Loess Hills
State Forest
Management Plan
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**Purpose**

The purpose for developing a management plan for the State Forests is to ensure that these lands are sustained for future generations and that the mission and core functions for the DNR Conservation and Recreation Division and The Bureau of Forestry are reflected in the management of these lands. Furthermore, this plan serves as a record of public input and desired uses for these lands. This plan reflects the management intentions for the next twenty years based on current knowledge of land capability, inventory data, sound forestry practices, land stewardship, and public demands. This plan will be a working document, and will be revised as needed to address the challenge of managing a forest resource that is constantly changing.

The mission and core functions of the DNR are as follows:

**Iowa DNR Mission:**

To conserve and enhance our natural resources in cooperation with individuals and organizations. To improve the quality of life in Iowa and ensure a legacy for future generations.

**Iowa DNR Vision:**

Leading Iowans in caring for our natural resources

**Core Functions of the Iowa DNR:**

Conservation, Protection, & Stewardship – Protect, manage, and ensure the lands through the effective use of policies and procedures. Provide sustainable, responsible recreational opportunities where possible. Increase awareness and understanding of natural resources values and needs. Provide all vital infrastructure needs necessary to administer and support agency operations to achieve results for Iowans.

**Bureau of Forestry Mission:**

To help Iowans value, protect, expand and enjoy our trees, forests, savannas and prairies and the amenities they provide.

This plan will achieve forest and prairie management goals on the state forest to help accomplish our mission. In the planning process we have developed goals and objectives that will move the forest resource to a desired future condition. This plan ensures a system of orderly management and development of the state forest which reflects the current science regarding harvesting, forest stand improvement, and reforestation. The following management goals and objectives lay a foundation for the implementation of sound forestry management practices. An area forester is responsible for administration and management of the area.
Management Goals

**Sustainability** - Manage for healthy, sustainable forests, savannas and prairies. Maintain and improve the diversity of plant species and communities on the state forests.
- Improve forest age diversity through the harvest and regeneration of over-mature forest stands
- Use forest stand improvement to enhance species diversity.
- Manage native prairies and savannas using fire management to promote plant diversity and control unwanted woody plants and invasive species.
- Increase the quality, quantity, and connectivity of public forestlands in Iowa.

**Utilization** – Ensure a sustainable flow of wood products for public benefit while promoting forest vigor by applying proper forest management techniques.
- Intensify forest management practices to utilize and regenerate over-mature and declining forest stands.
- Use forest stand improvement to enhance tree growth rates and vigor.
- Reduce non-forest acreage through natural succession and tree planting.

**Demonstration and Research** - Create and maintain forest management demonstration areas and research areas to increase the public awareness of the value and role of forests in Iowa and provide educational opportunities for students, organizations and others.
- Establish and maintain forest research plots.
- Establish forest demonstration areas, host field days, and provide outdoor classrooms to increase awareness and understanding of forest and prairie management.
- Seek partnerships with supporting private organizations, non-profit groups, and educational institutions to promote forestry education and awareness.

**Wildlife** - Maintain or improve natural wildlife habitat for game and non-game species. Protect known endangered and threatened species, as well as species of concern and their habitats.
- Use forest stand improvement and other practices to improve mast production for wildlife species.
- Maintain prairie and grassland habitats, increase contiguous forest cover, and create forest edge where appropriate to promote habitat diversity.
- Identify, study, and preserve unique habitats and T & E species.

**Recreation** – Create and enhance primitive, low-impact recreational opportunities.
- Maintain primitive trail and camping facilities where appropriate.
- Promote hunting, fishing and other game management activities.
- Promote other primitive activities such as backpacking and bird-watching.

**Water quality** – Enhance water quality by protecting watersheds and preventing soil loss by erosion.
- Prevent soil erosion by employing good conservation practices
- Protect and enhance streams and waterways adjacent to agricultural land by establishing riparian buffers.
- Use “Best Management Practices (BMP’s)” in all forest management operations.
Management Objectives

Conduct over 1000 acres of forest stand improvement over twenty years concentrating the efforts on the high quality north facing aspects, and other stands showing high productivity potential.

Work on restoration efforts of 500 acres of savanna management improvement work using prescribed fire and other management control measures and attempts.

Continue to acquire additional acres of land

Prescribed burn 1000 – 3000 acres per year throughout the different land cover types: grass, prairie, savanna, woodland, and forest.

Create demonstration sites to show vegetation improvement work sites (i.e.: tree plantings, silvicultural techniques, prairie and savanna mgmt. and research).

Identify locations for short hiking, nature trails, and overlook areas and work on signing the hiking trails throughout the forest

Harvest 24 of forest stands on good soil sites that are deteriorated, and regenerate with quality oak and walnut species to create new quality stands of forest.

Have a mosaic of the different forest management classes spread throughout each of the units.

Inventory and monitor the progression of land management activities on the state forest areas for contiguous habitats.

Update and improve GIS coverage of the forest and add new acquisitions.

Dredge the Jones Creek Pond to make it a more viable fishery now that the upstream improvements have been completed.

Host a 25th year Anniversary Celebration in September of 2010, celebrating the beginning of the Loess Hills State Forest.

Create and develop an Adopt a Prairie Program.

Host a Forestry Field Day each year to increase public awareness and forestry education

Continue to partner with other organizations and departments to help educate the public and increase awareness of the value and role of forests, savannas and prairies in Iowa.

Continue to partner and work with DNR Parks and Recreation, Fisheries, Law Enforcement, and Wildlife to help manage recreation facilities and structures.
History and Overview

Historical Account

The area was characterized by a slowing economy with declining school enrollment and loss of services. A hope for the state forest was a revitalization of surrounding communities. Early on, there was indication that this was indeed happening. The area that is encompassed by the state forest has been settled and developed over the years by landowners who farmed small plots of agriculture ground in earlier days to larger fields in most recent, and livestock grazing. The farmers in the area worked hard to scrape together a livelihood. Ownerships ranged from 10 acre woodlots to 1000 acre farms and handed from one generation to another.

Interest in a Loess Hills State Forest had been expressed for some time prior to its being recommended in the Iowa Conservation Commission’s 1985 Forest Resources Plan. When the State Lottery became a reality, acquisition of the forest became possible. The first lands were acquired in June 1986 with the purchase of the Bothwell and Hrabik properties.

Prior to the start of acquisition the area was a mixture of private ownerships. Mid America Council of the Boy Scouts of America is one of the largest land holders in the area with 1,834 acres. The sizes of acquisitions have varied ranging from 3 to 1,037 acres.

The first acquisition was purchased in 1986 using Land and Water Conservation Fund (LAWCON) and Lottery funds. Since REAP funds became available in 1987, approximately $400,000 of the annual land acquisition account for IDNR has been earmarked for the forest. Land is acquired only from willing sellers. An average of 1,000 acres has been purchased each year from 1987 through 1994. The largest acquisition was the Rice property in the Preparation Canyon Unit of 1037 acres, purchased May 1993. Refer to the appendix for the record of purchases.

In September 1989, the city of Pisgah donated a 3 acre lot to be used as the site of the forest headquarters. A combination office/equipment storage building was completed in July, 1993, at which time Governor Branstad, other officials and local citizens held an open house to observe completion of the building. In October 1999, a visitor center was completed. Located on the southwest corner of the Pisgah lot, it holds the area manager's office, a meeting room and space for exhibits about the Loess Hills. Governor Vilsack was here to observe the completion of the Visitor Center and planted a couple of Landscape trees in the yard.

The forest is named after the geological formations found in western Iowa and a few other deep deposits around such as in China. The Loess Hills are a very unique formation. The fact of their existence and the fact that they have become vegetated in recent years with pioneer plant species played an important role in decisions to develop a state forest in this area.

Three of the Units were named for the towns in the nearby vicinity; Mondamin, Pisgah and Little Sioux. The Preparation Canyon Unit was named after the small settlement of Mormon travelers that split off of the main Mormon migration. The Gifford Unit, located near Council Bluffs, is a forty acre tract of timber which was given to the state by the late Dr. Gifford. The Gifford unit is managed as a part of L.H.S.F.
Landscape

The loess hills region runs 210 miles from northern Iowa to northern Missouri. It ranges in width from 1 mile to 7 miles wide and contains about 640,000 acres with depths of 50-250 feet deep. To the west of the hills where the state forest is located reside the Missouri river bottoms, a very flat area. To the east of the forest areas are rolling hills with less steepness and deposits of loess.

Changes to the Landscape

Human alterations to the Loess Hills landscape were at first small in scale; horse hooves formed trails “where passage was easiest; through lowlands or along the western edge of the bluffs” (Mutel 1989b). Then more dramatic changes occurred: settlers built dams for water power; carved the bluffs to construct caves for storage, kilns, and stables; quarried limestone, sand, gravel, shale and construction fill; leveled bluffs to make way for cities; constructed roads and railroads; and farmed the prairies. Settlers reshaped the valleys as well, straightening the meandering Missouri river and its tributaries into channels to hasten drainage and constructing dams to control flow and dikes to prevent floods. Some impacts were inadvertent: plowing slopes for cropland accelerated erosion; grazing large herds of cattle degraded the prairies, also exacerbating erosion; and baring soil for construction or recreational purposes. Exposing the soil to water destabilized the loess, often rendering it unable to support its own weight. Farmers cut native woodlands for construction and fuel, and replaced them with exotic species. They simultaneously suppressed wildfires, which allowed woody species to commence massive invasion of the prairie grassland. River channelization and drainage projects destroyed formerly abundant marshlands. Settlers altered native habitats and hunted many large mammals to local extinction. The Loess Hills had been transformed. There are up to 12 landscape areas in the Loess Hills landform region that may meet the criteria for National Natural Landmark designation.

Topography

The Loess Hills are a distinctive topographic region encompassing over 640,000 acres and extending for nearly 210 miles in a narrow band adjacent to the Missouri River valley. Although loess is a widespread geologic deposit, its development in western Iowa is of such magnitude, accumulating to depths of 200 feet in some places, that it dominates the landscape. The terrain is characterized by distinctive shapes: steep, narrow ridge crests, peaks, and saddles; numerous steep side slopes and branching spurs; and precipitous bluffs, some with sheer, nearly vertical faces rising from the adjoining Missouri River floodplain. These deposits form an extensive landscape of unique hill forms that is unparalleled in the United States and rare around the world. The Loess Hills’ intricately sculptured loess deposits have been described as “the best example of loess topography not only in the Central Lowlands, but in the United States.” (NPS 1985). This striking landform is an outstanding example of a landscape formed by two fundamental geological processes: wind and erosion.
Cultural History

The human story of the Loess Hills western Iowa is integrally related to the tale of the landform region’s prehistoric and historic occupants over the last 12,000 to 13,000 years. American Indians have lived in, hunted in, farmed in, and traveled throughout the landform region for thousands of years. In the historic period, the Loess Hills was home to tribes that were indigenous to the region, such as the Ioway (Iowa) and Otos; they were also home to the displaced Pottawatomis. French fur traders and missionaries discovered the Loess Hills in the early 1700s. Several historically important routes crossed through and paralleled the Loess Hills, including the paths taken by Lewis and Clark in 1804 and the Mormons from 1860-1869. A ‘track’ of the Underground Railroad led slaves from Kansas to freedom by way of the Loess Hills of Fremont County. Determined farmers employed whatever technology was available to raise crops on the steep hillsides. This human story is woven into the fabric of the Loess Hills.

Geology

The Loess Hills State Forest is located in the Loess Hills Landform Region which defines a narrow belt of thick windblown silt (loess) deposits along the western margin of the state. The landscape has a corrugated appearance which is defined by steep narrow ridges, branching side spurs and dense drainages. The primary source of the loess is the Missouri River valley and other major river valleys which served as melt water channels for numerous Pleistocene glaciations. Each winter season, the quantity of melt water was reduced considerably and large areas of flood-deposited sediments were left exposed to the wind. Silt, clay and fine sand were lifted by the wind into great clouds and carried to the east. As the dust clouds encountered the slopes of the east valley wall they slowed and dropped their silt loads.

The Loess Hills are composed of three major geologic units. From oldest to youngest, the layers are known as the Loveland Loess (140,000 to 160,000 years old), the Pisgah Loess (28,000 to 35,000 years old), and the Peoria Loess (12,500 to 30,000 years old). Most of the landform region consists of large continuous tracts of deep silt deposited by the wind 30,000 to 12,000 years ago, and sculpted into distinctive terrain during the last 12,000 years. The loess mantles an eroded Pre-Illinoian glacial till surface. Early geologists believed there were only two episodes of glaciations in Iowa: the Kansan and Nebraskan. Later regional studies determined that at least seven episodes of glaciations have occurred during the last several million years. The terms Kansan and Nebraskan were abandoned and replaced with the more inclusive term, Pre-Illinoian. The underlying bedrock of Harrison and Monona Counties is composed primarily of Pennsylvanian limestone.

The Loess Hills are an outstanding example of two basic geologic processes, the strong influence of wind deposition and the erosion action on the landscape. These processes contribute to potential environmental hazards of slope failure and collapse. In addition, the association of the loess, the topography and the vegetation combine for a classic display of the interdependence between geology and ecology. In this high relief area the terrain supports a mosaic of unique ecological niches. These natural features in the area are the Loess Hills themselves. Loess is a common geologic material and is thinly spread over much of the country’s agricultural midsection. More significant accumulations of this windblown silt are known especially from eastern Washington state, southeastern Nebraska, the central and southern Mississippi Valley, as well as the Midwest. It is, however, the large contiguous tracts of unusually thick loess sculpted into a distinctive
topography with a significant geologic record that sets the Loess Hills of western Iowa apart from the other areas.

**Soils**

The soils of the Loess Hills State Forest were formed in loess, alluvium, and glacial till; most soil series formed in a loess parent material. Mighty winds picked up the dust, or loess, left by glaciers and deposited it in great rolling drifts. Then it was water’s turn to begin carving. For 12,000 years or more, erosion has shaped the Loess Hills into rare and beautiful landforms. The hills are still changing and reacting to natural and human forces. Loess is yellowish-brown, wind-deposited material consisting largely of silt particles. This specific soil forming factor is what gives Iowa's Western Loess Hills their name as well as their peculiar form. The steep bluffs, comprised solely of loess soil, rise to between 150 and 250 feet above the Missouri River bottom land. The native vegetation of these soils was almost exclusively prairie grasses, with some timber along streams, north facing slopes and drainage ways.

The steep, ridged topography, combined with the special physical properties of loess, create some problems in the Loess Hills. The angles of the slopes often range from 50 to 75 degrees; this is due to the geo-technical or engineering properties of the soil. The loess, composed primarily of coarse silt particles, has very low shear strength when water-saturated, so that often it cannot bear its own weight. Loess particles are uniform in size and smooth-sided, but angular. They stick together when dry and form stable bluffs. When wet, loess particles become slippery and slump away. Cat steps are long narrow ledges that look like wide stairs going up a steep hillside. They can follow the contour of a hill for hundreds of feet. Ridges are the narrow crests along the tops of steep-sided hills connect, ridges can branch into networks. Short ridges in these systems are called side spurs. However, when relatively dry, the loess develops a greater apparent cohesion; this allows the loess to maintain the spectacularly bold bluffs and ridges-forms along the Missouri River valley. These special soil properties impose some serious limitations on any development involving roads and buildings.

