Arkansas Smoke Management Program

INTRODUCTION

Fire in Arkansas' forests, has been an important process in the ecology of the state since the beginning of time. Prescribed fire (controlled burning) is an indispensable tool used by the natural resource manager to accomplish natural resource management objectives.

In Arkansas, natural resource managers burn approximately 300,000 acres a year. This amount is likely to increase.

REASONS FOR HAVING A SMOKE MANAGEMENT PROGRAM

The purposes of the Arkansas Smoke Management Program (SMP) are to assure adherence to air quality regulations and to manage smoke from prescribed fire so that the smoke's impact on people and the environment will be acceptable. In 1997, the U.S. Environmental Protection Agency (EPA) reported that fine particles (2.5 micrometers or smaller in size) have the potential to significantly impair human health when people are exposed to high levels. The fine particles that can impair human health can also reduce visibility in federally mandated Class I areas such as Caney Creek Wilderness Area and Upper Buffalo Wilderness Area. In these areas, EPA has established a goal to make reasonable progress at removing any human-caused impairment to visibility.

An estimated 70 % of the particulate matter emissions in smoke are fine particles. Therefore, prescribed fire should be planned to: limit public safety hazards posed by smoke intrusion into populated areas; prevent deterioration of air quality; prevent National Ambient Air Quality Standards (NAAQS) violations; and limit visibility impairment at Class I areas or other smoke sensitive areas.

This SMP guides the prescribed fire manager to minimize the impact of particulate matter released into the atmosphere by estimating how many tons of fuel may be burned in an area. The amount of fuels that can be burned in an air shed (36 square miles) is based upon the ability of the atmosphere to disperse the particulate matter and the distance downwind to a smoke-sensitive area.

These guidelines address when to burn, not how to burn.

ADMINISTRATION

The Air Division of the Arkansas Department of Environmental Quality (ADEQ) regulates open burning. Regulation 18 of the Arkansas Pollution Control and Ecology Commission (the Arkansas Air Pollution Control Code) contains a General Prohibition on "open burning of refuse,

garbage, trade waste, or other waste material" but exempts controlled fires used for forest and wildlife management and certain agricultural activities (ADEQ Reg. 18.602 – 18.603).

Controlled burns should avoid areas known to contain open dumps, discarded tires or other similar waste.

When the ADEQ Director declares that the air is polluted in an area of Arkansas, all open burning in the area shall be discontinued (ADEQ Reg. 18.604).

The State Forester will disseminate and administer the forestry SMP. Daily implementation of the SMP will be coordinated by the Arkansas Forestry Commission (AFC) Dispatch Center.

The prescribed fire manager is responsible for implementing the SMP.

BURN NOTIFICATION

The AFC Dispatch Center coordinates prescribed fire activities. The AFC Dispatch Center will: 1) retrieve U.S. National Weather Service data; 2) calculate smoke management category day and dispersion index; 3) advise prescribed fire managers on the amount of particulate matter that can be released within an air shed; 4) advise prescribed fire managers if other prescribed fires are planned nearby; and 5) maintain appropriate records so that ADEQ may further analyze air quality.

The fire weather or forestry forecast is available on the National Weather Service website (www.srh.noaa.gov).

Arkansas law requires prescribed fire managers to notify the AFC Dispatch Center on the morning of the prescribed fire by calling 1-800-830-8015. See Arkansas Code Annotated §20-22-302.

The AFC recommends that the prescribed fire manager prepare a written prescribed fire plan before starting the prescribed fire. On the day of a planned prescribed fire, the prescribed fire manager will inform the AFC Dispatch Center of the following:

1. person in charge of prescribed fire and how he/she can be contacted;
2. location of prescribed fire (Section, Township, Range or GPS reading and county);
3. acres to be burned;
4. purpose of prescribed fire (site preparation such as natural or artificial regeneration, hazard fuel reduction, wildlife habitat, ecosystem restoration, forage/grazing, or others);
5. fuel type and tonnage of fuel to be consumed (see section on determining the total amount of fuels to be consumed by the prescribed fire); and
6. planned ignition time and duration of prescribed fire.

