FOREST STEWARDSHIP PLAN

FOR

CARDINAL MARSH WILDLIFE AREA

Developed by Gary Beyer
District Forester
And

Terry Haindfield
Wildlife Biologist

IOWA DEPARTMENT OF NATURAL RESOURCES WILDLIFE BUREAU

FOREST STEWARDSHIP PLAN

A plan that will increase the diversity of forest wildlife and prioritize species of greatest concern.

In Iowa, the Department of Natural Resources (IDNR) is the government agency responsible for the stewardship of indigenous and migratory wildlife species found in the state. Many of these species live near and in IDNR Wildlife Management Area (WMA) forests. Forests are a relatively slow-changing landscape with some stands reaching maturity after a period of 100 years. This time span may extend through the careers of several wildlife managers. The longevity factor emphasizes the need for a Forest Stewardship Plans (FSP) in order to wisely manage our WMA forests.

There are 3 primary factors emphasizing the need for FSP's for WMA's:

1) The continued succession of many forest stands past the oak-hickory stage to the shade tolerant stands of maple and basswood.
2) The loss of early successional forest stands and associated wildlife species.
3) The lack of proper management to secure mature forest stands with proper overstory and understory tree species for associated forest-interior species.

Some wildlife species use all the forest age classes but others have very specific needs where one or two of particular forest age classes are needed to survive. Although the over-all change in forest succession is relatively slow, changes in the early stages of forest succession occur relatively fast. For example, some populations of indigenous and migratory bird species, dependent on these short-lived forest age classes, are experiencing dramatic declines.

In Iowa, they include the indigenous game bird, the ruffed grouse and the migratory game bird the American woodcock. Nation-wide declines of both species have been detected. Many migratory non-game birds including the gold-winged warbler, blue-winged warbler, black-billed cuckoo, yellow-billed cuckoo and eastern towhee are also dependent on this early stage of forest growth. Each of these species is showing populations declines.

Conversely, some species of Neotropical migratory birds are dependent upon mature, undisturbed woodlands. The Acadian flycatcher, Cerulean warbler, and the veery are some examples of bird species needing mature forests. Management objectives will attempt to either protect these types of sites or include needed management to secure these necessary habitats for the future.

The IDNR Wildlife Bureau's, State Comprehensive Wildlife Conservation Plan, identifies these species and others as species of "greatest conservation needs".

Generally, the Wildlife Bureau manages state-owned forest for the greatest diversity of forest wildlife and esthetic value. The IDNR Wildlife Bureau's FSP will

prioritize the "species of greatest conservation needs," and will utilize habitat factors to benefit species of declining populations. Forests land inventory will be conducted on each WMA and the information will be entered into a database. This database along with the following FSP definitions and guiding factors will be use to make forest management decisions on the WMA's.

FOREST STEWARDSHIP PLAN
DEFINITIONS AND GUIDING FACTORS

Upland Forest Wildlife – Representative tree species include oak, hickory, hard maple, cherry, elm, walnut, ash, and red cedar. This habitat factor will provide habitat for wildlife such as ruffed grouse, woodcock, songbirds and woodpeckers, deer, turkey, raptors, owls, squirrels, and associated furbearing predators.

Floodplain Forest Wildlife –Characterized by species such as silver maple, cottonwood, walnut, green ash, elm, hackberry and willows. This habitat factor will benefit wildlife such as songbirds and woodpeckers, furbearers, raptors, reptiles and amphibians on relatively level areas inundated by water from time to time.

Woodland Edge – An area of habitat transition that consists of vegetation (herbaceous and woody) of different heights and densities. This habitat factor will favor early successional vegetation for wildlife benefiting from edge cover.

Conifer/Wildlife Plantation – A conifer or tree/shrub planting designed for wildlife habitat. This habitat factor will provide nesting sites, food and cover for wildlife. Conifers are also important to wildlife during the winter providing thermal benefits and areas of decreased snow depths.

Restoration – A new planting of seedlings, direct seeding, or regeneration of roots. This habitat factor will create new forest habitat that will be of higher quality for wildlife.

Conversion – An existing shade tolerant forest stand converted to nut and fruit bearing species of trees and shrubs to provide more food and cover. This habitat factor is a timber stand improvement increasing the forest quality. It will begin forest succession from early stages to old growth.

Riparian Buffer – Woodland next to streams, lakes, and wetlands that is managed to enhance and protect aquatic resources from adjacent fields. This habitat factor will provide a woody cover buffer to enhance soil and water conservation while providing wildlife habitat.

Old Growth – Natural forests that have developed over a long period of time, generally at least 120 years, without experiencing severe, stand-replacing disturbance---a fire, windstorm, or logging. This habitat factor will provide necessary wildlife habitat for species requiring mature woodlands.

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. Viewshed's are a habitat factor that will be primarily a "hands-off" area for aesthetics, proper soil and water conservation, along with providing special wildlife habitats.

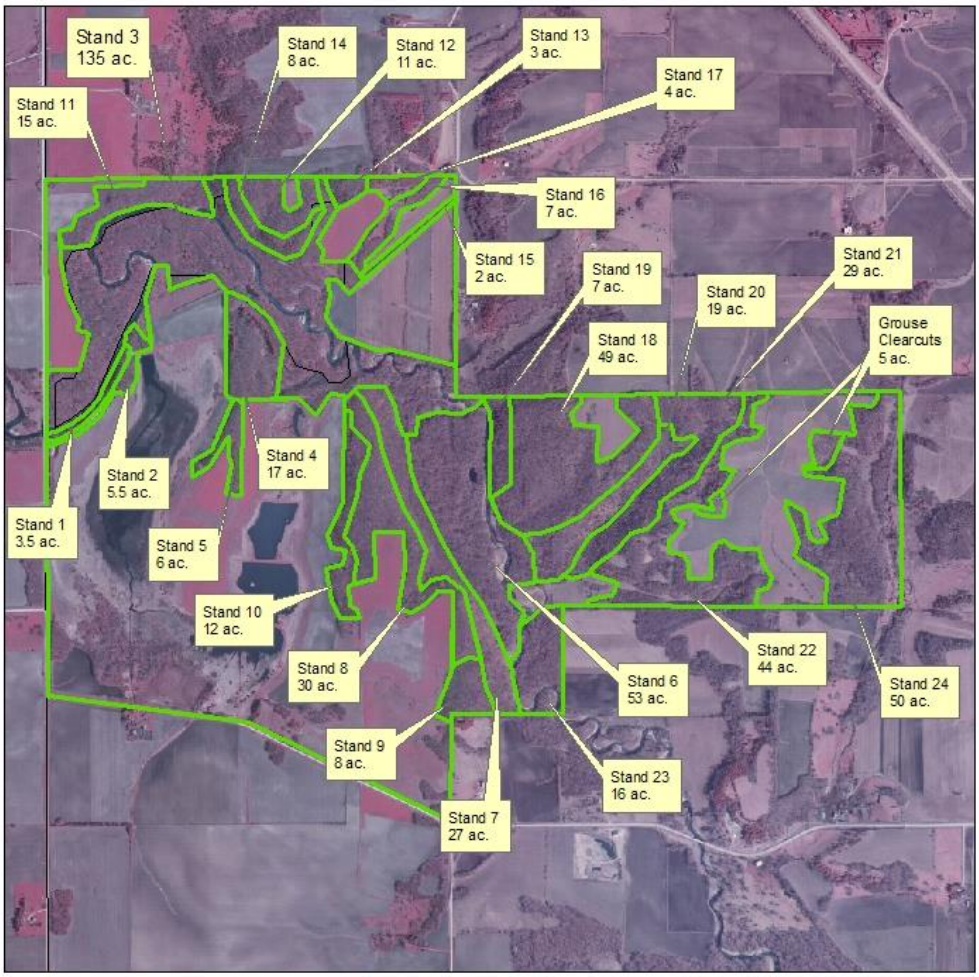
Unique Natural Sites – Sites that contain unusual or rare natural components that should be preserved for their unique characteristics, such as algific slopes. This habitat factor will identify these uncommon sites for management considerations.

Preserve Status – An area of land or water formally dedicated for maintenance as nearly as possible in its natural condition though it need not be completely primeval in character at the time of dedication or an area which has floral, fauna, geological, archeological, scenic, or historic features of scientific or educational value. This habitat factor will recognize the quality of preserve sites and apply proper maintenance to protect its integrity.

Recreation –Leisure activities involving the enjoyment and use of natural resources. This habitat factor will favor hunting activities while taking into consideration secondary activities such as wildlife watching, mushroom picking, photography, and hiking.

Special Restrictions – Certain limitations or conditions on the use or enjoyment of a natural resource area. This habitat factor will take into consideration these limitations or conditions to select proper management.

