Forest Wildlife Stewardship
Plan for Augusta Wildlife Management Area

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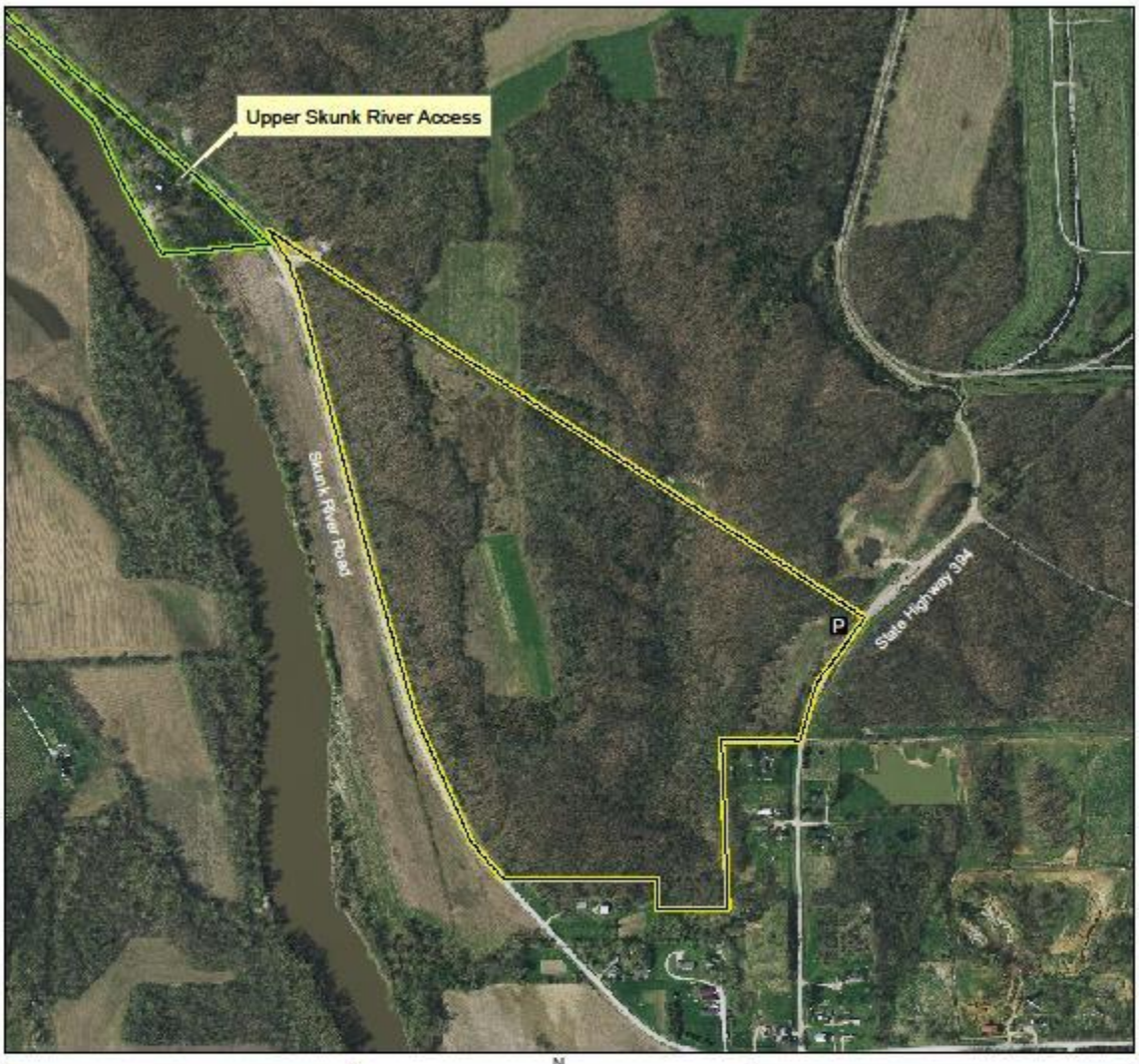
Area Map

Augusta Wildlife Management Area



Legend

State Areas open to hunting
WMA Boundary
P Parking Lot
Other Public Land
2010 Aerial Photography

Map Creation Date: 5/2011

N
Miles
0 0.05 0.1

Acres: 115

Habitat: 3/4 Timber, 1/4 Upland

Species: Deer, Turkey, Squirrel

Contact: Andy Robbins
Odessa Wildlife Unit
319-551-8459

Des Moines County, Iowa
T-69N, R-04W, Sections 23-24

Directions: N edge of Augusta on Hwy 394.

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.

Forest Wildlife Stewardship Plan for Augusta Wildlife Management Area

MANAGER:
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Odessa Wildlife Unit
9726 County Road X61
Wapello, IA 52653
(319) 551-8459

LOCATION: Sections 23 & 24, Township 69N Range 4W, Union Township, Des Moines County, Iowa
TOTAL ACRES: 115

Introduction

The Iowa DNR is the state government agency whose vision is to lead Iowans in caring for their natural resources. Conservation and enhancement of natural resources to ensure a legacy for future generations is part of the Iowa DNR's mission. Within the DNR, the wildlife bureau manages more than 350,000 acres of land as wildlife management areas (WMAs) for a variety of public users. Many of these WMAs, especially in southern and northeast Iowa, are either partially or mostly forest covered. These forests, if properly managed, provide a unique opportunity for the DNR to carry out its mission by demonstrating to the public the wise use (conservation) and enhancement of these valuable resources for wildlife.

In recent years, the wildlife bureau has recognized and acted on the need for forest wildlife stewardship plans (FWSPs) to properly manage their forest resources. Forests are not static systems, even though changes occur over a long period of time. A hands-off or "preservation" philosophy will ensure that the forest of 100 years from now will be much different and likely lower quality than the forest of today. Some forest stands may take more than 120 years to mature, a time span that may extend through the careers of several managers. This slow but relentless change requires managers to plan over the long term and leave a written record of these plans in the form of FWSPs.

Unfortunately, there is no single type of forest stand that can provide all of the requirements for all forest wildlife species. Different species require different (and sometimes quite specific) forest types and ages classes. Some generalist wildlife species use all of the forest age classes, while some specialist species have such specific requirements that only one or two particular forest types are needed to survive. A classic example of this conflicting habitat need is the requirement of some species for an abundance of forest edge while others need relatively large blocks of un-fragmented forest. Unfortunately, there is no one type of forest stand that can provide all of the requirements for all forest wildlife species. This plan will strive to find balance for all species.

Description of the Area

Augusta Wildlife Management Area (WMA) is a 115-acre parcel located in Des Moines County. It was previously owned by the U.S. Government and transferred to the Iowa DNR as "excess lands" from the Iowa Army Ammunition Plant (IAAAP) in Middletown in 1976, with the stipulation that the property be used for the conservation of wildlife. Prior to the ammunition plant being established in the early 1940s, this area was in private ownership. Aerial photos dating back to the 1930s show that the forest component was much sparser at that time with the majority of this tract being utilized for agriculture. Most of the forested portion of the area was likely used for pasture. Currently, the WMA is primarily composed of upland forest with some bottomland timber along the main drainages.

There are no previous records of forest management on the WMA until 2014 when removal and control of woodland invasive shrubs in fields 13 & 14 took place along with the planting of desirable hardwoods such as oak, hickory and cherry (2016 Direct Seeding in field 14, 2016 large sapling planting in field 13). Timber Stand Improvement (TSI) work was completed by DNR staff under direction of the district forester in stands 8 & 11 in 2016 and partial stands 6 & 7 in 2018. Further TSI work was completed by DNR staff in stands 2, 4, 9, 10 and the remainder of stand 6 during the winter of 2019-20.

For purposes of this FWSP, the Augusta WMA forested land was divided into 18 stands shown in the Stand Map aerial

photo. Each stand is described in this plan and recommendations are outlined for woodland management by stand. A priority level has been established for each stand recommendation to assist in management decisions.

Objectives

Because Augusta WMA is a wildlife management area, the primary focus of the FWSP will be to provide habitat for a wide variety of forest wildlife species. Funding for the management of Augusta WMA has been almost exclusively hunter generated monies, i.e. license fees and excise taxes on sporting equipment. Consequently, a primary objective for management of the area is to improve habitat for hunted species such as deer, turkey, and squirrels. On the other hand, the DNR is obligated to consider the effects of its management actions on nongame species as well, particularly those that are threatened, endangered, or species of special concern. The "Iowa Wildlife Action Plan" (IWAP) identifies "species of greatest conservation need" (SGCN) in the state. A list of SGCN potentially found at Augusta WMA can be found in Table 1. Recognizing that it is difficult if not impossible to manage for all of these species at the same time and on one tract, this list provides an important guideline by which management strategies and decisions will be made.

To summarize, the primary objectives for this wildlife area are: creating and maintaining quality wildlife habitat for a wide variety of wildlife species, promoting quality wildlife-dependent recreation, and protecting SGCN. This Forest Wildlife Stewardship Plan strives to develop forest stands that have a wide diversity of tree sizes and species. Developing a diverse forest will benefit the widest variety of wildlife species.

