

CONSERVATION PRACTICE SPECIFICATION

Brush Management - 314

Brush Management - 314 shall be installed in accordance with the Standard detailed in the Field Office Technical Guide (FOTG) – Section IV – Conservation Practices. This document addresses Brush Management techniques along with the positive and negative aspects of each technique. Planners shall recommend the technique that is best suited to the site and meets the objective of the producer.

BACKGROUND

Brush Management is the application of appropriate techniques to control or eradicate brushy plants (perennial woody plants) to achieve one or more of the purposes listed in the standard. Four methods of controlling brush are recognized; mechanical, biological, herbicides, and fire. It is important that planners and applicators of control methods understand the physiology of the species to be controlled and the mechanisms of the various control methods. Woody plant species will respond differently to any given control method depending upon the time of year, plant growth stage, plant growth characteristics, climatic conditions, and other factors.

Rarely will a single application of any control method be sufficient to achieve brush management goals. Follow-up treatments or application of a combination of treatment methods will often be necessary to achieve desired results.

Level of control to be achieved will be based on landowner objective, practicality of controlling a particular species, or the potential of a particular species to rapidly spread and infest large acreage. For instance, salt cedar infests relatively few acres in North Dakota but has the potential to colonize most all available saline and riparian areas. Complete eradication of inland salt cedar should be sought. Conversely, Russian-olive infests hundreds of thousands of acres. Complete eradication is unlikely and sometimes is not compatible with landowner goals. Control to a level compatible with landowner objectives is acceptable and may be the best that could be achieved.

DETERMINING NEED FOR BRUSH MANAGEMENT

Brush control should be considered if the existing brush infestation or expected brush infestation interferes with, or could be expected to interfere with grazing use, desired wildlife species, the maintenance or restoration of native plant community, or other producer objectives.

For some species brush control to the point of eradication is appropriate, such as situations where salt cedar has become established but currently has not infested a vast acreage. For other species brush management might consist only of containment, reducing the plant's ability to infest additional acres while allowing compatible uses (areas infested with Russian-olive or silverberry may be managed to reduce the level of infestation to a point that grazing becomes a compatible use).

Table 1 – Percent Crown Canopy For Determining Brush Management Needs can be used as a guide to determine the feasibility of brush management. Priorities are determined on the percent crown canopy of the species concerned. Crown canopy cover at, or above, the levels indicated is thick enough to depress herbaceous vegetation, favor invasive species and

influence grazing patterns. Crown canopy is defined as the percent of the ground shaded by a species with the sun in a vertical, overhead position.

Dominant Species	% Crown Canopy
Fringed sagewort (<i>Artemisia frigida</i>)	25+
Prickly pear (<i>Opuntia polyacantha</i>)	20+
Silverberry (<i>Elaeagnus commutata</i>)	35+
Silver sagebrush (<i>Artemisia cana</i>)	30+
Western snowberry/buckbrush (<i>Symphoricarpos spp.</i>)	30+

Woody species other than those listed in Table 1 may also increase/invade to the point where some type of accelerated control measures are necessary to meet the producer's goals. These situations will be handled on a case-by-case basis in consultation with the appropriate area or state office specialist. Where available, the ecological site description for the site(s) involved may provide additional information regarding plant community dynamics and management.

Determining needs and developing management options, until planners have gained experience, will often involve input from foresters, range conservationists, prescribed burners and herbicide specialists.

BRUSH CONTROL TECHNIQUES

There are four general methods by which brush can be controlled:

Mechanical	Biological	Chemical	Fire
Dozing	Grazing	Foliar spray	Prescribed burning
Shearing	Insects/Diseases	Cut and Frill	
Sawing		Basal	
Pulling/Grubbing		Cut stump	
Mowing		Soil applied	
Girdle			

Brush management control methods will vary depending upon the landuse and the brush species to be controlled. To reduce the likelihood of a recurring brush problem, land management techniques should be modified to encourage the establishment and spread of desirable plant communities while discouraging brush encroachment.

