

## Chapter 3 – PRESCRIBED FIRE

TNC and other agencies and organizations that manage land for biodiversity often use prescribed burns to promote desired vegetation and species. Fire is sometimes necessary to prompt the germination of some plants, including a number of rare and endangered species. On the other hand, fire can also sharply reduce the abundance of some species. The weather, topography, and available fuel will determine the temperature and intensity of the prescribed burn, and this along with the timing of the treatment, largely determine how the burn impacts the vegetation and the abundance of particular species.

The most effective fires for controlling invasive plant species are typically those administered just before flower or seed set, or at the young seedling/sapling stage. Sometimes prescribed burns that were not originally designed to suppress an invasive species have that happy side effect. But in some cases, prescribed burns can unexpectedly promote an invasive, such as when their seeds are specially adapted to fire, or when they resprout vigorously. These prescriptions must be modified or other management actions taken to undo or reverse the promotion of the invader.

Most successful weed control efforts that result from burning are due to the restoration of historical (natural) fire regimes, which had been disrupted by land use changes, urban development, fire breaks, or fire suppression practices. Many prescribed burn programs are, in fact, designed to reduce the abundance of certain **native** woody species that spread into unburned pinelands, savannas, bogs, prairies, and other grasslands. Repeated burns are sometimes necessary to effectively control weedy plants, and herbicide treatments may be required to kill the flush of seedlings that germinate following a burn.

When planning to implement a prescribed burn, be sure to that it fits within the context of an entire Site Conservation Plan. **TNC's Fire Initiative** can help you create a Site Fire Management Plan, and get necessary training and certification to conduct burns safely. Burns on TNC property can be conducted **ONLY** under the supervision of a TNC-designated Fire Leader ("burn boss"). The Fire Initiative has created a Fire Management Manual, which details TNC's Standard Operating Procedures for prescribed fires, information on how to start a burn program, writing a fire management plan, TNC requirements and guidelines for conducting burns, various administrative procedures, and fire management resources. The Manual can be downloaded from <http://www.tncfire.org>. The Fire Initiative can also be reached by phone at (850) 668-0827 and by e-mail at [fire@tnc.org](mailto:fire@tnc.org).

Spot-burning invasive weeds with a propane torch can be cheaper and easier than implementing a prescribed fire (permits are still required), but is only effective when the infestation is small. Spot-burning can be used to burn individual plants, groups of plants in a small area, or to ignite brush piles. Propane torches can be used in areas where there is little or no fine fuel to carry a prescribed burn, and can also be used to kill plants when

conditions are wet. See Appendix 2 for additional information on using a propane torch for spot-burning.

## **IMPLEMENTING A FIRE MANAGEMENT PROGRAM**

Before implementing a fire management program to control the spread of invasive weeds, several steps must be taken. First and foremost, **contact the TNC Fire Initiative**. Any prescribed burn on any TNC property must be reviewed and approved by a Fire Manager trained and certified by TNC's Fire Initiative. Once site management goals and objectives have been compiled, and problem invasive plants and the methods that could be used against them have been identified, the following 4 steps should be completed:

### **1. Determine if fire management is needed.**

It is important to determine, if the need to use prescribed fire to control weed invasions and meet other management goals, justifies the risks inherent in burning. Consider all available options for control of the weed; i.e., manual, mechanical, encouraging competition from native plants (restoration), herbicides, and biocontrol. Also consider the setting: is the weed in an old field, along roadsides, or in a pristine natural area with highly valued species and communities? Benefits from the chosen control option should always outweigh the overall risks and costs. In some cases the best option will be doing nothing to control the weed.