FOREST STEWARDSHIP PLAN
FOR CARDINAL MARSH



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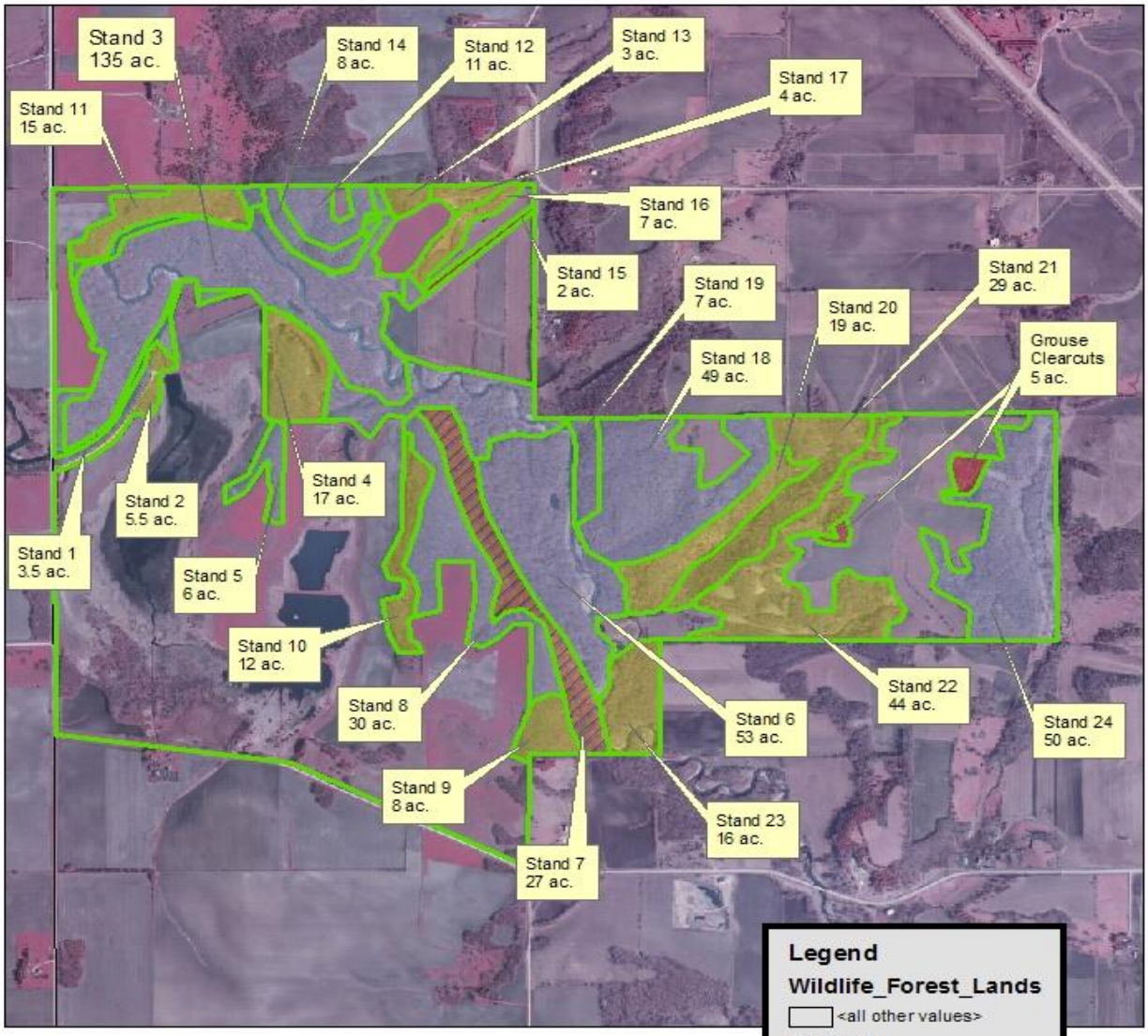
CARDINAL MARSH
AVERAGE TREE SIZE



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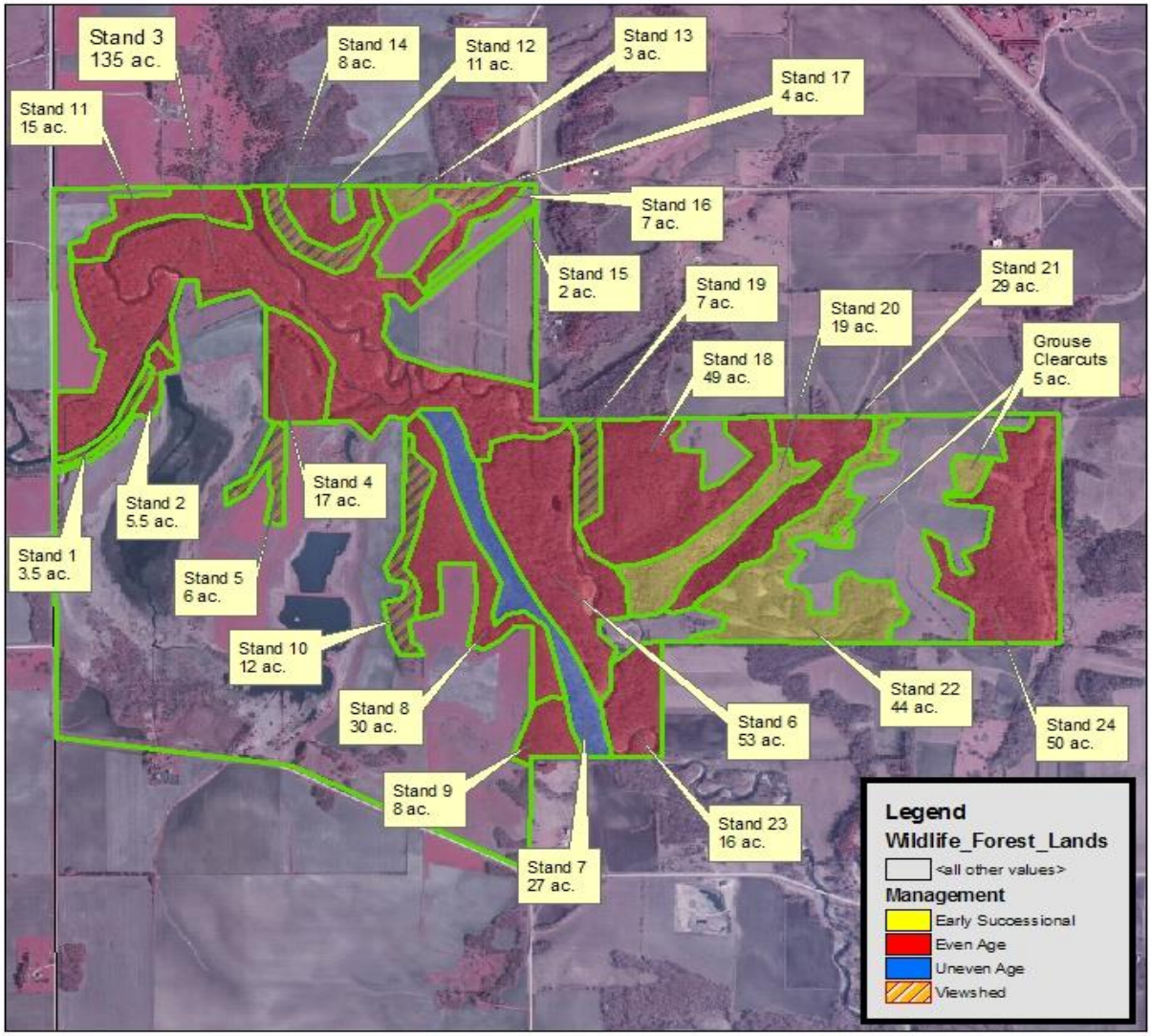
CARDINAL MARSH
MANAGEMENT SYSTEMS



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DATE: 7/25/05

FOREST WILDLIFE STEWARDSHIP PLAN FOR CARDINAL MARSH

Prepared by Gary Beyer, District Forester
And Terry Haindfield, Wildlife Biologist

MANAGER:

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Decorah, Iowa 52101

TELEPHONE: 563/382-4895

LOCATION: Sec. 6, 7, and 8 Lincoln Twsp., T98N-R10W, Winneshiek County

TOTAL ACRES: 566

DESCRIPTION OF AREA

The 566 acres addressed in this plan are outlined on the attached aerial photo. The area is divided into 24 different areas or stands, labeled 1-24 on the map. Each area is described in this plan and recommendations outlined for woodland management.

Cardinal Marsh has the Turkey river running through the area and a 145 acres marsh. The marsh is in the southwest corner of the property and will not be affected by the proposed forest management activities

Objectives -

The primary objectives for the area are improving wildlife habitat for a variety of wildlife species, recreation, water quality, and protecting threatened and endangered species. This Forest Wildlife Stewardship Plan strives to develop a forest ecosystem that has a diversity of tree sizes and species. Developing a diverse forest will benefit the widest variety of wildlife species. Wildlife species have diverse habitat requirements. Even on a Wildlife Management Area, what is productive habitat for one species may be unproductive for another.

