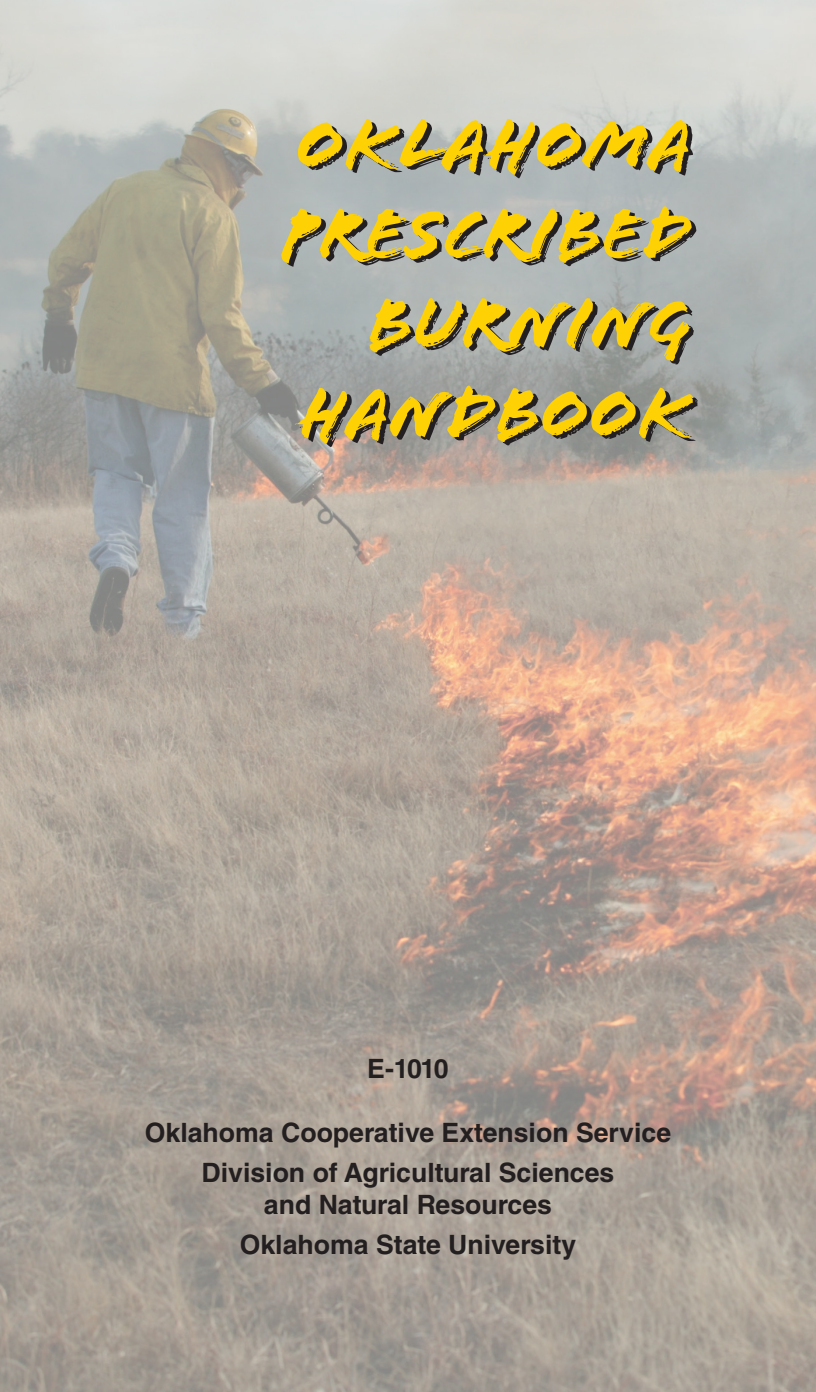

OKLAHOMA PRESCRIBED BURNING HANDBOOK

E-1010

Oklahoma Cooperative Extension Service
Division of Agricultural Sciences
and Natural Resources
Oklahoma State University

OKLAHOMA PRESCRIBED BURNING HANDBOOK

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Revised June 2021

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FIRE EFFECTS

The frequency, intensity and season of fire is second only to precipitation in terms of vegetation response. In other words, if it does not rain, nothing will grow whether it was burned or not. The amount of time since a fire is the most important factor of a fire's impact on vegetation structure and composition. Time of year (season) has minimal impact on the native plant community.

FIRE EFFECTS ON MAJOR TREES AND SHRUBS

Non-sprouting: These are woody plants that fire will kill if the above ground portion is heated sufficiently (i.e. all the growing points are killed or the cambium is killed).

Eastern Redcedar (*Juniperus virginiana*)
Mountain Cedar/Ash Juniper (*J. Ashei*)
Cottonwood (*Populus deltoides*) mature trees when exposed to extreme heat (i.e. understory of eastern redcedar that burns)
Loblolly Pine (*Pinus taeda*) trees less than 12 feet tall or less than 4 inches diameter at breast height (dbh)
Mockernut Hickory (*Carya tomentosa*)

Sprouting: These are woody plants top killed by fire, but come back from stump or root sprouts. Fire will normally reduce plant height, percent canopy cover and volume. Stem density usually increases after fire. Some of these plants are vigorous resprouters and will recover to pre-fire status in three years or less. Others are slower to return, such as sand plum, but they will recover. Depending upon objectives, a three year or less fire return interval is recommended for most woody plant species to maintain at appropriate levels.

Blackberry (*Rubus oklahomus*)
Black Locust (*Robinia pseudoacacia*)
Bois d'Arc/Osage Orange (*Maclura pomifera*)
Honey Locust (*Gleditsia triacanthos*)
Mesquite (*Prosopis glandulosa*)
Oaks (*Quercus* spp.)
Persimmon (*Diospyros virginiana*)
Rough-Leaf Dogwood (*Cornus drummondii*)
Salt Cedar (*Tamarix chinensis*)
Sand Plum (*Prunus angustifolia*)
Sand Sagebrush (*Artemisia filifolia*)
Shinnery Oak (*Quercus havardii*)
Shortleaf Pine (*Pinus echinata*) seedlings and saplings
Sumac (*Rhus copallinum*, *R. glabra*)
Winged Elm (*Ulmus alata*)

FIRE EFFECTS INFORMATION

For more information:

Fire Effects in Native Plant Communities NREM-2877 (extension.okstate.edu/fact-sheets/fire-effects-in-native-plant-communities.html)

The Effects of Fire in Oklahoma video (ostate.tv/media/The+Effects+of+Fire+in+Oklahoma/1_dntodjs7)

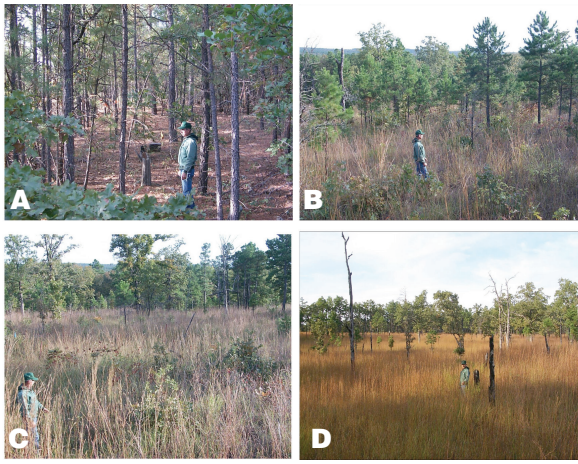
Other useful DASNR fire effects videos (video.okstate.edu/category/resources)

OSU NREM Fire Ecology (fireecology.okstate.edu)

Fire Effects Information System (feis-crs.org/feis)

FIRE FREQUENCY

Fire frequency is the key to managing woody plants. Fire is not a one-time tool, it is a management process.



Fire frequency is the key to land management. From the top: A) no burn, B) 3-year burn frequency, C) 2-year burn frequency and D) 1-year burn frequency for the past 20 years in oak-pine forest of southeast Oklahoma.

