Forest Wildlife Stewardship Plan

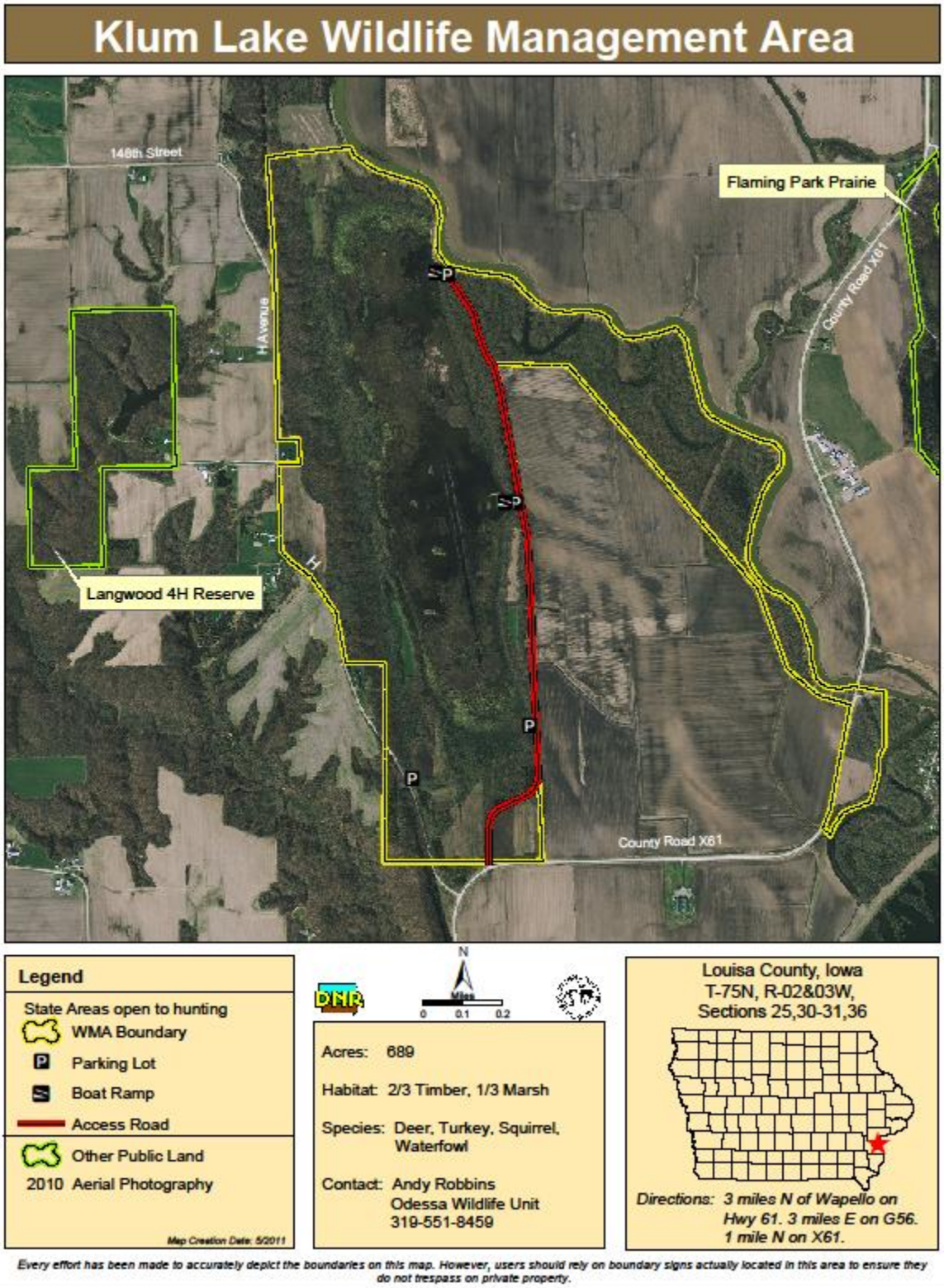
Prepared for:

Klum Lake Wildlife Management Area

Developed by:
Lisa Louck, Iowa DNR Forester
Andy Robbins, Iowa DNR Wildlife Biologist