Oak acorns are an important food source for many species of wildlife. Maintaining large oak trees and regenerating young stands of oak to replace the older trees are a major focus of the recommendations. Oak is by far the most important tree for a variety of wildlife species, and is a difficult tree to regenerate because it will not survive in shade. Ruffed grouse, woodcock, and Eastern Towhee populations in northeast Iowa are declining due to a lack of early successional growth. Neotropical migratory birds dependent on early successional growth are also declining.

Clearcutting or Shelterwood cutting are even age management techniques to regenerate oak and provide early successional growth. Areas suitable for even age management will be managed to create stands with an oak component. Although clearcutting is planned for even age stands, the next harvest will not occur for 125 years on that area. Some current even age stands may not be harvested for 60-80 years. Even age management is the only forest management system that will regenerate stands with an oak component.

Uneven age management develops a forest with all tree sizes, from seedlings to large trees present. Uneven age management will gradually convert areas to hard maple and basswood, because these species are able to grow in shade. As older trees are selectively harvested or die, species that are able to survive in the shade will fill in the openings.

Fragile sites and areas that are important for their visual impact will be left as viewshed or old growth forests to provide areas where natural beauty, stream protection, and erosion control are the primary focus.

Income from Timber Harvests -

Harvesting is conducted to regenerate stands to desirable species and to achieve a diversity of tree sizes and species. Income from timber harvesting operations will be reinvested into the area to plant trees, thin young stands, convert areas to more desirable species, and cut the early successional habitats. Harvesting is a very minimal portion of this plan. The majority of the work recommended is to thin young stands so that the oak is not shaded out by other trees, remove undesirable species to encourage natural regeneration of desirable trees, complete the early successional work, and tree planting.

Current Distribution of Tree Size on the Area -

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

Tree Size	Acres	% of Total Area
Sapling (<4" dbh)	7	1
Pole size (5-12" dbh.)	179.5	32
Medium (14-18" dbh.)	352.5	62
Large (>20" dbh)	27	5
Totals	566	100

Proposed Management Systems for the Area

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

Based on my recommendations for Cardinal Marsh Wildlife Area, the acres under each management system are as follows -

Management System	Acres	% of Total Area
Early Successional	73	13
Even Age	431.5	76
Uneven Age	27	5
Viewshed	34.5	6
Totals	566	100

Cardinal Marsh has a large percentage of even age management due to Stand 3, 135 acres. This is a unique bottomland forest that is dominated by young walnut. Walnut is managed on an even age system because it requires full sunlight, however walnut is normally harvested on a tree by tree basis because of its high value. Regeneration is accomplished by very small openings or a shelerwood system.

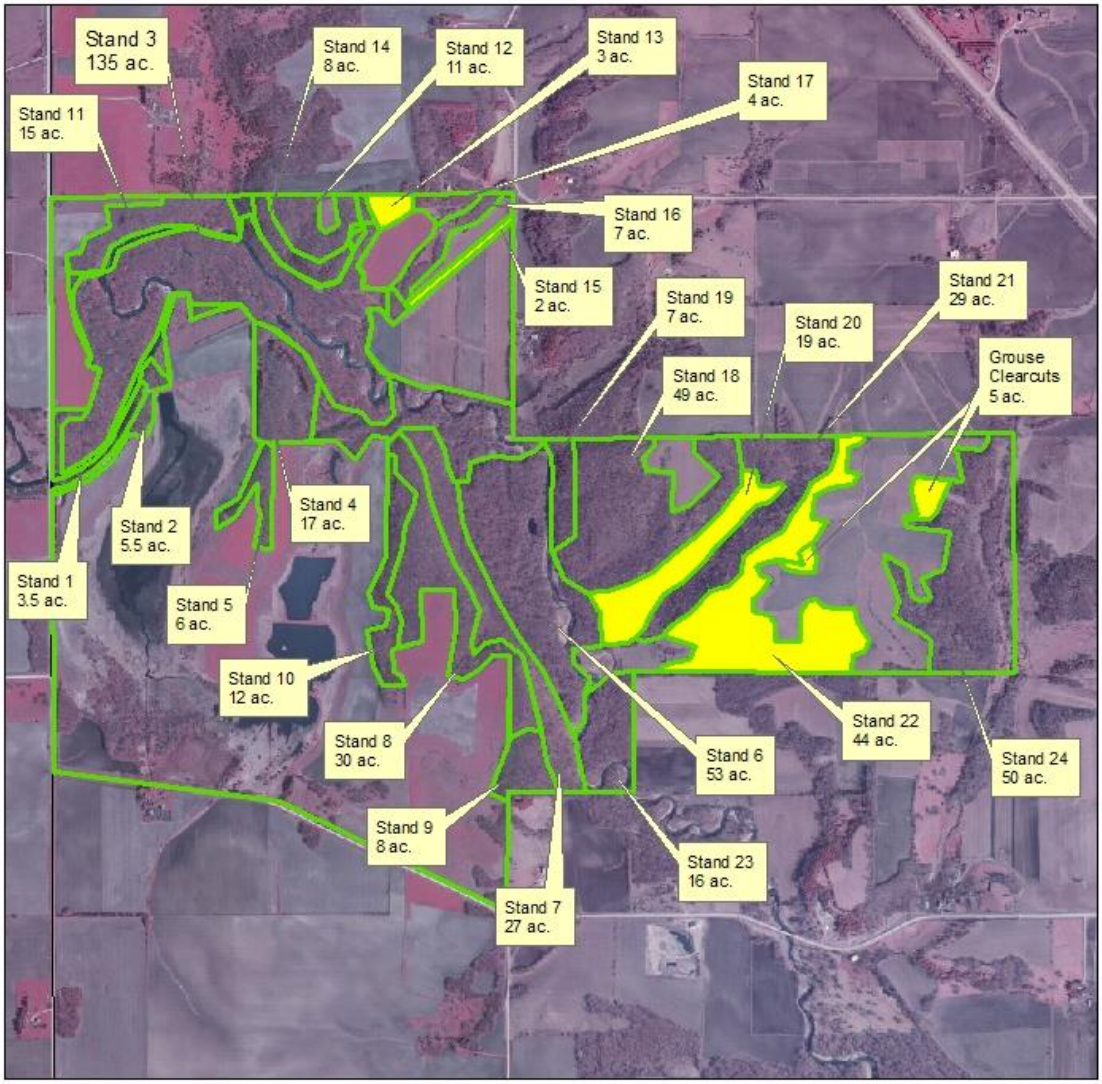
Early Successional Management -

Many species of birds such as ruffed grouse, American woodcock, gold winged warbler, blue winged warbler, black billed cuckoo, yellow billed cuckoo, and eastern towhee are dependent on the early stages of woody growth. The high stem density of both trees and shrubs provides suitable nesting habitat and protection from predators. Because aspen will spout from the roots when the parent tree is cut, aspen is an excellent species to create the dense growth needed by these species. Aspen also is a short lived tree species, and cutting the aspen will rejuvenate and expand the aspen stands through root sprouting.

The majority of early successional management is on the woodland edges and aspen stands. This work will "feather" the edges and make a gradual transition from the field edges to the larger trees. Feathering or softening the edges results in less nest parasitism of interior forest bird species by brown-headed cowbirds.

Aspen provides critical habitat for ruffed grouse. Aspen is most easily regenerated by root suckering. Once aspen is allowed to become over mature, its ability to root sucker is decreased. The best method to maintain aspen and expand the aspen clone is to cut the stand while the trees are in a healthy condition. Ideally, 1/3 of the aspen would be sapling size (1-4" dia.), 1/3 pole sized (5-10" dia.), and 1/3 medium sized (12-16" dia.). Big tooth aspen will grow to 16-20" in diameter, but small tooth aspen generally begins to die at 14-16" in diameter.

CARDINAL MARSH WILDLIFE AREA
EARLY SUCCESSIONAL MANAGEMENT AREAS



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Even Age Management -

Even age management is essential for wildlife species depending on oak/hickory forests. Even though large blocks of forest are needed on some Wildlife Management Areas for some wildlife species, each stage of an even age stand provides habitat for wildlife. For example, regenerating stands (1-10 years) benefit the same species of birds as does early successional stands; golden-winged warbler, blue-winged warbler, black-billed cuckoo, yellow-billed cuckoo, Eastern towhee, along with ruffed grouse and American woodcock.

Sapling to small pole sized stands between 10 and 20 years, may be used by black and white, Kentucky, and worm eating warblers. From age 20 to 60 years, pole to medium size trees tend to be used by canopy nesters such as scarlet tanagers, wood thrushes, and ground nesters such as ovenbirds and black and white warblers.