### **2. Develop a Site Fire Management Plan<sup>1</sup>**

The Site Fire Management Plan should be incorporated into the Site Conservation Plan, and designed to move conditions towards established conservation goals and objectives. TNC's Fire Initiative can assist in developing management plans for TNC preserves. A Site Fire Management Plan should include the following components:

- A. Site Background Information
- B. Fire Management Justification
- C. Fire Management Goals
- D. Fire Regime Proposal
- E. Site Specific Fire Operations
- F. Smoke Management Plan
- G. Neighbor and Community Factors
- H. Maps

### **3. Develop and implement a Prescribed Burn Plan<sup>1</sup>**

A Prescribed Burn Plan is a field document that includes specifics for conducting a particular burn treatment at a particular burn unit. It is also a legal document that details

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<sup>1</sup> Modified from TNC's Fire Management Manual. Please refer to the Manual for specific details in developing and implementing each plan. See <http://www.tncfire.org>.

the professional standards and guidelines to be used when conducting the burn. A Prescribed Burn Plan includes the objectives to be accomplished by a particular burn, an acceptable range of environmental factors under which the burn can be carried out (such as wind speed and relative humidity), lists of equipment needed, sources of emergency assistance, maps, and a checklist for burn preparation and crew briefing. Before conducting any burn, be sure to get approvals for all parts of the management plan. Only qualified personnel<sup>2</sup> are allowed to conduct or work during a burn, and all burns must be supervised by a TNC-designated Fire Leader (“burn boss”).

#### **4. Monitor and assess the impacts of management actions**

Plan and implement a program to monitor the impacts of burning. The design and intensity of monitoring required will depend on the situation. John Randall at the Wildland Invasive Species Team is available to TNC staff for assistance with developing effective monitoring programs. Help is also available from TNC’s Fire Initiative as well as from Bob Unnasch, monitoring specialist and Senior Ecologist of TNC’s Aridlands Grazing Network. Analyzing monitoring data regularly will help determine whether management objectives are being met and if modifications are needed.

### **EXAMPLES OF PRESCRIBED FIRE TO CONTROL INVASIVE WEEDS**

#### **Spot-Burning**

Spot-burning using a propane torch has been used successfully by Jack McGowan-Stinski in several Michigan preserves. Jack reported killing >90% of baby’s breath (*Gypsophila panicula*) seedlings with spot-burning. This method also kills most seedlings/saplings of buckthorn (*Rhamnus* spp.), where the adult plants have already been removed. In contrast, hand-pulling the seedlings requires more time and labor. Jack recommends burning buckthorn seedlings early in the first growing season after adult removal. Repeat burn treatments are necessary since seeds in the soil may germinate later and plants may resprout. These repeat treatments, however, are generally not labor intensive and is usually required only on a small patch basis.

#### **Prescribed Burns**

Prescribed burns are used to control a variety of weeds at sites scattered across North America. They are effective, especially in the short-term, for controlling the spread of Japanese honeysuckle (*Lonicera japonica*) in Alabama. Further north in southern New Jersey, where Japanese honeysuckle is semi-evergreen, winter burns were used to sharply reduce its abundance without any detectable impact on native species.

Carlen Emanuel of the Alabama Natural Heritage Program reports that prescribed burns are useful for controlling small seedlings and saplings of native loblolly pine (*Pinus taeda*), and that control rates are especially high when burning is combined with cutting.

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<sup>2</sup> Training for burn crew personnel can be certified only through TNC’s Fire Initiative. Refer to the Manual for specific details regarding how to receive this training.

She also finds fire invaluable for preventing native sweetgum (*Liquidambar* spp.) from invading wetlands.

In California's Dye Creek and Vina Plains Preserves, prescribed burns help control the spread of invasive medusahead grass (*Taeniatherum caput-medusae*). California's Lassen Foothills Project also reported good success with >95% mortality of medusahead and yellow starthistle (*Centaurea solstitialis*) following prescribed burns.

Fire was used to kill small native Eastern redcedars (*Juniperus virginiana*) in Ohio, and to control alien tree-of-heaven (*Ailanthus altissima*) in Indiana's Blue River Project. Repeated burns were required, however, for full effectiveness. See Table 3.1 at the end of this chapter for more examples of the effects of burning on specific species.

### **Prescribed Burning and Herbicides**

Some invasive species have underground storage organs that resprout vigorously after fire, and/or seeds whose germination is stimulated by fire. Some of these species may not be possible to control with fire, but some can be controlled with repeated burns and others may be especially vulnerable to herbicides after a burn. Resprouts or seedlings that are 1 to 3 months old are often especially sensitive to herbicides. Be sure to read the Guidelines for Herbicide Use and Developing a Rationale for Herbicide Use in this handbook, if you are considering the use of an herbicide.

