

NATURAL RESOURCES CONSERVATION SERVICE

PRESCRIBED BURNING DESIGN PROCEDURES

(338DP)

Contents of Prescribed Burning Design Procedures include:

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1. SPECIFICATIONS FOR PRESCRIBED BURNING FOR ALL PURPOSES

a. *The prescribed burn plan will be prepared using NE-ECS-72, Prescribed Burn Management Plan or other format that contains the following required criteria:*

- i) Location and description of the burn area
- ii) Pre-burn vegetative cover type and estimated fuel load in pounds/acre or other quantitative value
- iii) Resource management objectives that will be accomplished through prescribed burning
- iv) Notification checklist for adjoining landowners, fire departments, sheriff's office and others that may be affected by the prescribed burn
- v) Preparation requirements of the area prior to burning
- vi) Equipment checklist and crew assignments
- vii) Safety review including notification of safety zone locations

- viii) A detailed aerial photograph or topographic map containing the location, field numbers, description of the burn area, ignition points, planned wind direction, locations of resource/personnel, and safety zones.
- ix) Proposed dates of the burn, or vegetative growth stage of the target vegetation, and/or vegetative conditions prior to burning
- x) The burn prescription in terms of relative humidity, wind direction, wind velocity, fuel type and condition, and soil moisture conditions. Burn prescriptions will follow the specifications listed below*:
 - o relative humidity >25 %
 - o wind speed <20 mph
 - o air temperature <80 degrees F
 - o soil moisture – moisture in top 6 inches

** Burn prescriptions that exceed these parameters and that are recommended for a more effective mortality on targeted vegetation require special Job Approval Authority and authorization from the State Rangeland Management Specialist.*

- xi) Firebreak requirements (394 and 394DP)
- xii) Firing sequence and ignition techniques
- xiii) A 24-hour weather outlook prior to the proposed burn
- xiv) Smoke management plan criteria
- xv) Fire escape contingency plan
- xvi) Post-burn evaluation

Prescribed burn plans will comply with applicable federal, state, and local laws; including all elements required in a prescribed burn plan according Nebraska State Statute 81-520. A burn permit from the local fire district must also be obtained.

The burned area must be incorporated into a system of management allowing for the desired objective. Refer to the following conservation practice standards for suited application(s) for meeting the primary resource objectives:

<u>Primary Objective</u>	<u>Management System</u>
Plant production, health, vigor on grazed lands	Prescribed Grazing (528)
Habitat maintenance or enhancement	Upland Wildlife Habitat Management (645)
	Wetland Wildlife Habitat Management (644)
	Early Successional Habitat Development/Management (647)
Invasive plant treatment	Pest Management (595)
	Brush Management (314)
	Forest Stand Improvement (666)

2. BURN PLANNING CONSIDERATIONS

- a. Avoid burning sandy sites or other lands during time periods that will be subject to severe wind erosion, unless adequate erosion control measures are put in place.
- b. Existing barriers such as lakes, streams, wetlands, roads, ridge tops, and constructed firebreaks are important to the design and layout of this practice. Involving adjacent landowners in a larger scale burn to take advantage of natural or existing firebreaks may be more feasible than constructing firebreaks along property boundaries.
- c. Weather parameters and other data that affect fire behavior should be monitored at regular intervals during the burn. As a minimum, wind speed, wind direction, relative humidity, and air temperature should be monitored every 30–45 minutes.
- d. Safety precautions including designated safety zones are to be planned before the burn and monitored during the burn.
- e. Timing of burning will be commensurate with soil and site conditions to maintain site productivity and minimize effects on soil erosion and soil properties (structure, soil moisture).
- f. Burning between April 1st and August 1st may disturb nesting birds. Adjust timing to address this wildlife consideration or adjust the plan to reduce the disturbance. Options might include conducting nest searches prior to the burn to determine the level of impact and treating only a portion of the total area in any one year to provide residual nesting habitat.
- g. Burning should not be conducted after April 15th on areas managed to provide prairie grouse habitat unless the expected habitat enhancement will offset short-term impacts to nesting cover and prairie grouse production.
- h. Cooperators must fully understand that they are responsible for confining prescribed burns to their own lands.
- i. All necessary tools, equipment, and manpower necessary to contain the fire to the area planned for prescribed burning will be on-site prior to ignition. All prescribed fire equipment should be tested for functionality prior to the burn.
- j. Identify and provide for the protection of headquarters, windbreaks, wildlife areas, etc.
- k. Heavy smoke particulates can conduct electricity. Electrical lines will be mapped and identified as part of the burn plan so crews are aware of potential hazards associated with heavy particulates conducting electricity.
- l. Burn when wind velocity is steady or nearly steady and between 8 to 20 mph. Do not burn when a weather front is forecasted within 12 hours.
- m. Normally, the optimum time for burning is between 10 a.m. and 2 p.m., however, timing of burn should be planned around the time which is most likely to meet prescription requirements.
- n. Make sure all hot spots are extinguished before leaving the area. Monitoring of the burn site will follow these criteria:

Light fuels (grass)	12 hours
Moderate fuels (shrubs)	24 hours
Heavy fuels (trees)	72 hours
- o. Burn as soon after a rain as possible and when the material to be burned is dry enough to carry a fire. Generally this is 3 to 5 days after a rain on grassland.

- p. Burning should be managed with consideration for wildlife needs such as existing barriers: lakes, streams, wetlands, roads, etc. Constructed firebreaks are important to the design and layout of this practice
- q. Notify adjoining landowners, local fire departments and public safety officials within the air shed prior to burning.
- r. Consider cultural resources and threatened and endangered plants and animals when planning this practice. Weather parameters and other data that affect fire behavior should be monitored during the burn.
- s. Consider the location of utilities such as telephone lines and natural gas pipelines to prevent damage to the utility and avoid personal injury.
- t. Deferment from grazing may be necessary on areas dominated by mid-grasses in order to provide an adequate amount of fine herbaceous fuels needed to carry fire and meet management objectives of the burn. Refer to the Ecological Site Descriptions for the proposed burn unit for an estimate of production potentials for rangeland in various states or conditions.
- u. On severely overgrazed or encroached areas dominated by bluegrass or smooth brome, a single prescribed burn cannot guarantee an increase in the yield of native grasses. In order to reach this objective, an integrated treatment approach using grazing management, herbicide treatments, inter-seeding, and/or repeat burns may be needed.

3. SMOKE MANAGEMENT

Prescribed burning helps achieve many desired resource objectives, however, smoke from burning can also have a negative effect on air quality and visibility. To minimize adverse environmental effects, use the following guidelines to reduce the impact from smoke.

- a. **Obtain and use weather and smoke management forecasts.** Weather information, including spot-weather forecasts and smoke management forecasts are available from the National Oceanographic and Atmospheric Service, (NOAA). Such information is needed to predict smoke generation and movement as well as fire behavior. The website address for NOAA is listed:

<http://www.crh.noaa.gov/lbf/forecasts/firewx/firewx.php>
- b. **Don't burn during pollution alerts or stagnant conditions.** Smoke will tend to stay near the ground and will not disperse readily. Many fire-weather forecasters include this in their regular forecasts.
- c. **Comply with air pollution control regulations.** The purposes of smoke management are to mitigate the nuisance and public safety hazards (e.g. on roadways and at airports) posed by smoke intrusions into populated areas, to prevent deterioration of air quality and National Ambient Air Quality Standards (NAAQS) violations, and to address visibility impacts in mandatory Class I Federal areas" (EPA 1998). The air quality standards are for particulate matter (PM) < 2.5 microns (PM2.5) and particulate matter < 10 microns (PM10).

At this time, these conditions do not present themselves in Nebraska. For example, the annual values of PM2.5 and PM10 concentrations are well below the required standard. Although these conditions may not now exist in Nebraska, the nature of following smoke management guidance is preventive.