Mature stands of 60 to 125 years of age are used by birds such as the wood thrush, Acadian flycatcher, ovenbird, worm-eating warbler, and scarlet tanagers.

Even age management involves growing a stand of trees which are close to the same age. At some point in the stands life, the area is clearcut which creates the even age structure. Even age management creates excellent habitat for deer, turkey, and grouse and is essential for regeneration of oak which require full sunlight. The only way that oak can be maintained as a component of the forest is by practicing some form of even age management.

Even age management involves clearcuttting and planting, clearcutting with regeneration already established, or a shelterwood system to develop desirable seedlings on the ground.

Shelterwood is a form of even-age management. The final cut is a clearcut, but several thinnings are done prior to the final cut. The large, healthy trees are left to provide seed for naturally reseeding the stand, and to create partial shade to inhibit the growth of weeds and brush until the desirable seedlings are well established. The final cut or clearcut is normally done when there are a sufficient number of desirable trees that are 3-5 ft. tall. The shelterwood system can take many years to develop a good stocking of desirable young trees. You may have to kill the undesirable species several times to favor the species you want. The final clearcut should not be made until you are satisfied with the stocking of desirable young trees.

Clearcutting to create full sunlight is essential at some point in the stands life to successfully regenerate oak. If stands are not clearcut, the oak

component of the forest will be lost to shade tolerant species. Clearcuts also provide additional early successional habitat in the early stages. The area is in the brushy stage for a very short period, normally 10-15 years. After that time, the trees will totally shade the ground, and the area becomes a pole sized (5-10" dia.) stand of trees.

CARDINAL MARSH WILDLIFE AREA
EVEN AGE MANAGEMENT AREAS

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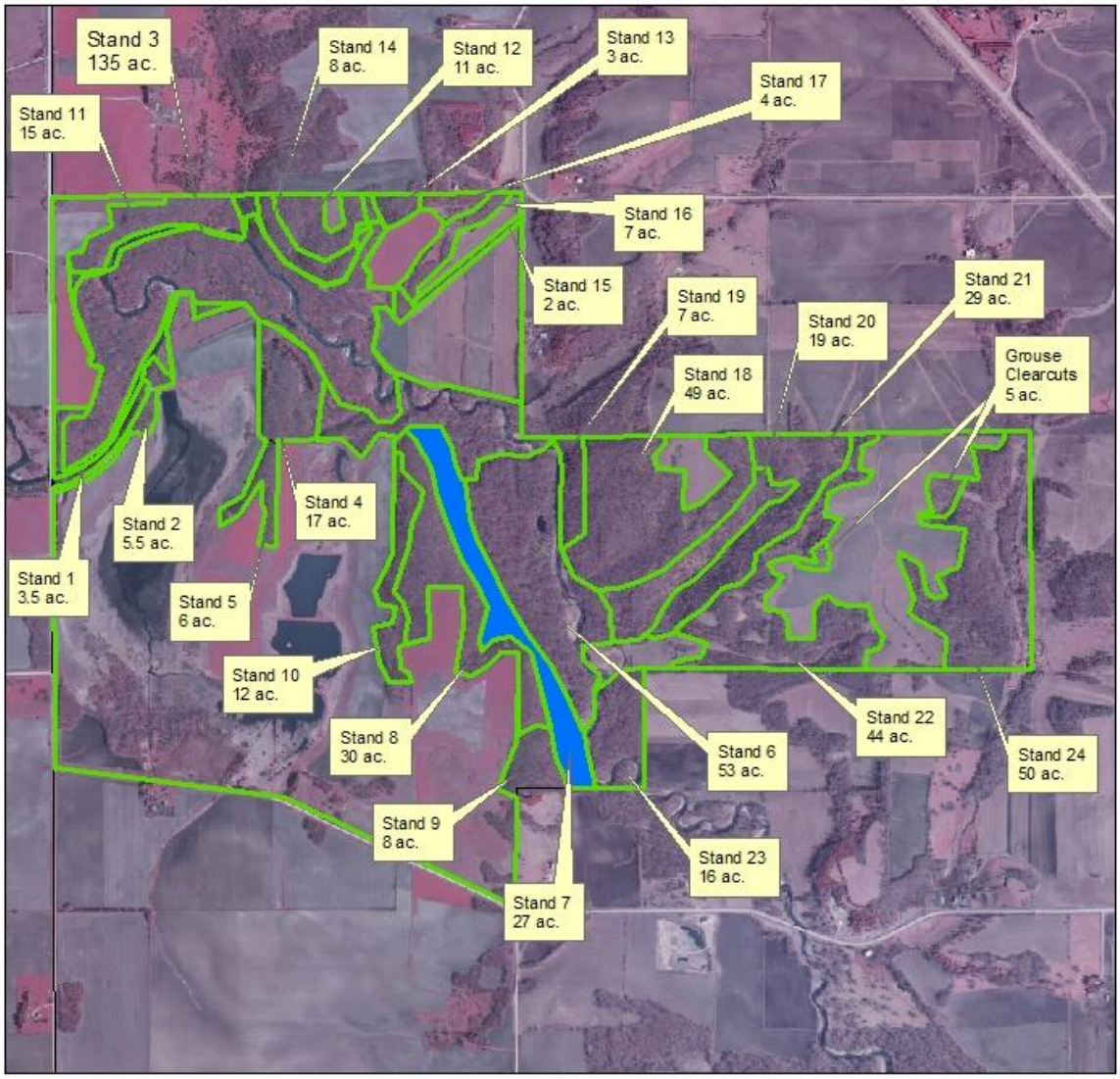
Uneven Age Management -

Uneven age management develops a stand of trees with all tree sizes represented. The stand structure is developed by selectively harvesting mature and defective trees, and removing unwanted small trees that are damaged or defective. Because uneven age stands always have large trees present, this system favors species that will grow in shade such as hard maple and basswood.

Uneven age management will maintain blocks of woodland that will always have larger trees. Uneven age management is desirable where the understory is mainly hard maple, on steep slopes, and on areas where always having large trees is important.

Uneven age management areas will provide continuous tracts of woodland with minimal disturbance. Large tracts of uneven management will provide necessary habitat for neotropical migratory birds such as cerulean, hooded, Canada, and Kentucky warblers. Selective harvesting will create small openings in the canapy, which will increase ground cover, and enhance stand structure. Den trees will be left to provide cavities for wildlife such as woodpeckers, bats, and squirrels, including the Northern myotis and red squirrel, species of greatest conservation need. Timber stand improvement and selective harvesting will create woody debris on the forest floor for reptiles and amphibians.

CARDINAL MARSH WILDLIFE AREA
UNEVEN AGE MANAGEMENT AREAS



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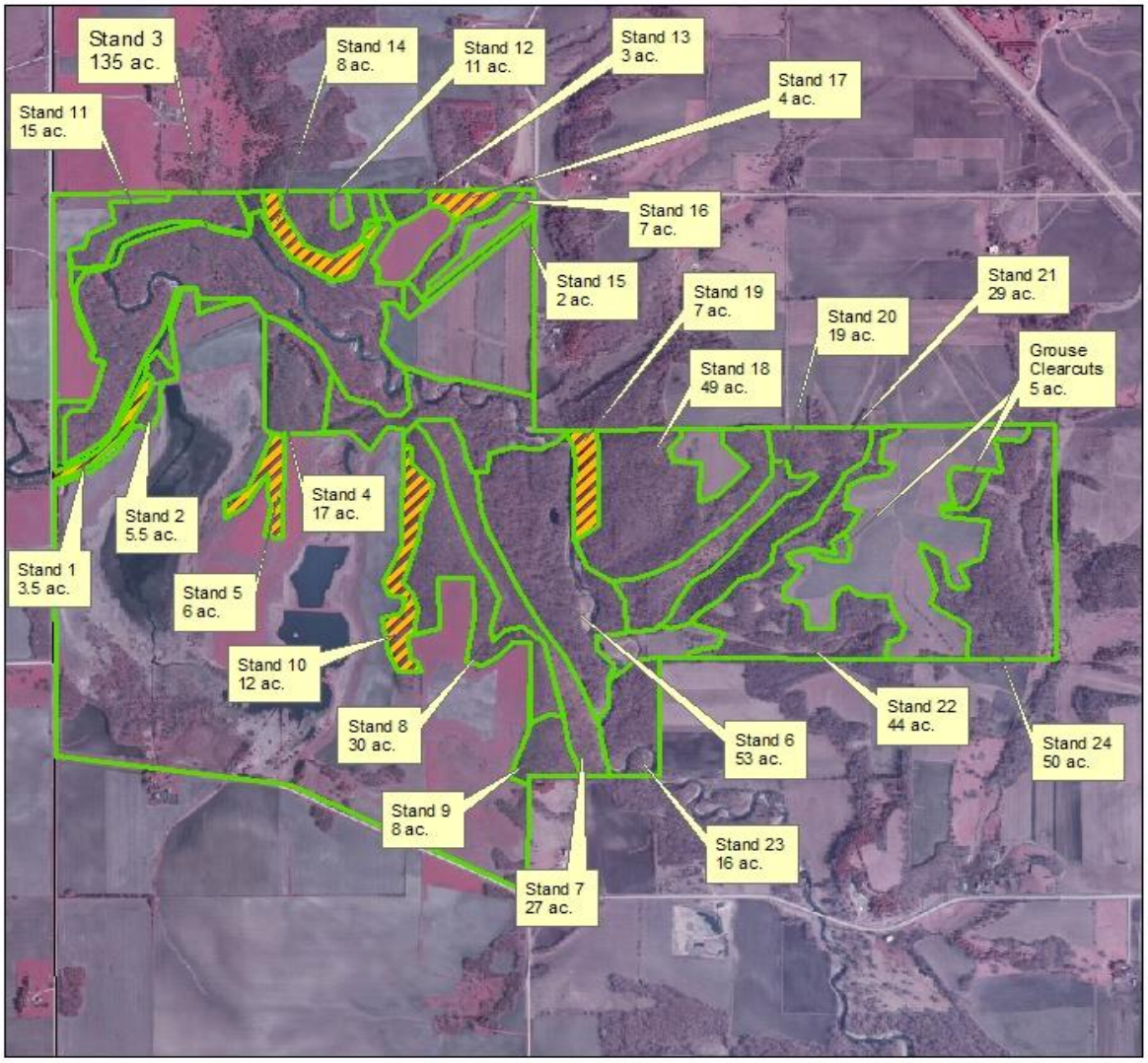
Viewshed Management -

