, and small twigs.

Fire Behavior
A general term that refers to the combined effect of fuel, weather, and topography on a fire.

Firebreak
Any natural or constructed barrier used to prevent or retard the spread of fire that is in existence or made before a fire occurs. It is usually created by the removal of vegetation.

Fire Effects
Physical, biological, and ecological impacts of a fire on the environment.

Fire Front
The strip within which continuous flaming occurs along the fire perimeter.

Fireline
A narrow line, 2 to 10 feet wide, from which all vegetation is removed by soil sterilization, yearly maintenance, treatment with chemical fire retardant, or clearing just before ignition of a prescribed burn.

Fireline Intensity
The rate of heat release per unit time per unit length of fire front. Numerically, it is the product of the heat yield, the quantity of fuel consumed in the fire front, and the rate of spread.

Firing Technique
The type(s) of fire resulting from one or more ignition(s), e.g. backing fire, flanking fire, and heading fire.

Flame Height
The average height of flames as measured on a vertical axis. It may be less than flame length if the flames are angled.

Flame Length
The distance measured from the tip of the flame to the middle of the flaming zone at the base of the fire. It is measured on a slant when the flames are tilted due to the effects of wind and/or slope.

Flaming Front
The zone of a moving fire within which the combustion is primarily flaming. Behind this flaming zone, combustion is primarily glowing. Light fuels typically have a shallow, flaming front, whereas heavy fuels have a deeper front.

Fuel Moisture Content
The water content of a fuel expressed as a percentage of the oven-dry weight of the fuel.

Heading Fire
A fire front spreading or set to spread with the wind or upslope.

Herbaceous Fuels
Grasses and other plants that contain little woody tissue.

Ladder Fuels
Fuels that provide vertical continuity between the ground and tree crowns, thus creating a pathway for a surface fire to move into the overstory tree crowns.

Line Ignition
Setting a line of fire as opposed to individual spots.

Mopup
Extinguishing or removing burning material, especially near control lines after an area has burned to make it safe, or to reduce residual smoke.

Residual Smoke
Smoke produced by smoldering material behind the actively burning fire front.

Ring Fire
A fire started by igniting the perimeter of the intended burn area so that the ensuing fire fronts converge toward the center of the area.

Site Prep Burn
A fire set to expose adequate mineral soil and control competing vegetation until seedlings of the desired species become established.

Smoke Management
Application of knowledge of fire behavior and meteorological processes to minimize air quality degradation during prescribed burning.

Smoke Plume
The gasses, smoke, and debris that rise slowly from a fire while being carried along the ground because the buoyant forces are forces are exceeded by those of the ambient surface wind.

Smoke-sensitive Area (SSA)
An area within which, for reasons of visibility, health or human welfare, smoke could have an adverse impact. Examples of smoke-sensitive areas include residential and urban areas, public roadways, areas with schools or hospitals, and other areas where the health and welfare of humans may be put at risk.

Spot Fire
Fire ignited outside the perimeter of the main fire by a firebrand.

Spot Fire Forecast
Special prediction of atmospheric conditions at a specific site, sometimes requested by the Burning Boss before ignition of a prescribed fire.

Strip-Heading Fire
A series of lines of fire upwind (or downslope) of a firebreak or backing fire that will burn with the wind toward the firebreak or backing fire.

Underburning
Prescribed burning under a timber canopy.

Wetline
A line of water, or water and chemical retardant, sprayed along the ground to serve as a temporary control line from which to ignite or stop a low-intensity fire.