Loess is easily eroded by running water and high impact uses. This factor, combined with its collapsibility, contributes to another major problem: soil erosion and resultant gullies. Some of the highest soil erosion rates in the nation, averaging about 40 tons per acre per year, have been documented in this region. The resulting high sediment loads in local streams necessitates continual maintenance of drainage ditches and stream channels and results in detrimental conditions for many aquatic species.

The Loess Hills State Forest is made up of six general soil associations that are located in Harrison County and five general soil associations that are in Monona County. The Nine different soil associations of the two counties are the Sarpy-Albaton-Carr, Albaton-Haynie-Onawa, Luton-Keg, Kennebec-McPaul-Nodaway, Hamburg-Ida-Monona, Monona-Ida-Napier, Luton-Salix-Blencoe-McPual, Kennebec-Zook-McPaul, and the Hamburg-Ida-Castana-Napier. Soil appendix C contains information about the soils found on the forest. Soil information is available in farm plans covering the various units of the forest. Each of the farms that have been purchased and are managed by the state forest has conservation plans prepared by the NRCS. They present soil information, best crop or non-crop activities which are allowed or not allowed and can enhance the goals of the forest on a long-term basis.
Climate

The climate in the Loess Hills is of the continental type, characterized by wide variations and rapid changes in temperature. Snow cover of nearly an inch is common for about 47 days per winter. The average depth of snow through the winter months is approximately six inches. Winter conditions are, however, often mild with temperatures ranging from 20 to 25 degrees Fahrenheit, with occasional sub-zero temperatures.

During the spring, annual average temperatures range from 45 to 75 degrees Fahrenheit. The average monthly rainfall during the spring reaches nearly 4.6 inches. The extent of precipitation is enough to cause erosion in the loess as well as damage to facilities. The last spring freeze usually occurs about May 1, and the first fall freeze occurs about September 6. The growing season is about 160 days. Summer temperatures average between 71 and 86 degrees Fahrenheit with some high temperature extremes above 100 degrees Fahrenheit. These high temperatures restrict plant growth to drought resistant species along ridges and south facing slopes. The average total precipitation for the entire year is nearly 31 inches of rain or snow.

The Loess Hills boast some desert-like habitats for two reasons: loess itself doesn’t absorb water. Rain runs off the hills or soaks through rapidly, leaving the loess particles high and dry. The already arid hilltops and southwest-facing slopes are directly exposed to the hot midday sun and are constantly swept by summer winds. As a result, unusual mixtures of drought-loving plants and animals have found a home in the hills. Some of these species are typical of arid regions in the West, but are rare in Iowa.

Archeological Sites

There are many Native American artifacts that have been recorded by the state archeologist office over the years. To prevent further vandalism of these sites, the locations are not identified or marked on the forest. The State archeologist office has the records that contains the information about each site and maps showing the location of the sites. Every attempt has and will continue to be made to prevent disturbance of these artifact sites. Therefore recreational opportunities need to be very low-impact to reduce soil disturbance and further protect the archeological resources.
Land Acquisition Priorities

The Loess Hills State Forest contains large acreages of woodlands, savanna and prairies, and provides excellent numbers of wildlife species (deer, turkeys, quail, songbirds, ) It lies within an easy drive of Omaha, Nebraska and Sioux City, Iowa, and attracts heavy public use. The existing areas of the state forest property are already heavily hunted for deer, turkeys, quail and pheasants and also used a lot by bird watchers, prairie enthusiasts and hikers.

Land expansion would allow for new lands to join previous purchased lands and create larger contiguous tracts of public ownership for the multiple uses that take place on the state forest. It will also allow us to do more management operations including forest, savanna, and prairies management (i.e.: prescribed burns, TSI, understory plantings, restoration seed plantings of prairies and forbs).

There are many species of state and federal listed threatened and endangered plant, reptile, birds and amphibian animal species found throughout the state forest acquisition properties. There are high populations of game wildlife found throughout the areas of acquisitions and should give the department some good opportunities for special zone hunts.

Land acquisition will help square up boundaries and bring boundaries out to public access roads. These areas will allow us to protect the waterways and will allow us to put permanent vegetation cover on some of the highly erodible agricultural lands, which will in turn produce better non-game and game wildlife habitats. This will allow us to create larger contiguous blocks of prairie, savanna, and oak woodlands and high quality forests for Iowans to enjoy.

Much of the forest is under consideration by the Loess Hills Audubon Society as a Bird conservation Area. We have been doing ongoing bird surveys over the last several years. These areas being considered, are a part of the National Natural Landmarks, and are a part of the Twelve Special Landscape Areas identified by the Iowa Conservation Commission in the 1950’s and also re-identified by the National Park Service Study done in 2000.

The Loess Hills State Forests has used REAP open spaces funds, USFS Legacy funds, Turkey Federation monies, Iowa Natural Heritage Foundation, Loess Hills Alliance funds, The Nature Conservancy, Loess Hills Audubon Society, and Scenic Byway funds to help assist in acquiring lands for the state forest properties.

Lands under consideration for acquisition pass the primary criteria of the new Iowa DNR land acquisition policy; and further qualify under the attributes of scenic or unique landscapes, fish and wildlife habitat, threatened or endangered species habitats, water quality enhancements, land cover, and recreational opportunities. In addition, lands must also help the department to achieve its mission to conserve and enhance our natural resources in cooperation with individuals and organizations to improve the quality of life in Iowa and ensure a legacy for future generations.
Recent Changes and Trends inForest Composition

For over a century, Iowa’s Loess Hills have attracted botanists who have studied the unusual assemblage of plants found in this area. Approximately 700 species of vascular plants (over a third of Iowa’s flora) have been identified in the Loess Hills. The high diversity of both species and ecological communities is explained by the varied micro-sites created by the dissected terrain. The regional climate, on the whole, is mid-continental with extreme temperature variations exemplified by cold winters and hot summers. However, in this landscape with its diverse exposures, one can climb within a few hundred feet from moist valley woodlands onto sun-scorched, dry ridge tops sparsely vegetated with drought tolerant grasses and forbs.

Until the 1850s, fire-dependent native prairies dominated the Loess Hills, as was true of most of the Western Central Lowlands. Eastern deciduous forest species flourished only in moist sites along creeks and at the base of sheltered slopes. A dynamic border separated the two major types of ecosystems, with frequent wildfires favoring the sweeping expanses of prairie grassland. The post-settlement exclusion of wildfire has allowed woodlands to expand into many areas previously covered by prairie. However, prairies still cover broad expanses of the driest, harshest Loess Hills sites; the westernmost bluffs and sun and wind exposed ridge tops with their adjacent south and west facing slopes. Protected from intensive agricultural use by rugged topography, many of these prairies have retained much of their original integrity and diversity and remain relatively large. Indeed, Loess Hills prairies in Iowa in 1980 comprised a minimum of 22,250 acres (three-percent of the landform region), over half of the remaining prairies in the state that was once the heart of the tall-grass prairie (Selby 2000; Appendix G species list of plants).

The expanses of native prairies and forests that today dominate the Loess Hills constitute a highly diverse mixture of eastern and western plant and animal species, many of which reach the edge of their distributional range. At this significant biological crossroad, eastern deciduous forest species at or near the edge of their range interlace with dry prairies that are fostered by the harsh, extremely dry environment (produced by wind, sun, and well drained soils) and include a rich mixture of plants and animals typically found much further to the west. A total of 96 Loess Hill species are of interest because they are either western species at or near the eastern edge of their range, eastern species at or near the western edge of their range, or are listed by the State of Iowa as endangered, threatened, or special concern species. The 39 state-listed species constitute one of the largest concentrations of rare species in the state. While 11 of the listed species have woodland affinities, 25 are prairie species, a dominance that reflects the relatively large amount of prairie habitat remaining in the Loess Hills (Appendix G). The continued woodland expansion of remaining prairies poses a major treat to many of these regionally rare species. While seven federally listed species occur in one or more of the seven counties that the landform is located in, there are no known occurrences within the upland areas of the Loess hills (Howell, personal communication).

Most scientific interest has been focused on the prairies that house a variety of rare western plants and animals at the eastern terminus of their distributional range. These dry prairies are dominated by little bluestem and side-oats grama, joined on the westernmost bluffs by plains muhly. Great Plains forbs such as skeletonweed, soapweed, and scarlet gaura lend a distinctive element to mid-grass communities. These plant communities, like all prairies, evolved in the presence of wildlife, which stimulates the vigor and health of these fire-adapted ecosystems. The plant communities are matched by western animals such as the Great Plains skink, prairie rattlesnake, and plains pocket

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mouse, which join more ubiquitous species such as the badger to form a grassland fauna of small, secretive animals. Western species are most diverse toward the north, where the prairies are the largest. These mid-grass prairies, with their western forbs, are unique in Iowa. They probably resemble the mixed grass prairies 70 miles or more to the west more than the other dry prairies in the region, or the tallgrass prairies that are the norm for this longitude (for a listing of species scientific names, see Appendix B).

Renewed awareness of the landform region’s significance shifted attention toward the identification of areas worthy of preservation, and led to the identification of the Loess Hills in 1998 as one of The Nature Conservancy’s national priorities. The Conservancy’s studies of the central tallgrass ecoregion have revealed that the Loess Hills contain the best examples in the world of three natural community types: Eastern Great Plains Big Bluestem Loess Prairie, Loess Hills Little Bluestem Dry Prairie, and Eastern Great Plains Bur Oak Woodland. Additional recent scientific studies include vegetation analyses primarily by Rosburg and lepidopteral investigations. These have progressed simultaneously with intensified management efforts.

Woody vegetation (primarily forests) covers about 73,500 acres (11 percent) of the landform region (IDNR 1991). The majority of the forests result from woody invasion of prairies, a process that has been aggravated by the exclusion of wildfires that kill most trees and stimulate native grasslands. Bur Oak is the most abundant tree species. Subdominants such as ironwood or red elm may commingle with the bur oak but the understory of bur oak woodlands is often sparse, consisting of a few common species such as Virginia creeper. The low species-richness and diversity emphasize the immaturity of these forests. This is also true of very dense eastern red cedar woodlands that plague pastures. Invasive woodlands of green ash and Siberian elm mix with cottonwood, ironwood, or other trees to cover very disturbed hillside. Although uncommon, older forests occupying historically wooded locations remain western outposts of the eastern deciduous forest.

Woodland animals include common species such as the fox squirrel, eastern cottontail, and woodchuck, as well as a diverse assemblage of birds. Larger animals such as the red fox, white-tailed deer, and coyote wander between woodlands and grasslands. A few rare species such as the hickory hairstreak butterfly and speckled kingsnake also inhabit the forests. Forest animals in general are increasing and expanding their ranges northward as woodlands expand, often at the cost of prairie animals. For example, all increasing Loess Hills reptiles are woodland species, while prairie reptiles are declining in number (Christiansen and Mabry 1985).

Ironwood has been dominating the understory in many stands of trees on the forest, which decreases the diversity in the woodlands and depletes natural regeneration of any other species. Ironwood is very shade tolerant. Elm species continue to die from Dutch elm disease. Eastern Red Cedar and deciduous shrubs and trees such as: sumac, dogwood, honey locusts, green ash, and cottonwoods, continue to invade the native prairie remnants.

Within the last 10 years there has been a tremendous growth of population in and around the Loess Hills region, which has increased the values of the land which in turn makes it much harder to acquire lands for public ownership. There has also been an increase interest in the work we have done with our prescribed fire program of woodlands and prairie for restoration purposes and used for controls of noxious species of plants.
The predominant plant communities on the forest are prairie and mixed hardwood forests. The forests range from pure bur oak to mixtures of oaks, hickories, basswood, elms, ashes, Kentucky coffee tree, cottonwood, ironwood and red cedar. If one species was to be singled out as predominant it would be bur oak due to its ability to grow on dry sites and withstand fire. Black walnut is the most important and valuable commercial species. Bur Oak is the major forest type that is present throughout the Loess Hills State Forest. There is 60% of the forest cover that has Bur Oak present in the stands, and of the 60% there is 35% that is solid Bur Oak, with less than <5% mixture of species in the solid stands. The other 25% of the Bur Oak stands are a 50/50 mixture of species; consisting of elms, ash, hackberry, walnut, ironwood and mulberry.

The forest contains many acres of natural prairie comprised of big and little bluestem, Indian grass, side oats grama and forbs such as yucca, pasque flower and lead plant. A complete list plants found on the forest is included in the Appendix G.

Forest Health

Throughout the Loess Hills State Forest is Dutch elm disease, ash decline, anthracnose of oak, sycamore, maple, and different decays and fungi present in the area. The environmental stresses and age of the forests are causing the most significant loss throughout the forests.

Invasive species

A relatively new threat to Iowa’s forests are invasive species. Some of these species were actually planted by land managers in the past because of their wildlife benefits and ease of establishment. The problems that occur are due to the prolific seed production of these species, their lack of natural enemies (disease or insect) and adaptability to a variety of conditions. Once established, these species can crowd out all native species, resulting in an ecological dessert. Species of most concern at this time in the forests include multi-flora rose, common buckthorn, autumn olive and honeysuckle. Forest managers use a variety of control measures for these species including cutting, spraying, pulling, and burning. The hard part of trying to control these invasives is that when people come to visit by any form of transportation, (from wheels to legs) they are capable of spreading it all over.

**Garlic mustard** has no natural growth controls, spreads rapidly, grows tall, and becomes extremely dense. Within a few years, it dominates the understory. It crowds out understory wildflowers, ferns and tree seedlings. It seriously degrades or destroys high quality woodlands and wildlife habitat. A single plant produces hundreds of seeds, which remain viable 5 years or more. Controls can be done successfully with routine monitoring and early detection. New infestations must be treated immediately and thoroughly by herbicides, prescribed burning, hand pulling and mechanical control. Attacking established invasions with multiple techniques, and careful and continued follow-up will yield favorable results.
**Senescence and decline of oak**

Many of Iowa’s oak stands are in a state of senescence. Midwest foresters generally agree that red oak forests reach this state and start to decline at about 140 to 150 years of age. At this point the trees have surpassed their age of biological maturity and are actually losing more biomass than they are producing through breakage, root rot and disease. Two other contributing factors that affect aging oak trees are the insect called the two-lined chestnut borer and a disease called armillaria root rot. These two factors are not problems for young and vigorously growing trees, but as the trees natural defense mechanisms weaken with age they become the predominant reason for the death of a tree. Much of the management on the state forests is aimed at regenerating these stands to a more diverse mixture of species.