AFC Dispatch Center will locate each prescribed fire in the center of the air shed for purposes of complying with these guidelines. If the fuel tonnage for a single prescribed fire causes the air pollution tonnage for a given air shed to exceed permissible limits, the AFC Dispatch Center will

recommend to the prescribed fire manager that the plan should be altered (either by delaying the burn or reducing the acreage to be burned).

There could be situations where a smoke sensitive area may lie within overlapping air sheds of simultaneous prescribed fires. When this occurs, prescribed fires are prioritized according to the order in which they are reported. When a prescribed fire is reported and the estimated fuel weight that will be burned is less than the recommended maximum fuel weight, a proportion of that maximum remains available for use.

Finally, if a prescribed fire is completed before 4:00 p.m., the prescribed fire manager should tell AFC Dispatch Center. This may allow another prescribed fire manager in the same air shed to conduct his/her prescribed fire.

OZONE ACTION DAYS

During periods of relatively stagnant air and at the request of ADEQ, the National Weather Service will issue an Ozone Action Day statement. The AFC Dispatch Center will advise prescribed fire managers when the National Weather Service declares an Ozone Action Day.

Prescribed fire managers should reduce ground-level ozone formation by delaying the prescribed fire on Ozone Action Days. The ozone season is typically May through September. Voluntary pollution reductions will minimize ozone related health risks.

ALTERNATIVES TO PRESCRIBED FIRE

Natural resource managers have an array of tools, including fire, to achieve management objectives. Natural resource managers are urged to evaluate the potential public health and environmental impacts of fire and other land management tools. If prescribed fire is likely to harm public health and the environment, other land management tools should be considered.

Land management tools include on-site chipping, whole tree harvesting, roll chopping, shear and pile, and removal of slash for off-site burning. When the management objective is to preclude, reduce, or remove live vegetation and/or specific plant species from a site, herbicide treatments may be an appropriate tool.

There maybe situations where fire in combination with other types of treatment methods may be a better approach to achieving the desired resource benefits while protecting air quality. Combinations of treatments may include mechanically pretreating the area to reduce the fuel load before use of prescribed fire.

SMOKE MANAGEMENT COMPONENTS OF THE PRESCRIBED FIRE PLAN

The prescribed fire manager should take measures to reduce the impact of smoke. Consider the following steps while planning the prescribed fire:

A. actions to minimize smoke impacts;
B. determine the total amount of fuels to be consumed by the prescribed fire;
C. identify the closest smoke sensitive target and distance from the prescribed fire;
D. determine under which conditions the prescribed fire can be safely conducted;
E. identify public notification and exposure reduction procedures; and
F. monitor air quality.

A. Actions to minimize smoke impacts.

The prescribed fire plan should document the steps taken before, during and after the burn to reduce smoke impacts. Where applicable, use one of the following approaches:

- Reduce the size of the burn to achieve the allowed emissions.
- Reduce the fuel loading in the area to be burned by mechanical means or by using frequent, low-intensity burns to gradually reduce fuels.
- Reduce the amount of fuel consumed by the fire by burning when fuel moistures for larger fuels and duff moistures are high.
- Rapid and complete mop-up after the burn or mop-up of certain fuels.
- Reference "Smoke Management Guide for Prescribed Fire and Wildland Fire" by National Wildfire Coordinating Group Fire Use Working Team, publication NFES 1279.

B. Determine the total amount of fuels to be consumed by the prescribed fire.

A wide variety of fuel types and conditions are found in Arkansas. Table 1 describes those fuel types that are found in greatest quantities on typical prescribed fire sites.

In most prescribed fires, "available" tons of fuel will be less than "total" tons of fuel. Due to fuel moisture and other factors, the burn will not consume all the fuel. The emission data needed by the AFC Dispatch Center is the consumption of "available" fuels. The prescribed fire manager must provide reasonable estimates of the total amount of available fuels that will be burned by the prescribed fire. The prescribed fire manager may need to consider a higher fuel loading estimate than shown in Table 1 for forest stands that have been fuel-loaded by insects, diseases, tornadoes, ice storms or other factors.

