Range, Wildlife and Fisheries Management

PRESCRIBED BURNING JUNIPER COMMUNITIES IN TEXAS[1]

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Considerable prescribed fire research has been conducted on Ashe juniper (Juniperus ashei) and redberry juniper (J. pinchotii) communities in Texas. Prescribed fire is an effective, cost competitive method of controlling juniper. This paper outlines how to safely and efficiently conduct prescribed fires in juniper communities and discusses vegetation responses in the two major juniper types found in Texas.

Prescribed burning is rarely used on mature juniper stands because they do not support enough fine fuel to carry the fire. Prescribed fire in juniper communities is generally used in combination with other range improvement techniques which reduce the juniper canopy cover, allowing herbaceous vegetation to increase. Mechanical methods (chaining or tree dozing) are the most common range improvement techniques used on these vegetation types.

Prescribed fire and mechanical methods work well together. Use of mechanical methods as pretreatments for prescribed

fire increases fine fuel, making pastures easier to burn. The increased fine fuel load also ensures that the objectives can be met. Prescribed fire prolongs the life of mechanical treatments, eliminating large amounts of downed woody debris, removing many of the smaller plants missed by the original treatment, killing brush seedlings which have established after removing the original woody cover, and suppressing resprouting brush plants. Direct advantages of prescribed fire include improved animal distribution, forage utilization, quality and production, and altered species composition depending on season of the burn.

Preburn Requirements

After chaining or dozing a mature juniper stand, it is recommended the area not be burned for 3 to 5 years. This delay allows time: (1) for herbaceous vegetation to establish and form a relatively continuous fuel bed; (2) for the needles to dry and drop off (decreasing chance of spot fires); and (3) for juniper seeds to germinate and be killed with subsequent fire. While a minimum period is needed to ensure adequate fine fuel accumulations, the area should be burned before juniper plants are 4 feet tall. Juniper resistance to fire increases dramatically as plant height increases beyond 4 feet. Grazing during this period should be light to ensure herbaceous plant vigor and adequate fine fuel accumulation. In most instances complete deferment is recommended the growing season before the burn.

For safety considerations, juniper stands should be burned in two separate units, firelines and headfires. These general techniques are discussed in detail in Management Note 9.

The reader is referred to this Note if information is required on organization, number of personnel, and equipment.

Chained Juniper

Chained juniper is considered the easiest juniper pretreatment to burn. Herbicide-treated juniper or tree-dozed stands that have not been piled can also be burned using the following prescription. The first step is establishment of a mineral-soil, dozed line around the perimeter of the unit to be burned. A second dozed line is plowed 400 to 500 feet inside the perimeter, on the downwind side of the prescribed winds for the headfire. The area between these dozed lines is called the fireline. Firelines should be burned in January or February.

Basic weather conditions required for burning firelines are:

Relative humidity	40-60%
Temperature	40-60 F
Wind	0-8 mph.

Mature juniper stands do not support enough fine fuel to support a surface fire.

Accumulations of 2000 lb/ac of fine fuel with few fuel discontinuities are recommended. If the fine fuel is dominated by sod-forming grasses (e.g., buffalograss), successful burns can be conducted on areas with as little as 1000 lb/ac because of the continuous nature of the fuel bed. However, if the fuel is dominated by bunchgrasses (e.g., little bluestem), at least 2000 lb/ac is required. As fine fuel decreases, weather conditions must be at the upper end of the prescription (lower relative humidity, higher temperature and wind speed) to reduce the work of burning firelines.

A strip headfire technique is recommended to burn firelines. This technique is fast and offers good control of fire intensity. The 500-foot firelines can be efficiently burned with a crew including the fire boss, 5 ignition personnel, 2 people manning the pumper, and 2 or 3 people with swatters or backpack water pumps. A crew of this size can burn 2 or 3 miles of line in approximately 6 hours depending on topography, weather, and fine fuel characteristics.

Since the purpose of the fireline is to stop the headfire, as much fine fuel as possible must be removed. This removal of fine fuel will minimize the chance of a spot fire within the fireline building enough intensity to send firebrands outside the unit during the headfire. When fuel is discontinuous (generally with low fuel loads) in the fireline, the ignition crew must "carry the fire" within the fireline to burn the fine fuel under the juniper plants. This results in the ignition crew having to zigzag within the fireline. Caution must be exercised among ignition personnel and the fireboss to ensure that a torch bearer does not pass another torch bearer in front of him during this zigzagging. Zigzagging also slows down burning and increases the torch fuel needed.

