Forest Management Plan for
Boone Forks Wildlife Management Area
Northeast Portion (NE)

Iowa Department of Natural Resources

Plan Date: February 13, 2023

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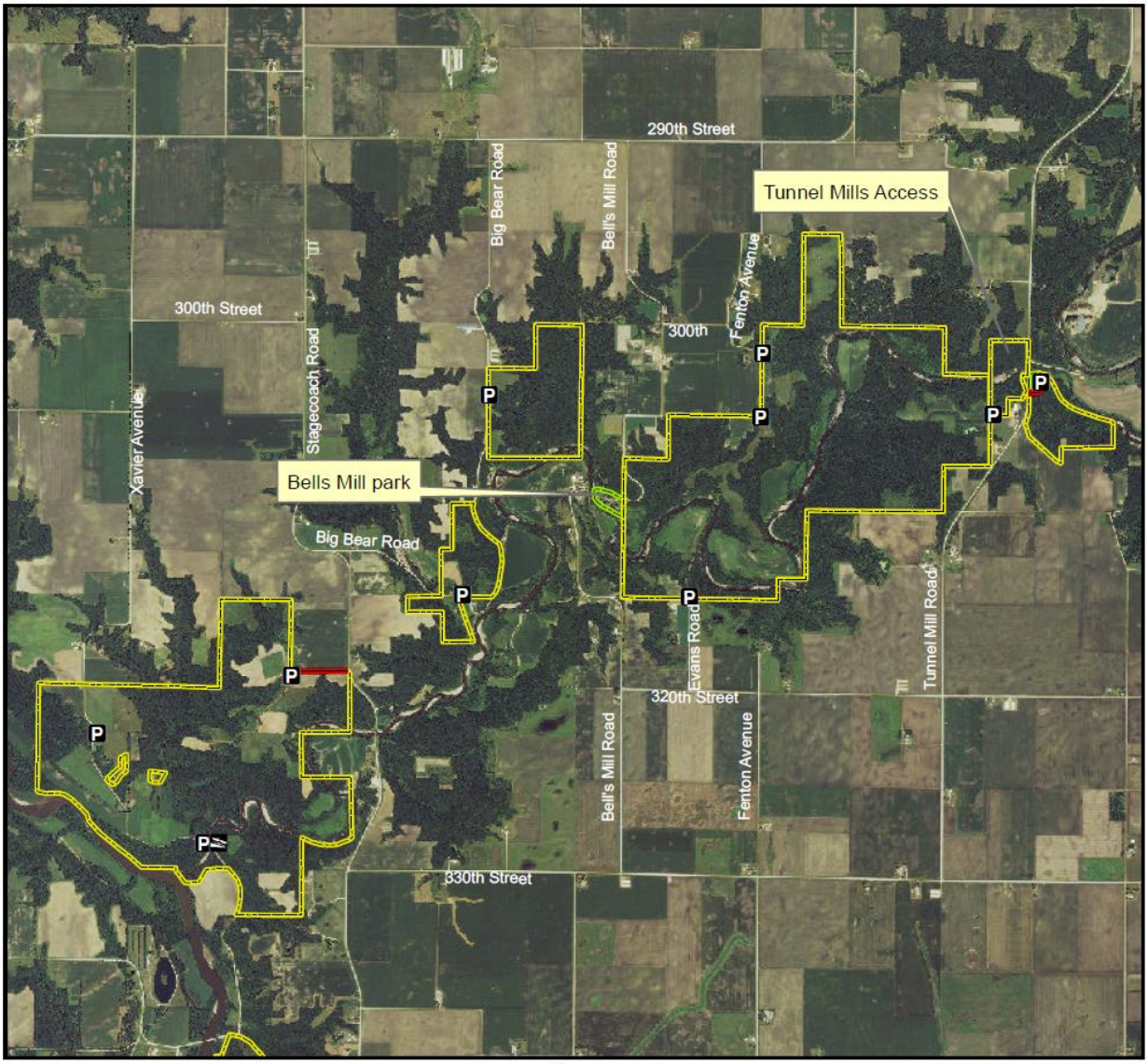
Boone Forks Wildlife Management Area - NE



Legend

State Areas open to hunting
- WMA Boundary
- Boat Ramp
- Parking Lot
- Access Road
- Other Public Land

2013 Aerial Photography

Map Creation Date: 8/2014

N

Miles 0 0.25 0.5

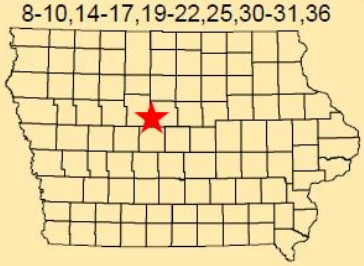
Acres: 4,456

Habitat: 3/4 Timber, 1/4 Upland, River Access

Species: Deer, Turkey, Pheasant, Dove

Contact: Josh Gansen
Saylorville Wildlife Unit
515-432-2545

Webster & Hamilton Counties, Iowa
T-86&87N, R-26&27W, Sections 1-3,6, 8-10,14-17,19-22,25,30-31,36



Directions: 3 miles E of Lehigh on D46.

Every effort has been made to accurately depict the boundaries on this map. However, users should rely on boundary signs actually located in this area to ensure they do not trespass on private property.

Introduction

This plan summarizes the current condition of forested habitat in the Boone Forks Wildlife Management Area (WMA) and identifies silvicultural management activities intended to improve its future health and condition. The Boone Forks WMA is part of a State-designated Bird Conservation Area (BCA) and Protected Water Area (PWA) as identified in Iowa legislative code. In addition to the hunting & fishing opportunities, wildlife habitat, soil and watershed protection, and natural biodiversity, this large piece of contiguous natural forest provides economic benefits to the area in the way of outdoor recreation and tourism, fall color viewing, mushroom hunting, forest & timber products, and more. The goal of this effort is to manage the forests of the Boone Forks WMA to benefit wildlife species, plant communities, terrestrial and aquatic ecosystems, and both current and future recreational users of the Boone Forks WMA.

This plan focuses specifically on the 2,100+ acres in the northeast (NE) portion of the Boone Forks WMA depicted in the map above. There are another 1,100 +/- acres in the southwest (SW) portion of the Boone Forks WMA that will be addressed in a future plan.

This plan represents a collaborative effort among DNR staff from the Wildlife Bureau, Forestry Section, and other DNR staff, as well as input from WMA users and local county conservation departments. Funding for this work was provided in part by the US Forest Service Landscape Scale Restoration (LSR) program.

Forest/Wildlife Habitat Goals

The overall goals of this forest management plan for Boone Forks WMA include:

1. Maintain and improve overall wildlife habitat for both game and nongame species in alignment with Iowa's Wildlife Action Plan
2. Diversify the forest both in terms of species makeup and age-classes/successional stages, with a special emphasis on oaks as a keystone species as cited in Iowa's Forest Action Plan
3. Provide robust, unfragmented habitat that supports the 245 or more species of nesting and migratory birds of the Boone Forks Bird Conservation Area (BCA)
4. Protect high-quality habitat for all Species of Greatest Conservation Need (SGCN)
5. Maximize forest health by strengthening its resiliency in the face of new pests & diseases
6. Maintain and enhance other societal benefits provided by forests including watershed protection, outdoor recreation, air quality, carbon sequestration, aquatic habitat, diversification of the rural economy and jobs, and more

Current Conditions

There is a total of 2,161 forested acres addressed in this plan, lumped into 117 unique stands. The stands were delineated using GIS coverages including current and historic aerial photography, LiDAR terrain maps, USDA soil mapping units, and other ancillary datasets. Stands are generally homogenous across their extent in terms of forest composition, age, and density. Maps depicting the locations of all stands are included in Appendix 1. The average stand size is 18.5 acres, with a range of 1.8 acres to 95.5 acres.

Field reconnaissance and forest inventory data was collected for each stand by Forestry/Wildlife field staff in 2019-2020. Information was recorded for each forest stand including overstory species composition, density/stocking, forest health concerns, invasive species observations, understory composition, predominant regeneration species, and general management recommendations. These findings were entered into a GIS database used by the Iowa DNR to plan and schedule forest management activities. A table summarizing the GIS data is included in Appendix 1.

A written narrative was also created for each unique forest stand. These narratives contain the most detailed information about each forested stand, but are not included in this abridged document.

Size Classes and Successional Stage

In terms of the size class distribution, the forests at Boone Forks WMA are skewed towards larger/older forests. The table below summarizes the data by average tree size class. Combining the two largest categories, "small sawtimber and sawtimber," we see that over 86% of the forests are in a late-successional stage.

Table 1. Description of forest size classes and their prevalence in the Boone Forks WMA (NE).

Size class	No. of Stands	Acres	Percent	Importance
Seedling (0-1”)	1	17	0.7%	Young “early-successional” forest habitat is important for quail, pheasant, woodcock, rabbit, specialist songbirds. Young forests represent future replacement trees and are less impacted by severe storms & diseases.
Sapling (1-3”)	12	98	4.5%	
Poletimber (4-11”)	16	175	8.1%	Transitional stage that is critical management point for deciding future stand composition, mast production, crown size, and tree health
Small Sawtimber (12-17”)	54	1,064	49.2%	Old, “late-successional” forest habitat has large trees with cavities, dead wood for insects, roost and mast trees, complex structure with multiple canopy layers. Old forests are more at-risk by storms and disease but support a unique suite of species like Northern Long-eared bat, Southern Flying Squirrel, Pileated Woodpecker, Red-shouldered Hawk, Eastern Screech-Owl, and Cerulean Warbler
Sawtimber (18”+)	34	807	37.3%	

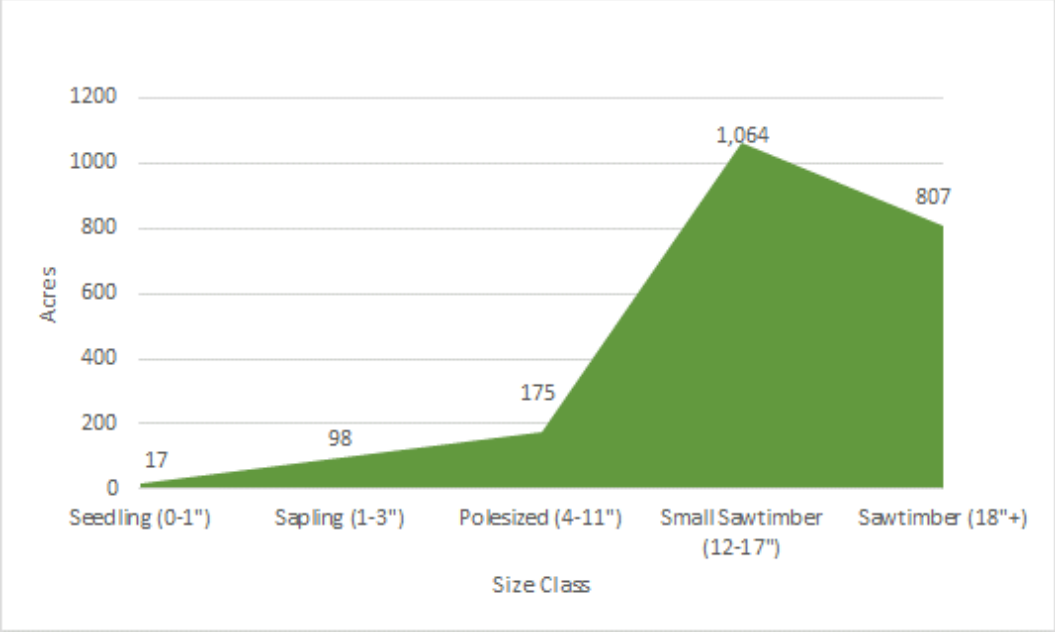


Figure 1. Acres of forest by size class in the Boone Forks WMA (NE).

Species and Forest Composition

In terms of species and forest plant community composition, the Oak-Hickory woodland type and Central Hardwoods type are the most common types as portrayed in the table below. For definitions of these forest associations, please see Appendix 2.

Table 2. Summary of overstory forest composition types in the Boone Forks WMA (NE).

Overstory Types of all Stands	No. of Stands	Acres	Percent
Oak-Hickory	45	808	37.4%
Central Hardwoods	34	768	35.5%
Bottomland Hardwoods, First Bench	15	283	13.1%
Bottomland Hardwoods, Second Bench	17	213	9.8%
Maple-Basswood	1	53	2.5%
Black Walnut	2	18	0.9%
Exotics	1	7	0.3%
Plantation	1	6	0.3%
Aspen	1	4	0.2%

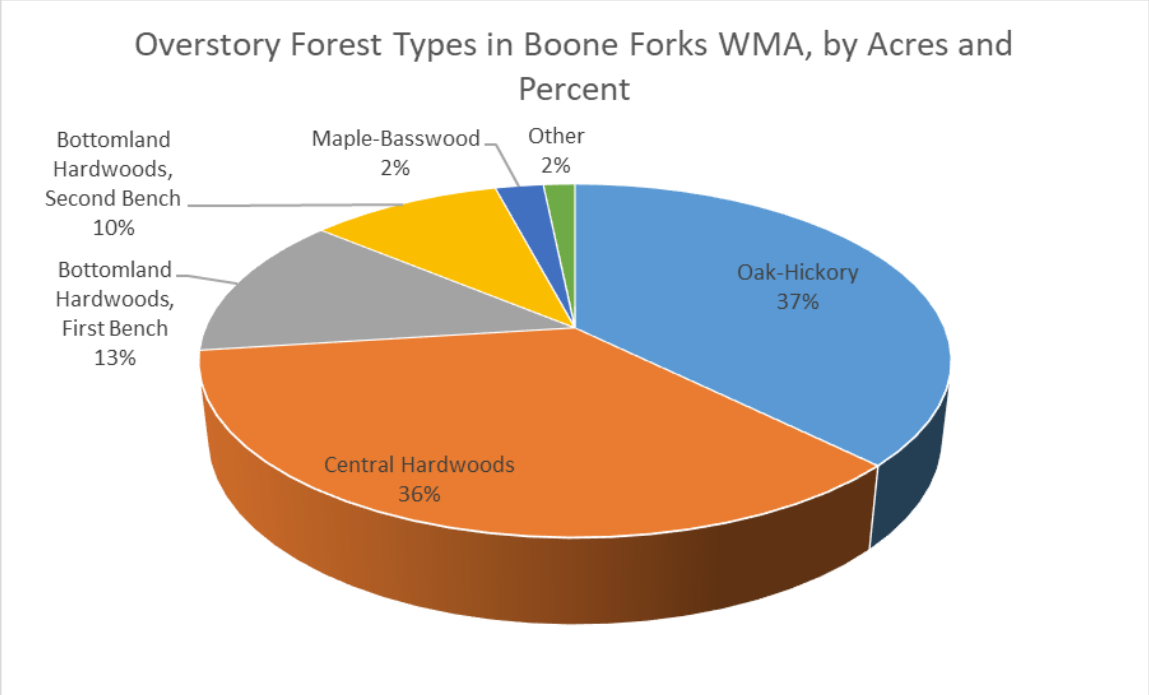


Figure 2. Overstory types in Boone Forest WMA (NE), by acres and percent.

Regeneration Species and Future Forest Composition

The composition of the future forests of Boone Forks WMA is captured by the "Regeneration" status of the current conditions forest inventory. Regeneration species are those occurring on the forest floor and midstory layers of the forest canopy and represent the next generation of trees that will succeed into the overstory as time goes on. The data paint a clear picture of a future forest that will transition away from Oak-Hickory type towards a more mixed species composition.

Table 3. Summary of tree regeneration species types in the Boone Forks MWA (NE).

Predominant regeneration species type across all stands	No. Stands	Acres	Percent
elm-bitternut hickory-ironwood	21	480	22%
elm-ash-hackberry	22	357	16%
maple-basswood	10	241	11%
mixed upland hardwoods	12	219	10%
mixed hardwoods	5	180	8%

Predominant regeneration species type across all stands	No. Stands	Acres	Percent
ironwood	9	168	8%
hackberry-silver maple-elm-ash	7	100	5%
red cedar-mixed hardwoods	9	81	4%
boxelder	4	78	4%
hard maple (sugar or black)	2	69	3%
Other	16	188	<3% ea.
Oak-Hickory	0	0	0%

Oak Woodland Size Distribution and Successional Stage

To further illustrate the future forecast for the Oak-Hickory forest type, the stand size class of all Oak-Hickory stands was analyzed to assess the demographic breakdown. As the data below shows, just 55 acres (7%) of oak stands are in the pole-sized stage of growth (4-11" DBH) and just 2%, or 17 acres, are in the seedling stage (trees less than 4.5 feet tall). That means 91% of all Oak-Hickory forest type stands at Boone Forks are sawtimber sized and larger, implying a large deficit to come for future generations.

Table 4. Summary of Oak-hickory woodland size classes in the Boone Forks WMA (NE).

Avg. DBH of Oak-Hickory Stands	No. Stands	Acres	Percent
Seedling (0-1")	1	17	2%
Poletimber (4-11")	4	55	7%
Small Sawtimber (12-17")	28	549	68%
Sawtimber (18"+)	12	186	23%

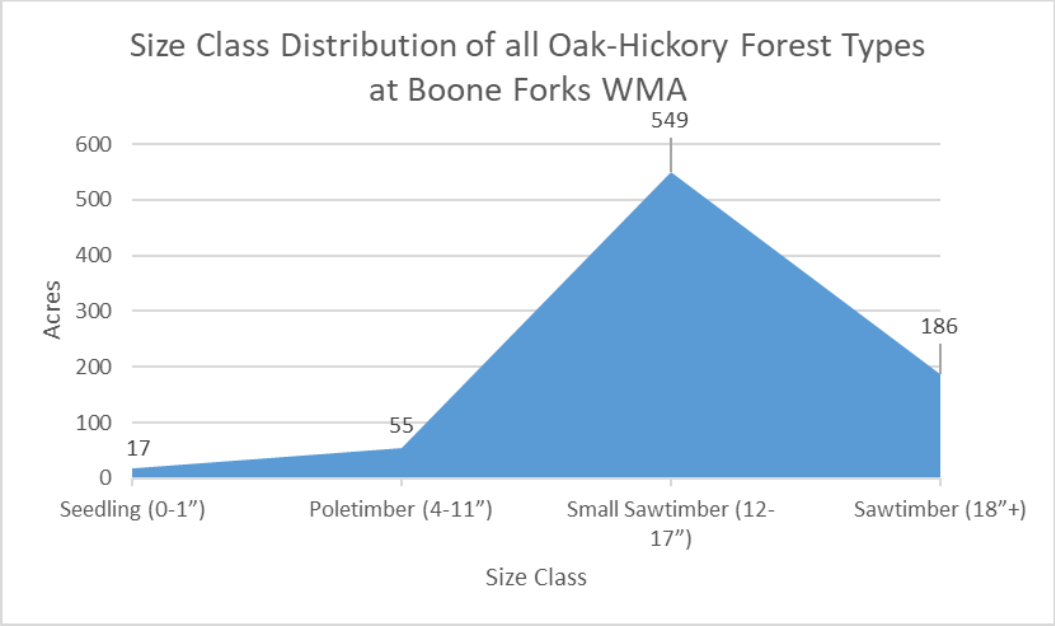


Figure 3. Size class distribution of all oak-hickory forest types at the Boone Forks WMA (NE).

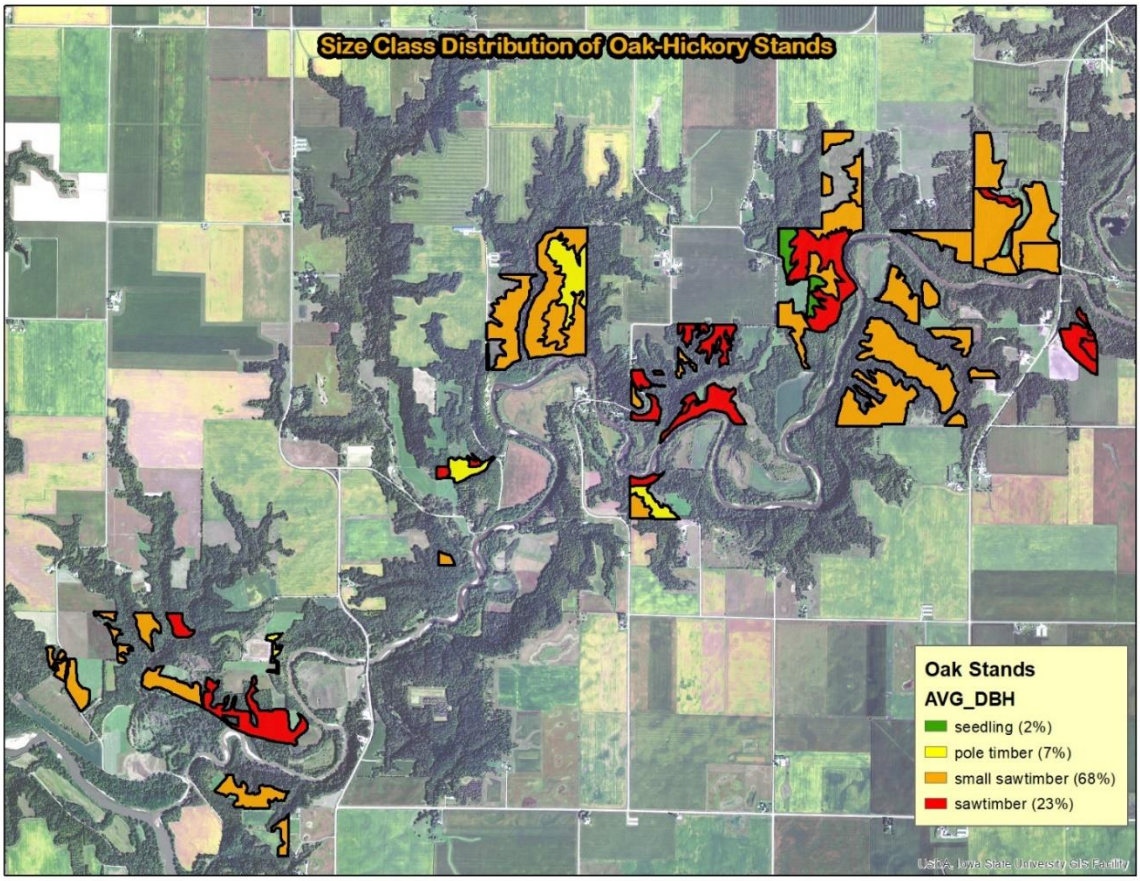


Figure 4. Distribution of oak-hickory stand by size class.