Several methods listed below involve killing brush and letting the brush stand or lay on the soil surface for several years until brush can be consumed with a prescribed burn. When attempting to control Siberian elm on sites where healthy American elm trees are within 2 miles of the site, select a brush control method that will dispose of elm debris. Elm branches larger than 2 inches in diameter with bark attached **must be** disposed (burned, buried, chipped) before the next growing season. If the bark can be completely removed from trunks, limbs, and stumps larger than 2" in diameter, the risk of spreading Dutch elm disease is minimal and the debris could be left exposed.

Mechanical

Mechanical treatment methods may remove just the top growth or they may remove stumps and roots as well as top growth. Once completed the site should be smooth enough that

subsequent management activities can be completed without hazard. Stumps and roots shall be removed or left undisturbed below the soil surface. Soil surface disturbances shall be smoothed and debris stacked, burned, or buried to meet landowner objectives and State or local ordinances. Debris cleanup, stacking, and burning is easier if completed during removal while specialized equipment is on site. For details on building a debris pile of green material that will burn completely, check out the video, "windbreak renovation", released in 2001 available at all North Dakota Field Offices.

❖ Dozing

Removal of brush using standard construction equipment is a common practice. A single operation is quite effective on brush species that do not resprout from roots or stumps, such as the conifers that grow in North Dakota. Removing only the tops through dozing can also kill mature trees of some deciduous tree species.

However, most young deciduous trees, most shrubs, and older specimens of a few deciduous tree species will usually resprout from roots and stumps after top removal. To effectively control these species by only dozing will require extensive soil disturbance that removes more of the stumps and roots.

Conventional construction equipment is readily available and can be used for brush removal. Risks of erosion will be increased and substantial smoothing and leveling of the site may be necessary to establish herbaceous vegetation or to facilitate future management of the area. Depending upon the extent of brush encroachment, costs could be substantial. Disposal of debris may be complicated by soil mixed in the debris piles. Root and limb cleanup by hand is usually needed prior to seeding. Some resprouts are likely to occur and reseeding may be necessary.

After the initial removal, additional control methods such as chemical, fire, mowing, or prescribed grazing will usually be needed to provide adequate control of resprouts.

Requirements of a successful dozing operation:

- *95% of the above ground stems will be removed from the root systems leaving no more than a 6" high stump. If site is to be negotiated with machinery and or livestock the stumps should have minimal ragged edges and be as low to the ground as possible.*
- *If roots and stumps are to be removed, the site must be leveled and cleaned enough that normal farm machinery can negotiate the site.*
- *Depending upon site needs or landowner objectives, debris may be left in a uniform layer spread about the site or stacked in windrows or piles.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying, or chipping before the following spring).*
- *Root and basal resprouts must be addressed as needed to meet plan objectives*

❖ Shearing

Shearing is the removal of the "above ground" portion of the plant by specialized machines such as feller-bunchers, shear blades, hydraulic saws, etc. It is very effective on conifers, but in many cases it will encourage sprouting on young shrubs and deciduous trees. This method works well when combined with chemical stump treatments or foliar herbicide applications. Shearing removes the top growth and exposes the cambium layer in the stump for easy herbicide application. To prevent resprouts after shearing, an appropriate chemical must be applied to the cambium layer within minutes of the top being removed. Brush

species susceptibility and stump treatment herbicide mode of action may dictate a particular time of year when shearing will be most effective. It may be desirable to time shearing to allow for a vigorous brush regrowth that can subsequently be sprayed, burned or grazed at a time when serious decline and injury to the brush can occur. For example, shearing in July would allow a vigorous regrowth that could be grazed or sprayed in August or September, killing or severely stressing most plants as they try to build up root reserves for the winter.

Surface soil disturbance is usually minimal, however, compliance with buried utility and cultural resource protection policies, as outlined under "laws" at the end of this document, must be followed.

With properly sized machines shearing can quickly remove larger diameter brush. Many shears or hydraulic saws are ineffective at removing smaller diameter (<3") stock. The particular machine used and skill of the operator will determine how rough the site is left and how effectively debris can be cut, sheared, and stacked.

Shearing can be accomplished by a wide assortment of specialized tools that require machinery ranging in size from medium-sized skid steer loaders to large bulldozers. Sheer blades on dozers can clear large acreage in a fairly short time, but leave a fairly rough site that is difficult to access with traditional farm equipment without further cleanup. Sheers and similar tools on skid steer loaders leave a fairly clean site but require that each tree or shrub be sheared individually.