One fire will not change years of fire suppression. With the appropriate fire frequency (based on objectives), the native plant community can be maintained as a forest, woodland, savannah, shrubland or grassland. Thus, depending on the objectives (such as wildlife, brush control, forage production for livestock, etc.), land can be molded with fire to meet landowner goals.

FIRE EFFECTS ON WILDLIFE

White-tailed Deer

White-tailed deer have a diverse diet and occur in many different habitats. However, they are primarily browsers that consume shrubs and young woody vegetation, vines, forbs and a limited amount of grass. Acorns and soft mast (fruit) are seasonally important. To be accessible, these plants must be at or near

ground level (<6 feet). Many of the desired plants for deer need ample sunlight to grow. Thus, closed canopy forest and redcedar-dominated rangelands provide little forage or browse for deer. Fire can be used to open up forest canopy and to stimulate growth of desirable plants for deer. A fire frequency of four years or less will accomplish this on many sites in Oklahoma. Longer fire frequencies may be appropriate, as long as redcedar does not dominate (usually after seven years). The size of a burn unit can be quite large for deer as their home ranges usually cover several miles. Thus, burns up to a section (640 acres) in size are appropriate, although larger burns may be warranted under some conditions. For more information see *Quality Deer Management in Oklahoma* NREM-9020 at extension.okstate.edu/fact-sheets/quality-deer-management-in-oklahoma.html

This forested area is burned every four years and provides good habitat for white-tailed deer. Notice the abundant available browse.

Wild Turkey

Wild turkey require varied habitat depending on the season of the year. In the spring, they seek out areas with abundant forbs and insects to feed. These same areas are important for poults after hatching. A recently burned area will provide this type of vegetation. A portion of the property should be burned annually to provide for the brood cover needed for turkey. Up to half of the area would be appropriate on most properties, as long as adequate cover is available for that year. Turkeys will use brood habitat throughout the summer. As fall approaches and mast begins to drop, turkeys use forest edges more and will gradually flock up in hardwood draws for the winter. They will use many species of trees for winter roosting, as long as the understory is not occupied by redcedar. Thus, riparian draws should be periodically burned to keep redcedar from encroaching (at least every seven years). For more information see *Ecology and Management of the Rio Grande Wild Turkey in Oklahoma* E-1045 at extension.okstate.edu/fact-sheets/ecology-and-management-of-the-rio-grande-wild-turkey-in-oklahoma.html

Immediately following a fire, there will be a response of forbs and legumes, such as this showy partridge pea, that are beneficial to wild turkey. Many of these beneficial plants decrease over time in the absence of fire.

Bobwhite Quail

Quail, like turkey, require a diverse habitat that contains forbs, grasses and some woody thickets. During the spring, quail seek out areas with last year's grass cover for nesting. Thus, having some areas not burned that year is beneficial for nesting quail. However, once the chicks hatch, they need a forb rich area to find insects and cover. This vegetation should be open at ground level with limited litter so as to not impede chick movement. Recently burned areas provide this type of habitat. On sandier soils in western Oklahoma, this type of vegetation persists for many years following fires, but in the eastern portion of the state grass and litter cover builds quickly. Thus, fire frequency should be greater as you move east. In fact, fire frequency of two to three years is appropriate in eastern Oklahoma, while fire once every seven years may maintain habitat conditions in the far western portions of the state. Woody cover (thickets) must be maintained. Many woody plants re-sprout quickly following fire. But in areas with very frequent fires (such as two years), protecting some of the woody cover is beneficial to quail. The size of a burn unit for quail should match their home range, which is generally small. Burns of 25 acres to 100 acres would be ideal, although this may not always be possible for safety and cost reasons. Note: it is more important to burn quail habitat, even if you must burn large areas, to keep redcedar to a minimum. Once redcedar becomes dominant, quail numbers decline. For more information see *Northern Bobwhite Habitat Requirements and Evaluation Guide* E-904 at extension.okstate.edu/fact-sheets/northern-bobwhite-habitat-requirements-and-evaluation-guide.html

An example of a diverse plant community maintained by fire. Note the cedar skeletons and abundant forbs six months after the burn. This is excellent quail habitat.

FIRE AND FOOD PLOTS

Many landowners spend considerable effort and money on food plots to attract wildlife. However, as noted above, fire promotes plants that wildlife prefer for food. Thus, a burned plot of any size is a food plot. Strategic placement of burned areas can provide excellent hunting for deer, turkey and quail. Additionally, a late summer fire can produce a September dove field. These growing season fires are often dominated by plants highly preferred by dove. Using fire to produce food plots is not only cost effective, but also meets other land management goals. For more information see *A Practical Guide to Food Plots in the Southern Great Plains* E-1032 at extension.okstate.edu/fact-sheets/a-practical-guide-to-food-plots-in-the-southern-great-plains.html

FIRE EFFECTS ON EROSION

Research has shown soil loss following fire is insignificant and should not be a concern.

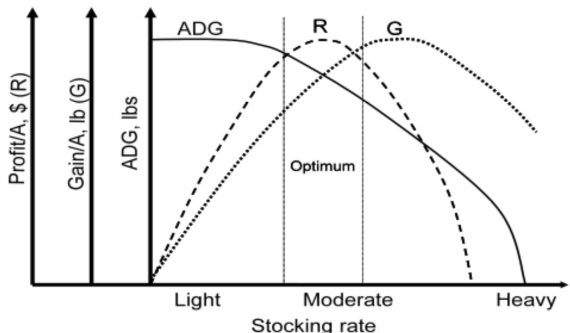
FIRE EFFECTS ON FENCING

The effects of fire on livestock fencing is a concern following wildfires, as well as before applying prescribed fire. There are many opinions and beliefs about what fire does to fencing materials. Research shows there is no impact to 12-gauge barbed wire and metal T-post fencing materials, even after numerous burns. So these fencing materials should not be a concern for landowners before burning. For more information see *Fire Effects: Fencing* NREM-2906 at: extension.okstate.edu/fact-sheets/fire-effects-fencing.html

FIRE AND GRAZING

Selecting the proper stocking rate is the most important consideration in grazing management. Some land managers believe that higher stocking rates are better, but research and ranch budgets have shown that maximum net return per acre occurs at a moderate to light stocking rate.

Land managers should ask the question "Is grass fuel, forage or habitat?" If thought of as forage only, there will not be enough fuel to burn. Deferment of grazing before conducting prescribed burns is not necessary, if a proper stocking rate is used. If there



Maximum return per acre occurs at a moderate stocking rate, which incidentally allows for adequate fuel accumulation for conducting prescribed burns.

is not enough fuel to burn, you are overstocked and losing income on your livestock enterprise.

Additionally, with the proper stocking rate, there is no need to withhold livestock from burned pastures. Cattle will graze on the new high-quality forage following a prescribed fire until a newer burned area is available. Thus, the land manager should be burning some portion of the grazed land every year and move cattle around on the property and providing rest on the unburned portions of the land for fuel accumulation.

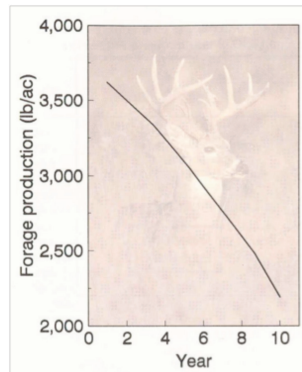
This is called patch burning and it is an effective way to manage forage for cattle, fuel for fire and habitat for wildlife. To learn more about this concept see *Patch Burning: Integrating Fire and Grazing to Promote Heterogeneity* E-998 at extension.okstate.edu/fact-sheets/patch-burning-integrating-fire-and-grazing-to-promote-heterogeneity.html

EASTERN REDCEDAR AND FIRE

Forage/Fuel Loss

Cedar severely limits forage/fuel production beneath its canopy. It has been shown that 250 large trees per acre will cut forage/fuel production by half.