Forest Health Concerns

All stands had primary and secondary forest health concerns recorded during the field inventory/data collection. The top 5 most prevalent primary forest health concerns are depicted in the map below, with the frequency (number of stands having that issue as its primary concern) noted in parentheses. We see that Dutch Elm Disease and invasive plant infestations rank first and second in terms of forest health, followed by oak wilt/oak decline issues.

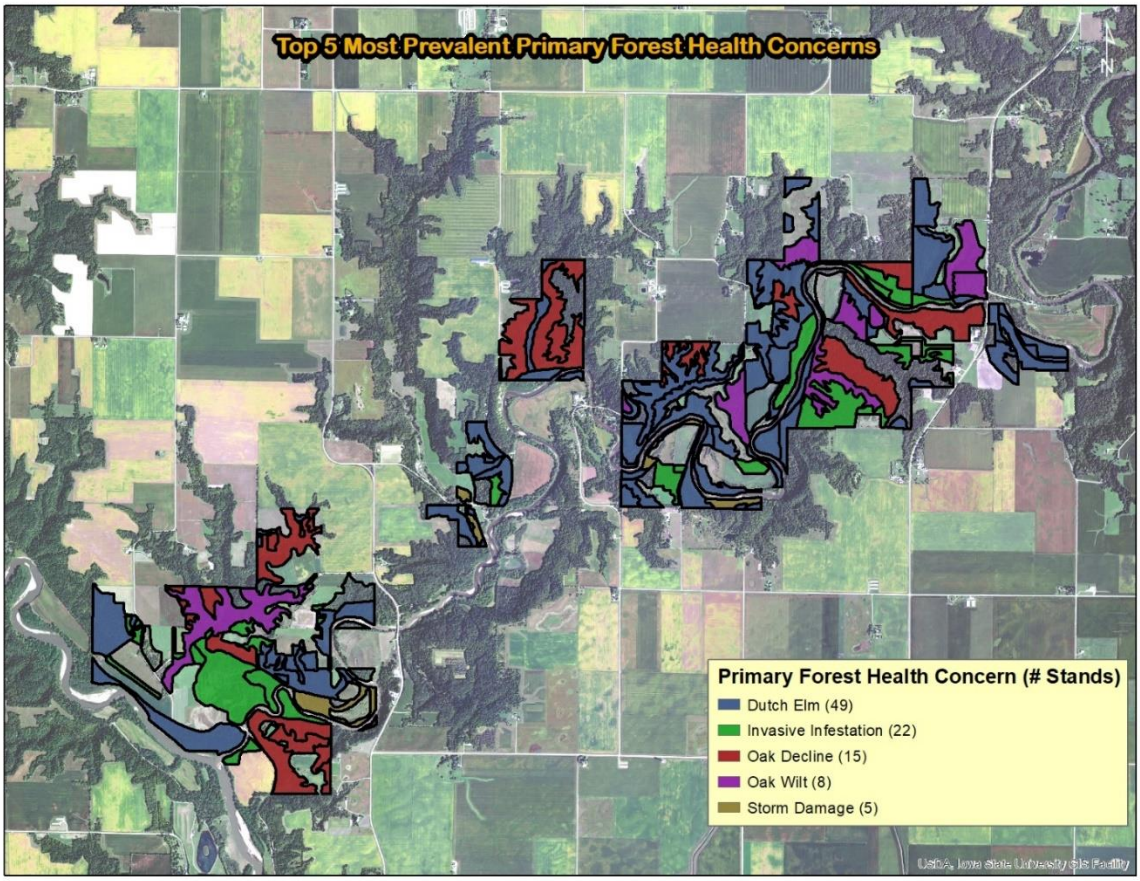


Figure 5. Distribution of the top five most prevalent primary forest health concerns in the Boone forks WMA (NE).

With respect to oak forest health problems specifically, 17 out of the total 45 total Oak-Hickory stands had either Oak Wilt or Oak Decline observed, comprising 394 acres in Boone Forks WMA. This represents 49% of all Oak-Hickory forest type acres. Interestingly, when we look at all forest types (not just Oak-Hickory), a total of 26 stands of representing 763 acres had the presence of Oak Wilt/Oak Decline, suggesting that these diseases may have already contributed to the degradation and transition from those stands away from an Oak-Hickory dominated stand to a more mixed/central hardwood forest type.

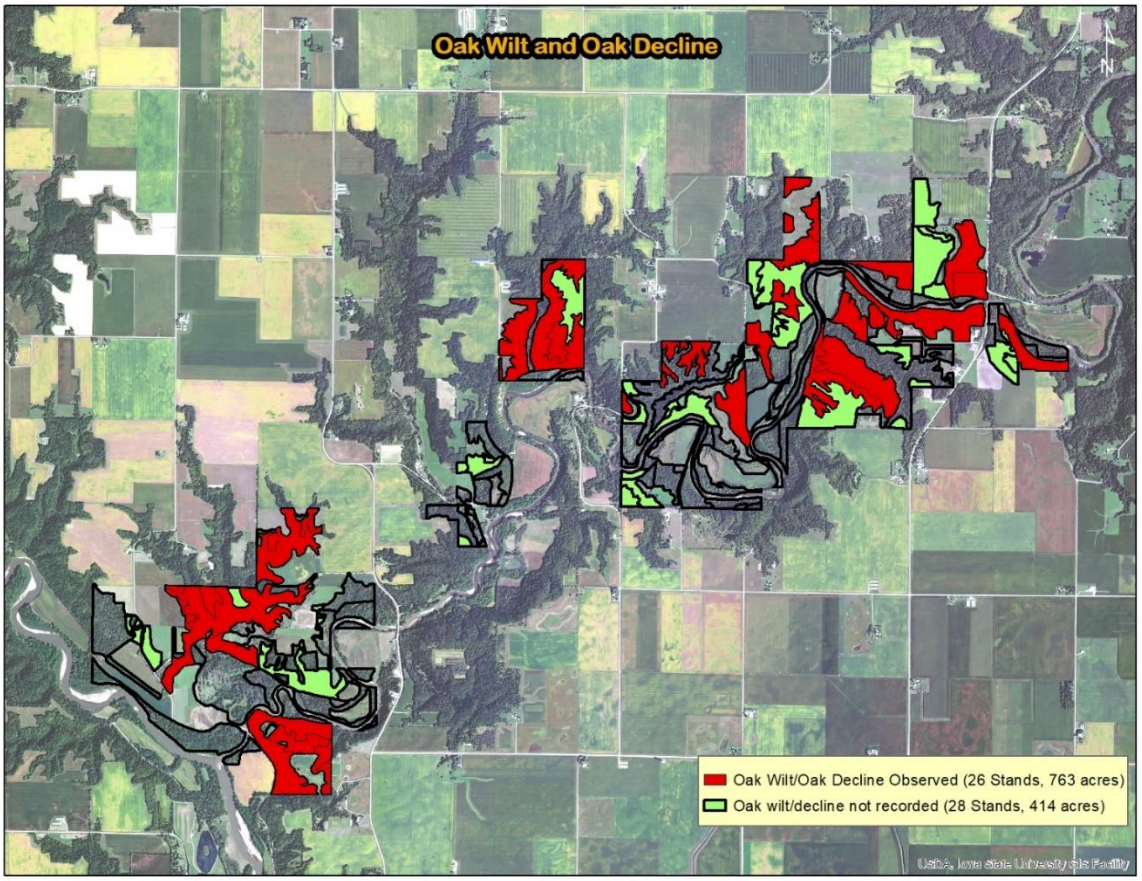


Figure 6. The distribution of oak wilt and oak decline across all Boone Forks WMA (NE) stands.

Invasive Plant Populations

All invasive plants observed during field work were recorded and entered in the GIS database for each stand. Only 17 out of 117 stands did not have any occurrences of an invasive plant species; in terms of stand-acres, invasive plants were observed in 91% of Boone Forks WMA forested areas. The following table breaks down the acres affected by species, followed by a map depicting the most heavily-infested stands in terms of unique species observed. It should be noted that the GIS database only allows for entry of up to three (3) unique invasive species.

Table 5. The prevalence of invasive species across stands in the Boone Forks WMA (NE).

Species	Total Stand Acres	Percent of all stand acres
Honeysuckle	1573	73%
White Mulberry	679	31%
Garlic Mustard	638	30%
Multiflora Rose	456	21%
Buckthorn	406	19%
Autumn Olive	333	15%
Reed Canary Grass	235	11%
Siberian Elm	40	2%

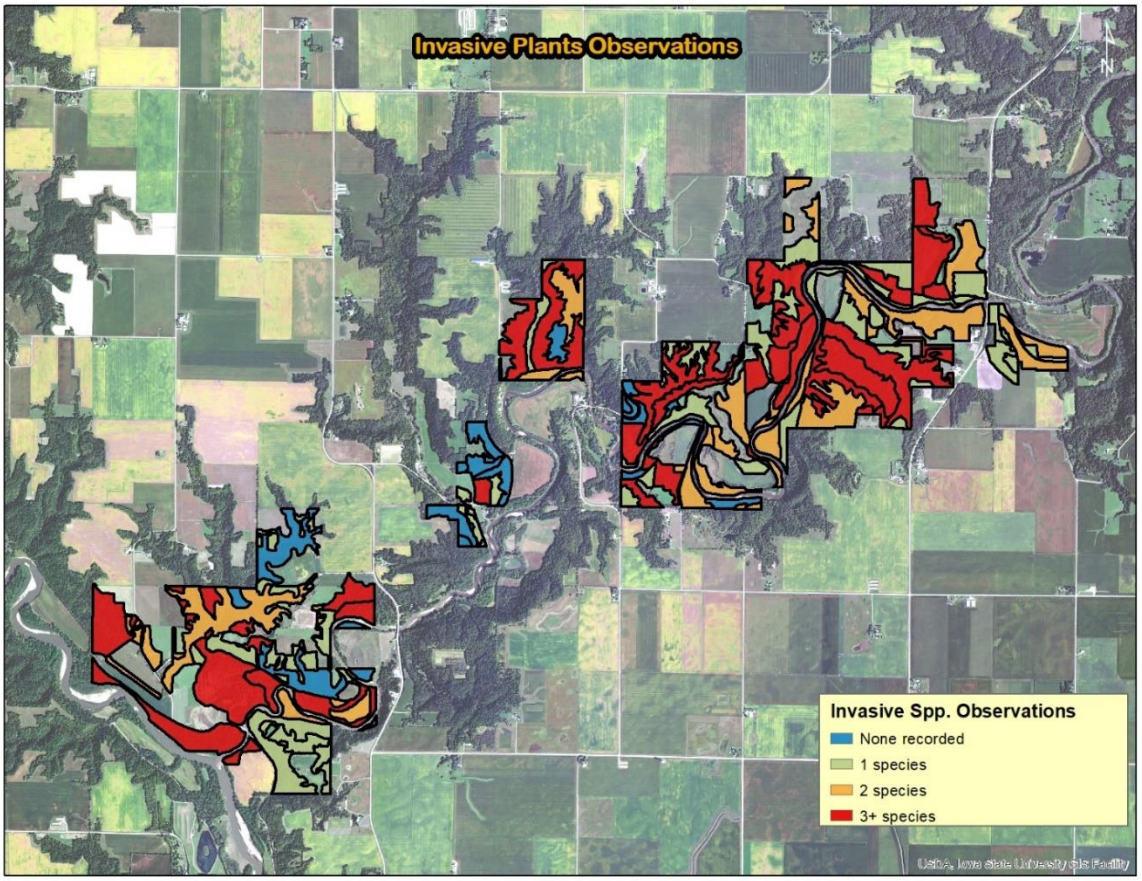


Figure 7. The number of invasive plant species observed in each stand in the Boone forks WMA (NE).

Non-forested Areas

As part of the land inventory and planning process, all "open field" areas at Boone Forks WMA were mapped out in GIS, which included crop leases, pasture/hay fields, food plots, and some brushy areas in the early stages of volunteer tree encroachment. This effort yielded roughly 700 acres of land that is essentially non-forested at the present time.

USDA soils data were then cross-referenced to identify which of these areas were historically forested; i.e. the "native vegetation" of the soil types is listed as either "Forest" or "Transitional" oak savanna. These areas represent high priority opportunities for reforestation at Boone Forks WMA to replenish the amount of land in young forest habitat and encourage oak-hickory forest types.

The resulting dataset was given one final pass to "square up" fields and identify small, irregular peninsulas that would be hard to farm or hay and which would be prone to quick tree colonization if left idle. The culmination of this was a database of 29 fields totaling 271 acres that represent a high priority for reforestation with oaks and other native trees & shrub species. The following map shows the location and layout of these fields colored in bright green.

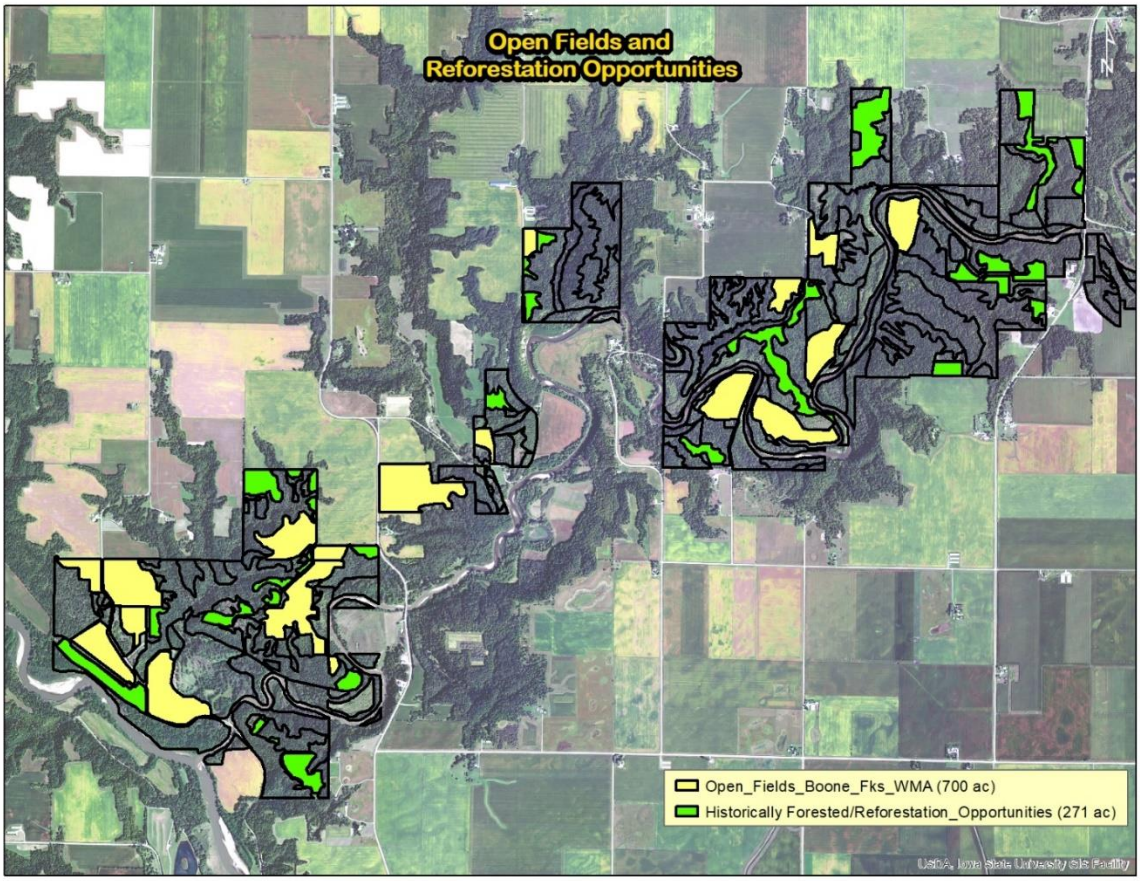


Figure 8. Historically forest areas that are currently fields (green) and open field area (yellow) on the Boone Forks WMA (NE).

Current Forest Conditions - Key Points:

- 86% of all stand acres in Boone Forks are in a 12" and larger DBH size class. While this is good for old-forest wildlife that need cavities and dead wood, it limits species that need early-successional habitat and puts the forest more at-risk for storms and disease issues
- There are at least 8 unique invasive plant species present in 91% of all forested stand acres in the Boone Forks WMA
- Honeysuckle is by far the most widespread and impactful invasive plant, affecting over 1,500 cumulative acres, or nearly 75% of the total acres
- The data surrounding Oak-Hickory woodlands suggest a large deficit in that forest type to come for future generations:
    - 88% of current Oak-Hickory stands have at least one invasive plant species in the understory, complicating natural regeneration
    - Nearly half (49%) of all Oak-Hickory acres have significant Oak Decline or Oak Wilt observed in mature overstory trees
    - 0% of current Oak-Hickory stands have adequate advanced oak regeneration to sustain themselves as oak woodlands at this time
    - Just 9% of all current Oak-Hickory forest stands at Boone Forks are "young", defined as less than 12" DBH in size
- There are approximately 700 acres of non-forested lands in the Boone Forks WMA that could be reforested. Some of these are being used for food plots, crops, or hay, while others are idle and filling in with pioneer trees/brush. Of these areas, 271 acres (39%) were either historically forested or oak savanna habitat, or are small/irregular polygons that represent key opportunities to be put back to diverse native trees & shrubs and reduce forest fragmentation.

Silvicultural Treatments to be Used

The following are general descriptions of seven forest management (silvicultural) treatment actions that will be applied at Boone Forks WMA to address some of the primary concerns identified by the forest inventory and to accomplish the goals laid out at the beginning of this plan. The exact details of each treatment will vary in timing, extent, and procedures as projects move from the planning stage to execution. More detailed site-scale planning will be done in many cases, beyond what is described here. For instance, when planning harvests or tree plantings, the exact locations of skid roads, log landings, stream crossings, and the particular species to be replanted, method of planting, number of seedlings, maintenance and protection will all be carefully planned at the time of project implementation. In some cases, contractors will be used to accomplish work. Stand-scale reviews by DNR Natural Areas Inventory staff will precede any actions that may potentially impact legally protected plant or wildlife species.

Open Field Reforestation

This treatment involves planting bareroot seedlings by machine method, direct seeding, by hand, or using a combination of all three to establish new forest habitat in old fields, old pastures, or other non-forested areas that will support desired trees. Site preparation & post-planting maintenance are included. Typical machine plantings are done at 600 seedlings per acre, but exact methods to be used, species mix, planting or seeding rates, time of year, and maintenance routines will be planned on a site-specific scale for each individual project. In some cases, native herbaceous plant ground covers (e.g., Virginia wild rye, sideoats grama, little bluestem, wild bergamot, partridge pea, etc.) will be seeded ahead of tree planting to increase diversity and wildlife benefits as opposed to using non-native monoculture seedings. This practice represents the most efficient way of successfully increasing the amount of acres of young oak forest type across the WMA as compared to trying to naturally regenerate oak inside of existing forested stands. It also helps defragment the landscape by “filling” in wildlife corridors and gaps in forested habitat.

Oak Shelterwood and Prescribed Burning

An oak shelterwood is a long-term natural regeneration technique used in oak-hickory ecosystems under certain conditions. It deploys a combination of repeated prescribed burnings and thinnings to reduce unwanted trees from the forest floor and middle canopies to allow partial sunlight into the forest. In some cases, a selective commercial harvest removes a portion of canopy trees from the overstory to complement the non-commercial thinning. Enough large oak trees are left in the overstory to provide a seed source and to shade or “shelter” the ground, allowing oaks to germinate and grow while suppressing competing trees. This process can take many years, if not decades, and repeated treatments to recruit new oak saplings in adequate numbers.


Prescribed burning is used repeatedly and often in the shelterwood process to eliminate very small woody plants from the forest floor and understory. The prescribed fire helps improve oak germination by reducing leaf litter and competition and by increasing the soil temperatures after burning. Oak and hickory seedlings have deep taproots and resprout readily after being burned from the roots. Once an abundance of oak seedlings has become established, burning will be paused to allow them to grow taller into the midstory and overstory canopies.

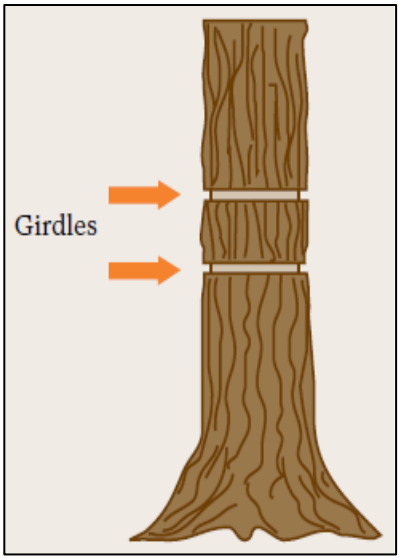
Shelterwood thinnings will target surplus common species in the midstory and understory such as ironwood, elm, hackberry, cherry, ash, and others less than 12" diameter at breast height (see Weed Tree Removal, WTR below). Thinning objectives will take the average stand density from approximately 120 sqft/acre down to a residual target of 50-70 sqft/acre by removing trees from below the median diameter and targeting unwanted/surplus species. The thinning may be implemented in phases to help monitor changes to the woodland more gradually. Small trees will be cut low to the ground and lopped into pieces to decompose. In some stands, small weed trees may be killed and left standing using a "hack-and-squirt" method. Some large trees may be girdled and left standing for insect/woodpecker/ den trees. No trees will be girdled and left standing close to roads, parking lots, etc. Pesticides will be carefully applied to the cut stumps of trees using 41% glyphosate to prevent them from resprouting. This work would largely take place from November - March.