Contents

Area Map


Klum Lake Wildlife Management Area
148th Street
H Avenue
Flaming Park Prairie
County Road X61
Langwood 4H Reserve
County Road X61
Legend
State Areas open to hunting
WMA Boundary
Parking Lot
Boat Ramp
Access Road
Other Public Land
2010 Aerial Photography
Map Creation Date: 5/2011
N
Miles
0 0.1 0.2
Acres: 689
Habitat: 2/3 Timber, 1/3 Marsh
Species: Deer, Turkey, Squirrel, Waterfowl
Contact: Andy Robbins
Odessa Wildlife Unit
319-551-8459
Louisa County, Iowa
T-75N, R-02&03W,
Sections 25,30-31,36
Directions: 3 miles N of Wapello on Hwy 61. 3 miles E on G56. 1 mile N on X61.
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 Klum Lake Wildlife Management Area

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FORESTER: Lisa Louck - District Forester, 260 Mulberry St Ste 4, Wapello IA 52653, (319) 759-1108

LOCATION: Sections 25, 30, 36 Range 03W; Sections 31, 30 Range 02W Township 75N Grandview and Port Louisa North Townships, Louisa County, Iowa

TOTAL ACRES: 689

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.

Different species require different (and sometimes quite specific) forest types and age 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

Klum Lake Wildlife Management Area (WMA) is a 689-acre parcel located in Louisa County acquired by the State of Iowa in the 1940s and 1950s. The area is heavily used by the public for hunting, foraging, and wildlife viewing. Aerial photos dating back to the 1930s show that much of the forest area was open and likely being used for agriculture and grazing (with the exception of one large block in the center of the west side). Much of the forested bluff portion of the area was likely used for pasture, with flat areas being utilized for row crop along with an unsuccessful attempt made to drain the shallow lake for farming. Currently, the WMA is composed of both upland forest and bottomland first and second bench forest along with a large 280-acre wetland. There are no known records of forest management on this WMA.

For purposes of this FWSP, the Klum Lake WMA is divided into stands shown in the stand map aerial photo (refer to page 12). 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

Klum Lake WMA is designated as a wildlife management area. Therefore, the primary focus of the FWSP will be to provide habitat for a wide variety of forest wildlife species. Funding for the management of Klum Lake 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, squirrel, and waterfowl. On the other hand, the IDNR 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. Recognizing that it is difficult, if not impossible, to manage for all of these species at the same time and on one tract, The IWAP 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 Klum Lake 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 shade tolerant species 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, veeries, 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. Klum Lake WMA, however, is part of a relatively large corridor (by Iowa standards) of public (DNR, County, USFWS) and private forest along the Mississippi River bluff. 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 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 reaching the forest floor will result in more flowering plants which will attract insects and spiders, an important food source for many birds, amphibians, reptiles 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 benefit 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 -8 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 Mississippi 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:
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. However, any income generated from timber harvesting operations is reinvested into the WMAs for forest management purposes. These funds are used to thin young stands, convert areas to more desirable species and otherwise manage the forest for wildlife. They can also be used to conduct 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.

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, uneven aged 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.

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. Many birds that nest in more mature forest also 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 plants that produce fruits 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. Klum Lake WMA has 29.6 acres scheduled for early successional management.

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 29.6 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, and 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 Shagbark and Shellbark hickories 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.

Consequently, 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 shelterwood harvesting are the most common. Clearcutting is a practice that opens the stand all at once. Regeneration using clearcutting requires the presence of sufficient oak seedlings or advanced regeneration. Without these seedlings, planting may be necessary following a clearcut.

Shelterwood harvests are one way of encouraging seedling production prior to a clearcut. Shelterwood 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 sunlight to get to the forest floor. Ironwood, sugar maple, and other shade tolerant species warrant this practice if species like oak are desired 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 ironwood. 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 296.6 acres on the WMA that will be managed as even age forests to regenerate oak. The eventual acreage requiring clearcutting every 5 years depends on the rotation age used for the stand. With a typical 100-125 year rotation, approximately 10-11 acres could be clearcut every 5 years. If the rotation age can be extended without jeopardizing the ability to regenerate oak, the acres of clearcutting every 5 years can be reduced accordingly.