Fuel Loading Range can vary by amount and age of fuels or number of years since last burned. (Low – less than 2 years since last burned; Medium – 2 to 5 years; and Heavy - 6 years or more).

References used to predict fuel loading were computer model "FOFEM" (First Order Fire Effects Model) developed by the USFS Intermountain Research Station; "Aids to Determining Fuel Models for Estimating Fire Behavior" by Hal E. Anderson, General Technical Report INT-

122; and "Photo Guide for Appraising Surface Fuels in East Texas" by Hershel C. Reeves, Center for Applied Studies- School of Forestry, Stephen F. Austin State University.

Table 1 is an average. Organizations and agencies in Arkansas are involved in prescribed fire emission and fuel consumption studies. Published fuel loading data from these studies may be substituted. The fuel loading values, shown below, will be revised as new data is submitted to the Arkansas Prescribed Fire Committee and approved by the Arkansas Forestry Commission.

Table 1. Common Fuel Types

Typical Arkansas timber and vegetative types	**Fuel Loading Range**	**Total fuels (tons/acre)**	**Available fuels (tons/acre)**
Shortleaf pine with Oak – Overstory composed of shortleaf pine stands mixed with oak or oak/hickory. Amount of litter will vary with the age of the stand, degree of crown closure, species and age of rough. (FM 9)	Low Medium Heavy	8.5 8.9 9.3	3.0 4.0 4.4
Shortleaf pine regeneration – Overstory composed of immature shortleaf pine mixed with scattered oak brush. Surface fuel is mostly grass with some low shrubs. (FM 2)	Low Medium Heavy	4.8 7.1 8.8	2.6 3.8 5.1
Loblolly pine with Oak – Overstory composed of loblolly pine mixed with oak or oak/hickory. Amount of litter will vary with age of the stand, degree of crown closure, species, and age of rough. (FM 9)	Low Medium Heavy	10.7 11.1 12.0	6.4 6.8 7.9
Loblolly pine regeneration – Overstory composed of immature loblolly pine mixed with immature hardwood. Surface fuels are mostly grass, briers and low shrubs. (FM 2)	Low Medium Heavy	9.6 12.3 14.7	4.4 7.6 8.5
Hardwood leaf litter – Overstory usually composed of oak or hickory with a mixture of other hardwoods such as maple, elm, or gum. Amount of litter will vary with the age of the stand, degree of crown closure, species, and age of rough. (FM 9)	Low Medium Heavy	2.7 4.7 6.7	0.8 1.5 2.5
Grass/Brush – First fuel type to appear on site prepared, burned, or cutover areas. Also applies to pastures, old fields, or young pine stands where grass is the primary carrier of the fire. (FM 1,2,3)	Low Medium Heavy	2.0 3.0 5.0	2.0 3.0 5.0
Dispersed Slash – Normally follows heavy thinning, or a clear-cut, where debris is not piled. Needle or leaf litter may or may not be present. Limb-gate piles should be excluded because of residual smoke. (FM 11,12,13)	Low Medium Heavy	8.0 12.0 16.0	4.0 6.0 8.0
Piled Debris –Normally follows land clearing or timber cutting where all debris is piled. Due to heavy fuel loading, fuel size and arrangement, and inefficient burning, piled debris produces greater amounts of smoke and particulate matter for long time periods.	Low Medium Heavy	10.0 15.0 20.0	5.0 7.5 10.0
Shortleaf/Loblolly with grass – Open overstory composed of loblolly or shortleaf pine. Amount of grass or litter will vary with age of the stand, degree of crown closure, and age of rough. (FM 2)	Low Medium Heavy	3.7 7.4 11.7	1.5 3.8 5.9

(FM- National Fire Danger Rating System fire behavior fuel models)

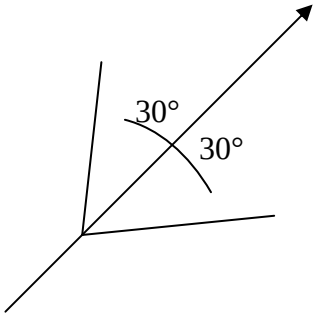
Determining available fuels:

Once the amount of fuels that will be consumed has been determined, multiple the value times the amount of acres to be burned. For example, a person plans to burn 300 acres of a loblolly pine stand mixed with oak. The stand was burned previously two years ago and examination of the site reveals there is a low amount of fuels on the ground. Therefore, the prescribed fire is expected to consume 1920 tons of fuel (6.4 tons/acre times 300 acres).