Rough and broken terrain also slows ignition. The crew must be more cautious and communication is critical to ensure there is an escape route for every crew member.

Topography modifies wind patterns and fire behavior. A common example of this situation occurs when the fireline crosses a drainage. The extent of wind pattern modification depends upon drainage size. The primary concern for ignition personnel lighting downslope is to avoid being cut off by sheer bluffs (blocking their escape route). The ignition pattern may need to be altered to account for changes in topography or fuel. Even if there is no significant slope change caused by the drainage, fuel loads are often increased enough to modify fire behavior.

Since fires move faster up slopes, the ignition crew must be aware that fire can overtake them. Having an experienced fire boss becomes critical in these situations. The fire boss must decide which technique should be used to ensure the safety of the crew and minimize spot fire potential.

Breaks placed in the fireline at 1/4 to 1/2 mile intervals will allow the burning crew a chance to evaluate fuel and topographical changes in the fireline and provide a safe stopping point if conditions warrant. Existing breaks (i.e.,

roads, cow trails, pipelines, etc.) can be used, but the fire boss must be aware of them.

Use of mechanical methods as pretreatments for prescribed fire increases fine fuel (slash and herbage).

After firelines are burned, the remainder of the unit can be burned as Soon as weather conditions for the prescribed headfire occur. Firelines provide a safe barrier for the rest of the unit to be burned with warmer weather conditions and greater fire intensity .This greater fire intensity will enable the fire to cross small fuel breaks, and achieve the desired objectives. Ignition of the remaining part of the unit is usually achieved using the headfire technique.

Required weather conditions for headfires are:

Relative humidity	25-40%
Temperature	70-80 F
Wind	8-15 mph.

As with the firelines, fine fuel load will influence the success of the burn. As the amount of fine fuel decreases weather conditions must be at the warmer, drier end of the prescription, with increased wind speeds, to have a successful prescribed burn. Increasing the fine fuel on the unit greatly enhances the success of the burn.

Personnel needed on a headfire for this fuel type will vary with the size of the unit. At Texas Tech University, units of 1000 acres are commonly burned with 7 people--- a fire boss, a 2-man ignition crew and 2, 2-man suppression crews. The pumper (or water source) should be stationed in such a position that it is out of the smoke but can be quickly and easily moved to a problem area. Several patrols should be made along firelines to check for spot fires during the headfire. Additionally, the area should be patrolled immediately following the completion of the headfire. Large juniper stumps or piles of debris covered with soil adjacent to the perimeter line should be removed and placed 50 feet inside the unit (called “mopping up”). The burn should be checked for several days, especially when there is a wind shift.

Using this headfire prescription, 70% burn coverage is commonly achieved on 1000-acre pastures with relative safety. However, if herbaceous vegetation consists of widely spaced bunchgrasses (e.g., little bluestem), burn coverage may achieve only 50% even with fine fuel loads as high as 2500 lb/ac.

Dozed Juniper

Juniper sites which were dozed and piled will follow the same basic prescription with the following exception; the piles within and immediately adjacent to the firelines are burned separately. Piles are burned in May or June while the surrounding grass is green to reduce the danger of spot fires. Large piles are capable of throwing firebrands which can ignite spot fires 1000 feet away.

Weather conditions needed to burn Juniper piles are:

Relative humidity	35-60%
Temperature	40-80 F
Wind	0-10 mph.

After the piles have been burned, the rest of the firelines can be burned the following winter when grass is dormant. Prescriptions required for firelines and headfires in this fuel type are the same as described for chained juniper. Piles burning adjacent to perimeter lines can burn for several days and are a source of firebrands. They should be mopped up and checked for several days, especially if there is a wind shift.

Burning should be delayed 3 to 5 years after mechanical treatments to allow time for juniper seeds to germinate and to be assured of successful burn.

Dissected terrain associated with juniper communities can block escape routes. Ignition personnel should be cautious of rough topography.

Mature Juniper

Mature juniper stands are very hazardous to burn because of the extreme environmental conditions required to overcome the lack of fine fuel under their canopies. Prescribed burns have had limited success in this vegetation type by pushing windrows of dozed juniper against dense canopies. The risk of spot fires is high. Research has shown crown fires stop when the average distance between tree canopies is greater than 26 feet.