**Oak wilt** has been and continues to be the biggest forest health problem in Iowa. Oak wilt has been killing all species of oak trees since the earliest days of state forest establishment. The red oak group is more susceptible than the white oak group to this disease and often dies within weeks or months after infection. Since oak wilt is a native disease of oak, it is not epidemic, but does cause a loss of thousands of board feet of oak annually. Forest managers continue to monitor oak wilt activity and attempt to eliminate the inoculum whenever practical to do so. It is a bigger problem in over-mature oak stands where the trees are no longer growing vigorously enough to ward off the disease and insect vectors are more abundant.

**Insects**

**Gypsy moth** will defoliate oak trees once populations become established and are able to build up. Once populations become high enough they will be capable of completely defoliating oak trees during the summer, causing these trees to produce a second set of leaves, while draining the nutrient reserves of the tree. Oak trees already stressed from weather events, old age, stocking density or site conditions may die from the defoliation by the gypsy moth. Gypsy moth is established in Wisconsin and Illinois, with it only being a matter of time before it establishes itself in Iowa. The time for managing our mature oak forests for the establishment of gypsy moth is now.

The **emerald ash borer** is a new exotic insect first detected in Detroit, MI in 2002. Since its arrival, millions of healthy ash trees have been killed in Michigan and the insect is now present in Indiana and Ohio. Although not yet found in Iowa, this insect has more potential for future harm to Iowa’s forests than any other insect currently being dealt with in the United States.

The **sirex wood wasp** is another exotic insect that can attack and kill living pine trees, unlike the native wood wasps that attack only dead and dying trees. The main concern for landowners will be keeping their pine stands thinned, to reduce their susceptibility to this insect. Mortality has been reported as high as 80% in overstocked pine plantations by this insect. Sirex has only been detected in New York, but efforts are under way to survey surrounding states to monitor the spread of this insect.
Prairie Health Issues

Leafy Spurge is a native of Europe and Asia, it emerges early in the spring and gets a head start on other vegetation in a race for space, sunlight, nutrients and water. Prolific seed production and an extensive root system give the plant a huge competitive advantage and makes consistent, long term control difficult. Deep tap roots which can exceed 20 feet in depth, store reserves of nutrients to see the plant through hard times, while lateral roots form a network that enable it to rapidly reproduce and spread. Perhaps worst of all, leafy spurge is highly adaptable and can thrive in a variety of conditions and situations. In short, this exotic invader is extremely competitive and quite capable of completely displacing desirable plants. It invades a variety of land types, reduces range productivity and species diversity, threatens sensitive species, degrades wildlife habitat and reduces land values. We have burned at different times of year to try and set it back, released flea beetles and sprayed. We are now in the monitoring phase of those control treatments.
Demonstration Areas

State Forests provide an environment where management techniques can be tried and documented for success by Area Foresters, the private lands District Foresters, universities, environmental or wildlife organizations, and others. Because of the distribution of the State Forests, the same management techniques can be tested on a variety of forest types, soil types, and landforms. The types of projects suitable for establishment is dependent upon the impact the demonstration will have on the forest and the ability of the local manager to maintain the project.

Non-profit organizations such as National Wild Turkey Federation (NWTF) and Pheasants Forever (PF) have proven to be valuable allies when establishing demonstration plots or areas. For example, NWTF provides $4000 every year for demonstration plots on state forests each year. Additionally, demonstrations of sustainable forest management practices have been established on or near easily accessible areas in order to be used for field days and tours with the public or school classes.

Area Foresters keep records of these demonstration areas and will document the location of each project on their forests.

Water Quality Management

Forests are some of nature’s best air and water filters, as long as they are well managed. When managed properly, forests provide different levels of vegetation cover from the tall overstory canopy, to mid-canopy, brush and herbaceous vegetation. Numerous studies have shown that forests reduce the impact of precipitation on the soil, and slow the rate of rainfall thus, allowing more of the rain to absorb into the soil rather than flowing over the soil. This decreases the erosion and soil loss.

Pollutants can enter surface waters from point sources, such as single source industrial discharges and waste-water treatment plants; however, most pollutants result from nonpoint source pollution activities, including runoff from agricultural lands, urban areas, construction and industrial sites, and failed septic tanks. These activities introduce harmful sediments, nutrients, bacteria, organic wastes, chemicals, and metals into surface waters.

Nonpoint source pollution can be difficult to control, measure, and monitor. In most cases, a combination of practices are required to address the problem. This may include the proper application of fertilizers and pesticides or the introduction of practices to reduce storm water runoff and soil erosion. These practices are commonly known as Best Management Practices (BMP’s).

One BMP which can be very effective in influencing water quality is the construction of riparian forest buffers along streams, lakes, and other surface waters. Through the interaction of their unique soils, hydrology, and vegetation, riparian forest buffers influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms.

Sediment refers to soil particles that enter streams, lakes, and other bodies of water from eroding land, including plowed fields, construction and logging sites, urban areas, and eroding stream banks. Sedimentation of streams can have a pronounced effect on water quality and stream life. Sediment can clog and abrade fish gills, suffocate fish eggs and aquatic insect larvae, and cause fish to modify their feeding and reproductive behaviors. Sediment also interferes with recreational
activities as it reduces water clarity and fills in ponds and lakes. In addition to mineral soil particles, eroding sediments may transport other substances such as plant and animal wastes, nutrients, pesticides, petroleum products, metals, and other compounds that can cause water quality problems.

Nutrients are essential elements for aquatic ecosystems, but in excess amounts, they can lead to many changes in the aquatic environment and reduce the quality of water for human uses. Some nutrient inputs into surface waters are entirely natural, such as nutrients contained in plant materials or naturally eroding soils. However, most nutrients in surface waters today result from human activities.

Nutrients can enter surface waters in subsurface or surface flows (as a dissolved form or attached to soil particles). For example, nitrogen is most commonly transported as dissolved nitrogen through subsurface flows, with peak nitrate levels occurring during the dormant season after crops have been harvested and soil evaporation rates are reduced. In contrast, phosphorus most often enters the stream adsorbed into soil particles and organic materials in surface runoff after storm events.

Riparian forests have been found to be effective filters for nutrients, including nitrogen, phosphorus, calcium, potassium, sulfur, and magnesium. Because excessive levels of nitrogen and phosphorus are of particular concern in the nation's streams and lakes, the ability of riparian buffers to filter these nutrients has been the focus of much interest and continual research.

Management activities on state forests are designed to protect water quality and prevent erosion. Riparian buffers along streams, creeks and around lakes and ponds are protected from harvesting or have limited harvesting to remove damaged or diseased trees and to allow some new vegetation to become established. Heavy equipment is generally not allowed in these areas. Pesticide and herbicide use are kept to a minimum in these zones. Creek and stream crossings are evaluated and improved when possible.

**The Jones Creek Watershed**

Located in Monona County, the Jones Creek Watershed is a system of spillways and small impoundments erected by Soil Conservation Service (SCS) between 1937 and 1942. In the mid-1930s, a group of engineers challenged the established practice of building large and hugely expensive dams at key points along major rivers, proposing that the erection of “little dams” along streams feeding those major waterways would be less costly and equally effective. The Jones Creek Watershed was one of a handful of projects selected by the Soil Conservation Service (SCS) to test this hypothesis. The undertaking successfully slowed the flow of water and captured silt, thus protecting farmlands in the Jones Creek drainage area and also downstream. The success of Jones Creek project’s pivotal role in resolving the “big dam vs. little dam” controversy may render it eligible for National Historic Landmark status under Criterion A, properties associated with events that have made a significant contribution to the broad patterns of its history. In 2004, 2 acres of the pond was dredged out to give it some much needed depth for fish survival. In 2006, more vegetation plantings along the waterways of trees and native grasses were planted. In 2007, many repairs were done to the upland concrete structures to further control erosion. Further dredging is recommended in order to make the pond a good fishing area.
Recreation

Recreational opportunities compatible with the other forest uses will be permitted and encouraged.

Low impact recreation is any outdoor activity that treads lightly on the fragile loess hills soils. Because the loess hills soil erodes so easily, up to 40 tons/acre/year, we restrict activities on our trail system that will disturb the soil. To that end, motorized vehicles, ATV’s, bicycles or horses are not allowed on the trails of the forest. These restrictions ensure that the miles of trails that are maintained on the forest will be available for generations to come. Some of the low-impact recreation activities on the forest include: fishing, picnicking, driving for pleasure, birding, hiking, nature study, primitive camping, photography, plant and wildlife study, cross-country skiing is allowed on the entire forest during the winter months, snowshoeing, sledding and hunting, snowmobiling with 12” base minimum.

Hunting is allowed on all acres of the forest. Parking areas for access are available throughout the forest areas. Trail construction for hiking access is located around the Jones Creek Pond and from the Loess Hills Forest Overlook. Fishing is available at the Jones Creek Pond, and we are looking into ways to fund some projects to enhance this fishery area. Primitive camping is allowed throughout the forest, and many people especially during the hunting seasons will camp at some of the 40 parking lots spread throughout the forest. The entire forest is open to hiking and backpacking. Outdoor enthusiasts can find opportunities ranging from strolling along well groomed roads and trails, to backpacking into the primitive wilderness and enjoying the solitude of a backcountry experience. Otherwise the forest is open to hiking anywhere the visitors would like to discover. State Forest Boundaries signs are posted on corners of property and approximately every 1/10 of mile along fence lines and roadways.

The DNR and State forest is committed to offering low-impact recreation opportunities that develop awareness, understanding and commitment to our natural world in other words whenever you come to State Forest to relax or play; we strive to help you develop a personal attachment to the Loess Hills.
Wildlife

The Loess Hills of western Iowa have a diversity and abundance of wildlife species, many unique to this area alone. Wildlife management is an important goal on the state forests. The DNR Wildlife Bureau is the authority on wildlife management in the state of Iowa, and we depend heavily on their expertise in this area of management. The Iowa Wildlife Action Plan can be viewed online at http://www.iowadnr.gov/wildlife/diversity/plan.html

The three greatest impacts on wildlife numbers and composition in the loess hills are wildfire suppression, agriculture and human settlement. Historically, Black bear, elk, buffalo, antelope and wolves roamed the rugged Loess Hills in its pristine state of native grassland interspersed with narrow strips of woodland along the edges of narrow gullies formed by erosion of the fragile loess soils. Settlement in the mid 1800’s brought about a change in land use as agriculture became more intensive in the loess hills, bringing with it a need to protect homesteads from the natural fires that maintained the vast area of prairie grasslands. Land use changes and fire protection allowed woodland encroachment into vast areas of unbroken prairie sod. Until today, only remnants of prairie remain on steep ridge tops. Changes to the landscape brought about a change in the wildlife species composition inhabiting the Loess Hills. Gone were the nomadic grazers, and the predators that relied on them for survival. The new landscape now supports those species adapted to the grassland/woodland mix interspersed with agricultural fields of corn, soybeans and cool season grasses.

In addition to a change in large game species, other species such as prairie chickens, prairie rattlesnakes and the plains pocket mouse also declined. Species composition now includes species such as whitetail deer, raccoon, quail, pheasant, and wild turkey. These species have been highly successful in surviving and expanding their numbers. The changes in habitat have brought to light a need to protect those few remaining rare or endangered species as they attempt to survive in small remaining areas of pristine prairie that are so critical for their survival.

Through a cooperative effort between wildlife and forestry staff in the Loess Hills, forestry practices and agricultural activities are combined to enhance the forest area for deer, turkeys, quail and pheasants, as well as squirrels, rabbits. An increasing effort is being made to accommodate the needs for other non-game species including insects, herps and small mammals. Management plans include the use and placement of commodity crops such as corn and beans to provide food plots available as winter food for wildlife. Cool season grasses and forbs such brome and alfalfa are included in agricultural practices to provide nesting cover for ground nesting game birds as well as forage for deer and turkeys.

The combination of good forest practices, fire management and agriculture within the Loess Hills State Forest enhances wildlife populations and creates a hunting surplus for Iowa’s hunting public. The same practices enhance the area for non-consumptive users such as bird watchers, hikers and others who are out on the area sampling enjoying the aesthetics. Tree planting will benefit most forest species by continuously increasing the amount of habitat for those species. Forest fragmentation will be addressed by continuing to plant trees in open areas to create large tracts of interior forest habitat. Edge habitat around the perimeter of these large tracts will be enhanced by the planting of various small tree and shrub species to provide habitat for edge dwelling species.
Providing wildlife habitat by the use of forest management practices will result in increased food and cover. The forest and woodland areas will benefit from forest stand improvement, and harvesting techniques will leave den trees for the use of certain species. The timber management will take into account the impacts to species and timing of year, so as not to disturb the species at certain times of the year. Development of a diverse forest will benefit a large number of wildlife species. Oak acorns are an important food source for many species. Forest stand improvement techniques will be used to improve hardwood mast production. Harvesting to regenerate oak will benefit many species as well by sustaining the oak component of the forest. Some species will benefit from more extensive areas of closed-canopy forest, while others will benefit from the edge habitat created through various timber management practices. Loess Hills State Forest will be managed for various wildlife species present using various forestry practices that benefit wildlife. Wildlife species at the forest include, but are not limited to: deer, turkey, bobcat, squirrel, rabbit, red fox, quail, pheasant, and many songbirds.

The open land on the forest will be used for the production of vegetation that benefits wildlife, or to enhance the beauty of the area by offering a change of scenery. Grassland species will benefit from continued fire management in grassland areas.

The state forest will also maintain a base of acres for agricultural ground to enhance wildlife and to show good agricultural practices and follow NRCS farm conservation plans. The agricultural ground of the steep slopes will be planted to trees, native ecotype prairie, and grassland. Agricultural crops left in the field as food plots will serve as a valuable alternative food source for many species during the winter months. These open areas are important for wildlife and the viewing of wildlife.

Several attempts have been made to introduce or re-introduce certain wildlife species at Loess Hills State Forest in the past. Today, the forest boasts a huge turkey population and is one of the most popular turkey hunting areas in the state. The various forestry practices used to manage the timber resource at Loess Hills State Forest will be aimed at improving habitat and natural food sources for all species of wildlife present at the forest. Forest stand improvement practices will benefit many wildlife species by improving forest health and increasing mast production of individual trees which are valuable food sources. Timber harvesting and regeneration will benefit species by providing new and healthy forest stands for sustainable habitat.
**Forest Units**

The Loess Hills State Forest is comprised of 4 units. These units are named Pisgah, Preparation Canyon, Little Sioux and Mondamin Units. These units are then divided into manageable sized compartments. There are 5 or 6 compartments in each of the units. The compartments are then broken down into stands by cover type. This allows management to be organized. We have a cultural practice schedule which helps us to rotate the management activities throughout the forest over a 10 year basis.