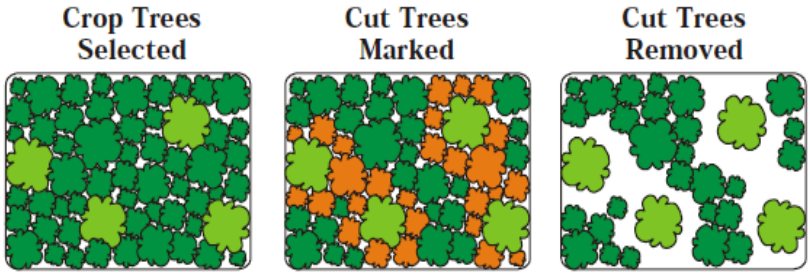
The final phase of a traditional shelterwood is to remove the overstory trees once adequate regeneration has been created (a clearcut). In the case of Boone Forks WMA, the shelterwood treatment will be used as a long-term process to create and maintain a low-density oak woodland condition along the same spectrum as an oak savanna or an "open" oak woodland. This habitat type is beneficial to numerous wildlife species. The long-term goal will be to transition these stands to a two-aged composition, with roughly equal proportions of the stand area devoted to old mature oaks and young oak saplings.

Crop Tree Release/Basal Area Thinning

Crop Tree Release (CTR) is a practice used to aid the crown expansion, health, vigor, growth rate, flowering, and seed production of targeted young to intermediate-aged trees in crowded conditions. Trees in the pole-sized stage of growth (typically between 4-11" diameter at breast height) have the greatest potential to benefit from this practice, but it can be used on larger trees as long as they have a need and capacity to expand their crowns and trunks.

Stands receiving this treatment are typically overstocked, with 90-130 sqft/acre of basal area (BA). Approximately 10-40 crop trees per acre will be selected with species preference to favor oaks, hickories, walnut, hard maple, and other long-lived species. The trees that are cut will either be carefully felled to the ground or girdled and left standing for woodpeckers/insect trees. No trees will be girdled and left standing close to parking lots, roads, etc. No pesticides are needed for this practice. In the years following the thinning, the targeted crop trees will be able to expand their crowns which will boost flowering and mast (seed) production as well as health, growth, and vigor.





Weed Tree Removal (WTR)

This Forest Stand Improvement (FSI) technique refers to the killing or culling of unwanted species or unhealthy trees throughout a given stand. The goals of this practice are to eliminate the seed source of unwanted trees and/or to increase available growing space in the stand for more desirable trees or regeneration to fill back in. In oak shelterwood treatment areas and uneven-age management units, WTR will be used to thin the midstory and understory layers of surplus ironwood, elm, locust, mulberry, or other "weed" species as described earlier. Stand density is typically reduced from around 100-120 sqft/acre down to 70-80 sqft/acre throughout all size classes. Small trees will typically be cut low to the ground and lopped into pieces to decompose. In some stands, small weed trees may be killed and left standing using a "hack-and-squirt" method. Some large trees may be girdled and left standing for insect/woodpecker trees. No trees will be girdled and left standing close to roads, parking lots, etc. Pesticides will be carefully applied to the cut stumps of trees using 41% glyphosate to prevent them from resprouting. This work would largely take place from November - March.

Commercial Harvesting

Commercial timber harvests are done in situations where management goals call for removing trees either to reduce competition between trees (thinning), to increase sunlight and room for new trees to emerge (regeneration), or in cases where high-value trees are at-risk of dying or losing value (salvage). In the latter scenario, it refers to trees that were damaged in a storm or by floods, are diseased, are being undercut by an eroding stream or river, are rapidly declining in health, or are no longer growing in trunk size.

All commercial timber harvests at Boone Forks WMA will be carried out according to Iowa DNR policy pertaining to public lands timber sales outlined in Appendix 3. Iowa DNR Best Management Practices (BMPs) will be utilized to protect soils and water quality as described in General Management Considerations.

There are essentially three types of commercial timber harvests that will be employed at Boone Forks WMA: 1) Salvage harvests of high-risk, storm-damaged, diseased, and overmature trees; 2) Selective harvests governed by uneven-aged or shelterwood management protocols and sustainable yield targets described in Appendix 4; and 3) Patch clearcuts designed to be replanted with oaks and other species and regrow as even-aged forests. More information on the patch clearcut/regeneration technique is found below.

Invasive Plant Control

In some cases where funding and resources permit and for high-priority stands, controlling invasive plant infestations will take precedent as the main management objective. But in most cases, control of unwanted invasive plants will fall in line with other silvicultural treatments being applied and be done on an as-needed basis (e.g., in clearcuts, WTR operations, prescribed burning, oak shelterwood stands, etc.) Appendix 5 contains more detailed information on how the most common invasives will be battled at Boone Forks WMA.

Patch Clearcut/Regeneration

Patch clearcuts may range in size from as small as ½ acre up to 10 acres. Patch clearcuts are usually smaller than their total overall stand size (which is what gives them the name "patch") and often irregular in shape to conform to natural land features such as ridges or gullies. After the merchantable trees are harvested (if any), all remaining stems will be felled at ground level or girdled and left standing dead, with some exceptions: all patch clearcuts will include 1) at least 6-8 large snags per acre (standing dead trees 16"+); 2) 10-15% of the area will be left in reserve trees, such as clumps of desirable wildlife species, scattered large seed trees, standing live cavity trees, and native shrubs such as dogwood, serviceberry, hazelnut, et al.

After the harvest and residual tree felling work, bareroot oak seedlings will be planted in patch clearcuts at a rate of 25-50 trees per acre and protected with 5-foot tall ventilated tree shelters. In some stands, a heavier planting rate of 200-300 trees/acre and/or acorn seeding may be used for regeneration in lieu of plastic tree shelters. Other species such as walnut, cherry, serviceberry, hickory, and native shrubs might also be incorporated in some plantings. The rest of the patch clearcut areas will be left to regenerate naturally by root sprouts, seedlings, and suckers to help fill in the regeneration and provide natural species diversity. The planted trees will be maintained for 5-10 years to ensure survival before moving on to a new patch regeneration project.

It should be noted that not all patch clearcuts will be commercial harvests. In fact, a higher priority will be placed on putting the patches in locations where disease, wind, storms, or previous timber high-grading has occurred to replenish these degraded, understocked areas with a new crop of oaks & other desirable trees. The primary goal of patch clearcuts is to regenerate new trees, not to generate revenue from harvesting.

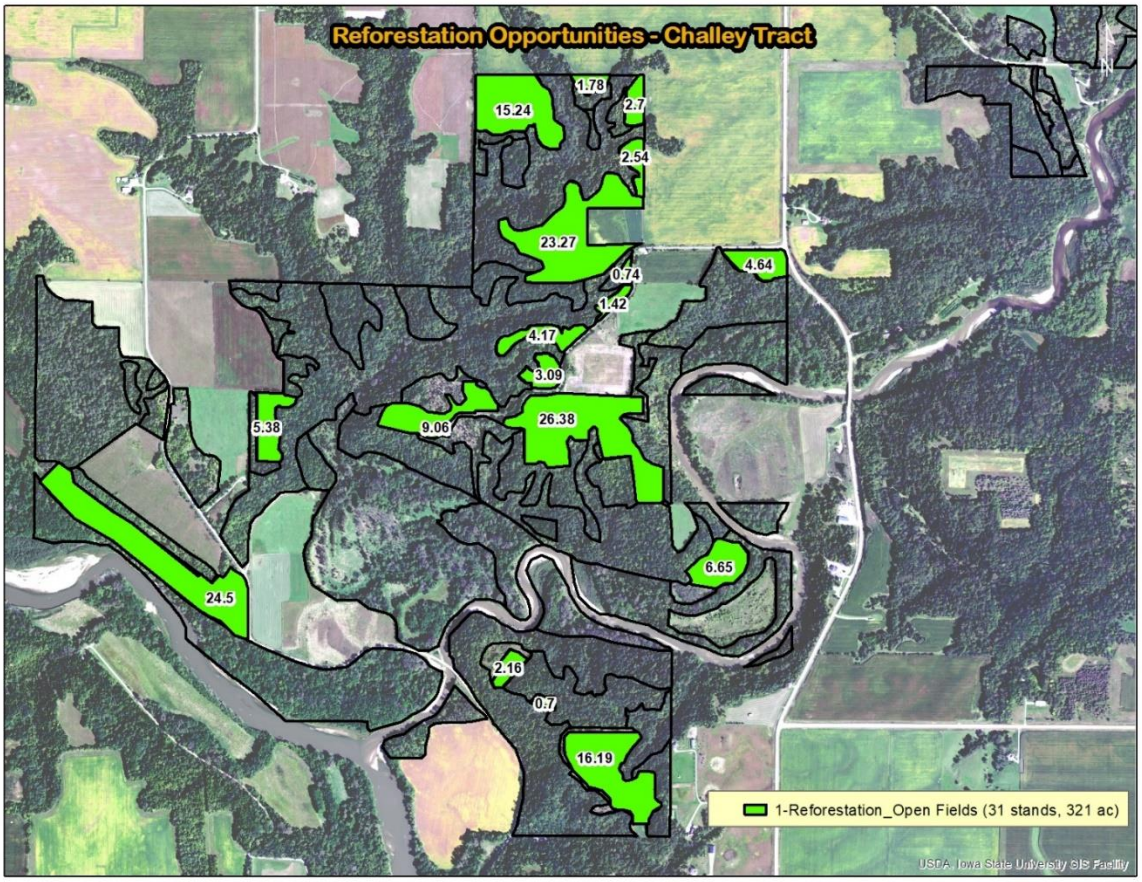
Patch clearcut at planting time (left) and after 5 years of growth (right)

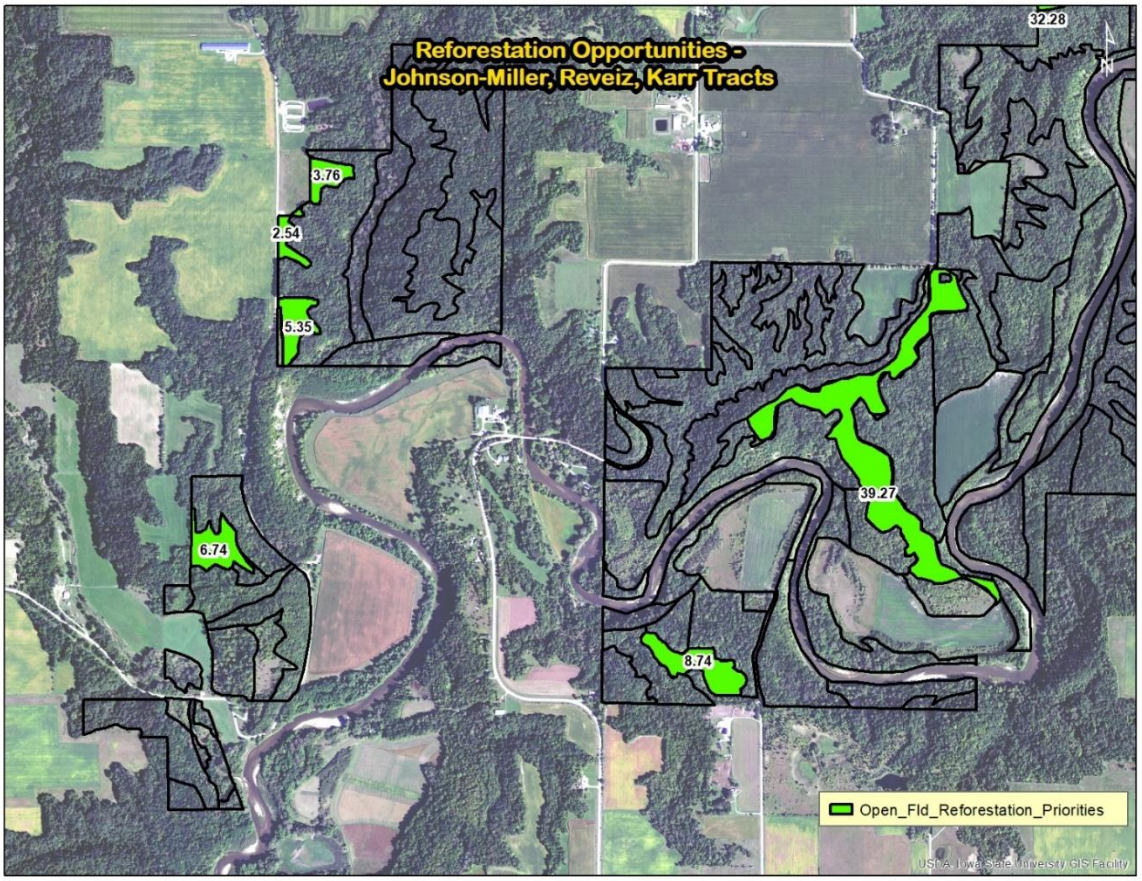
Work Plan Summary

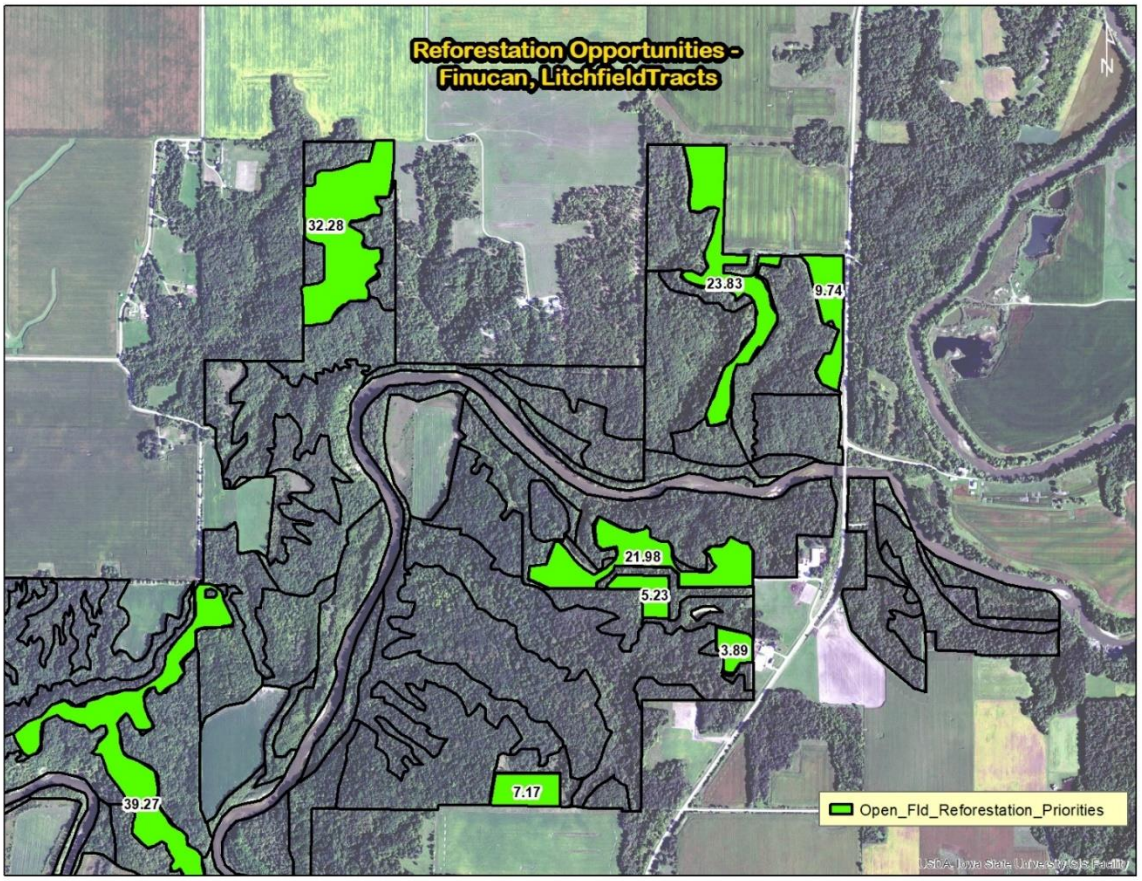
The following sections summarize the highest priority work projects to be undertaken as part of this effort. Note that some stands appear under multiple treatments, such as cases where a stand calls for prescribed burning, invasive species control, commercial harvest, and Weed Tree Removal. The order of these operations will vary in such stands.

Open Field Reforestation

There are 31 fields totaling 321 acres identified for this practice. The average field size is about 9 acres. Setting the goal of reforesting about 20 acres on average every 3 years, it will take 40 years to complete this task. The following three maps depict the locations of suggested reforestation projects at close-scale.

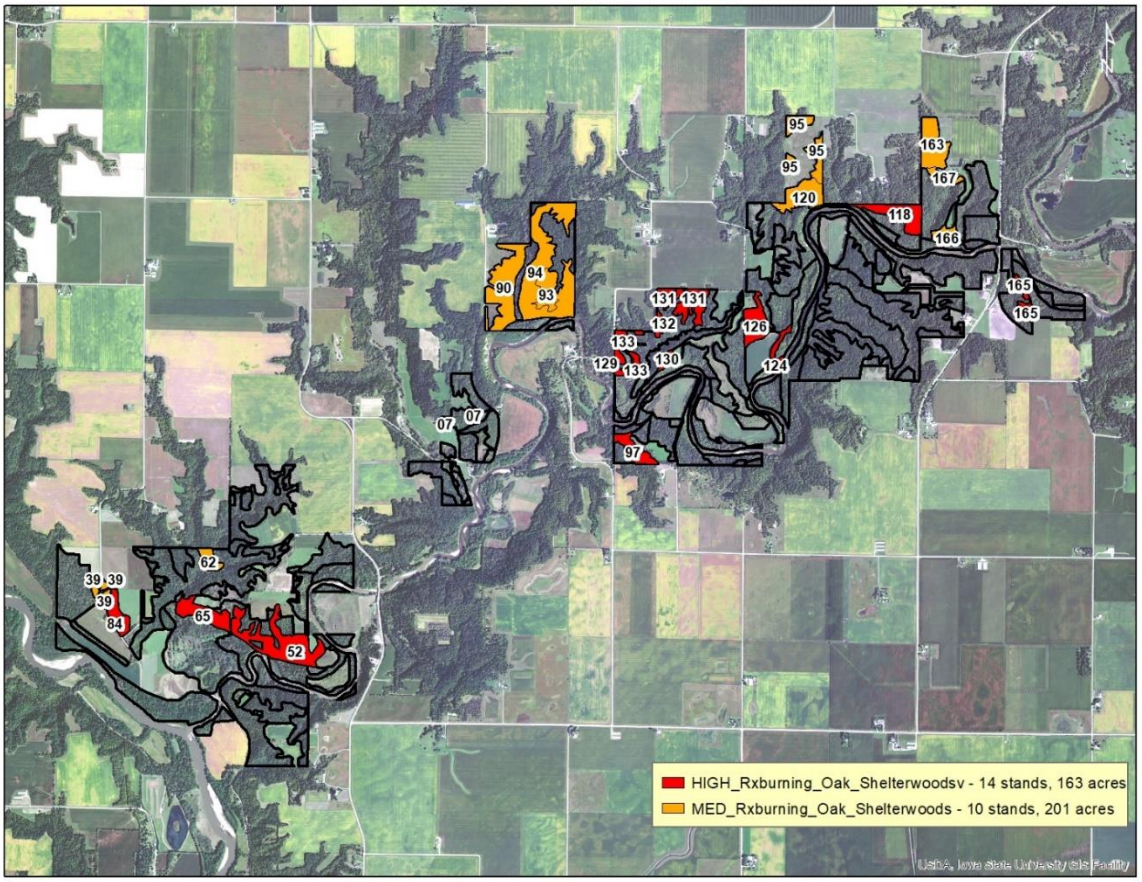

Reforestation Opportunities - Challey Tract
1.78
15.24
2.7
2.54
23.27
4.64
0.74
1.42
4.17
3.09
5.38
9.06
26.38
6.65
24.5
2.16
0.7
16.19
1-Reforestation_Open Fields (31 stands, 321 ac)
USDA Iowa State University GIS Facility


Reforestation Opportunities -
Johnson-Miller, Reveiz, Karr Tracts
32.28
3.76
2.54
5.35
39.27
6.74
8.74
Open_Fld_Reforestation_Priorities
USDA Iowa State University GIS Facility


Reforestation Opportunities -
Finucan, LitchfieldTracts
32.28
23.83
9.74
21.98
5.23
3.89
7.17
39.27
Open_Fld_Reforestation_Priorities

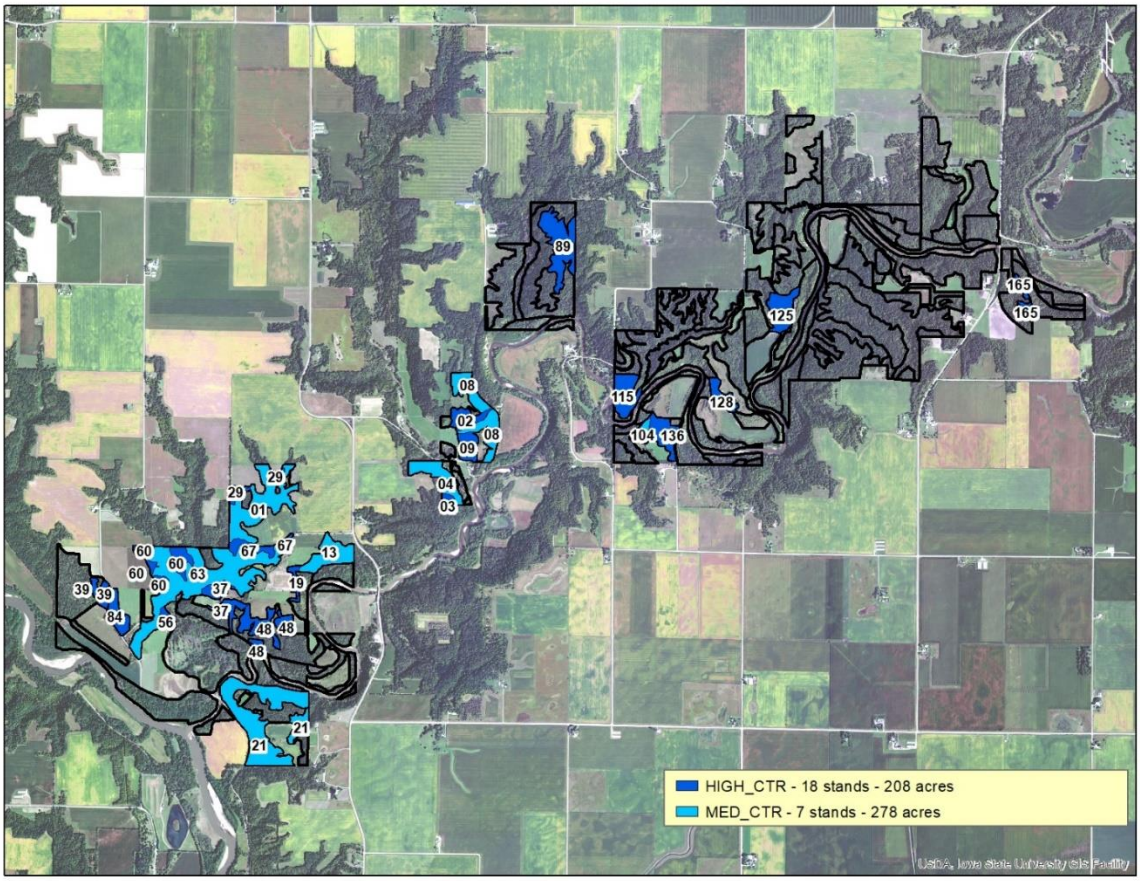
Prescribed Burning/Oak Shelterwood

There is a total of 24 stands totaling 364 acres where prescribed burning and oak shelterwood restoration are recommended. The map below shows all 24 stands assigned by either medium or high priority status. Some small stands may not be logistically feasible to burn. A 2-3 year burn frequency is recommended for the next 5-10 years, followed by WTR thinning and monitoring of the response. At least 3-4 burns per stand is recommended for desired results. All prescribed burning activities must have site-specific burn planning completed in accordance with DNR fire policies.