- d. **Determine the location of smoke sensitive areas.** Burning should be done when wind will carry smoke away from public roads, airports, and populated areas. Do not burn if a smoke-sensitive area is within 1/2 mile downwind of the proposed burn.
- e. **Burn when conditions are good for rapid dispersion.** Ideally, the atmosphere should be thermally neutral to slightly unstable so smoke will rise and dissipate, but not so unstable as to cause a control problem. NOAA publishes smoke dispersal wording in spot weather forecasts per agreement with federal users. The Smoke Dispersal Wording in Fire Weather Planning Forecasts (FWF) are as follows: poor, fair, good, very good, and excellent. ***Do not burn when the smoke dispersal value is poor and the burn location is < .25 miles from a smoke sensitive area.***
- f. **Estimate the projected length of time the prescribed burn will be producing smoke.** Give an estimate in hours of the time it will take to complete the prescribed burn from ignition until the time the burn is extinguished. The size, fuel load, and fuel type will determine the intensity of smoke impact on an area. A time estimate will help the burn planner manage these smoke impacts.
- g. **Notify your local fire control office, nearby residents, and adjacent landowners.** Notification is common courtesy and required as part of the prescribed burn plan. The notification should include an awareness of the possible smoke effects of the prescribed burn.
- h. **Use test fires to confirm smoke behavior.** Set these in or adjacent to the area proposed for burning, away from roads or other edge effects.
- i. **Use backing-fires when possible.** Backing fires consume dead fuels more completely and produce less smoke. Even though slower and more expensive, they produce fewer pollutants and restrict visibility less.
- j. **Burn during the middle of the day when possible.** Atmospheric conditions for dispersion of smoke will generally be most favorable.
- k. **Consider burning in small blocks if the smoke dispersion value is fair or poor.** The larger the area being burned the higher the concentration of particulates put into the air, and the longer the duration of the visibility reduction downwind. However, if weather conditions are good for rapid smoke dispersion, e.g., the Smoke Dispersion Value is good or higher, it is often better to burn the whole area at one time from a smoke management standpoint.
- l. **Do not ignite organic soils.** It is difficult to put out an organic soil (peat) fire without submerging it in water. It will smoke for weeks despite control efforts, creating severe smoke problems for miles around. Such fires can also re-ignite surface fuels, resulting in a wildfire.
- m. **Be cautious of nighttime burning.** Smoke drift and visibility are very difficult to predict at night. The wind may lessen or stop completely keeping smoke concentrations high in the vicinity of the burn. Burn at night only when there is a definite forecast of optimum conditions. A nighttime smoke patrol is often necessary.
- n. **Anticipate down-drainage smoke flow.** Atmospheric conditions tend to become stable at night. Stable conditions tend to keep smoke near the ground. In addition, downslope winds generally prevail at night. Thus, smoke will flow down drainage and concentrate in low areas.

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

4. BURN PLAN DESIGNS

a. *Patch Burn-Grazing for Wildlife Habitat Improvement*

Patch burning is defined as the application of prescribed fire for the purpose of focusing grazing use on a burned portion of land, with less use occurring on un-burned portions. This management practice can create a mosaic of heavily grazed and lightly grazed areas that provide a diversity of plant types, vegetation cover and structure for improved wildlife habitat while maintaining livestock production. A prescribed grazing plan and a prescribed burn plan are required for implementing this system. Refer to the Prescribed Grazing (528) for grazing planning guidance. Use Nebraska Biology Technical Note 79, "Patch Burning: Integrating Fire and Grazing to Promote Heterogeneity", as a resource to design a patch burn-grazing system. The following procedures apply to designing a 3 unit, patch-burn grazing system. This system can be adapted to incorporate additional patch-burn portions on less than 1/3 of the grazing unit to achieve a more diverse, multi-structured landscape:

b. *Year 1*

- ii)** Evaluate the kind of herbaceous vegetation (cool-season or warm season dominant) and current herbaceous fuel load in the grazing unit. At least 4 inches of residual plant material or 1000 lbs/acre should be present to carry fire in the first portion to be burned. This vegetation should not be hayed, mowed, or grazed from mid summer until the time of the burn to ensure an adequate, uniform fuel load. Temporary fencing or livestock movement may be needed.
- iii)** Conduct a prescribed burn on one third of the unit where grazing has been deferred. The burn should be conducted at a time of the year to stimulate grass growth. The following time periods are recommended guidelines. Actual timing should be determined based upon local field conditions:

Cool-season grasses

September 1-March 1

Warm-season grasses

March 1-April 15

- iv)** Stock the grazing unit based on the entire paddock acreage, not just the burned portion. Delay turnout of livestock until there is at least 4-6 inches of new herbaceous growth in the burned portion of the unit. Recommended initial stocking rate guidelines for the unit can be found in the ecological site descriptions for the area. These are located in the Field Office Technical Guide, Section II, A. Statewide Soil and Site Information, 1. Rangeland, Grazed Forestland, Native Pastureland Interpretations.
- v)** End grazing when forage in the unburned portion of the unit reaches 50-60% of the current year's growth, or 6-8 inches for cool season grasses and 10-12 inches for warm-season grasses. Forage utilization in the burned portion may be very heavy, allowing for lighter utilization levels on forage in the unburned portion of the unit. The unburned two-thirds should not be heavily grazed, mowed, or hayed so that adequate fuel remains for the second year burn. The management objective for the unburned portion should be for improving plant health and/or habitat for wildlife. Additional grazing units may be needed for livestock in order to achieve this objective.

c. Year 2

- i) Conduct a prescribed burn on the second third of the unburned unit from the previous year. Repeat the process as described for year one. During the second year, cattle should graze primarily in the newly burned area, while the previous years burned unit and remaining unburned unit are used to a lesser extent. Continue to maintain minimum grazing heights in the unburned two-thirds of the unit.

d. Year 3

- i) Burn the remaining third of the unit and repeat the grazing procedures as described above.

e. Year 4

- i) Burn the first area treated and repeat the cycle as needed to achieve or maintain the resource objective. Establish a monitoring program to measure the effectiveness of the management treatments. Minimum Monitoring Standards for Nebraska NRCS, Photo-Point Monitoring is located in the Field Office Technical Guide, Section I, F. Reference Lists, TECHNICAL NOTES (by Discipline), Range and Pasture, Tech Note 16. The use of temporary livestock grazing enclosures for the purpose of comparing grazed to non-grazed forage levels can be a helpful monitoring tool.

The following illustration provides an example of how prescribed burning and prescribed grazing can be used in a patch-burn graze system over a three year period. The system is repeated in years 4 through 6.

Illustration 1 - Patch Burn Graze System Single Unit, 3 Year Cycle



Subsequent “cycles” can be altered so that the routine of fire and/or grazing doesn’t begin to skew species composition in a certain direction within each patch. (For example, the exact three patches do not need to maintain the same borders year after year and the timing of burning and/or grazing should be adjusted if possible.)

5. BURNING FOR EASTERN RED CEDAR CONTROL

- a. Eastern red cedar is a native tree with volatile compounds that make it susceptible to mortality through fire. The most effective conditions for controlling cedar with prescribed fire is as follows:
 - i) tree height is < 6 feet
 - ii) fine herbaceous fuel load is at least 2500 lbs/acre
 - iii) % moisture is < 60% (typically from January through April)

Larger trees, > 6 feet in height that are in denser groupings or have a high canopy cover (>15%) are less affected by fire with typical spring burning prescriptions. Fine fuel loads of at least 3000 lbs/acre are typically needed to adequately carry fire into the lower branches of trees. Warm season dominated pastures in good condition can typically produce adequate fine fuels for carrying fire into cedar trees >6 feet. Degraded ranges, dominated by mid-grasses or short grasses generally lack the production potential to successfully carry fire in larger trees, even with full year grazing deferments. Refer to *Integrated Management of Eastern Redcedar on Grasslands*, Ortmann, et al., 2007 for more information about designing a burn plan for cedar control.

6. BURNING FOR IMPROVING NATIVE WARM-SEASON GRASS COMMUNITIES:

- a. Prepare burn prescriptions for a time when the warm-season plant component are just beginning new growth. This is generally on or near May 1. When cool season grasses are a large component in the plant community, time the burn when new growth of the cool season grasses reach 4 to 6 inches but before warm season grass growth exceeds 2 inches.
- b. Burn only when there is an adequate fine fuel load, (at least 1500 lbs/acre), but generally not more often than once every 3 years. After burning, delaying grazing until leaves of mid and tall warm-season grasses have at least 6 to 10 inches of new growth. On degraded rangelands, delay grazing for up to a full growing season to help reach resource objectives.