The cultural practices groups are comprised of a number of compartments. This allows for management work to be spread throughout the forest over the ten year period, so as not to have any areas of the state forest become neglected. There is one cultural practices group for each year of the cultural practices cycle and management activities are rotated from one cultural practices group to another in turn. Compartments are arranged so that each cultural practices group is as equal in acres as possible in area of forest to another. The compartment is a division of the forest on a geographic basis. It is an administrative unit for the purpose of convenience in location, assignment of work and record keeping. As nearly as possible, compartment boundaries should be easily recognized on the ground.
**Forest Management Classes**

<table>
<thead>
<tr>
<th>Management Classes</th>
<th>Acres</th>
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<tr>
<td>Active Management</td>
<td>5,100</td>
</tr>
<tr>
<td>Limited Management</td>
<td>714</td>
</tr>
<tr>
<td>Non-Forest Management</td>
<td>5,800</td>
</tr>
</tbody>
</table>

**Active Forest Management**

**Even-Aged Management**

Even-aged management is essential to regenerate shade intolerant species such as oaks, walnut, and Kentucky coffee tree. Even-aged management areas are clear-cut harvested every 125-200 years. Iowa is losing its oak woodlands. Even-aged management will establish young oak stands to replace the old oak trees that are dying. Even-aged management involves growing a stand of trees which are close to the same age. At some point in the stand's life, the area is clear-cut which creates the even-aged structure. This creates excellent habitat for deer, turkey, and quail 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-aged management. Regeneration using even-aged management involves clearcutting and planting, clearcutting with regeneration already established, or a shelterwood system to develop desirable seedlings on the ground.

With the shelterwood method the final cut is a clear-cut, 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 clear-cut 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 clear-cut should not be made until satisfactorily stocking rates of desirable young trees are met.

Areas can also be clear-cut harvested and planted to regenerate oak. All merchantable trees would be sold. Following the harvest, all remaining undesirable trees over 1 inch in diameter would be felled. The stumps of ironwood, elm, and bitternut hickory should be treated with Tordon to prevent sprouting. The area should be planted with 30 oak and walnut seedlings per acre. Each seedling should be protected with a 4 ft. tall, tree shelter.

Clearcutting to create full sunlight is essential at some point in the stand's life to successfully regenerate oak. If stands are not clear-cut, the oak component of the forest will be lost to shade tolerant species. Clear-cuts 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.

Fire is a tool in managing oak stands that is currently being utilized throughout the forest to promote oak and set back invasives. Frequent 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. Oak seedlings will tolerate light fires. The top will be killed by the fire, but the deep root systems survive and sprout. Fire will be utilized on a limited scale to encourage oak regeneration in oak stands. Once a good number of oak seedlings are present, these stands will have to be clear-cut or the young oak will die from lack of sunlight.

**Uneven- Aged Management**

Uneven-aged management involves selective harvesting mature and damaged trees. These stands consist of basswood, elm, ash, hackberry, “wolf” oak, (large, poor formed, spreading crown oak), bitternut hickory and ironwood. The harvest is followed by removing undesirable species and damaged trees in the understory. Because there are always large trees present, only species that can survive in shade are regenerated. Uneven-aged management will result in a basswood-ironwood forest.

Uneven-aged 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-aged stands always have large trees present, this system favors species that will grow in shade such as ironwood, hackberry and basswood. Uneven-aged management areas will provide continuous tracts of woodland with minimal disturbance. Forest stand improvement and selective harvesting will create woody debris on the forest floor for reptiles and amphibians.

**Limited Forest Management**

These areas are steep slopes, ridge tops, riparian areas, unique areas with historical or archaeological sites, and areas with endangered species. Viewshed areas will be left as is, with no active management. Limited management 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, historical sites, and archaeological sites 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. Some steep slopes will be under limited management.
Non-Forest Areas

Prairie Management

Loess Hills State Forest Management Burn Units

Legend

- Exclusion
- Prairie
- Prairie / Savanna
- Savanna
- Savanna / Woodland
- Woodland
- Woodland / Forest
- Forest
The forestry bureau of the DNR feels it is very important to manage and protect the native prairie remnants of the Loess Hills State Forest. It will concentrate its management efforts towards protecting and enhancing large contiguous tracts of native prairie and savanna throughout the state forest. The Loess Hills unusual ecological conditions support many rare plant and animal species. Many of these are considered threatened or endangered in Iowa. Fire is one of the tools that will be used to maintain the essential integrity of the prairie and savanna habitat. Fire keeps undesirable brush and trees from encroaching on prairies and enhances plant diversity through improved seedling generation. Fire will be used to provide numerous benefits, including brush and weed management, forage production, oak seedling regeneration, and improved wildlife habitat. Other tools that may be used to stop the invasive woody vegetation and weed species can be mowing, spaying, tree shearing, and the use of other new technologies as they come along.

In the Loess Hills State Forest, approximately 2500 acres of prairie and savanna are maintained through active management. These acres of prairies and savanna are among some of the most pristine areas left in the state. The habitat provided by these communities is host to many of the special and endangered plants found in the state.

The prairies and savannas of the LHSF provide productive butterfly and bird habitat. We have had two butterfly surveys completed, and an extensive bird survey conducted by the volunteers of the Loess Hills Audubon Society. Volunteers are continuously monitoring throughout the year for the different bird species using the region. This information will eventually be used to make a checklist for forest visitors to use while out and about in the Loess Hills.

One of the most important management tools we have is controlled fire. Without active fire management, woody vegetation and exotic species would eventually claim these important areas. Prairie and savanna management is not an exact science, so the staff at LHSF along with other agencies and volunteer groups have worked together to learn and improve management techniques.

Since 1990, LHSF has been applying prescribed fire to maintain the many acres of prairie. From 1990-1995, our three-person crew burned 400-720 acres a year, primarily on the ridge prairies. Since 1996, we expanded our burn units to encompass more of the native grass ridge prairies and added degraded savanna and woodland sites. During the period from 1996 to 2005 LHSF burned an average of 1520 acres per year, with peak of 2208 acres in 2004. On page 45, the map shows the burn units of the forest. Detailed plans of the units for upcoming years activities are on file in the Area Foresters office.

In addition to prescribed fire, we have planted prairies and cleared cedar on potential prairie sites. Volunteers have participated in cedar clearing days for the past ten years. About 212 acres of grassland prairie was seeded in the first ten years of the state forest. We have expanded our planting efforts in the last 6 years to include local ecotype collecting and seeding. Volunteers have been active in these activities. Forty-seven acres of abandoned farm ground has been seeded with diverse mixtures of 10-35 species of locally collected seed. In a few more years we will be able to begin harvesting some of these seeded fields for use on sites on the Forest.

We have tried other techniques as well in managing these resources. These techniques include mowing sumacs and dogwoods, and spraying to control woody vegetation and non-native species. There have been successes and failures, but each attempt has increased our knowledge of prairie and savanna management in the region.
We have been continuously striving to restore, create and sustain large contiguous vegetation coverage in the region to give wildlife and people a great chance to observe these unique resources of the region. As the forest has increased in size through the purchase of properties from willing sellers, it has allowed us to enlarge our management schemes to cover more continuous acres of resources. By using REAP monies to make these purchases, the county does not lose tax income because the DNR continues to pay the taxes on these properties.

Many times the properties that we buy have been farmed hard for many years. We have discovered that after we purchase a piece of property, it is best to let the property sit idle for a year or two from use, to allow the vegetation to heal the property and make advances of its own. We then will put fire to the resource and are often amazed at the responses of the vegetation.

\textit{Agricultural Land}

The Loess Hills State Forest maintains around 2000 acres of agricultural ground of the some 3700 acres we have purchased from willing sellers. We leave 15-20\% of the crops over winter for food plots for wildlife use. After the purchase of a property, the crop ground is evaluated by the Area Forester and NRCS, and a crop management plan is written for the property. We then decide to take out of production D, E, F, G, H slopes by putting them into permanent vegetation such as tree plantings, native prairie local ecotype seedings, alfalfa or other vegetations depending on the slope and aspect of the field. We cash rent out the crop ground for 5 year leases and usually have 10-15 different farm cooperators. A farm manager is hired to administer the leases of agricultural land.

\textit{Savanna}

We currently have one savanna management area in each of the four units. We have been doing different types of management techniques from mowing, thinning, burning, chemicals, grazing etc. to try and accomplish a sustainable savanna, which will benefit different wildlife species than just woodland and grassland species. These areas are demonstration areas to show the different techniques, what worked and what did not work.
Management Options

The Loess Hills State Forest is managed in accordance with the IDNR Forest Ecosystem Management Guide for several uses including wood products, wildlife, quality water and recreation. Protection of soils, plant and animal communities is an important consideration when planning and carrying out activities on the forest. An active forest management program assures the health, sustenance and diversity of the forest resource.

Timber management practices of planting, harvesting and forest stand improvements are carried out for the purposes of assuring a healthy forest, a diverse forest and sustainable forest resources. One of the most important tools available for meeting these goals is by harvest and regeneration of stands. On state forests, harvests are conducted to intentionally create conditions needed for new oak forests to grow, to provide for a range of tree ages and sizes throughout the entire forest area, evenly distributed.

Harvest methods differ in the percentage of crown cover that is removed and are chosen to produce a future stand of trees that will result in a healthy, diverse and sustained forest. Even-aged harvest methods (clear cutting, shelterwood and seed tree) are used to regenerate species that are intolerant of shade such as oak and walnut. Uneven-aged harvest methods (single tree and small group selection) are used to regenerate shade tolerant species like basswood, hickory or maple. Harvests assure forest health by replacing trees that are declining in health with a young vigorous stand of growing trees. Harvests assure sustainability in the sense that without major disturbances on a regular basis, shade intolerant species would cease to exist in the forest setting on many sites. Forest harvesting can be used to accomplish more than forest health, diversity and sustainability. Forest harvest also contributes to: improved aesthetic qualities, better wildlife habitat, carbon storage, and production of clean water.

Not all forest management activities are aimed at regenerating the forest stand. Some harvest activities may be carried out for the purpose of thinning a stand, removing injured or diseased trees or salvaging high value trees. Forest management is carried out according to the ecosystem management guidelines book.

The sustainable harvest volume for the Loess Hills State Forest will be 5,000 to 20,000 bd.ft. / year. These areas will be harvested to maintain the health of the stands, regenerate good potential growing sites that have been high graded from the past uses, and protect watersheds. The state forest will also do forest stand improvement on 15-100 acres per year.

The prescriptions for the stands can be updated and or changed before implementation. When each prescription is developed, consideration will be given to its impact on the entire forest. The prescriptions for the forest stands can be found in Appendix A. The concept of how one action causes a reaction within the forest system is monitored to sustain the ecological health of the landscape. In order to maximize opportunities for the flora and fauna of the forest, as well as mankind, a goal of the Bureau of Forestry is to enhance and maintain biodiversity, and health of the resources. The goal is also to maintain varying populations distributed throughout a range of conditions.
These prescribed treatments can be grouped into either harvest and regeneration practices or FSI practices. Generally, these treatments can fulfill both purposes. Reproduction treatments are divided into even-aged or uneven-aged. An even-aged stand is one where the difference between the oldest and the youngest trees in the stand is no more than 20% of the length of the rotation. The rotation age of a forest stand is the time from establishment to a specified harvest age (biological or economical). If a condition other that the above exists, the stand is considered uneven-aged.

Demonstrations of forestry in on all areas of the forest which have been given silvicultural treatments serve as tools for educating the general public and others in the practice of forestry. New management techniques and forestry practices are developed and tested as part of the Forestry Bureau’s objectives.

In the process of fulfilling management goals, prescriptions have been developed for 12,000 acres. Each prescribed treatment will be the result of an evaluation of the unit in its present condition, the desired future condition, and the practices best suited to attain the desired goals.
**Land Cover Management Descriptions**

**Prairie**

Prairie is the presence of native remnants or locally planted ecotype seedlings, with a 1-5 year burn rotation. The areas will be remnant ridges and south facing exposures.

**Prairie / Savanna**

This is the presence of some areas which have native remnants or seedlings, with scattering of trees throughout the area and mostly south facing aspects, with a 3-7 year burn rotation.

**Savanna**

Generally a grassland with a scattering of trees or shrubs, west to southeast aspect exposures, with a 3-7 year burn rotation. Generally more tree areas than open grassland.

**Savanna / Woodland**

Is mainly woodland having an undergrowth mainly of grasses, the trees being of moderate height with a 3-9 year burn rotation.

**Woodland**

Is a plant community in which, in contrast to a forest, the trees are often small, characteristically short-boled relative to their crown depth, and forming only an open canopy with intervening area being occupied by lower vegetation, shade tolerant and pioneer species of trees and shrubs. The slope aspects are generally west to north to east, with a burn rotation of 5-9 years.

**Woodland / Forest**

This is generally a plant community that will have periodical burns from 7-15 years to reduce fuel loads and to work on invasives if needed. It will generally sit facing west to north to east facing slopes. It is less dense than a forest and has some openings throughout the area.

**Forest**

Is an ecosystem characterized by a more or less dense and extensive tree cover, often consisting of stands varying in characteristics such as species composition, structure, age class, and associated processes. These areas will generally be located on the northwest to east facing slopes that will be a generally richer soil, with minerals and moisture and will have many shade tolerant species. These areas will be managed to have the least amount of forest fragmentation in them, and may have an occasional fire for fuel load reduction every 10-25 years.