Requirements of a successful shearing operation:

- *>95% of the above ground stems shall be removed from the root systems leaving no more than a 6" high stump. If site is to be negotiated with machinery and or livestock the stumps should have minimal ragged edges and be cut as low to the ground as possible.*
- *Smaller stems that are unable to be sheared must be cut with hand equipment or by some other method if necessary to meet plan objectives.*
- *Debris may be left in a uniform layer spread about the site or stacked in windrows or piles depending upon site needs or landowner objectives.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying or chipping before the following spring).*
- *Root and basal resprouts must be addressed as needed to meet plan objectives. The may be left to grow or killed using chemicals, grazing or fire.*

❖ Sawing

Chain saws, larger capacity brush trimmers, and specialized saws on tractors and skid steer loaders can be effectively used to remove top growth. Chainsaws and brush trimmers are labor-intensive and most appropriate for smaller jobs. Tools mounted on tractors and skid loaders are effective on larger jobs, but cost more and are more limited in availability. Difficulty of debris cleanup is dependent upon the size of the material removed and the amount of the acreage involved. As with shearing, effective control of deciduous plants will depend upon immediate treatment of the stump with an approved herbicide. Herbicide requirements may dictate when brush should be cut. Stump heights shall be low enough to meet landowner objectives and not hinder subsequent management of the area.

Chainsaws and gas powered brush trimmers are potentially dangerous tools. They must be used only by operators equipped with appropriate safety apparel, and those possessing the appropriate skills and stamina.

Requirements of a successful sawing operation:

- *>95% of the above ground stems shall be removed from the root systems leaving no more than a 6" high stump.*
- *If site is to be negotiated with machinery and or livestock the stumps should have minimal ragged edges and be cut as low to the ground as possible.*
- *Cuts should be nearly horizontal. Avoid angled cuts as they increase the danger to the saw operator and increase the likelihood of vehicular damage or livestock injury.*
- *Smaller stems that are unable to be sheared must be cut with hand equipment or by some other method, if necessary, to meet plan objectives.*
- *Debris may be left in a uniform layer spread about the site, or stacked in windrows or piles depending upon site needs or landowner objectives.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying, or chipping before the following spring).*
- *Root and basal resprouts must be addressed as needed to meet plan objectives. They may be left to grow or killed using chemicals, grazing or fire.*

❖ Pulling/Grubbing

Specialized machines resembling 3-point rock pickers or heavy tines on a front-end loader may be used to pull out woody plants. Ordinary loaders may be used to grub out plants by digging out the root balls. When soils are moist, a chain and tractor can effectively remove moderate to small-sized trees or shrubs. These methods are only appropriate for smaller jobs, as they are very time consuming and are limited by the size of brush. Plants that have prominent and deep taproots are harder to pull. Equipment requirements increase geometrically as the size of the plant increases. There is some risk that roots remaining in the soil could initiate resprouts. Root balls with soil increase disposal difficulties.

Ensure that appropriate safety devices such as ROPS and FOPS cabs are part of the machinery used to pull or grub brush. Ensure that chains, cables, and ropes used in pulling brush are in good condition, of appropriate size, and fastened properly. Safety is a concern when using these techniques. Even small trees can whip down on the operator when being pulled. Chains, cables, nylon ropes, hitches, clevises, etc. can break, propelling objects towards the operator or bystanders causing serious injury or death.

Requirements of a successful grubbing and pulling operation:

- *>95% of the above ground stems shall be removed.*
- *The site must be leveled enough that normal farm machinery can negotiate the site.*
- *Debris may be left in a uniform layer spread about the site, or stacked in windrows or piles depending upon site needs or landowner objectives.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying or chipping before the following spring).*
- *Resprouts must be addressed as needed to meet plan objectives. They may be left to grow or controlled using chemicals, grazing or fire.*

❖ Mowing

Smaller brush can be managed by timely mowing with conventional rear mount rotary grass mowers. The size of the brush should usually be smaller than one-inch diameter at the soil surface. Heavy-duty brush mowers specifically designed for tree and brush cutting, work well on material up to 8 inches in diameter. Availability of specialized machinery for larger diameter brush is somewhat limited in North Dakota and the price of the machinery increases as the brush stem diameter increases. It is best to use mowing as a control method when brush is small.