If fire is suppressed from a site for seven to 10 years, cedars become tall and dense enough that fire



Forage production starting with 200 trees per acre and ending with 470 trees per acre reduces forage production by half. With the use of prescribed fire, this can be reversed.

alone may not kill them. For more information about cedar control see:

Cedar Control by Individual Scorched-tree Ignition Following Fire NREM-5053
(extension.okstate.edu/fact-sheets/cedar-control-by-individual-scorched-tree-ignition-following-fire.html)

Cut and Stuff Practices for Enhanced Cedar Control with Prescribed Fire NREM-2902
(extension.okstate.edu/fact-sheets/cut-and-stuff-practices-for-enhanced-cedar-control-with-prescribed-fire.html)

Eastern Redcedar Control and Management – Best Management Practices to Restore Oklahoma's Ecosystems NREM-2876
(extension.okstate.edu/fact-sheets/eastern-redcedar-control-and-management-best-management-practices-to-restore-oklahomas-ecosystems.html)

The following are general guidelines on the effectiveness of fire to remove redcedar.

Trees less than 1 foot tall = 100% control with 2,000 pounds per acre of fine fuel

Trees 1 foot to 5 feet tall = 95% control with 4,000 pounds per acre of fine fuel, only 60% control with 2,000 pounds per acre of fine fuel.

PRESCRIBED FIRE WEATHER

WEATHER CONDITIONS FOR CONDUCTING PRESCRIBED BURNS

Potential fire prescription variation for conducting a prescribed fire:

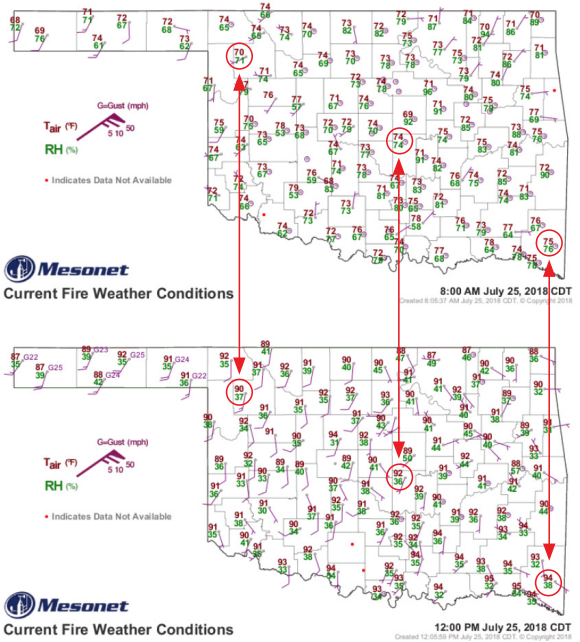
Temperature	30 F to 110 F
Relative Humidity	10% to 80%
Wind Speed	4 mph to 25 mph
Season of Year	Winter, Spring, Summer or Fall

Prescriptions will vary with each burn unit, fire boss and crew experience, equipment, areas surrounding burn unit, firebreak and fuel type. For more information about prescriptions see *Fire Prescriptions for Restoration and Maintenance of Native Plant Communities* NREM-2878 at extension.okstate.edu/fact-sheets/fire-prescriptions-for-maintenance-and-restoration-of-native-plant-communities.html

GENERAL GUIDELINES

Rule 1. For those with limited burn experience or wanting to reduce spotfire risk, use the **60:40 Rule.** The 60:40 rule can be applied in one of two ways: 1) conduct burns when the air temperature is less than 60 F and relative humidity is greater than 40% or 2) burn when the temperature (F) and the relative humidity (%) are between 60 and 40.

Rule 2. When concerned about weather conditions changing during the day or possibly burning outside the prescription, use the **Rule of Halves.** This rule is used in the field to predict changes in relative humidity, which will change fire behavior. The Rule of Halves states that when the air temperature increases by

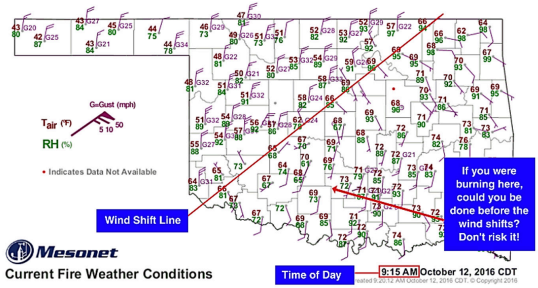


The Rule of Halves states that when the air temperature (in red) Increases by 20 F, relative humidity (In green) decreases by about 50%.

20 F, relative humidity decreases by about 50%. For example, if the air temperature in the morning is 60 F with 40% relative humidity and the afternoon high temperature is forecast to be 80 F, the relative humidity will be about 20%. A fire that can be conducted safely at 40% relative humidity may pose a safety risk at 20%. This also works inversely: as the temperature decreases by 20 F, relative humidity will approximately double.

Rule 3. In most cases, do not burn if there is a forecasted frontal passage or wind shift, such as a dryline, within 12 hours of the planned burn.

Rule 4. In general, the width of firebreak on the downwind side of the area to be burned should



Do not burn within 12 hours of a predicted wind shift or frontal passage. In the example above, a strong cold front is crossing the state with an abrupt shift in wind directions.

be 10 times the height of flammable vegetation. Firebreaks are usually a combination of bare ground, mowed strips and backfired strips. If the firebreak is insufficient, there may be a fire escape.

Rule 5. If the conditions are not right, including all parts of the prescription (adequate personnel, equipment, weather conditions, etc.), do not start the fire. Wait until everything is right.

Rule 6. If the fire is not going well, put it out. Difficulties could be due to spotfires, creep-overs, equipment problems, extreme fire behavior, utilizing too much water or resources stretched too thin.

Rule 7. Do not leave the fire until it is completely out and the edges have been mopped up properly, with no smoke or embers for at least one hour along the edges of the burn unit.

SPOTFIRES

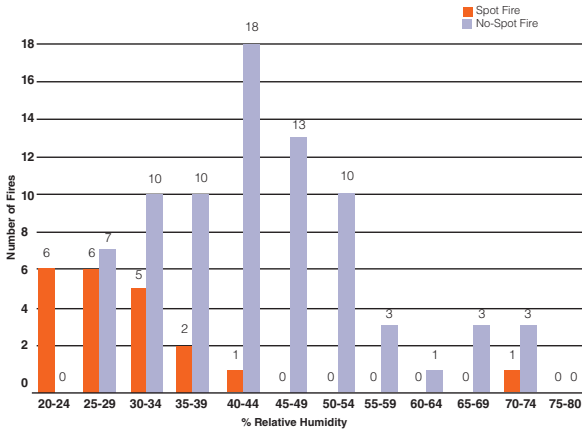
Spotfires are fires that occur outside the burn unit. They can be caused by crowning eastern redcedar, brush piles on the edge of the burn unit, leaf litter blowing across the firebreak, smoke or fire whirls, low relative humidity or improper firebreaks.

Spotfires are started by numerous causes, fire whirls like the one pictured above can leave the burn unit igniting a fire outside the planned burn area. Fire personnel should know what causes spotfires and be prepared.

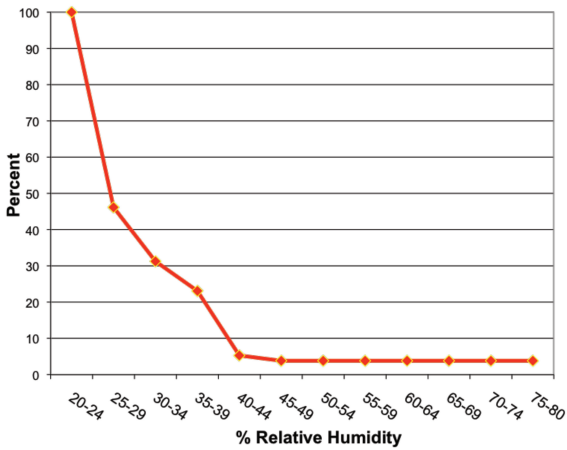
SPOTFIRES AND RELATIVE HUMIDITY

Spotfires are more prevalent when the relative humidity is below 40%.