Viewshed areas are typically steep slopes and areas along streams which are fragile and are best left to naturally progress through succession. Areas where endangered plant or animal species exist will also be under viewshed management. Management can take place on these areas where desirable, but the major objective is to have very minor disturbance if any.

Many neotropical migratory birds will benefit greatly from the areas designated as viewshed. Algific slopes and maderate slopes will be under viewshed management which will protect 8 species of land snails listed as species of greatest conservation need.

Viewshed management is designated for 589 acres on the area, or 40% of the forest resource.

CARDINAL MARSH WILDLIFE AREA
VIEWSHED MANAGEMENT AREAS



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SOILS

There are a large variety of soil types on Cardinal Marsh, from boggy soils to steep, rocky bluffs. The east end of the area has very sandy, upland soils such Burkhardt and Chelsea sandy loams. The attached map is colored according to soil limitations to management. The blue area are soils that are poorly drained and subject to flooding. The cross hatched, red areas are the steep slopes and very sandy sites. The remainder of the area has loam soils with good potential for growing upland, hardwood timber.

WORK PLAN

FOR

CARDINAL MARSH WILDLIFE AREA

This is the “working plan” for North Bear Wildlife Area designed to aid professional biologists and foresters in the implementation of forest management practices. It is written with the understanding that these professionals have an understanding of forest management principles and techniques. All of the details of the management techniques suggested are not listed because the plan would become too long to be of practical use. This plan is intended to get work accomplished on the ground.

FOREST MANAGEMENT RECOMMENDATIONS

DESCRIPTION AND RECOMMENDATIONS FOR INDIVIDUAL STANDS

Stand 1: 3.5 acres

Stand 1 is a steep, north facing slope along the Turkey River. The timber is red cedar, bur oak, basswood, hard maple, and red oak. The trees are pole to medimum in size. The understory consists of ironwood, hard maple, and elm. This area provides a nice buffer along the river and is along the main entrance to the marsh area. I recommend leaving this area as is.

Stand 2: 5.5 acres

This area is pole sized mixed hardwoods. The major species are basswood, ash, bitternut hickory, elm, black oak, cherry, hard maple, and bur oak. The understory consists of ironwood, hard maple, and honeysuckle. This area could be thinned to favor the oak and nice quality cherry, maple, and basswood.

Timber Stand Improvement (Crop Tree Release) -

In pole-sized stands (4-10" dia.), potential crop trees can be selected and released. At maturity, there is room for 35-50 trees per acre. Now you can select the trees you want to comprise your future stand of mature trees and thin around them to give them more growing space. Select a crop tree every 30-35 ft. apart. Remove trees with crowns that are touching or overtopping the crowns of your crop trees. Crop trees can be selected based on criteria that meets your objectives. Normally, the crop trees will be a desirable species, show good form without large side limbs, and be free of major defects. Species normally favored are black walnut, red oak, white oak, white ash, basswood, cherry, and hard maple.

Locate your good quality trees. Do not waste your time and money on poor quality trees. If there are no high quality trees present on an area, go on to an area with good trees. You can not create high quality trees. Either they are present or not. Be selective and work with only your best trees.

The trees to be removed can be felled or double girdled. No herbicide is necessary.

Stand 3: 135 acres

Stand 3 is a large bottomland area with a tremendous stocking of young walnut. The walnut are 6-18 inches in diameter. Other species include basswood, hackberry, bur oak, and elm. There are scattered, mature walnut, basswood, hackberry, cottonwood, and elm.

The scattered, mature trees could be harvested to create a more even age stand, and provide more growing space for the young walnut. Following the harvest, the stand could be thinned to provide optimum growing space for the best trees.

Improvement Harvest –

The mature and poor quality walnut could be harvested. In addition, the scattered, large mixed hardwood could also be harvested to create an even age stand.

Timber Stand Improvement (Crop Tree Release) -

Following the harvest, the stand could be thinned to release the crop trees. Select a crop tree every 30-35 ft. apart. Remove trees with crowns that are touching or overtopping the crowns of your crop trees. Crop trees can be selected based on criteria that meets your objectives. Normally, the crop trees will be a desirable species, show good form without large side limbs, and be free of major defects. Favor good quality walnut, oak, basswood, ash, and cherry.

Locate your good quality trees. Do not waste your time and money on poor quality trees. If there are no high quality trees present on an area, go on to an area with good trees. You can not create high quality trees. Either they are present or not. Be selective and work with only your best trees.

The trees to be removed can be felled or double girdled. No herbicide is necessary.

Stand 4: 17 acres

Stand 4 is a ridgetop and side slopes. The trees are pole sized (4-10” dia.) walnut, black oak, elm, bur oak, hackberry, and basswood. This stand could be thinned to release the nice oak and walnut.

Timber Stand Improvement (Crop Tree Release) –

Select a crop tree every 30 ft. apart or 50 trees per acre. Remove trees with crowns overtopping or touching the crowns of the crop trees.

The walnut crop trees should be pruned.

Stand 5: 6 acres

Stand 5 is a ridge with medium sized (14-18" dia.) bur oak, basswood, and black oak. The understory is hackberry, basswood, elm, and buckthorn. This area borders a prairie area.

This area could be prescribed burn and managed as a savanna or transition area to the closed canapy woodland.

Prepare the area by killing all non oak species. Cut the trees and treat the stumps with Tordon RTU herbicide to prevent sprouting. Then begin burning the area. You will need to burn the area several years in a row to kill the woody species in the understory. You may need to remove some of the stunted oak to achieve a 50% canapy.

Stand 6: 53 acres

Stand 6 is a bottomland and bench area. This area has very nice quality walnut, 16-24" in diameter. There are scattered elm, hackberry, ash, and poor quality bur and red oak. The understory consists of ironwood, bitternut hickory, hackberry, elm, walnut, basswood, and boxelder. There are oak, ash, and cherry seedlings present on the bench areas, but the bottomland has mainly nettles.

Stand 6 can be managed on a "Shelterwood" system to encourage the natural regeneration of oak, walnut, ash, and cherry. The first step is to kill the unwanted species to open up the ground to sunlight. Once regeneration is established, some of the larger trees can be harvested to provide additional space and sunlight. The shelterwood system is long term management system that may take 15-20 years to establish a good stocking of young trees.

Timber Stand Improvement (Weed Tree Removal) -

The undesirable species such as elm, ironwood, bitternut hickory, and boxelder could be killed. The trees should be cut off or girdled. Tordon RTU should be applied to the cut surface to prevent resprouting. This work can be done anytime except spring during heavy sap flow. Remove undesirable species that are 1" and larger in diameter.

In addition, desirable species that are poor formed or damaged should be coppiced. This is cutting the trees at ground level so the stumps will sprout. No herbicide should be used on the stumps of desirable species.

Shelterwood Harvest -

In 10-15 years, some of the larger walnut and oak can be harvested if there is a good stocking of young seedlings established. If not, the undesirable species should be killed again.

Stand 7: 27 acres

Stand 7 is a steep, east facing slope with large (16" and larger dbh) red oak, basswood, hard maple, and white oak. The understory is ironwood, hard maple, and basswood. There is a dense stocking of hard maple seedlings throughout much of the area.