Management Considerations

There are several considerations that have entered into the formulation of this FWSP for the Augusta WMA:

1. There has been a steady decline and projected future decline in oak forest throughout Iowa caused by continuous succession of forest stands to the more shade tolerant species such as maple, basswood, ironwood, and bitternut hickory. Oak-hickory forests are extremely important for a wide variety of wildlife species in Iowa. Oak-hickory woodlands also provide critical invertebrate food sources (Narango et al. 2020) and habitat for canopy-dwelling birds as well as nesting sites for both birds and mammals that occupy cavities. Mast from these species provides an important food resource for many mammal and bird species. The eventual replacement of oak forest with stands dominated by more shade tolerant species such as basswood, elm, bitternut hickory or hackberry would undoubtedly have a negative effect on a huge variety of wildlife species.
2. There has been a loss of early succession forest stands and associated wildlife species throughout much of southern Iowa. Many of the disturbance factors such as fire, grazing, and cutting have dramatically decreased over the past 40 years. As a result, much of the upland forest in this vicinity has progressed beyond the early succession stage. While this may have been beneficial to those wildlife species requiring more mature forests, it has probably been a negative for species such as bobwhite quail, American woodcock, black-billed and yellow-billed cuckoos, and blue-winged warblers.
3. Many forest interior bird species such as Acadian flycatchers, veerys, eastern wood pee-wee, cerulean and Kentucky warblers, and other neotropical migrants have experienced population declines, with eastern forest birds declining by nearly 18% since 1970 (Rosenberg et al. 2019). Forest fragmentation and loss across their annual range, declining forest health and associated cowbird parasitism are considered among the factors causing declines in some of these species. Iowa is a state with exceptionally fragmented forests where addressing the needs of some of these large-block, interior nesting species is particularly difficult, if not impossible. Augusta WMA, however, is part of a relatively large block (by Iowa standards) of public (U.S. Army Ammunition Plant) and private forestland. It is important to consider the habitat components of this larger landscape when making land management decisions and every attempt should be made to minimize fragmentation of this forest when designing and implementing silvicultural practices.

This FWSP starts with the assumption that it is very important to maintain an oak-hickory forest to the extent possible. The maintenance of oak-hickory forest on public land becomes even more important in light of likely future trends on privately held forest. Much of the private forest has been subdivided and sold to sportsmen and small acreage holders, many of whom will probably be resistant to implementing the forestry practices necessary to regenerate oak. If this occurs, much of the forest landscape in Iowa will eventually convert to shade tolerant species at the expense of oak.

Management Strategies

Several management strategies will need to be used to implement the objectives of the plan within the management considerations mentioned above:

1. Natural oak regeneration requires sunlight to give the oak seedlings a competitive edge over shade tolerant species. Clearcuts and shelterwood cuts (described under Proposed Management Systems) are the typical systems used for regenerating oak. To prevent any potential negative effects on interior nesting species, clear-cuts should be kept as small as possible (3-10 acres) while still large enough to achieve oak regeneration and be economically feasible. To achieve economic feasibility with small clear-cuts, sales may need to be combined with other sales on public land in the vicinity. Subdividing larger stands will be necessary to keep clear-cuts as small as possible.
2. Early successional stages and mature stages of forest both tend to be more productive for a variety of wildlife than the intermediate crowded pole-size stage. Practices such as basal area thinning and crop tree release can be used to minimize the time a stand must spend in this intermediate stage. Basal thinning will result in greater sunlight for the entire forest, including desirable understory grasses, forbs and sedges. More sunlight to the forest floor will mean more flowering plants which will attract insects and spiders, an important food source for many birds, amphibians, and small mammals.
3. While there is no feasible way of extending the early successional stage of a forest stand, the mature stage of succession may be able to be extended significantly beyond the typical 100 or 120-year rotation age. While this may result in some decline in timber quality and economic return, the trade-off value for certain wildlife species may make it worth it. The longer rotation should tend to postpone the amount of fragmentation needed to regenerate the stand. The limiting factor may be how long the rotation can be extended without jeopardizing natural oak regeneration. Natural regeneration is preferred and planting should be avoided if at all possible.
4. Some interior nesting bird species seem to select for large spreading “wolf trees” within a given stand. When clearcuts and shelterwood cuts are marked, these trees should be left, especially since they typically have little economic value. Many wildlife species require dead or dying trees to provide insects for food and cavities for nesting. When clearcuts and shelterwood cuts are marked for harvest, provisions should be made to leave snags, cavity trees and 6-7 cull trees per acre to provide this component for the future stand.
5. It is probable that Indiana bats use this area during the summer, in particular the riparian forest adjacent to the Skunk River and its adjacent creeks. Cutting on any stands described in this FWSP must be done in a manner that does not disturb potential bat maternity trees during the breeding season.
6. This FWSP should be updated regularly as more information becomes available on wildlife use and on the efficacy of various silvicultural/management procedures. If funding is available, wildlife surveys should be done to determine species use to help evaluate success of management decisions.

Income from Timber Harvest

It should be emphasized that income generation is not the goal behind FWSPs. Harvesting is conducted to regenerate stands to desirable species and to achieve a desirable diversity of tree sizes and species. However, any income generated from timber harvesting operations must be reinvested into the WMA forest management in Iowa to thin young stands, convert areas to more desirable species and otherwise manage the forest for wildlife, and invest in surveys and/or research to evaluate success of management decisions and help direct future management. Without this reinvestment, there is little chance that the WMA annual budget will allow the recommendations in this plan to be implemented. Harvesting is a very minimal portion of this plan. The majority of work recommended is directed at thinning or burning young stands so the oak is not shaded by other trees and at removing undesirable species to encourage regeneration of desirable trees.

Current Distribution of the Tree Size on the area

The woodland was stand mapped according to the average tree size as follows:

Tree Size (dbh)	Acres	% of Forested Area
Sapling 1-4”	15.7	14.6%
Pole 5-12”	23.9	22.2%
Small Saw 13-18”	67.6	63.0%
Sawlog > 20”	0	%
Total	107.2	100%

Proposed Management Systems for the area

Recommendations for each stand were based on whether the area will be managed to create an even age system, early successional stand, or a viewshed. The decision on what system would be used was based on the objectives for the area to maintain an oak component where feasible, develop a diverse woodland landscape, and to protect fragile sites.

The management recommendations for Augusta WMA are shown in the table below:

Management System	Acres	% of Forested Area
Early Successional	10.3	9.6%
Even Age	93.1	86.8%
Viewshed	3.8	3%
Total	107.2	100%

Early Successional Management

Many bird species such as American woodcock, blue-winged warbler, black-billed cuckoo, yellow-billed cuckoo, and eastern towhee are dependent on the early successional stages of woody growth for breeding and many birds that nest in older forest ages, utilize early successional habitat for foraging and rearing fledglings. The high stem density of both trees and shrubs provides suitable nesting habitat and protection from predators. The open canopy also provides foraging habitat for bats and encourages the growth of sun-loving fruiting plants which are utilized by birds and mammals.

The early successional management areas can be managed on a 15-20 year rotation. In other words, every 15-20 years the stands could be cut to create areas with high stem density. Augusta WMA has 10.3 acres scheduled for early successional management. Applying sustainable forestry guidelines, about 2 acres could be cut every 10-15 years

Many of the timber edges contain narrow bands of sapling to pole size trees that were not identified as stands to be managed for early successional management. If there was a desire to maintain these stand edges as early successional forest, the total number of acres managed for early succession could be increased from the 10.3 acres currently identified.

Even Age Management

Even age management involves growing a stand of trees which are close to the same age. At some point in a stand's life, the area is clearcut which results in the even age structure. This type of management creates excellent habitat for deer, turkey, squirrels and a wide variety of other wildlife species. It is essential for regeneration of oak, which requires full sunlight. The only way that oak can be maintained as a component of the forest over the long run is by practicing some form of even age management.

Each stage or age class of an even age stand provides habitat for a suite of wildlife species. For example, regenerating stands (1-10 years old) benefit the same species as do early successional stands, i.e. blue-winged warblers, black-billed cuckoo, yellow-billed cuckoo, eastern towhee, as well as northern bobwhite and American woodcock. This stage is also attractive to pollinators and foraging bats.

Sapling to small pole-size stands between 10-20 years old may be used by black and white, Kentucky warblers. Pole-size to medium-size trees (20-60 years) tend to be used by canopy nesters such as scarlet tanagers, and ground nesters such as ovenbirds and Kentucky warblers.

Mature stands of 60-125+ years of age are used by birds such as the eastern wood pee-wee, Acadian flycatcher, ovenbird, worm-eating warbler, and scarlet tanager.

As woodland stands age, they constantly lose trees to shading, insects, disease, etc. The dead and dying trees provide habitat for cavity nesters such as woodpeckers, nuthatches, wood ducks, eastern screech owls, and tufted titmice. The

federally endangered Indiana bat uses loose barked live trees such as hickory as well as the sloughing bark from dying trees for their maternity colonies. Snags and live hickory trees should be maintained at a level of 6 -8 per acre or more.