In Illinois, reed canarygrass (*Phalaris arundinacea*) was controlled by a burning-herbicide combination treatment. Burning removed the surrounding thatch, and then glyphosate herbicide was applied. The spread of leafy spurge (*Euphorbia esula*) was halted, at least temporarily, with burning-herbicide treatments on preserve in Minnesota and Michigan. Burning initially reduces the litter layer, and also stimulates the seeds of leafy spurge to germinate, therefore reducing the seed bank.

Purple loosestrife (*Lythrum salicaria*) was successfully controlled in Michigan by burning, then applying glyphosate (Rodeo<sup>®</sup>).

Fire alone failed to control cogongrass (*Imperata cylindrica*) in Florida's Apalachicola Bluffs and Ravine Preserve, but good control was achieved when herbicide was applied following burns.

More examples of invasive weeds that have been controlled by prescribed fire, and the effects of burning on them, are presented in Table 3.1 at the end of this chapter.

## OTHER CONSIDERATIONS

### Timing of Burn

The timing of a burn can strongly affect the fire's impact on native and exotic plant populations. For example, in California's Carrizo Plain Natural Area, Meyer & Schiffman (1999) determined that warm-season prescribed burning (late-spring and fall) was most effective for reducing abundance of Mediterranean annual grasses. Native plant cover and diversity also increased significantly following warm-season prescribed burns. Winter burns, however, did not affect the abundance of native plants, and exotic plant cover was only moderately reduced.

Timing was also key in controlling smooth brome (*Bromus inermis*) and encouraging the growth of native grasses in Nebraska and Minnesota (Willson & Stubbendieck 2000). Timing prescribed burns so that they occurred at the time of tiller (aboveground lateral stem) elongation, yielded an immediate and persistent reduction in both tiller density and biomass of smooth brome.

### Burning in Extensively Disturbed Areas

Not all burn treatments in wildlands are beneficial. When fires become too intense, crown-fires and death of native plants that typically survive fires can result. If temperatures are too hot, soil organisms and seeds, even those of species that require fire stratification for germination, may perish, and valuable soil nutrients may be volatilized or otherwise lost. In extensively disturbed areas of southwest Australia, fire actually enhanced the invasion of weeds along roadsides, and resulted in an overall decrease in the abundance of native species (Milberg & Lamont 1995). Schwartz & Heim (1996) reported that fire was at best moderately successful for garlic mustard (*Alliaria petiolata*) control in Illinois forests, and Luken & Shea (2000) determined that repeated prescribed burning had no significant effect on garlic mustard in Kentucky. In both cases, however, the burns were detrimental to native herbaceous species, reducing both density and richness. Even three years after the initial burns, native plant composition did not recover to pre-burn values.

### Preventing Spread of Weeds

Keep all equipment, trucks, and engines clean of weed seeds. After each burn, and before moving to another site, be sure to clean (hose-off) all equipment, tools, and clothing used. This will minimize changes of carrying weed seeds directly to a new site where a fire might provide perfect conditions for their establishment.

**Table 3.1.** Examples of weeds that have been controlled by prescribed fire, and the effects of burning on these weeds.