Weather and fuel conditions needed are:

Juniper canopy	>35%
Relative humidity	20-35%
Temperature	70-85 F
Wind	>10 mph.

Juniper canopy cover must be greater than 35% to form a relatively continuous fuel bed. However, firebrands are a serious problem if fine fuel loads in adjacent units are adequate to support a fire. Generally, fires only spread 50 to 180 feet through juniper crowns and should be conducted only where fine fuel is scarce.

If this fuel type is to be burned, the manager should be aware of the danger and limited coverage which can be achieved. Personnel experienced with this fuel type should be consulted.

Vegetation Response

Response of vegetation following fire depends upon environmental conditions, fire coverage, and post-burn management. Changes in fire intensity during the burn because of changing fuel loads and microclimate result in the patchwork pattern normally seen on a burned area and explain why only 70% coverage is normally achieved in juniper community types. This is best illustrated by the degree of brush topkilled between the firelines and headfires.

Juniper piles should be burned in May or June when grass is green to reduce danger of spot fires.

Shrub Response

Ashe juniper (a nonsprouting species) is easily controlled with prescribed fire depending on its size. Trees less than 4 feet tall can be eliminated with recommended minimum fine fuel loads, but as fuel load increases larger trees can also be killed. However, Ashe juniper is often replaced by secondary brush species, such as shin oak, live oak, or flameleaf sumac, depending on the soil.

Redberry Juniper (a sprouting species) is difficult to kill with fire unless the bud zone (sprouting region) is above the soil surface. About 70% mortality can be expected on plants with an exposed bud zone. Plants with buried bud zones can be top killed by prescribed fires. The rate at which redberry juniper bud zones become covered with soil depends upon several site factors. Trees on shallow, rocky soils generally have an exposed bud zone until they are 10 to 15 years old. Trees on deep soils have an exposed bud zone for less than 10 years. Sites dominated by redberry juniper usually are not invaded by other brush species following fire. Although little leaf sumac, skunkbush sumac, algerita, and *Ephedra* species sprout after fire, their densities do not increase enough to present a problem.

Herbaceous plant response

Herbaceous plant species favored by burning will depend on the time of year the area is burned. The prescription described here will favor perennial warm season grasses. Response of these plants to prescribed fire is largely dependent upon precipitation following the burn. Wet years increase yield of little bluestem, tall grama, blue grama,

sideoats grama, vine-mesquite, buffalograss, and meadow dropseed. Cool-season grasses (e.g., Texas wintergrass) as well as perennial three-awns and sand dropseed are usually harmed by fire. Production of all perennial grass species declines when prescribed burning is followed by a dry spring. Most species recover within 3 years when precipitation is below normal following late-winter or spring burns.

Forb response is generally short-lived. Prescribed burning in late winter or early spring usually reduces forb densities, and can provide excellent control of annual broomweed for one year, although annual sunflower and ragweed may increase. Forbs may increase slightly in dry years. Effects of burning on forb densities are negligible for the second and subsequent years following burning.

Post-Burn Management

Deferring pastures from grazing following burning is recommended to allow herbaceous vegetation to recover to a healthy condition. Usually livestock are not put on burned juniper communities until mid-June, when most grass plants have 6 to 10 leaves. During dry years, deferment may be needed until as late as September.

Success of prescribed bums in mature juniper stands have been limited, even when windrows of dozed juniper have been pushed against dense canopies.