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 to protect certain public use facilities. Certain Neotropical migrants will benefit from the areas designated as viewshed. Management can take place on these stands where desirable, but the major objective is to have minimal disturbance. Stand 5 will be managed as viewshed due to the steep slopes adjacent to the county road. An additional area adjacent to a private residence will be managed as a viewshed, but is not delineated.

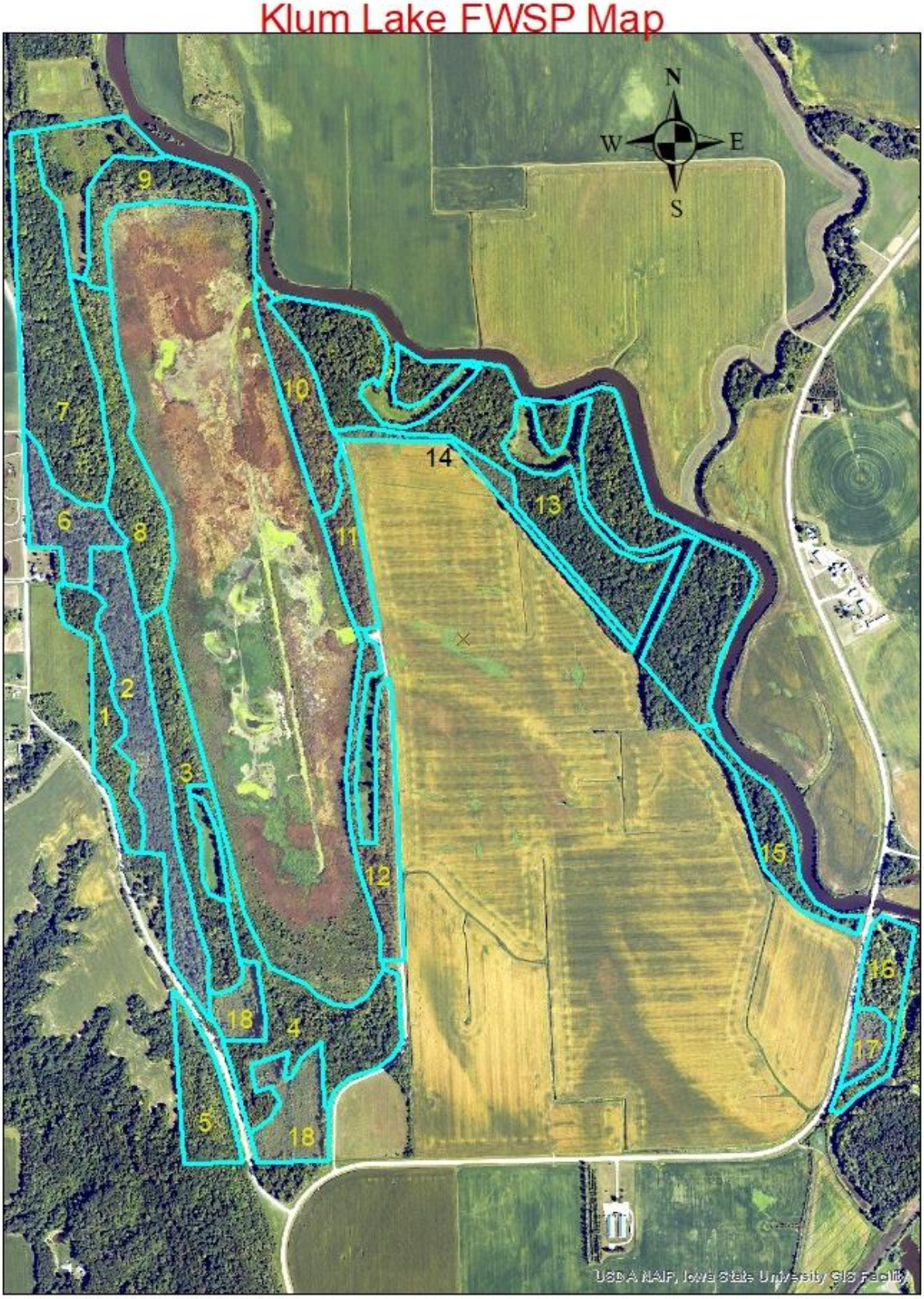
Uneven Age Management-
Uneven age management will be applied to 50.1 acres, in stand 6 where maple is already dominant but where woodland planting may be possible, and in stand 8 in the bottom slope where few oaks exist and various desirable species occur, and stand 9 along the north side of the marsh where no oaks occur.

