APPENDIX IV – Environmental Evaluations and Management Information

FOREST MANAGEMENT

The stocking level of a forest stand is an indication of the number and size of trees in a stand in relation to the desired number of trees. When trying to maximize the tree growth potential of a forest stand, a stocking level less than 60% is considered *"understocked."* Stocking levels from 60% to 80% are considered *"optimally stocked,"* with space available for additional growth. Stocking levels from 80% to 100% are *"fully stocked,"* but may be thinned to allow trees room to grow and for improved stand health. Stands greater than 100% stocked are *"overstocked,"* have limited growth potential, and are likely in need of some level of thinning or harvest.

Since many of our forests are overstocked, thinning or forest stand improvement is a commonly recommended practice. The goal is to choose the most desirable trees and kill or remove the competing, less desirable ones or to remove unwanted trees across the stand in order to improve overall forest stand composition. This allows more growth to occur on the best trees.

Timber harvests are a good forest management tool when the trees are large enough to attract the interest of a logger. An overstocked stand could be thinned by harvesting selected trees. In many cases, low quality trees of various sizes and trees considered mature are selected for harvest. A forest stand improvement thinning is often needed after the harvest to remove additional undesirable and damaged trees. The end result should be a properly stocked stand of better-quality trees. This increases the vigor and health of the stand and adds more value to future sales. Avoid diameter limit cuts where all trees over a certain size will be harvested. This almost always leads to high grading, a practice where only the best trees are harvested leaving poor quality trees with little future potential.

FOREST STAND IMPROVEMENT (FSI)/ TIMBER STAND IMPROVEMENT (TSI)

General Overview: A thinning may be either commercial, which involves the harvest and sale of materials, or pre/post-commercial, which does not involve the harvest or sale of forest products. This section covers pre- and post-commercial thinnings which are most commonly referred to as forest stand improvement (FSI) or timber stand improvement (TSI) treatments. FSI is often used in conjunction with a timber harvest to ensure the future health of a timber stand. This commonly occurs as a post-harvest FSI in which undesirable or damaged trees that aren't harvestable are removed. All FSI treatments involve killing undesirable or coppicing desirable trees to improve the residual quality of the stand as measured by a given objective. FSI can be conducted to meet a number of objectives such as improving the quality and volume of forest products, improving wildlife habitat, natural community restoration and improving aesthetic and recreational values.

Increasing Forest Product Quality & Yield: FSI can be used to improve the quality and yield of forest products. To increase value and growth, undesirable species and trees with poor form are killed or coppiced, leaving a stand of faster growing, higher quality trees. Trees are considered low quality for timber production if they will not develop into a valuable forest product. Natural stands are often overstocked. A proper FSI reduces stocking to an optimal level to maximize health and growth rates. Trees with sufficient resources may be growing at a rate of up to ½-3/4" diameter per year. The growth rate of suppressed trees in overstocked stands may be only a fraction of that, often only growing 1/10-1/4" diameter per year. Increasing growth rates increases the yield of forest products. Removing the poor form,

suppressed, undesirable species and trees of no merchantable value, increase the growing space for the more valuable individuals and frees up growing space and resources for the next age class.

The trees left after a FSI are referred to as crop trees. Crop trees should be desirable species (I.E., native species) with good form. Form refers to both the trunk and canopy sections of the tree. Trees with large, healthy canopies can provide the best growth rates and seed production. Crop trees will have quality logs free of defect. The highest value logs are veneer quality, which have almost no defect whatsoever. Defect is anything that devalues a log, including scarring from past damage, internal rot, or discoloration, sweep or crook and large branches. The lower quality trees removed in a FSI may be overstory trees with poor form; they could be hollow or too crooked to mill into a valuable product, or slow growing midstory trees with small canopies which do not receive enough resources to maintain desirable growth rates.

In addition to improving growth rates, overall forest health increases in optimally stocked stands. In overstocked stands, resource competition is high for nutrients, water, and sunlight. When none of the trees have sufficient resources, growth, and health decline. Resilience is greater in optimally stocked stand because trees have adequate resources and minimal stress. Trees in optimally stocked stands are more adept at surviving stresses such as drought or insect or disease infestations.

FSI is often necessary before or after conducting a timber harvest operation. A post-harvest FSI is typically more appropriate since conducting FSI immediately prior to a harvest can result in impediments to access and increase the risk or difficulty of harvesting. In this case, the FSI removes the undesirable trees that cannot be sold. These may be undesirable either due to species or poor form. Not conducting FSI before or after a harvest may lead to high grading, a practice in which the best trees are harvested, and the lower quality trees are left to grow. This leads to a stand of large, low value trees. Failing to remove undesirable species when conducting a timber harvest often allows the undesirable species to seed into all of the newly opened space and take over the area. It imperative to remove the low value trees to free up growing space for new, desirable trees.

FSI for Wildlife Habitat Improvement: FSI may be prescribed to improve wildlife habitat. Forest thinning can improve habitat for many species in a number of different ways. First, trees that produce more food for wildlife are typically selected as crop trees. These include hard mast producers such as oak, walnut and hickory as well as prolific soft mast producers such as mulberry or fruiting shrubs. Increasing the resource availability for these species should increase the number of seed (forage) they produce.

Overstocked stands typically have little herbaceous growth which limits their appeal to wildlife. The lack of sunlight reaching the forest floor restricts growth there. Vegetation on the ground provides both food and shelter for wildlife. By increasing light reaching the forest floor, growth is stimulated to increase browse and cover. Increased insect activity on the flush of new growth also benefits wildlife and ecosystem health. Slash from trees cut in a FSI will also provide cover and insects for wildlife. Recent studies have also shown that amphibian populations are directly correlated with the number of woody debris on the forest floor.

Opening the canopy significantly, typically thinning to below "b-line" stocking, provides extra benefits in the form of wildlife cover. Over several years after the initial cutting, open areas are colonized by thickets of early-successional and often wildlife-friendly species. These areas provide excellent bedding and escape cover. Many of the early-successional species are good fruit producers for wildlife as well. For this reason, practices such as edge feathering and group openings are often used in conjunction with FSI when managing for wildlife habitat.

When managing with an emphasis on wildlife, diversity is often key. There is a temporal change in vegetation after a disturbance with a predictable sequence of plants colonizing a site. This is known as succession. Providing different successional stages on a single property will help maximize the wildlife benefits. Thinning at different rates (cutting more or fewer trees) and in different years is used to maximize the diversity of successional stages.

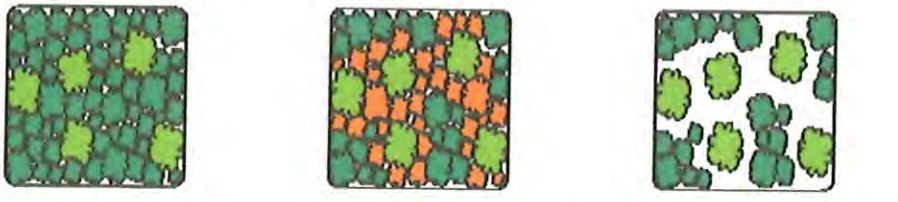
Natural Community Restoration: FSI can also be used for natural community restoration. Historically, disturbance regimes shaped the ecosystems that we inherited. Over the last several decades, we have altered forest connectivity and disturbance patterns. Fire suppression has had a significant role in altering forest species composition and structure. Poor harvesting methods have also negatively affected forest structure in many areas. FSI may be used alone or in conjunction with other management tools such as prescribed fire to restore plant communities and ecosystem health. When conducting FSI for natural community restoration, the thinning most commonly removes "unnatural" vegetation and reduces stocking to match what would have been present under historic disturbance regimes.

Cautions when conducting FSI: FSI should only be prescribed and implemented by trained professionals. Thinning too heavily in stands of quality timber can lead to epicormic sprouting, which lowers timber values. Thinning too heavily can also lead to windthrow when trees are exposed to higher wind speeds than they have had to deal with in the past. Determining the value of a log takes experience and education, and to the untrained eye it can be difficult to identify defect in logs. Using a chainsaw is dangerous without training, and there can be significant risks of personal injury. Improper felling of trees can damage residual crop trees and lower future values. When used in conjunction with prescribed fire, FSI can increase the risk of damage to residual trees because of increased fuel loading. However, with a little training many landowners can learn to apply FSI on their own property.

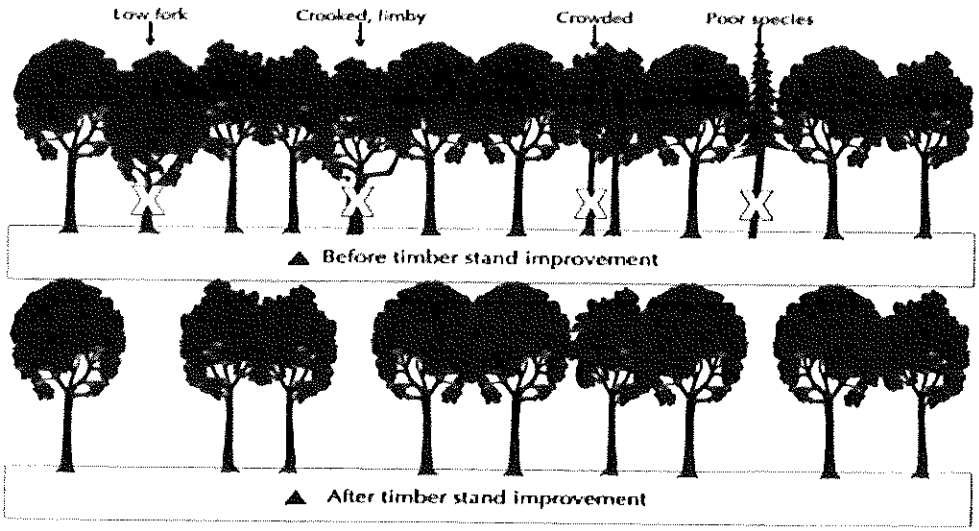
Thinning Specifications:

Thinning involves cutting, girdling, and/or using herbicide to treat trees of poor quality, health, or that are an undesirable species.