Mowing can treat a larger area in less time than sawing, shearing, or pulling. Mowing as an efficient control method rapidly loses efficiency as brush diameters exceed 4 inches at the ground. A common mistake is using a brush or tree mower that is too lightly constructed or under powered for the brush to be treated. Depending upon the severity of the brush encroachment, mowing can leave a fairly dense layer of limbs, twigs, and leaves on the ground. This debris layer may or may not hinder subsequent management options.

Generally, brush should be mowed as close to the ground as possible without damaging equipment. Mowing height may need to be adjusted to minimize stress to desirable herbaceous plants. Timing and frequency of mowing will depend upon the follow-up treatments planned. If herbicides are used as a follow-up treatment, mowing shall be timed to allow woody regrowth to reach the desired height, at the proper time, for best herbicide control. If grazing is to follow, mowing should be timed so that brush regrowth occurs when it would be most palatable to livestock. Usually sheep or goats are most effective for brush control.

The benefits of mowing are 1) removing tops so the brush won't produce seed, 2) weakening the brush so it is more susceptible to other treatment methods, 3) reducing the size and maturity of the brush so that fire, grazing, or herbicides will be more effective, 4) opening the canopy so that herbaceous plants have access to full sunlight.

Rarely will mowing alone completely control brush. It may only suppress brush vigor or it may encourage a rapid flush of growth. Subsequent treatments will usually be needed for control of the resprouts. For example, effective control of western snowberry/buckbrush may require up to three consecutive years of mowing. Mowed brush will exhibit a profusion of stubs, quite often with ragged ends. These stubs may prove hazardous to tires, people, and livestock. Use caution.

Requirements of a successful mowing operation:

- *All of the above ground stems shall be removed from the root systems leaving no more than a 3" high stump. If site is to be negotiated with machinery and or livestock the stumps should be cut even closer to the ground, if possible.*
- *Larger stems that are unable to be mowed must be cut with hand equipment or by some other method if necessary, to meet plan objectives.*
- *Debris may be left in a uniform layer spread about the site, or stacked in windrows or piles depending upon site needs or landowner objectives.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying or chipping before the following spring).*
- *Root and basal resprouts must be addressed as needed, to meet plan objectives. The may be left to grow or killed using chemicals, grazing, or fire.*

❖ Girdle

Girdling is usually performed on trees larger than four inches in diameter at 4.5 feet height (dbh) above the ground. It can effectively kill the plant parts above the girdle but usually does not kill the plant below the girdle. (If there are no live limbs below the girdle, this method alone, will kill conifers.) Girdling is similar to the first step of a cut-and-frill herbicide control method. Girdling removes the bark, inner bark, and cambium in a 1-2" band that is contiguous around the tree trunk. It is usually performed 3-5 feet off the ground at a height that is comfortable for the operator. Axes, machetes, hatchets, chainsaws, or other sharp tools may be used. It is best performed in the spring before leafout when the bark peels off easiest and the plant has lower food reserves.

The dead tree is still standing after the application of this method. This dead standing material may provide roosting sites and cavities for wildlife. It may prove a hazard to livestock and persons using the site several years later. Several years after girdling that completely kills the tree, brush may be easier to knock down, stack, and burn. For most deciduous species in North Dakota, girdling without herbicide treatment will often initiate a profusion of root or basal sprouts or sprouts just below the girdling mark. Follow-up treatment with fire, grazing, or herbicides is usually needed to completely control brush.

Requirements of a successful girdling operation:

- *>95% of the top growth, above the girdle, shall be killed.*
- *Management plans should address the subsequent management of the dead snags and the resprout potential below the girdle line.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying, or chipping before the following spring).*

Biological

❖ Grazing

One of the most commonly used biological brush control measures is grazing. The effectiveness is dependent upon the species of brush and herbaceous vegetation present, age of the brush, species of animal, and management objectives of the landowner. Generally, sheep and goats are most effective at stressing or reducing the presence of woody brush.

To develop a brush control system utilizing animals, work closely with a qualified range management specialist to develop a prescribed grazing system that reduces the amount of brush while increasing the health and vigor of the herbaceous vegetation. A management change will be needed to ensure future containment and control of brush species. Care must be taken to ensure that the grazing animals do not increase the erosion risk from the site or negatively impact water resources.