Stand 7 can be managed as an uneven age woodland. The mature and defective trees can be selectively harvested. Following the harvest, the undesirable species should be killed. This will gradually convert the area to predominantly hard maple.

Selective Harvest –

Harvest the scattered, mature and defective trees. This would be a light cut of 1,000 to 1,500 board feet per acre. The large oaks that are in good condition could be left for their wildlife values.

Timber Stand Improvement (Weed Tree Removal) -

The undesirable species such as elm, ironwood, bitternut hickory, and boxelder could be killed. The trees should be cut off or girdled. Tordon RTU should be applied to the cut surface to prevent resprouting. This work can be done anytime except spring during heavy sap flow. Remove undesirable species that are 1" and larger in diameter.

In addition, desirable species that are poor formed or damaged should be coppiced. This is cutting the trees at ground level so the stumps will sprout. No herbicide should be used on the stumps of desirable species.

Stand 8: 30 acres

Stand 8 is upland with pole to medium size (6-18" dia.) bur oak, walnut, basswood, bitternut hickory, aspen, and black oak. The understory is bitternut hickory, ironwood, elm, hackberry, and prickly ash. The regeneration is mainly hard maple, ironwood, a few oak, and brushy species.

Stand 8 could be managed on an even age system of management. The narrow edge could be clearcut and replanted with oak where aspen are absent. This would also create a nice edge for grouse. The remainder of the stand could be prepared for future clearcutting by burning in the spring and fall. Burning will eliminate the maple seedlings and help establish advance, oak reproduction.

Clearcut & Planting –

All merchantable trees can be sold on a lump sum, sealed bid sale. Following the harvest, all trees 1 inch and larger in diameter should be felled. Treat the stumps of undesirable species with Tordon RTU herbicide to prevent sprouting. In areas lacking aspen, plant large oak seedlings. Planting large stock is essential for the trees to compete with the competition and grow above deer browsing height. The trees should be a minimum of 18-24" in height and 3/8" in caliper. Plant the trees 30 ft. apart, or 50 trees per acre.

Deer and rabbits will heavily browse oak seedlings. It is nearly impossible to establish oak without protection. You can protect the seedlings with a vented, plastic shelter or a wire cage. It you use wire, I suggest using 14 gauge welded wire with 2 X 4 inch openings. Cut a 4 ft. piece of wire and wrap it into a hoop making a 15 inch diameter cage. Fasten the wire cage to a steel post or stake.

Control competing vegetation by spot spraying a combination of Roundup and Princep 4L herbicides. Protect the seedling from the spray and spray an area 4 ft in diameter around each tree. Apply 2 quarts of Roundup and 4 quarts of Princep 4L per acre treated. The herbicides must be applied when the vegetation is actively growing.

Prescribed Burning –

Prepare the remaining area for future harvesting by burning the understory. This will help eliminate brushy species and shade tolerant species such as hard maple. After 1 or 2 burns, the undesirable species in the understory can be killed to create more sunlight. Once oak regeneration is established, you can stop burning. Areas with the best oak reproduction would be the best areas to clearcut in 5-10 years.

Stand 9: 8 acres

Stand 9 is a ridge and east facing slope with pole sized walnut, elm, bitternut hickory, and a few red oak. This would be a good area to thin to release the oak and nice walnut. There are scattered, large bur oak and walnut. Some of these trees could be harvested along with Stand 8 to create an even age stand.

Timber Stand Improvement (Crop Tree Release) -

Locate the oak and nice quality walnut. Select crop trees 30 ft. apart, or 50 trees per acre. Remove trees with crowns that are touching or overtopping the crowns of the crop trees.

Stand 10: 12 acres

Stand 10 is a west facing slope facing the marsh. The woodland consists of red cedar, bur oak, and black oak. There are scattered walnut and basswood pole sized trees. The understory is prickly ash, gooseberry, and honeysuckle.

Stand 10 can be left as is as a "Viewshed" for the marsh.

Stand 11: 15 acres

Stand 11 is upland with pole sized cherry, basswood, walnut, black ash, bitternut hickory, elm, black oak, and bur oak. The understory is buckthorn, elm, prickly ash, and gooseberry.

This is a high priority area to thin to release the good quality oak, cherry, walnut, black ash, and basswood.

Timber Stand Improvement (Crop Tree Release) -

In pole-sized stands (4-10" dia.), potential crop trees can be selected and released.

At maturity, there is room for 35-50 trees per acre. Now you can select the trees you want to comprise your future stand of mature trees and thin around them to give them more growing space. Select a crop tree every 30-35 ft. apart. Remove trees with crowns that are touching or overtopping the crowns of your crop trees. Crop trees can be selected based on criteria that meets your objectives. Normally, the crop trees will be a desirable species, show good form without large side limbs, and be free of major defects. Species normally favored are black walnut, red oak, white oak, white ash, basswood, cherry, and hard maple.

Locate your good quality trees. Do not waste your time and money on poor quality trees. If there are no high quality trees present on an area, go on to an area with good trees. You can not create high quality trees. Either they are present or not. Be selective and work with only your best trees.

The trees to be removed can be felled or double girdled. No herbicide is necessary.

Stand 12: 11 acres

Stand 12 is medium to large (14" and larger in diameter) bur oak, black oak, aspen, and elm. The understory is ironwood, elm, cherry, hackberry, hazel, and buckthorn. There are ash, hackberry, and bitternut seedlings present.

Stand 12 surrounds a small, grass field. There are aspen along the edges of the field. This would be an excellent area to clearcut and provide early successional growth in the area for grouse.

Clearcut (Edge Management) -

Clearcut 5-6 acres of the stand. Clearcut the areas that have an aspen component. The merchantable trees can be sold on a lump sum, sealed bid sale. Following the harvest, fell all trees 1 inch and larger in diameter. Treat the stumps of ironwood, elm, bitternut hickory, and buckthorn with Tordon RTU to prevent sprouting.

No planting is recommended for this stand. The aspen will root sucker and spread.

Stand 13: 3 acres

This is a ridge top with pole sized aspen. The understory is buckthorn. This would be an ideal spot to clearcut to create dense, early successional growth.

Stand 14: 8 acres

Stand 14 is a steep slope with small sawtimber bur oak, black oak, and red cedar. The understory is elm, hackberry, buckthorn, and prickly ash. This area has low potential for timber management, and the buckthorn threatens to take over the area if the canapy is opened up. I suggest leaving this area as is.

Stand 15: 2 acres

This area was planted with honeysuckle and ninebark. Boxelder has naturally seeded in and is overtopping the shrubs. All trees should be removed. Cut the trees and treat the stumps with Tordon RTU to prevent sprouting. The trees should be felled into the area, leaving the fields free of debris.

Stand 16: 7 acres

Stand 16 is a drainage with pole sized boxelder. Parts of this area could be converted to more desirable species. The following steps are suggested for Stand 16 –

1. ***Site Preparation*** -

Kill approximately ½ of the boxelder. The killing of the boxelder should create approximately 50% sunlight to the ground. Leaving a 50% canapy will inhibit weed growth while the seedlings are becoming established. Girdle the trees and treat the girdle with Tordon RTU to kill the root system.

2. ***Tree Planting*** -

Plant the area with hackberry, bur oak, swamp white oak, green ash, and walnut. Plant the trees 15 ft. apart, or 200 trees per acre.

Control competing vegetation by spot spraying a combination of Roundup and Princep 4L herbicides. Protect the seedling from the spray and spray an area 4 ft in diameter around each tree. Apply 2 quarts of Roundup and 4 quarts of Princep 4L per acre treated. The herbicides must be applied when the vegetation is actively growing.

3. ***Overstory Removal*** -

When the seedlings are well established after roughly 5 years, kill the remaining boxelder overstory. At that time, the seedlings will have a good root system developed and be able to keep up with the competition.

Stand 17: 4 acres

Stand 17 is a steep, south facing slope with red cedar, elm, hackberry, and a few black cherry. The understory is buckthorn and prickly ash. The soils are very shallow. I suggest leaving this area as is.

Stand 18: 49 acres

Stand 18 is medium size (14-20" dia.) black oak, white oak, bur oak, aspen, and walnut. There are scattered, good quality walnut, 18-22 inches in diameter. The understory consists of elm, basswood, black cherry, bur oak, walnut, ironwood, and hackberry. Regeneration is sparse, but consists of hackberry, elm, and prickly ash.

Stand 18 can be managed on an even age system of management. Areas approximately 5 acres in size can be clearcut and replanted. Future clearcut areas could be burned to build up a stocking of oak advance regeneration.

Clearcut & Plant -

All merchantable trees can be sold on a lump sum, sealed bid sale. Following the harvest, all trees 1 inch and larger in diameter should be felled. Treat the stumps of undesirable species with Tordon RTU herbicide to prevent sprouting. In areas lacking aspen, plant large oak seedlings. Planting large stock is essential for the trees to compete with the competition and grow above deer browsing height. The trees should be a minimum of 18-24" in height and 3/8" in caliper. Plant the trees 30 ft. apart, or 50 trees per acre.