- The thinning procedure should minimize damage to the land and remaining trees.
- Favor hard-mast producers (oak, hickory, and walnut), with particular preference for oaks. Leave some fruit producing trees, such as cherry, mulberry, and persimmon.
- Removal focuses on sugar maple, red maple, ironwood, elm, black gum, tulip poplar, American beech, and sweet gum that are in the understory/midstory, to promote desired oak regeneration.
- Remove all trees with poor growth form, are of undesirable species such as those listed above, or that are in direct competition with your preferred crop trees, as shown in the following image.



Select Crop Trees Mark Competing Trees Remove Competing Trees



- Select your crop trees based on the following criteria:
  - Desired species, such as oak
  - Dominant or co-dominant canopy tree
  - Healthy crown and good form
  - Minimal epicormic branching (sprouting along the trunk)
  - Free of defects and disease

- Leave seven snags and seven den trees per acre, ranging in size from 6 to 20 inches Diameter Breast Height (DBH).
- Leave about four vines per acre. Favor vines on trees that will be left as den trees, or trees that are girdled. Cut vines from desirable trees.
- Eastern redcedars do not require chemical.
- Trees greater than 9" in diameter that are potential roost trees for Indiana bats such as dead standing trees, shagbark hickory, and trees with loose and shaggy bark should not be cut down from April 1st through October 31st. This will help to avoid any potential conflicts with federally listed Indiana Bats. However, trees can be girdled any time.

Determining Basal Area:

A penny works as a 10-basal area factor angle gauge. That is, every tree counted represents 10 square feet of basal area. To measure basal area using a penny, follow these steps.

1. Standing at plot center, hold the bottom edge of the penny between two fingers and aim it at a spot on the tree at DBH.
2. Hold the penny 25" from one eye and close the other eye.
3. Count and record trees with trunks that looks wider than the penny. Do not count a tree if its trunk looks narrower than the penny. Count every other tree with a trunk that is the same size as the penny.
4. Holding the penny over the plot center, repeat this test on all trees within your view by rotating to the right until you return to the starting point.
5. Multiply the number of countable trees by 10 (10 basal area factor) to obtain the square feet of basal area per acre. For example, if you counted 9 trees on the plot, the basal area per acre would be 90 square feet.
6. Measure the basal area on several plots in the stand and average to obtain the average basal area per acre.

Controlling Undesirable Trees and Shrubs

Conservation Practice Information Sheet ***(IS-MO666cut)***

Non-Removal Forest Stand Improvement Techniques [1]

What is Forest Stand Improvement?

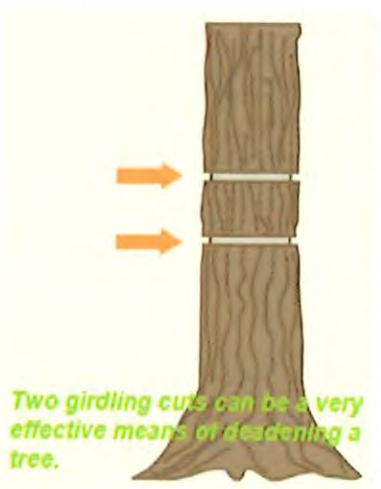
Forest stand improvement is the removal or deadening of undesirable vines, shrubs, and trees in a forest stand. It is a major forest management tool to help woodland owners achieve their management objectives. Once site objectives are identified, the less desirable trees can be removed or killed to favor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


Single tree injection with a Hypo-Hatchet

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.

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.

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.

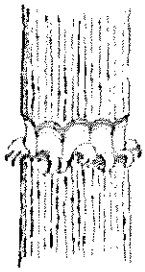


Figure 3

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.

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.

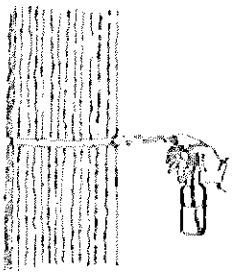


Figure 4

Exceptions to the above recommendation of using a water soluble herbicide for girdling and frilling are commonly-used forestry herbicides that contain ester formulations. They 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

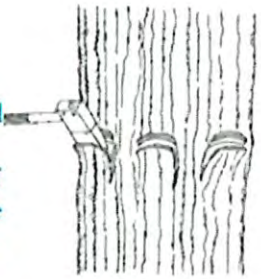


Figure 5

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 long and are spaced with their edges 1 to 3 inches apart, depending on tree species and specific herbicide being used. A small amount of herbicide is then placed in each cut. This 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. There are also various tree injectors available including the "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. For this reason, 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

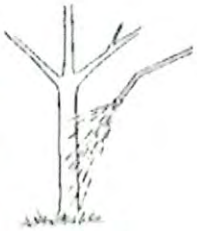


Figure 6

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, this technique becomes less effective. Care must be taken when the herbicide is applied to minimize the amount that runs into the soil. This 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 this 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.


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

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.


Figure 7

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 these materials 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, an herbicide in an oil carrier should be used rather than one in a water carrier.

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.*).

PRESCRIBED FIRE FOR FOREST & WOODLAND MANAGEMENT

Fire management: Controlled, or prescribed, burning is often recommended by forest and land managers. There are a number of benefits associated with prescribed burning, but there are risks as well. Without proper planning and education, fire is a difficult force to manage. With the proper training, preparation, and timing, it can be a safe and effective management tool. With an understanding of how, when, and why to apply fire on your property, you can improve the health and value of your farm in a safe and economical manner.

Why to Burn: Prescribed fire is recommended for a number of different reasons, and it is important to differentiate between goals. Common objectives are increasing oak regeneration, reducing undesirable woody vegetation, improving browse and herbaceous diversity, fuel reduction and woodland/glade

restoration.

Improving oak regeneration. Oaks are fire adapted species. Some oak species are more fire tolerant that others, but as a whole they are more fire tolerant than many other tree species found in Missouri such as maple, ash, or elm. There are a number of ways in which fire improves oak regeneration. Acorn sprouts must find bare mineral soil to succeed. In the absence of fire, leaves build up on the forest floor creating a thick layer between acorns and the soil. Under these conditions, acorns will not survive. Fire removes this barrier, allowing the oak root to enter the soil and begin absorbing water and nutrients. As a stand moves forward in succession, the leaf litter composition will shift to less fire adapted species (maple, ash elm, beech) whose leaves retain moisture more easily than fire adapted oaks thus, altering the fuels loads and making it challenging to get a prescribed fire to carry.

Fire favors oak over most other tree species. Most oak species have thick bark capable of tolerating fire, while many species we consider undesirable (maple, ash, and elm) do not. Oak seedlings are also uniquely fire adapted. Although fire will top kill seedlings, they will resprout vigorously. Oaks form what are known as "grubs". Oak grubs are groups of sprouts with a large root system. The root system is much older than the sprouts, which can be killed back repeatedly without harming the root system. These grubs represent oaks which are waiting for their chance to mature into the forest canopy. Less fire tolerant species is not able to continuously resprout after burning and can often be killed back with relatively mild fires.

Herbaceous diversity & production. Prescribed burning is often recommended to increase herbaceous diversity and browse production. Fires can be especially beneficial when encouraging the growth of wildflowers and native grasses. These herbaceous species have tiny seeds which also need bare soil to germinate. Exposing bare soil will allow these seeds a place to grow. Often there are also a plethora of seeds already in the soil waiting for ideal conditions to germinate. This is known as the "seed bank". The seeds of many species will lay dormant in the soil, waiting for a fire to germinate. This adaptation allows the seeds to wait to germinate until growing conditions are ideal. Increasing the volume of flowering plants improves pollinator habitat and wildlife browse. Many perennial grasses are adapted to fire as well. Like oak grubs, these grasses have deep root systems. Fire will burn off the above-ground vegetation, removing competing species, but the grasses will grow back vigorously.

Fire also promotes nutrient cycling, which is like fertilizing the forest. Fire coverts nutrients stored in vegetation to an available form, increasing the availability of many nutrients in the soil. Coupled with the increased light reaching the forest floor, this will cause a flush of new growth. This new growth on the forest floor provides forage for wildlife in the form of new green vegetation, fruit, and insects attracted by the flowers.

Fuel Reductions. Controlled burning can be defined as burning a designated area under controlled conditions to achieve an objective. Wildfire is just the opposite- uncontrolled, destructive fire without boundaries. Routinely burning under mild conditions allows for gradual, controlled reduction of fuels that would be consumed in a wildfire. Without regular fire, fuels can accumulate, and wildfires may be more intense. Prescribed fires are only set when weather conditions are forecast to provide favorable, controllable fire conditions. Humidity and wind speed are the largest climatic factors in fire behavior. We only light prescribed fires when we feel that weather conditions are ideal to produce a mild fire. Wildfires tend to occur during hotter, drier, and/or windier conditions. This produces more damaging fire which can damage or kill desirable vegetation, damage structures or even sterilize the soil. By reducing fuels when conditions are favorable, the intensity of a possible fire is reduced. Installation of firebreaks for prescribed burning can also aid in fire suppression in the event of a wildfire.

Natural Community Restoration. One of the most important and most common uses of prescribed fire is to restore natural communities. Although plant communities have always and will always be in a constant flux, we often try to restore ecosystems to resemble pre-European conditions. Re-introducing fire should promote a more diverse, healthier ecosystem. We recommend burning under different intervals and intensities to try and emulate historic fire regimes, always with the goal of restoring what we imagine is a "natural" or "intact" community. By maximizing diversity, we encourage systems that are resilient against insect, disease, and climatic extremes and are productive for our management goals.

We prescribe burning to restore the natural communities because fire has historically been part of our ecosystem. Some areas historically burned often and under hot conditions, while some areas did not have frequent or hot fires. Woodlands and glades are smaller ecosystems often found within forested areas. These are areas that historically burned often. Glades are areas with exposed bedrock and very little soil. Species found here can be similar to desert flora and fauna. These areas were historically kept nearly free of tree cover by frequent, hot fires. Many glades are now being encroached by eastern redcedar, a fire-intolerant species. Woodlands often exist between forest and glades. While forests typically have deep, productive soils, woodlands often have thinner, rockier, and drier soils. They are less productive for timber growth but host a number of unique species. Woodlands are often described as "park-like," with large, open grown trees, an open midstory and a thick carpet of wildflowers and native grasses on the forest floor. Routine prescribed fire is necessary to maintain woodland and glade communities; without fire they will be overgrown by woody species, losing their diversity of unique herbaceous plant species.