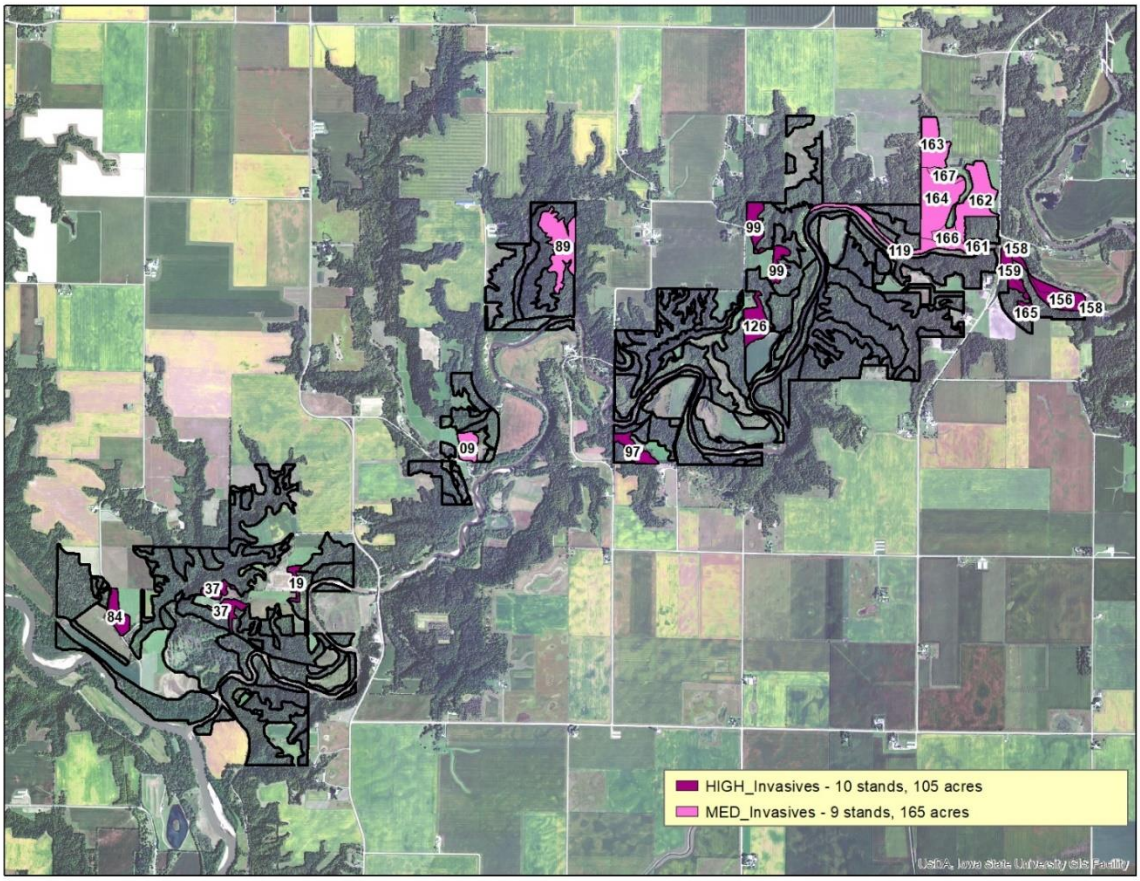
Crop Tree Release/Basal Area Thinning

There is a total of 25 stands covering 486 acres in need of Crop Tree Release thinning/basal area reduction. These stands are broken into high and medium-level priorities and displayed in the map below. This work will be carried out using a combination of tree marking by the Forester and cutting by Wildlife unit staff or contractors.



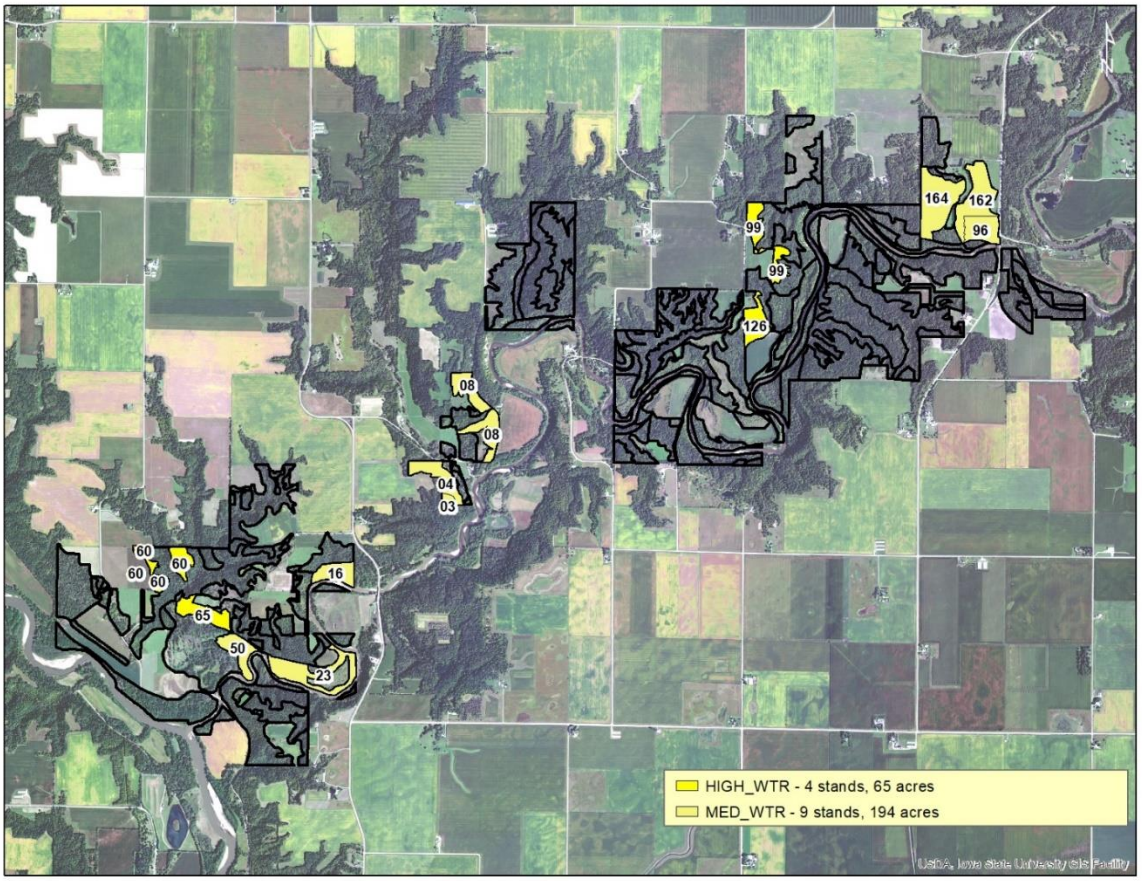
Invasive Plants Control

There are 19 stands comprising 270 acres recommended for either medium or high priority invasive species control activities. They are shown in the map below. These treatments will require monitoring and multiple passes.



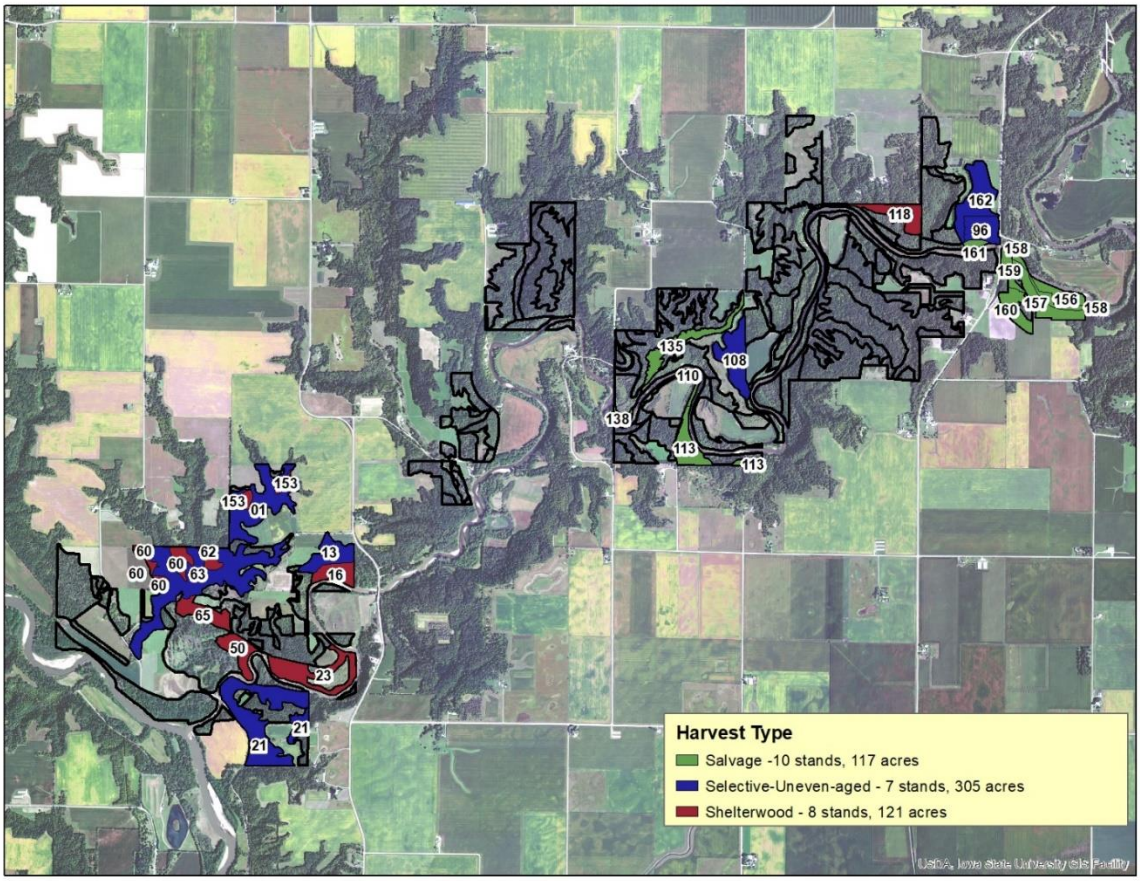
Weed Tree Removal

There are 13 stands that total 259 acres in need of weed tree removal thinning work, as depicted in the map below.



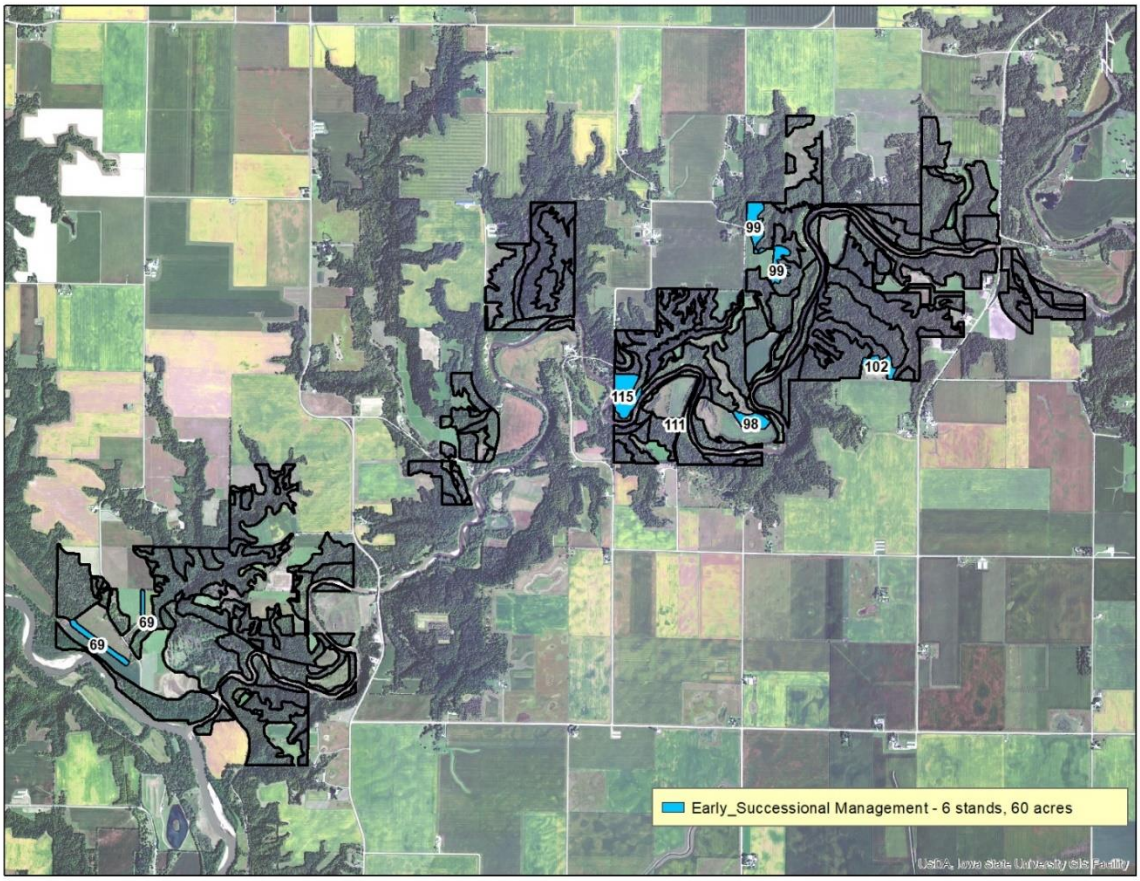
Commercial Harvests

A total of 25 stands comprising 543 acres have potential for commercial harvesting, as broken down in the types shown in the map below. Of these three categories, salvage harvesting is of the highest priority to capture value of high-risk trees.



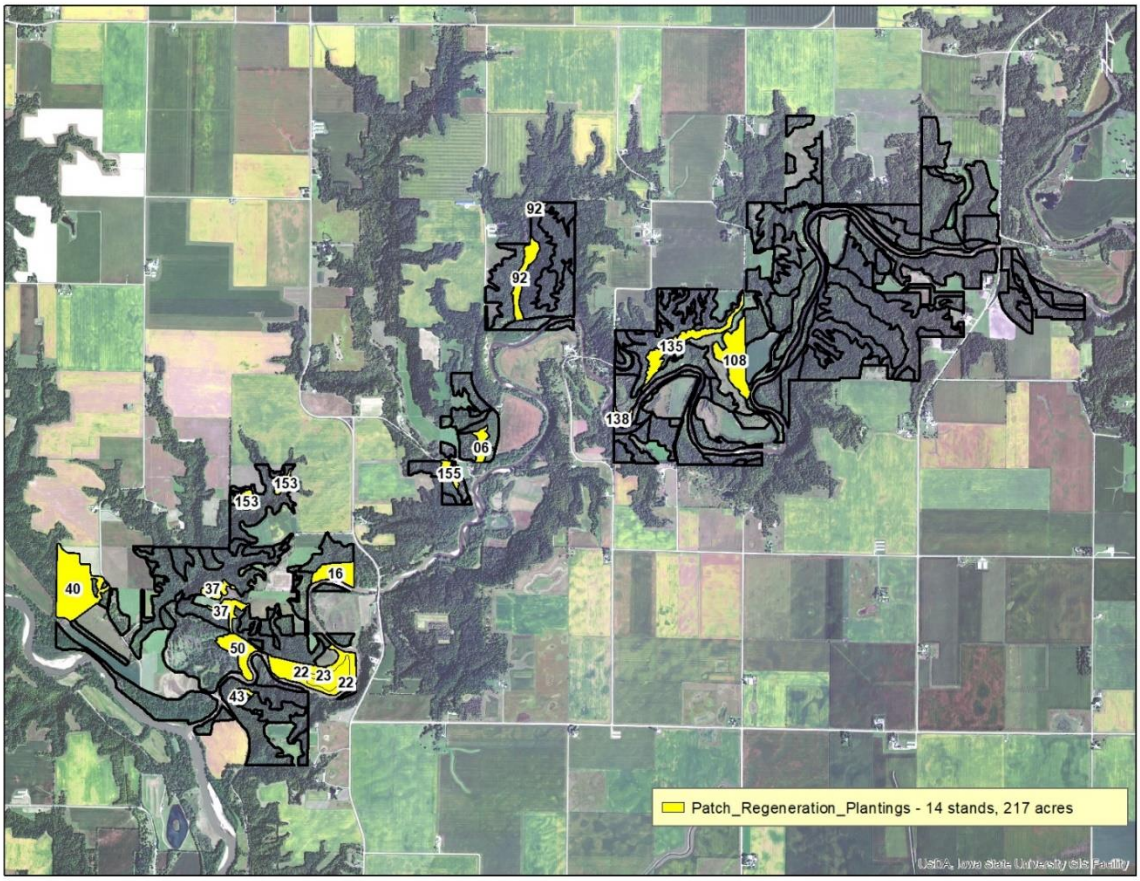
Early-Successional Management (ESM)

There are 6 stands totaling 60 acres assigned for ESM, in which the site would be mowed/cut back on a 5-15 year return interval to keep these areas in young forest habitat.



Patch Clearcut/Regeneration Plantings, Site Preparation, and Gap Tree Plantings

There are 14 stands covering 217 acres where patch clearcuts/regeneration tree plantings can be done. Patches will be ½ acre up to 10 acres in size, with a goal of doing approximately 10 acres every 5 years. These projects include a variety of steps. Commercial timber or firewood sales may precede the site preparation and tree planting steps, but the selected stands were chosen because they are focused on restoring degraded areas with poor stocking, diseased overstory, or storm-damaged sites. If no commercial trees are present, the steps include site preparation (mowing, brush cutting, herbicide, etc.), tree clearing, and eventually tree planting by machine, by hand, or by direct seeding using acorns, walnuts, hickory seed, etc.