Thus, even age management has the potential to provide a large variety of age classes over time that can meet the needs of a variety of wildlife species.

While there are many methods to open a stand to sunlight, clearcutting and shelter wood harvesting are the most common. Clearcutting is a practice that opens the stand all at once. Regeneration using clearcutting requires there to be sufficient oak seedlings or advanced regeneration present. Without these seedlings, planting may be necessary following a clearcut.

Shelter wood harvests are one way of encouraging seedling production prior to a clearcut. Shelter wood harvests include several thinnings done prior to the final clearcut. If the shelter wood is done correctly, the trees left after the thinnings will provide seed and the forest will be open enough to allow sunlight to reach the forest floor. The trees left will also help provide shade that limits the growth of undesirable or invasive plant species. This method can take many years to create the next oak stand and may need mechanical or fire disturbance to keep out undesirable species. After sufficient seedling or advanced regeneration is present, the stand needs to be clearcut to successfully regenerate the oak stand.

Crop tree release is discussed in this plan. This practice is done most frequently when the trees are pole-sized. The goal of the practice is to choose no more than 50 trees per acre that are considered to have the best genetics. All trees that touch the canopy of the crop tree are killed to allow the tree to reach maximum growth potential.

Thinning the understory is a practice also used in even age management. This practice involves removing trees that are below the main canopy to allow more sun light to get to the forest floor. Ironwood, sugar maple, and other shade tolerant species warrant this practice if species like oak are wanted in the future.

Fire is an effective and inexpensive tool that has a long history of use and continues to be studied in managing oak stands. Occasional burning of the leaf layer in the woods will kill thin barked species such as hard maple, cherry, elm, bitternut hickory and iron wood. Fire will expose mineral soil and open up the ground to sunlight. These conditions favor the natural regeneration of oak. Depending on the extent of root system development, some oak seedlings will tolerate fire better than others, but as a whole, oaks tolerate fire better than other tree species. The top of an oak seedling often will die back following fire, but the roots will send up new growth soon thereafter.

There are 93.1 acres on this area that will be managed as even aged woodlands to regenerate oak. The eventual acreage requiring clearcutting every 5 years depends on the rotation age used for the stand. With a typical 125-year rotation, approximately 7-8 acres would need to be clearcut every 5 years. If the rotation age can be extended significantly without jeopardizing the ability to regenerate oak, the acres of clearcutting every 5 years can be reduced correspondingly.

Viewshed Management

Viewshed areas are typically steep fragile slopes and areas along streams that are best left to naturally progress through succession. Viewsheds may also be used to protect areas for endangered species or be used to protect certain public use facilities. Management can take place on these areas where desirable, but the major objective is to have minimal disturbance.

Certain Neotropical migrants will benefit from the areas designated as viewshed. On Augusta WMA, the steep bluff near the Skunk River will be mostly in viewshed to protect potential Indiana bats as well as provide habitat for Neotropical migrants such as the Acadian flycatcher. There will be 3.8 acres that will be managed as viewshed.

Monitoring Forest & Wildlife Response to Management Practices

Knowledge of vegetation and wildlife response to silvicultural practices (e.g. oak regeneration, SGCN use of managed stands), will assist managers in developing future FWSPs to reach the goals of conserving SGCN as well as keeping common wildlife common. It will also help build public acceptance of silvicultural practices which are not always viewed

favorably by the public. Information from monitoring will allow public and private forest managers to ensure that proper silvicultural techniques are being used in early successional habitat creation to meet the wildlife and vegetation goals of the plan. A detailed forest and wildlife monitoring plan will be developed as an addendum to this forest stewardship plan that will outline procedures, species monitoring to be conducted and timetable.

Work Plan

The work plan for Augusta Wildlife Management Area is designed to aid officials and foresters in the implementation of forest management practices. It is written with the understanding that these professionals have a basic understanding of forest management principles and techniques. Every detail has not been outlined in the plan because the plan would become too long to be of practical use. This plan is intended to get work accomplished on the ground.

Stand Level Information

Tree Size Classes Diameter at Breast Height (DBH)
Sawtimber: 18" above; Small Sawtimber: 12-16"; Pole: 5-12"; Sapling: 2-5"; Seedling: <2"

Stand 1
Acres: 3.5

Objectives & Current Conditions: To manage for even age mixed hardwood growth and future oak regeneration.

General description, including density/structure, forest type and diameter size class: This stand is located in the NE corner of the property with the Ammunition plant fence line to north, parking/field to east and stand 2 to south and west. The species here include sawtimber black oak, black walnut, and a few basswood with small sawtimber walnut, black oak, white oak and bitternut hickory. There are some double trunks that are a result of past cutting/disturbance, often one trunk is larger but not always. The pole species (or next generation of canopy/dominant trees with no action) include elm, hard maple, ironwood, hackberry with sapling ironwood, hard maple and hackberry. The density of stems per acre, measured in basal area of tree trunks at 4.5' above ground level, is about 70% relative stocking. The average diameter of stems is 16-17" DBH.

Forest Health Management Activities/Monitoring: A select harvest to retain best crop trees for growth and future seed, and to reduce overall stems per acre. Remove vines from walnut crop trees. This is a higher priority stand based on species and average size. In 1-10 years Site Prep for Natural Regeneration (SPNR) work can begin here. SPNR work may include a weed tree removal, Rx burning and (if not completed through selective harvest) a shelterwood (or partial) harvesting of mature, declining, and some desirable trees to make space and allow sunlight for the natural regeneration of shade intolerant oak and walnut trees. A weed tree removal would include a manual killing of pole and sapling hackberry, ironwood, maple and some elm (from 1-10" diameter) in conjunction with one or more timely Rx burns to open up canopy to allow sunlight to forest floor, while also preparing seedbed for acorn drop.

Harvesting/Post Harvest Activities/slash management: Trees girdled and left standing or felled trees and tree tops provide great wildlife habitat. Canopy openings from harvest activity result in temporary brushy cover for use by many game and non-game animals.

Stand 2
Acres: 5.8

Objectives & Current Conditions: To manage for even age mixed hardwood growth and diversity.

General description, including density/structure, forest type and diameter size class: This stand is located west of stand 1, is bordered to west by main creek and north by fence line. The species present here include a few sawtimber red and black oak scattered, with small sawtimber and large pole white oak, black oak, red oak, with some bitternut hickory, ash and elm. There are double stems of sawtimber and small sawtimber oaks. There is evidence of oak wilt in last 10-15 years with a few standing dead red and black oaks. The small pole and sapling species include elm, hard

maple, bitternut hickory, suppressed and overcrowded white oak, with seedling hard maple and elm. The density of stems per acre is high, around 90% relative stocking with an average diameter of 13-14" DBH.

Forest Health Management Activities/Monitoring: Crop tree release to favor white oak, red oak, black oak, and hickory in that order, favoring single stemmed trees over double stems, and trees with healthy and wide crowns over more suppressed trees. A selective harvest could remove some of the largest black and red oak that are getting over-mature, and also add to crop tree thinning by harvesting some of the merchantable trees rather than girdle and leave standing.

Site Preparation for Natural Regeneration (SPNR) work can begin here in 10-15 years, as the white oak average is currently around 15-16" DBH. A prescribed burn in next 5 years, as well as additional burns as needed closer to maturity can keep smaller seedling and sapling ironwood and maple from becoming too dominant in stand. This stand may be around 10-25 years behind stand 1 for final harvesting to regenerate stand. This is moderate to higher priority based on heavier white oak component and larger average diameter of oaks.

Stand 3
Acres: 2.6

Objectives & Current Conditions: To manage for even age hardwood growth and invasive species control.

General description, including density/structure, forest type and diameter size class: This stand is south of stand 2 and is bordered by parking lot/field to east. The species here include scattered sawtimber black oak, shingle oak, ash with pole ash, honey locust, ironwood and a few walnut and hickory. There is heavy autumn olive, an invasive, exotic species that should be controlled when possible and need to be controlled when doing oak regeneration work. The density of stems per acre is lower, around 60% relative stocking and the average diameter is 11-12" DBH. The ash trees are showing signs of moderate to heavy bird flecking and some upper canopy decline, a sign that Emerald Ash Borer has already infested many trees in this area.

Forest Health Management Activities/Monitoring: Weed tree removal to lessen the autumn olive and also to favor other desirable growth over ash that may not be dead but could be shading a more desirable tree. Where terrain is too steep for mechanical control of olive, manual cutting and chemical treatment of stump, or hack and squirt method is recommended to control as many olive plants as possible. This weed tree removal work is a moderate priority to reduce seed and spread while work is being completed in other areas of the timber, as well as the recently controlled open field stand 13. A light crop tree release could be needed in 3-5 years to continue to manage for oak growth.

Stand 4
Acres: 5.4

Objectives & Current Conditions: To manage for even age mixed hardwood growth and diversity.