When to Burn: In Missouri, we almost always recommend burning wooded areas during the dormant season. This can help prevent excessive damage to desirable vegetation (overstory trees). Often, stands won't burn after leaf-out except under extreme conditions. Winter is often too wet to burn, so most burns occur either during late fall or early spring. The specific timing of burns will produce different results. Fall burns tend to favor wildflowers, because they allow wildflower seed to reach the forest floor before winter and be worked into the soil by the natural freeze/thaw cycle. Late spring burns typically favor warm season grasses. It is usually desirable to alternate between spring and fall burns, especially in different areas of a farm, to maximize diversity. Burning during the fall does expose an area to an increased risk of erosion and should be considered when planning burn activities.

How Often to Burn: We typically recommend burning at least once before forest thinning activities take place. After examining several areas years after forest thinning (FS1) operations have occurred we believe this is the best way to obtain the desired plant community. Often, shade tolerant species such as maple and ironwood form a carpet of seedlings on the forest floor in overstocked stands. When the forest canopy is opened through thinning or harvest activities, these seedlings begin to grow vigorously and shade out all other vegetation. However, by improving vegetation conditions *before* the canopy is opened, the response to a thinning or harvest is greatly improved. Burning before a thinning can also significantly reduce the manual labor input by removing many small stemmed undesirable trees that would otherwise be cut with a chainsaw and/or individually treated with herbicide. By burning prior to a thinning, you can allow slash from the thinning to decompose before resuming a burn regime; this reduces the risk of fire damage to crop trees.

If woodland and glade restoration is the main management objective, fire should be applied regularly. Typically, we recommend one to three burns before a thinning. After the canopy is opened, continue burning every 1-5 years until the desired understory conditions have been achieved, at which point the interval can be extended. More open canopies and less frequent burning will lead to an increase in dense woody vegetation. More closed canopies and more frequent burning will lead to more open understories

with more annual herbaceous vegetation. Both of these have benefits to wildlife. Due to high fuel loading, special precautions are likely needed when burning soon after a thinning and/or harvest to prevent excessive fire intensities and/or damage to crop trees.

When burning to improve oak regeneration, fire should be applied until there is a carpet of oak seedlings on the forest floor. Once the desired level of oak regeneration is present, the canopy should be opened and burning should stop. Small trees are much more susceptible to damage from fire, so they should be protected until they are large enough to tolerate fire without damaging future timber qualities. This is dependent on several factors including (but not limited to) species, size, and fire intensity.
When in doubt about the need for or timing of a prescribed burn, consult a professional forester.

How to Burn: Prescribed burning can be dangerous if done under the wrong conditions or without the proper preparation and education. Most of the work of a prescribed burn is done days or weeks before burn day in the form of planning and fire line installation. A fire line can be a strip of bare mineral soil that fire cannot cross or a mowed or disked strip along forest edge. The specifics of fire line installation are too complex to be included in this document. Trained professionals can be hired to install fire line on private land. The lighting sequence (i.e., where to begin lighting and how to progress throughout the day) is also critical for maintaining control of the fire. Landowners interested in burning are highly recommended to attend one or more workshops on the use of prescribed burning. The Missouri Dept. of Conservation holds several workshops each year. See the link below for more information. Always obtain a burn plan written by a trained professional detailing fire line requirement, acceptable weather conditions, firing sequence, and personnel and equipment requirements before conducting a prescribed burn.

https://mdc-event-web.s3licensing.com/Event/AllEvents?maxDistance=50&EventTypeId=16&EventTitleId=16214&CountyId=16&isVirtualIncluded=True

Risks Associated with Prescribed Burning: Fire is a unique management tool, and it can be difficult to predict and control fully. There will almost always be variation in the way fire behaves in the woods based on small changes in topography, fuels, and weather. There is an inherent risk of damage to vegetation within any burn unit. When fire escapes a burn unit it becomes a wildfire. Wildfire poses great risk of damage to land, property, and people under dangerous conditions. With proper planning and preparation these risks are minimal but should never be underestimated or taken lightly.

The best way to ensure the use of fire is safe on your property is to obtain the necessary information and plan accordingly before undertaking any prescribed burn activity. Always have a burn plan written by a trained professional and follow the instructions in that burn plan. Burn plans should be updated when vegetation conditions change, such as after a thinning or harvest. Attending prescribed burn workshops will help you further understand the risks and benefits of using fire for land management, as well as helping you implement prescribed burns in a safe and effective manner.

As stated earlier, there is an inherent risk of damage to existing crop trees when burning. For this reason, we don't recommend burning stands of valuable timber to prevent economic losses. For example, recent studies estimate an **average reduction of 10-15% in timber values in red oak** associated with regularly burned timber stands in the Missouri Ozarks. This value can vary widely depending on the individual stand and how fire is applied. Factors including tree species and size, fuel loading and moisture content, and interval between fire and harvest all play a role in determining the reduction in value caused by fire damage. For this reason, we do not recommend burning stands with quality timber or where risk of

damage from fire is exceptional. Damage to high quality timber will be more significant, but fire adapted, or lower value trees should suffer lower losses. Different ecosystems are adapted to different fire intensity and frequency, and so recommended fire regimes will vary across the landscape.

ARCHAEOLOGICAL, CULTURAL, & HISTORICAL SITES

Cultural resources are important to protect. They include any prehistoric or historic district, site, building, structure, or object listed or eligible to be listed in the National Register of Historic Places. Cultural resources that are also protected under other authorities (such as the American Indian Religious Freedom Act) include tangible traces such as districts, sites, buildings, structures and objects, and less tangible traces such as dance forms, aspects of folk life, landscapes, vistas, cultural or religious practices; historical documents; and some landscapes, vistas, cemeteries (if they have historic or cultural value). If a planned conservation practice is ground disturbing or potentially ground disturbing, contact the local NRCS field office for additional planning considerations.

The following sites have been noted on your property:

FOREST HEALTH AND PROTECTION

Your property is a valuable asset and should be protected from destructive grazing, wildfire, insects and diseases, invasive species, or any other disruptive force. Practices that will improve forest health include fencing, fire breaks/lanes, and monitoring for insect and disease activities and invasive species.

Destructive grazing: Cattle, hogs, horses, or other livestock compact the soil in a woodland, trample young seedlings and sprouts, damage roots, rub bark from stems, and eat or defoliate small trees. Once woodlands have been grazed, they are more prone to disease and insect problems. If excessive grazing is allowed, soil compaction and erosion problems may also occur. If present, fencing livestock out of woodlands is necessary to meet the objectives you have for your forested land.

Fire management: Fire is a natural force and may be either beneficial or harmful. The difference is a matter of timing, intensity, and management objectives. Uncontrolled fire that occurs in a place or time that is not desired is considered a wildfire. Wildfire can cause damage to woodlands. It may weaken or kill trees, cause wounds where insects and diseases can enter, and reduce timber quality and value. Alternatively, prescribed fires are conducted under carefully controlled and managed conditions to accomplish land management objectives as outlined in a site-specific prescribed burn plan. Prescribed fire is a tool that can be used to improve oak regeneration, increase herbaceous vegetation and diversity, restore natural communities, and improve wildlife habitat.

Insect and disease: There are a lot of common misconceptions about tree and forest health. Frequently, people believe that if a tree is green, it is healthy. Many times, trees impacted by insects or disease are beyond the point of treatment before any symptoms are noticed. Active management that removes these declining trees and provides sufficient growing space to the remaining, more vigorous, healthy trees is important for optimal forest health. However, it is also important to remember that an occasional dead tree is natural in a healthy forest due to competition for sunlight and nutrients. These dead trees, commonly known as snags, also provide habitat for many types of woodland wildlife. If applying pesticides to treat insects or diseases **always read and follow the label directions**.

Invasive species: An "invasive species" is defined as a species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or

environmental harm or harm to human health. Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions. You can help prevent and control the spread of exotic invasive species by maintaining or developing well-established, diverse communities of native plants to resist these invaders. When applying herbicides to treat invasive species **always read and follow the label directions**.

Japanese Honeysuckle (*Lonicera japonica*):
-Apply herbicide solution mixed according to the labeled rate with a surfactant using backpack sprayer to apply herbicide to foliage during late fall or early spring, while other vegetation is dormant. Larger bushes should be treated with the cut-stump method. For additional information please see: https://mdc.mo.gov/trees-plants/problem-plant-control/invasive-plants/japanese-honeysuckle-control

Bush Honeysuckle (Amur- *Lonicera maackii*) and (Bella- *Lonicera bella*)
- Spray herbicide solution mixed according to the labeled rate with a surfactant using backpack sprayer to apply herbicide to foliage during late fall or early spring, while other vegetation is dormant. Larger bushes should be treated with the cut-stump method. For additional information please see: https://mdc.mo.gov/trees-plants/problem-plant-control/invasive-plants/bush-honeysuckles-control

Multiflora Rose (*Rosa multiflora)*
- Spray herbicide solution mixed according to the labeled rate with a surfactant using backpack sprayer to apply herbicide to foliage during late fall or early spring, while other vegetation is dormant. Larger bushes should be treated with the cut-stump method. For additional information please see: https://mdc.mo.gov/trees-plants/problem-plant-control/invasive-plants/multiflora-rose-control

- Herbicide recommendations for Invasive Treatment. **Always read and adhere to labeled rate mixtures**
  - Milestone
  - Garlon 3A
  - Garlon 4
  - Crossbow
  - Pathway

SOIL & WATER RESOURCE & QUALITY

Water is an important renewable resource. It is also one of the most important resources that a landowner can affect. Three of the most important items you can do to maintain water quality is to retain adequate forested buffers along streams and drainages, avoid soil erosion by properly planning and/or maintaining roads/trails used for vehicles, and/or logging equipment, and exclude livestock from your woods. More specific information on best management practices for water quality and resource protection can be found in the MDC "*Missouri Watershed Protection Guide*" and "*Missouri Woody Biomass Harvesting Manual.*"

RECREATION & AESTHETIC RESOURCES

Many management practices affect the appearance and recreation resource of your property. Your forest stewardship/forest management plan recommends management activities with your aesthetic and recreational considerations in mind.