Projects summary list

FID	Tract	Stand	YR Sched	Treatment	Ac.	YR Complete	Contractor	Est Costs	Est Revenue
0	Johnson-Miller	0	0	Reforestation-Open Field	6.70	0		5360	0
1	Challey	0	2024	Reforestation-Open Field	15.20	0		12160	0
2	Challey	0	0	Reforestation-Open Field	0.70	0		560	0
3	Challey	0	0	Reforestation-Open Field	1.80	0		1440	0
4	Challey	0	0	Reforestation-Open Field	2.70	0		2160	0
5	Challey	0	2024	Reforestation-Open Field	4.60	0		3680	0
6	Challey	0	0	Reforestation-Open Field	3.10	0		2480	0
7	Challey	0	0	Reforestation-Open Field	1.40	0		1120	0
8	Challey	0	2022	Reforestation-Open Field	4.20	0		3360	0
9	Challey	0	2025	Reforestation-Open Field	9.10	0		7280	0
10	Challey	0	0	Reforestation-Open Field	16.20	0		12960	0
11	Challey	0	0	Reforestation-Open Field	2.20	0		1760	0
12	Challey	0	0	Reforestation-Open Field	0.70	0		560	0
13	Karr	0	0	Reforestation-Open Field	8.70	0		6960	0
14	Karr	0	2026	Reforestation-Open Field	39.30	0		31440	0
15	Litchfield	0	0	Reforestation-Open Field	7.20	0		5760	0
16	Litchfield	0	0	Reforestation-Open Field	3.90	0		3120	0
17	Litchfield	0	0	Reforestation-Open Field	5.20	0		4160	0
18	Litchfield	0	0	Reforestation-Open Field	22.00	0		17600	0
19	Draeger	0	0	Reforestation-Open Field	9.70	0		7760	0
20	Draeger	0	0	Reforestation-Open Field	23.80	0		19040	0
21	Challey	0	0	Reforestation-Open Field	6.60	0		5280	0
22	Challey	0	0	Reforestation-Open Field	2.50	0		2000	0
23	Challey	0	0	Reforestation-Open Field	5.40	0		4320	0
24	Challey	0	0	Reforestation-Open Field	24.50	0		19600	0
25	Reveiz	0	0	Reforestation-Open Field	5.30	0		4240	0
26	Reveiz	0	0	Reforestation-Open Field	2.50	0		2000	0
27	Reveiz	0	0	Reforestation-Open Field	3.80	0		3040	0
28	Finucan	0	2027	Reforestation-Open Field	32.30	0		25840	0
29	Challey	0	2022	Reforestation-Open Field	26.40	0		21120	0
30	Challey	0	2023	Reforestation-Open Field	23.30	0		18640	0
31	Reveiz	90	0	MED_Rxburning_Oak_Shelterwood	37.50	0		18750	0

FID	Tract	Stand	YR Sched	Treatment	Ac.	YR Complete	Contractor	Est Costs	Est Revenue
32	Reveiz	93	0	MED_Rxburning_Oak_Shelterwood	13.90	0		6950	0
33	Reveiz	94	0	MED_Rxburning_Oak_Shelterwood	65.40	0		32700	0
34	Finucan	95	0	MED_Rxburning_Oak_Shelterwood	18.60	0		9300	0
35	Finucan	120	0	MED_Rxburning_Oak_Shelterwood	19.40	0		9700	0
36	Draeger	163	0	MED_Rxburning_Oak_Shelterwood	21.30	0		10650	0
37	Draeger	166	0	MED_Rxburning_Oak_Shelterwood	8.30	0		4150	0
38	Draeger	167	0	MED_Rxburning_Oak_Shelterwood	4.40	0		2200	0
39	Challey	39	0	MED_Rxburning_Oak_Shelterwood	5.70	0		2850	0
40	Challey	62	0	MED_Rxburning_Oak_Shelterwood	6.30	0		3150	0
41	Johnson-Miller	7	0	HIGH_Rxburning_Oak_Shelterwood	3.90	0		1950	0
42	Tunnell Mill	165	0	HIGH_Rxburning_Oak_Shelterwood	5.80	0		2900	0
43	Litchfield	118	0	HIGH_Rxburning_Oak_Shelterwood	18.60	0		9300	0
44	Karr	97	0	HIGH_Rxburning_Oak_Shelterwood	10.10	0		5050	0
45	Karr	124	0	HIGH_Rxburning_Oak_Shelterwood	4.90	0		2450	0
46	Karr	126	0	HIGH_Rxburning_Oak_Shelterwood	15.80	0		7900	0
47	Karr	129	0	HIGH_Rxburning_Oak_Shelterwood	2.50	0		1250	0
48	Karr	130	0	HIGH_Rxburning_Oak_Shelterwood	3.00	0		1500	0
49	Karr	131	0	HIGH_Rxburning_Oak_Shelterwood	17.30	0		8650	0
50	Karr	132	0	HIGH_Rxburning_Oak_Shelterwood	3.00	0		1500	0
51	Karr	133	0	HIGH_Rxburning_Oak_Shelterwood	10.70	0		5350	0
52	Challey	52	0	HIGH_Rxburning_Oak_Shelterwood	40.10	0		20050	0
53	Challey	65	0	HIGH_Rxburning_Oak_Shelterwood	16.50	0		8250	0
54	Challey	84	0	HIGH_Rxburning_Oak_Shelterwood	10.60	0		5300	0
55	Johnson-Miller	4	0	MED_CTR/Basal_Area_Thinning	16.10	0		3220	0
56	Johnson-Miller	8	0	MED_CTR/Basal_Area_Thinning	28.40	0		5680	0
57	Karr	104	0	MED_CTR/Basal_Area_Thinning	5.10	0		1020	0
58	Challey	1	0	MED_CTR/Basal_Area_Thinning	45.10	0		9020	0
59	Challey	13	0	MED_CTR/Basal_Area_Thinning	20.10	0		4020	0
60	Challey	21	0	MED_CTR/Basal_Area_Thinning	67.20	0		13440	0
61	Challey	63	0	MED_CTR/Basal_Area_Thinning	95.50	0		19100	0
62	Reveiz	89	0	HIGH_CTR/Basal_Area_Thinning	31.30	0		6260	0
63	Johnson-Miller	2	0	HIGH_CTR/Basal_Area_Thinning	10.30	0		2060	0
64	Johnson-Miller	3	0	HIGH_CTR/Basal_Area_Thinning	2.80	0		560	0

FID	Tract	Stand	YR Sched	Treatment	Ac.	YR Complete	Contractor	Est Costs	Est Revenue
65	Johnson-Miller	9	0	HIGH_CTR/Basal_Area_Thinning	9.70	0		1940	0
66	Tunnell Mill	165	0	HIGH_CTR/Basal_Area_Thinning	5.80	0		1160	0
67	Karr	115	0	HIGH_CTR/Basal_Area_Thinning	17.10	0		3420	0
68	Karr	125	0	HIGH_CTR/Basal_Area_Thinning	17.40	0		3480	0
69	Karr	128	0	HIGH_CTR/Basal_Area_Thinning	9.30	0		1860	0
70	Karr	136	0	HIGH_CTR/Basal_Area_Thinning	15.80	0		3160	0
71	Challey	19	0	HIGH_CTR/Basal_Area_Thinning	3.60	0		720	0
72	Challey	37	0	HIGH_CTR/Basal_Area_Thinning	13.00	0		2600	0
73	Challey	48	0	HIGH_CTR/Basal_Area_Thinning	20.90	0		4180	0
74	Challey	56	0	HIGH_CTR/Basal_Area_Thinning	4.40	0		880	0
75	Challey	60	0	HIGH_CTR/Basal_Area_Thinning	15.60	0		3120	0
76	Challey	67	0	HIGH_CTR/Basal_Area_Thinning	9.90	0		1980	0
77	Challey	84	0	HIGH_CTR/Basal_Area_Thinning	10.60	0		2120	0
78	Challey	39	0	HIGH_CTR/Basal_Area_Thinning	5.70	0		1140	0
79	Challey	29	0	HIGH_CTR/Basal_Area_Thinning	4.30	0		860	0
80	Johnson-Miller	3	0	MED_WTR	2.80	0		770	0
81	Johnson-Miller	4	0	MED_WTR	16.10	0		4428	0
82	Johnson-Miller	8	0	MED_WTR	28.40	0		7810	0
83	Draeger	162	0	MED_WTR	31.20	0		8580	0
84	Draeger	164	0	MED_WTR	39.50	0		10862	0
85	Draeger	96	0	MED_WTR	17.90	0		4922	0
86	Challey	16	0	MED_WTR	14.00	0		3850	0
87	Challey	23	0	MED_WTR	28.70	0		7892	0
88	Challey	50	0	MED_WTR	14.90	0		4098	0
89	Karr	99	0	HIGH_WTR	17.10	0		4702	0
90	Karr	126	0	HIGH_WTR	15.80	0		4345	0
91	Challey	60	0	HIGH_WTR	15.60	0		4290	0
92	Challey	65	0	HIGH_WTR	16.50	0		4538	0
93	Tunnell Mill	156	0	Commercial Harvest	12.10	0		0	6050
94	Tunnell Mill	157	0	Commercial Harvest	21.90	0		0	10950
95	Tunnell Mill	158	0	Commercial Harvest	9.20	0		0	4600
96	Tunnell Mill	159	0	Commercial Harvest	7.60	0		0	3800
97	Tunnell Mill	160	0	Commercial Harvest	15.40	0		0	7700

FID	Tract	Stand	YR Sched	Treatment	Ac.	YR Complete	Contractor	Est Costs	Est Revenue
98	Litchfield	118	0	Commercial Harvest	18.60	0		0	9300
99	Draeger	161	0	Commercial Harvest	3.30	0		0	1650
100	Draeger	162	0	Commercial Harvest	31.20	0		0	15600
101	Draeger	96	0	Commercial Harvest	17.90	0		0	8950
102	Karr	108	0	Commercial Harvest	28.20	0		0	14100
103	Karr	113	0	Commercial Harvest	20.80	0		0	10400
104	Karr	135	0	Commercial Harvest	20.30	0		0	10150
105	Karr	138	0	Commercial Harvest	2.30	0		0	1150
106	Karr	110	0	Commercial Harvest	3.70	0		0	1850
107	Challey	1	0	Commercial Harvest	45.10	0		0	22550
108	Challey	13	0	Commercial Harvest	20.10	0		0	10050
109	Challey	16	0	Commercial Harvest	14.00	0		0	7000
110	Challey	21	0	Commercial Harvest	67.20	0		0	33600
111	Challey	23	0	Commercial Harvest	28.70	0		0	14350
112	Challey	50	0	Commercial Harvest	14.90	0		0	7450
113	Challey	60	0	Commercial Harvest	15.60	0		0	7800
114	Challey	63	0	Commercial Harvest	95.50	0		0	47750
115	Challey	65	0	Commercial Harvest	16.50	0		0	8250
116	Challey	62	0	Commercial Harvest	6.30	0		0	3150
117	Challey	153	0	Commercial Harvest	6.60	0		0	3300
118	Reveiz	89	0	MED_Invasives	31.30	0		8608	0
119	Johnson-Miller	9	0	MED_Invasives	9.70	0		2668	0
120	Litchfield	119	0	MED_Invasives	16.30	0		4482	0
121	Draeger	161	0	MED_Invasives	3.30	0		908	0
122	Draeger	162	0	MED_Invasives	31.20	0		8580	0
123	Draeger	163	0	MED_Invasives	21.30	0		5858	0
124	Draeger	164	0	MED_Invasives	39.50	0		10862	0
125	Draeger	166	0	MED_Invasives	8.30	0		2282	0
126	Draeger	167	0	MED_Invasives	4.40	0		1210	0
127	Tunnell Mill	156	0	HIGH_Invasives	12.10	0		3328	0
128	Tunnell Mill	158	0	HIGH_Invasives	9.20	0		2530	0
129	Tunnell Mill	159	0	HIGH_Invasives	7.60	0		2090	0
130	Tunnell Mill	165	0	HIGH_Invasives	5.80	0		1595	0

FID	Tract	Stand	YR Sched	Treatment	Ac.	YR Complete	Contractor	Est Costs	Est Revenue
131	Karr	97	0	HIGH_Invasives	10.10	0		2778	0
132	Karr	99	0	HIGH_Invasives	17.10	0		4702	0
133	Karr	126	0	HIGH_Invasives	15.80	0		4345	0
134	Challey	19	0	HIGH_Invasives	3.60	0		990	0
135	Challey	37	0	HIGH_Invasives	13.00	0		3575	0
136	Challey	84	0	HIGH_Invasives	10.60	0		2915	0
137	Reveiz	92	0	Patch_Regeneration_Plantings	14.70	0		14700	0
138	Johnson-Miller	6	0	Patch_Regeneration_Plantings	7.10	0		7100	0
139	Johnson-Miller	155	0	Patch_Regeneration_Plantings	2.50	0		2500	0
140	Karr	108	0	Patch_Regeneration_Plantings	28.20	0		28200	0
141	Karr	135	0	Patch_Regeneration_Plantings	20.30	0		20300	0
142	Karr	138	0	Patch_Regeneration_Plantings	2.30	0		2300	0
143	Challey	16	0	Patch_Regeneration_Plantings	14.00	0		14000	0
144	Challey	22	0	Patch_Regeneration_Plantings	15.80	0		15800	0
145	Challey	23	0	Patch_Regeneration_Plantings	28.70	0		28700	0
146	Challey	37	0	Patch_Regeneration_Plantings	13.00	0		13000	0
147	Challey	40	0	Patch_Regeneration_Plantings	46.50	0		46500	0
148	Challey	43	0	Patch_Regeneration_Plantings	2.50	0		2500	0
149	Challey	50	0	Patch_Regeneration_Plantings	14.90	0		14900	0
150	Challey	153	0	Patch_Regeneration_Plantings	6.60	0		6600	0
151	Litchfield	102	0	Early_Successional_Mgmt	6.40	0		1760	0
152	Karr	99	0	Early_Successional_Mgmt	17.10	0		4702	0
153	Karr	111	0	Early_Successional_Mgmt	1.80	0		495	0
154	Karr	115	0	Early_Successional_Mgmt	17.10	0		4702	0
155	Karr	98	0	Early_Successional_Mgmt	8.50	0		2338	0
156	Challey	69	0	Early_Successional_Mgmt	9.50	0		2612	0

General Management Considerations

Hazard Tree Management

Hazard trees carry a risk of structural failure coupled with the potential to cause property damage or personal injury. To be considered hazardous, a tree must have the following: 1) major structural defect(s) that make it more prone to failure and 2) a nearby target that it could land on such as a building, picnic table, parked car, campsite, bench, high use trail, etc. Hazard tree management, especially in and adjacent to "high use" areas should be conducted continuously in accordance with DNR policy to lessen or eliminate potential danger to WMA users. In general, trees will not be girdled for management reasons if there is potential to fall onto a road, parking lot, high-use trail or other feature that draws frequent & prolonged use.

Rare, Threatened, and Endangered Species

While habitat management activities are intended to have an overall conservation benefit through habitat improvement, at times these activities may have unintended consequences for a variety of species. For this reason, prior to implementation, forest management activities described here will be reviewed internally to assess potential impacts to both state and federal species of concern. When protected species are known to occur in the management area or if suitable habitat for these species is present, management biologists implement conservation measures as described in the Operation & Maintenance Plan for Wildlife Management Areas in the State along with recommendations from NAI staff. Management activities are not initiated until this review has been completed and T/E comments/concerns have been addressed.

Although surveys for threatened and endangered plants and animals have not been completed for the Boone Forks WMA to date, numerous state- and federally-protected species are known to occur or may occur in Hamilton and Webster counties and may be present in the WMA in areas of suitable habitat if present. According to the State's Natural Areas Inventory database, there are 61 rare, threatened, or endangered plant or animal species known to occur in Hamilton & Webster Counties. Some of these occur in the Boone Forks WMA. These species are listed in Appendix 6. In addition, there is the potential for two federally endangered animals to occur in these areas including the northern long-eared bat and the rusty-patched bumble bee. An on-site environmental review must be done in all management units prior to the commencement of work to assess the presence and abundance of these or other rare, threatened, or endangered species and to ensure no harm is done to them.

Wildlife

Forest management activities such as tree harvesting, thinning, burning, planting, and others can have both beneficial effects and detrimental effects for wildlife, depending on the species and its needs. The conscious decision to do no forest management (i.e., "hands off" preservation) also has pros and cons. Such tradeoffs can be hard to quantify and understand due to the complexity of natural ecosystems.

Iowa's 2015 Wildlife Action Plan (available at www.iowadnr.gov) identifies 405 "Species of Greatest Conservation Need" which are rare, threatened, endangered, or declining in numbers in Iowa. Of these, 115 species across the state are obligatory or at least partially dependent on woodlands, shrublands, oak savannas, or other forest habitat types. The activities recommended in this plan are meant to optimize the overall diversity and quality of wildlife habitat for both common wildlife species as well as those that are in need of habitat protection and restoration.

Best Management Practices for Soil, Wetland, and Water Quality Protection

Protection of soil and water resources is of utmost importance. Forest management and timber harvesting activities have the potential to negatively impact these qualities, but with careful timing and best management practices these impacts can be made negligible:

- Timber harvests and any work involving heavy equipment will only be done during times when the ground is frozen, firm, or dry. This prevents compaction of the soil and also protects the fragile herbaceous plants of the forest floor
- No logging slash or debris is to be left in streams or flow pathways
- Pesticides used for invasive species control are to be applied in the appropriate dosage and at the proper time, according to product label

- Access trails and forest roads shall be carefully situated on stable slopes with erosion control measures such as waterbars installed
- Protect sensitive areas like stream banks & lake shores (riparian areas) by leaving forested buffer strips from 50 to 150 feet wide (depending on stream width and topography) next to streams. Management in these areas should be limited to woodland understory and midstory tree manipulation and selective overstory harvesting. Always try to maintain a minimum of 70% overstory canopy cover in riparian areas
- If bare soil areas are created or existing trails are not properly constructed, use soil stabilization practices to minimize the existing erosion hazard. These may include mulching, seeding, and building sediment control structures

All other considerations and best practices for protecting water & soil resources are discussed in Iowa's Forestry Best Management Practices manual, available online at www.iowadnr.gov.

Aesthetics & Recreation

The woodlands of Boone Forks WMA are a large part of its popularity for outdoor recreation and enjoyment. Forest management activities can negatively impact these qualities in the short term. Trees and tops left after thinning and harvest operations are seen by some as unsightly "brush" and prescribed burning leaves the ground bare and black scorch marks and char on the trees & downed wood. Some of this must be dealt with by educating WMA users on what they are seeing and why it is being done for long-term ecological benefits. Beyond that, the following measures are meant to help minimize the impact of forest management to the aesthetic beauty and recreation capacity of Boone Forks WMA:

- Limit the size of clearcut areas to average 3-5 acres, max 10 acres, and do not locate them near high-use areas or scenic vistas
- Either remove, pile, or break down slash from thinning/invasive plants control operations to fall flush to the ground and decompose. Maintain clean trails and roads at all times. Do not leave hazardous snags within striking distance of trails or infrastructure.
- Require stumps from thinning operations be left no higher than 6" above the top of the root flare

Forest Health & Integrated Pest Management

Forest ecosystem health is best maintained by using management practices that promote maximum diversity of native species, environments, and habitats throughout the area. This will help buffer major, catastrophic losses to pests such as spongy (formerly gypsy) moth, emerald ash borer (EAB), oak wilt, and others. Patch regeneration tree plantings and natural regeneration are extremely important to diversifying the age structure of the forest population and prevent catastrophic storm damage.

Limiting all or most management work to the dormant season helps minimize soil disturbance and injury to non-target plants & trees, and reduces the incidence of invasive pests, insects, and diseases. For instance, to prevent and hasten the spread of oak wilt, most tree cutting activities are to be done between November and March.

Incidental tree damage by harvesting and thinning activities is to be minimized by timing these activities to occur during the dormant season and through the requirement of careful selective felling practices. Machinery must be kept to skid trails and roads to minimize physical injury to the other trees.

The use of pesticides will be minimized by using silvicultural practices that promote native species when possible (e.g., prescribed burning), and using selective cut-stump application methods at the appropriate timing and rates, according to label instructions.

Important Cultural, Archeological, or Ecological Sites

Every effort will be made to identify and protect natural resource and man-made "special sites" before and during forest management work. Sites that are historical and cultural resources include such things as buildings and structures of historical significance, human burial sites, special land features, and artifacts. If such things are ever observed or discovered, those sites will be located, preserved, and avoided when implementing forest management activities.

Human remains that are discovered or accidentally uncovered must be reported to local law enforcement officials. This reporting is required by Iowa Code 558.69. Discovered artifacts or structures of suspected historical significance will be reported to the State Archaeologist and the discovery will be protected.

No excavation of stumps or earthwork is being proposed by this plan. The following are practices that will help minimize the chances of accidentally destroying items of cultural or historical significance when doing forest management work:

- Thoroughly inspect a project area before working. Look for unusual looking areas such as obvious mounds or groups of mounds, or square and rectangular shaped depressions or extrusions.
- Minimize ground disturbance when tree planting, logging, and doing forest stand improvement work. Cut trees and use heavy equipment only when the ground is frozen, dry, or firm.
- Be especially careful of disturbing soil around streams, lakes, and riparian (stream bank) areas.
- Locate trails and management access roads along natural land contours.

Monitoring

Monitoring the long-term results of forest management decisions, including the decision to do nothing in a specific stand or area, is important in order to document successes and failures and ensure that the desired effects are being had on native flora and fauna. Ideally, monitoring should be an interdisciplinary effort that includes foresters, wildlife biologists, botanists, and ecologists, and it should be founded on science-based methodology and should be ongoing to capture long-term effects. Historically, limited staff and funding have constrained the amount of monitoring that can be done. Thus, every effort will be made by DNR staff to collaborate internally to measure and assess the effects of forest management subject to resource availability.

Public Forestry Field Days

Workshops that showcase and demonstrate land stewardship and conservation to the public in ways that are easy to understand and apply are a very effective way to reach out to adjacent landowners. As improvement projects get underway, Wildlife and Forestry staff from both public and private land backgrounds should coordinate and hold tours of project sites and invite expert guest speakers for public education and promotion of good conservation practices.