Deer and rabbits will heavily browse oak seedlings. It is nearly impossible to establish oak without protection. You can protect the seedlings with a vented, plastic shelter or a wire cage. It you use wire, I suggest using 14 gauge welded wire with 2 X 4 inch openings. Cut a 4 ft. piece of wire and wrap it into a hoop making a 15 inch diameter cage. Fasten the wire cage to a steel post or stake.

Control competing vegetation by spot spraying a combination of Roundup and Princep 4L herbicides. Protect the seedling from the spray and spray an area 4 ft in diameter around each tree. Apply 2 quarts of Roundup and 4 quarts of Princep 4L per acre treated. The herbicides must be applied when the vegetation is actively growing.

Prescribed Burning -

Prepare the remaining area for future harvesting by burning the understory. This will help eliminate brushy species and shade tolerant species such as hard maple. After 1 or 2 burns, the undesirable species in the understory can be killed to create more sunlight. Once oak regeneration is established, you can stop burning. Areas with the best oak reproduction would be the best areas to clearcut in 5-10 years.

Stand 19: 7 acres

This area is a steep, west facing slope with red cedar and bur oak. There are small patches of prairie in the more open areas.

The trees in the "goat prairie" could be removed. Then these sites could be burned to encourage prairie species.

Stand 20: 19 acres

Stand 20 is a valley with pole sized elm, aspen, black locust, walnut, and black oak. With the aspen component, this would be a good area to clearcut for grouse. I suggest clearcutting roughly ½ of the area now, and the remainder in 10 years. Treat the stumps of undesirable species with Tordon RTU herbicide to prevent sprouting.

Stand 21: 29 acres

The area is predominantly pole sized (5-10" dbh) walnut, elm, bur oak, and basswood. There are scattered, large bur oak, black oak, and basswood.

The scattered, large trees can be harvested to create a pole sized, even age stand. Following the harvest, the stand could be thinned to release the crop trees.

Improvement Harvest -

The scattered, sawtimber sized trees could be harvested.

Timber Stand Improvement (Crop Tree Release) -

Following the harvest, locate the good quality oak, walnut, and basswood. Select no more than 50 trees per acre or a crop tree every 30 ft. apart. Remove trees with crowns that are touching or overtopping the crowns of the crop trees.

Stand 22: 44 acres

Stand 22 is pole sized black locust, boxelder, and aspen. There are scattered, pole sized bur oak, black oak, walnut, and red cedar. The understory is buckthorn, prickly ash, honeysuckle, and wild plum. There are patches of garlic mustard. There is sumac along the edges. This is one of the most abused, messed up stands of timber I've ever seen.

The best management for this area would be to begin clearcutting the area for grouse habitat. Roughly ¼ of the area could be clearcut every 5 years. Begin clearcutting where there is a aspen component. Treat all undesirable species with Tordon RTU so that the aspen clones will expand.

Stand 23: 16 acres

The area is bottomland and a second bottom with pole sized basswood, walnut, hackberry, elm, ironwood, cherry, and black oak. There are scattered, sawtimber sized red oak, bur oak, basswood, and walnut.

The larger trees can be left for now for their wildlife values. The stand could be thinned to release the crop trees.

Timber Stand Improvement (Crop Tree Release) -

In pole-sized stands (4-10" dia.), potential crop trees can be selected and released. At maturity, there is room for 35-50 trees per acre. Now you can select the trees you want to comprise your future stand of mature trees and thin around them to give them more growing space. Select a crop tree every 30-35 ft. apart. Remove trees with crowns that are touching or overtopping the crowns of your crop trees. Crop trees can be selected based on criteria that meets your objectives. Normally, the crop trees will be a

desirable species, show good form without large side limbs, and be free of major defects. Species normally favored are black walnut, red oak, white oak, white ash, basswood, cherry, and hard maple.

Locate your good quality trees. Do not waste your time and money on poor quality trees. If there are no high quality trees present on an area, go on to an area with good trees. You can not create high quality trees. Either they are present or not. Be selective and work with only your best trees.

The trees to be removed can be felled or double girdled. No herbicide is necessary.

Stand 24: 50 acres

Stand 24 is pole to medium sized (6-18" dbh) aspen, black oak, bur oak, elm, cherry, basswood, boxelder, and hackberry. The understory is elm, buckthorn, prickly ash, gooseberry, nannyberry, and boxelder. There are scattered, low quality, large bur and black oak. This area has a good component of aspen throughout.

Stand 24 can be managed on an even age system. Areas roughly 5 acres in size can be clearcut harvested every 15 years. Where aspen is present, no planting will be needed. Where there are no aspen, oak could be planted to improve the species composition.

Clearcut & Plant -

All merchantable trees can be sold on a lump sum, sealed bid sale. Following the harvest, all trees 1 inch and larger in diameter should be felled. Treat the stumps of undesirable species with Tordon RTU herbicide to prevent sprouting. In areas lacking aspen, plant large oak seedlings. Planting large stock is essential for the trees to compete with the competition and grow above deer browsing height. The trees should be a minimum of 18-24" in height and 3/8" in caliper. Plant the trees 30 ft. apart, or 50 trees per acre.

Deer and rabbits will heavily browse oak seedlings. It is nearly impossible to establish oak without protection. You can protect the seedlings with a vented, plastic shelter or a wire cage. It you use wire, I suggest using 14 gauge welded wire with 2 X 4 inch openings. Cut a 4 ft. piece of wire and wrap it into a hoop making a 15 inch diameter cage. Fasten the wire cage to a steel post or stake.

Control competing vegetation by spot spraying a combination of Roundup and Princep 4L herbicides. Protect the seedling from the spray and spray an area 4 ft in diameter around each tree. Apply 2 quarts of Roundup and 4 quarts of Princep 4L per acre treated. The herbicides must be applied when the vegetation is actively growing.

SUSTAINABLE FORESTRY GUIDELINES

Sustainable forestry is managing a forest to maximize the distribution of age classes on the property, and insure there is a balanced distribution of tree sizes. With even age management, the acres of even age management divided by the rotation age is the allowable cut per year. The target rotation age for the area is 125 years. This insures that large oaks will always be present on the area.

Early Successional Management Areas-

The early successional areas will be managed on a 15 year rotation. There are 73 acres designated for early successional management. The allowable cut is 4.87 acres per year (73 acres divided by 15 years). With a working cycle of 5 years, approximately 25 acres could be cut every 5 years.

Even Age Management Area –

There are 431.5 acres under even age management. Dividing 431.5 acres by 125 years, yields an allowable cut of 3.4 acres per year, or 17 acres every 5 years.

Uneven Age Management Area –

Stands can be selectively harvested every 20 years to remove mature and defective trees. There are 27 acres under uneven age management. Because there is only one stand of uneven age management, I recommend harvesting the entire stand every 20-25 years. This amount of acreage will be needed to have a commercial timber sale.

HIGH PRIORITY PROJECTS

Timber Stand Improvement -

Stand #	**Acres**	**Prescription**
2	5.5	Release crop trees
4	17	Release crop trees
9	8	Release crop trees
11	15	Release crop trees
13	3	Clearcut for grouse
15	2	Kill all trees overtopping shrub planting
20	10	Clearcut for early successional habitat
22	10	Fell all trees and treat stumps of undesirable species
Total	70.5	

Harvests -

Stand #	**Acres**	**Prescription**
3	135	Improvement harvest
8	10	Clearcut and plant oak
12	5	Clearcut to expand aspen along edges
18	5	Clearcut and plant oak
Totals	155	

APPENDIX

CARDINAL MARSH

SUMMARY OF WOODLAND STANDS

No.	Acres	Timber Type	TreeSize	Mngt. System	Prescription	Priority	Year Complete	Comments
1	3.5	Mixed Hdwds. Red Cedar	Medium	View shed				
2	5.5	Mixed Hardwds	Pole	Even	Crop Tree Release	High	2005	
3	135	Bottom Land Hdwds.	Medium	Even	Harvest and Crop Tree Release	High	2005	
4	17	Walnut & Oak	Pole	Even	Crop Tree Release	High	2005	
5	6	Oak & Basswood	Medium	Savanna	Prescribed Burn	Medium	2010	
6	53	Bottom Hdwds. Walnut	Medium	Even	Weed Tree Removal	Medium	2010	
7	27	Mixed Hdwds	Large	Uneven	Selective Harvest & Weed Tree	Medium	2010	
8	30	Oak, Basswood Walnut	Medium	Even	Clearcut and Plant 5 ac.	High	2005	
9	8	Walnut Hickory Oak	Pole	Even	Crop Tree Release	High	2005	
10	12	Oak Cedar	Pole	View Shed				
11	15	Oak Basswood Walnut	Pole	Even	Crop Tree Release	High	2005	
12	11	Bur, Black Oak	Medium	Even	Clearcut 5-6 acres	High	2005	
13	3	Aspen	Pole	Early Successional	Clearcut	High	2005	
14	8	Bur, Black Oak	Medium	View Shed				