<table>
<thead>
<tr>
<th>MANAGEMENT</th>
<th>ACRES</th>
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<tbody>
<tr>
<td>Exclusion</td>
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<tr>
<td>Forest</td>
<td>1533.20</td>
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<tr>
<td>Prairie</td>
<td>174.50</td>
</tr>
<tr>
<td>Prairie / Savanna</td>
<td>3238.10</td>
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<tr>
<td>Savanna</td>
<td>608.10</td>
</tr>
<tr>
<td>Savanna / Woodland</td>
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</tr>
<tr>
<td>Woodland</td>
<td>1776.50</td>
</tr>
<tr>
<td>Woodland / Forest</td>
<td>1762.30</td>
</tr>
</tbody>
</table>
Coverage Types of the Current Vegetation Cover

14% Prairie  Native remnants and seedings
14% Savanna  Oak, walnut, and elm trees with grassland understory
8% Limited Management  Mature/old growth, scenic, erosive
2% Riparian  Protection areas along streams and creeks
14% Agriculture  Farm rental ground for wildlife
13% Uneven Aged  Uneven-aged management on woodlands and forests (i.e.: single tree selection, high value)
35% Even Aged  Even-aged management on Woodlands and Forests (i.e.: group selection, clear-cuts, shelterwood, and fsi)
## Total Acres by Type of Cover

<table>
<thead>
<tr>
<th>Cover Types</th>
<th>ACRES</th>
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<tbody>
<tr>
<td>Agriculture</td>
<td>1939.10</td>
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<tr>
<td>Open Grass Area</td>
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<tr>
<td>Native Grass Plantings</td>
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</tr>
<tr>
<td>Native Prairies</td>
<td>1426.10</td>
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<tr>
<td>Tree Planting</td>
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<tr>
<td>Water</td>
<td>20.00</td>
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<tr>
<td>Building and Lots</td>
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<tr>
<td>Eastern Red cedar</td>
<td>134.10</td>
</tr>
<tr>
<td>Eastern Red cedar/ Hardwoods</td>
<td>242.40</td>
</tr>
<tr>
<td>Black Oak / Hickory</td>
<td>4.90</td>
</tr>
<tr>
<td>Bur Oak</td>
<td>1934.90</td>
</tr>
<tr>
<td>Black Locust</td>
<td>4.80</td>
</tr>
<tr>
<td>Hackberry/ Elm/ Ash</td>
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<tr>
<td>Oak / Elm / Ash</td>
<td>831.10</td>
</tr>
<tr>
<td>Elm / Ash / Cottonwood</td>
<td>328.10</td>
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<tr>
<td>Oak Basswood</td>
<td>278.80</td>
</tr>
<tr>
<td>Sycamore/ Pecan/ Elm</td>
<td>50.00</td>
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<tr>
<td>Willow</td>
<td>2.20</td>
</tr>
<tr>
<td>Bottomland MH / Walnut</td>
<td>28.50</td>
</tr>
<tr>
<td>Basswood/ Ironwood</td>
<td>50.60</td>
</tr>
<tr>
<td>Poplar</td>
<td>2.10</td>
</tr>
<tr>
<td>Black Walnut</td>
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Allowable Sustainable Harvest

Board Foot Volume by Tree Species

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<th>TIMBER</th>
<th>Volume (bd.ft.)</th>
<th>ACRES</th>
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<tbody>
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<td>Tree Planting</td>
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<tr>
<td>Eastern Red cedar</td>
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<tr>
<td>Eastern Red cedar/ Hardwoods</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
<td>Oak Basswood</td>
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<tr>
<td>Sycamore/ Pecan/ Elm</td>
<td>21,300</td>
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<tr>
<td>Willow</td>
<td>2,100</td>
<td>2.20</td>
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<tr>
<td>Bottomland MH / Walnut</td>
<td>8,700</td>
<td>28.50</td>
</tr>
<tr>
<td>Basswood/ Ironwood</td>
<td>13,200</td>
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<td>Poplar</td>
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<tr>
<td>Black Walnut</td>
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<td><strong>Totals</strong></td>
<td><strong>1,343,160.00</strong></td>
<td><strong>4789.30</strong></td>
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</table>

Annual Harvest Goals

By using the above information: The following table shows allowable cut/10 year period

If you take 4,789.3 acres and divide all acres by a 200 year rotation, it would equal 24 acres/year. But not all areas will have a rotation age of 200 so the table below shows the breakdown.

<table>
<thead>
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<th>Unit</th>
<th>Management</th>
<th>Rotation Age</th>
<th>Acres/ 10 years</th>
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<td>26</td>
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<td>Uneven Age</td>
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<tr>
<td></td>
<td>Even Age</td>
<td>200</td>
<td>15</td>
</tr>
<tr>
<td>Little Sioux</td>
<td>Successional</td>
<td>75</td>
<td>34</td>
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<td></td>
<td>Uneven Age</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Even Age</td>
<td>200</td>
<td>16</td>
</tr>
<tr>
<td>Mondamin</td>
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<tr>
<td></td>
<td>Even Age</td>
<td>15</td>
<td></td>
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<tr>
<td>Preparation Canyon</td>
<td>Successional</td>
<td>75</td>
<td>33</td>
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<td></td>
<td>Uneven Age</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Even Age</td>
<td>200</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>249/ 10 years</td>
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</table>

The Bur Oak species has a annual growth of 1/8” to 1/3”. The walnut grows at ¼ to ½ inch, and the majority of the other species have growths of ¼ -3/4” per year.
**Diameter Distribution**

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<tr>
<th>DBH</th>
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<tr>
<td>2</td>
<td>52.0</td>
</tr>
<tr>
<td>4</td>
<td>46.0</td>
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<tr>
<td>6</td>
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<td>8</td>
<td>437.0</td>
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<tr>
<td>10</td>
<td>636.0</td>
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<tr>
<td>11</td>
<td>700.0</td>
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<tr>
<td>12</td>
<td>1054.0</td>
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<tr>
<td>14</td>
<td>1046.0</td>
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<tr>
<td>16</td>
<td>626.0</td>
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<tr>
<td>18</td>
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<tr>
<td>20</td>
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<td>22</td>
<td>150.0</td>
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**Age Class Distribution**

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<tr>
<td>1895</td>
<td>2.4</td>
</tr>
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<td>1900</td>
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</tr>
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<td>1905</td>
<td>28.1</td>
</tr>
<tr>
<td>1910</td>
<td>55.7</td>
</tr>
<tr>
<td>1920</td>
<td>60.2</td>
</tr>
<tr>
<td>1925</td>
<td>5.8</td>
</tr>
<tr>
<td>1930</td>
<td>103.5</td>
</tr>
<tr>
<td>1940</td>
<td>32.5</td>
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<tr>
<td>1950</td>
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<td>1955</td>
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<tr>
<td>1988</td>
<td>19.2</td>
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<tr>
<td>1989</td>
<td>42.9</td>
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<tr>
<td>1990</td>
<td>67.1</td>
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<tr>
<td>1991</td>
<td>19.7</td>
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<tr>
<td>1992</td>
<td>36.6</td>
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<td>1993</td>
<td>102.9</td>
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<td>1994</td>
<td>56.7</td>
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<td>1995</td>
<td>53.5</td>
</tr>
<tr>
<td>1996</td>
<td>15.1</td>
</tr>
<tr>
<td>1997</td>
<td>53.8</td>
</tr>
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</table>
Appendices
Appendix A

Forest Work Plan
## Work Plan Summary for Loess Hills State Forest

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>FOREST ACRES</th>
<th>CULTURAL PRACTICES UNITS AND COMPARTMENTS</th>
<th>Cultural Practices Needed Acres (CTR,FSI) Stand #’s</th>
<th>Cost of Harvest Acres</th>
<th>Stand #’s</th>
<th>Est. $</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>287</td>
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<td>111 2,3,4,5,7,9,10,12,16,18,20,26,50,68,2-4</td>
<td>$16,650</td>
<td>20</td>
<td>6,11</td>
</tr>
<tr>
<td>2008</td>
<td>335</td>
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<td>$19,950</td>
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<td>16,52</td>
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<tr>
<td>2009</td>
<td>592</td>
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<td>182 1,4,21,36,39,43,44,46,49,65,66,71,73,80,81,83,88,90,92,100,101,103,108,110,1-2-4</td>
<td>$27,300</td>
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</tr>
<tr>
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<td>358</td>
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<td>17,26</td>
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<tr>
<td>2019</td>
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<tr>
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<td>93 2,13,2-10,12,24,35,37,43,46,47,64,72,75,110</td>
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<td>342</td>
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<td>P 5, M 1</td>
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<td>$18,450</td>
<td>24</td>
<td>9,10,12</td>
</tr>
</tbody>
</table>
Pisgah Unit Management Prescriptions

Pisgah Unit Compartment 1, Stand 2,3,4,5,7,9,10,12,16,18,20,26,50, and 68: 100 acres

Site Description –
Gentle northwest to east facing slopes.

Woodland Description -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

Management Recommendations – Even Age
These areas are scheduled to have Forest Stand Improvement (FSI) in 2017 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Pisgah Unit, Compartment 1, Stands 6,11,15,22,24,51,65,66: 76 acres

Site Description -
Northwest to east facing slopes and valleys

Woodland Description –
Medium Sawtimber (14”-20” dia.) bur oak and black walnut species. These stands will be grown out to rotation age and diameters larger than 22”. The understory is elm, hackberry, and a few hard maple. The understory is brushy with prickly ash, gooseberry, raspberry, and hazelnut. The east side of the area has pockets of oak wilt.

Management Recommendations – Even Age
This area will be clear-cut to regenerate oak. Following the harvest, all remaining trees 1 inch and larger in diameter should be felled. Treat the stumps of aspen, elm, and ironwood with
Pathfinder II to prevent sprouting. Plant the area with 30 large oak seedlings per acre. Protect each tree with a 4 ft. tall, vented tree shelter.

These two small areas could be planted to reduce fragmentation in this large block of woods. Plant the areas with red oak, bur oak, and white oak. Plant the areas with 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.

Deer and rabbits will heavily browse oak seedlings. It is nearly impossible to establish oak without protection. You can protect the seedlings with a 4 ft. tall, vented, plastic shelter. 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.

**Pisgah Unit, Compartments 1, Stand 67: 4 acres**

**Site Description** -
Stand 67

**Woodland Description** –
Large sized (22” dia.) bur oak

**Management Recommendations – Even Age**
This stand will be managed to regenerate oak. Areas can be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter. The stand will be clear-cut harvest in 2017. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species will be treated with Pathfinder II to prevent sprouting. Plant the area with oak and walnut seedlings.

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.

**Pisgah Unit, Compartments 1, Stand 1.8.23.28,30,31,34,39,40,42,43,44,45,46,48,54,58,64: 86 acres**

**Site Description** –
Generally west facing to southeast facing slopes

**Woodland Description** -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.
Management Recommendations
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species. Benefits such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule.

Pisgah Unit, Compartment 1, Stand 33,53,55,57,61  24 acres

Site Description -
Ridge tops and north facing slopes

Woodland Description -
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.) .

Management Recommendations
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar if needed. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.

Pisgah Unit, Compartment 2, Stand 4  11 acres

Site Description –
Gentle northwest to east facing slopes.

Woodland Description -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

Management Recommendations – Even Age
These areas are scheduled to have Forest Stand Improvement (FSI) in the next rotation of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

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. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Pisgah Unit, Compartment 2, Stand 5  7 acres**

**Site Description** -
Ridge tops and north facing slopes

**Woodland Description** -
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

**Management Recommendations  even-aged**
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar if needed. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.

**Pisgah Unit, Compartment 2, Stand 6  11 acres**

**Site Description** –
Generally west facing to southeast facing slopes

**Woodland Description** -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.

**Management Recommendations – Uneven Age**
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species. Benefits such as stem density, food and den shelters. In 10-20 years, some of these stands will be selectively harvested during the compartment cultural practices schedule.

**Pisgah Unit, Compartment 3, Stand 3,17,20,21,22,23,35,39,40,47,50,55  105 acres**

**Site Description** –
Gentle northwest to east facing slopes.

**Woodland Description** -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.
Management Recommendations – Even Age

These areas are scheduled to have Forest Stand Improvement (FSI) in the next rotation of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Pisgah Unit, Compartment 3, Stand 2,4,12,14,15,19,26,28,30,32,36,43,45  65 acres

Site Description –
Generally west facing to southeast facing slopes

Woodland Description -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi-open and have a native grass component within and around these areas.

Management Recommendations – successional
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species. Benefits such as stem density, food and den shelters. In 10-20 years, some of these stand will be selectively harvested during the compartment cultural practices schedule

Pisgah Unit, Compartment 3, Stand 5,9,10,  6 acres

Site Description -
Ridge tops and north facing slopes

Woodland Description -
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

Management Recommendations
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar if needed. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.
Pisgah Unit, Compartment 3, Stand 16,52  11 acres

Site Description -
Stand 16,52

Woodland Description –
Large sized (14” dia.) bur oak

Management Recommendations – Even Age
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

Pisgah Unit, Compartment 4, Stand 2,4,11,16,21,22  28 acres

Site Description -
Stand 16,52

Woodland Description –
Large sized (14” dia.) bur oak

Management Recommendations – Even Age
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

Pisgah Unit, Compartment 4, Stand 3,10,13,15,17,19,23,25  41 acres

Site Description –
Generally west facing to southeast facing slopes

Woodland Description -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.
**Management Recommendations – Uneven Age**

These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule.

**Pisgah Unit, Compartment 4, Stand 9, 12 acres**

**Site Description** –
Gentle northwest to east facing slopes.

**Woodland Description** -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

**Management Recommendations – Even Age**
These areas are scheduled to have Forest Stand Improvement (FSI) in the next rotation of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Pisgah Unit, Compartment 5, Stands**
1,4,21,36,39,43,44,46,49,65,66,67,71,73,80,81,83,88,90,92,100,101,103,108,110 171 acres

**Site Description** –
Gentle northwest to east facing slopes.

**Woodland Description** -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

**Management Recommendations – Even Age**
These areas are scheduled to have Forest Stand Improvement (FSI) in the next rotation of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Pisgah Unit, Compartment 5, Stands 2,3,38,40,41,47,48,51,53,60,77,104,106** 86 acres

**Site Description** -
Generally north facing slopes and ridge tops

**Woodland Description** –
Large sized (14” 20” dia.) bur oak

**Management Recommendations – Even Age**
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

**Pisgah Unit, Compartment 5,**
**Stands 5,6,11,15,16,17,18,24,25,33,34,42,45,56,57,58,59,61,62,63,72,82,87,89,91,93,94,95,96,98,99,102,109** 196 acres

**Site Description –**
Generally west facing to southeast facing slopes

**Woodland Description** -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.

**Management Recommendations – successional**
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule

**Pisgah Unit, Compartment 5, Stands 75** 2 acres

**Site Description -**
Ridge tops and north facing slopes

**Woodland Description** -
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

**Management Recommendations**
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar if needed. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.

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**PISGAH UNIT 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.

**Successional Management** -
The successional areas will be managed on a 75 year rotation. There are 39 acres designated for successional management. The allowable cut is .52 acres per year (39 acres divided by 75 yrs.). With a working cycle of 10 years, approximately **5.2 acres could be cut every 10 years**.

**Even Age Management Area** –
There are 605 acres under even age management. Dividing 605 acres by 200 years yields an allowable cut of 3.025 acres per year, or **30 acres every 10 years**.

**Uneven Age Management Area** –
Stands can be selectively harvested every 10 years to remove mature and defective trees. There are 399 acres under uneven age management under 150 year rotation. The allowable harvest is **26 acres of selective harvest every 10 years**.
Little Sioux Unit Cultural Practices for 2012-2014

Legend
Cultural Practices
CPNeeded
CTR
Harvest
Little Sioux Unit Management Prescriptions

Little Sioux Unit, Compartment 1, Stands 1,7,8,9,10,15,16,17,18 53 acres

*Site Description* –
Generally west facing to southeast facing slopes

*Woodland Description* -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.

*Management Recommendations – Uneven Age*
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule

Little Sioux Unit, Compartment 1, Stands 2, 13 13 acres

*Site Description* –
Gentle northwest to east facing slopes.

*Woodland Description* -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

*Management Recommendations – Even Age*
These areas are scheduled to have Timber Stand Improvement (TSI) in the next rotation of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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. The trees to be removed can be felled or double girdled. No herbicide is necessary.

Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Little Sioux Unit, Compartment 2, Stands 1,3,4,6,7,8,11,13,14,20,22,23,25,28,29,32,36, 38,41,48,49,53,54,56,57,58,59,61,63,73,81,86,87, 90,92,93,95,96,99,101,107,109 247 acres

*Site Description* –
Generally west facing to southeast facing slopes

**Woodland Description**

These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.

**Management Recommendations – Uneven Age**

These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule.

**Little Sioux Unit, Compartment 2, Stands 10,12,24,35,37,43,46,47,64,72,75,110** 80 acres

**Site Description**

Gentle northwest to east facing slopes.