Acknowledgements

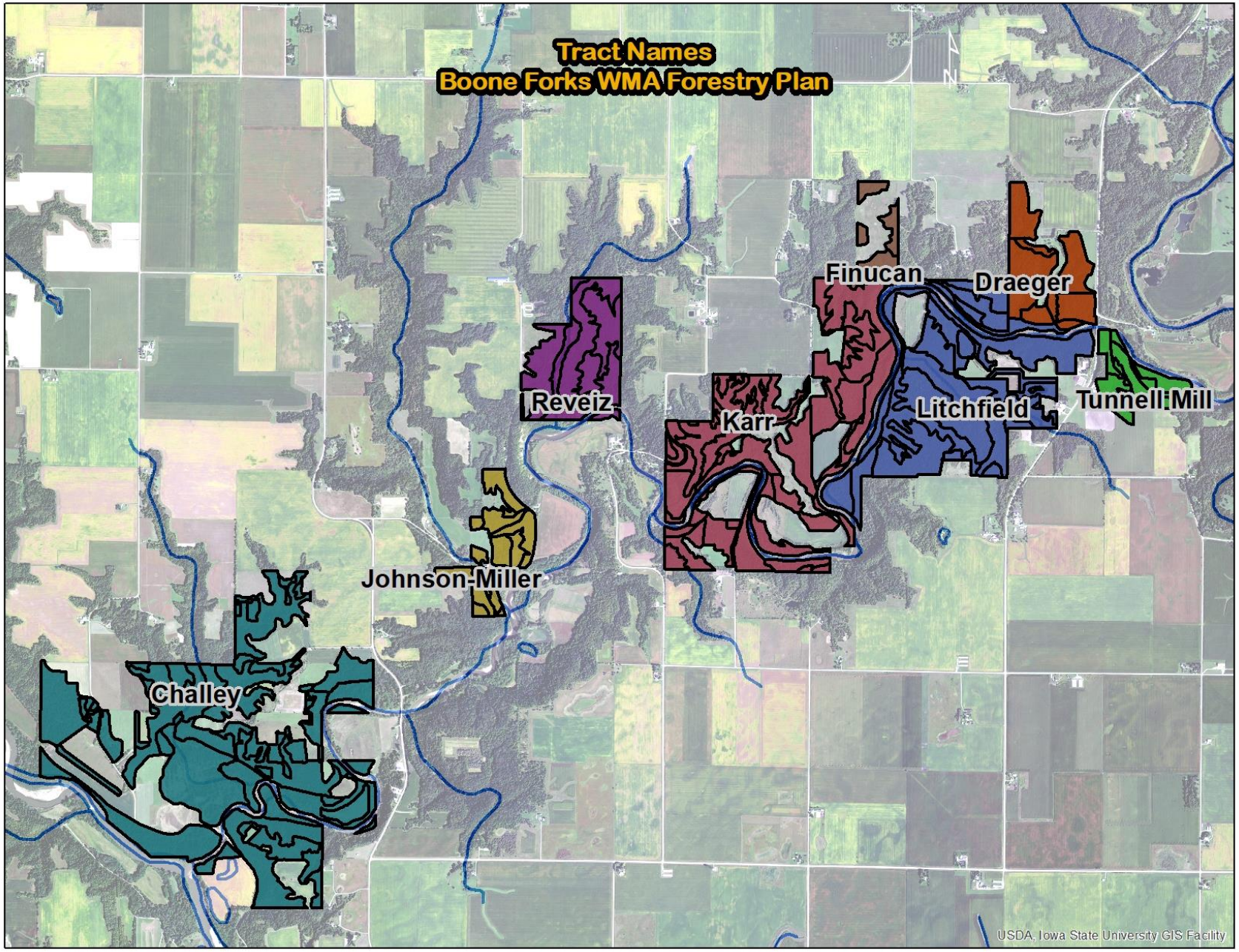
Funding for this plan was provided in part by the United States Forest Service Landscape Scale Restoration (LSR) Program. Internal peer reviews of the plan were provided by John Pearson, Tom Litchfield, Anna Buckardt Thomas, and Kelly Poole.

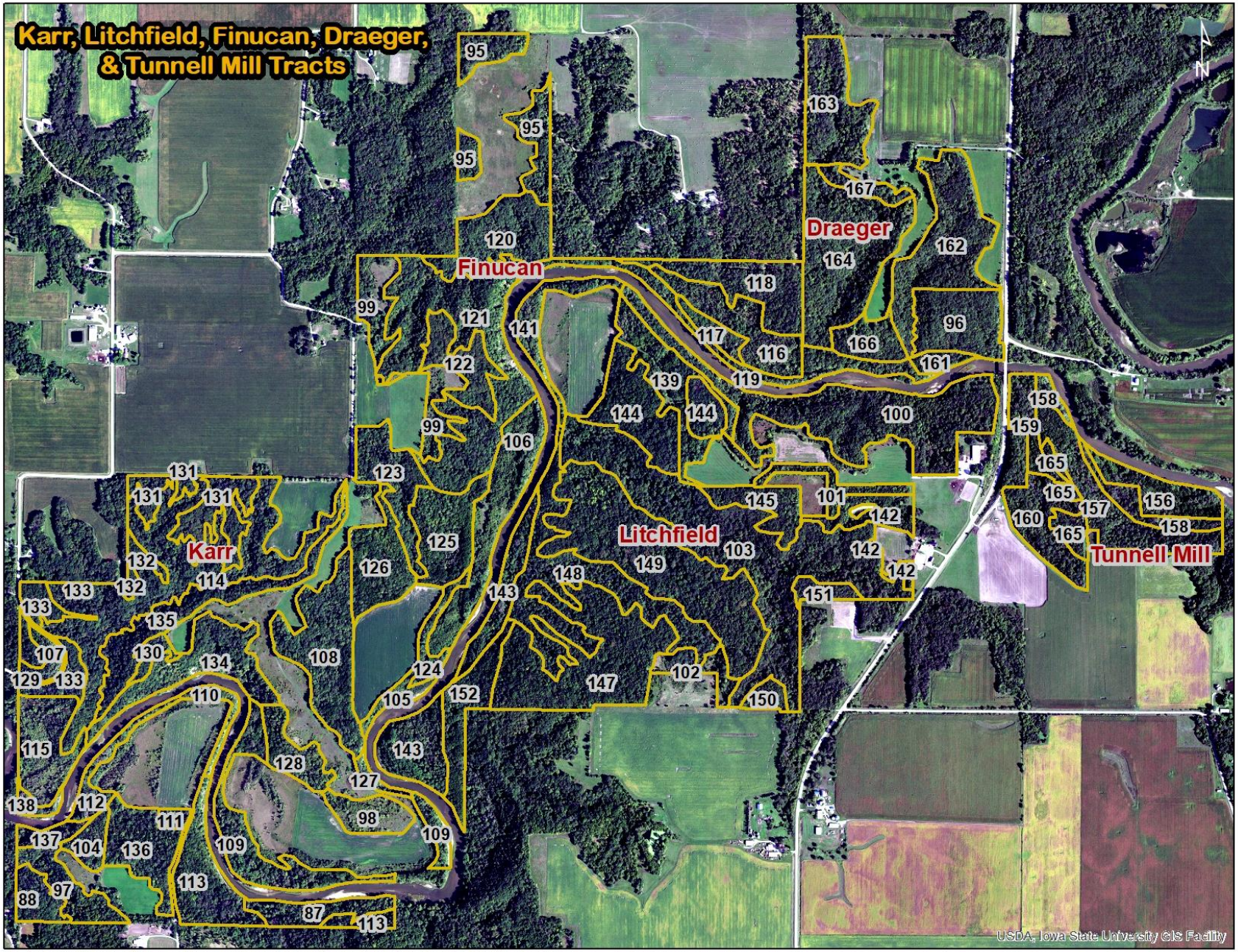
List of Appendices

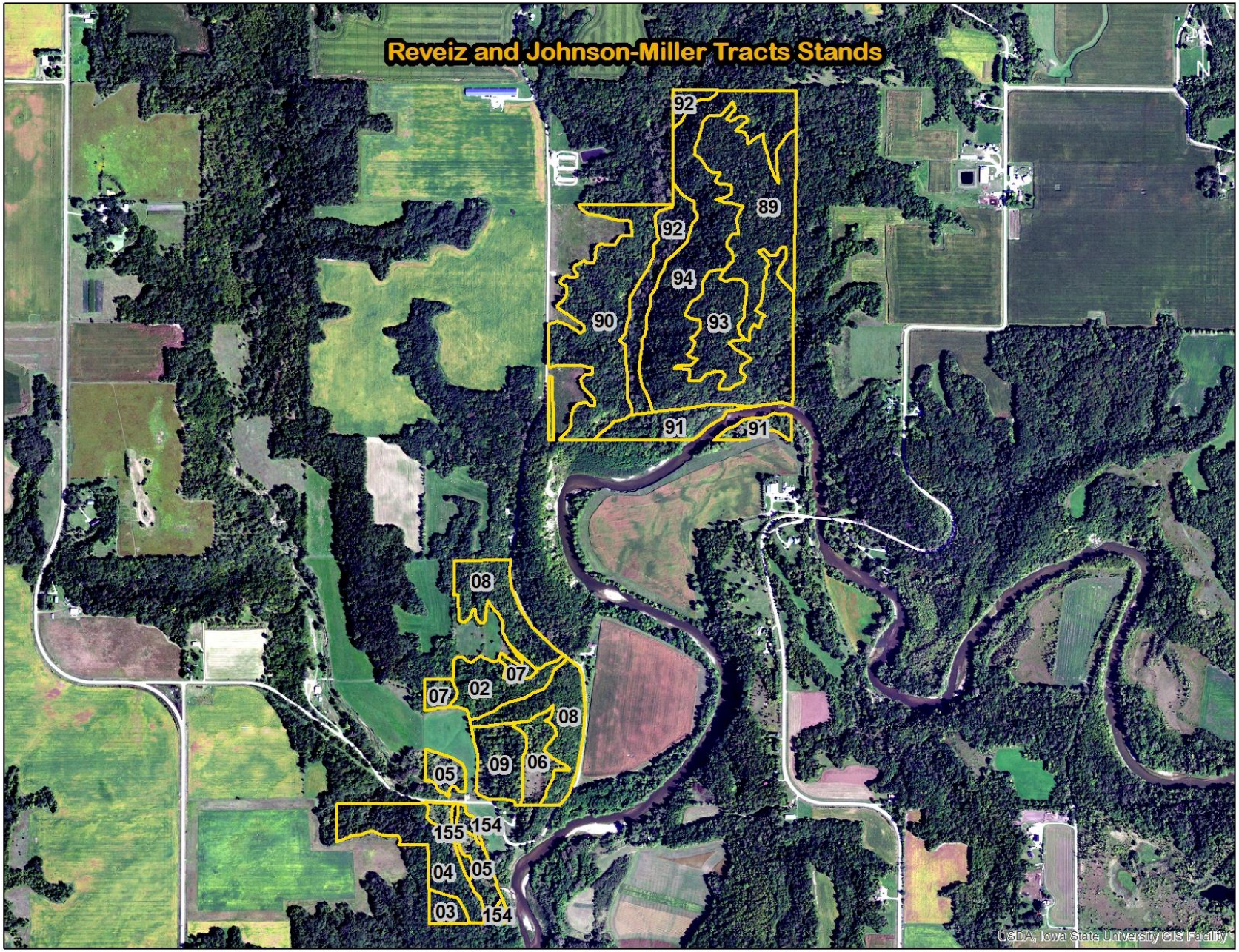
Appendix 1. Individual Stand Maps & Summary Reports

The following pages contain detailed information on the current forest conditions for all 117 stands covered by this plan. The stand numbers are arbitrary and not sequential; use “CTRL+F” to search for a particular stand number to look up information about it. The stands are organized into groups by Tract name in the following list.

1. Tunnel Mill Tract
2. Draeger Tract
3. Finucan Tract
4. Litchfield Tract
5. Karr Tract
6. Reveiz Tract
7. Johnson-Miller Tract
8. Challey Tract


Tract Names
Boone Forks WMA Forestry Plan
Finucan
Draeger
Reveiz
Karr
Litchfield
Tunnell Mill
Johnson-Miller
Challey
USDA, Iowa State University GIS Facility


Karr, Litchfield, Finucan, Draeger, & Tunnell Mill Tracts
Finucan
Draeger
Karr
Litchfield
Tunnell Mill
N
USDA, Iowa State University GIS Facility


Reveiz and Johnson-Miller Tracts Stands
92
89
92
94
90
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91
91
08
07
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02
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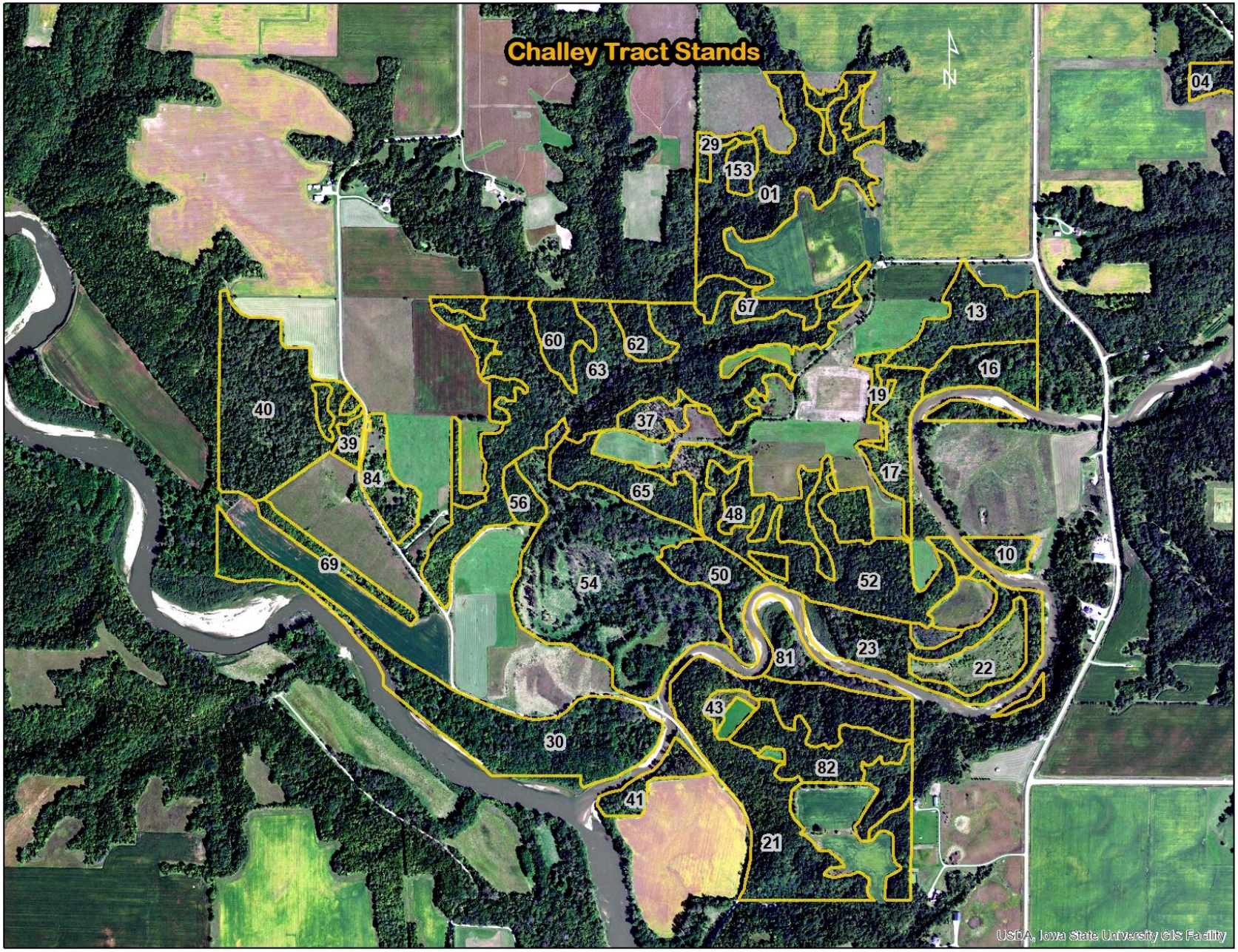
05
155
154
04
05
03
154
USDA, Iowa State University GIS Facility


Challey Tract Stands
N
04
29
153
01
67
13
60
62
63
16
19
40
37
39
84
17
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56
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USDA, Iowa State University GIS Facility

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
01	45.1	sawtimber	Central Hardwoods	hard maple-basswood, mixed hardwoods	Oak Decline, Dutch Elm		crop tree release, harvest	Challey	Uneven Age
02	10.3	pole timber	Oak-Hickory	hickory-elm-ironwood, red cedar-mixed hardwoods	Dutch Elm,		crop tree release, weed tree removal	Johnson-Miller	Even Age
03	2.8	small sawtimber	Oak-Hickory	hickory-elm-ironwood, ironwood			basal area thinning, weed tree removal	Johnson-Miller	Even Age
04	16.1	small sawtimber	Central Hardwoods	hackberry-black cherry-bitternut hickory, elm-bitternut hickory-ironwood	Dutch Elm, Storm Damage		crop tree release, weed tree removal	Johnson-Miller	Uneven Age
05	8.5	sapling	Bottomland Hardwoods, First Bench	grass, elm-ash-cottonwood-willow	Storm Damage,	Reed Canary Grass	no action,	Johnson-Miller	Viewshed
06	7.1	sapling	Exotics	dogwood-hazelnut-prickly ash, red cedar-mixed hardwoods	Invasive Infestation,	Autumn Olive	site prep for natural regen, seedling planting	Johnson-Miller	Even Age
07	3.9	sawtimber	Oak-Hickory	hickory-elm-ironwood, red cedar-mixed hardwoods	Dutch Elm,		prescribed fire, weed tree removal	Johnson-Miller	Even Age
08	28.4	small sawtimber	Central Hardwoods	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Dutch Elm,		crop tree release, weed tree removal	Johnson-Miller	Uneven Age
09	9.7	pole timber	Central Hardwoods	prickly ash-gooseberry-rose-raspberry, red cedar-mixed hardwoods		Siberian Elm, Honeysuckle, Multiflora Rose	crop tree release, weed tree removal	Johnson-Miller	Even Age
10	10.0	small sawtimber	Bottomland Hardwoods, First Bench				no action,	Challey	Viewshed
13	20.1	sawtimber	Central Hardwoods	maple-basswood, mixed hardwoods	Hickory Decline, Dutch Elm	Honeysuckle, Garlic Mustard, White Mulberry	harvest, crop tree release	Challey	Uneven Age
16	14.0	small sawtimber	Bottomland Hardwoods, Second Bench	elderberry-dogwood, boxelder	Dutch Elm,	Honeysuckle, Garlic Mustard, White Mulberry	harvest, site prep for natural regen	Challey	Even Age
17	15.6	small sawtimber	Central Hardwoods	hard maple-basswood, hackberry-elm-black cherry-bitternut	Dutch Elm,	Honeysuckle	weed tree removal,	Challey	Viewshed
19	3.6	pole timber	Oak-Hickory	prickly ash-coralberry-gooseberry, elm-bitternut hickory-ironwood	Invasive Infestation, Dutch Elm	Honeysuckle, White Mulberry,	crop tree release, weed tree removal	Challey	Even Age

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
21	67.2	small sawtimber	Central Hardwoods	hickory-elm-ironwood, maple-basswood	Oak Decline, Hickory Decline	Honeysuckle	harvest, crop tree release	Challey	Uneven Age
22	15.8	sapling	Bottomland Hardwoods, First Bench	boxelder, maple-boxelder-ash		Reed Canary Grass, Autumn Olive,	site prep for natural regen, seedling planting	Challey	Even Age
23	28.7	sawtimber	Bottomland Hardwoods, Second Bench	elderberry-dogwood, boxelder	Storm Damage, Dutch Elm	Reed Canary Grass, Garlic Mustard, White Mulberry	harvest, site prep for natural regen	Challey	Even Age
29	4.3	pole timber	Central Hardwoods	mixed shrubs, elm-ash-hackberry	Dutch Elm,	Honeysuckle	crop tree release, seedling planting	Challey	Even Age
30	56.2	sawtimber	Bottomland Hardwoods, First Bench	boxelder-elm, hackberry-silver maple-elm-ash	Dutch Elm, Storm Damage	Honeysuckle, Reed Canary Grass, White Mulberry	no action,	Challey	Viewshed
37	13.0	pole timber	Central Hardwoods	dogwood-gooseberry, nearly absent	Invasive Infestation, Dutch Elm	Honeysuckle, Garlic Mustard, Siberian Elm	crop tree release, seedling planting	Challey	Even Age
39	5.7	small sawtimber	Oak-Hickory	mixed shrubs, hackberry-elm-black cherry-bitternut	Invasive Infestation,	Honeysuckle, White Mulberry,	crop tree release, weed tree removal	Challey	Even Age
40	46.5	small sawtimber	Central Hardwoods	hackberry-elm-ash, elm-ash-hackberry	Dutch Elm,	Buckthorn, Honeysuckle, Multiflora Rose	stand conversion,	Challey	Even Age
41	7.3	small sawtimber	Bottomland Hardwoods, First Bench	nettles-weeds, elm-ash-hackberry	Invasive Infestation,	Garlic Mustard, Honeysuckle, Reed Canary Grass	no action,	Challey	Viewshed
43	2.5	sapling	Central Hardwoods	dogwood-gooseberry, mixed hardwoods		Honeysuckle	site prep for natural regen, seedling planting	Challey	Even Age
48	20.9	small sawtimber	Central Hardwoods	hackberry-elm-ash, elm-ash-hackberry	Dutch Elm,	Honeysuckle	crop tree release,	Challey	Even Age
50	14.9	small sawtimber	Bottomland Hardwoods, Second Bench	boxelder-elm, elm-ash-hackberry	Invasive Infestation, Storm Damage	Garlic Mustard, Reed Canary Grass, Honeysuckle	harvest, site prep for natural regen	Challey	Even Age
52	40.1	sawtimber	Oak-Hickory	ironwood, elm-bitternut hickory-ironwood	Dutch Elm,		prescribed fire, weed tree removal	Challey	Even Age