General description, including density/structure, forest type and diameter size class: This stand is located south of stand 2, west of stand 3 and is bordered to west by main creek. The species here include a few scattered sawtimber black oak, basswood and ash, with small sawtimber bitternut hickory, red oak, and basswood. The pole species include basswood, black oak, few honey locust, black cherry and hard maple. The sapling trees are hard maple, ironwood and basswood. There is a fairly heavy stocking of honeysuckle shrubs in this stand. There is also some black locust in this stand. The relative stocking is around 80%, the average diameter is 13-14" DBH.

Forest Health Management Activities/Monitoring: Crop tree release to favor red oak, black oak, black cherry, hickory and basswood in that order. A partial, salvage harvest could be completed in next few years to selectively cut out ash, poorly formed or declining black oak, basswood, bitternut hickory and any black or honey locust. The black locust should not be cut unless chemically treated with approved herbicide for black locust, as these trees will sprout prolifically and outcompete growth of nearby younger and more desirable species. Honeysuckle is invasive and should be controlled when any work is completed in this stand. This small patch of black locust is near the trail and edge of timber with available sunlight, so could be left as is, or treated at later date when more resources are available to follow up on a

stand conversion for this >1 acre area. This is a lower priority stand based on other stand compositions.

Harvesting/Post Harvest Activities/slash management: Tree tops above 8" diameter will be left on site as is.

Stand 5
Acres: 3.5

Objectives & Current Conditions: To manage for even age mixed hardwood growth and diversity.

General description, including density/structure, forest type and diameter size class: This stand is located south of stand 4 and is bordered to east and south by private property/adjacent neighbors. The stand runs along the south most part of creek that runs north/south through property and most of this stand is on steep, east/SE facing slope. The species here include few scattered small sawtimber red oak, elm, white oak and chinkapin oak. The pole species include hackberry, cedar, shingle oak, few red/black/white oak. There is sapling hard maple and hackberry. This is a smaller stand with 10" DBH being average, and the density is nearing 90% relative stocking. There are scattered dead and dying oaks throughout this stand on these shallow soils and steep slopes, leaving larger canopy openings being filled in with hackberry and maple.

Forest Health Management Activities/Monitoring: Crop tree release to favor mix of oak, cedar, hackberry and elm in that order. This is a low/moderate priority stand based on other stand compositions. Some scattered dead or dying oaks could be included if a nearby stand is harvested. This stand will be more difficult to manage for future natural regeneration with the steep slopes and heavier shade tolerant hackberry and maple. A woodland planting to increase oaks in this stand could be done to increase diversity and oak species.

Stand 6
Acres: 10.7

Objectives & Current Conditions: To manage for even age mixed hardwood growth and regeneration.

General description, including density/structure, forest type and diameter size class: This stand is located west of stand 5 and west of main creek. The species present here include small sawtimber black oak, red oak, few white oak/chinkapin oak, ash, shagbark hickory and walnut. The pole species include black oak, shagbark hickory, hackberry, ironwood and ash. The sapling trees are ironwood, ash and hackberry, with ironwood being dominant in the sapling/seedling stages. There is oak wilt present here, with small patches of 3-10 trees of varying degrees of decay, suggesting oak wilt has been active here over the years but has seldom spread past a small patch in any one season. All areas should be monitored annually to maintain up to date information on disease and insect issues. The relative stocking is around 70-75%, with average diameter being 13-14" DBH.

Forest Health Management Activities/Monitoring: Crop Tree Release has been completed here in east 2/3 of stand during 2017-18 winter. Crop trees were identified and nearby trees marked to girdle or cut down. Special attention was paid to oak wilt areas, and where recently active, more black and red oak trees were cut to slow spread to further trees. For the remainder of stand, a light crop tree release to favor mix of red oak, white oak, walnut, black oak and hickory in that order. Remove any vines from walnut. With most desirable trees being larger, a light crop tree release will be all that is needed, followed by a selective harvest in near future focusing on ash (salvage), hickory and some poorly formed or declining oak. A Rx burn should be done directly before selective harvest and possibly again 2-3 years after. Making small areas of brushy, open habitat in this area in 5-7 years will only last 10-15 years before getting too large and serving different habitat purposes. The idea of partial harvests over time and rotating these harvests is it will allow this wildlife management area to always have some brushy/thick habitat while always maintaining the large woodlands. *Re-evaluating plan every ten years will help assure that these areas are rotated and that follow up is not needed in one area before starting work in another area.* This is a high priority to finish thinning west 1/3 of stand and to salvage ash and larger red and black oak.

Stand 7
Acres: 6.7

Objectives & Current Conditions: To manage for even age mixed hardwood growth and regeneration.

General description, including density/structure, forest type and diameter size class: This stand is located north of stand 6 and has both a flatter area and also some east facing slopes. The species here include scattered sawtimber black oak, white oak and ash with small sawtimber white oak, black oak, bitternut hickory, hard maple, elm and ash. The pole species are hackberry, shagbark hickory, bitternut hickory, honey locust, hard maple and ash with sapling ironwood, maple, bitternut hickory and ash. There are areas with little/no oaks, and maple is dominant here on these couple of ½ acre ridges. The trees are larger near the lower slopes and smaller near the upland ridge with main trail. The density of stems per acre is moderate at 70% relative stocking, and the average diameter is 15" DBH.

Forest Health Management Activities/Monitoring: A light crop tree release to favor a mix of small sawtimber white oak, walnut, red oak, black oak, hickory in that order was completed in 2017-18 winter. SPNR work can begin in next 1-10 years, including a weed tree removal to cut and treat (to prevent stump re-sprout) ash, hackberry, hard maple and some ironwood where they are directly competing with crop trees or nearby seed trees. A Rx burn could be done one or more times as needed to kill out sapling and seedling maple, ash, bitternut hickory and ironwood, as well as prep forest floor for acorn drop if possible. Some trees in this stand could be included in nearby harvest to remove merchantable ash, declining or some of the overmature black and red oaks, and some large white oak as needed to open up canopy. This is a moderate priority stand to begin site prep work.

Stand 8
Acres: 5.9

Objectives & Current Conditions: To manage for even age mixed hardwood growth and diversity.

General description, including density/structure, forest type and diameter size class: This stand is located north of stand 7, east of main field and west of main creek. The species here include a sawtimber white oak scattered with small sawtimber white oak, black oak and some bitternut hickory. The pole size trees include white oak, elm, black oak, few walnut, black cherry and cedar. The average diameter is 12-13".

Forest Health Management Activities/Monitoring: Crop tree release to favor walnut, white oak, red oak, black oak in that order was completed in 2016-17 winter. Vine removal of walnut crop trees was also completed at that time. This is a low to moderate priority stand based on recent work completed and should be re-visited in 2030 to determine need for additional crop tree work.

Stand 9
Acres: 9.5

Objectives & Current Conditions: To manage for even age mixed hardwood growth and control invasive species.

General description, including density/structure, forest type and diameter size class: This stand is located north of stand 8, with large field bordering to west and Army ground bordering to north. The old foundation is within this stand. The species here include a few sawtimber walnut, black oak, ash and locust with small sawtimber average ash, bitternut hickory, walnut, black oak, honey locust, elm and a few hackberry. There are many dead and declining elm in this stand, Dutch Elm Disease is active right now. There is honeysuckle in this stand, an exotic, invasive species that should be controlled as possible. The relative stocking is around 75-80% with the average diameter 13-14" DBH.

Forest Health Management Activities/Monitoring: Crop tree release to favor walnut, black oak, hickory, hackberry and elm. Remove all vines from walnuts. As with all crop tree release work, favor single stems over double, high forks over low forks. Choose trees with decent stem and good canopy. Control honeysuckle by manual cutting and chemical treatment of stems as possible, follow up treatments of very small stems could include Rx burning. This is a moderate

priority stand.

Stand 10
Acres: 4.5

Objectives & Current Conditions: To manage for even age mixed hardwood growth and diversity.

General description, including density/structure, forest type and diameter size class: This stand is located east of stand 9, west of stand 2 and is bordered to north by Army land. The species here include scattered sawtimber black oak, with small sawtimber and pole black oak, honey locust, white oak, ash, hard maple, shagbark hickory, with a few walnut and elm. Sapling hard maple and ironwood dominate the under story. There is a narrow cedar stand at the west edge of this stand on a higher ridge. The pole and small sawtimber cedar stand has some mixed oak with pole ash, few walnut, white oak, shingle oak and hedge (Osage Orange). The density is moderate here at 65% relative stocking, and the average diameter is 13-14" DBH.

Forest Health Management Activities/Monitoring: Crop tree release could be done in the next five years to favor mix of white oak, walnut, and black oak. This is a moderate priority stand based on composition and average size.

Stand 11
Acres: 4.4

Objectives & Current Conditions: To manage for even age mixed hardwood growth and diversity.

General description, including density/structure, forest type and diameter size class: This stand is located around South and east portion of large field. The species present here includes pole cedar, walnut, elm, cherry, maple, with a few honey locust, hedge and black oak. There is sapling ash, cedar, dogwood shrub and also invasive autumn olive. The relative stocking is around 80% and the average diameter is 10".

