

Forest Stand Improvement

Forest Stand Improvement (FSI) is the removal or deadening of undesirable vines, shrubs, and trees in a forest stand. FSI is a major forest management tool to help woodland owners achieve their management objectives. Once site objectives are identified, the less desirable trees can be removed or killed to favor the growth of those that better satisfy these objectives (e.g., quality timber, wildlife habitat, edge feathering, savanna restoration, and aesthetics).

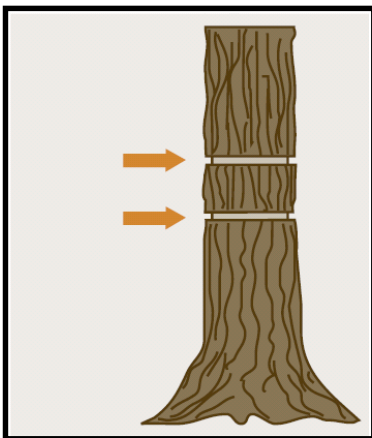
The safest, least damaging, and most efficient way to eliminate undesirable vegetation is often to kill the trees, shrubs, or vines and leave them standing without removing the material.



Single tree injection with EZ-Ject lance.

Non-Removal Forest Stand Improvement Techniques

One of the most effective non-removal methods for killing standing trees, shrubs, and vines involves the use of herbicides. For those who prefer not to use pesticides, cutting, frilling, or girdling can be used without herbicides. However, physical methods of deadening standing trees that do not use herbicides are generally less dependable (particularly with hard-to-kill species such as red maple, hickories, and dogwoods) and require longer to be effective than those that incorporate herbicides into the treatment.



Two girdling cuts can be a very effective means of deadening a tree.

Four commonly applied forest stand improvement techniques include frilling or girdling (opposite photo) spaced cuts or injection (above photo), basal bark spraying, and cut stump application. When using herbicides, it is essential that you read the entire label before using any herbicide. The label contains complete instructions for use, along with other valuable information such as personal and environmental safety considerations and procedures. Many of the labels also list information about the effectiveness of the herbicide in controlling different species of trees, shrubs, and vines. All herbicides are not equally effective in controlling different species.

Always consider adding a colored dye into all chemical formulations to avoid excessive or incomplete application to target species. A colored dye will provide you with an indication of trees and shrubs that have already been treated and will help you judge your effectiveness of the chemical application throughout the year.

Herbicides, like all pesticides, are approved for specific uses by the Environmental Protection Agency. Approved uses are listed and described on the pesticide's label. Because pesticide labeling may change at any time, always verify that a particular herbicide is still labeled for the intended use. Be sure to use eye protection and rubber gloves when applying herbicide. Follow the manufacturer's recommendations and precautions when using chemicals, and avoid mixing chemicals in amounts greater than what can be used in one day. It is recommended that anyone working with herbicides carry a bottle of eye wash in case of emergencies.

Frilling or Girdling

Girdling and frilling are methods of killing standing trees that may be done with or without an herbicide.

Girdling involves cutting a groove or notch into the trunk of a tree to interrupt the flow of sap between the roots and crown of the tree (Figure 1). The groove must completely encircle the trunk and should penetrate into the wood to a depth of at least 1/2 inch on small trees, and 1 to 1-1/2 inches on larger trees. Girdling can be done with an ax, hatchet, or chain saw. When done with an ax or hatchet, the girdle is made by striking from above and below along a line around the trunk so that a notch of wood and bark is removed. The width of the notch varies with the size of the tree. Effective girdles may be as narrow as 1 or 2 inches on small-diameter trees, and as wide as 6 or 8 inches on very large-diameter trees. When a chain saw is used to girdle, two horizontal cuts between 2 and 4 vertical inches apart are usually made completely around the tree when no herbicide is used (Figure 2) and one horizontal cut is made completely around the tree when herbicide is used (Figure 4).

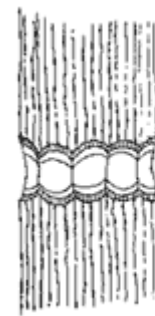


Figure 1

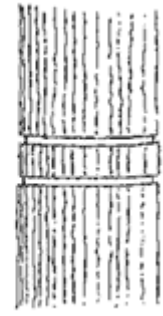


Figure 2

Frilling is a variation of girdling in which a series of downward angled cuts are made completely around the tree, leaving the partially severed bark and wood anchored at the bottom (Figure 3). Frilling is done with an ax or hatchet.

By themselves, girdling and frilling are physical methods to deaden trees that require very little equipment and may be done without herbicides. Both techniques require considerable time to carry out, particularly with an ax or hatchet. Girdling with a chain saw is much faster. The effectiveness of girdling and frilling depends on the tree species and on the size and completeness of the girdle or frill. To be effective, girdles and frills must completely encircle the tree. Because frills can heal-over more easily, girdling is usually more effective.

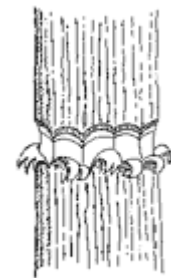


Figure 3

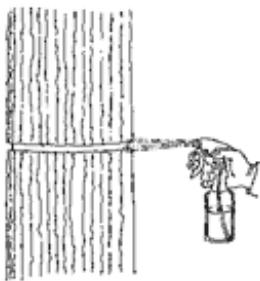


Figure 4

The effectiveness of both girdling and frilling can be increased by using herbicides. With frilling and girdling, water soluble forms of herbicides are most commonly used to get maximum movement of herbicide within the plant. When using water-soluble herbicides, the herbicide/water mixture is commonly applied by squirting it on the girdle or frill until the cut surface is wet. Hand-held, pint or quart spray bottles, such as those available at local garden stores, are ideal for applying herbicide to the girdle (Figure 4). Again, note that a single, rather than double chain saw girdle is used when a water soluble herbicide is to be applied.