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
54	82.3	sawtimber	Bottomland Hardwoods, First Bench	hackberry-elm-ash, elm-ash-hackberry	Invasive Infestation, Storm Damage	Reed Canary Grass, Honeysuckle, Garlic Mustard	no action,	Challey	Viewshed
56	4.4	pole timber	Bottomland Hardwoods, Second Bench	hickory-elm-ash, maple-basswood	Invasive Infestation,	Honeysuckle	crop tree release, weed tree removal	Challey	Even Age
60	15.6	small sawtimber	Oak-Hickory	hackberry-black cherry-bitternut hickory, hackberry-elm-black cherry-bitternut	Oak Decline, Storm Damage	Honeysuckle, Garlic Mustard, White Mulberry	harvest, crop tree release	Challey	Even Age
62	6.3	sawtimber	Oak-Hickory	hickory-elm-ironwood, ironwood			prescribed fire, weed tree removal	Challey	Even Age
63	95.5	sawtimber	Central Hardwoods	hard maple-basswood, mixed hardwoods	Oak Wilt, Dutch Elm	Honeysuckle, White Mulberry,	harvest, crop tree release	Challey	Uneven Age
65	16.5	small sawtimber	Oak-Hickory	ironwood, elm-ash-hackberry	Oak Decline, Dutch Elm	Honeysuckle	prescribed fire, weed tree removal	Challey	Even Age
67	9.9	small sawtimber	Central Hardwoods	hackberry-elm-ash, elm-ash-hackberry	Hickory Decline,	Honeysuckle	crop tree release,	Challey	Even Age
69	9.5	pole timber	Bottomland Hardwoods, First Bench	coralberry-gooseberry, hackberry-elm-black cherry	Invasive Infestation, Dutch Elm	White Mulberry, Honeysuckle,	weed tree removal,	Challey	Early Successional
81	12.4	sawtimber	Bottomland Hardwoods, First Bench	elderberry-dogwood, boxelder	Invasive Infestation, Dutch Elm	Garlic Mustard, White Mulberry,	no action,	Challey	Viewshed
82	24.9	small sawtimber	Oak-Hickory	hickory-elm-ironwood, ironwood	Oak Decline, Dutch Elm	Honeysuckle	prescribed fire, weed tree removal	Challey	Even Age
84	10.6	small sawtimber	Oak-Hickory	mixed shrubs, elm-ash-hackberry	Emerald Ash Borer, Dutch Elm	Honeysuckle, White Mulberry,	crop tree release, weed tree removal	Challey	Even Age
87	9.0	sawtimber	Bottomland Hardwoods, Second Bench	nearly absent, elm-ash-hackberry	Storm Damage, Dutch Elm		harvest, woodland planting	Karr	Uneven Age
88	6.7	small sawtimber	Oak-Hickory	maple-basswood, mixed upland hardwoods	Dutch Elm,	Buckthorn	no action,	Karr	Uneven Age
89	31.3	pole timber	Oak-Hickory	dogwood-hazelnut-prickly ash, elm-bitternut hickory-ironwood	Butternut Canker, Dutch Elm	Buckthorn, Multiflora Rose,	crop tree release, weed tree removal	Reveiz	Even Age

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
90	37.5	small sawtimber	Oak-Hickory	hickory-elm-ironwood, ironwood	Oak Decline, Dutch Elm	Buckthorn, Garlic Mustard, Multiflora Rose	weed tree removal,	Reveiz	Uneven Age
91	12.3	sawtimber	Bottomland Hardwoods, First Bench	hackberry-elm-ash, elm-ash-hackberry	Dutch Elm, Storm Damage	White Mulberry, Reed Canary Grass,	no action,	Reveiz	Viewshed
92	14.7	small sawtimber	Bottomland Hardwoods, Second Bench	hackberry-elm-ash, elm-ash-hackberry	Dutch Elm,	White Mulberry	woodland planting, stand conversion	Reveiz	Even Age
93	13.9	small sawtimber	Oak-Hickory	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Oak Decline, Dutch Elm		basal area thinning, prescribed fire	Reveiz	Even Age
94	65.4	small sawtimber	Oak-Hickory	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Oak Decline, Dutch Elm	Buckthorn, Garlic Mustard, White Mulberry	weed tree removal,	Reveiz	Uneven Age
95	18.6	small sawtimber	Oak-Hickory	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Dutch Elm, Oak Wilt	Honeysuckle, Autumn Olive,	prescribed fire, weed tree removal	Finucan	Even Age
96	17.9	small sawtimber	Oak-Hickory	hickory-elm-ironwood, ironwood	Oak Wilt, Oak Decline	Honeysuckle	basal area thinning, harvest	Draeger	Even Age
97	10.1	pole timber	Oak-Hickory	hickory-elm-ironwood, hackberry-elm-black cherry-bitternut	Dutch Elm, Invasive Infestation	Buckthorn, Honeysuckle, Multiflora Rose	crop tree release, prescribed fire	Karr	Even Age
98	8.5	sapling	Central Hardwoods	mixed shrubs, red cedar-mixed hardwoods	Invasive Infestation,	Multiflora Rose	weed tree removal,	Karr	Early Successional
99	17.1	seedling	Oak-Hickory	dogwood-hazelnut-prickly ash, red cedar-mixed hardwoods	Dutch Elm, Invasive Infestation	Honeysuckle, White Mulberry, Siberian Elm	prescribed fire, weed tree removal	Karr	Early Successional
100	53.4	small sawtimber	Maple-Basswood	hickory-elm-ironwood, hard maple	Oak Decline, Invasive Infestation	Honeysuckle, Autumn Olive,	weed tree removal,	Litchfield	Uneven Age
101	6.3	sapling	Plantation	prickly ash-gooseberry-rose-raspberry, elm-ash-hackberry	Invasive Infestation, Dutch Elm	Autumn Olive, Honeysuckle, Multiflora Rose	weed tree removal,	Litchfield	Even Age
102	6.4	sapling	Central Hardwoods	dogwood-hazelnut-prickly ash, red cedar-mixed hardwoods	Invasive Infestation,	Honeysuckle, Autumn Olive, Multiflora Rose	early successional mgmt,	Litchfield	Early Successional
103	74.7	sawtimber	Central Hardwoods	hard maple-basswood, maple-basswood	Butternut Canker, Invasive Infestation	Honeysuckle, Buckthorn, Garlic Mustard	basal area thinning, harvest	Litchfield	Uneven Age

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
104	5.1	small sawtimber	Central Hardwoods	hard maple-basswood, maple-basswood	Butternut Canker, Dutch Elm	Honeysuckle	basal area thinning,	Karr	Uneven Age
105	4.1	sapling	Bottomland Hardwoods, First Bench	nearly absent, nearly absent	Low Diversity,	Reed Canary Grass, Honeysuckle,	no action,	Karr	Even Age
106	25.5	pole timber	Bottomland Hardwoods, Second Bench	prickly ash-gooseberry-rose-raspberry, hackberry-silver maple-elm-ash	Invasive Infestation,	Honeysuckle, Buckthorn, White Mulberry	no action,	Karr	Even Age
107	3.9	pole timber	Aspen	nearly absent, mixed upland hardwoods	Dutch Elm,		no action,	Karr	Viewshed
108	28.2	sawtimber	Bottomland Hardwoods, Second Bench	nettles-weeds, hackberry-elm-basswood-bitternut	Oak Wilt, Dutch Elm	Garlic Mustard, Honeysuckle,	harvest, seedling planting	Karr	Uneven Age
109	23.4	sawtimber	Bottomland Hardwoods, Second Bench	hackberry-elm-ash, boxelder	Dutch Elm, Storm Damage	Garlic Mustard, White Mulberry,	harvest, seedling planting	Karr	Uneven Age
110	3.7	sawtimber	Black Walnut	boxelder-elm, elm-ash-hackberry	Storm Damage,		harvest,	Karr	Even Age
111	1.8	sapling	Central Hardwoods	nearly absent, red cedar-mixed hardwoods	Invasive Infestation,	Autumn Olive, Multiflora Rose,	early successional mgmt,	Karr	Early Successional
112	6.2	sawtimber	Bottomland Hardwoods, First Bench	mixed shrubs, hackberry-silver maple-elm-ash	Storm Damage, Dutch Elm	Autumn Olive, Multiflora Rose, Honeysuckle	no action,	Karr	Viewshed
113	20.8	small sawtimber	Central Hardwoods	hackberry-elm-ash, maple-basswood	Dutch Elm, Invasive Infestation	Buckthorn, Honeysuckle,	crop tree release, harvest	Karr	Uneven Age
114	57.6	small sawtimber	Central Hardwoods	maple-basswood, mixed upland hardwoods	Dutch Elm,	Honeysuckle, White Mulberry, Garlic Mustard	no action,	Karr	Uneven Age
115	17.1	sapling	Central Hardwoods	nearly absent, mixed hardwoods	Dutch Elm, Invasive Infestation	Honeysuckle, Autumn Olive, Multiflora Rose	crop tree release, early successional mgmt	Karr	Early Successional
116	17.3	sapling	Bottomland Hardwoods, First Bench	prickly ash-gooseberry-rose-raspberry, nearly absent	Invasive Infestation, Dutch Elm	Honeysuckle, Autumn Olive, White Mulberry	no action,	Litchfield	Even Age
117	4.4	small sawtimber	Bottomland Hardwoods, First Bench	dogwood-gooseberry, nearly absent	Invasive Infestation,	Honeysuckle	no action,	Litchfield	Even Age

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
118	18.6	small sawtimber	Oak-Hickory	hackberry-elm-ash, ironwood	Oak Decline, Dutch Elm	Honeysuckle	prescribed fire, weed tree removal	Litchfield	Even Age
119	16.3	sawtimber	Bottomland Hardwoods, Second Bench	dogwood-hazelnut-prickly ash, elm-bitternut hickory-ironwood	Invasive Infestation,	Honeysuckle	no action,	Litchfield	Viewshed
120	19.4	small sawtimber	Oak-Hickory	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Oak Wilt, Dutch Elm	Honeysuckle	weed tree removal, basal area thinning	Finucan	Even Age
121	53.8	sawtimber	Oak-Hickory	maple-basswood, mixed upland hardwoods	Dutch Elm,	Honeysuckle, White Mulberry, Autumn Olive	seedling planting, weed tree removal	Karr	Uneven Age
122	12.4	small sawtimber	Oak-Hickory	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Oak Decline,	Honeysuckle	prescribed fire, basal area thinning	Karr	Even Age
123	15.2	small sawtimber	Oak-Hickory	maple-basswood, hard maple	Dutch Elm, Oak Decline	Autumn Olive	no action,	Karr	Uneven Age
124	4.9	sawtimber	Bottomland Hardwoods, Second Bench	hackberry-elm-ash, hackberry-silver maple-elm-ash	Dutch Elm, Invasive Infestation	Honeysuckle, White Mulberry,	no action,	Karr	Uneven Age
125	17.4	small sawtimber	Central Hardwoods	hackberry-elm-ash, elm-bitternut hickory-ironwood	Dutch Elm, Invasive Infestation	Honeysuckle, Garlic Mustard, White Mulberry	crop tree release, basal area thinning	Karr	Even Age
126	15.8	small sawtimber	Central Hardwoods	prickly ash-gooseberry-rose-raspberry, mixed upland hardwoods	Dutch Elm, Invasive Infestation	Honeysuckle, Garlic Mustard, White Mulberry	basal area thinning, prescribed fire	Karr	Even Age
127	2.2	pole timber	Central Hardwoods	prickly ash-coralberry-gooseberry, mixed upland hardwoods	Dutch Elm,	Garlic Mustard, Honeysuckle, Autumn Olive	no action,	Karr	Viewshed
128	9.3	small sawtimber	Central Hardwoods	prickly ash-coralberry-gooseberry, mixed upland hardwoods	Dutch Elm,	Garlic Mustard, Honeysuckle,	crop tree release,	Karr	Even Age
129	2.5	small sawtimber	Oak-Hickory	hickory-elm-ironwood, mixed upland hardwoods	Oak Wilt, Dutch Elm		basal area thinning, weed tree removal	Karr	Even Age
130	3.0	sawtimber	Oak-Hickory	hickory-elm-ironwood, mixed upland hardwoods			prescribed fire, weed tree removal	Karr	Even Age
131	17.3	sawtimber	Oak-Hickory	hard maple-basswood, mixed upland hardwoods	Oak Decline, Dutch Elm	Garlic Mustard	prescribed fire, weed tree removal	Karr	Even Age

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
132	3.0	small sawtimber	Oak-Hickory	ironwood, hackberry-elm-black cherry	Oak Decline,	Garlic Mustard	basal area thinning, weed tree removal	Karr	Even Age
133	10.7	sawtimber	Oak-Hickory	ironwood, mixed upland hardwoods			basal area thinning, weed tree removal	Karr	Even Age
134	21.3	sawtimber	Oak-Hickory	hickory-elm-ironwood, hackberry-elm-black cherry	Dutch Elm,	Garlic Mustard	no action,	Karr	Uneven Age
135	20.3	sawtimber	Central Hardwoods	hickory-elm-ironwood, maple-basswood	Dutch Elm, Invasive Infestation	Garlic Mustard, Autumn Olive, Multiflora Rose	harvest, woodland planting	Karr	Viewshed
136	15.8	pole timber	Central Hardwoods	dogwood-gooseberry, red cedar-mixed hardwoods	Invasive Infestation, Butternut Canker	Buckthorn, Autumn Olive, Honeysuckle	crop tree release,	Karr	Uneven Age
137	3.9	sawtimber	Oak-Hickory	hickory-elm-ironwood, maple-basswood	Dutch Elm,		no action,	Karr	Viewshed
138	2.3	sawtimber	Bottomland Hardwoods, Second Bench	dogwood-gooseberry, hackberry-silver maple-elm-ash	Dutch Elm, Storm Damage	Honeysuckle	harvest, woodland planting	Karr	Uneven Age
139	17.4	pole timber	Central Hardwoods	prickly ash-gooseberry-rose-raspberry, elm-ash-hackberry	Dutch Elm, Invasive Infestation	Honeysuckle, Buckthorn,	crop tree release,	Litchfield	Even Age
141	9.3	sawtimber	Bottomland Hardwoods, Second Bench	hackberry-elm-ash, elm-ash-hackberry		Honeysuckle	no action,	Litchfield	Viewshed
142	10.3	pole timber	Central Hardwoods	prickly ash-gooseberry-rose-raspberry, ironwood	Invasive Infestation, Dutch Elm	Honeysuckle, Autumn Olive, Multiflora Rose	crop tree release, weed tree removal	Litchfield	Even Age
143	24.7	sawtimber	Bottomland Hardwoods, First Bench	nettles-weeds, elm-ash-hackberry	Dutch Elm, Invasive Infestation	Honeysuckle, White Mulberry,	no action,	Litchfield	Viewshed
144	25.1	small sawtimber	Oak-Hickory	prickly ash-coralberry-gooseberry, elm-bitternut hickory-ironwood	Oak Wilt, Invasive Infestation	Honeysuckle	prescribed fire, weed tree removal	Litchfield	Even Age
145	9.8	small sawtimber	Oak-Hickory	ironwood, elm-bitternut hickory-ironwood	Invasive Infestation, Dutch Elm	Honeysuckle	prescribed fire, weed tree removal	Litchfield	Even Age
147	46.1	small sawtimber	Oak-Hickory	prickly ash-gooseberry-rose-raspberry, ironwood	Invasive Infestation,	Multiflora Rose, Honeysuckle,	crop tree release, weed tree removal	Litchfield	Even Age

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
148	36.1	sawtimber	Central Hardwoods	maple-basswood, mixed upland hardwoods	Oak Wilt, Dutch Elm	Garlic Mustard, Multiflora Rose, Honeysuckle	harvest, seedling planting	Litchfield	Uneven Age
149	53.9	small sawtimber	Oak-Hickory	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Oak Decline, Invasive Infestation	Honeysuckle, Multiflora Rose, Buckthorn	crop tree release, weed tree removal	Litchfield	Even Age
150	3.4	small sawtimber	Oak-Hickory	ironwood, ironwood	Dutch Elm,	Multiflora Rose	no action,	Litchfield	Even Age
151	3.7	small sawtimber	Oak-Hickory	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Dutch Elm,	Honeysuckle	prescribed fire, weed tree removal	Litchfield	Even Age
152	14.7	small sawtimber	Black Walnut	coralberry-gooseberry, elm-ash-hackberry	Dutch Elm,	Honeysuckle	basal area thinning,	Litchfield	Even Age
153	6.6	small sawtimber	Central Hardwoods	hackberry-black cherry-bitternut hickory, elm-ash-hackberry	Oak Decline, Dutch Elm	Honeysuckle	weed tree removal, direct seeding	Challey	Even Age
154	2.2	small sawtimber	Bottomland Hardwoods, Second Bench	elderberry-dogwood, hackberry-silver maple-elm-ash	Dutch Elm, Storm Damage	Reed Canary Grass	no action,	Johnson-Miller	Even Age
155	2.5	sapling	Bottomland Hardwoods, Second Bench	elderberry-dogwood, hackberry-silver maple-elm-ash		Reed Canary Grass	site prep for natural regen, seedling planting	Johnson-Miller	Even Age
156	12.1	small sawtimber	Bottomland Hardwoods, First Bench	elderberry-dogwood, elm-ash-hackberry	Dutch Elm, Invasive Infestation	Honeysuckle, White Mulberry,	harvest, pruning	Tunnell Mill	Even Age
157	21.9	small sawtimber	Central Hardwoods	hard maple-basswood, maple-basswood	Dutch Elm, Oak Decline	Honeysuckle, White Mulberry,	harvest,	Tunnell Mill	Uneven Age
158	9.2	sawtimber	Bottomland Hardwoods, Second Bench	hackberry-elm-ash, elm-ash-hackberry	Dutch Elm, Invasive Infestation	Honeysuckle	harvest, weed tree removal	Tunnell Mill	Uneven Age
159	7.6	small sawtimber	Central Hardwoods	hackberry-black cherry-bitternut hickory, maple-basswood	Dutch Elm, Invasive Infestation	Honeysuckle	crop tree release, weed tree removal	Tunnell Mill	Uneven Age
160	15.4	sawtimber	Oak-Hickory	hickory-elm-ironwood, maple-basswood	Dutch Elm,	White Mulberry	harvest,	Tunnell Mill	Uneven Age
161	3.3	pole timber	Bottomland Hardwoods, Second Bench	boxelder-elm, elm-ash-hackberry	Dutch Elm, Invasive Infestation	Honeysuckle	harvest, crop tree release	Draeger	Even Age
162	31.2	small sawtimber	Oak-Hickory	prickly ash-gooseberry-rose-raspberry, elm-bitternut hickory-ironwood	Oak Wilt, Invasive Infestation	Honeysuckle, Multiflora Rose,	basal area thinning, weed tree removal	Draeger	Uneven Age

Stand No.	Ac.	Avg. DBH	Overstory	Understory/Regeneration	Forest Health	Invasives	Prescriptions	Tract	Mgmt. System
163	21.3	small sawtimber	Oak-Hickory	multiflora rose, elm-bitternut hickory-ironwood	Dutch Elm, Invasive Infestation	Honeysuckle, Multiflora Rose, Autumn Olive	basal area thinning, weed tree removal	Draeger	Even Age
164	39.5	small sawtimber	Oak-Hickory	maple-basswood, elm-bitternut hickory-ironwood	Dutch Elm, Invasive Infestation	Multiflora Rose, Honeysuckle, Autumn Olive	weed tree removal,	Draeger	Uneven Age
165	5.8	sawtimber	Oak-Hickory	hickory-elm-ironwood, hackberry-elm-basswood-bitternut		Honeysuckle	weed tree removal, prescribed fire	Tunnell Mill	Even Age
166	8.3	small sawtimber	Oak-Hickory	hickory-elm-ironwood, elm-bitternut hickory-ironwood	Dutch Elm, Invasive Infestation	Honeysuckle, Multiflora Rose, White Mulberry	prescribed fire, weed tree removal	Draeger	Even Age
167	4.4	sawtimber	Oak-Hickory	multiflora rose, elm-bitternut hickory-ironwood	Dutch Elm,	Honeysuckle, Autumn Olive, Multiflora Rose	prescribed fire, weed tree removal	Draeger	Even Age

Appendix 2. Forest Overstory Associations

Central Hardwoods: This forest cover type is often called *mixed hardwoods*. No one species dominates in this cover type. In the past, most of these upland stands have experienced disturbances such as livestock grazing, harvesting and storm damage. These stands also occur on retired pasturelands and retired crop fields. *Major species* include: northern red oak, white oak, shagbark hickory, bitternut hickory, black cherry, black walnut, aspen, sugar maple, basswood, white ash, white elm, red elm and ironwood. *Associated species* include: boxelder, hackberry, white birch, cottonwood, eastern red cedar, black oak and black ash.

Maple - Basswood: The major species in this forest type are all very tolerant of shade and are classified as *late successional*. Late successional species, because of their high tolerance to shade, are specialized to invade other forest cover types. Therefore, major species of this cover type are often found growing in the understory of other forest cover types, especially Oak - Hickory and Central Hardwoods types. The *major species* of include any combination of: sugar maple, basswood and white ash. Common *associated species* include: northern red oak, white oak, red elm, white elm, hackberry, black ash, shagbark hickory, bitternut hickory, black cherry, black walnut, and ironwood.

Oak - Hickory: When European settlers first viewed the landscape of Northeast Iowa, nearly all of the forest cover they witnessed was *oak - hickory*. This cover type is usually very diverse. This is especially true in the understory and herbaceous canopy layers due to the overstory allowing plenty of diffuse sunlight to penetrate. Oak - hickory forests are dependentdependentdependent on regular natural disturbances. Wildfire, either natural or human caused, was historically the primary disturbance that maintained and perpetuated oak - hickory forests. Species like oak are specially adapted to fire because of their ability to repeatedly stump sprout after being top killed and because of their heavy bark that protects them from fire as they get older. With frequent enough fires, this early successional habitat could be maintained indefinitely. Due to suppression of fires over many decade, this cover type is now rapidly diminishing. In particular, it is being replaced by shade tolerant species of the maple - basswood forest type. All the *major species* in the oak - hickory forest type are intolerant of shade which includes: white oak, red oak, bur oak, black oak, shagbark hickory, black walnut and aspen. *Associated species* include: black cherry, paper birch and, in some areas, eastern white pine. Common shrubs include: American hazelnut, gray dogwood, alternate leaf dogwood, nannyberry, and others.

First Bench, Bottomland Hardwoods: As its name implies, the major species for this cover type are adapted to life in wet bottomlands. These areas are wet much of the year with frequent flooding from long to short duration. Flood waters can cause heavy scouring or soil deposition. *Major species* include: cottonwood, silver maple, willows, green ash, boxelder and river birch. Associated species includes: sycamore, white elm, rock elm and black ash.

Second Bench, Bottomland Hardwoods: Stands occur on well drained soils that are wet, usually for short durations, during high flooding with heavy to light scouring and soil deposition. *Major species* include: cottonwood, silver maple, green ash, black ash, hackberry, white elm, rock elm, swamp white oak, sycamore. *Associated species* include: bur oak, river birch, willows, basswood, boxelder and sugar maple. (Black walnut can grow on second bench sites, but may perform poorly. It frequently suffers from fusarium root rot caused by waterlogged soils of excessive duration. Walnut is also prone to excessive frost damage in narrow river valley where extremely cool air can settle.)