This method is most effective on smaller brush that is within reach of the grazing animal such as the regrowth that might occur from other brush treatment methods. At times this method may need to be combined with herbicide, mechanical or fire control methods.

Requirements for successful brush control through grazing management:

- *Brush management plans, via grazing, indicate the brush to be controlled, the brush size and extent, the number, kind and size of the grazing/browsing animal, number of animals, and the duration of the grazing operation(s).*
- *Changes in grazing management show a reduction in the targeted brush and an increase in desirable species within 3 years of the management changes.*
- *Associated water resources show no adverse effects from the grazing.*
- *Erosion levels show no, or minimal increases.*

❖ Insects/Diseases

Currently there are no insects or diseases that have been utilized to control woody brush. There are a wide array of insects and diseases that affect woody plants, but none that are propagated for release into the environment as a brush management tool.

Chemical

Chemical brush control methods can vary considerably based upon time of year, growth stage of the brush, moisture conditions, desirable material to be left alive, proximity to water (ground and surface), and available application equipment. Many brush control herbicides are species and time-of-year specific. Several of the herbicides used in chemical control exhibit residual effects that may affect reseeding opportunities or the health and vigor of residual woody and herbaceous plants. Follow label directions closely and comply with all State and Federal laws.

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❖ Foliar

Foliar application is often one of the easier ways to apply herbicides for brush control. Appropriate herbicides can be directly applied to the foliage with air, ground, and hand application equipment. Depending upon the brush species, timing (growth stage) is critical. Usually the best control is achieved when the brush is small and the chemical is applied to vigorously growing foliage. Few products are effective on conifers. Many herbicides are available to suppress or control broadleaf deciduous brush; however, many of these products are not selective and can affect desirable forbs and woody plants.

Depending upon the species of brush and prior preparations (shearing, burning, mowing, etc.) herbicide control will usually require multiple applications. Select herbicides that are compatible with the herbaceous vegetation to be left.

Requirements of a successful foliar herbicide operation:

- *>95% of the brush plants are dead or dying following the second herbicide application (many brush species will require at least 2 applications).*
- *Foliar applications without some other method will result in dead brush standing on the site. Account for this when developing management plans.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying, or chipping before the following spring).*
- *Resprouts must be addressed as needed to meet plan objectives. They may be left to grow or killed using chemicals, grazing or fire.*

Additional guidance on chemical control of brush may be found in the South Dakota State University Cooperative Extension Service publication FS-525-P, [Weed Control in Pasture and Range](#).

❖ Cut and Frill

Cut and frill treatments involve applying an approved herbicide to cuts made on the trunk at a comfortable working height (usually 3-5 feet off the ground). Cuts can be made with a hatchet, machete, or small chain saw with a short bar. An appropriate chemical is then squirted into the cut as directed by the herbicide label. For best control both the cut and the area treated with chemical should be contiguous around the trunk. Effectiveness is dependent upon time of year, herbicide used, and species to be controlled.

Depending upon the species this method can be quite efficient. It is quite effective at controlling unwanted species within forested areas where broadcast herbicide methods are inappropriate. When properly timed and applied this method can be effective with minimal resprouting. Conservation planners should keep in mind that this method leaves dead standing brush. The most common difficulty with cut and frill is reaching through the limbs of the brush so that treatments can be applied to the trunk.

Specialized tools for this method include hypo-hatchets[®] that inject a small amount of herbicide with each blow of the hatchet against the trunk. Generally cuts with a hypo-hatchet[®] must be repeated every 1-3 inches around the trunk. Hypo-hatchets[®] are available through the major forestry supply companies.

Requirements of a successful cut and frill herbicide operation:

- *>80% of the brush species are dead or dying following the first application.*
- *This method will result in dead brush standing on the site. Account for this fact when developing management plans.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying, or chipping before the following spring).*
- *Resprouts must be addressed as needed, to meet plan objectives. They may be left to grow or killed using chemicals, grazing, or fire.*

❖ Basal

Basal treatments may be more effective than cut and frill on some species since the treatment is applied closer to the root system. Basal treatments may be applied in two ways. Both methods, even when successful, leave dead trees and brush standing.