With knowledge of the probability of spotfire occurring, personnel can determine necessary crew size and equipment. Inexperienced burn bosses should use this data to help reduce risk (liability) and increase safety for their crews. The most important point is to burn when conditions are safest for the crew and surrounding neighbors. For more information about spotfires and escapes see *Prescribed Burning: Spotfires and Escapes* NREM-2903 at extension.okstate.edu/fact-sheets/prescribed-burning-spotfires-and-escapes.html



Number of spotfires on 99 prescribed burns with the corresponding minimum relative humidity. Of the 21 burns that had spotfires (red), only two occurred when the relative humidity was greater than 40%.



Percent probability of a spotfire occurring at a given relative humidity.

FIRE PRESCRIPTION PLANNER

The "Fire Prescription Planner" in the OK-FIRE wildland fire management system (mesonet.org/index.php/okfire) allows the fire manager to specify lower and/or upper limits for various variables pertaining to weather, dispersion conditions, dead fuel moisture and fire danger. After the prescribed values are entered, the user chooses the Mesonet site closest to the burn unit. Using output based on the latest 84-hour forecast, a table will be produced indicating the hours (green shaded cells in "Criteria Met?" column) during which the burn criteria are met.

The Planner, as is the case with other OK-FIRE forecast products, is based solely on one particular numerical weather forecast model (the North American Model or NAM). As with all forecast models, the NAM, while a good model, is never perfect and

OK-FIRE **Fire Prescription Planner**

Latest forecast based on 1 pm CDT 07/23/18 NAM; NEXT 6-hr update expected 11 pm CDT 07/23/18

Fire Prescription Table for Vinita Print Table

Disclaimer: *This forecast table, as with other OK-FIRE products, is based solely on output from the latest 84-h NAM forecast. As no weather forecast model is perfect, users are encouraged to check the official forecasts of the National Weather Service for consistency or discrepancies in the weather variable portion of this forecast.*

Change Prescription or Site

DATE / TIME	Criteria Met?	TAIR	RELH	WDIR	WSPD	1hr PRECIP	DISPERSION	1hr DFM	10hr DFM
Mon 7/23/18 10 pm CDT	No	74°F	81%	NNE	6 mph	0.00 in	1 (VP)	11%	9%
Mon 7/23/18 11 pm CDT	No	72°F	84%	NNE	6 mph	0.00 in	1 (VP)	13%	11%
Tue 7/24/18 12 am CDT	No	71°F	87%	NNE	5 mph	0.00 in	1 (VP)	15%	12%
Tue 7/24/18 1 am CDT	No	70°F	90%	NNE	5 mph	0.00 in	1 (VP)	16%	14%
Tue 7/24/18 2 am CDT	No	69°F	89%	N	4 mph	0.00 in	1 (VP)	18%	14%
Tue 7/24/18 3 am CDT	No	69°F	89%	N	4 mph	0.00 in	1 (VP)	19%	15%
Tue 7/24/18 4 am CDT	No	69°F	89%	NNW	4 mph	0.00 in	1 (VP)	19%	15%
Tue 7/24/18 5 am CDT	No	69°F	89%	NNW	4 mph	0.00 in	1 (VP)	19%	15%
Tue 7/24/18 6 am CDT	No	69°F	89%	NNW	4 mph	0.00 in	1 (VP)	19%	16%
Tue 7/24/18 7 am CDT	No	69°F	90%	NNW	4 mph	0.00 in	2 (P)	19%	16%
Tue 7/24/18 8 am CDT	Yes	74°F	79%	NNW	5 mph	0.00 in	4 (MG)	16%	16%
Tue 7/24/18 9 am CDT	Yes	79°F	69%	NNW	6 mph	0.00 in	4 (MG)	14%	16%
Tue 7/24/18 10 am CDT	Yes	84°F	59%	N	7 mph	0.00 in	5 (G)	11%	15%
Tue 7/24/18 11 am CDT	Yes	87°F	55%	N	8 mph	0.00 in	6 (EX)	9%	14%
Tue 7/24/18 12 pm CDT	Yes	89°F	50%	N	9 mph	0.00 in	6 (EX)	8%	13%
Tue 7/24/18 1 pm CDT	Yes	91°F	46%	N	10 mph	0.00 in	6 (EX)	7%	11%
Tue 7/24/18 2 pm CDT	No	91°F	44%	N	10 mph	0.00 in	6 (EX)	6%	10%
Tue 7/24/18 3 pm CDT	No	92°F	43%	N	10 mph	0.00 in	6 (EX)	6%	9%
Tue 7/24/18 4 pm CDT	No	92°F	42%	N	10 mph	0.00 in	6 (EX)	6%	9%

Example of a resulting forecast table for Vinita in the Fire Prescription Planner on OK-FIRE. Using the entered prescription, the table indicates a burn window from 8 a.m. to 1 p.m. the next day (green shaded cells in the "Criteria Met?" column).

users are strongly encouraged to check the official National Weather Service (NWS) forecasts for any discrepancies with the NAM. To get an hour-by-hour NWS forecast chart for the Mesonet site location selected as the primary station on the OK-FIRE home page, click on the "NWS Forecast Chart" link in the left menu section of OK-FIRE. To get the corresponding forecast in table format, click on "NWS Forecast Table." In addition, local National Weather Service offices offer a wealth of other useful products, including fire weather information and forecasts.

FIRE WEATHER INFORMATION SOURCES

- OK-FIRE (mesonet.org/index.php/okfire)
- Oklahoma Mesonet (mesonet.org)

Site-specific fire weather forecasts for Oklahoma from the National Weather Service (NWS) can be found at the following local NWS addresses:

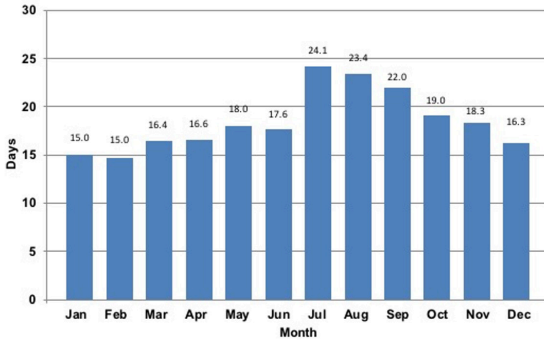
weather.gov/ama/fireweather (Amarillo NWS)
weather.gov/oun/fireweather (Norman NWS)
weather.gov/tsa/fireWeatherForecast (Tulsa NWS)
weather.gov/shv/fireweather (Shreveport NWS)

With respect to nationwide fire weather and fire danger products, the following sites may be of interest:

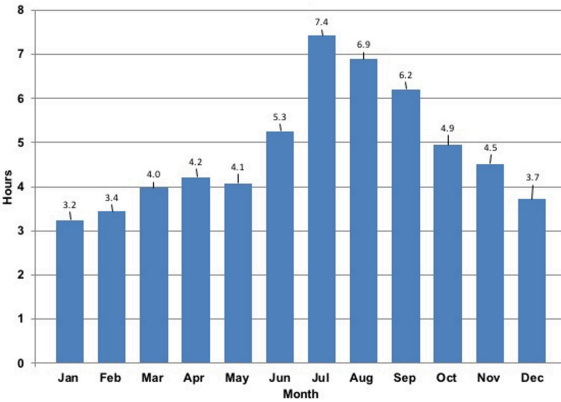
www.weather.gov/fire (NWS National Fire Weather)
www.wfas.net (USFS Wildland Fire Assessment System)
gacc.nifc.gov (Geographic Area Coordination Centers)
www.nifc.gov (National Interagency Fire Center)

BURN DAYS

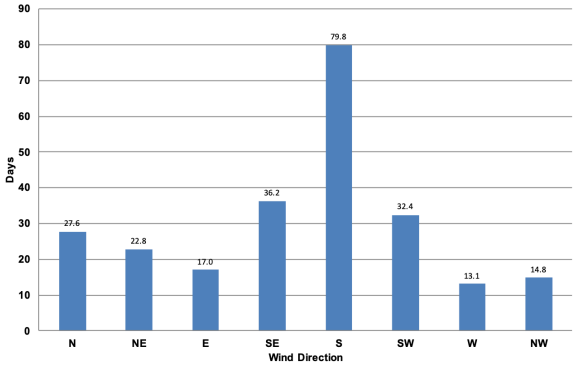
Weather constraints limit the number of days prescribed fires can be safely conducted. It has



The average number of burn days per month using the following weather parameters: temperature between 30 F to 110 F, relative humidity of 25% to 80%, wind speeds at 4 mph to 15 mph, no precipitation during the time period and there must be a minimum of a three-hour consecutive block of these conditions for that day to be considered a burn day.