FISH, WILDLIFE, AND WETLAND RESOURCES

Numerous fish and wildlife species rely on forests to provide needed habitat. Wildlife species need food, shelter, and water within their home range. Forest management can improve wildlife habitat for game and non-game species. The increased growth of trees in managed wooded lands can result in an increase in the mast (nuts, berries, acorns, seeds) production of these trees. Increased sunlight reaching the forest floor increases plant growth and provides additional food and cover for wildlife. Down tree tops and logs will provide escape cover and habitat for ground-dwelling birds, chipmunks, salamanders and frogs. Standing dead trees, or snags, and living trees with cavities provide diverse habitat for a variety of wildlife. Creating a transition zone or edge where stands meet open land or fields or developing forest openings can provide wildlife food, cover, and nesting areas. Construction of wildlife watering facilities, or small fishless ponds, can provide needed water where it is currently lacking in larger blocks of forest. Healthy forests also serve as filters for runoff water, thus protecting water quality in streams and wetlands. Natural community restoration of glades, woodlands, savannas, and bottomland forests restore declining habitats and the wildlife species associated with those habitats.

FOREST OF RECOGNIZED IMPORTANCE

Forests of Recognized Importance (FORI) are considered critically important because of their unique combination of social, cultural, biodiversity and environmental values. Social or cultural values include aspects of a forest that are important to the surrounding community's identity, like historical features or sacred sites or forest products that local residents depend on. Biodiversity values are critical to protecting rare ecosystems or habitats, or unusual plant or animal species. Environmental values include aspects of the forest that benefit the whole community, like protecting local watersheds or preventing erosion. These forests are evaluated at the landscape level, rather than the stand level and are recognized for the combination of unique values, rather than a single attribute. Examples of FORI's in Missouri include

priority areas identified in the State Forest and Wildlife Action Plans, and priority watersheds identified by various agencies and organizations. GIS files of these areas have been developed, which will make identifying their locations easier on the ground.

☒ Your land does not contribute to, or fall within, an area identified as a FORI.

☐ Your land does contribute to, or fall within, the area identified as the FORI. You should take the following steps to help conserve this area:

BIOLOGICAL DIVERSITY

Biodiversity is extremely important to the health of both a unique forest tract and the larger overall landscape. A diversity of plants, animals, and management makes an ecosystem more resilient to stressors such as wildfire, flooding, drought, or pest outbreaks. Biological diversity also contributes to the functionality and societal benefits, whether ecological or economical, that a property can provide.

AGROFORESTRY

Agroforestry is the intentional integration of trees and shrubs into crop and animal farming systems to create environmental, economic, and social benefits. It has been practiced in the United States and around the world for centuries. For a management practice to be called agroforestry, it typically must satisfy the four "I"s: intentional, intensive, integrated, and interactive. The five agroforestry practices include alley cropping, forest farming, riparian forest buffers, silvopasture, and windbreaks.

CONSERVATION BASED ESTATE PLANNING & LEGACY PLANNING INFORMATION

Estate planning is the act of preparing for the transfer of a person's wealth and assets after his or her death. Forestland is a real property asset which is included with estates, and forest owners are encouraged to consider what will happen to their land after death. The decisions that aging landowners make about the future use and ownership of their land are important. Ensuring that enough wooded land, in large enough property sizes, continues to be available in the future will not only help ensure working forests, but also the continuation of the many critical public benefits that these forests provide. Important estate planning and other information is available at the National Timber Tax Website: www.timbertax.org

CARBON SEQUESTRATION & CLIMATE RESILIENCE

Carbon dioxide and its impact on the climate is a concern of many. In the United States, forests make up 90% of the US carbon sink and sequester approximately 10% of the U.S. CO_2 emissions. Additionally, a healthy, managed forest can sequester greater amounts of carbon while still providing for wildlife habitat, recreation opportunities, wood products, and other uses. A healthy forest is much more resilient to extreme climate events, such as drought or flooding, than an unmanaged forest.

lossary/Helpful Internet Sites

(AGS): Trees that are of good form, species and quality and would be satisfactory as crop trees. .
slope faces (north, south, etc.)
nal area of a tree, in square feet, at 4.5 feet from the ground (at breast height). When the basal
a stand are added together, the result is expressed as square feet of basal area per acre, which is
measure of a stand's density.

Best management practices (BMP): applied forestry practices that protect or enhance a forest stand.

Biomass: A renewable energy source of biological materials derived from living, or recently living organisms, such as wood, waste, and crop residues.

Board Foot: A unit for measuring wood volumes. It is commonly used to express the amount of wood in a tree, saw log, or individual piece of lumber. A piece of wood 1 foot long, 1 foot wide, and 1 inch thick (144 cubic inches).

Canopy: The more or less continuous cover of branches and foliage formed collectively by the tops, or crowns of adjacent trees.

Clearcut: A harvest and regeneration technique that removes all trees from an area at the same time, resulting in an even-aged stand.

Crop Tree: A tree identified to be grown to maturity for the final harvest cut, usually on the basis of its location with respect to other trees and its timber quality.

Crown: The part of the tree made up of leaves and branches growing outward from the trunk.

Cull: A tree or log of merchantable size that because of a defect is useless for its intended purpose.

Den Tree: A living tree with a cavity large enough to shelter wildlife.

Diameter Breast Height (DBH): The diameter of a tree at 4.5 feet above the ground.

Even-Aged Management: Forest management with periodic harvest of all trees on part of the forest at one time or over a short period to produce stands containing trees all the same or nearly the same age or size.

Forest Stand Improvement: See timber stand improvement.

Girdling: Completely encircling the trunk of a tree with a cut that severs the bark and cambium of the tree. Herbicide is sometimes injected into the cut to ensure death of the tree.

Hack-n-squirt: A tree treatment method where an axe or hatchet is used to make "hacks" (injections) into the tree's cambium layer. A plastic "squirt" bottle is used to spray a specific amount of herbicide into the cuts placed around the tree.

High-grading: Cutting only the high-value trees from a forest property, leaving a stand of poor quality with decreased future timber productivity.

Intermediate Cut: Removing immature trees from the forest sometime between establishment and final stand harvest to improve the quality and spacing of the remaining forest stand. Contrast this technique with a harvest cut.

Landing: A place where logs are taken to be loaded on trucks for transport to the mill.

Log Rules: A table showing estimated amount of lumber that can be sawed from logs of given lengths and diameters. Two log rules are commonly used in Missouri:

Doyle Rule is a simple formula rule used in the eastern United States. It underestimates the amount of lumber in small logs and overestimates large logs.

International 1/4-inch Rule is a formula rule allowing ½ -inch taper for each 4 feet of length and 1/16 -inch shrinkage for each 1-inch board. This measure approximates the actual sawmill lumber tally.

Mast: Fruit of trees such that serve as food for many species of wildlife.

Mature Tree: A tree that has reached the desired size or age for its intended use.

MBF: Abbreviation for 1,000 board feet using the Roman numeral M.

Midstory: The trees growing beneath the overstory layer and above the understory.

Overstocked: A forest stand condition where too many trees are present for optimum tree growth.

Overstory: The portion of trees in a stand forming the upper crown cover.

Pole Timber: Trees from 6 inches to 12 inches in diameter at breast height.

Prescribed Burn: To deliberately burn natural fuels under specific weather conditions, which allows the fire to be confined to a predetermined area and produces the fire intensity to meet predetermined objectives.

Pruning: Removing live or dead branches from standing trees to improve wood quality.

Pulpwood: Wood cut primarily for manufacture of paper, fiberboard, or other wood fiber products.

Regeneration: The number of seedlings or saplings existing in a stand. The process by which a forest is renewed by direct seeding, planting, or naturally by self-sown seeds and sprouts.

Regeneration Cut: Any removal of trees intended to assist regeneration already present or to make regeneration possible.

Release: To free trees from competition by cutting, removing, or killing nearby vegetation.

Riparian Zone: The area adjacent to or on the bank of rivers and streams.

Sapling: Trees from 2 inches to 6 inches in diameter at breast height.

Sawtimber: Trees at least 12 inches in diameter at breast height from which a sawed product can be produced.
Seed-tree Harvest: A harvest and regeneration method where nearly all trees are removed at one time except for scattered trees to provide seed for a new forest.
Selection Harvest: Harvesting trees to regenerate and maintain a multi-aged structure by removing some trees in all size classes either singly or in small groups.
Shelterwood Harvest: A harvesting and regeneration method that entails a series of partial cuttings over a period of years in the mature stand. Early cuttings improve the vigor and seed production of the remaining trees. The trees that are retained produce seed and also shelter the young seedlings. Subsequent cuttings harvest shelterwood trees and allow the regeneration to develop as an even-aged stand.
Site Index: An expression of forest site quality based on the height of a free-growing dominant or co-dominant tree at age 50 (or age 100 in the western United States).
Skid Trail: A road or trail over which equipment or horses drag logs from the stump to a landing.
Skidding: Pulling logs from where they are cut to a landing or mill.
Slash: The treetops and branches left on the ground after logging or as a result of a storm, fire, or pruning.
Snag: A standing dead tree from which leaves and most of the branches have fallen. Used by wildlife.
Stand: A group of trees with similar characteristics, such as species, age, or condition that can be distinguished from adjacent groups. A stand is usually treated as a single unit in a management plan.
Stand density: A measure of the stocking of a stand of trees based on the number of trees per area and diameter at breast height of the tree of average basal area.
Stocking: An indication of the number of trees in a stand in relation to the desirable number of trees for best growth and management. There are three categories or levels of stocking:

- **A-level** – 100% stocking; stands at or above this level are considered overstocked and unable to support any more trees.
- **B-level** – approximately 60% stocking; stands at or above this level are considered adequately stocked and all growing space is utilized by existing trees.
- **C-level** – 40-50% stocking; stands at or above this level are considered understocked, but have the amount of trees necessary to reach B-level within 10 years on average sites. Any stand with a stocking level below B-level is considered understocked, but cutting below this level can be done to promote regeneration.