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 Klum Lake Wildlife Management Area is designed to aid wildlife biologists 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 Map


Klum Lake FWSP Map
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USDA NAIP, Iowa State University GIS Facility

Stand Level Information

Tree Size Classes Diameter at Breast Height (D.B.H.)
Sawtimber: 18" and above
Small Sawtimber: 12-17"
Pole: 5-12"
Sapling: 2-5"
Seedling: < 2"

Stand 1 Objectives/Current Conditions
Acres: 13.1
Objectives: To manage for mixed hardwood growth
General description, including density/structure, forest type and diameter size class: This stand is located east of the upper field, along the upper slope of the bluff. This stand was mostly open until the 1970's, and shows scattered trees in 1950 images. The trees here include small sawtimber black oak, honey locust, with pole honey locust, walnut, bitternut hickory, elm, and some hackberry. There is sapling hackberry with some elm and bitternut hickory. Honeysuckle is heavy in much of the stand and very heavy near the center of the stand. Ash was present in higher density, but has died from emerald ash borer.

Stand 1 Forest Management Objectives
Forest Health Management Activities/Monitoring: Crop tree release to favor a mix of walnut, black oak, bitternut hickory, and elm in that order, with hackberry and pod/fruit producing locust as secondary crop trees. Each crop tree should be released on all four sides whenever possible.

Control honeysuckle after crop tree release is completed.

Crop tree work is planned for 2027.

Stand 2 Objectives/Current Conditions
Acres: 29.5

Objectives: To manage for mixed hardwood growth and regeneration.

General description, including density/structure, forest type and diameter size class: This stand is east of stand 1, along mid and lower slopes across around 19 narrow ridges. The species include sawtimber and small sawtimber white oak, honey locust, with some red oak, hackberry, as well as a few basswood and dead ash. There are a few walnut and hard maple in the north end of the stand. The pole trees are honey locust, elm, basswood, red oak, hackberry, shagbark hickory, dead ash, with some maple heavier at the north end of the stand and walnut occurring on 5-7 ridges scattered throughout the stand. Pole red oak and basswood occur heavier on 1-2 ridges in the northern end of the stand. There is sapling ash, elm, hackberry, basswood, maple, ironwood, and some areas have little/no understory sapling/seedling layer. Honeysuckle is moderate to heavy along upper slopes, and is almost absent at the north ¼ of the stand and lower slopes.

Forest Health Management Activities/Monitoring: Control honeysuckle down to 3' tall plants or ½" diameter stem to minimize spread of plants during other work to open up canopy.

Site prep for natural regeneration can be started here with weed tree removal of midstory canopy to kill all honey locust, basswood, hackberry and maple between 1-12" diameter in all ridges where more than 3 mature seed oaks occur. Chemically treat stumps/stems of all honey locust, hackberry, maple and basswood to prevent resprouting. Light crop tree release of pole red oak and walnut where the trees are younger on a couple of upper slopes.

A shelterwood harvest can be done in the next 10 years to harvest mature red oak, maple, locust, hackberry, walnut, and near 50% of the white oak.

Rx fire can be used to control new growth and prepare the forest floor for acorn drop if possible.

Invasive and weed tree work is planned for 2027.

Stand 3 Objectives/Current Conditions
Acres: 19.3

Objectives: To manage for walnut and mixed bottomland hardwood growth

General description, including density/structure, forest type and diameter size class: This stand is located east of stand 2 and surrounds a small open field at the south half of the lake. The species on either side of the road/lane and occurring on the bottom of the slopes and the adjacent bottom are mostly small sawtimber and some sawtimber honey locust, walnut, with a few hackberry and a couple oaks (red oak, bur oak, pin oak) are found throughout. The pole trees are mostly elm and hackberry. Honeysuckle is moderate to heavy throughout this stand.