**Woodland Description**

Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

**Management Recommendations – Even Age**

These areas are scheduled to have Forest Stand Improvement (FSI) in the next rotation of the compartments. In pole-sized stands (4-10" dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Little Sioux Unit, Compartment 2, Stands 40,62,65,67,83,98** 86 acres

**Site Description**

Generally north facing slopes and ridge tops

**Woodland Description**

Large sized (14” 20” dia.) bur oak

**Management Recommendations – Even Age**
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

**Little Sioux Unit, Compartment 2, Stands 42,45,51 13 acres**

*Site Description* -
Ridge tops and north facing slopes

*Woodland Description* -
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

*Management Recommendations*
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar if needed. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.

**Little Sioux Unit, Compartment 3, Stands 1,18 16 acres**

*Site Description* –
Gentle northwest to east facing slopes.

*Woodland Description* -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

*Management Recommendations – Even Age*
These areas are scheduled to have Forest Stand Improvement (FSI) in the next rotation of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.
The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Little Sioux Unit, Compartment 3, Stands 3,11,12,13,14,23,24,32,34  59 acres**

*Site Description –*
   Generally west facing to southeast facing slopes

*Woodland Description -*
   These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.

*Management Recommendations – Uneven Age*
   These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule

**Little Sioux Unit, Compartment 3, Stands 4,6,10,16,30  63 acres**

*Site Description -*
   Generally north facing slopes and ridge tops

*Woodland Description –*
   Large sized (14” 20” dia.) bur oak

*Management Recommendations – Even Age*
   This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.
   Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.
   Control competing vegetation by spot spraying a combination of Roundup and Princep 4L herbicides. Protect the seeding 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.

**Little Sioux Unit, Compartment 3, Stands 5,8,31  22 acres**

*Site Description -*
   Ridge tops and north facing slopes
**Woodland Description**
- Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

**Management Recommendations**
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar if needed. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.

**Little Sioux Unit, Compartment 4, Stands 13,20,22 30 acres**

**Site Description**
- Gentle northwest to east facing slopes.

**Woodland Description**
- Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

**Management Recommendations – Even Age**
These areas are scheduled to have Forest Stand Improvement (SI) in the next rotation of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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. The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Little Sioux Unit, Compartment 4, Stands 1,2,4,6,7,8,10,11,15,17,18,21 111 acres**

**Site Description**
- Generally west facing to southeast facing slopes

**Woodland Description**
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.
Management Recommendations – Uneven Age
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stands could be selectively harvested during the compartment cultural practices schedule.

Little Sioux Unit, Compartment 4, Stands 9,12  28 acres

Site Description -
Generally north facing slopes and ridge tops

Woodland Description –
Large sized (14” 20” dia.) bur oak

Management Recommendations – Even Age
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

Little Sioux Unit, Compartment 4, Stands 5,  2 acres

Site Description -
Ridge tops and north facing slopes

Woodland Description -
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

Management Recommendations
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar if needed. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.

Little Sioux Unit, Compartment 5, Stands 8,15,17,20,22,32,  42 acres

Site Description –
Gentle northwest to east facing slopes.
Woodland Description -

Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

Management Recommendations – Even Age

These areas are scheduled to have Timber Stand Improvement (TSI) in the next rotation of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Little Sioux Unit, Compartment 5, Stands 1,5,6,7,16,19,23,28,33,35,37,38,41,45,47,48,49  42 acres

Site Description –

Generally west facing to southeast facing slopes

Woodland Description -

These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.

Management Recommendations – Uneven Age

These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule

Little Sioux Unit, Compartment 5, Stands 9,10,14,18,24,29  51 acres

Site Description -

Generally north facing slopes and ridge tops

Woodland Description –

Large sized (14” 20” dia.) bur oak

Management Recommendations – Even Age

This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.
Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

**Little Sioux Unit, Compartment 5, Stands 27,50,51  11 acres**

*Site Description -*
Ridge tops and north facing slopes

*Woodland Description -*
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

*Management Recommendations*
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.

**LITTLE SIOUX UNIT  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-aged management, the acres 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.

*Successional Management -*
The successional areas will be managed on a 75 year rotation. There are 48 acres designated for successional management. The allowable cut is .64 acres per year (48 acres divided by 75 yrs.). With a working cycle of 10 years, approximately 6.4 acres could be cut every 10 years.

*Even-Aged Management Area –*
There are 399 acres under even age management. Dividing 399 acres by 200 years, yields an allowable cut of 1.99 acres per year, or 20 acres every 10 years.

*Uneven-Aged Management Area –*
Stands can be selectively harvested every 10 years to remove mature and defective trees. There are 512 acres under uneven age management under 150 year rotation. The allowable cut is 3.413 and so the harvest is 34 acres of selective harvest every 10 years.
Mondamin Unit Management Prescriptions

Mondamin Unit, Compartment 1, Stands 2,4  11 acres

Site Description –
Gentle northwest to east facing slopes.

Woodland Description -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

Management Recommendations – Even-Aged
These areas are scheduled to have Forest Stand Improvement (FSI) in 2019 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Mondamin Unit, Compartment 2, Stands 5,9,10,13,14,15,16,17,21,22,  148 acres

Site Description –
Gentle northwest to east facing slopes.

Woodland Description -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

Management Recommendations – Even Age
These areas are scheduled to have Forest Stand Improvement (FSI) in 2010 and 2020 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.
The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin
the stand to release the crop trees. Select 50 crop 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. Species to
favor are oak and walnut species.

**Mondamin Unit, Compartment 2, Stands 1,19  35 acres**

**Site Description** –
Generally west facing to southeast facing slopes

**Woodland Description -**
These stands contain poor quality oak, naturally regenerating with sumac, box elder,
hackberry, elm, ash, red cedar, and clumps of dogwood. A 2-5 year frequency of fires through these
stands will maintain these areas as stunted trees and shrubs surround the area. These areas are semi-
open and have a native grass component within and around these areas.

**Management Recommendations – Uneven Age**
These stands are early successional and poor quality, but provide wildlife benefits to game
and non-game species such as stem density, food and den shelters. In 10-20 years, some of these
stand could be selectively harvested during the compartment cultural practices schedule.

**Mondamin Unit, Compartment 2, Stands 20  28 acres**

**Site Description -**
Generally north facing slopes and ridge tops

**Woodland Description –**
Large sized (14” 20” dia.) bur oak

**Management Recommendations – Even Age**
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut
and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre
with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger
than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated
with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

**Mondamin Unit, Compartment 3, Stands 4,6,10,18,  48 acres**

**Site Description –**
Gentle northwest to east facing slopes.

**Woodland Description -**
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

**Management Recommendations – Even Age**

These areas are scheduled to have Forest Stand Improvement (FSI) in 2020 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Mondamin Unit, Compartment 3, Stands 8,12,13  36 acres**

**Site Description** –
Generally west facing to southeast facing slopes

**Woodland Description** -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. With a 2-5 year frequency of fires thru these stands will maintain these area as stunted trees and shrubs around the area. These areas are semi open and have a native grass component within and around these areas.

**Management Recommendations – Uneven Age**
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stands could be selectively harvested during the compartment cultural practices schedule.

**Mondamin, Compartment 3, Stands 1,17,20  24 acres**

**Site Description** -
Generally north facing slopes and ridge tops

**Woodland Description** –
Large sized (14” 20” dia.) bur oak

**Management Recommendations – Even Age**
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.
Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

Mondamin Unit, Compartment 4, Stands 2,3,4,5,8  31 acres

Site Description –
Gentle northwest to east facing slopes.

Woodland Description -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

Management Recommendations – Even Age
These areas are scheduled to have Forest Stand Improvement (FSI) in 2011 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Mondamin Unit, Compartment 4, Stands 6,9  5 acres

Site Description –
Generally west facing to southeast facing slopes.

Woodland Description -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, poplar, red cedar, and clumps of dogwood. A 2-5 year frequency of fires through these stands will maintain these areas. These areas are semi-open and have a native grass component within and around these areas.

Management Recommendations – Uneven Age
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stands could be selectively harvested during the compartment cultural practices schedule.
Mondamin Unit, Compartment 5, Stands 1,9,10,13,16,18,21, 75 acres

**Site Description** –
Gentle northwest to east facing slopes.

**Woodland Description** -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

**Management Recommendations – Even Age**
These areas are scheduled to have Forest Stand Improvement (FSI) in 2021 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

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. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Mondamin Unit, Compartment 5, Stands 11,17, 9 acres

**Site Description** –
Generally west facing to southeast facing slopes

**Woodland Description** -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. A 2-5 year frequency of fire through these stands will maintain the areas. These areas are semi-open and have a native grass component within and around these areas.

**Management Recommendations – Uneven Age**
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule.
Mondamin Unit, Compartment 6, Stands 13,15  17 acres

*Site Description* –
Gentle northwest to east facing slopes.

*Woodland Description* -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

*Management Recommendations – Even Age*
These areas are scheduled to have Forest Stand Improvement (FSI) in 2021 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Mondamin Unit, Compartment 6, Stands 4,6,8,9,10,12,16,18,20  77 acres

*Site Description* –
Generally north facing slopes and ridge tops

*Woodland Description* –
Large sized (14” 20” dia.) bur oak

*Management Recommendations – Even Age*
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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 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-aged management, the acres 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.

**Successional Management** -
There is no substantial amount of acres of successional areas that will be managed on a 75 year rotation.

**Even Age Management Area** –
There are 316 acres under even age management. Dividing 316 acres by 200 years, yields an allowable cut of 1.58 acres per year, or **15 acres every 10 years**.

**Uneven Age Management Area** –
Stands can be selectively harvested every 10 years to remove mature and defective trees. There are 228 acres under uneven age management under 150 year rotation. The allowable cut is 1.52 and so the harvest would be **15 acres of selective harvest every 10 years**.
Preparation Canyon Unit Management Prescriptions

Preparation Canyon Unit, Compartment 1, Stands 7,8,26 49 acres

Site Description –
Gentle northwest to east facing slopes.

Woodland Description -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

Management Recommendations – Even Age
These areas are scheduled to have Forest Stand Improvement (FSI) in 2014 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Preparation Canyon Unit, Compartment 1, Stands 2,4,6,9,10,13,14,17,21,23,24,25,27,28 74 acres

Site Description –
Generally west facing to southeast facing slopes

Woodland Description -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. A 2-5 year frequency of fires thru these stands will maintain the areas. These areas are semi-open and have a native grass component within and around these areas.

Management Recommendations – Uneven Age
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stands could be selectively harvested during the compartment cultural practices schedule.
Preparation Canyon Unit, Compartment 2, Stands 1,4,6,11,12,13,14,15,16,20, 21,61,95,97,99,108,110,139 161 acres

Site Description –
Gentle northwest to east facing slopes.

Woodland Description -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

Management Recommendations – Even Age
These areas are scheduled to have Forest Stand Improvement (FSI) in 2015 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Preparation Canyon Unit, Compartment 2, Stands 3,7,8,24,51,52,54,69,70,71,78,80,89,90, 101,103,117,120,136,140,141,142,143 158 acres

Site Description –
Generally west facing to southeast facing slopes

Woodland Description -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. A 2-5 year frequency of fires though these stands will maintain the areas. These areas are semi open and have a native grass component within and around these areas.

Management Recommendations – Uneven Age
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species such as stem density, food and den shelters. In 10-20 years, some of these stands could be selectively harvested during the compartment cultural practices schedule.
Preparation Canyon Unit, Compartment 2, Stands 2,10,17,26,49,77,82,92,96,98,102,113,114,126,129,144 190 acres

Site Description -
Generally north facing slopes and ridge tops

Woodland Description –
Large sized (14” 20” dia.) bur oak

Management Recommendations – Even Age
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

Preparation Canyon Unit, Compartment 2, Stands 5,9,18,19,22,23,25,27,28,29,30,31,35,38,39,40,45,47,50,59,63,64,65,66,106,122,123,130 221 acres

Site Description -
Ridge tops and north facing slopes

Woodland Description -
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

Management Recommendations
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.

Preparation Canyon Unit, Compartment 3, Stands 5,8,10,18 acres

Site Description –
Gentle northwest to east facing slopes.

Woodland Description -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.
**Management Recommendations – Even Age**

These areas are scheduled to have Forest Stand Improvement (FSI) in 2015 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Preparation Canyon Unit, Compartment 3, Stands 1,2,4,6,9, 47 acres**

**Site Description** -
Generally north facing slopes and ridge tops

**Woodland Description** –
Large sized (14” 20” dia.) bur oak

**Management Recommendations – Even Age**

This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

**Preparation Canyon Unit, Compartment 4, Stands 22,23,24,60, 42 acres**

**Site Description** –
Gentle northwest to east facing slopes.

**Woodland Description** -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.
Management Recommendations – Even Age

These areas are scheduled to have Forest Stand Improvement (FSI) in 2016 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

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. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

Preparation Canyon Unit, Compartment 4, Stands 1,4,16,25,26,30,31,33,44,45,46,49,53,54,56,59,61 102 acres

Site Description –
Generally west facing to southeast facing slopes

Woodland Description –
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. A 2-5 year frequency of fires through these stands will maintain the areas. These areas are semi-open and have a native grass component within and around these areas.

Management Recommendations – Uneven Age

These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species. Benefits such as stem density, food and den shelters. In 10-20 years, some of these stand could be selectively harvested during the compartment cultural practices schedule.

Preparation Canyon Unit, Compartment 4, Stands 6,8,9,15,20,32,36,52 111 acres

Site Description –
Generally north facing slopes and ridge tops

Woodland Description –
Large sized (14” 20” dia.) bur oak

Management Recommendations – Even Age

This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.
Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

**Preparation Canyon Unit, Compartment 5, Stands 4,8,22,25,36,37,42,43,50,52, 57 acres**

**Site Description** –
Gentle northwest to east facing slopes.

**Woodland Description** -
Pole sized (8-12 dia.) bur oak, and black walnut. The understory consists of ironwood, elm, and bitternut hickory.

**Management Recommendations – Even Age**
These areas are scheduled to have Forest Stand Improvement (FSI) in 2016 of the compartments. In pole-sized stands (4-10” dia.), potential crop trees can be selected and released. At maturity, there is room for 30-50 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.

The trees to be removed can be felled or double girdled. No herbicide is necessary. Thin the stand to release the crop trees. Select 50 crop 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. Species to favor are oak and walnut species.

**Preparation Canyon Unit, Compartment 5, Stands 9,13,26,35,38,39,40,41,47,56,59,60,61,64,66,67,72,78 74 acres**

**Site Description** –
Generally west facing to southeast facing slopes.

**Woodland Description** -
These stands contain poor quality oak, naturally regenerating with sumac, box elder, hackberry, elm, ash, red cedar, and clumps of dogwood. A 2-5 year frequency of fires through these stands will maintain the areas. These areas are semi-open and have a native grass component within and around these areas.

**Management Recommendations – Uneven Age**
These stands are early successional and poor quality, but provide wildlife benefits to game and non-game species. Benefits such as stem density, food and den shelters. In 10-20 years, some of these stands could be selectively harvested during the compartment cultural practices schedule.