Aspen: The *major species* in this cover type represent greater than 50% of the overstory and include any combination of bigtooth and quaking aspen. Locals may lump these two species together and call them either *popple* or *poplar*. Aspen is very intolerant of shade and is considered an early successional invader. Aspen's primary method of reproduction is through adventitious root suckering. Common early to mid-successional *associated species* include: red oak, white oak, black oak, black walnut, black cherry, white elm, red elm, shagbark hickory, bitternut hickory, eastern red cedar and white birch. Though less common, shade tolerant late successional species may be present including: hard maple, basswood, white ash, black ash and hackberry. Shrub species may be common in the understory due to the relatively high levels of light transmission through the aspen canopy. Common native shrubs include: gray dogwood, alternate-leaf dogwood, nannyberry and wild plum. Aspen is common in retired pasturelands growing alongside wild apple, hawthorn, prickly ash and multiflora rose.

Scrub Oak: This is an early successional forest type that occurs on steep slopes and ridges with thin, droughty soils. Slope aspects are usually south and west facing. The *major species* in this cover type includes any combination of: bur oak, black oak and chinquapin oak. Common *associate species* include: eastern red cedar, aspen, shagbark hickory, bitternut hickory, black walnut, white oak and northern red oak. Mid to late successional species may also occur to varying degrees and include species like: hard maple, white elm, red elm, black cherry, basswood, ash and hackberry. Ironwood may also be very abundant especially if the stand had a recent history of livestock grazing.

Black Walnut: In this cover type, black walnut makes up greater than 50% of the overstory. These stands are usually the result of black walnut slowly encroaching and accumulating into open pasturelands. Common *associated species* include: red elm, white elm, hackberry, boxelder and white ash.

Eastern Red Cedar: In this cover type, eastern red cedar makes up greater than 50% of the overstory. This cover type usually occurs where site conditions are droughty. This usually occurs on poorly maintained open pasturelands with a south or west aspects. Eastern red cedar can be invasive on open pasturelands, and is especially troublesome on very steep south facing high quality native prairie remnants call *goat prairies*. Common *associated species* include: black walnut, shagbark hickory, bitternut hickory, hackberry, white elm, red elm, black cherry, aspen, white birch, bur oak, black oak, red oak, ironwood, white ash, boxelder, hard maple and basswood.

Plantation: Stands of planted hardwoods, conifers or mixed hardwoods and conifers. Stands are usually very even-aged.

Conifers: Old groves, windbreaks, old tree plantings and native stands of eastern white pine where conifers (not including eastern red cedar) make up greater than 50% of the overstory trees. Other species could be any hardwoods.

Appendix 3. Iowa DNR Policy for Conducting Timber Sales on State Lands

Timber sales may be conducted on state owned forested lands in accordance with an approved Forest Management Plan. Once an area has a plan in place, forest management activities (including timber harvesting) may be scheduled and implemented according to the plan.

Management Planning

A District Forester will meet with the Area Manager, stand map and inventory the area, and develop a management plan based upon the Area Manager's management objectives and the current, science based forestry practices that will meet those objectives. Once a plan is developed, it will be sent to the Area Supervisor, Bureau Chief, State Forester and Natural Areas Inventory staff *(currently send to John Pearson, Mark Leoschke and Kelly Poole)* for distribution and review. Once the plan is reviewed and approved by the State Forester, it will be posted on the respective Bureau's website.

Public Meeting

The management plan will be presented at a public meeting.

Natural Areas Review

Planned timber sales must be sent to Land and Waters Bureau staff for review to determine if a natural areas inventory needs to be conducted (*currently send to John Pearson, Mark Leoschke and Kelly Poole for distribution and review*). Land and Waters staff will complete a natural areas inventory and identify any species of concern; or determine that no inventory is necessary.

Timber Sale Checklist

A timber sale checklist must be completed for the sale using the current template from the State Forester.

Timber Marking

The District Forester will mark and scale the trees in the timber sale area. A tally of board foot volume and number of trees by species will be completed.

Bid Solicitation
The Area Manager, with the assistance of the District Forester will prepare a "Notice of Timber for Sale". The District Forester will provide a list of Bonded Timber Buyers to whom bid notices can be sent. (*The contract routing process will begin here. Legal approval of the bid notice is needed before it is sent out.*) The bid opening date will be set at least 3 weeks from the date the bid notices are sent. Bids will be opened locally, and the results will be sent to the State Forester.

Additional Public Meeting
If the timber sale is in a state park or preserve, a public hearing must be conducted prior to the sale if the amount of timber sold exceeds 10,000 board feet in volume, or $5000 in value. Once the public hearing has been conducted, the sale may proceed (Code of Iowa 461A.31A).

NRC Approval
If the winning bid is $25,000 or more, the sale must be approved by the Natural Resource Commission (NRC) prior to executing a contract. The State Forester will prepare the project brief for the NRC agenda if approval is necessary. Once the NRC has either approved the sale, or the sale is under $25,000 and does not need approval, a contract may be executed.

Execution of Contract
The District Forester will assist the Area Manager with drafting of the timber sale contract. (The current contract routing process must be followed, including legal approvals and the use of the current timber sale contract template from the State Forester.) Once legal has approved the contract, **the timber buyer must sign the contract and pay for the sale in full before any trees are cut**. The timber buyer may proceed with the harvest once the full payment has been received and the contract is signed by the timber buyer and the appropriate DNR signatory.

Follow-up Management
Once the harvest is completed, the District Forester will meet with the Area Manager and assist with implementing the plan for reforestation. Post-harvest work, tree planting, or any other prescribed work will commence during the first year following completion of the harvest.

Checklist for Conducting Timber Sales

Item	Description	Date Completed
Management Plan	Area Manager and District Forester develop a Forest Management Plan	
Public Meeting	Forest Management Plan is presented at a public meeting	
Natural Areas Review	Natural Areas Inventory staff will review site and conduct a natural areas inventory if required	
Timber Sale Checklist	Checklist is completed and approval signatures or emails are obtained	
Timber marking	District Forester marks and scales the timber and provides volume estimates	
Bid Solicitation	Area Manager and District Forester prepare bid notice, bid notices are sent out and bids are received	
Additional Public Meeting	For state parks and preserves only if sale is over 10,000 board feet or $5000	
NRC Approval	Required for sales over $25,000	
Execution of Contract	Contract is drafted, reviewed, and signed by both parties	
Follow-up Management	Reforestation and follow -up work completed following harvest	

Appendix 4. Long-Term Forest Management Systems

The Iowa DNR uses a classification system for managing large forested tracts on public areas such as state parks, state forests, wildlife management areas, etc. This system helps to establish the "big picture" of long-term management goals and actions that will take place in a forest stand, so that the appropriate short-term actions can be decided upon. Each stand is assigned a unique classification:

Early successional management: This system establishes a very short rotation period in which the entire area is clearcut every 15 years or so and then allowed to grow back naturally. It applies to woodland edges where the goal is to maintain a young, brushy stage of wildlife habitat that provides a soft edge between a mature woodland and field, and also to aspen stands in NE Iowa to maintain high quality grouse habitat. In southern Iowa, it's a useful practice to help quail, woodcock, pheasants, and other wildlife.

At Boone Forks WMA, there are a total of 60 acres in 6 stands assigned for early successional management. With a 15-year cutting return interval, four (4) acres could be clearcut every year on average to maintain these stands.

Even-aged management: Even-aged forests are ones that all began growing at about the same time in which all the dominant canopy trees are the same age. Trees that demand full sunlight to grow well, such as oaks, walnut, aspen, and bottomland species are all best managed using an even-aged system, because it affords them the open light they need and is the most efficient way to regenerate them. Even-aged management practices include crown release thinning in young immature stands, and then eventually, a clearcut to start the process over. The smallest clearcut is usually no less than about 3 acres. Patch clearcuts, which is what will be employed in this WMA, are clearcuts that are usually smaller than their total overall stand size and often irregular in shape to conform to natural land features such as ridges or gullies. Even-aged management requires that prompt reforestation or natural regeneration be done following a clearcut. For oak woodlands and wildlife habitat, a target rotation age of 150 years is recommended to calculate sustainable harvest/regeneration targets.

At Boone Forks WMA, there are a total of 880 acres in 65 stands assigned for even-aged management. With a designated rotation age of 150 years, the allowable harvest/regeneration target would be about 6 acres per year on average, or 30 acres every 5 years.

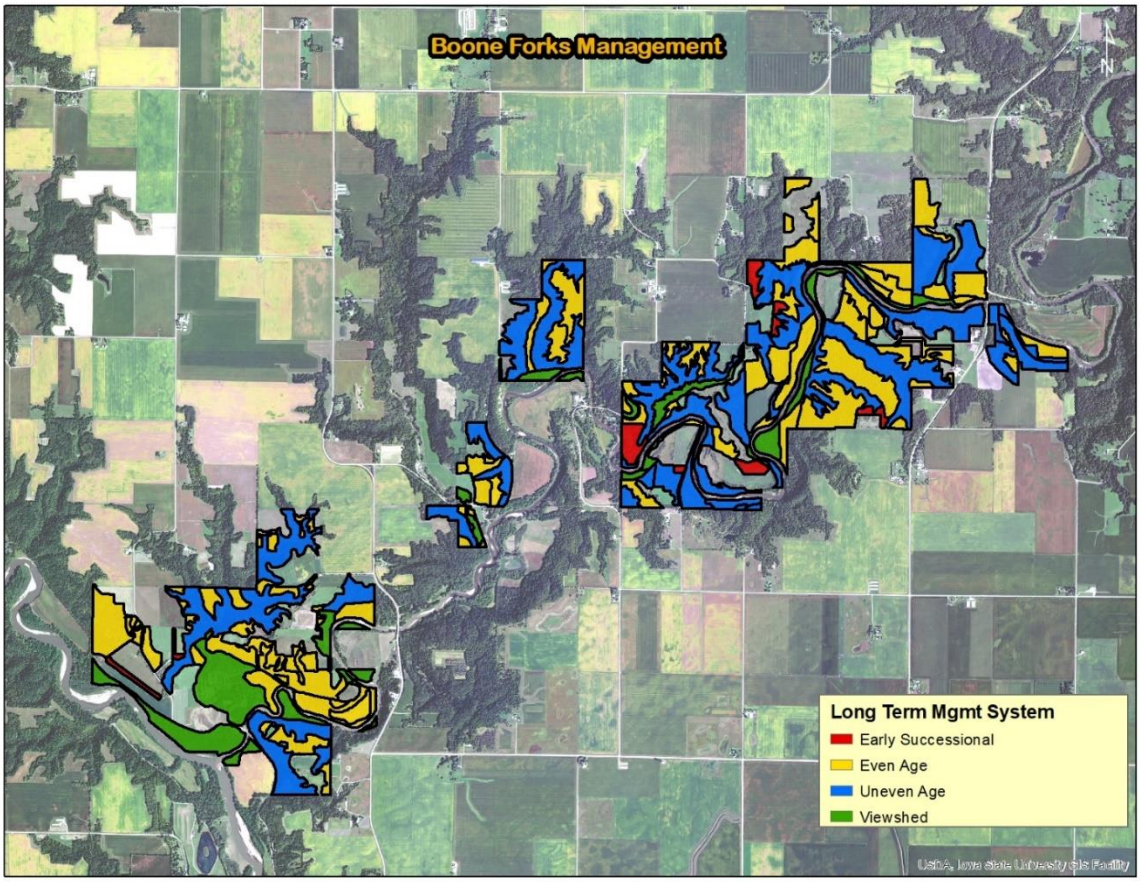
Uneven-aged management: This system is used to culture a forest with at least 3 different age classes present throughout the stand continuously. It can involve doing single-tree or small "gap" group selection harvests of clustered trees. Because the harvests are relatively light and there is always partial canopy shade, it favors shade-tolerant tree species over time such as maple, basswood, and hackberry. The trees marked for harvest are typically mature or defective trees that have completed their growth cycle or aren't wanted in the stand for some reason. Midstory or understory trees are left alone to grow up into the canopy gaps created by harvests or natural mortality. The primary task to ensure sustainability in this management system is to control invasive understory vegetation and other unwanted species to allow acceptable or desired shade-tolerant trees, such as hard maple, basswood, hickory, or others to persist.

At Boone Forks WMA, there are a total of 929 acres in 30 stands assigned for uneven-aged management. Assuming sustained volumetric ingrowth on a 25-year cutting cycle, the target cutting cycle would allow for conducting selective harvests on 35 acres per year, or 175 acres every 5 years.

Viewshed management: The "viewshed" classification is meant for areas of high visual stature for recreational users, so as not to distract from the aesthetic and recreational qualities. It can also include environmentally-sensitive sites such as wetlands or fragile slopes. Viewshed designation may also imply that active management of an area is simply not feasible or practical due to location, access, or a limitation of resources. Invasive species control, hazard tree mitigation, salvage harvesting after storms, or other low-impact activities might be necessary from time to time, but otherwise these areas will not be aggressively managed.

At Boone Forks WMA, there are 291 acres in 16 stands designated as viewsheds.

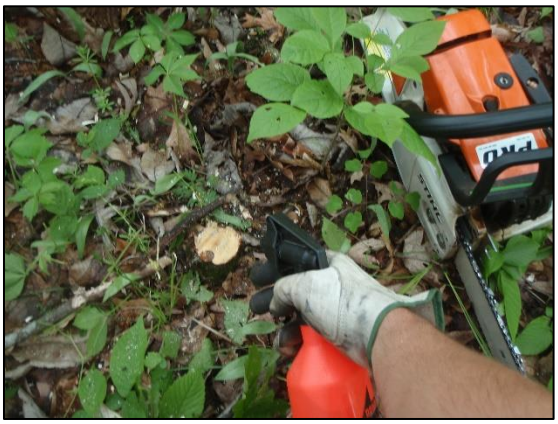
MANAGEMENT	Stands	Acres	Percent
Early Successional	6	60	3%
Even Age	65	880	41%
Uneven Age	30	929	43%
Viewshed	16	291	13%



Appendix 5. Invasive Species Control Tactics

Bush honeysuckle (Lonicera spp.), Autumn Olive (Elaeagnus umbellate), and Buckthorn (Rhamnus spp.)
For large bushes, cut-stump herbicide applications can be done using Glyphosate with 41% active ingredient. Cut-stump treatments work most times of year other than late winter and spring sap flow, but best results may occur July-November.

For widespread infestations of small plants, foliar application in late fall after all other plants have shed their leaves (late October - mid November) is very effective. Use Glyphosate at 2% by volume strength (2.5 ounces per gallon). Apply when leaves are still firmly attached.



Oriental Bittersweet (Celastrus orbiculatus)
Use hand pulling of small seedlings when the soil is moist coupled with cutting the larger vines and treating the stumps with 41% Glyphosate solution. Avoid spring sap flow and very cold winter conditions. Basal bark spray using Garlon formulations works well for larger infestations.

Black locust (Robinia pseudoacacia)
This species of tree tends to spread aggressively by rhizome/root suckering, forming small clusters of single-species pockets. It tends to be very hard to kill using chemicals and cutting. Black locust trees won't be explicitly targeted for widespread control. If they're encountered in areas where tree clearing work is being done, undiluted Transline™ herbicide (40.9% clopyralid) is recommended in a cut-stump or frill application.

Multiflora rose
Spray plants with Metsulfuron-Methyl (e.g., Escort™, MSM 60™) plus a surfactant. Spray after flowering for maximum effectiveness (July-October). Make a stock solution by mixing 2oz. of 60% MSM/Escort™, a surfactant, and one gallon of water. Then use 5oz. of the stock solution in 3 gallons of water in a sprayer.

Appendix 6. List of Endangered, Threatened & Special Concern Species in Hamilton and Webster counties. (Updated 12/1/22)

County	Common Name	Scientific Name	Class	State Status	Federal Status	Link to Species Profile
Hamilton	Mudpuppy	*Necturus maculosus*	Amphibians	T		Mudpuppy
Hamilton	Bald Eagle	*Haliaeetus leucocephalus*	Birds	S		Bald Eagle
Hamilton	Barn Owl	*Tyto alba*	Birds	E		Barn Owl
Hamilton	Northern Harrier	*Circus cyaneus*	Birds	E		Northern Harrier
Hamilton	Red-shouldered Hawk	*Buteo lineatus*	Birds	E		Red-shouldered Hawk
Hamilton	Topeka Shiner	*Notropis topeka*	Fish	T	E	Topeka Shiner
Hamilton	Creeper	*Strophitus undulatus*	Freshwater Mussels	T		
Hamilton	Cylindrical Papershell	*Anodontoides ferussacianus*	Freshwater Mussels	T		
Hamilton	Round Pigtoe	*Pleurobema sintoxia*	Freshwater Mussels	E		
Hamilton	Acadian Hairstreak	*Satyrium acadicum*	Insects	S		
Hamilton	Northern Long-eared Bat	*Myotis septentrionalis*	Mammals		E	
Hamilton	Buckbean	*Menyanthes trifoliata*	Plants (Dicots)	T		Buckbean
Hamilton	Canada Plum	*Prunus nigra*	Plants (Dicots)	E		
Hamilton	Frost Grape	*Vitis vulpina*	Plants (Dicots)	S		
Hamilton	Hill's Thistle	*Cirsium hillii*	Plants (Dicots)	S		
Hamilton	Missouri Lambsquarters	*Chenopodium missouriensis*	Plants (Dicots)	S		
Hamilton	Nodding Thistle	*Cirsium undulatum*	Plants (Dicots)	S		
Hamilton	Ragwort	*Senecio pseudaureus*	Plants (Dicots)	S		
Hamilton	Shining Willow	*Salix lucida*	Plants (Dicots)	T		
Hamilton	Silverweed	*Potentilla anserina*	Plants (Dicots)	T		
Hamilton	Water Shield	*Brasenia schreberi*	Plants (Dicots)	S		
Hamilton	Water Starwort	*Callitriche heterophylla*	Plants (Dicots)	S		
Hamilton	Crawe Sedge	*Carex crawei*	Plants (Monocots)	S		
Hamilton	Glomerate Sedge	*Carex aggregata*	Plants (Monocots)	S		
Hamilton	Great Plains Ladies'-tresses	*Spiranthes magnicamporum*	Plants (Monocots)	S		Great Plains Ladies'-tresses
Hamilton	Hidden Sedge	*Carex umbellata*	Plants (Monocots)	S		
Hamilton	Meadow Bluegrass	*Poa wolfii*	Plants (Monocots)	S		
Hamilton	Oval Ladies'-tresses	*Spiranthes ovalis*	Plants (Monocots)	T		

County	Common Name	Scientific Name	Class	State Status	Federal Status	Link to Species Profile
Hamilton	Showy Lady's Slipper	*Cypripedium reginae*	Plants (Monocots)	T		
Hamilton	Slender Sedge	*Carex tenera*	Plants (Monocots)	S		
Hamilton	Small White Lady's Slipper	*Cypripedium candidum*	Plants (Monocots)	S		
Hamilton	Tall Cotton Grass	*Eriophorum angustifolium*	Plants (Monocots)	S		
Hamilton	Toad Rush	*Juncus bufonius*	Plants (Monocots)	S		
Hamilton	Tumble Grass	*Schedonnardus paniculatus*	Plants (Monocots)	S		
Hamilton	Western Prairie Fringed Orchid	*Platanthera praeclara*	Plants (Monocots)	T	T	Western Prairie Fringed Orchid
Hamilton	Blanding's Turtle	*Emydoidea blandingii*	Reptiles	T		Blanding's Turtle
Hamilton	Smooth Green Snake	*Liochlorophis vernalis*	Reptiles	S		Smooth Green Snake
Webster	Long-eared Owl	*Asio otus*	Birds	T		Long-eared Owl
Webster	Blacknose Shiner	*Notropis heterolepis*	Fish	T		Blacknose Shiner
Webster	Orangethroat Darter	*Etheostoma spectabile*	Fish	T		Orangethroat Darter
Webster	Western Sand Darter	*Ammocrypta clara*	Fish	T		Western Sand Darter
Webster	Pistolgrip	*Tritogonia verrucosa*	Freshwater Mussels	E		
Webster	Sheepnose	*Plethobasus cyphyus*	Freshwater Mussels	E	E	
Webster	Yellow Sandshell	*Lampsilis teres*	Freshwater Mussels	E		
Webster	Regal Fritillary	*Speyeria idalia*	Insects	S		
Webster	Southern Flying Squirrel	*Glaucomys volans*	Mammals	S		Southern Flying Squirrel
Webster	Spotted Skunk	*Spilogale putorius*	Mammals	E		Spotted Skunk
Webster	Bicknell Northern Crane's-bill	*Geranium bicknellii*	Plants (Dicots)	S		
Webster	Broadleaf Water-milfoil	*Myriophyllum heterophyllum*	Plants (Dicots)	S		
Webster	Clustered Poppy-mallow	*Callirhoe alcaeoides*	Plants (Dicots)	T		
Webster	Earleaf Foxglove	*Tomanthera auriculata*	Plants (Dicots)	S		
Webster	Flat Top White Aster	*Aster pubentior*	Plants (Dicots)	S		
Webster	Limestone Rockcress	*Arabis divaricarpa*	Plants (Dicots)	S		
Webster	Roundstem Foxglove	*Agalinis gattingeri*	Plants (Dicots)	T		
Webster	Water Milfoil	*Myriophyllum verticillatum*	Plants (Dicots)	S		
Webster	Wooly Milkweed	*Asclepias lanuginosa*	Plants (Dicots)	T		
Webster	Alkali Muhly	*Muhlenbergia asperifolia*	Plants (Monocots)	S		
Webster	Broom Sedge	*Andropogon virginicus*	Plants (Monocots)	S		
Webster	Slender Cotton Grass	*Eriophorum gracile*	Plants (Monocots)	T		
Webster	Glandular Wood Fern	*Dryopteris intermedia*	Plants (Monocots)	T		
Webster	Ledge Spikemoss	*Selaginella rupestris*	Plants (Monocots)	S		
Webster	Rusty-patched Bumble Bee	*Bombus affinis*	Insects		E	