Exceptions to the above recommendation of using a water soluble herbicide for girdling and frilling are commonly-used forestry herbicides that contain ester formulations. Ester formulations are labeled for use with frilling in an oil carrier, and the recommendation is to fill the frill with the mixture. They are commonly applied with a backpack or hand-held, hand-pumped sprayer.

Spaced Cuts - Tree Injection

Tree injection involves introducing an herbicide into the undesirable tree through spaced cuts made around the trunk of the tree with an ax, hatchet, or tree injector (Figure 5). The procedure can be visualized as a discontinuous frill with a small amount of herbicide placed in each cut. With an ax or hatchet, non-overlapping horizontal cuts penetrating into the sapwood (the outer area of lighter-colored wood in the stem cross section) are made completely around the tree. Cuts are approximately 2 inches

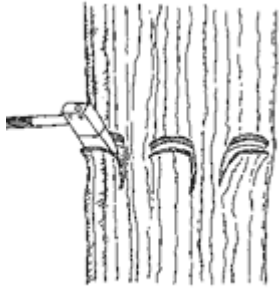


Figure 5

long and are spaced with their edges 1 to 3 inches apart, depending on tree species and specific herbicide being used (also referred to as hack and squirt). A small amount of herbicide is then placed in each cut. Application can be done conveniently with a pint or quart spray bottle (such as those available at garden stores). The amount of herbicide to be placed in the cut is specified on the herbicide label, but is generally 1 to 2 milliliters. Various tree injectors are available including "EZ-Ject" lances that hold herbicide capsules internally and inject them into the base of trees for slow release or "Hypo-Hatchet," which is a hatchet with a reservoir constructed to inject herbicide when it is struck into the tree.

Tree injection is generally more effective than mechanical girdling or frilling without herbicide because of the use of the herbicide. However, on difficult-to-control species, such as red maple, hickories and dogwoods, a continuous frill or girdle with herbicide may be necessary to obtain acceptable control. Effectively, many commercial FSI (Forest Stand Improvement) contractors routinely use a single chain saw girdle with herbicide on all species to maximize effectiveness.

As with most of the herbicides suggested for use with girdling and frilling, the herbicides for tree injection are mostly water-soluble materials that move vertically and horizontally within the tree to complete a chemical girdle.

Basal Bark Spray

Basal spraying or basal bark application as it is sometimes referred to, is a technique to deaden small trees, shrubs, and occasionally vines by spraying the lower 12 to 18 inches of the trunk with an herbicide (Figure 6). The intent is for the herbicide to penetrate the bark and kill the tree and any basal buds that might sprout. Herbicides used for basal spraying are generally applied in oil carriers. The technique is effective on trees less than 4 to 6 inches in diameter and thin bark species such as honey locust and maple. As bark becomes rougher and thicker and the trees become larger, basal bark applications become less effective. Care must be taken when the herbicide is applied to minimize the amount that runs into the soil.

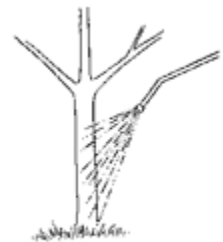


Figure 6

Minimizing runoff is important not only from an environmental quality standpoint, but also to avoid damaging non-target trees. The roots of trees often extend well out beyond their crowns. It would not be at all unusual for the roots of an adjacent desirable tree to extend below the trunk of a tree being basal sprayed. If excess amounts of herbicide were applied to the treated tree, the adjacent desirable tree could absorb the herbicide and be killed or seriously damaged.

Cut Stump

When a tree or vine is cut, there is a high probability that the stump will sprout. When sprouting is undesirable, the sprouting can be eliminated by treating the cut stump with an herbicide. Herbicide can be applied to the stump in many ways, the most common being to spray with a backpack or hand-held sprayer.

How much of the stump needs to be treated depends on the formulation of herbicide used. Many of the herbicides labeled for cut stump application are water soluble. With these materials it is not necessary to treat the entire stump. The critical area of the stump that must be treated to prevent sprouting is the sapwood (outer rings) and bark of the stump's cut surface. Stump treatment with water soluble herbicides must be done immediately after cutting the tree or vine in order to be effective. If treatment is delayed, adequate downward movement of the herbicide will not occur and sprouting will not be eliminated.



Many tree stumps will produce sprouts if not treated with herbicide.

Some herbicides labeled for cut stump application are formulated to be mixed with oil. These materials do not move readily within the plant, but penetrate the bark. To be effective in suppressing stump sprouting, the entire stump (Figure 7), particularly the bark and exposed roots, must be thoroughly sprayed. Timing is less critical with oil solutions because they are not so dependent on movement downward from the cut surface to distribute the herbicide. In situations where immediate treatment of stumps is not possible or when cold temperatures may induce freezing of water soluble formulations, an herbicide in an oil carrier should be used rather than one in a water carrier.



Figure 7

Water-carried herbicides may not be adequately absorbed to be effective during the spring "sap-flow". Treatment with an oil-carried herbicide is recommended in the spring when treating species that exhibit a strong spring "sap flow," such as the maples (*Acer spp.*), grape (*Vitis spp.*) and ironwood (*Ostrya virginiana.*).

References:

Adapted from Ohio State University Fact Sheet F-45 – Controlling Undesirable Trees, Shrubs, and Vines in Your Woodland. Photo credits: James H. Miller, USDA Forest Service.

Adapted from Missouri NRCS Crop Tree Management Conservation Practice Information Sheet (IS-MO666ctm) December 2005

For additional information on Forest Stand Improvement, contact your local USDA Service Center or Illinois Department of Natural Resources office.

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