7. BURNING FOR INVASIVE PLANT MANAGEMENT:

- a. A prescribed burn plan prepared for the purpose of treating an invasive plant(s) should be part of a Pest Management Plan. A Prescribed Grazing Plan should be prepared for treatment areas where grazing occurs.
- b. Determine peak growth period and other factors related to the growth cycle of the target plant. Develop the burn prescription so that the time of the burn coincides with the critical growth period of the target plant, generally when the most rapid growth period occurs. Often, the critical growth period of the targeted plant coincides with the critical growth period of desirable plants. Consider the health and vigor of the desired plant community before initiating a prescribed burn.
- c. When burning to control re-sprouting woody plants, it may be necessary to burn 2 or more consecutive years. Integrated follow-up treatments such as herbicide application on re-sprouting undesirable woody species can be applied. Without follow-up herbicide treatments, fire can also be used to regenerate re-sprouting woody plant thickets such as plum, sumac, and buckbrush.
- d. Where invasive plants occur in the understory of woodlands, litter build-up, low fine-fuel loads, and discontinuity of fuels can make prescribed burning difficult. Top-killing of the

target plant may result, with crowns, rosettes, and basal plant parts remaining intact. Subsequent follow-up with mechanical, chemical or grazing treatments may be required to effectively reduce the target vegetation.

- e. Fire effects on invasive plants are widely varied. Use of prescribed fire as a single management tool may have limited effect, with target plant populations quickly returning to pre-burn levels or even increasing under certain conditions. Consult the Fire Effects Information system of the USDA Forest Service for more information about the interactions of fire and specific plant species.
 - i) Burning may lead to increases in some invasive species (i.e. serotia lespedeza). Refer to individual species and their effects from fire by referencing the Fire Effects Information website listed at the end of this guide.

8. BURNING COOL-SEASON PLANT DOMINATED PASTURES

- a. Earlier green-up can occur when dead residue from previous year growth in cool-season dominated pastures is burned off. Substantial decreases in forage yield for the season after a burn may occur. First year production following a burn may also be lowered as a result of long-term shading from mature plant material and competing vegetation.
- b. Prescribed burning in cool season dominated pastures should only be planned on pastures in good condition, where forage stands have large amounts of dead, low quality residue, or where invading brush and weeds are targeted for control. In this case, a prescribed burn could hasten the return to good forage production and reduce invading brush.
- c. Burns should be implemented when the soil is moist to protect roots and crowns from damage.

9. OPERATION AND MAINTENANCE

The kinds and expected variability of site factors (e.g., fuel condition and moisture content, weather conditions, human and vehicular traffic that may be impeded by heat or smoke, liability, and safety and health precautions) shall be monitored during the operation of this practice. Sufficient fire suppression equipment and personnel shall be available commensurate with the expected behavior of these factors during the time of burning to prevent a wildfire or other safety, health or liability incident.

Maintenance shall include monitoring of the burned site and adjacent areas until such time as ash, debris and other consumed material is at pre-burn temperatures.

Once the resource objectives are met, a management program on grazed lands consisting of a grazing plan that helps maintain the desired plant community should be implemented. An integration of multiple methods such as targeted grazing, mechanical, biological, and chemical treatments should be evaluated to achieve long term maintenance of resource goals.

Generally, a burning return interval of 3-5 years will keep most re-sprouting woody plants in check.

10. SUPPORTING REFERENCES

[Prescribed Burn Management Plan Jobsheet \(NE-ECS-72\)](#)

[Prescribed Grazing Standard \(528\)](#)

[Firebreak Standard \(394\)](#)

[Upland Wildlife Habitat Management Standard \(645\)](#)

[Wetland Wildlife Habitat Management Standard \(644\)](#)

[Early Successional Habitat Development/Management Standard \(647\)](#)

[Pest Management Standard \(595\)](#)

[Forest Stand Improvement Standard \(666\)](#)

[Brush Management Standard \(314\)](#)

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Patch Burn Grazing, IS-MO528A, Conservation Practice Information Sheet, NRCS, Missouri, July, 2004

Smoke Management, Private Forest Management Team, Auburn University, Alabama

Prescribed Burning (338), Conservation Practice Standard, NRCS, Oklahoma, May, 2004.

Nebraska NRCS Policy for Participation in the Planning and Application of Prescribed Burns

Smoke Management Plan for Nebraska NRCS Prescribed Burns

Nebraska State Statute 82-521

Fire Effects Information, USDA, Forest Service

National Range and Pasture Handbook, Appendix A, NRCS, rev 2003