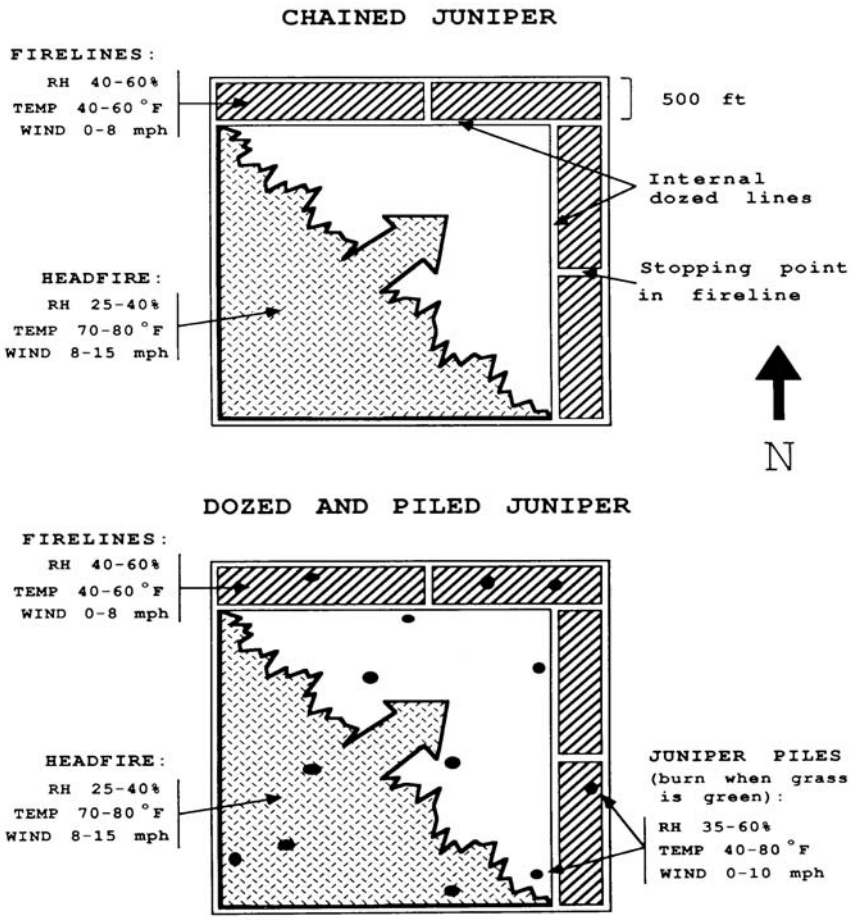
One month after burning, herbaceous vegetation responds favorably when moisture is adequate. Large oak trees are undamaged.

Prescribed burning is an inexpensive technique to maintain juniper habitats in good condition.Burning every 10 to 20 years can maintain these communities in a productive state for both wildlife and livestock. This burning interval may also prevent the need for other range renovation techniques such as herbicide or mechanical control. Length of the burning cycle is dependent upon the rate of reinvasion of juniper and secondary brush species. Ashe juniper sites should be reburned before juniper plants are 4 feet tall. Redberry juniper sites should be burned before resprouts of previously burned plants are 5 feet tall. Junipers are easiest to kill when they are small.

Safety Considerations

Advantages of prescribed burning are commonly listed. Land managers must also be aware of the disadvantages of this technique and know how to compensate for them. They include risk of fire escape, inadequate growing conditions (before and after the burn), and over-utilization after the burn that may be detrimental to forage. Disadvantages can be minimized by having a good working knowledge of plant responses, fire behavior, and prescribed burning techniques. These can be obtained from actual experience with prescribed burning, talking with other practitioners, and reading available information.

The possibility of fire escape is largely avoided by burning within prescription. This pertains to prescribed weather and fuel loads. Following these prescriptions will also help ensure the objectives are met.



Ideal pasture layout of a chained and a dozed and piled juniper community for a prescribed burn. Chained and dozed and piled juniper pretreatments are burned with the same prescriptions for firelines and headfires. However , juniper piles in the dozed and piled treatment must be burned with a different prescription in the spring when the surrounding grass is green.

Managers have no control over the growing conditions following a prescribed fire. Nonetheless, a modification can be made if soil moisture is low going into the burning season or adequate precipitation does not occur following the bum. If growing conditions (low soil moisture) are inadequate, a manager must adjust stocking rates or defer the unit for a longer period. Over-utilization can be minimized by burning

an area large enough to accommodate the animals (livestock as well as wildlife).

If readers are interested in a more detailed treatment of vegetation responses or ignition techniques, they are referred to the following texts:

McPherson, G. R., G. A. Rasmussen, H. A. Wright, and C. M. Britton. 1986. Getting started in prescribed burning. Texas Tech Univ., Dept. of Range and Wildlife Management Note 9.

Wright, H. A., and A. W. Bailey. 1982. *Fire Ecology: United States and Southern Canada*. John Wiley & Sons, Inc. 501 p.

COVER PHOTO : Prescribed fire is a useful management tool in juniper communities if applied properly.

[1] Contribution No. T-9-458, of Agricultural Sciences, Texas Tech University