The average number of burnable hours per day by month using the same weather parameters as above.



The average number of burnable days per year by wind direction using the same weather parameters as above.

been determined there about 222 days per year in which prescribed burns can be safely conducted (using an Oklahoma Mesonet at a site in north central Oklahoma). December through April is the worst time of the year to conduct prescribed fires due to variable weather conditions and burn bans. July through September is the best period to conduct burns due to stable weather patterns and conditions. The data also shows there are more hours per day available to burn during July to September than December to April. Wind direction is also a concern regarding timing of burns. For more opportunities to conduct prescribed burns fire managers should consider burning in different seasons of the year. For more information see *The Best Time of Year to Conduct Prescribed Burns* NREM-2885 at extension.okstate.edu/fact-sheets/the-best-time-of-year-to-conduct-prescribed-burns.html and *Burning in the Growing Season* E-1025 at extension.okstate.edu/fact-sheets/burning-in-the-growing-season.html

There may be a need to doze or cut eastern redcedar around the boundary of the burn unit. This will make the burn safer. Keep the piles small and push them at least 300 feet into the burn unit.

The best time to burn brush piles is in May and June when the grass is green. Exercise care when burning piles in areas that have been ungrazed or lightly grazed.

BURNING BRUSH PILES

As a general rule, eastern redcedar trees and brush should never be cut, dozed or piled prior to a prescribed burn. This will only complicate the burn and increase the chance of an escaped fire. Brush piles can cause spotfires up to 500 feet downwind. However, trees may need to be dozed or cut around the boundary of the burn unit to prevent spotfires. This will make the burn safer, but be sure to push and spread the brush into the burn unit. If piling is absolutely necessary, then push the piles 300 feet into the burn unit and keep the piles small.

There also are some economic benefits to not cutting down eastern redcedar until after you burn. If you burn first, the fire should kill many of the eastern redcedar, depending upon tree height and fuel load. You can then remove only the eastern redcedar trees that did not burn or brown out. This will reduce costs.

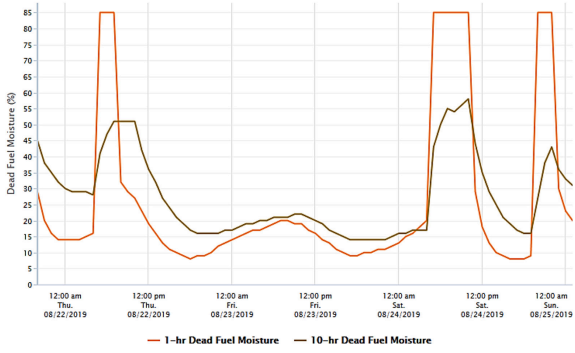
The best time to burn brush piles is after the prescribed fire when fuels are low. It has been found the safest time to burn brush piles is in May and June. During this time, most vegetation is green and will not burn well. Care should be exercised when burning brush piles in areas that have been ungrazed or lightly grazed. Have suppression equipment available on site anytime you burn. Remember brush piles can smolder for many days, so keep track of the weather. For more information about burning brush piles see *Managing Brush Piles* NREM-2894 at extension.okstate.edu/fact-sheets/managing-brush-piles.html

FUEL MOISTURE

Dead fuels are those wildland fuels whose moisture contents are controlled exclusively by changing weather conditions. Examples include dead herbaceous fuels, dead roundwood, fallen dead leaves and needles and the litter and duff layers of the forest floor. For purposes of fire behavior modeling, dead fuels are divided into four "timelag" categories: 1-hour, 10-hour, 100-hour and 1,000-hour fuels. The shorter the timelag, the more responsive the fuel is to changing weather conditions. For example, 1-hour fuels only take about one hour to respond to changing weather conditions, which explains why fire danger can still be very high even right after a heavy rain if the subsequent weather conditions allow the 1-hour fuels to dry out.

For purposes of determining dead fuel moisture, woody fuel samples are taken from standing dead trees or shrubs and must not be lying on the ground. Moisture in woody fuel samples is measured in the field by a moisture meter or weighed in the field and then dried in an oven and weighed again. Herbaceous fuel is weighed in the same manner and must be standing erect.

Dead fuel moisture can also be calculated from observed or forecast weather data. Using Mesonet data, OK-FIRE (mesonet.org/index.php/okfire) calculates 1-hour, 10-hour, 100-hour and 1,000-hour dead fuel moisture every 15 minutes, as well as their predicted values over the next 84 hours using forecast data. This information is available in map, chart and table formats and is valid for fuels in unshaded locations.



Forecast chart of 1-hour and 10-hour dead fuel moisture for Woodward from OK-FIRE.

1-hour fuels are less than 0.25 inch in diameter (also dormant grasses).

10-hour fuels are 0.25 inch to 1 inch in diameter (also leaf litter and pine needles).

100-hour fuels are 1 inch to 3 inches in diameter.

1,000-hour fuels are 3 inches to 8 inches in diameter.

RECOMMENDED FUEL MOISTURE CONDITIONS FOR CONDUCTING PRESCRIBED FIRES

You should burn when 1-hour fuels are between 7% and 20% moisture.

1-hour fuels <5%: spotfires certain
1-hour fuels >11%: spotfires rare
1-hour fuels >20%: fire may not spread

10-hour fuels burn best when between 6% and 15% moisture
10-hour fuels greater than 15% moisture: fire may not burn in certain fuel types.

FIRE LAW/FIRE PLANS

In Oklahoma, it is lawful to burn and is considered a property right if conducted properly. The person conducting the burn is considered liable if the fire escapes. Though you are considered only civilly liable for the amount of actual damages, but only if you follow the guidelines stated within the law. A person can be considered criminally liable if found to have committed gross negligence in setting the fire. For more information about law and liability see *Prescribed Fire: Understanding Liability, Laws and Risk* NREM-2905 at extension.okstate.edu/fact-sheets/prescribed-fire-understanding-liability-laws-and-risk.html

HOW DO I BURN PROPERLY?

Have a written burn plan, take reasonable precautions against the fire spreading to other lands and provide adequate firebreaks, manpower and fire fighting equipment. Stay with the fire until it is extinguished, which means there is no smoke or embers along the edges of the burn unit for at least one hour. Notify a local Oklahoma Forestry Services representative at least four hours in advance in forest protection areas of eastern Oklahoma. Within 60 days before conducting the fire, notify orally or in writing all adjoining landowners. Include proposed date, location and contact number. Complete the prescribed burning notification plan and submit it to the local fire department and in forest protection areas to the Oklahoma Forestry Services representative, as well as keeping a copy for your records. Within 48 hours before conducting the burn, notify the local fire department and/or local Oklahoma Forestry Services representative if in a protection area.