C. Identify the closet smoke sensitive target and distance from the prescribed fire.

Every effort should be made to keep smoke away from sensitive areas. Examples are: airports, highways, communities, Class I areas recreation areas, schools, hospitals, nursing homes, and industry (especially facilities that emit sulfur dioxide – smelters, coal fired power plants, and factories with large boilers). Follow these five steps to identify smoke- sensitive targets:

1. Locate on a map the prescribed fire and all potential smoke sensitive targets, plus areas known to already have air pollution problems. (Table 4 considers targets up to 30 miles from the prescribed fire.)
2. Determine the wind direction that will have the least impact on smoke sensitive targets.
3. Draw a line representing the centerline of the path of the smoke plume using the wind direction chosen in the previous step.
4. Determine the distance from the edge of the prescribed fire to the nearest smoke-sensitive target.
5. To allow for horizontal dispersion of the smoke, as well as shifts in wind direction, draw two other lines from the burn at an angle of 30 degrees from the centerline(s). If a prescribed fire is represented as a spot, draw as in Figure A. If larger, draw as shown in Figure B.



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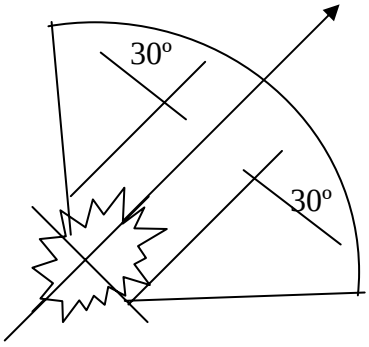

B

Figures A and B. Examples of how to estimate a smoke plume dispersion for prescribed fire planning.

Planning and public notification are recommended when igniting large areas in a short amount of time, such as is done with aerial ignition. The heat produced from the prescribed fire may allow the smoke to penetrate above the mixing height where dispersion of the smoke is minimal. Smoke from these prescribed fires may travel long distances before descending to the ground. Therefore, it is important to monitor the smoke column downwind to determine if a problem will develop.

D. Determine under which conditions the prescribed fire can be safely conducted.

One goal of safely conducting a prescribed fire in Arkansas is to perform the burn when atmospheric conditions will disperse the smoke so people and Class I areas are not effected. The smoke management plan uses two pieces of information to determine how many tons of fuels can be consumed within an air shed:

1) downwind distance to the nearest smoke-sensitive target, and
2) category day.

The National Weather Service measures the transport wind speed and mixing height daily by 8:00 a.m. and an estimate is made for the afternoon. The predicted afternoon mixing height and transport wind speed will be used by the AFC Dispatch Center to calculate category day. See Table 2 for category day burning guidelines. Table 3 lists the category day for each combination of mixing height and transport wind speed.

The National Weather Service issues an afternoon forecast predicting conditions for the following day. Using the afternoon forecast, the predicted category day for the following day is for planning purposes only. The category day issued by the AFC Dispatch Center will remain in effect until a new forecast is received the following day.

Table 2. Category Day Guidelines

Category Day	Guidelines
1	Daytime burning only, between 11:00 a.m. and 4:00 p.m., maximum of 100 acres. No burning in slash, piled debris, or heavy fuel loads.
2	No burning until 11:00 a.m. and not before surface inversion has lifted. Burn should be substantially burned out by 4:00 p.m.
3	Burn only after surface inversion has lifted.
4	Burn anytime.
5	"Unstable" and windy. Excellent smoke dispersal. Burn with caution.

Table 3. Relationship between category day, transport wind speed – TWS - (miles per hour), and mixing height (feet).