Forest Health Management Activities/Monitoring: Crop tree release to favor cedar, walnut, cherry and black oak in that order was completed in 2016-17 winter. This is a lower priority stand and should be re-visited in 2025 to determine need for additional crop tree work. Control olive through cutting and chemical treatment of stems and management of sunlight where possible.

Stand 12
Acres: 2.1

Objectives & Current Conditions: To manage for early successional/winter habitat by favoring cedar and edge habitat

General description, including density/structure, forest type and diameter size class: This stand is located on a flat area south of large field, with a very old hedge (Osage orange) row at the south end. The species here are mainly pole eastern red cedar, with some pole and sapling shingle oak, hedge, elm, ash and large autumn olive shrubs. There are a few dogwood, honeysuckle and some multi-flora rose here.

Forest Health Management Activities/Monitoring: Basal Area (BA) thinning to allow continued growth and lower branches to persist on the cedar. Control invasive species growth as any other management is completed. Favor mixed hardwoods, especially hedge and shingle oak, which can both act as different habitat than rest of woodlands. This is a lower priority stand.

Stand 13
Acres: 8.2

Objectives & Current Conditions: To manage for near term early successional habitat with conversion from dying ash stand to young hardwood stand.

General description, including density/structure, forest type and diameter size class: This stand is located along west side of large field. The species present on this upland and flatter area include scattered sawtimber and small sawtimber black oak, honey locust, ash, with a couple red oak and shagbark hickory. The pole trees are honey locust, shagbark hickory, hard maple, red oak, with a few ash, walnut, and basswood. Hard maple sapling and hard maple and ironwood seedlings dominate the understory. The ash component is larger average diameter at south end, and makes up over 50% of canopy at north half of stand. There is autumn olive and some multi-flora rose along these edges, and also some brushy spots of dogwood along the edges. The average diameter is 13-14".

Forest Health Management Activities/Monitoring: Harvest to salvage any few or remaining ash, include honey locust where possible. With heavier ash component and higher density of less desirable species in the rest of stand, this could be converted to mixed hardwood woodlands to improve diversity and wildlife use.

Stand conversion could include clearing where ash and invasive species are heaviest, as well as cutting some hard maple, basswood and ironwood, followed by a woodland planting. Cut and treat invasive species, cut and treat some hard maple and ironwood around existing openings and where these species are too dominant. Cut hard maple, basswood and ironwood in other areas where existing more desirable trees are being out-competed by maple/ironwood and do not chemically treat to allow these trees to re-sprout as woody deer browse. Some ash can be left as standing dead habitat and others cleared to open up space and access for woodland planting as needed.

Plant 50 trees per acre of mixed native hardwoods such as white oak, chinkapin oak, red oak, bur oak, hickory, pecan, and also some soft mast such as hackberry, cherry, pawpaw. Tube or fence each planted tree. Use larger bare root seedlings or 3 gallon potted seedlings if desired.

Not all 8.2 acres may need planting at full 50/tree acre rate, likely 6 acres will be full planting rate with 2 acres needing little/no additional trees to fill in the canopy.

Stand 14
Acres: 3.8

Objectives & Current Conditions: To manage for viewshed.

General description, including density/structure, forest type and diameter size class: This stand is located on a very steep, west facing slope along the Skunk River at west border of property. The species present here include some scattered small sawtimber ash, red oak, black oak, with pole cedar, ash, shagbark hickory, and some chinkapin oak. There are a few large cottonwood trees along lower slope. The average diameter is around 13".

Forest Health Management Activities/Monitoring: No action, this area will be managed as viewshed.

Stand 15
Acres: 10.1

Objectives & Current Conditions: To manage for even age mixed oak regeneration

General description, including density/structure, forest type and diameter size class: This stand is located west of stand 13 along the less severe slopes. The species present here include sawtimber and small sawtimber white oak, black oak, red oak, with a few larger ash, shagbark hickory and elm. There are pole hard maple, buckeye, bitternut hickory, with a few ironwood, bur oak and ash. The sapling and seedling trees are mostly hard maple, with some areas of heavier ironwood and buckeye. The average diameter is 16-17".

Forest Health Management Activities/Monitoring: SPNR work can begin here in next few years. Work would include 1-3 Rx burn over next 1-10 years while oak is still heavy enough to provide enough leaf litter fuel to carry fire. This stand could be harvested lightly to salvage out larger ash, red and black oak that are declining. A weed tree removal to kill ash,

maple, buckeye and ironwood from 1-10" diameter could be started in next 1-5 years.

Stand 16
Acres: 4.8

Objectives & Current Conditions: To manage for even age chinkapin and red oak regeneration

General description, including density/structure, forest type and diameter size class: This stand is located west of stand 15 along steeper slopes. The species present here include sawtimber and small sawtimber chinkapin oak, black oak, red oak, with a few maple, ash, and shagbark hickory and bur oak. There are pole hard maple, bitternut and shagbark hickory, and buckeye. The sapling and seedling trees are mostly hard maple, with some areas of heavier ironwood and buckeye. The average diameter is 13-14".

Forest Health Management Activities/Monitoring: SPNR work can begin here in next few years. Work would include 1-2 Rx burn over next 1-10 years while oak is still heavy enough to provide enough leaf litter fuel to carry fire. This stand could be harvested lightly to salvage out larger ash, red and black oak that are declining. A weed tree removal to kill ash, maple, buckeye and ironwood from 1-10" diameter could be started in next 1-5 years. The slope here might restrict some burning, and weed tree work but is mostly traversable.

Stand 17, 18
Acres: 3.6, 12.1

Objectives & Current Conditions: To manage for even age long term and young, desirable habitat

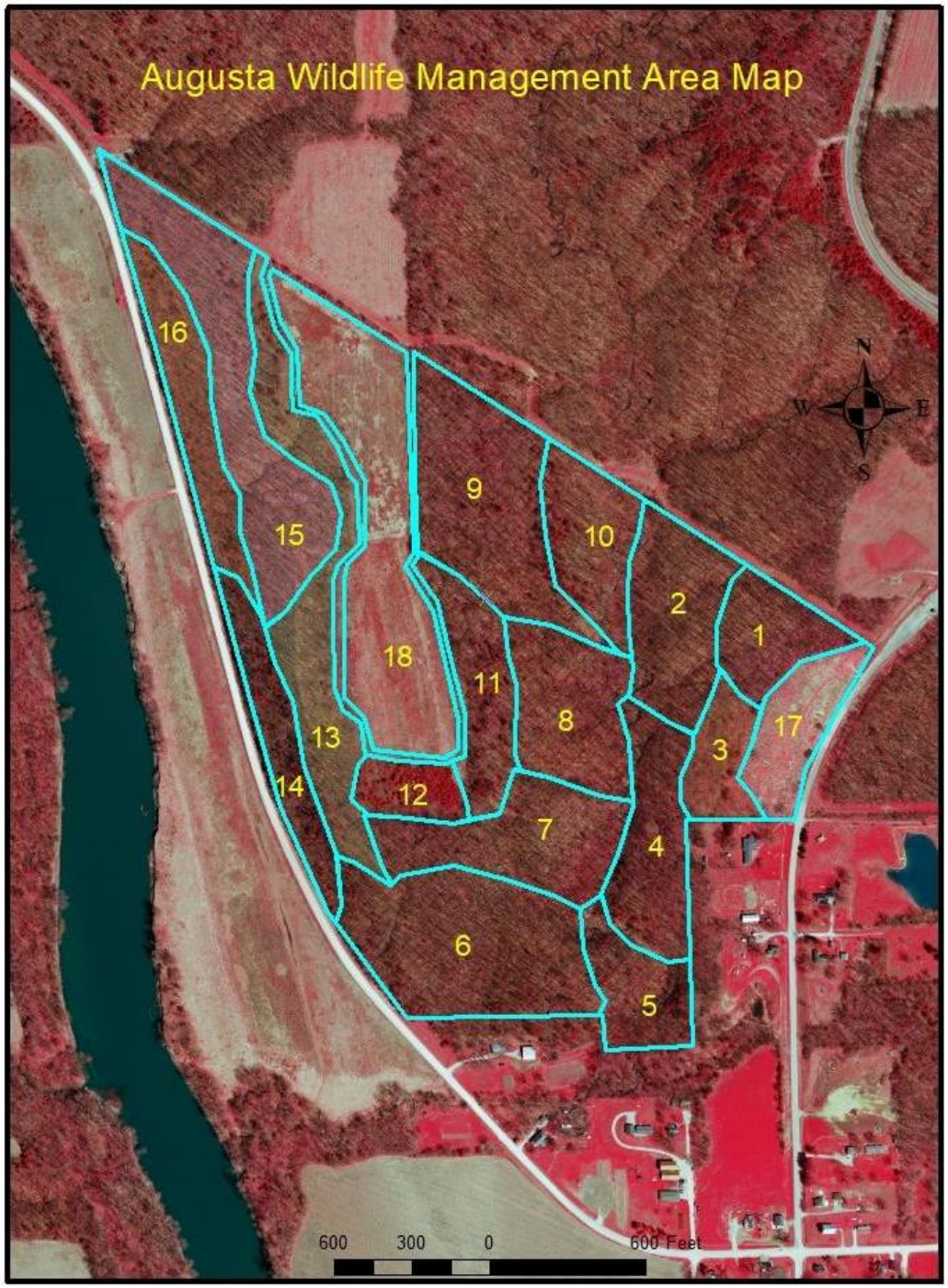
General description, including density/structure, forest type and diameter size class: Stand 17 is located at far east side of property along road with parking area at north end. This field currently has mixed grass, annuals and was cleared of invasive shrubs and multi-flora rose in the fall and winter of 2017-18. A tree planting of bare root and potted larger (4-7' tall, 1-2" stem diameter) mixed oak and hickory trees in spring of 2018. Herbicide was sprayed at the time of planting around the base of each tree. There has been deer browsing damage and antler rubbing of stems, with most trees sprouting back from base after damage. **Stand 18** is located in center of property. The field was an old crop field that recently was over-run with autumn olive and honeysuckle. The average olive plant was 2" diameter and 12' tall. Machine work was completed to clear field of heavy invasive species. The field was plowed and disked in late October/early Nov and direct seeded to hickory, white oak, black oak, walnut, bur oak, cherry on November 9th 2016. After dispersal of seed, the field was packed and/or disked again to bury seed. A spring and summer herbicide application took place in 2017 along with an additional application in the spring of 2018 to control competition from weeds. A drought during first growing season affected the survival of seed.