Streamside Management Zone (SMZ): An area adjacent to the banks of streams and bodies of open water where extra precaution is necessary in carrying out forest practices to protect the stream bank and water quality.
Thinning: A cutting or killing of trees in an immature forest stand to reduce the tree density and concentrate the growth potential on fewer, higher quality trees,
Timber Stand Improvement (TSI): A thinning made in immature stands to improve the composition, structure, condition, health, and growth of the remaining trees, while also increasing sunlight to the forest floor to promote regeneration and herbaceous vegetation
Undesirable Growing Stock (UGS): Trees of low quality or less valuable species that should be removed in a thinning.
Understocked: Insufficiently stocked with trees.
Understory: All forest vegetation growing under the overstory and midstory trees.
Uneven-Aged Management or Stand: A stand of trees containing at least three age classes intermingled on the same area.
Volume: The amount of wood in a tree, stand of trees, or log according to some unit of measurement, such as board foot, cubic foot, etc.
Wolf Tree: A very large, oftern overmature tree that is or was open grown.

Helpful Internet Sites

- USDA NRCS Web Soil Survey: https://websoilsurvey.nrcs.usda.gov/.
- USDA NRCS Field Office Technical Guide (FOTG): http://www.nrcs.usda.gov/technical/efotg/.
- USDA NRCS Program Information: https://www.nrcs.usda.gov/wps/portal/nrcs/main/mo/programs/ .
- Missouri Department of Conservation: http://mdc.mo.gov/.
- Missouri Managed Woods Program: https://mdc.mo.gov/property/property-assistance/missouri-managed-woods
- Missouri Tree Farm System: http://www.forestandwoodland.org/missouri-tree-farm-system.html.
- American Tree Farm System: http://www.treefarmsystem.org/.
- Forest Stewardship Program Plan Elements: https://www.fs.fed.us/cooperativeforestry/library/elementsguide.pdf.
- Missouri Consulting Foresters Association: http://www.missouriforesters.com/.
- University of Missouri Natural Resource Extension publications: http://extension.missouri.edu/main/DisplayCategory.aspx?C=3

- US Forest Service publications: http://www.fs.fed.us/publications/.
- Forest health updates for the central states including Missouri: http://na.fs.fed.us/fhp/fhw/csfhw/.
- Missouri timber price trends: https://mdc.mo.gov/trees-plants/timber-sales/timber-price-trends.
- Missouri Forest Products Association : http://www.moforest.org/resources/landowners.php
- USDA National Agroforestry Center: http://www.unl.edu/nac/index.htm.
- University of Missouri Center for Agroforestry: http://www.centerforagroforestry.org/.
- Forest and Woodland Association of Missouri: http://www.forestandwoodland.org/
- Missouri Walnut (and other fine hardwoods) Council: http://www.walnutcouncil.org/state-chapters/missouri.html

APPENDIX VI– Supporting Documents/Stand Information

This section contains base-line data or supplemental information and documentation that supports or guides the management of your forest and forest related resources. This information may also be required for federal or state cost share programs.

Stand #	# Plots Taken	Total BA/ Ac	Mature BA/AC	Sawtimber AGS BA/AC	Sawtimber UGS BA/AC	Pole Size AGS BA/AC	Pole Size UGS BA/AC	Small Tree AGS BA/AC	Small Tree UGS BA/AC	Cull BA/AC	Total Trees/AC	B-Level BA/AC	C-Level BA/AC	Stocking %	Volume/ acre (scale)	Average Diameter
1	6	122	24	56	12	14	12	2	2	0	204	67	52	105.6%	10	10.5
2	10	120	21	49	11	19	18	1	1	0	205	66.8	51.8	104.2%	9	10.4
Field 1	3	83.3	7	10	3	27	33	3	0	0	285	59.3	46	81.5%	2	7.3

FOREST STEWARDSHIP PLAN

For the Property of: Gary Noisworthy
Plan Prepared by: Becky Blue

New ☒ Revision ☐

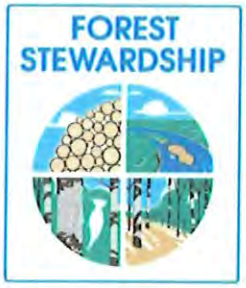
INTRODUCTION

A healthy and productive forest is the primary focus of forest management. Developing a plan is a reflection of your intent to follow a balanced approach to forest management that considers your forest resources, expectations and goals. This plan will help guide you in achieving the benefits of managing your forest and forest related resources.

Many forest and wildlife management terms are unfamiliar to landowners. A glossary is included (APPENDIX V) to help clarify terms and concepts used in this report.

This forest management plan will meet the unique requirements of the following: U.S. Forest Service's Forest Stewardship Program, the NRCS's Farm Bill Programs, the American Tree Farm System's Tree Farm Program, and the Missouri Department of Conservation's Missouri Managed Woods Program.

NRCS Natural Resources Conservation Service



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SIGNATURES AND APPROVALS

This plan is provided as a guide to help you accomplish your objectives and achieve the benefits of managing your forest and forest related resources.

I certify that this FOREST STEWARDSHIP PLAN meets the requirements of the federal Forest Stewardship Program.

_____
Plan Preparer Date

I certify that this FOREST STEWARDSHIP PLAN meets the requirements of the federal Forest Stewardship Program.

_____
Forestry Regional Supervisor Date

I certify that this FOREST MANAGEMENT PLAN meets the requirements of the USDA Environment Quality Incentives (EQIP) Program and/or the Quality Criteria for forest activity plans in Section III of the USDA NRCS Field Office Technical Guide.

_____
Technical Service Provider Number Date

I accept this plan as written and certified by the Technical Service Provider and approve the item for payment as scheduled in the landowner's Environmental Quality Incentives Program (EQIP) contract.

_____
NRCS Forester Date

I have reviewed this plan and approve its content.

_____
Landowner Date

TABLE OF CONTENTS

PROPERTY INFORMATION

Landowner	Gary Noisworthy	Plan Writer	Becky Blue
Address	1300 Columbine St.	Address	2206 W. St. Joseph
Phone	573-380-6119	Phone	573-547-4537 Ext. 1084
Email	Gary.noisworthy@sbcglobal.net	Email	Rebecca.blue@mdc.mo.gov

County	Perry	Farm Number	Click here to enter text.
Township	34	Tract Number	Click here to enter text.
Range	8 & 9 E	Tracking Number	Click here to enter text.
Section	1 & 6	EQIP Contract Number	Click here to enter text.

Plan Preparation Date	07/01/2021
Plan Acres	Click here to enter text.
Forested Acres	Click here to enter text.
Total Acres	Click here to enter text.

LANDOWNER OBJECTIVES

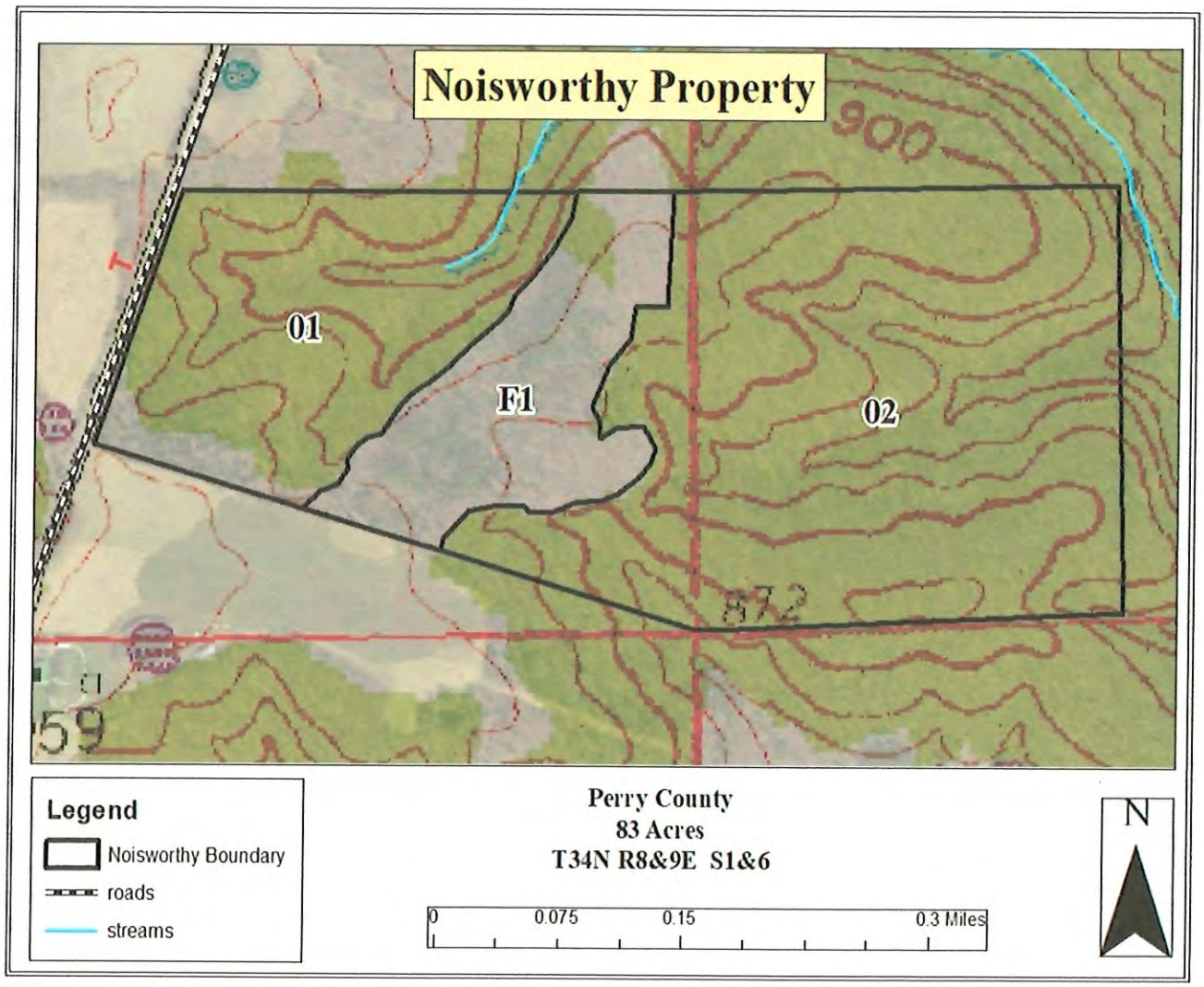
The purpose of forest management is to achieve and maintain a healthy and productive forest. Depending upon your goals, forest health and productivity can be measured by the amount or quality of wood products, diversity of wildlife species, variety of recreational opportunities, or intensity of personal enjoyment your woodlands provide.