**Preparation Canyon Unit, Compartment 5, Stands 2,7,10,14,16,17,18,19,21,27,28, 29,31,57 132 acres**

*Site Description -*
Generally north facing slopes and ridge tops

*Woodland Description –*
Large sized (14” 20” dia.) bur oak

*Management Recommendations – Even Age*
This stand will be managed to grow the oak to 22” diameters. Areas will then be clear-cut and planted with oak and walnut seedlings. 30 oak and walnut seedlings would be planted per acre with each tree protected by a 4 ft. tall, tree shelter.

Clear-cut harvest the stand. Following the harvest, all remaining undesirable trees larger than 1 inch in diameter should be felled. The stumps of the undesirable species should be treated with Pathfinder II to prevent sprouting. Plant the area with large oak seedlings.

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.

**Preparation Canyon Unit, Compartment 5, Stands 3,32,48,51,54,63,68,70,75 33 acres**

*Site Description -*
Ridge tops and north facing slopes

*Woodland Description -*
Pole sized Eastern Red Cedar with some oak and black walnut. (4-8” dia.)

*Management Recommendations*
The density and size of these cedar stands are too large of areas to eliminate, so we will prune and thin the stands to grow saw log size cedar logs for the increasingly growing markets in the area. Crop Tree Release (CTR) will be done on good quality and formed Oak and Walnut in amongst the cedars. When the stands reach 16-20” diameter they can be clear-cut harvested and either replanted with cedar. They can also be conversion stands to deciduous hardwoods. These sites are very nutrient rich and grow oak and walnut stands well.
PREPARATION CANYON UNIT 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-aged management, the acres 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.

Successional Management -

The successional areas will be managed on a 75 year rotation. There are 254 acres designated for successional management. The allowable cut is 3.38 acres per year (254 acres divided by 75 yrs.). With a working cycle of 10 years, approximately 33.86 acres could be cut every 10 years.

Even Age Management Area –

There are 605 acres under even age management. Dividing 808 acres by 200 years, yields an allowable cut of 4.04 acres per year, or 40 acres every 10 years.

Uneven Age Management Area –

Stands can be selectively harvested every 10 years to remove mature and defective trees. There are 408 acres under uneven age management under 150 year rotation. The allowable cut is 2.72 and so the harvest is 25 acres of selective harvest every 10 years.
Appendix B

Wildlife Species List
**L.H.S.F. Wildlife Appendix**

The following is a list of the wildlife present in the Loess Hills: Lampe, R.P. and J.B. Bowies, “Annotated checklist of the Mammals of the Loess Hills of Western Iowa” Proceedings of the Iowa Academy of Sciences 92(5) : 176-179, 1985

**MAMMALS**

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<th>CLASSIFICATION</th>
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Indian Bat (E)
Silver-Haired Bat
Eastern Pipistrelle
Hoary Bat
Richardson’s Ground Squirrel
Southern Flying Squirrel
Plains Pocket Mouse (R)
Northern Grasshopper mouse
Southern Bog Lemming (R)
Least Weasel
Spotted Skunk
Bobcat (E)
Mule Deer

woodland  woodland
riparian  riparian
woodland urban
prairie
woodland
prairie
moist bluegrass, fencerows
savanna, fields
riparian, prairie
woodland, cliffs
woodland, grassland
insectivore  insectivore
insectivore  insectivore
insectivore
insectivore
herbivore, grainivore
herbivore, grainivore
herbivore, grainivore
grainivore, insectivore
herbivore
carnivore
omnivore
carnivore
carnivore
herbivore
**BIRDS**

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Yellow Warbler
Ovenbird
Northern Cardinal
Rose-Breasted Grosbeak
Green-Backed Heron (R)
Great Blue Heron
Mallard (g)
Blue Winged Teal (g)
Copper’s Hawk
Sharp-Shinned Hawk
Killdeer
Upland Sandpiper (R)
American Woodcock (R)
Burrowing Owl (R)
Chuck-Will’s-Widow (R)
Chimney Swift
Ruby-Throated Hummingbird
Acadian Flycatcher
Willow Flycatcher
Western Kingbird ( R)
Horned Lark ( R)
Tree Swallow
Cliff Swallow ( R)
Tufted Titmouse ( R)
Blue-Gray gnatcatcher ( R)
Northern Mockingbird ( R)
Loggerhead Shrike ( R)
Warbling Vireo( R)
Red-Eyed Vireo
Blue Grosbeak ( R)
Scarlet Tanager
Song Sparrow ( R)
Indigo Bunting
Dickcissel
Common Yellowthroat
Rufous-Side Towhee
Chipping Sparrow
Vesper Sparrow
Lark Sparrow
Grasshopper Sparrow
Red-Winged Blackbird
Eastern Meadowlark
Western Meadowlark
Common Grackle
Brown-Headed Cowbird
Orchard Oriole
American Goldfinch
House Sparrow

savanna, edge, ponds
edge
woodland, savanna
woodland, edge
riparian, marsh, pond
marsh, pond
marsh, pond
marsh, pond
woodland
woodland, riparian
prairie, pasture, pond
prairie, pasture, pond
edge
ag land, ditches
woodland
urban
urban, ag land
riparian, woodland
riparian
riparian
woodland
ag land
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edge
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riparian
edge, woodland
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savanna ag land, woodland
woodland, orchards, g land
savanna ag land
ag land

insectivore
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AMPHIBIANS & REPTILES

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Appendix C

Soils
SOILS

1. SARPY-ALBATON-CARR association

   Excessively drained and poorly drained, nearly level to gently
   Undulating, stratified sandy, loamy, and clayey soils on bottom lands of
   the Missouri River.
   Besides the indicator soil series, this association is comprised
   of Onawa, Haynie, Kenmoore, Grable, and Modale soils

2. ALBATON-HAYNIE-ONAWA association

   Well drained to poorly drained, nearly level silt and clay
   soils on bottom lands of the Missouri River
   Other soil series include Blake, Grable, Percival, Vore and Modale

3. LUTON-Keg association

   Well drained to very poorly drained, nearly level silt and clay soils
   on bottom lands of the Missouri River.
   Less extensive soil series included in this association are Salix, Blencoe,
   Woodbury, Lakeport, Forney, and Solomon soils.

4. KENNEBEC-McPAUL-NODAWAY association

   Moderately well drained and well drained, nearly level silt soils on bottom lands.
   Colo, Moville, Monona, and Napier soils are included in this association.

5. HAMBURG-IDA-MOON association

   Somewhat excessively drained and well drained, moderately sloping to very
   steep silt soils on uplands.
   The less extensive soil series are mainly Napier and Castana soils.

6. MONONA-IDA-NAPIER association

   Well-drained, nearly level to steep silt soils on uplands.
   Other soils included in this association are Kennebec, McPaul, and Nodaway

7. LUTON-SALIX-BLENCO-McPAUL association.

   Nearly level areas or slight depressions on bottom lands of the Missouri River.
   Colo Copper, and Napa soils also occur in this association.

8. KENNEBEC-ZOOK-McPAUL association

   Wet soils located on the bottom lands of Missouri River and uplands along
   Maple, Soldier, and Little Sioux Rivers.
Less extensive soils include Colo, Luton, Napa series.

9. HAMBURG-IDA-CASTANA-NAPIER association

These soils occupy the steep slopes of the area. Monona, Shelby, and Steinauer Soils comprise the lesser abundant soils series.
<table>
<thead>
<tr>
<th>SOIL SERIES</th>
<th>SLOPE</th>
<th>DRAINAGE</th>
<th>LANDSCAPE</th>
<th>TEXTURE POSITION</th>
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<td>bottom</td>
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</tr>
<tr>
<td>Blake</td>
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<tr>
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<td>upland</td>
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<td>bottom</td>
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<td>ridgeside</td>
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<td>Kenmoor</td>
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<td>bottom</td>
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<td>0-2%</td>
<td>somewhat poor</td>
<td>poorlybottom</td>
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<td>poorly</td>
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<td>Sarpy</td>
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<td>Shelby</td>
<td>8-35%</td>
<td>well</td>
<td>side</td>
<td>loam</td>
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<tr>
<td>Solomon</td>
<td>0-2%</td>
<td>poorly/ very poorly</td>
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<td>silty clay</td>
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<tr>
<td>Steinauer</td>
<td>9-18%</td>
<td>well</td>
<td>upland</td>
<td>clay loam</td>
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<td>Vore</td>
<td>0-2%</td>
<td>moderately well</td>
<td>bottom</td>
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<tr>
<td>Woodbury</td>
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<td>bottom</td>
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</tr>
<tr>
<td>Zook</td>
<td>0-1%</td>
<td>poorly</td>
<td>bottom</td>
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Employee History
INDR Employees on LHSF

State Foresters
H. Gene Hertel 1969-1987
William Farris 1987-1999
Mike Brandrup 1999- 2005
Paul Tauke 2005- Present

Section Chief State Forests & Management
James Bulman 1986-2000
Jerry Kemperman 2000-2004
Linda Howard 2004-2007
Jeff Goerndt 2008-Present

Area Foresters
Allan Pratt 1986-1989
Randy Cook 1989-1990
Brent S. Olson 1990-1991 Laid Off
Roger Jacob 1991-1992
Brent S. Olson 1992-Present

Permanent Full Time Employees
Dennis Stoner 1988-Present

Seasonal Employees
Dee Arion Mann 1986-1998
Tom Clark 1992-1993
Bryan Taylor 1993-Present
Larry Pape 1998- 2002
Chase Durfee 2001 - Present
Joy Carson 2000- Present
Joanna Nuzum 2006 – Present
Appendix E

Additional Maps
The 2002 Legacy Plantings have been completed. They were planted on May 16, 2002. They are located in Section 3 of Jackson Township, Harrison County on the Loess Hills State Forest.
Loess Hills State Forest
Vegetation Cover

Preparation Canyon Unit
Pisgah Unit
Little Sioux Unit
Mondamin Unit

Vegetation Cover
Red = Agricultural
Green = Trees
Orange = Prairies and Seedings
Lilac = Grass Areas
Blue = Water

0 0.4 0.8 1.6 2.4 3.2 Miles
State Forest Potential Harvest Sites in FY 2008-2011

Mondamin Unit
Acquisition History
### Acquisition History

**Loess Hills State Forest**

**UPDATE DATE:** October 20, 2007

#### Little Sioux Unit (4,700 acres)

<table>
<thead>
<tr>
<th>Name</th>
<th>Acres</th>
<th>Cost</th>
<th>Date Acquired</th>
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<td>Joe Bothwell</td>
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<tr>
<td>Doug Collison</td>
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<tr>
<td>Karol King</td>
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<tr>
<td>Larry Eickhoff</td>
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<td>23,000</td>
<td>Aug-87</td>
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<tr>
<td>Ray and Wes Spencer</td>
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<td>200,000</td>
<td>Nov-88</td>
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<tr>
<td>Nina Hildreth</td>
<td>80</td>
<td>39,000</td>
<td>Jul-89</td>
</tr>
<tr>
<td>William Roden</td>
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<td>73,700</td>
<td>Jul-89</td>
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<tr>
<td>Don and Lillian Wheeler</td>
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<tr>
<td>Donald Bothwell</td>
<td>125</td>
<td>53,250</td>
<td>Oct-90</td>
</tr>
<tr>
<td>Thomas &amp; Dorothy Erwin</td>
<td>70</td>
<td>23,000</td>
<td>Apr-92</td>
</tr>
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<td>Dwight &amp; Anita Nuzum</td>
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<td>186,000</td>
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<tr>
<td>Herbert Clark</td>
<td>32</td>
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<td>Oct-92</td>
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<tr>
<td>Bill Bothwell</td>
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<td>Dec-92</td>
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<tr>
<td>FMHA Peasley</td>
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<td>22,806</td>
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<td>Patricia Alton</td>
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<td>Shriners Hospital</td>
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<td>Don Powell</td>
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<td>Jim Rains</td>
<td>40</td>
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<td>Wayne &amp; Norma Jensen</td>
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<td>Raymond Dixon</td>
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<td>Dave Thomas</td>
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<td>Murray Hill INHF</td>
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| Total              | 3,017 | $1,818,966 |

64.19%
<table>
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<td>51,890</td>
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<td>Maude Conyers</td>
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<td>Nov-87</td>
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<td>Robert Conyers</td>
<td>160</td>
<td>44,379</td>
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<td>Blencoe State Bank</td>
<td>216</td>
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<td>Darrell Vanness</td>
<td>38</td>
<td>24,250</td>
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<tr>
<td>Addison Hebb</td>
<td>205</td>
<td>96,969</td>
<td>Feb-89</td>
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<tr>
<td>Darrell &amp; Virginia Vanness</td>
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<td>I Harry Rice</td>
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<td>Harvey Swensen</td>
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<td></td>
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<td>62%</td>
<td>3,674</td>
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</table>

<p>| Ida Cox                     | 80      | 21,000  | Aug-87   |        |
| Larry Pape                  | 196     | 82,000  | Jul-88   |        |
| Colleen Alton               | 12      | 3,700   | Nov-88   |        |
| Sylvia Rains                | 40      | 24,000  | Apr-89   |        |
| Illa Mae Storm              | 35      | 75,000  | Jun-89   |        |
| Marvin &amp; Norma Holsapple    | 129     | 81,075  | Sep-89   |        |
| City of Pisgah              | 3       | Donation| Sep-89   |        |
| Addison Hansen              | 40      | 26,000  | Jan-90   |        |
| Bryan Remington             | 8       | 6,400   | Jan-90   |        |
| Bessie Bell                 | 35      | 15,000  | May-90   |        |
| Paul Gochenour              | 112     | 85,000  | Jun-90   |        |
| Don and Lillian Wheeler     | 10      | 2,500   | Sep-90   |        |
| Francis Haggerman           | 93      | 64,000  | Sep-90   |        |
| Dorothy Rains               | 54      | 41,500  | Sep-90   |        |
| Larry Bryceson              | 354     | 255,000 | Feb-91   |        |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Percentage</th>
<th>Acres</th>
<th>Value</th>
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<td>1</td>
<td>435</td>
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<td>Tom &amp; Clara Heimforth</td>
<td>365</td>
<td>182,800</td>
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<td>Maynard and Mabel Christensen</td>
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<td>186,905</td>
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<td>Don Powell</td>
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<td>May-96</td>
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<td>Petrus &amp; Griffith</td>
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<td>Mondamin Unit (1,992 acres)</td>
<td>56%</td>
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<td>Donald Maule</td>
<td>73</td>
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<td>Ed and Francine Camenzind</td>
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<td>18,000</td>
<td>Oct-89</td>
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<tr>
<td>Bryan Remington</td>
<td>120</td>
<td>66,000</td>
<td>Feb-90</td>
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<td>Gene Sorick</td>
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<td>Delores Kay</td>
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| TOTALS                        | 53%        | 1,065  | 477,762  |