TWS Wind (m.p.h.)	MIXING HEIGHT (Feet) CATEGORY DAY												
	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500
7			1	1	1	2	2	3	3	3	3	3	3
8		1	1	2	2	3	3	3	3	3	3	3	4
9	1	1	1	2	3	3	3	3	3	3	3	4	4
10	1	1	1	3	3	3	3	3	3	4	4	4	4
11	1	1	2	3	3	3	3	3	4	4	4	4	4
12	1	1	3	3	3	3	3	4	4	4	4	4	4
13	1	2	3	3	3	3	3	4	4	4	4	4	4
14	1	2	3	3	3	3	4	4	4	4	4	4	4
15	2	3	3	3	3	4	4	4	4	4	4	4	4
16	2	3	3	3	3	4	4	4	4	4	4	4	5
17	2	3	3	3	4	4	4	4	4	4	4	5	5
18	2	3	3	3	4	4	4	4	4	4	4	5	5
19	2	3	3	3	4	4	4	4	4	4	5	5	5
20	3	3	3	4	4	4	4	4	4	5	5	5	5

Exercise caution with high transport wind speeds and low mixing height, or low transport wind and high mixing height. These conditions can cause poor smoke dispersion and burn behavior problems.

Table 4 provides guidelines on the total amount of fuel that can be allocated to an air shed. Estimates were developed where VSMOKE (Lavdas 1996) model predicted between 159 to 175 ug/m^3. All model calculations had a stability class of slightly unstable. The fine particulate release rate and heat release rate were estimated by using the Fire Emission Production Simulator (http://www.fs.fed.us/pnw/fera/feps/).

Table 4. The range in tons of fuel that can be allocated to an airshed based upon the downwind distance to the nearest smoke-sensitive target and the category day.

Distance to Smoke Sensitive Target (miles)	Category Day 2	Category Day 3	Category Day 4	Category Day 5
0-0.19	Recommend do not burn			
0.2-4.9	488	560	720	1,280
5-9.9	1,000	1,200	1,840	3,200
10-19.9	1,840	2,240	4,200	7,200
20-29.9	2,880	3,280	6,400	11,600

For sensitive targets further than 29.9 miles, use the maximum range in tons of fuel for the category day.

E. Public notification and exposure reduction procedures.

The prescribed fire plan should identify actions that will be taken to notify people and authorities at smoke-sensitive areas before the prescribed fire. The prescribed fire plan should identify contingency actions that will be taken during a prescribed fire to reduce the exposure of people at smoke-sensitive areas if smoke intrusions occur. Appropriate contingency actions may include:

- Notifying the affected public (especially sensitive persons) of elevated pollutant concentrations,
- Suggesting actions to be taken by sensitive persons to minimize their exposure (e.g., remain indoors, avoid vigorous activity, avoid exposure to tobacco smoke and other respiratory irritants), and
- Halting ignitions of any new prescribed burning that could add smoke to the same area.

F. Monitor air quality.

The prescribed fire plan should include monitoring of the smoke from the prescribed fire. Visibility in Class I areas will be monitored. The extent of the monitoring should match the size of the fire. For small, or short duration fires (such as those in grass or leaf litter), visual monitoring of the directions of the smoke plume and monitoring nuisance complaints by the public may be sufficient. Other monitoring techniques include posting personnel on vulnerable roadways to look for visibility impairment and to initiate safety measures for motorists; posting personnel at other smoke sensitive areas to look for smoke intrusions; using aircraft to track the progress of smoke plumes; and continued tracking of meteorological conditions during the fire. For prescribed fires in fuels with longer duration burning (such as timber litter or slash), and which are expected to last more than one day, locating real-time particulate matter (PM) monitors at smoke- sensitive areas may be warranted to facilitate timely response to smoke problems.

COMPONENTS OF PRESCRIBED FIRE PLANS

Prescribed fire managers should prepare a prescribed fire plan for each burn (or, if the units are small and the burn objectives and prescription is the same, one plan may cover several burn units). These plans are written following protocols specific to each agency. At a minimum, the prescribed fire plan should include the following information:

- Location and description of the area to be burned.
- AFC Dispatch Center, local fire department or sheriff's office to be contacted.
- Occupants in all dwellings within ¼ mile of prescribed fire to be contacted.
- Personnel responsible for managing the fire.
- Type of vegetation to be burned.
- Number of acres to be burned.
- Amount of fuel to be consumed (tons/acre).
- Fire prescription including weather, ignition techniques, personnel and equipment.
- If available, documentation (along with any maps or tables) from atmospheric dispersion

models/ smoke dispersion prediction models which present information on what impact the smoke may have on any smoke sensitive areas.