The following objectives have been identified as important to you and your property:

- *Maintain healthy and productive forests/woodlands*
- *Enhance wildlife habitat on the property*
- *Protect soil and water quality*

PLAN/STAND MAP

A forest stand is a community of trees and plants growing together. The trees in a stand are generally similar in size, age, and/or species composition. Forest stands can be distinguished from other stands by these characteristics, as well as by aspect, slope, and other dividing features. The map shown below identifies these stands on your property.



Stand	Acres
1	21.3
2	48.5
Field 1	13.3

RECORD OF DECISIONS - SUMMARY/ACTIVITY SCHEDULE

To assist with meeting your individual objectives, the following planned practices and treatment activities will help achieve and insure sustained forest health, improve water quality, and increase wildlife habitat associated with your forest. Additional details about each stand can be found on the following pages. The plan should be implemented according to the following prioritized schedule.

Stand	Acres	Practice Code or Treatment Activity	NRCS Resource Concern	Treatment Details	Planned Date	Completed Date
1 & 2	69.8	Commercial Timber Harvest	Degraded Plant Condition	Harvest mature/declining trees along with poor form/suppressed small sawtimber and large poles	2022	
1 & 2	69.8	6SS Forest Trails and Landings	SOIL EROSION	Road improvements post-harvest to protect soil and water quality. Water bars, road grading, gravel etc.	2022-2023	

Annually:

- Maintain boundaries.
- Monitor and control invasive species.
- Monitor for insect and disease outbreaks.
- Review forestry plan for needed changes – update accordingly.
- Keep good records.

Within ten years: Re-inventory your forested acres with the assistance of a professional forester. Contact your agency forester, private consulting forester, or biologist with any questions you have about implementing any part of this plan. Progress should be evaluated at least every five years to ensure that management of your forest land is consistent with existing planning standards and your current objectives. This management plan is for a ten-year period and should be updated in August 2021.

THREATENED AND ENDANGERED SPECIES

Over 600 native plants and 300 native animals in Missouri are of concern because they are uncommon, rare, or because their numbers are low or rapidly declining. Many of these species occur on private land. As a consequence, private landowners can have a significant impact on these rare plants, animals, critical habitat, and natural communities (e.g., caves, high conservation value forests).

As the owner of forest land, you have the opportunity to maintain or improve habitat that is essential to many types of wildlife, including threatened and endangered species. Based on a review of the Missouri Natural Heritage Database, the following state or federally listed threatened or endangered species may be present on or associated with your property. Guidelines for protecting threatened or endangered species associated with your property are shown below. Policy for addressing Threatened or Endangered species may differ among state and federal agencies. Therefore, before implementing any conservation practice, especially practices that may involve tree removal, on your property that will be cost-shared or reimbursed through state or federal monetary sources, consult the MDC Private Land Conservationist or NRCS planner in your county to determine program requirements that mitigate impacts to Threatened or Endangered species and if any additional species have been added since the development of this plan.

Endangered or Threatened Species (Common Name)	Practice/Activity with Potential to Impact	General Guidelines for Protection
Gray Bat (*Myotis grisescens)*	Timber harvest/Forest Stand Improvement/Prescribed fire	*(Myotis grisescens)* The gray bat is a federally endangered species found where karst topography occurs in the southeastern and midwestern United States. Gray bats use caves year-round with separate maternity, transient, bachelor, and maternity caves. Gray bats typically hibernate in mid to late Oct. through early to Mid-March. They inhabit caves year-round and prefer to roost in deep vertical pit caves, while maternity caves often contain large entrances with large dome rooms. **Conservation Measures** NRCS will conserve the gray bat by following these conservation measures: • Suggest to landowners that maternity and bachelor caves should be closed to human entry from April 1 through October 31. Winter hibernacula should be closed to human entry from September 1 through April 30. • Suggest to landowners that all streams and riparian areas be fenced out from livestock access.

Table

heritage2019_a_mo

FID	Shape *	COUNTY	EO_ID	SNAME	SCOMNAME	SRANK	GRANK	STSTAT	FEDSTAT
7211	Polygon		34174	Myotis grisescens	Gray Myotis	S3	G4	E	E

EXISTING CONDITIONS/FIELD EXAMINATION FINDINGS

The forest inventory data used in this plan was collected on 08/03/2021. Below is a summary of findings by stand. Additional stand information can be found in APPENDIX VI. Further detailed inventory/plot data can be provided upon request.

Stand: 1 **Acres:** 21.3

Dominant Aspect:	**NE**	**Total Basal Area:**	**122**
Average Slope:	20%	**AGS Basal Area:**	72
Soil Type(s):	Hildebrecht silt loam and Goss very cobbly silt loam	**B-level Basal Area:**	67
Predominant Stand Age:	Large poles to Small Sawtimber	**C-level Basal Area:**	52
Site Index & Species:	White oak- 62	**Average DBH:**	10.5
Stocking Level (%):	105.6%	**Trees/Acre:**	204
Merch Volume/Acre and Scale:	10 MBF Int. ¼ inch	**Snags/Acre:**	10
		Den Trees/Acre:	3
Common Overstory Trees:	Black oak, Post oak, White oak, Scarlet oak, and Black gum		
Common Midstory Trees:	White oak, Post oak, Black gum, Hickory, Red maple, Sugar maple, and Shingle oak		
Common Tree Regeneration:	Black oak, White oak, Hickory, Flowering Dogwood, Black gum, Red maple, and Sugar maple		
Common Understory Plants:	Desmodium species, Coralberry, Viburnum, Lowbush Blueberry, Aromatic sumac, and Dittany		
Ecological Site(s) (# and name):	F116AY062MO- Chert Exposed Backslope Woodland, F116AY002MO- Chert Protected Backslope Forest & F116AY004MO- Fragipan Upland Woodland		

Description of Stand Condition:

Stand one can be accessed off Hwy T on the western boundary, but a woods road or trail will be necessary to access the rest of the stand and property for any habitat and forestry management. Japanese honeysuckle and multiflora rose are present nearest the road and their presence drops off moving into the woods.

The overstory is composed of moderate quality black oak, white oak, post oak, and hickory sawtimber. Mature black oak, scarlet oak white oak, and hickory sawtimber are scattered throughout the stand and are beginning to show signs of decline in the canopy. The vast majority of the stand's basal area lies in the Acceptable Growing Stock (AGS) small sawtimber class and varies from 12-18 inches measures at Diameter at Breast Height (DBH). There is a small component of Unacceptable Growing Stock (UGS) small sawtimber including, poor form/suppressed oaks and hickories along with undesirable black gum. Midstory poles to small trees (2–10-inch DBH) are an even mixture of AGS oak/hickory and UGS black gum, red maple, sugar maple, and sassafras. Red maple and sugar maple are more prevalent on the lower slopes, but there are some parts of the stand where maple has encroached into the midstory upslope. In some areas, oak/hickory poles are not as plentiful and are becoming suppressed by undesirable shade tolerant species. Oak advanced regeneration is excellent in areas where openings exist, and the oaks already had a head start on the maple and black gum.

Stand Management Objectives:
Improve wildlife habitat as well as forest and woodland health

Desired Future Condition:
Uneven age oak/hickory forest and woodland

Stand Management Recommendations:
Primary recommendation for the stand are: Invasive species management, Timber harvest, and FSI. Optional recommendations include prescribed burning and edge feathering along the eastern stand boundary.

Invasive species management: Focus on keeping the Japanese honeysuckle and multiflora rose from encroaching into the woods, otherwise any forest management work will only further their spread. Continue to monitor your property at the least, twice a year for invasive species. For further information on invasive species control, please see Appendix IV.

Timber harvest: A commercial sale timber harvest is recommended to free up growing space and reallocate resources towards quality AGS small sawtimber and large poles. The focus of the timber harvest should be on removing poor form UGS small sawtimber and low-quality poles down to 10-inches DBH and salvaging the value from the scattered standing mature sawtimber before they further decline. Target a residual basal area of 74 Ba/acre by removing approximately 48 BA/acre of mature sawtimber and UGS small sawtimber and large poles. Mark as far as slope will allow. Opportunistically create gaps and favor higher quality white oak, black oak, scarlet oak, post oak, and hickory. Leave all den and cavity trees for wildlife. Road work, including rock, grading, and water bars will more than likely be necessary to reduce the effects of erosion post-harvest.

Post-harvest FSI: A new basal area will need to be established after the timber harvest. Any post-harvest FSI prescribed will be based upon the new basal area recorded. Follow the timber harvest within the next year with post-harvest FSI to clean up any damage done during the harvest and decrease the number of 4-8-inch UGS eastern redcedar, sugar maple, red maple, black gum, and any poor form or suppressed oak/hickory not taken during the timber harvest. All midstory/understory red maple, sugar maple, and black gum from 4-8- inches in diameter should be removed. Allow *some* of the maple to resprout to promote deer browse by not applying herbicide to the cut portion of the tree. Leave all flowering and fruiting species in the understory. The residual stand will benefit from the increased growing space and less competition for resources, encouraging more vigor throughout the stand. FSI can be implemented by single/double girdling and felling. For all of these methods except double girdling, herbicide will be needed to treat the wound and inhibit the UGS species (except eastern redcedar) from resprouting. When possible favor higher quality oak and hickory poles. Hack & squirt is another FSI option, but it is best to avoid this method when planning to have a prescribed burn after FSI. Hack & squirted trees remain standing dead for a long time, and these can be hazardous when conducting a fire. For further information on FSI, please see Appendix IV.