The first method is performed with a specialized tool (tree injector) available from most forestry supply companies. Tree injectors inject a small amount of concentrated herbicide in a capsule directly into the base of the tree. Usually one injection is required for each 2.5 inches of tree diameter. It is somewhat easier than cut and frill as the 5-6' long injector tubes can be pushed through the lower branches of the tree and fewer injection sites are needed. The amount of herbicide injected is small, though concentrated, and reduces the risk of environmental exposure. Generally speaking, best results occur when this treatment is applied in late summer or early fall when phloem layers of the plant are sending sugars, and the injected herbicide, to the roots for the winter.

The second method involves saturating the lower 1-foot of the trunk and any exposed roots with herbicide to the point of runoff. This method is quite effective and it can be done with simple equipment such as backpack and hand sprayers. It is most effective when applied in the fall. Plants that are younger or have thinner bark are most easily controlled with this method. However, it involves considerably more environmental risk than injection as larger amounts of concentrated herbicides are released in areas where humans, animals, sensitive plants, and water bodies may become damaged or contaminated. Do not use this method where fumes from the herbicide may damage sensitive plants (such as 2-4D or dicamba fumes damaging desirable broadleaf plant foliage) or where there is a risk that the chemical may reach a water body (ground or surface).

Requirements of a successful basal herbicide operation:

- *>80% of the brush species are dead or dying following the first application.*
- *This method will result in dead brush standing on the site. Account for this fact when developing management plans.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying, or chipping before the following spring).*

❖ Stump

Stump treatment is applied in combination with any of the mechanical methods that remove the tops of the brush. An appropriate herbicide is applied to the cambium layer of the stump immediately after the top has been removed. Chemical treatment of stumps reduces the amount of herbicide used compared to foliar treatment methods. It is most effective when treatment is applied in late summer or early fall.

On larger stumps herbicide can be applied with squirt bottles, weed wipers, hand sprayers, or brushes. Usually only the cambium and phloem need to be treated. Depending upon the species of brush some herbicides need to saturate the bark of the exposed stump and root collar. There is no need to apply the chemical to the interior, xylem, of the stump.

Smaller stumps, such as those left after mowing, can be treated using the same equipment to apply the herbicide but in these instances the entire cut surface of stump will be treated.

Specially formulated colored dyes may be added to the spray mixture to identify which stumps have been treated. These dyes are available from chemical supply companies or forestry supply companies.

Requirements of a successful cut stump treatment operation:

- *95% of the above ground stems needing treatment have been removed from the stump. If site is to be negotiated with machinery and or livestock the stumps should have minimal ragged edges and be as low to the ground as possible. Elm stumps must be cut flush to the surface of the ground to minimize bark beetle habitat.*
- *Stump treatment with an approved herbicide occurs within a few minutes of the top growth removal and results in an 80% kill after the first application.*
- *Debris may be left in a uniform layer spread about the site, or stacked in windrows or piles depending upon site needs or landowner objectives. Debris management should allow for easy access to the stump by the applicator.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying, or chipping before the following spring - even exposed bark on a stump can provide a habitat for elm bark beetles).*

- *When stump treatments are applied according to label, root and basal resprouts will usually be minimized. Some species however, such as Siberian elm, are aggressive resprouters and resprouts are the norm rather than the exception. Root and basal resprouts must be addressed as needed, to meet plan objectives. They may be left to grow or killed using chemicals, grazing, or fire.*

❖ Soil Applied

There are several soil-applied herbicides that can effectively control woody brush. Unfortunately, some of these products also have a fairly long residual life and are nonselective. They tend to kill or stress all of the woody plants in the application area, making it difficult or impossible to selectively remove unwanted woody brush. Some of these herbicides are quite mobile in the environment and are severely restricted in where they can be applied, especially in areas of high water tables or high runoff potential. Some of these products can be moved offsite through the urine of animals grazing the treated areas. Depending upon density of the brush to be treated, uniform herbicide application may only be possible using aerial application.

With correct application methods on suitable sites, soil applied herbicides can be quite effective in removing unwanted woody brush from grazing land and pasture land. Label directions should be closely followed to minimize damage to non-target plants and water sources.