Forest Health Management Activities/Monitoring: Control invasive honeysuckle down to 3' tall plants, or ½" diameter of stem.

Light crop tree release to favor walnut, any smaller oaks to kill only non-merchantable trees.

Selective harvest of merchantable and poorly formed or growing walnut, as well as many honey locust and hackberry to further release the best walnut and oaks to continue growing. Harvest work can be done in the next 10 years.

Crop tree work is planned for 2027.

Stand 4 Objectives/Current Conditions
Acres: 29.9

Objectives: To manage for bottomland hardwood growth.

General description, including density/structure, forest type and diameter size class: This stand is south and east of the west parking area and also includes a small idle field. The small field was chipped some years ago and has regrown with sapling walnut, ash, shingle oak, elm and dogwood.

The species in stand 4 include scattered to very scattered small sawtimber and sawtimber cottonwood, with some honey locust, dead ash, a few hackberry, silver maple, and river birch. The pole trees are hackberry, walnut, elm, pin oak, and shagbark hickory. There is honeysuckle throughout the stand, but there are also native plants such as dogwood, prickly ash, nettles and woodland wildflowers still present.

Forest Health Management Activities/Monitoring: Control invasive honeysuckle down to 3' tall plants or ½" stem diameter. Crop tree release to favor walnut, pin oak, shagbark hickory, elm.

Crop tree work planned for 2028.

Stand 5 Objectives/Current Conditions
Acres: 12.4

Objectives: To manage for uneven age mixed hardwood growth.

General description, including density/structure, forest type and diameter size class: This stand is located southwest of stand 4 and east of the gravel road, with private land as south and west adjacent neighbors. The species here include

scattered sawtimber red oak and white oak, with small sawtimber red oak and dead ash along the east facing slopes. The pole species include shagbark hickory and hard maple.

Forest Health Management Activities/Monitoring: Due to steep terrain, the utility ROW, and poor access, this stand will be managed as viewshed for the near future.

Stand 6 Objectives/Current Conditions
Acres: 12.6

Objectives: To manage for hardwood regeneration.

General description, including density/structure, forest type and diameter size class: This stand is north of stands 1 and 2 and also north and east of private house. The terrain is different from much of the rest of the bluff, with a large bowl at the north half of the stand and a wider and flatter area at the south half. The species present here include small sawtimber and sawtimber white oak, with a few elm, maple, shagbark hickory and a couple of hackberry, walnut, mockernut hickory and red oak. Ash occurred in many areas but is now dead. The pole species include shagbark hickory, hackberry, hard maple, and elm. The sapling trees and seedling trees are maple and basswood, with most areas nearly absent of seedling or sapling growth from the competition of upper and mid canopies.

Forest Health Management Activities/Monitoring: Ash made up a big part of the upper canopy before death, and some areas have little/no seed trees and an abundance of hard maple. Where seed oaks occur in enough numbers a weed tree removal of hard maple and hackberry from 1-11" diameter to attempt natural regeneration of existing white oaks. Where no oaks occur, on this gentler slope accessible by the field, some acres could have a woodland planting of 40-100/trees per acre, with 25/acre or more being tubed or fenced to protect from deer browse damage to the main trunk/stem. Planting could replace or complement any natural regeneration.

Stand 7 Objectives/Current Conditions
Acres: 39.1

Objectives: To manage for uneven 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 is similar to stand 2 with a series of narrow ridges. The species here include scattered to somewhat scattered sawtimber red oak, hard maple, with a few white oak, black cherry, walnut, pecan, small sawtimber shagbark hickory and hard maple. The pole species are hard maple, shagbark hickory, bitternut hickory, hackberry, and elm with sapling hard maple. Maple is dominant here, with most of the oaks mature or overly mature.

Forest Health Management Activities/Monitoring: A light crop tree release to favor a mix of small sawtimber and pole white oak, pecan, walnut, red oak and hickory can be done to encourage better growth and seed production of these larger trees. Encourage other more shade tolerant species like bitternut hickory and hackberry to maintain diversity of the stand where no other trees aside from maple are dominant. A Rx burn could be done one or more times as needed to prep forest floor for an acorn drop if possible. Some trees in this stand could be included in a nearby harvest to remove some mature hard maple, declining or overly mature red oaks, poorly formed or declining walnut, and other trees as needed to open up canopy to allow increased sunlight for natural regeneration of all species. Snag and den tree retention will be considered in all harvest work for habitat.