This is not intended to be used as a substitute for the law. Read and know the law before conducting any prescribed fire. For more about the burn law and prescribed burn notification plan go to:

Burn Within the Law (forestry.ok.gov/rxburn-law)

Prescribed Burn Notification Plan at forestry.ok.gov/sites/g/files/gmc801/f/documents/2020/pbnp.pdf

COUNTY BURN BANS

In 2008, county commissioners and local fire chiefs were granted the authority by state law to declare a county burn ban. The law reads as follows:

"*It is unlawful for any person to set fire to any forest, grass, range, crop or other wildlands, or to build a campfire or bonfire, or to burn trash or other material that may cause a forest, grass, range, crop or other wildlands fire in any county of this state in which the board of county commissioners of the county has passed a resolution declaring a period of extreme fire danger.*"

As used in this subsection, "extreme fire danger" means:

a. moderate, severe or extreme drought conditions exist as determined by the National Oceanic and Atmospheric Administration (NOAA) pursuant to its criteria and
b. no more than one-half (1/2) inch of precipitation is forecast for the next three (3) days and
c. fire occurrence is significantly greater than normal for the season and/or initial attack on a significant number of wildland fires has been unsuccessful due to extreme fire behavior and
d. more than 20% of the wildfires in the county have been caused by escaped debris or controlled burning.

A majority of the board of county commissioners may call an emergency meeting at any time to pass or

revoke a resolution declaring a period of extreme fire danger in accordance with this section.

A board of county commissioners shall have the documented concurrence of a majority of the chiefs, or their designees, of the municipal and certified rural fire departments located in the county that a period of extreme fire danger exists prior to passage of a resolution declaring a period of extreme fire danger in the county. If extreme fire danger conditions persist, subsequent resolutions may be passed by the board of county commissioners in the same manner as provided in this paragraph. In the resolution, the board of county commissioners may grant exceptions to the fire prohibition based on appropriate precautionary measures. To find out more about burn bans or to check counties with burn bans, go to forestry.ok.gov/burn-ban-info

BURN PLANS

Every prescribed burn should have a written burn plan. The burn plan allows you to set goals and have a prescription for each burn. It also lets the burn boss make operational and contingency plans prior to the burn. If a liability issue arises, the burn plan demonstrates due diligence by the person conducting the burn.

Items that could be included on a burn plan:

- Description of burn unit – physical and legal
- Objectives of burn – why and expectations
- Maps/photos of burn unit
- Prescription parameters
- Observed weather conditions
- Firebreak types
- Ignition plan – written and map
- Smoke management plan – written and map
- Contacts – fire dept., neighbors, sheriff dept., etc.
- Hazards within burn unit
- Crew members present
- Equipment present

- Escaped fire plan
- Mop-up plans
- Date of preparation
- Preparer's signature

Sources of burn plans:

- *Burn Plan for Prescribed Burning* NREM-2893 at extension.okstate.edu/fact-sheets/burn-plan-for-prescribed-burning.html

- *Burn Plan for Prescribed Burning* (blank fillable form) NREM-2893-B at extension.okstate.edu/fact-sheets/images/burn-plan-for-prescribed-burning/producer_burn_plan.pdf

- OSU Extension county office

- USDA-NRCS county office

PRESCRIBED FIRE SAFETY

Proper clothing for prescribed burning

Proper clothing includes long sleeve shirts and long pants that are free of holes, rips and tears. They should be made of 100% cotton, wool, NOMEX™, Indura™ cotton or labeled as FR (fire resistant) clothing. Do not wear any clothing made of nylon, polyester or other synthetic material. Gloves should be all leather and not oil tanned. Goggles or safety glasses should be worn to protect eyes from smoke, embers and debris. Footwear should be comfortable and provide protection from heat and uneven surfaces. A helmet is recommended, especially if working in areas with trees. Personnel with long hair should secure it and place inside shirt or under helmet or hat.

PRESCRIBED FIRE ORDERS

Read over the burn plan and go over the burn unit before you begin.

e**X**tinguish all smoldering objects around the fireline after the burn.

Fire should be set as quickly as possible, but provide for safety first.

Initiate all actions based on current and expected fire behavior.

Recognize current weather forecasts and conditions and obtain information on weather often.

Ensure instructions to crew members are given and understood.

Obtain current information on prescribed fire status during burn.

Remain in communication with all crew members.

Determine proper ignition technique and deployment of personnel and equipment for each burn.

Establish lookouts in potentially hazardous situations.
Retain control at all times.
Stay alert, keep calm, think clearly, act decisively.

Prescribed Burn situations that shout "watch out"

If any of these situations are encountered on a burn, they should be watched or changed to prevent injury to personnel or the fire escaping.

- Burn unit not scouted and sized up.
- Burn unit not seen in the daylight.
- Problem areas and potential spotfire areas not identified.
- Unfamiliar with weather and local factors influencing fire behavior.
- Uninformed on prescribed fire strategy, tactics and hazards.
- Instructions and assignments not clear.
- No communication link with crew leaders and members.
- Firebreak not constructed to bare ground or mineral soil.
- Lighting fire uphill.
- Attempting to burn strips on backfire that are too wide.
- Unburned fuel in backfire area.
- Cannot see down the fireline and not in contact with anyone who can.
- Burning within 12 hours of a predicted frontal passage or wind shift.
- Weather is getting hotter and drier.
- Wind increasing and or changing direction.
- Getting frequent spotfires across the firebreak.
- Firebreak, terrain or fuels too rough for pumper trucks to enter.
- Stopping to eat lunch.

GO/NO-GO CHECKLIST

(use before each burn to make sure everything is ready)

- ☐ Fire plan prepared?
- ☐ Prescribed burn notification plan completed and submitted to local fire department and Oklahoma Forestry Services official (if in protection area)?
- ☐ Have all required notifications been made (fire dept, neighbors, etc.)?
- ☐ Are all weather parameter prescriptions met?
- ☐ Have all current and projected weather forecasts been obtained and are they favorable?
- ☐ Adequate personnel available for burn?
- ☐ Equipment operational and available?
- ☐ Smoke management guidelines met?
- ☐ Have all personnel been briefed on objectives, assignments, tactics, hazards and safety?
- ☐ In your opinion, can the burn be conducted safely according to the fire plan and will the burn meet the planned objectives?

If the answer to **all** of these questions is YES, then proceed with burn. If the answer to **any** of these questions is NO, make corrections or plan the burn for another day.

HANDTOOL SAFETY

- Use the proper tool for the job.
- Make sure tools with an edge are sharp.
- Carry next to the body by the handle, near the head of the tool.
- Do not carry over the shoulder.
- Carry handtools on the downhill side when walking across slopes.
- Keep safe distances among personnel using handtools.

Do not carry handtools over the shoulder and always keep a safe distance between personnel using them.

VEHICLE SAFETY

- Once the fire starts, do not turn vehicle or pump off.
- Turn headlights on.
- Do not drive too fast along firebreaks, even if going to an escaped fire. Remember there are other personnel working there also.

Do not drive too fast along firebreaks, even if going to an escaped fire. Remember other personnel are working there as well.

- Do not drive into areas of thick smoke. Think about who or what may be in it or on the other side.
- Make sure hoses, nozzles and equipment are secure in the back of the truck.

FIREBREAKS

Firebreaks help delineate the boundary of the burn unit and reduce the fuel along edge of the unit to make ignition easier. Additionally, firebreaks are used for access by personnel and equipment. Firebreaks should be to bare ground or mineral soil, yet constructed to not cause erosion problems.

Establish permanent firebreaks, remember, prescribed fire is not a one-time treatment. For more information see *Firebreaks for Prescribed Burning* NREM-2890 at extension.okstate.edu/fact-sheets/firebreaks-for-prescribed-burning.html

FIREBREAK WIDTH

In general, the width of the firebreak on the downwind side of the area to be burned should be ten times the height of the flammable vegetation within the burn unit. Firebreaks are usually a combination of bare ground, mowed strips and backfired or blackened strips. If the firebreak is insufficient, you may experience an escaped fire. Some recommended widths of blackened areas are:

Grass fuels only = 100 feet
Grass fuels with cedar = 300 feet
Grass fuels with sand shinnery oak = 200 feet
Grass fuels with sand sage brush = 200 feet
Forest understory of leaf litter fuels = 50 feet
Forest understory of leaf litter fuels with cedar = 300 feet

Firebreaks allow access for personnel and equipment.