Scientific Name	Common Name	Effects of Burning	Reference
<i>Bromus inermis</i>	Smooth brome	<ul style="list-style-type: none"> <li>burning at time of tiller elongation, yields an instant and persistent reduction in tiller density and biomass</li> </ul>	Willson 1990 Willson & Stubbendieck 2000
<i>Bromus japonicus</i>	Japanese brome	<ul style="list-style-type: none"> <li>litter accumulation aids in the growth of Japanese brome; burning once every 5 years will reduce litter and <i>B. japonicus</i> cover</li> </ul>	Whisenat 1990
<i>Centaurea maculosa</i>	Spotted knapweed	<ul style="list-style-type: none"> <li>repeated burning will reduce spotted knapweed, but it is often difficult to get a burn to carry through dense knapweed patches</li> <li>burning is only effective where regrowth of native species is vigorous</li> </ul>	Mauer 1985 Watson & Renney 1974
<i>Cirsium arvense</i>	Canada thistle	<ul style="list-style-type: none"> <li>fewer thistles were seen in years following a burn than before or year of the burn</li> <li>late spring burns (May-June) are most detrimental – thistles may increase the first year following a May burn, but will decline within 2 growing seasons; immediate reductions in thistles occur following a June burn</li> <li>early spring burns can increase sprouting and reproduction</li> <li>during first 3 years of control efforts, burning should be conducted annually</li> </ul>	Evans 1984 Hutchinson 1992 Sather 1988 Smith 1985
<i>Dipsacus sylvestris</i>	Teasel	<ul style="list-style-type: none"> <li>in sparse stands, late spring burns are effective</li> <li>little control is provided by burning in dense stands, because fire will not carry through</li> <li>burning works best in conjunction with other means of control</li> </ul>	Glass 1991
<i>Euphorbia esula</i> <i>Euphorbia cyparissias</i>	Leafy spurge Cypress spurge	<ul style="list-style-type: none"> <li>fire stimulates vegetative growth</li> <li>fire followed by herbicide treatment has been effective, because the regrowth is more vulnerable to herbicides</li> <li>late fall herbicide application of picloram and 2,4-D followed by a fall burn resulted in 100% control after 2 years of treatment</li> </ul>	Biersboer & Koukkari 1990 Cole 1991a
<i>Hypericum perforatum</i>	St. John's Wort	<ul style="list-style-type: none"> <li>fire tends to increase stands</li> </ul>	Crompton et al. 1988

Scientific Name	Common Name	Effects of Burning	Reference
<i>Lysimachia nummularia</i>	Moneywort	<ul style="list-style-type: none"> <li>▪ best to burn in spring when moneywort is green and native vegetation is dormant</li> <li>▪ regular burning regime for several years will be needed for control</li> </ul>	Kenney & Fell 1992a
<i>Melilotus alba</i> & <i>Melilotus officinalis</i>	White sweet clover & Yellow sweet clover	<ul style="list-style-type: none"> <li>▪ at least two burns are necessary for control</li> <li>▪ increase in abundance in first year after burn</li> <li>▪ burning in late spring of the second-year as the shoots elongate, results in a kill of second year plants prior to flowering and seed set</li> <li>▪ mulching was found to be more effective than late spring burning</li> <li>▪ dormant season burns stimulate germination and increase the chance that plants will survive to produce seeds</li> <li>▪ dormant season burns can be used in conjunction with mowing or clipping in summer of the following year as plants flower</li> </ul>	Cole 1991b  Eidson & Steigmann 1990  Kline 1983  Schwarzmeier 1984  Turkington et al. 1978
<i>Pastinaca sativa</i>	Wild parsnip	<ul style="list-style-type: none"> <li>▪ fire removes ground litter and standing litter, providing favorable conditions for the development of parsnip rosettes</li> <li>▪ periodic burning may help maintain the vigor of native plants to allow them to better compete with parsnip</li> </ul>	Eckardt 1987  Kenney & Fell 1992b
<i>Phalaris arundinacea</i>	Reed canarygrass	<ul style="list-style-type: none"> <li>▪ growing season fires may reduce vigor and help control the spread</li> <li>▪ growing season burns may give native species a competitive advantage</li> </ul>	Apfelbaum & Sams 1987  Henderson 1990
<i>Phragmites australis</i>	Phragmites	<ul style="list-style-type: none"> <li>▪ burning will not reduce growth unless the roots burn</li> <li>▪ burning removes phragmites leaf litter, allowing seeds of other species to germinate</li> <li>▪ burning in conjunction with chemical control has been found effective</li> <li>▪ burn with caution, since spot fires can occur up to 100 feet from burning phragmites</li> </ul>	Beall 1984  Marks 1986
<i>Typha</i> spp.	Cattail	<ul style="list-style-type: none"> <li>▪ fire provides little or no control unless the roots are burned</li> <li>▪ drawdown followed by burning and then flooding to a depth of 8 – 18” will provide control</li> </ul>	Apfelbaum 1985  Nelson & Dietz 1966

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