Prescribed Fire (Optional Recommendation): If desired, the undesirable understory can be controlled by conducting a prescribed fire. A fire would be particularly useful in controlling undesirable species < 2'' that will not be treated during the FSI. Prescribed fire in this stand can also be used to promote herbaceous growth and wildlife use. It is advisable to wait a few years to conduct a prescribed fire following a thinning treatment. It is advised to remove slash and heavy fuels from the bases of quality white oaks in the stand to preserve their economic value. Always follow an approved Burn Plan when prescribed burning. Contact NRCS for details on obtaining a burn plan if interested. Woodland burn units are typically on more exposed aspects (south and west) and are burned from November to Mid-March or April. The woods road running through the center of the stand can act as a burn line separating the more protected slopes and exposed slopes.

Edge Feathering (Optional Recommendation): Edge feathering can be utilized to provide a transitional area of brushy cover for wildlife in forested areas adjacent to a field. Identify and delineate 30' X 50' areas around fields where this habitat would be beneficial. Cut all trees greater than 15 feet tall and 1 inch in diameter within the delineated areas. Fell trees into loose piles. Cut stumps (except eastern redcedar) should be treated with approved herbicide to discourage unwanted species from resprouting.

Stand: 2 **Acres:** 48.5

Dominant Aspect:	**N-NE-E**	**Total Basal Area:**	**120**
Average Slope:	25%	**AGS Basal Area:**	69
Soil Type(s):	Goss very cobbly silt loam and Hildebrecht silt loam	**B-level Basal Area:**	66.8
Predominant Stand Age:	70	**C-level Basal Area:**	51.8
Site Index & Species:	White oak- 65	**Average DBH:**	10.4
Stocking Level (%):	103.2%	**Trees/Acre:**	205
Merch Volume/Acre and Scale:	9 MBF Int. ¼ inch	**Snags/Acre:**	21
		Den Trees/Acre:	4
Common Overstory Trees:	White oak, Black oak, Post oak, Northern red oak, and Hickory		
Common Midstory Trees:	White oak, Black oak, Black gum, Sugar maple, and Hickory		
Common Tree Regeneration:	Sugar maple, Black gum, Flowering dogwood, Black cherry Oak, Hickory, Red maple, White ash, and Sassafras.		
Common Understory Plants:	Aromatic sumac, Goldenrod, Lowbush blueberry, Viburnum, Coralberry, and Bluestem		
Ecological Site(s) (# and name):	F116AY062MO- Chert Exposed Backslope Woodland, F116AY002MO- Chert Protected Backslope Forest & F116AY004MO- Fragipan Upland Woodland		

Description of Stand Condition:

Access to this stand is not readily available at this time and a woods road or trail will be needed for any future habitat and forest management work. A very light amount of Japanese honeysuckle and multiflora rose can be found on the southern property boundary and near the old field boundary. The southern ridge top and western stand boundary are dry and rocky with mosses and large blueberry plants. The midstory composition contains low quality eastern redcedar, sassafras, blackjack oak, black hickory, but these species drop off moving east through the stand.

Mature and small sawtimber black oak, white oak, northern red oak, hickory, and post oak sawtimber quality is moderate to good quality, white oak quality and prevalence increases moving down slope. There is a small component of Unacceptable Growing Stock (UGS) small sawtimber including, poor form/suppressed oaks and hickories along with undesirable black gum. The midstory component is sparse but where present, it is an even mixture of AGS oak/hickory and UGS black gum, red maple, sugar maple, black cherry, and sassafras. Advanced regeneration and seedling regeneration of oak and hickory is not a problem as of now, but it is important to ensure UGS maple and black gum does not shade out the AGS oak/hickory regeneration.

Stand Management Objectives:
Improve forest health and sustainability

Desired Future Condition:
Uneven age oak and hickory forest

Stand Management Recommendations:
Primary recommendations for the stand are: Invasive species management, Timber harvest, and FSI. Optional recommendations include prescribed fire and edge feathering along the stand's western boundary.

Invasive species management: At this time, only a light amount of Japanese honeysuckle and multiflora rose is present in the stand along the western boundary near the overgrown field. Focus on keeping the Japanese honeysuckle and multiflora rose from encroaching into the woods, otherwise any forest management work will only further their spread. Continue to monitor your property at the least, twice a year for invasive species. For further information on invasive species control, please see Appendix IV.

Timber harvest: An uneven age commercial sale timber harvest is recommended to free up growing space and reallocate resources towards quality AGS small sawtimber and large poles. The focus of the timber harvest should be on removing poor form UGS small sawtimber and low-quality poles down to 10-inches DBH and salvaging the value from the scattered standing mature sawtimber before they further decline. Target a residual basal area of 70 Ba/acre by removing approximately 50 BA/acre of mature sawtimber and UGS small sawtimber and large poles. Mark as far as slope will allow. Opportunistically create gaps and favor higher quality white oak, black oak, scarlet oak, post oak, and hickory. Leave all den and cavity trees for wildlife. Road work, including rock, grading, and water bars will more than likely be necessary to reduce the effects of erosion post-harvest

Post-harvest FSI: A new basal area will need to be established after the timber harvest. Any post-harvest FSI prescribed will be based upon the new basal area recorded. Follow the timber harvest within the next year with post-harvest FSI to clean up any damage done during the harvest and decrease the number of 4-8-inch UGS eastern redcedar, sugar maple, red maple, black gum, and any poor form or suppressed oak/hickory not taken during the timber harvest. All midstory/understory red maple, sugar maple, and black gum should be removed. Leave all flowering and fruiting species in the understory. The residual stand will benefit from the increased growing space and less competition for resources, encouraging more vigor throughout the stand. FSI can be implemented by single/double girdling and felling. For all of these methods except double girdling, herbicide will be needed to treat the wound and inhibit the UGS species (except eastern redcedar) from resprouting. When possible, favor higher quality oak and hickory poles. Hack & squirt is another FSI option, but it is best to avoid this method when planning to have a prescribed burn after FSI. Hack & squirted trees remain standing dead for a long time, and these can be hazardous when conducting a fire. For additional information on FSI, please see Appendix IV.

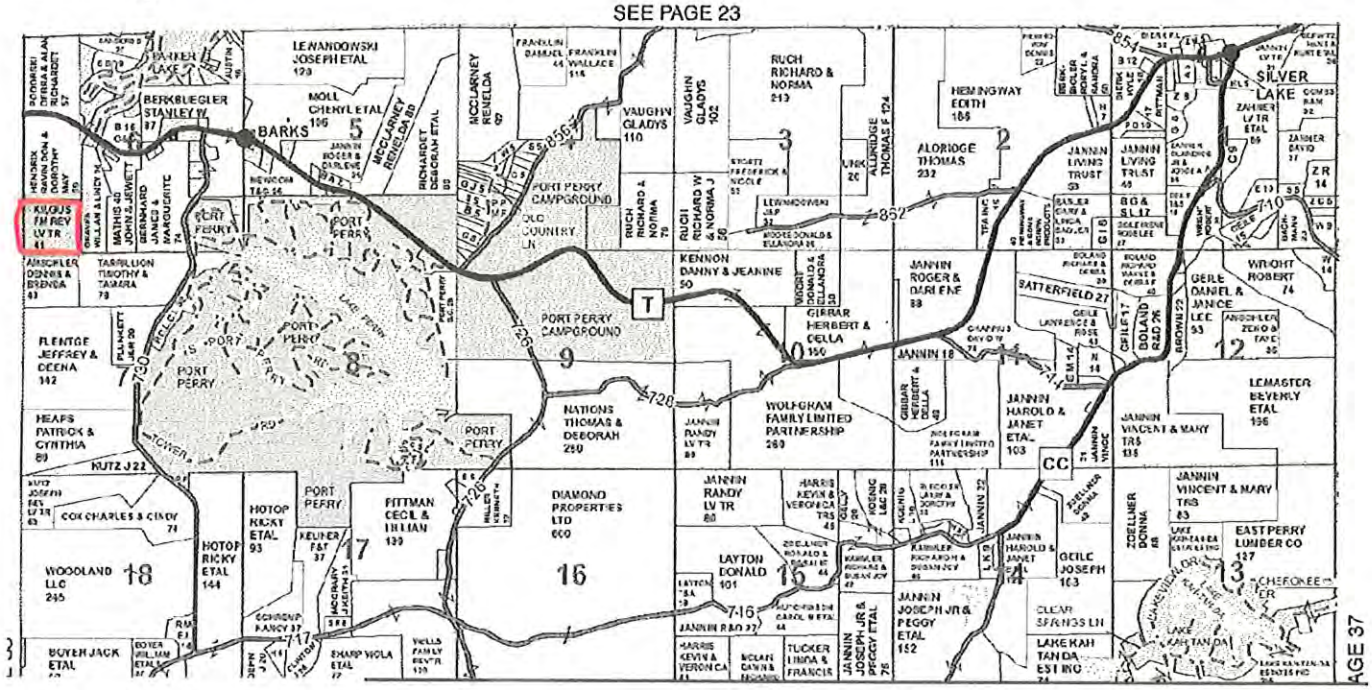
Prescribed Fire (Optional Recommendation): If desired, the undesirable understory can be controlled by conducting a prescribed fire. A fire would be particularly useful in controlling undesirable species < 2'' that will not be treated during the FSI. Prescribed fire in this stand can also be used to promote herbaceous growth and wildlife use. It is advisable to wait a few years to conduct a prescribed fire following a thinning treatment. Always follow an approved Burn Plan when prescribed burning. Contact NRCS for details on obtaining a burn plan if interested. Woodland burn units are typically on more exposed aspects (south and west) and are burned from November to Mid-March or April.