- Actions needed to stop a burn if weather conditions degrade from the forecast values.
- Criteria the fire manager will use for making burn/no burn decisions.
- Safety precautions for personnel on the prescribed fire.

SMOKE EVALUATION

Determining tons of fuel to be consumed for the prescribed fire completes an important part of the analysis. Prescribed fire managers should examine the results of their analysis to determine if the prescribed fire could be divided into smaller units since others may be burning near them on the same day.

If weather parameters are questionable, the prescribed fire manager should conduct a test burn to determine feasibility of the burn.

The prescribed burn managers should evaluate frequently traveled roads within one mile of the prescribed fire, especially if these roads are down smoke-drainage of the burn. Residual smoke flows and settles in low areas during the night and early morning and may contribute to heavy fog, which creates hazardous road conditions.

Predicting visibility and smoke drift is more difficult at night. Winds may lessen or die out completely, and smoke will tend to stay near the ground. Although burning at night may help achieve other objectives, it may aggravate smoke management problems. Night time burning will require the same planning as daytime burns. For night burns, consider the following recommendations:

1. Burn in light fuels.
2. Use backing fire.
3. Burn when humidity is 80 percent or less.
4. Do not burn if overnight low is within 5 degrees of dew point.
5. Burn with surface wind speed of 4 miles per hour or more.
6. Obtain a night time dispersion index. (See Table 5.)
7. Monitor down drainage and low areas, especially populated areas, airports or roads near the burn site.

The following situations could result in smoke impacting the surface downwind, particularly when there has been a large production of smoke:

1. Transport wind speed exceeds 25 mph, and average surface wind speed is over 20 mph with stronger gusts.
2. Transport wind direction carries smoke over a large lake.
3. A thick layer of smoke from a large burn significantly reduces the heating of the ground.

4. Transport wind direction moves smoke from a fire on the slope of a ridge toward and over the top of the ridge. Smoke may return to the ground in the eddy that can develop on the lee side of the ridge.

To ensure optimum dispersal of smoke during prescribed fire, the mixing layer must be sufficiently deep and transport wind speed adequate. Table 5 uses mixing height, transport wind speed and stability class to produce an index that describes the ability of the atmosphere to disperse smoke. The dispersion index will be included as part of the daily fire weather forecast by AFC Dispatch Center. Estimates of the dispersion index for each hour of the day for Arkansas can be obtained from http://shrmc.ggy.uga.edu. Prescribed fire managers who intend to ignite burns in the morning should consult their local National Weather Service office to determine the anticipated dispersion at the time of ignition. A low dispersion index indicates the atmosphere has poor capacity to disperse smoke; the ignition of a prescribed fire is discouraged. A high dispersion index indicates the possibility of losing control of the prescribed fire.

Table 5. Relationship between dispersion index and atmospheric conditions to disperse air pollution. (Lavdas 1996).

Dispersion Index	Burning Condition
100	Very good burning conditions; fires may be difficult to control. Reassess decision to burn.
61-100	Good-preferred range for prescribed fires.
41-60	Generally OK afternoon climatological values 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 burn.
7-12	Poor-do not burn. Stagnant during the day, but not near or above average at night.
1-6	Very poor-represents the majority of nights at many locations.

SURVEILLANCE AND ENFORCEMENT

Trained and experienced people should supervise prescribed fires. The prescribed burn manager ensures that the burn is conducted in accordance with the prescribed fire plan.

ADEQ will enforce national and Arkansas air quality regulations and laws. ADEQ will investigate smoke nuisance complaints.

PUBLIC EDUCATION AND AWARENESS

The AFC in cooperation with the Arkansas Prescribed Fire Committee will explain the use and importance of fire for ecosystem management, the implications of smoke to public health and safety, and the goals of the SMP. This public awareness effort will use posters, pamphlets, news releases, and public presentations. Prescribed fire managers should train on-the-ground personnel to understand the SMP.