Forest Health Management Activities/Monitoring: Stand 17: Apply herbicide annually around base of trees for 1-2 years to allow root growth and minimize competition. **Stand 18:** The ideal stocking would be 600-800 trees per acre, and depending on animal depredation and weed control over the last year, this may be unattainable in some areas of field. Monitor annually to determine need for additional herbicide spray or supplemental planting.

Appendix

Stand #	Acres	Timber Type	Tree Size class	Management System	Prescription	Priority	Mgmt. History
1	3.5	Bl oak, walnut, elm, basswood, white oak	sawtimber	Even aged	Select harvest, SPNR work	Mod-high	
2	5.8	White oak, bl oak, red oak, ash, bitternut hickory	Small sawtimber	Even aged	Crop Tree Release	High	Crop tree completed 2019-20
3	2.6	Cedar, sh oak, ash, locust, hickory	pole	Even aged	Crop tree, olive control	Mod-low	
4	5.4	Bl oak, hickory, locust, ash, hickory	Small sawtimber	Even aged	Crop Tree Release	Mod-low	Crop tree completed 2019-20
5	3.5	Red oak, chinkapin oak, cedar, maple	pole	Even aged	Crop Tree Release	Low	
6	10.7	Bl oak, red oak, white oak, hickory	Small sawtimber	Even aged	Crop Tree Release	High-finish crop tree	7 of 10.7 complete 2018
7	6.7	Bl oak, hickory, locust, white oak, maple	Small sawtimber	Even aged	SPNR work	Mod-high	Crop tree completed 2017
8	5.9	Bl oak, white oak, hackberry, elm, walnut	Pole/sm saw	Even aged	SPNR work	Mod-low	Crop tree completed 2017
9	9.5	Walnut, locust, elm, ash, hickory, bl oak	Small sawtimber	Even aged	Crop Tree Release	Moderate	Crop tree completed 2019-20
10	4.5	Bl oak, red oak, white oak, cherry, locust	Small sawtimber	Even aged	Crop Tree Release	Mod-high	Crop tree completed 2019-20
11	4.4	Cedar, walnut, cherry, maple, locust	pole	Even aged	Crop Tree Release-2023-	Mod-low	Crop tree completed 2016
12	2.1	Cedar, olive, ash, elm	Sm pole	Early successional	Basal Area Thin	low	
13	8.2	Ash, bl oak, locust, few hickory	Sm saw	Early successi onal - short term	Weed tree/ invasive removal and mixed hardwood wildlife planting	high	
14	3.8	Chinkapin oak, red oak, maple	Sm saw	Viewshed	Future planting?	low	
15	10.1	White oak, red oak, hickory, ash	Sm saw	Even Aged	SPNR work	Mod-high	
16	4.8	Chinkapin oak, bl oak, red oak, maple,	Sm saw	Even aged	SPNR work	Mod-High	
17	3.6	Red oak, bur oak, white oak, hickory	seedling	Even aged	Maintenance of planting	High	
18	12.1	Red oak, bur oak, cherry, hickory, white oak, walnut	seedling	Even Aged	Maintenance of planting	High	

Stand Map



Potential Impacts to Threatened and Endangered Species

Due to constantly changing listings, priorities, etc., the forest management activities described in this plan will be reviewed internally prior to implementation to determine potential impacts to both state and federally listed threatened or endangered species.

The current guidance for known woodland dependent T&E species in the Augusta area are as follows:

Augusta is within the summer range for the federally endangered Indiana bat (also state endangered) and the federally threatened northern long-eared bat. Both species forage and roost in floodplain and upland forests and form maternity colonies in trees with loose exfoliating bark, cracks, crevices, and/or cavities (e.g., live shagbark hickory or dying trees of

other species). Management activities that benefit bats (and other wildlife like the southern flying squirrel) include retaining trees with these characteristics and 6-10 snags per acre whenever possible. In areas of suitable habitat, current guidelines allow for tree removal activities between Sept 30 - April 1 and woodland burns outside of the maternity and nesting season (Sept 30 - April 1).

There are historic records of the state endangered copperhead and the state threatened western worm snake near Augusta WMA. The active periods for these snakes closely aligns with the tree removal avoidance guidelines for bats, so if current T&E bat guidance is followed, forest management impacts to snakes will be avoided as a result. Woodland burns should be timed as early as possible in the spring or as late as possible in the fall to avoid direct mortality to active snakes.

The state endangered red-shouldered hawk could also potentially nest in this area. Nest sites have a tendency to be near streams/wetlands in large tracts of bottomland forest. Although Augusta WMA is primarily upland forest, due to its close proximity to the Skunk River, zones of planned management activities should be checked for nests and management activities planned to avoid the breeding period (mid-March through mid-August) if present to reduce disturbance/stress.

Species of Greatest Conservation Need

Table 1. Species of Greatest Conservation Need potentially found at Augusta WMA/Lower Skunk River drainage based on NAI data, local MSIM reports, and direct communication with DNR Avian Ecologist.

Group	Scientific name	Common name	T&E Status
Bird	*Colinus virginianus*	Northern Bobwhite	
	Haliaeetus leucocephalus	Bald Eagle	Special Concern
	Buteo lineatus	Red-shouldered Hawk	State Endangered
	Buteo platypterus	Broad-winged Hawk	
	Buteo swainsoni	Swainson's Hawk	
	Scolopax minor	American Woodcock	
	Coccyzus americanus	Yellow-billed Cuckoo	
	Coccyzus erythropthalmus	Black-billed Cuckoo	
	Otus asio	Eastern Screech-Owl	
	Asio otus	Long-eared Owl	State Threatened
	Chordeiles minor	Common Nighthawk	
	Caprimulgus vociferus	Eastern Whip-poor-will	
	Chaetura pelagica	Chimney Swift	
	Ceryle alcyon	Belted Kingfisher	
	Melanerpes erythrocephalus	Red-headed Woodpecker	
	Colaptes auratus	Northern Flicker	
	Falco sparverius	American Kestrel	
	Contopus cooperi	Olive-sided Flycatcher	
	Contopus virens	Eastern Wood-Pewee	
	Empidonax virescens	Acadian Flycatcher	
	Tyrannus tyrannus	Eastern Kingbird	
	Vireo bellii	Bell's Vireo	
	Cistothorus platensis	Sedge Wren	
	Catharus fuscescens	Veery	
	Hylocichla mustelina	Wood Thrush	
	Toxostoma rufum	Brown Thrasher	
	Helmitheros vermivorus	Worm-eating Warbler	

Group	Scientific name	Common name	T&E Status
	Vermivora chrysoptera	Golden-winged Warbler	
	Protonoraria citera	Prothonotary Warbler	
	Oporornis formosus	Kentucky Warbler	
	Geothypis trichas	Common Yellowthroat	
	Setophaga cerulea	Cerulean Warbler	
	Dendroica castanea	Bay-breasted Warbler	
	Wilsonia canadensis	Canada Warbler	
	Spizella arborea	American Tree Sparrow	
	Spizella pusilla	Field Sparrow	
	Zonotrichia querula	Harris's Sparrow	
	Spiza americana	Dickcissel	
	Strunella magna	Eastern Meadowlark	
	Icterus galbula	Baltimore Oriole	
Mammal	*Myotis lucifugus*	Little brown myotis	
	Myotis septentrionalis	Northern long-eared bat	Federally Threatened
	Nycticeius humeralus	Evening bat	
	Lasionycteris noctivagans	Silver-haired bat	
	Myotis sodalis	Indiana bat	State & Federally Endangered
	Perimyotis subflavus	Tri-colored bat or Eastern pipistrelle	
	Glaucomys volans	Southern flying squirrel	Special concern
Herptiles	*Acris crepitans*	Blanchards cricket frog	
	Ambystoma texanum	Smallmouth salamander	
	Apalone mutica	Smooth softshell turtle	
	Bufo woodhousii fowleri	Fowlers toad	
	Chelydra serpentina	Snapping turtle	
	Diadophis punctatus	Prairie ringneck snake	
	Hyla versicolor	Eastern gray treefrog	
	Lampropeltis calligaster	Prairie kingsnake	
	Lithobates areolata	Crawfish frog	
	Pantherophis ramspotti	Western fox snake	
	Pituophis melanoleucus	Bullsnake	Special concern
	Rana palustris	Pickerel frog	
	Rana pipiens	Northern leopard frog	
	Storeria occipitomaculata	Northern redbelly snake	
	Thamnophis proximus	Western ribbon snake	
	Carphophis vermis	Western worm snake	State threatened
	Agkistrodon contortrix	Copperhead	State endangered
	Crotalus horridus	Timber Rattlesnake	
	Elaphe obsoleta	Western rat snake	
Butterflies	*Poanes zabulon*	Zabulon Skipper	Special concern
	Danaus plexippus	Monarch	
Odonates	*Agria plana*	Springwater Dancer	

Glossary

Acre: An area of land containing 43,560 square feet. A *forty* of land contains 40 acres and a *section* of land contains 640 acres.