Stand 8 Objectives/Current Conditions
Acres: 23.0

Objectives: To manage for mixed hardwood growth and diversity.

General description, including density/structure, forest type and diameter size class: This stand is east of stand 7 and west of the lake. The species here include a sawtimber hackberry, bitternut hickory, with hard maple, walnut, bur oak

and Kentucky coffee tree. The small sawtimber and pole trees are honey locust, hackberry, hard maple, with mostly maple, basswood and some hackberry sapling and seedlings.

Forest Health Management Activities/Monitoring: Crop tree release to favor walnut, Kentucky coffee tree and hackberry to increase future diversity of the stand. A harvest could achieve much of the crop tree release here with the average diameter above 18".

Encourage any other natural regeneration of oak, walnut or hickory through future weed tree removal when oak regeneration is present.

Stand 9 Objectives/Current Conditions
Acres: 14.7

Objectives: To manage for mixed bottomland hardwoods.

General description, including density/structure, forest type and diameter size class: This stand is located at the north end of the property with the Muscatine Slough bordering it on the north. The species here are some sawtimber and small sawtimber cottonwood, with pole and sapling silver maple and willow. A younger area of dogwood, willow, and some other sapling and pole growth could be managed for early successional habitat.

Forest Health Management Activities/Monitoring: Control any honeysuckle by manual cutting and chemical treatment of stems as possible.

Stand 10 Objectives/Current Conditions
Acres: 14.2

Objectives: To manage for even aged bottomland hardwoods

General description, including density/structure, forest type and diameter size class: This stand is west of the gravel WMA road and east of the lake. The species here are scattered sawtimber pin oak, with mostly small sawtimber pin oak, hackberry and some black cherry, honey locust, elm, and a few pecan, bitternut hickory and Kentucky coffee tree. There is heavy prickly ash and dogwood in some areas, and heavy honeysuckle in most areas.

Forest Health Management Activities/Monitoring: Control honeysuckle as possible by cutting and treating all plants above 1/2" stem diameter.

Light crop tree release can be done to favor any pecan, Kentucky coffee tree, black cherry, hickory, pin oak, and hackberry.

Stand 11 Objectives/Current Conditions
Acres: 8.5

Objectives: To manage for even aged bottomland hardwoods

General description, including density/structure, forest type and diameter size class: This stand is located south of stand 10. The species present here includes pole and sapling cedar, river birch, pin and shingle oak, honey locust, and mulberry. There is sapling ash, cedar, dogwood shrub and also invasive honeysuckle.

Forest Health Management Activities/Monitoring: Control honeysuckle through cutting and chemical treatment of stems and management of sunlight where possible. Rx fire could be a tool here to set back existing growth and control honeysuckle. When trees become large enough, crop tree work can begin to favor oak and other desirable growth.

Stand 12 Objectives/Current Conditions
Acres: 17.3

Objectives: To manage for even aged bottomland hardwoods

General description, including density/structure, forest type and diameter size class: This stand is located south of stand 11. The species here are scattered sawtimber cottonwood, with some honey locust, pin oak and silver maple, and a few river birch and a couple of pecan. There are scattered cedars, with a few heavy dogwood patches and honeysuckle.

Forest Health Management Activities/Monitoring: Thinning for diversity/crop tree release.
Control honeysuckle through cutting and chemical treatment of stems and management of sunlight where possible.

Stand 13 Objectives/Current Conditions
Acres: 92.1

Objectives: To manage for an even-aged stand, and to vary stand maturity and structure.

General description, including density/structure, forest type and diameter size class: This stand is east of the WMA road, north of the neighboring crop field and along the south border of the Muscatine Slough. The species here are sawtimber and small sawtimber pin oak, cottonwood, with some honey locust and a few black cherry and walnut. The pole trees are pin oak, honey locust, elm and hackberry, with some sapling elm, hackberry and some black cherry. There are some desirable prickly ash and dogwood, with many areas thicker with honeysuckle.