AFC Dispatch will maintain a daily listing of planned prescribed fires on the AFC website (www.forestry.state.ar.us). The planned prescribed burn listing will have the county, nearest community, legal description, planned ignition time and acres of the prescribed burn. AFC will cooperate with organizations and government agencies such as Arkansas Lung Association or ADEQ to make the public aware of planned prescribed fires.

PROGRAM EVALUATION

The AFC will annually:

1. Collect and review information on acres burned by prescribed fire and wildfire.
2. Review the reference, continuous, and IMPROVE monitoring station data maintained by ADEQ.
3. Use information from reports of nuisance complaints or significant smoke intrusions to measure the effectiveness of the SMP.
4. Provide recommendations to ADEQ and Arkansas Prescribed Fire Committee concerning the SMP.

GLOSSARY

Air shed – the atmosphere covering a 36 square mile area (6 miles by 6 miles) approximately 23,040 acres. The amount of fuel that can be burned in the air shed depends on the distance to the nearest downwind smoke sensitive area and meteorological conditions.

Ambient air – the surrounding air external to a building, which the public is exposed to.

Air quality – characteristics of the ambient air, as indicated by concentrations of the six air pollutants for national standards, have been established. For the purposes of this document, concentrations of PM 2.5 are the primary indicator of ambient air quality.

Available fuel - an estimate of the tons of fuel per acre that will actually be consumed by a burn under a specific set of burning conditions. It is influenced by fuel moisture and other factors.

Category day - a scale from 1 to 5 based on transport wind speed and mixing height. For smoke dispersal, 1 is poor and 5 is excellent.

Class I area – an area set aside under the Clean Air Act to receive the most stringent protection from air quality degradation. Designated Class I areas in Arkansas are Caney Creek and upper Buffalo Wilderness.

Cooperator - those forest landowners or managers that have agreed to carry out prescribed burning consistent with the Smoke Management Plan.

Dispersion index - this index is an estimate of the atmosphere's capacity to disperse smoke from prescribed burns over a 1,000-square-mile area. It takes into account mixing height, transport wind, and stability near the ground.

Fuel loading – total amount of fuel at the prescribed burn site.

Inversion - increase of temperature with height in the atmosphere. This condition often exists in the morning and prevents smoke from rising into the atmosphere.

Mixing height - the layer of the atmosphere that pollutants are dispersed into due to turbulent mixing. A forecast of mixing height indicates the height of the top of the layer with respect to mean sea level.

National Ambient Air Quality Standards – established procedures that Federal agencies must follow in making decisions on Federal actions, which may impact the environment.

National Fire Danger Rating System (NFDRS) – system used by the USFS and other organizations to integrate the effects of topography, fuels, and weather on fire behavior.

Ozone Action Day – an action day is declared when the ozone concentrations are expected to reach a level that will affect the health of sensitive groups such as children, the elderly, and people with respiratory disease.

Particulate matter - any airborne finely divided material except water vapor, which exists as a solid or liquid at standard conditions.

PM 2.5 – particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.

Prescribed fire – any fire ignited by management actions to meet specific objectives.

Prescribed fire manager – person responsible for managing a prescribed fire from planning to ignition and mop up.

Residual smoke - smoke that continues after the initial burn has passed through the fuel.

Screening distance - the area to examine for possible sensitive targets.

Sensitive area - areas that can be harmed by smoke. Examples: Airports, major highways, communities, Class 1 areas, recreation areas, schools, hospitals, nursing homes, and factories, etc.

Smoke management - conducting a prescribed fire under fuel moisture, meteorological conditions, and firing techniques that keep the impact of the smoke on the environment within acceptable limits.

Smoke plume – the column of smoke resulting from prescribed fire.

Stagnant air - conditions under which pollutants build up faster than the atmosphere can disperse them.

Transport wind – the average wind speed and direction through the mixing layer. Higher wind speeds allow for more rapid transport of pollutants downwind.

Ventilation rate - the mixing height times the transport wind speed gives a rate indicating the ability of the lower atmosphere to diffuse and disperse smoke.

Wind direction – compass direction from which the wind is blowing.