Annual ring: Trees in climates where growths stops or slows during portion of the year will form annual rings which can be read to determine tree age and growth rate. Annual rings are highly visible in species that form less dense wood during favorable growing conditions early in the season and denser wood during less favorable conditions later in the year. In some tree species this differentiation does not occur and annual rings are difficult to see. In tropical species growth never, or seldom, ceases and annual rings may not be apparent.

Bark: The outer layer of the stems, limbs and twigs of woody plants. Often bark is characteristic of the species and can be used for identification.

Basal area: The cross-sectional area of the base of any object. In forestry, it is the cross sectional area of a tree at 4.5 feet above the ground, expressed in square feet. The sum of all the trees on an acre is a measure of the density of the trees growing on the acre and is useful for making forest management decisions. Basal area can be calculated from tree diameter or can be easily measured with an angle gauge when certain relationships are known. Basal area will commonly range from 20 to 70 square feet per acre for poorly stocked stands to more than 200 square feet per acre for dense stands of conifers.

Biodiversity (biological diversity): The variety and abundance of species, their genetic composition and the communities and landscapes in which they occur, including the ecological structures, functions and processes occurring at all of those levels.

Board foot: A unit of measure of wood 1" thick and 1 foot on each side equaling 1/12 cubic foot of wood.

Bole: The stem or trunk of a tree; usually thought of as being that part without limbs- the merchantable part of the stem.

Clearcut: A method of regenerating a forest in which all trees on a given area are cut. Clearcutting results in conditions which allow the greatest amount of sunlight to reach the forest floor, a desirable condition for the regrowth of certain valuable tree species which need a lot of sunlight to grow, such as oak and walnut. Clearcutting also can create certain benefits for wildlife.

Competition: The struggle between trees to obtain sunlight, nutrients, water and growing space. Every part of the tree, from the roots to the crown, competes for space and food.

Conversion: A change though forest management from one tree species or association to another within a forest stand or site.

Cover type: Expressed as the tree species having the greatest representation in a forest stand. A stand where the major species is oak would be called an oak cover type.

Crop: The vegetation growing on a forest area, more particularly the major woody growth having commercial value.

Crop tree release (CTR): Crop tree release is the practice of selecting the individual trees that are to remain in the stand until maturity and then removing the trees competing with them. Crop trees could be selected on the basis of any of the values associated with trees such as aesthetics, wildlife or economic values. Selected trees should be straight with long, clear boles, dominant or co-dominant and should be the trees bringing the best returns upon maturity.

Crown: Refers to that part of the tree consisting of limbs, branches, twigs and leaves.

Cruise: A survey of forest land to identify timber and estimate its species composition, products, size, quality or other characteristics.

Cull: Refers to a tree having no commercial value, usually from having rot, holes, large knots or being crooked. It is important to note that a cull, though having no commercial value, may have wildlife, aesthetic or other values.

Cultural practice: The manipulation of vegetation to meet objectives of controlling stand composition or structure such as site improvement, forest stand improvement, increased regeneration, increased growth or insect and disease control measures.

DBH: Stands for Diameter at Breast Height. Always taken at 4.5 feet above the ground.

Den tree: A tree that has a hole in its stem that can be used as shelter by wildlife.

Disturbance: Any event, either natural or human induced, that alters the structure, composition or functions of an ecosystem. Examples include forest fires, insect infestations, windstorms and timber harvesting.

Dominant (trees): Individuals or species of the upper layer of the forest canopy.

Early successional forest: The forest community that develops immediately following the removal or destruction of vegetation in an area. Plant succession is the progression of plants from bare ground (e.g., after a forest fire or timber harvest) to mature forest. Succession consists of a gradual change of plant and animal communities over

time. Early succession forests commonly depend on and develop first following disturbance events. Each stage of succession provides different benefits for a variety of species.

Endangered species: A plant or animal species that is threatened with extinction throughout all, or a significant portion, of its native range.

Even-aged stand: A stand of trees composed of a single age class.

Forest: A forest is an ecosystem, an association of plants and animals. Trees are its dominant feature. They provide many benefits including habitat, water quality improvement, recreation, climatic amelioration and wood products. The plants and animals that make up a forest are interdependent and often essential to its integrity.

Forester: A professional engaged in the science and profession of forestry; foresters are commonly accredited by states or other certifying bodies (e.g., the Society of American Foresters) and may be licensed, certified or registered indicating specific education and abilities.

Forest cover: All trees and other plants occupying the space in a forest, including any ground cover.

Forest fire: An uncontrolled fire on lands covered wholly or in part by timber, brush, grass, grain or other flammable vegetation.

Forest floor: The accumulated organic matter at the soil surface, including litter and unincorporated humus.

Forest inventory: A set of objective sampling methods designed to quantify the spatial distribution, composition and rates of change of forest parameters within specified levels of precision for the purposes of management.

Forest management: The practical application of biological, physical, quantitative, managerial, economic, social and policy principles to the regeneration, management, utilization and conservation of forests to meet specified goals and objectives while maintaining the productivity of the forest. Forest management includes management for aesthetics, fish, recreation, urban values, water, wilderness, wildlife, wood products and other forest resource values.

Forest stand: A stand may loosely be defined as a contiguous group of trees sufficiently uniform in species composition, arrangement of age classes and general condition to be a homogeneous and distinguishable unit. A stand is usually treated as a basic silvicultural unit, but it seldom represents a natural ecological unit. Its composition and structure are most strongly affected by management, other disturbances and chance factors affecting seed distribution, germination and seedling survival.

Forest Stand Improvement (FSI): A practice in which the quality of a residual forest stand is improved by removing less desirable trees to achieve the desired stocking of the best quality trees or to improve the reproduction, composition, structure, condition and / or volume growth of a stand.

Fully-stocked stand: A forest stand in which all growing space is effectively occupied but having ample space for development of crop trees.

Game species: Game species include those terrestrial species that are hunted and trapped.

Geographic Information System (GIS): Computer software used to manipulate, analyze and visually display inventory and other data.

Group selection: A process of harvesting patches of selected trees to create openings in the forest canopy and to encourage reproduction of uneven-aged stands.

Hardwood: Hardwoods are generally defined as the woods of deciduous trees (i.e., trees which shed their leaves in the winter).

Landform: Any physical, recognizable form or feature of the earth's surface having a characteristic shape and produced by natural causes. Examples of major landforms are plains, plateaus and mountains. Examples of minor landforms are hills, valleys, slopes, eskers and dunes. Together, landforms make up the surface configuration of the earth.

Landscape: A general term referring to geographic areas that are usually based on some sort of natural feature or combination of natural features. They can range in scale from very large to very small.

Leave trees: Live trees selected to remain on a site to provide present and future benefits, such as shelter, resting sites, cavities, perches, nest sites, foraging sites, mast and coarse woody debris.

Management goals: Overall purpose for managing the composition and structure of forest land. For example: to protect land from erosion, to maintain wildlife habitat, to control insect and disease outbreaks, etc.

Management objectives: Defined conditions for the property, or segments of property (e.g. stands or management units), that will achieve management goals.

Management plan: A plan outlining the objectives for individual management units and describing steps for achieving them. Silvicultural procedures are identified in broad terms, but detailed prescriptions are developed in the field.

Mast: Nuts, seeds, catkins, flower buds and fruits of woody plants that provide food for wildlife.

Mature tree: A tree that has reached the desired size or age for its intended use. Size or age will vary considerably depending on the species, intended uses and site conditions.

Merchantable timber: Trees or stands having the size, quality and condition suitable for marketing under a given economic condition.

Multiple use: Using and managing a forested area to provide more than one benefit simultaneously. Common uses may include wildlife, timber, recreation and improvement of water quality.