Forest Health Management Activities/Monitoring: Control honeysuckle by Rx fire and manual removal where possible. This mature stand could be shelterwood harvested to open up canopy and allow natural regeneration of pin oak to begin here. Different areas could be harvested in various intensities to begin a multi-canopied stand structure throughout this large stand. Most release of smaller sawtimber trees could be done through harvesting, crop tree release after harvest as needed to favor diversity and best form. Monitor stand for oak wilt.

Stand 14 Objectives/Current Conditions
Acres: 6.9

Objectives: To manage for edge/early successional habitat.

General description, including density/structure, forest type and diameter size class: This stand is located along a narrow strip south of stand 13. The species here are sapling and small pole river birch, pin oak, and a few walnut. There are patches of dogwood throughout this area.

Forest Health Management Activities/Monitoring: This young area could be cut back every 10-15 years to promote edge and brushy habitat.

Stand 15 Objectives/Current Conditions
Acres: 10.7

Objectives: To manage for even age mixed bottomland hardwoods

General description, including density/structure, forest type and diameter size class: This stand is located east of stand 13 in a narrower strip of woods bordering the Slough. The species here are sawtimber and small sawtimber pin oak and cottonwood in the widest area of timber, and pole/sapling pin oak, river birch, with a few ash, elm, black oak. There are dogwood and sumac patches at the more open canopy south end of the stand, with a few sapling and pole walnut.

Forest Health Management Activities/Monitoring: Light crop tree work can be done here to favor the few walnut, black oak, and elm, with pin oak favored where these other species don't occur.

Stand 16 Objectives/Current Conditions
Acres: 10.3

Objectives: To manage for even aged mixed bottomland hardwoods

General description, including density/structure, forest type and diameter size class: This stand is east of CR X61. The species present here include scattered sawtimber and small sawtimber pin oak and hackberry. There are mostly pole walnut, elm, hackberry, and river birch. The under-story has desirable prickly ash and dogwood, with moderate honeysuckle.

Forest Health Management Activities/Monitoring: Crop tree release to favor walnut, pin oak, and elm, with hackberry and river birch as secondary crop tree species.

Stand 17 Objectives/Current Conditions
Acres: 4.5

Objectives: To manage for early successional habitat

General description, including density/structure, forest type and diameter size class: Stand 17 is surrounded by stand 16, and bordered to the west with CR X61. This idled field has some woody growth, and has natural regeneration of pin oak and dogwood.

Forest Health Management Activities/Monitoring: Monitor woody growth and recut as needed to maintain early successional habitat.

Stand 18 Objectives/Current Conditions
Acres: 18.2

Objectives: To manage for early successional habitat

General description, including density/structure, forest type and diameter size class: This stand is located at the south end of the property, with the county gravel road on the west side. These two areas encompass the small parking area lot along county gravel road, and the south end of the property. Both of these areas were open fields in past years, with woody growth and annual growth occurring on both areas. The area north of the parking lot had machine grinding done in 2018 to control invasive growth and create early successional habitat.

Forest Health Management Activities/Monitoring: Manage for early successional habitat by cutting back the field periodically (every 10-15 years). Monitor for invasive growth that should be managed more frequently. Monitor for desirable mixed hardwood growth, and allow some trees, or some areas, to become forested if enough desirable species are present. If allowed to grow, these converted forested acres would become even aged management.