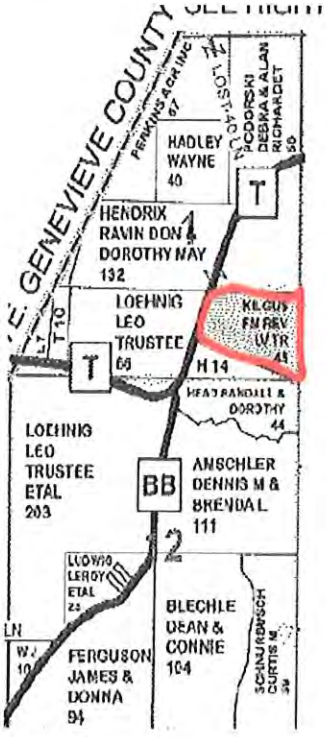
Edge Feathering (Optional Recommendation): Edge feathering can be utilized to provide a transitional area of brushy cover for wildlife in forested areas adjacent to a field. Identify and delineate 30' X 50' areas around fields where this habitat would be beneficial. Cut all trees greater than 15 feet tall and 1 inch in diameter within the delineated areas. Fell trees into loose piles. Cut stumps (except eastern redcedar) should be treated with approved herbicide to discourage unwanted species from resprouting.

APPENDIX I – Location Information/Plat Map

Township 34N - Range 9E

SEE PAGE 23

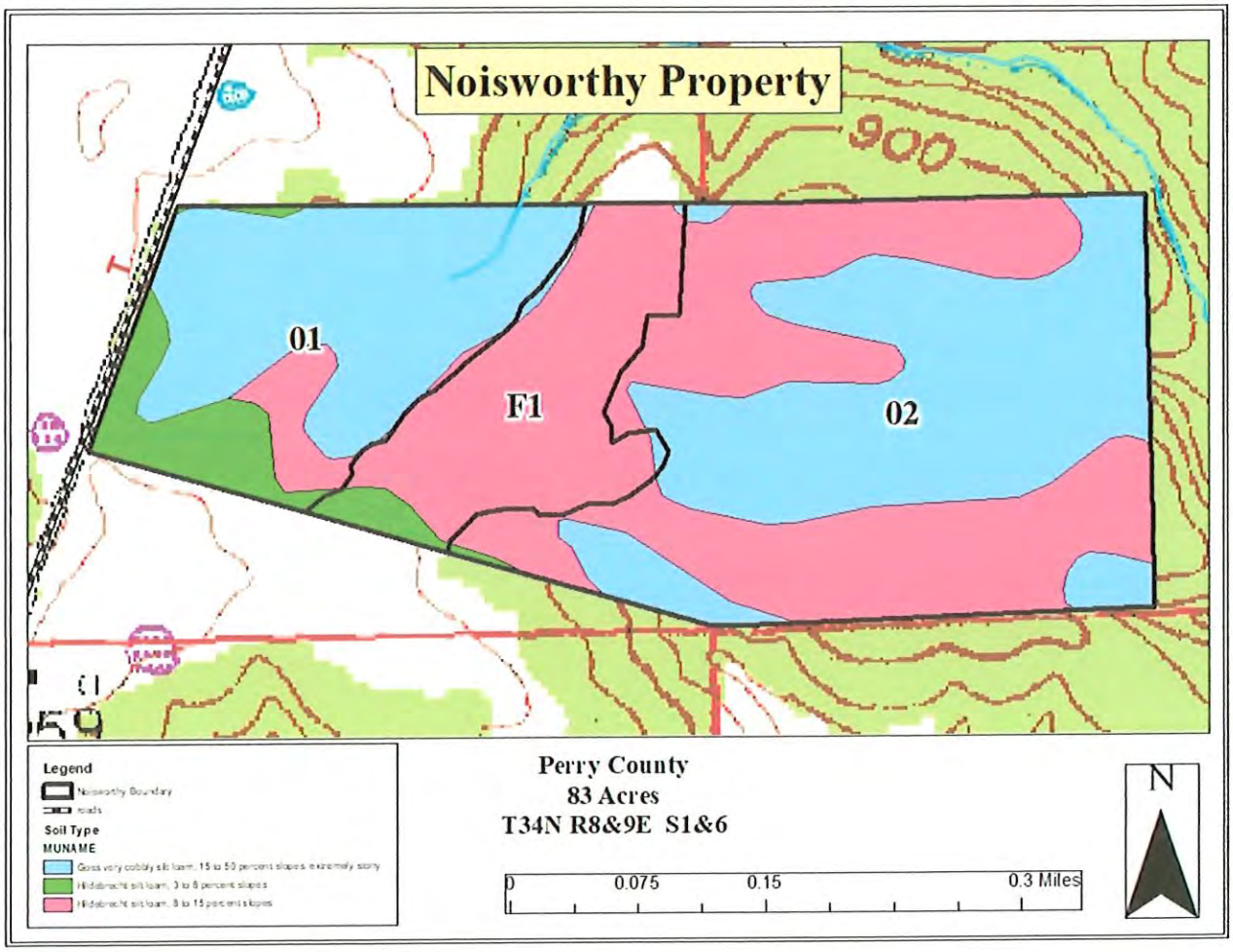




APPENDIX II – Soil Information

Soils are the foundation on which trees grow. Not all soils have the same ability to grow trees. Bottomland soils and north and east facing slope soils are usually more productive. They retain soil moisture and have the capability of producing good tree growth. On south and west facing slopes, soils are usually shallower in depth, lose soil moisture quicker, and are not as productive for tree growth. Having a knowledge and understanding of soils provides the forest owner and manager with a better idea of forest land potential.

Soil Map:



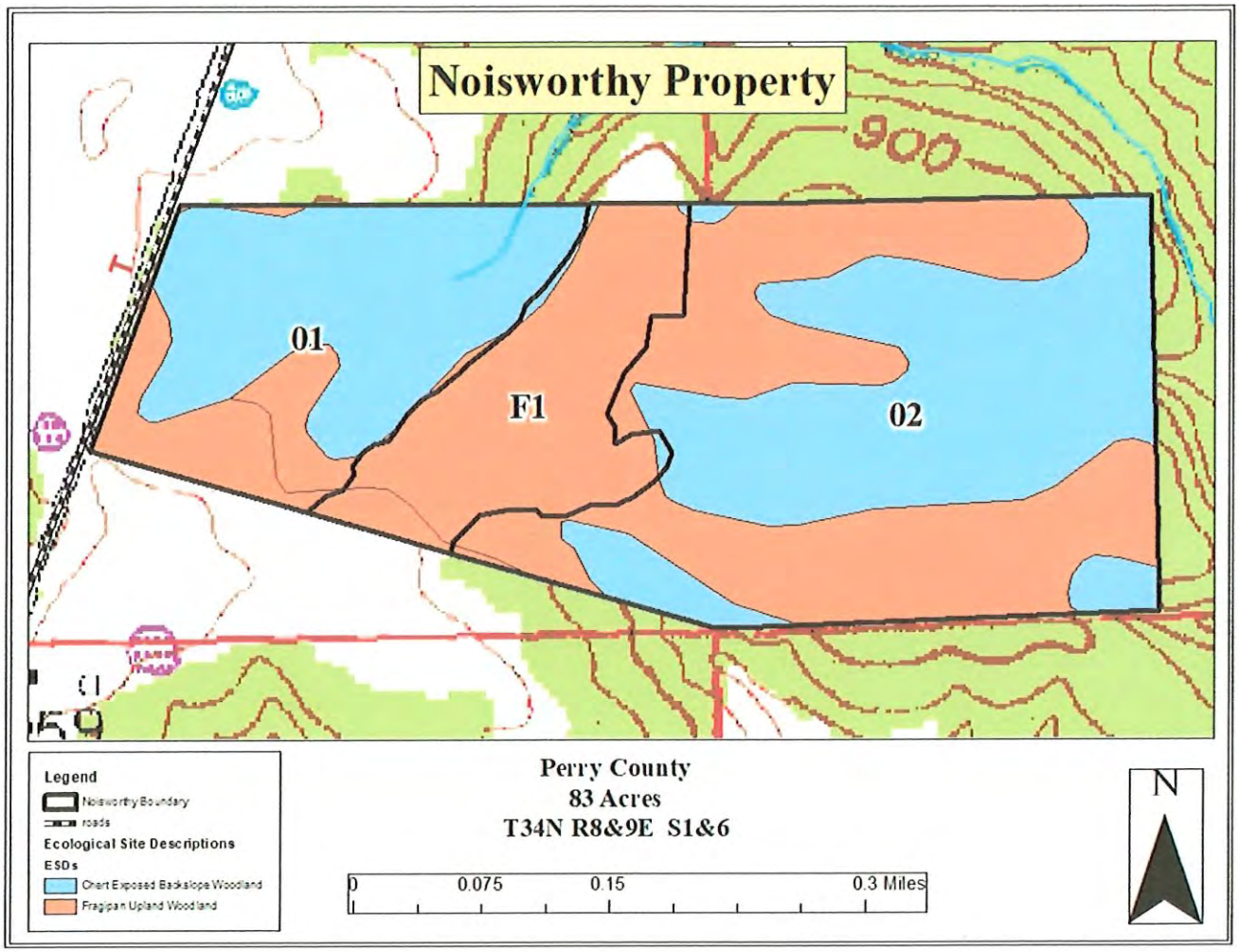
Description of Your Soils

A brief description of your soil types is discussed below. These condensed descriptions are included for quick reference.

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
73210	Goss very cobbly silt loam, 15 to 50 percent slopes, extremely stony	40.4	48.6%
73272	Hildebrecht silt loam, 3 to 8 percent slopes	4.9	5.9%
73456	Hildebrecht silt loam, 8 to 15 percent slopes	37.9	45.5%
Totals for Area of Interest		**83.1**	**100.0%**

For more detailed information about the soils found on your property contact your local USDA, NRCS (Natural Resource Conservation Service) office at 1003 N. Main, Perryville, MO 63775

Ecological Site Map



APPENDIX III – Topographic Map