FIREBREAK TYPES

Mowed lines/wet lines

Require more personnel, equipment, water and takes longer to conduct fire. They also are risky without a high level of experience.

Mowed firebreak with water being applied just before ignition. The area to the left of the person is the burn unit.

Cattle trails

Use mowing to reduce fuel loads next to cattle trails.

Roads, paved, county, two track or feed roads

Make sure smoke and traffic will not be an issue.

Road being used as a firebreak on this large prescribed burn.

Dozed lines

These are scraped to mineral soil to remove fuels.

Dozed firebreaks allow for access of personnel and equipment in complex terrain.

Disked lines

Be sure to mow and then disk the area twice to ensure there is no continuous fuel in the line.

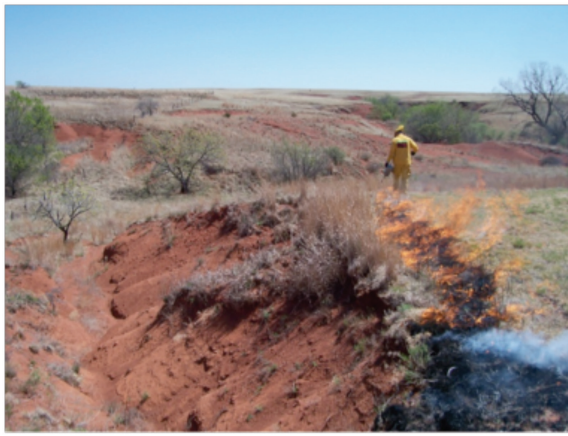
Example of well-constructed disked firebreak.

Leaf blower or raked lines

These work well for short distances in forested areas where fuel levels are low.

Natural barriers

Creeks, rivers, lakes, cultivated fields and forest edges can be used to minimize cost, effort and erosion potential.



If using a draw or canyon as a firebreak, make sure the fire cannot get across the firebreak. Always inspect the entire perimeter of the burn unit prior to ignition.

PRESCRIBED FIRE EQUIPMENT

DRIP TORCH USE AND OPERATION

Set up

Place torch on the ground and unscrew locking ring, then remove and secure flow plug from bottom of spout. Pull spout assembly out of torch body and allow excess fuel to drain back into torch. Place spout assembly in upright position on torch, with loop in spout on opposite side of handle. Place lock ring over spout and secure snugly on torch. Open air vent on top of torch by handle one turn. To store the torch, reverse steps once wick and spout have cooled.

Operation

Grasp by the handle and tip the torch downward, allowing fuel to flow over the wick. Allow a small amount of fuel to collect on the ground and ignite with match or lighter. Then place wick of torch in flames to ignite. To operate, tip downward and walk. To stop ignition, lift torch up.

Extinguishing

The flame can be extinguished by holding the torch upright and blowing, by covering the flame with the gloved hand or a combination of both.

Safety

The person operating the drip torch should always be aware of their surroundings. Watch for other personnel and do not trap them with your fire. Do not get close to personnel with a lit torch and be careful around vehicles. A lit torch should always be carried upright when not lighting. The torch should never be taken outside the burn unit when lit. Torches should be extinguished if you stop lighting for any period of

The drip torch is a safe and effective tool for igniting prescribed fires.

time. This helps save the wick and keeps the torch from becoming hot and not operating properly. When refueling torch, make sure to do so in an area off the active fireline and away from crowning trees and blowing embers.

Fuel Mix
Winter, Fall and Spring = 50:50 diesel:gasoline
Summer = 60:40 or 70:30 diesel:gasoline.

HANDTOOLS FOR PRESCRIBED BURNING

Shovel

Used for making firebreaks, suppression of fire in light fuels, covering smoldering debris with soil, mop-up or assisting with removal of stuck vehicle.

Fire Rake or McLeod

Used for making firebreaks, suppression of fire in light fuels and post burn mop-up.

Common handtools used on prescribed burns, from left to right: McLeod, leaf rake, fire rake, broom and swatter.

Leaf Rake

Used for making firebreaks, suppression of fire in light fuels and post burn mop-up. Works well in areas with surface rock.

Fire Broom

Used for suppression of fire in light fuels and post burn mop-up.

Swatter

Used for suppression of fire in light fuels and post burn mop-up.

Backpack pump

Used for laying wetline in places a pumper truck cannot get to, suppression of fire, follow up for pumper trucks on escaped fires and post burn mop-up.

Leaf blower

Used for creation of firebreaks in leaf litter, suppression of fire in light fuels and post burn mop-up. Caution: make sure to blow embers back into blackened area.

Leaf blower being used to mop-up along the edge of the burn unit. Make sure to blow embers and debris back into the blackened area.

For more information about prescribed fire equipment, see *Prescribed Burn Equipment* NREM-2899 at extension.okstate.edu/fact-sheets/prescribed-burn-equipment.html

SMOKE MANAGEMENT

CATEGORY DAY

"Category Day" is a system developed to determine the ability of the atmosphere to mix and transport smoke throughout the boundary layer, which at times can extend more than a mile above the surface. The "mixing height" is the depth of the mixed layer above the earth's surface throughout which smoke can be dispersed. "Transport wind" is the average wind speed through the depth of the mixed layer. Multiplying these two variables gives "ventilation rate". The greater the ventilation rate, the greater the ability of the atmosphere to ventilate smoke and get it out of the area. A variable called "Category Day," which is a function of ventilation rate and ranges from 1 to 5, has been developed as a smoke management index to provide guidance as to when and when not to burn. Using mixing height in meters and transport wind in meters per second, the table below relates ventilation rate to Category Day, along with burning guidelines. Category Day and ventilation rate information can be found in the "Fire Weather" sections of local National Weather Service websites listed earlier. If selected by the user, ventilation rate also can be shown in the NWS hourly forecast chart and table products.

Category Day	*Ventilation Rate*	*Burning Guidelines*
I	<2,000	No burning
II	2,000-4,000	No burning until 11 a.m. and not before surface inversion has lifted.
III	4,000-8,000	Fire out by 4 p.m. Daytime burning only after inversion has lifted.
IV	8,000-16,000	Burn anytime.
V	>16,000	Unstable and windy. Excellent smoke dispersal. Burn with caution.

OKLAHOMA DISPERSION MODEL IN OK-FIRE

This model was developed to assess surface dispersion conditions several miles downwind. It breaks the atmosphere in six dispersion categories:

1-Very Poor (VP)
2-Poor (P)
3-Moderately Poor (MP)
4-Moderately Good (MG)
5-Good (G)
6-Excellent (EX)

The lower end of this scale typically occurs with surface inversion conditions, in which temperatures increase with height above the surface. Such conditions inhibit mixing and cause poor dispersion. Within such inversions, the smoke plume hangs together as it drifts downwind and anyone caught

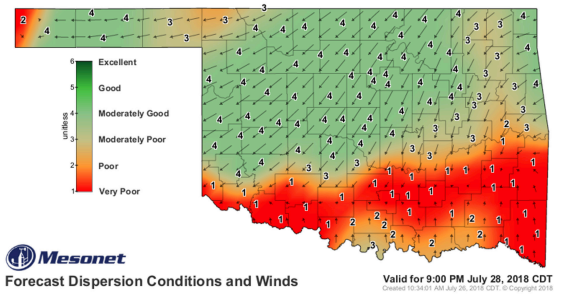
Good smoke dispersal occurs when burning on Category III days or higher.

near the plume centerline could be smoked out. The upper end of this scale typically occurs with unstable atmospheric conditions, when the dispersion is good, both in the vertical and horizontal directions.