Appendix

Stand #	Acres	Timber Type	Tree Size class	Management System	Prescription	Priority	Management History
1	13.1	Black oak/h locust/b hickory/cedar/walnut	Small saw	Even aged	Crop Tree Release	High	Planned 2027
2	29.5	White oak/red oak/few Bass, pole-sapling elm/hick/locust	Saw	Even aged	Site Prep/CTR walnut	High	Planned 2027
3	19.3	Locust/walnut/few hackberry/bur, pole walnut/locust/elm	Small saw	Even aged	Crop Tree Release	High	Planned 2027
4	29.9	Cottonwood/locust/walnut/ few hack, pole hack/elm/hickory/pin oak	Small saw	Even aged	Invasive management Crop Tree Release	High Moderate	Planned 2028
5	12.4	Red oak/white oak, pole hard maple	Small saw	Uneven aged	Invasive management Basal Area Thin	Moderate Low	
6	12.6	White oak/few elm/hickory/maple, pole hard maple/elm/hackberry	Saw	Even aged	Site prep Possible woodland planting	Moderate Low	
7	39.1	Red oak/hickory/few white oak, pole maple/hickory/basswood	Small saw	Even aged	SPNR Rx fire	Mod-high	2029
8	23.0	Hackberry/maple/few bur/walnut/coffee tree	Pole/sm saw	Uneven aged	Basal Area Thin	Mod-low	
9	14.7	Cottonwood/few silver maple/willow, pole-sap ash/willow/dogwood		Uneven aged	Invasive control Thinning	Low	
10	14.2	Pin oak/hackberry/few black cherry/locust/elm/pecan	Small saw	Even aged	Crop Tree Release	Moderate	
11	8.5	Cedar/river birch/locust/pin oak/mulberry	Pole-sapling	Even aged	Invasive control	Mod-low	
12	17.3	Cotton/few pin oak/locust/silver maple/river birch/pecan	Small saw	Even aged	Basal Area Thin	low	
13	92.1	Pin oak/cottonwood, few locust/cherry/walnut, pole hackberry/elm/pin oak/locust	Small saw	Even aged	Harvest	Moderate	
14	6.9	River birch/pin oak/few walnut, dogwood patches	Sapling	Early succ.		low	
15	10.7	Pin oak/elm/river birch/few black oak/walnut	Pole-sapling	Even Aged	Crop Tree Release	Mod-high	
16	10.3	Walnut/hackberry/elm/river birch	Pole	Even aged	Crop Tree Release	Mod-High	
17	4.5		seedling	Early succ.		Low	
18	18.2	Walnut/elm/cottonwood/river birch	seedling-sapling	Early succ.	Invasive control	Mod-low	

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 Klum Lake area are as follows:

- Klum Lake is within the summer range for the federally endangered Indiana bat (also state endangered) and the federally endangered northern long-eared bat. Both species forage and roost in floodplain and upland forests. They 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 6-8 snags per acre whenever possible. In areas of suitable habitat, current guidelines allow for tree removal activities and woodland burns outside of the maternity and nesting season (Sept 30-April 1).
- Known T&E reptiles and amphibians (referred to as "herptiles" or "herps") potentially found on this WMA are not woodland dependent species, so any impacts to those species would be minimal to non-existent. Also, the active periods for most herps generally aligns with the tree removal avoidance guidelines for bats, so if current T&E bat guidance is followed, forest management impacts to herps would also be similarly avoided.
- 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. Klum Lake WMA is a mix of upland and floodplain forest, and due to its close proximity to the Mississippi 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.
- Known populations of T&E plant species will be avoided by forestry management practices.

Threatened and Endangered Species

Table 1. Threatened and Endangered species potentially found at Klum Lake/Mississippi River drainage based on NAI data and MSIM reports.

Group	Scientific name	Common name	T&E Status
Plant	*Spiranthes ovalis*	Oval ladies'-tresses	State Threatened
	Carex lurida	Shallow sedge	Special Concern
	Tomanthera auriculata	Earleaf foxglove	Special Concern
Bird	*Haliaeetus leucocephalus*	Bald Eagle	Special Concern
	Buteo lineatus	Red-shouldered Hawk	State Endangered
	Asio otus	Long-eared Owl	State Threatened
Mammal	*Myotis septentrionalis*	Northern long-eared bat	Federally Endangered
	Myotis sodalis	Indiana bat	State & Federally Endangered
	Glaucomys volans	Southern flying squirrel	Special concern
Herptiles	*Emydoidea blandingii*	Blanding's turtle	State Threatened
	Nerodia rhombifer	Diamondback water snake	State Threatened

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 growth stops or slows down during a 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 in 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.

D.B.H..: 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, forbs 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 plant 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) fruit 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, invertebrates, 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 D.B.H.

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 predetermined 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 (D.B.H. < 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 is 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 fruit; 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 the 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 classes 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.