The top growth of woody brush is still standing after application of this method. These dead plants are attractive bird roosts and provide a site for fresh infestation from seeds deposited by birds. After several years of drying this standing debris can be easily knocked down and burned. Rarely will a prescribed burn effectively consume the dead material without some mechanical manipulation such as knocking it down to place it closer to fine fuels or pushing it into piles or windrows to concentrate the fuel wood.

Requirements for a successfully applied soil herbicide operation:

- *Product applied according to label directions and State regulations.*
- *80% of the target brush plants are controlled.*
- *Desired species of residual plants show no negative effects of herbicide application.*
- *Foliar applications without some other method, will result in dead brush standing on the site. Account for this fact when developing management plans.*
- *This method is suitable for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying, or chipping before the following spring).*
- *Surface and ground water sources and associated habitats are not adversely affected by the application.*
- *Disposal of killed brush is consistent with landowner's brush management plan.*

Fire

Fire can be used, often in conjunction with other brush control practices, to control woody brush. It can be particularly effective where chemical or mechanical methods have killed the top growth and the debris and regrowth sprouts need to be cleared. When used alone, repeat application of fire is often needed.

Fire as a brush control method should only be used after a complete inventory of the resources has been developed. A prescribed fire plan shall be developed only by qualified individuals familiar with the physiology of the plants to be controlled and the plants to be favored. Long term effectiveness of fire as a brush control tool is usually dependent upon the follow-up treatments applied to the area. Follow-up treatment is particularly important when brush control is applied to rangeland and grazing land.

Note: Rarely will a prescribed burn effectively consume standing dead brush (trees) over 8 feet in height. Many of the brush management practices may kill brush and trees and leave them standing for a few years. In order to use fire to "clean up" such a situation the woody material must be knocked down to be in closer contact with fine fuels or it must be pushed into piles or windrows.

There is an inherent risk to using fire. Only those certified (trained) in its use should plan or apply the practice. All applicable laws and regulations must be followed. Refer to Prescribed Burning Standard - 338 for requirements. All conservation practices are located in FOTG – Section IV – Conservation Practices.

Requirements for successful brush management with prescribed burning operation:

- *Fire has killed at least 50% of the top growth.*
- *Brush disposal (burning by fire) has been sufficient to allow subsequent management options.*
- *Plan addresses methods to control resprouts after the initial prescribed burn.*

DESIGN AND INSTALLATION

Brush management designs shall include the method(s) chosen, the species to be controlled, percent canopy cover for the species being controlled (either estimated or measured), the specie(s) to be favored if any, the time(s) the treatments should be applied, and any subsequent management necessary to increase effectiveness of the practice

For mechanical brush control: include instructions on equipment to be used and modifications needed, if any.

For chemical control: cite herbicide name, rate of application, planned application date, and any other necessary details as required by State regulations.

For biological control: Cite the biological agent to be used; time (s) of introduction and extent (delineate treatment area).

When using grazing: cite type of animal, intensity of grazing or browsing, (stocking rate and duration) desired degree of browsing (percentage of plants browsed) for effective control of target species, and maximum allowable use of desirable non-target species. Refer to Prescribed Grazing Standard - 528 to determine an effective grazing system. Cite any Federal or State precautions regarding use of insects or infectious agents. (Currently there are no known insects or diseases utilized as brush management agents.) Specify site-specific management needed to increase likelihood of success.

IMPLEMENTATION

Chemical control shall be planned and applied in accordance with herbicide label directions and NDSU Extension Service recommendations.

Fire shall be planned and applied in accordance with NRCS Prescribed Burning Standard – 528.

Follow-up to determine the effectiveness of the treatment method(s) is recommended. It may not be possible to confirm the effectiveness of a brush control method until 2-3 years after the initiation of the practice.

LAWS

For any soil disturbing operation the appropriate NRCS buried utility policies must be followed. In North Dakota persons are advised to contact ONE CALL at 1-800-795-0555 for locations of utilities that might be affected.

State law requires control of State-listed noxious weeds. Currently only inland salt cedar is listed as a woody noxious weed in North Dakota.

Many of the mechanical control methods and fire are considered undertakings in North Dakota. Applicable local, State, Tribal and NRCS cultural resource protection policies must be followed. In North Dakota the NRCS policy regarding cultural resources may be found at county, area or State offices.