Current and forecasted smoke dispersion information from the Oklahoma Dispersion Model can be found in map, chart and table formats throughout the OK-FIRE website (mesonet.org/index.php/okfire)

HOW TO MINIMIZE SMOKE PROBLEMS

- Burn smaller burn units.
- Burn when weather conditions are forecast to produce the best dispersion. Consult both the Category Day forecast as well as the Oklahoma Dispersion Model forecast in OK-FIRE.
- Burn when fuel conditions are likely to produce the least amount of smoke. This can be accomplished by selecting the correct fuel moisture range for the fuel size class that needs to be removed to meet the burn objectives (e.g., leaf litter, grass fuels, amount of cedar in unit).
- Use appropriate ignition techniques for smoke management. Consider using backfires to reduce the amount of smoke or mass ignition devices such



Example of forecast smoke dispersion conditions during a frontal passage from the Oklahoma Dispersion Model on the OK-FIRE website. Wind directions are indicated by the arrows. Dispersion conditions at this time range from very poor (red) along and ahead of the cold front to moderately good (4) behind.

as helitorch or Delayed Aerial Ignition Devices for larger burn units.

- Conduct post burn mop-up to reduce nuisance smoke. Outline actions to be taken after the burn to reduce residual smoke. If post burn smoke could be a problem, be sure to monitor unit to suppress any fuels that begin to smolder.
- Reduce the amount of fuels in burn unit to reduce smoke emissions. This can be accomplished by burning frequently, grazing, or haying.
- Reduce the impact of smoke on people. Be sure to notify all people downwind that could be affected by the smoke and use appropriate signage to inform the public about areas were smoke will impact them.

Remember that even when the smoke leaves the burn unit, it is still your smoke and you should do everything possible to reduce the smoke impact outside of the burn unit. For more information see *Smoke Management for Prescribed Burning* E-1008 at extension.okstate.edu/fact-sheets/smoke-management-for-prescribed-burning.html

PRESCRIBED BURN ASSOCIATIONS

A Prescribed Burn Association (PBA) is a group of landowners and other concerned citizens that form a partnership to conduct prescribed burns safely.

These partnerships are beneficial because the members can share equipment and labor and it provides training for the members Finally, PBAs foster good relations between neighbors and within the community in regards to the use of and need for prescribed fire.

GUIDELINES FOR PRESCRIBED BURN ASSOCIATIONS

Burn Associations should elect officers and a board of directors if multiple area/counties are involved. Officers should consist of landowners/lessees; agency/university personnel can only provide technical assistance. Dues should be established to buy equipment for the association and a fire training school should be planned annually.

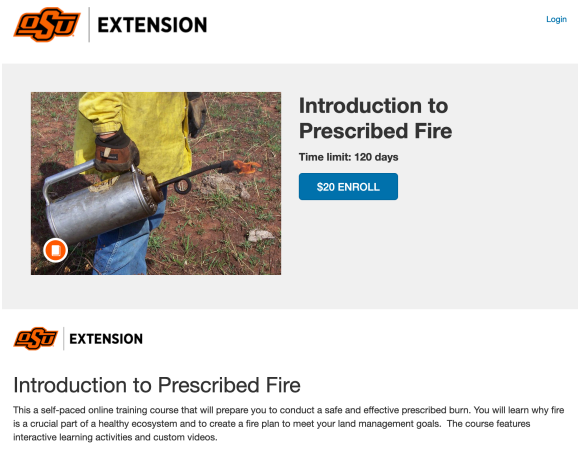
Remember, the landholder still assumes liability for fire and must show proof of insurance before the burn. The landholder also is responsible for preparing firebreaks and they must be adequate. You should set a minimum number of personnel that must be present on each burn. Make sure you have an inventory of what equipment is available. Finally, members should assist with a certain number of burns before their land is burned. For more information about PBAs in Oklahoma:

Oklahoma Prescribed Burn Association website (ok-pba.org)

Prescribed Burn Associations NREM-2880 (extension.okstate.edu/fact-sheets/prescribed-burn-associations.html)

Online Prescribed Fire Training and Apps

The Introduction to Prescribed Fire course is set up to walk people through the process of conducting a prescribed burn, as well as the effects of fire on various plant communities. The course is designed for both people who have little to no knowledge about prescribed fire as well as people who have had years of experience conducting burns. To access the course, go to osuextension.catalog.instructure.com/courses/introduction-to-prescribed-fire



APPS FOR PRESCRIBED FIRE

RxBurnTracker – Used to monitor and track prescribed burns through photo points and data entry. Available at your phone's app store. For more information see *App: RxBurnTracker* NREM-2898 at extension.okstate.edu/fact-sheets/app-rxburntracker.html

Prescribed Burn Entry Form – The app is intended to collect the details of burn activities for research. Confidential, with no personal information required or taken. Available at your phone's app store.

Mesonet - Oklahoma weather information, including current conditions, forecasts, radar and severe weather advisories. Available at your phone's app store.

Prescribed Fire Smoke Management Pocket Guide – Informational app regarding smoke management for prescribed burning can be found at smokeapp.serppas.org

OKLAHOMA PRESCRIBED BURN ASSOCIATION

The Oklahoma Prescribed Burn Association (OPBA) is an incorporated non-profit 501(c)(3) created to support local burn associations across Oklahoma. OPBA increases landowners' capacity to do neighbor-to-neighbor prescribed burns for reduction of fuel loads, wildlife habitat improvement, grassland production increases and enhancing public health and safety of Oklahomans. OPBA's goal is to provide Oklahoma landowners with access to support, training and equipment to safely implement prescribed fire as a management tool. This effort includes a public information campaign to unite local communities, tribes, fire departments and county government on the use and understanding of prescribed fire. This effort to support prescribed fire through OPBA is made possible through numerous state and regional conservation partners.

Vision: The Oklahoma Prescribed Burn Association aspires to be the premier organization that significantly increases the application of prescribed fire on the Oklahoma landscape.

Mission: Our Mission is to promote and protect the right of Oklahoma landowners to use prescribed burning as a safe, economical and effective land management practice by supporting member prescribed burn associations and individual landowners.

For more information about OPBA, go to their website at ok-pba.org

OKLAHOMA PRESCRIBED FIRE COUNCIL

MISSION STATEMENT

To promote the implementation of prescribed fire in Oklahoma as a natural resource management tool.

STRATEGIES

Education, training, legislative advocacy, facilitation of fund raising.

CHARTER MEMBERS

Natural Resource Ecology and Management Department - OSU
The Nature Conservancy
U.S. Fish & Wildlife Service - Ecological Services
OK Association of Conservation Districts
OK Conservation District Employee Association
OK Conservation Commission
OK Department of Wildlife Conservation
The Noble Foundation
OK Department of Agriculture, Food and Forestry
USDA Natural Resources Conservation Service

The OKPFC website has additional information on fire, fire laws and planning, and fire weather: oklahomaprescribedfirecouncil.okstate.edu

BURNS CONDUCTED

Log your burns at burn entry form link on ok-pba.org

Pasture Name _____

Acres _____

Date Burned _____

Conditions _____

Problems _____

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BURNS ASSISTED WITH

Owner_____

Pasture Name _____

Acres _____

Date Burned _____

Conditions _____

Problems _____

Owner_____

Pasture Name _____

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Date Burned _____

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Owner_____

Pasture Name _____

Acres _____

Date Burned _____

Conditions _____

Problems _____

PRESCRIBED FIRE TRAINING AND WORKSHOPS ATTENDED

Date Attended_____

Location_____

Instructor/Agency/Organization_____

Topics Covered_____

_____

Date Attended_____

Location_____

Instructor/Agency/Organization_____

Topics Covered_____

_____

Date Attended_____

Location_____

Instructor/Agency/Organization_____

Topics Covered_____

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Topics Covered_____

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Date Attended_____

Location_____

Instructor/Agency/Organization_____

Topics Covered_____

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PRESCRIBED FIRE TRAINING AND WORKSHOPS ATTENDED

Date Attended_____

Location _____

Instructor/Agency/Organization_____

Topics Covered_____

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Topics Covered_____

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EXTENSION