Native plant community: A group of native plants that interact with each other and with its environment in ways not greatly altered by modern human activity or by introduced organisms. Native plants communities are classified and described by physiognomy, hydrology, landforms, soils and natural disturbance regimes (e.g., wild fires, wind storms, normal flood cycles).

Natural disturbances: Disruption of existing conditions by natural events such as wildfires, windstorms, droughts, flooding, insects and disease.

Natural regeneration: The growth of new trees from one of the following ways: (a) seeds naturally dropped from trees or carried by wind or animals, (b) seeds stored on the forest floor or (c) stumps that sprout or roots that sucker.

Non-forest land: Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses such as crops, pasture, residential areas, city parks, improved roads and power line clearings.

Non-game species: Non-game species include the amphibians, reptiles, mammals, and bird species that are not hunted or trapped.

Old-growth forests: Forests defined by age, structural characteristics and relative lack of human disturbance. These forests are essentially free from catastrophic disturbances, contain old trees (generally over 120 years old), large snags and downed trees.

Overstory: The canopy in a stand of trees.

Plantation: A stand composed primarily of trees established by planting or artificial seeding.

Pole or pole timber: A young tree or stand of young trees between 3.5 inches and 12.9 inches dbh.

Prairie: An extensive tract of level or rolling land that was originally treeless and grass covered. A prairie is generally characterized by deep fertile soil and regular disturbance, usually by fire.

Prescribed burn: To deliberately burn wild lands in either their natural or their modified state under specified environmental conditions, which allows the fire to be confined to a predetermine area and produces the intensity and spread required to attain planned resource management objectives.

Pruning: The practice of removing tree limbs so that a straight bole, free of limbs, will develop. Pruning can be a component of FSI.

Recreation: Leisure activities involving the enjoyment and use of natural resources.

Recreation facility: The improvements within a developed recreation site offered for visitor's enjoyment.

Regeneration: The act of renewing tree cover by establishing generation usually maintaining the same forest type forest that was removed. Regeneration may be artificial (direct seeding or planting) or natural (natural seeding or planting).

Release (release operation): A treatment designed to free young trees from undesirable, usually over-topping, competing vegetation.

Restoration: A new planting of seedlings, direct seeding or regeneration of roots. This creates new habitat that will be of higher quality for wildlife.

Riparian: Related to, living or located in conjunction with a wetland, river, stream or lake.

Riparian buffer: Woodland next to streams, lakes and wetlands that are managed to enhance and protect aquatic resources. Buffers provide woody cover that will enhance soil and water conservation while providing wildlife habitat.

Rotation age: The period of years between when a forest stand is established and when it receives its final harvest. This time period is an administrative decision based on economics, site conditions, growth rates and other factors.

Salvage cut: A harvest made to remove trees killed or damaged by fire, wind, insects, disease, or other agents. The purpose of salvage cuts is to use available wood fiber before further deterioration occurs to recover value that otherwise would be lost.

Sanitation cut: A cutting made to remove trees killed or injured by fire, insects, disease or other injurious agents (and sometimes trees susceptible to such injuries).

Sapling: A young tree larger than a seeding but smaller than a pole (DBH < 3.5 inches).

Sapwood: The wood found closest to the bark or outside of the bole and usually distinguished from heart wood by being lighter in color.

Saw log: A log large enough to produce lumber or other products that can be sawed. Its size and quality vary with the utilization practices of the region.

Sawtimber: Trees that yield logs suitable in size and quality for the production of lumber.

Scarify: To break up the forest floor and topsoil preparatory to natural regeneration or direct seeding.

Seedling: A baby plant. In forestry the term usually used to refer to young trees that have grown beyond the stage where they have just emerged from the soil up to the point that they become saplings.

Seed tree: Any tree that bears seed; specifically, a tree left standing to provide the seed for natural regeneration.

Seed tree method: The harvest of all trees except for a small number of widely dispersed trees retained for seed production and to produce a new age class. Seed trees are usually removed after regeneration is established.

Selective harvest: Removal of single scattered trees or small groups of trees at relatively short intervals. The continuous establishment of reproduction is encouraged and an all-aged stand is maintained. A management option used for shade-tolerant species.

Shade tolerance: Relative ability of a tree species to reproduce and grow under shade. The capacity to withstand low-light intensities caused by shading from surrounding vegetation.

Shelterwood: A method of regenerating a forest whereby a portion of the stand is harvested and the rest of the stand is evenly distributed over the area to protect the site and provide seed to regenerate the area. After the new stand is well established, the residual trees are harvested. This method is used to regenerate shade intolerant species.

Shelterwood harvest: A harvest cutting in which trees in the harvest area are removed in a series of two or more cuttings to allow the establishment and early growth of new seedlings under partial shade and protection of older trees. Produces an even-aged forest.

Silvics: The study of the life history and general characteristics of forest trees and stands, with particular reference to environmental factors, as basis for the practice of silviculture.

Silviculture: The art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.

Silvicultural prescription: Specific steps prescribed to achieve specific management objectives.

Single tree selection: Individual trees of all sizes classes are removed more or less uniformly throughout the stand, to promote growth of remaining trees and to provide space for regeneration; synonym: individual tree selection.

Site index: A measure of the productive quality of an area where trees grow. Site index is based on the height of dominant and co-dominate trees at age 50. That is to say, if the average height of dominant and co-dominate trees on a site was 70 feet at age 50, 70 would be the site index. Graphs are developed to enable determination of site index over a range of tree ages.

Site potential: Collective physical resources (e.g., soil moisture, nutrients, light, heat) available for plant growth. Different potentials facilitate growth of some species and limit growth of others. Consequently, site potential has a strong effect on plant community development.

Slash: The non-utilized and generally unmarketable accumulation of woody material in the forest, such as limbs, tops, cull logs and stumps that remain in the forest as residue after timber harvesting.

Snag: A snag tree is a dead tree; commonly a tall, limbless tree. Though of little or no commercial value, they are a very valuable wildlife resource.

Softwood: Generally considered to be the wood of conifers.

Stand: A contiguous group of trees similar in age, species composition, structure and growing on a site of similar quality. One stand will usually have characteristics that will distinguish it from other stands. Differences could include species, average diameter, density and location.

Succession: The natural replacement, over time, of one plant community with another.

Sucker: A shoot rising from below ground level from a root.

Suppressed: The condition of a tree characterized by low growth rate and low vigor due to competition from overtopping trees or shrubs.

Sustainability: Protecting and restoring the natural environment while enhancing economic opportunity and community well-being. Sustainability addresses three related elements: the environment, the economy and the community. The goal is to maintain all three elements in a healthy state indefinitely. Meeting the needs of the present without compromising the ability of future generations to meet their needs.

Thinning: A silvicultural treatment made to reduce the density of trees within a forest stand; primarily used to improve

growth, enhance forest health or recover potential mortality. *Row thinning* is where selected rows are harvested, usually the first thinning, which provides equipment operating room for future selective thinning.

Selective thinning is where individual trees are marked or specified (e.g., by diameter, spacing, or quality) for harvest. *Commercial thinning* is thinning after the trees are of merchantable size for timber markets. *Pre- commercial thinning* is done before the trees reach merchantable size, usually done in overstocked stands to provide more growing space for crop trees.

Threatened species: A plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its native range.

Tolerance (shade tolerance): A plant's ability to tolerate conditions under a forest canopy.

Normally thought of as tolerance to low light conditions, but other understory conditions, such as root competition for water and nutrients, are also factors.

Two-aged stand: A stand with trees of two distinct age class separated in age by more than 20 percent of the rotation age.

Under plant: The planting of seedlings under an existing canopy or overstory.

Under-stocked: A stand of trees so widely spaced that even with full growth potential realized, crown closure will not occur.

Understory: The shorter vegetation (shrubs, seedlings, saplings, small trees) within a forest stand that forms a layer between the overstory and the herbaceous plants of the forest floor.

Uneven-aged stand: A stand with trees of three or more distinct age classes, either mixed or in small groups.

Uneven-aged management: A planned sequence of treatments designed to maintain and regenerate a stand with three or more age classes. Uneven-aged (selection) methods will maintain a multi-aged structure by removing some trees in all sizes classes either singly, in small groups or in strips: synonym: all-aged method.

Viewshed: A physiographic area composed of land, water, biotic and cultural elements which may be viewed from one or more viewpoints and which has inherent scenic qualities and/ or aesthetic values as determined by those who view it. Viewsheds are a habitat factor that will be primarily a "hands-off" area for aesthetics and proper soil and water conservation, along with providing special wildlife values.

Volume: Refers to the amount of wood in a tree or log. Expressed as board feet, cords or other measures.

Well-stocked: The situation in which a forest stand contains trees spaced widely enough to prevent competition yet closely enough to utilize the entire site.

Wolf tree: A generally predominant tree with a broad, spreading crown that occupies more growing space than its neighbors.

Woodland: A plant community in which, in contrast to a typical forest, the trees are often small, characteristically short-boled relative to their crown depth, and forming an open canopy with intervening area occupied by lower vegetation, commonly grass.

Woodland edge: An area of habitat transition that consists of vegetation (herbaceous and woody) of different heights and densities. Edge can favor early successional wildlife species.