Brush control area of treatment and methods must not pose any hazard to threatened and endangered (T&E) species or their potential habitat. A list of T&E species found in North Dakota can be found in FOTG – Section II – Threatened and Endangered Species.

Brush control activities conducted in wetlands shall be in compliance with applicable USDA Wetland Conservation Provisions and Corps of Engineers 404 guidelines.

Herbicide application and record keeping must comply with label instructions and the most recent update to chapter 60-03-01-07 of the North Dakota Pesticide Act of 1975.

Prescribed Burning must be in compliance with State and local burn restrictions and the North Dakota NRCS Prescribed Burning Standard – 338.

CONSIDERATIONS

Stack brush and woody debris in piles and leave as habitat for mammals.

Additional References

For specific how-to information on pushing, piling, and burning brush (both green and dead) contact your North Dakota Natural Resources Conservation Service or Cooperative Extension Service field office and borrow a copy of the video "Windbreak Renovation" distributed in 2001. Besides showing how to stack and burn brush this video shows some of the machines used to remove windbreaks that can also be used for brush management.

Results Expected From a Particular Brush Management Technique													
Table A Expected Brush Management Results	Brush Management Techniques												
	Doze	Shear	Saw	Grub /Pull	Mow	Girdle	Herb. foliar	Herb. cut/frill	Herb. basal	Herb. stump	Herb. soil	Graze	Burn
> 95% of top growth removed	XXX	XXX	XXX	XXX	XXX	----	----	----	----	XXX	----	----	OBJ
< 6" high stumps	XXX	XXX	XXX	----	----	----	----	----	----	OBJ	----	----	----
stumps and roots removed	OBJ	----	----	XXX	----	----	----	----	----	----	----	----	----
site leveled, negotiable by farm machinery	XXX	----	----	XXX	----	----	----	----	----	----	----	----	----
debris spread and scattered on surface (1)	OBJ	OBJ	OBJ	OBJ	OBJ	----	----	----	----	OBJ	----	----	----
debris piled or placed in windrows (1)	OBJ	OBJ	OBJ	OBJ	OBJ	----	----	----	----	OBJ	----	----	----
debris buried	OBJ	OBJ	OBJ	OBJ	OBJ	----	----	----	----	OBJ	----	----	----
debris burned	OBJ	OBJ	OBJ	OBJ	OBJ	----	----	----	----	OBJ	----	----	----
debris left standing (1)	----	----	----	----	----	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	----	----
<3" high stumps	OBJ	OBJ	OBJ	----	XXX	----	----	----	----	XXX	----	----	----
smaller stems cut by hand or other method	XXX	XXX	XXX	----	----	----	----	----	----	----	----	----	----
root and basal resprouts controlled/killed	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	----	OBJ	----	XXX	XXX	OBJ	OBJ
cuts nearly horizontal	----	XXX	XXX	----	XXX	----	----	----	----	----	----	----	----
> 95% of the targeted brush top growth is killed	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	----	XXX	----	----
herbicide application follows label and state law	----	----	----	----	----	----	XXX	XXX	XXX	XXX	XXX	----	----
> 80% of the resprouts controlled with herbicide	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	----	OBJ	----	XXX	----	----	----
surface and ground water not adversely affected	XXX	----	----	XXX	----	----	XXX	XXX	XXX	XXX	XXX	XXX	XXX
desired plants show increased quantity and vigor	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
grazing plan developed showing animal type and numbers, grazing intensity and duration, species to be favored, species to be controlled.	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	OBJ	XXX	OBJ
erosion has been controlled	XXX	----	----	XXX	----	----	----	----	----	----	----	XXX	XXX
prescribed burning plan has been developed	----	----	----	----	----	----	----	----	----	----	----	----	XXX
treatments followed prescription of the burn plan	----	----	----	----	----	----	----	----	----	----	----	----	XXX

XXX = this expected result must result if this technique is used.

OBJ = this expected result may result when this technique is used, depending upon landowner objectives and site-specific conditions.

---- = this particular technique usually does not yield this expected result.

(1) = this expected result is appropriate for elm brush control only when combined with other methods that will make the debris unsuitable habitat for the elm bark beetle (burning, burying or chipping before the following spring).