15	2	Shrub Planting	Sapling	Early Successional	Remove trees overtopping shrubs	High	2005	
16	7	Boxelder	Pole	Even	Kill boxelder and plant	Low	2015	
17	4	Red Cedar	Pole	View Shed				
18	49	Oak Walnut	Medium	Even	Clearcut and plant 5 ac.	High	2005	
19	7	Cedar Prairie	Medium	View Shed				
20	19	Oak Aspen	Pole	Early Successional	Clearcut 10 ac.	High	2005	
21	29	Oak Walnut Basswood	Pole	Even	Improvement Harvest Crop Tree Release	Medium	2010	
22	44	Locust Boxelder Elm	Pole	Early Successional	Clearcut 10 ac.	High	2005	
23	16	Basswood Walnut	Pole	Even	Crop Tree Release	Medium	2010	
24	50	Oak Aspen	Small Sawtimber	Even	Clearcut and plant	Medium	2015	

Table 1. Forest Breeding Birds of Greatest Conservation Need in NE Iowa

Common Name	Scientific Name
Bald eagle	*Haliaeetus leucocephalus*
Red-shouldered hawk	*Buteo lineatus*
Broad-winged hawk	*Buteo platypterus*
Peregrine falcon	*Falco peregrinus*
Ruffed grouse	*Bonasa umbellus*
American woodcock	*Scolopax minor*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Yellow-billed cuckoo	*Coccyzus americanus*
Long-eared owl	*Asio otus*
Whip-poor-will	*Caprimulgus vociferus*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Acadian flycatcher	*Empidonax virescens*
Willow flycatcher	*Empidonax traillii*
Least flycatcher	*Empidonax minimus*
Brown creeper	*Certhia americana*
Veery	*Catharus fuscescens*
Wood thrush	*Hylocichla mustelina*
Blue-winged warbler	*Vermivora pinus*
Cerulean warbler	*Dendroica cerulea*
Black-and-white warbler	*Mniotilta varia*
Prothonotary warbler	*Protonotaria citrea*
Worm-eating warbler	*Helmitheros vermivorus*
Louisiana waterthrush	*Seiurus motacilla*
Kentucky warbler	*Oporornis formosus*
Hooded warbler	*Wilsonia citrina*
Eastern towhee	*Pipilo erythrophthalmus*

Table 2. Forest Migratory Birds of Greatest Conservation Need in NE Iowa

Common Name	Scientific Name
Golden-winged warbler	*Vermivora chrysoptera*
Canada warbler	*Wilsonia canadensis*

Table 3. Forest Mammals of Greatest Conservation Need in NE Iowa

Common Name	Scientific Name
Northern myotis	*Myotis septentrionalis*
Red squirrel	*Tamiasciurus hudsonicus*
Woodland vole	*Microtus pinetorum*
Spotted skunk	*Spilogale putorius*
Southern Flying Squirrel	*Glaucomys volans*

Table 4. Forest Reptiles and Amphibians of Greatest Conservation Need in NE Iowa

Common Name	Scientific Name
Cricket Frog	*Acris crepitans*
Northern Prairie Skink	*Eumeces septentrionalis*
Bullsnake	*Pituophis catenifer sayi*
Timber Rattlesnake	*Crotalus horridus*

Table 5. Forest Land Snails of Greatest Conservation Need in NE Iowa (Restricted to Algific Talus Slopes and Maderate Slopes)

Common Name	Scientific Name
Iowa Pleistocene Snail	*Discus macclintocki*
Frigid Ambersnail	*Catinella gelida*
Minnesota Pleistocene Succinea	*Novasuccinea n. Sp. Minnesota a*
Iowa Pleistocene Succinea	*Novasuccinea n. Sp. Minnesota b*
Briarton Pleistocene Snail	*Vertigo brierensis*
Hubricht's Vertigo	*Vertigo hubrichti*
Iowa Pleistocene Vertigo	*Vertigo iowaensis*
Bluff Vertigo	*Vertigo occulta*

Table 6. Forest Butterflies of Greatest Conservation Need in NE Iowa

Common Name	Scientific Name
Pepper and Salt Skipper	*Amblyscirtes hegon*
Sleepy Duskywing	*Erynnis brizo*
Dreamy Duskywing	*Erynnis icelus*
Columbine Duskywing	*Erynnis lucilius*
Silvery Blue	*Glaucopsyche lygdamus*
Hickory Hairstreak	*Satyrium caryaevorum*
Edward's Hairstreak	*Satyrium edwardsii*
Striped Hairstreak	*Satyrium liparops*

EXPLANATION OF TIMBER MANAGEMENT PRACTICES:

Timber Stand Improvement:

Timber stand improvement (TSI) is the removal of undesirable or low value trees. Removing these unwanted trees will provide more space and sunlight for desirable trees to grow. Timber stand improvement is a "weeding" to increase the growth of your forest.

Weed Tree Removal-

In older timber, the undesirable species can be killed to encourage the natural reseeding of desirable species. The removal of the "weed" trees allows sunlight to reach the ground so that seedlings can become established. The undesirable species can be killed standing by cutting flaps in the trunk and applying Tordon RTU or Pathway into the cuts. The cuts must be in a circle around the trunk and overlapping. The trees can also be cut off and the stumps treated with Tordon RTU or Pathway to prevent resprouting. Wet the outer rim of freshly cut stumps. The work can be done anytime except spring during heavy sap flow.

Desirable trees that are poor formed or damaged should also be removed. These trees should not be treated with herbicide. The stumps will resprout and produce another tree. Cut the stumps close to the ground so that the sprout will originate near the ground.

Crop-Tree Release-

In pole-sized stands (4-10" dia.), potential crop trees can be selected and released. At maturity, there is room for 35-50 trees per acre. Now you can select the trees you want to comprise your future stand of mature trees and thin around them to give them more growing space. Select a crop tree every 30-35 ft. apart. Remove trees with crowns that are touching or overtopping the crowns of your crop trees. Crop trees can be selected based on criteria that meets your objectives. Normally, the crop trees will be a desirable species, show good form without large side limbs, and be free of major defects. Species normally favored are black walnut, red oak, white oak, white ash, basswood, cherry, and hard maple.

Walnut Pruning-

Walnut trees that are 2-12" in diameter can be pruned to promote veneer quality trees. You should prune during the dormant season. Limbs less than 1 inch in diameter are providing foliage which produces food for the tree and should be left. When the limbs approach 1 1/2 to 2" in diameter, they should be removed. Do not remove over 1/3 of the live crown in any one year. At least 50% of the total height of the tree should be maintained in live crown.

Harvest:

Uneven-Age Management:

Uneven-age management can be implemented to manage shade tolerant species. The timber is selectively harvested to remove mature, damaged, and defective trees. Because large trees are always present in the timber, only species that can grow in the shade can reproduce. Hard maple and basswood can be managed on an uneven-age system of management. Uneven-age management involves maintaining a good distribution of all tree sizes in your timber. It is critical that following a selective harvest, the smaller trees are thinned to remove the trees damaged by logging, poor formed trees, and low value species. The thinning following the harvest insures that you have high quality trees ready to replace the older trees as they are harvested.

Even-Age Management:

Even-age management involves a clearcut at some point in the stands rotation. Clearcutting creates full sunlight to the ground. All trees 2" and larger in diameter are felled. Oak, ash, hickory, and walnut require full sunlight to grow. Even-age management must be applied to successively manage these species. Clearcutting creates stands of trees all the same age. The trees compete equally for sunlight and are forced to grow straight and tall, resulting in high quality timber. Clearcutting also provides excellent browse and cover for wildlife.

Shelterwood:

Shelterwood is a form of even-age management. The final cut is a clearcut, but several thinnings are done prior to the final cut. The large, healthy trees are left to provide seed for naturally reseeding the stand, and to create partial shade to inhibit the growth of weeds and brush until the desirable seedlings are well established. The final cut or clearcut is normally done when there are a sufficient number of desirable trees that are 3-5 ft. tall.

The first thinning can be a killing of the undesirable species such as ironwood, elm, bitternut hickory, and boxelder. This removes the seed source for the undesirable species and opens up the ground to sunlight.

The mature and defective trees can be harvested if additional sunlight is needed for the development of desirable seedlings. The harvest should be light, removing the trees that are deteriorating and leaving the high quality trees for seed.

The shelterwood system can take many years to develop a good stocking of desirable young trees. You may have to kill the undesirable species several times to favor the species you want. The final clearcut should not be made until you are satisfied with the stocking of desirable young trees.