<p>| PROPOSED TOTAL ACRES          | 17,626     |
| Average $ / Acre              | $          |</p>
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<th>Cost</th>
<th>$/ acre</th>
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<td>448,995</td>
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<p>| Total         |       | 6,580,769.00 | $727.71 | 71    |</p>
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<tr>
<td><strong>January 23, 2007</strong></td>
</tr>
<tr>
<td><strong>Little Sioux Unit</strong></td>
</tr>
<tr>
<td><strong>Preparation Canyon Unit</strong></td>
</tr>
<tr>
<td><strong>Pisgah Unit</strong></td>
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<tr>
<td><strong>Mondamin Unit</strong></td>
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<p>| <strong>Little Sioux Unit</strong>                           |</p>
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<tr>
<th><strong>Name</strong></th>
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<th><strong>Pisgah Unit</strong></th>
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<td>David Leonard</td>
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<td>Nicolas Bean</td>
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<td>Bill Harl</td>
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<td>Bryan Remmington</td>
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<td>Thomas Armstrong</td>
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<td>David Thomas</td>
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<td>Larry and Donna Pape</td>
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<td>Ed Seabury</td>
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<p>| <strong>Preparation Canyon Unit</strong>                     |</p>
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<th><strong>Mondamin Unit</strong></th>
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<td>Hutchinson Trust</td>
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<td>Maxine McIntosh</td>
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<td>Virginia Vanness</td>
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<td>LSSR Boy Scouts</td>
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<td>Catherine Webb</td>
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<td><strong>Total</strong></td>
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| **Totals Four Units** | **10,978.00** | **Current Rates @ 2,100 / acre = $ 23,053,800.00** |

These properties all depend on the availability of willing sellers within the acquisition boundaries.
Appendix G

Prairie and Savanna Species Lists
### Plant List

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common horesetail</td>
<td>Equisetum arvense L.</td>
</tr>
<tr>
<td>Prairie scouring-rush</td>
<td>Equisetum laveigatum A.Br.</td>
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<tr>
<td>Water Hemlock</td>
<td>Cicuta maculata L</td>
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<tr>
<td>Rattlesnake Master</td>
<td>Eryngium yuccifolium Michx.</td>
</tr>
<tr>
<td>Golden Alexanders</td>
<td>Zizia aurea (L) W. Koch</td>
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<tr>
<td>Indian Hemp</td>
<td>Apocynum sibiricum Jacq.</td>
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<tr>
<td>Hemp Dogbane</td>
<td>Apocynum cannabinum L</td>
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<tr>
<td>Common Milkweed</td>
<td>Asclepias syriaca L</td>
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<tr>
<td>Prairie Milkweed</td>
<td>Asclepias sullivantii Engelm.ex Gray</td>
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<tr>
<td>Swamp Milkweed</td>
<td>Asclepias incarnata L</td>
</tr>
<tr>
<td>Whorled Milkweed</td>
<td>Asclepias verticillata L</td>
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<tr>
<td>Butterfly Weed</td>
<td>Asclepias viridiflora Raf.</td>
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<tr>
<td>Green Milkweed</td>
<td>Achillea millefolium L</td>
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<tr>
<td>Western Yarrow</td>
<td>Ambrosia psilostachya DC</td>
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<td>Western Ragweed</td>
<td>Artemisia campestris L</td>
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<tr>
<td>Pussytoes</td>
<td>Artemisia neglecta Greene</td>
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<tr>
<td>White Sage</td>
<td>Artemisia ludovicianna Nutt.</td>
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<tr>
<td>Tall Wormwood</td>
<td>Aster lanceolatus Willd.</td>
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<tr>
<td>Panicled Aster</td>
<td>Aster ericoides L</td>
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<tr>
<td>Heath Aster</td>
<td>Aster umbellatus Miller</td>
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<tr>
<td>White Aster</td>
<td>Aster laevis L</td>
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<tr>
<td>Smooth Blue Aster</td>
<td>Aster azureus Lindley</td>
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<tr>
<td>Sky Blue Aster</td>
<td>Aster sericeus Vent.</td>
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<tr>
<td>Silky Aster</td>
<td>Aster oblongifolius Nutt.</td>
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<tr>
<td>Aromatic Aster</td>
<td>Aster novae-angliae L</td>
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<tr>
<td>New England Aster</td>
<td>Brickellia eupatorioides (L) Shinners</td>
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<tr>
<td>False Boneset</td>
<td>C tuberosa Nutt.</td>
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<tr>
<td>Prairie Indian plantain</td>
<td>Crisium discolor (muhl ex Wild)</td>
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<tr>
<td>Field Thistle</td>
<td>Crisium altissimum (L) Sprengel</td>
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<tr>
<td>Tall thistle</td>
<td>Cirasium flodmanii (Rydb) Arthur</td>
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<td>Flodmans Thistle</td>
<td>Coreopsis palmata Nutt.</td>
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<td>Tickseed</td>
<td>Echinacea pallida Nutt.</td>
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<td>Pale Coneflower</td>
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<td>Purple coneflower</td>
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<td>Helianthus maximiliani Schrader</td>
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<td>Maximilians Sunflower</td>
<td>Heliopsis helianthoides (L) Sweet</td>
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<td>Ox-eye</td>
<td>Chrysopsis villosa Nutt.ex DC</td>
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<td>Golden aster</td>
<td>Krigia biflora (Wlter) Blake</td>
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<tr>
<td>False Dandelion</td>
<td>Lactuca canadensis L</td>
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<tr>
<td>Wild Lettuce</td>
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</table>
Prairie Lettuce  
Lactuca ludoviciana (Nutt.) Riddell

Blue Lettuce  
L pulchella (Pursh) DC

Prairie Blazing Star  
Liatris pycnostachya Michx

Rough Blazing Star  
Liatris aspera Michx

Dotted Blazing Star  
Liatris puncata Hooker

Scaly Blazing Star  
Liatris squarrosa (L) Michx

Skeleton Weed  
Lygodesmia juncea (Pursh) D Don.

Cut-leaved goldenrod  
Haplospspud spinulosus (Pursh) DC

Prairie Dandelion  
Agoseris cuspidata (Pursh) DC

Rough White Lettuce  
Prenanthes aspera Michx

Gray-headadr coneflower  
Ratibida pinnata (Vent) Barnh.

Thimble weed  
Ratibida columnifera (Nutt) Wooton and Standley

Black-Eyed Susan  
Rudbeckia hirta L

Sweet coneflower  
Rudbeckia subtomentosa Pursh

Prairie ragwort  
Senecio plattensis Nutt

Rosinweed  
Silphium integrifolium Michx

Compass Plant  
Silphium laciniatum L

Missouri Goldenrod  
Solidago missouriensis Nutt

Tall Goldenrod  
Solidago canadensis L

Showy Goldenrod  
Solidago speciosa Nutt

Smooth Goldenrod  
Solidago gigantea

Gray Goldenrod  
Solidago nemoralis Aiton

Stiff Goldenrod  
Solidago rigida L

Ironweed  
Vernonia fasciculata Michx

Baldwind Ironweed  
Vernonia baldwinii Torrey

Hoary Puccoon  
Lithospemum canescens (Michx)

Finged puccoon  
Lithosperum incisum Lehm

Hairy puccoon  
Lithospernum caroliniense (walter) MacM

False Gromwell  
Onosmodium molle Michx

Spring cress  
cardamine bulbosa (Schreber) BSP

Little prickly pear  
Opuntia humifusa (Raf)

Little Prickley Pear  
Opuntia fragilis (Nutt) Haw

Spiked Lobelia  
Lobelia spicata Lam

Giant lobelia  
Lobelia siphilitica L

Sleepy Catchfly  
Silene antirrhina L

Frost Weed  
Helianthemum bicknellii Fern

Flowering Spurge  
euphorbia corollata L

Toothed sputge  
Euphorbia dentata Michx

Spurge  
Euphorbia glyptosperma Engelm

Snow-On-The Mountain  
Euphorbia marginata Pursh

Fragrant false indigo  
Amorpha nana

Lead Plant  
Amorpha canescens Pursh

Milk Vetch  
Astragalus canadensis L

Ground Plum  
Astragalus crassicarpus Nutt.

Milk Vetch  
Astragalus lotiflorus Hooker

False indigo  
Baptisia bracteata Muhl ex Ell

White wild indigo  
Baptissia lactea (Raf) Thieret

Partridge Pea  
Chamaecrista fasciculata (Michx)
RattleBox Crotalaria sagittalis L
Nine Anther Dalea Dalea enneandra Nutt
Foxtail Dalea D. alopecuroides Wild
White Prairie Clover Petalostemon candidum ( Wild ) Michx
Purple Prairie Clover Petalostemon purpureum ( Vent ) Rydb
Prairie mimosa Desmanthus illinoensis ( Michx ) MacM
Show tick trefoil Desmodium canadense ( L ) DC
Illinois Tick Trefoil Desmodium illinoense Gray
Wild licorice Glycyrrhiza lepidota Pursh
March Vetchling Lathyrus palustris L
Wild Pea lathyrus venosus Muhl ex Willd
Round-Headed Bush Clover Lespedeza capitata Michx
Locoweed Oxytropis lambertii Pursh
Prairie Turnip Psoralea esculenta Pursh
Silverleaf Scurf-Pea Pediomelum argophyllum ( Pursh)
Trailing Wild Bean Strophostyles helvula ( L ) Ell
Wild Bean Strophostyles leiosperma ( T & G ) piper
Purple Vetch Vicia americana Muhl ex Wild
Downy gentian G puberula Michx
Cranesbill Geranium carolinianum L
Round-Fruited St. Johns Wort Hypericum sphaerocarpum Michx
Water Horehound Lycopus americanus Muhl ex Barton
Horsemint Monarda fistulosa L
Shelf heal Prunella vulgaris L
Narrow-Leaved Mt. Mint Pycnanthemum tenuifolium Schrader
Skullcap Scutellaria parvula Michx
Wood Sage Teucrium canadense L
Wild Flax Linum sulcatum Riddl
Stiff Flax Linum rigidum Pursh
Winged Loosestrife Lythrum alatum Pursh
Wild Four-O-Clock Mirabilis nyctaginea ( Michx ) MacM
Hairy Four-O-Clock Mirabilis hirsuta ( Pursh ) MacM
Toothed Evening Primerose Calylophus serrulatus ( Nutt ) Raaven
Prairie sunrops Oenothera pilosella Raf
Ragged Evening Priemerose Oenothera laciniata Hill
Purple-Leaved-Willow Herb Epilobium coloratum Biehler
Biennial Gaura Gaura biennis L
Scarlet Gaura Gaura coccinea Pursh
Gray Evening Primerose Oenothera villosa Thunb
Sand Primerose Oneohera rhombipetala Nutt
Violet wood sorrel Oxalis violacea L
Plantain Plantago patagonica Jacq
Prairie Phlox Phlox pilosa L
Whorled Milkwort Polygala verticillata L
Pennsylvania Smartweed Polygonum pensylvanicum
Fringed Loosestrife Lysimachia ciliata L
Canada Anemone Anemone canadensis L
Thimbleweed Anemone cylindrica Gray
<table>
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<th>Plant Name</th>
<th>Scientific Name</th>
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<td>Prairie Larkspur</td>
<td>Delphinium virescens Nutt</td>
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<td>Pasque Flower</td>
<td>Pulsatilla patens (L) P Miller</td>
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<td>Ranunculus pensylvanicus L F</td>
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<td>Purle Meadow-Rue</td>
<td>Thalictrum dasycapum Fischer &amp; Ave-Lall</td>
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<td>Redroot</td>
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<td>Rosa carolina L</td>
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<td>Galium poreale L</td>
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<td>Hoary Vervain</td>
<td>Verben stricta Vent</td>
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<td>Narrow-Leaved Vervain</td>
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<td>White Vervain</td>
<td>Verbena urticifolia L</td>
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<td>Yucca glauca Nutt ex Fraser</td>
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<td>Tradescantia bracteata Small</td>
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<td>Tradescantia ohiensis Raf</td>
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<td>Sedge</td>
<td>Carex gravida Bailey</td>
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<tr>
<td>Sedge</td>
<td>Carex brevior (Dewey) Mack ex Lunell</td>
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<tr>
<td>Sedge</td>
<td>Carex bicknellii Britton</td>
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<tr>
<td>Blue Flag</td>
<td>Viraginica var shrevie (Small)</td>
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<tr>
<td>Blue Eyed Grass</td>
<td>Sisyrinchium campestrae Bickn</td>
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<tr>
<td>Wild Onion</td>
<td>Allium canadense L</td>
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<tr>
<td>Wild Prairie Onion</td>
<td>Allium stellatum Nutt ex Ker- Gawl</td>
</tr>
<tr>
<td>Yellow Stargrass</td>
<td>Hypoxis hirsuta (L) Cov</td>
</tr>
<tr>
<td>Michigan Lily</td>
<td>Lilium michiganense Farw</td>
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<tr>
<td>Bunch-Flower</td>
<td>Veratrum virginicum (L) Ait f</td>
</tr>
<tr>
<td>Western prairie finged orchid</td>
<td>Platanthera praecella Sheviak &amp; Bowles</td>
</tr>
<tr>
<td>Nodding ladies-tresses</td>
<td>Spiranthes cernua (L) L C Rich</td>
</tr>
<tr>
<td>Scientific Name</td>
<td>Common Name</td>
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<tr>
<td>-----------------------------------------------------</td>
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</tr>
<tr>
<td>Western wheatgrass</td>
<td>Agropyron smithii Rydb</td>
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<tr>
<td>Slender Wheatgrass</td>
<td>Agropyron trachycaulum (Link) Malte</td>
</tr>
<tr>
<td>Big Bluestem</td>
<td>Andropogon gerardii Vitman</td>
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<tr>
<td>Side-oats grama</td>
<td>Bouteloua Curtipendula (Michx)</td>
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<td>Hairy Grama</td>
<td>Bouteloua hirsuta Lag</td>
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<td>Blue Grama</td>
<td>Bouteloua gracilis (Wild ex HBK)</td>
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<td>Bluejoint</td>
<td>Calamagrosits canadensis (Michx)</td>
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<td>Sand-Reed-Grass</td>
<td>Calamoavilfa longifolia (Hooker)</td>
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<tr>
<td>Rosette panic grass</td>
<td>Dichanthelium acuminatum (Sw)</td>
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<tr>
<td>Scribners panic grass</td>
<td>Panicum scribnerianum Nash</td>
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<tr>
<td>Wilcox Panic Grass</td>
<td>Panicum wilcoxiunum Vasey</td>
</tr>
<tr>
<td>Leiberg Panic Grass</td>
<td>Panicum leibergii (Vasey) Scribner</td>
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<tr>
<td>Rosette Panic Grass</td>
<td>Panicum linearifolium Scribner</td>
</tr>
<tr>
<td>Canada Wild Rye</td>
<td>Elymus canadensis L</td>
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<tr>
<td>Fescue Grass</td>
<td>Festuca paradoxa Desv.</td>
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<tr>
<td>June Grass</td>
<td>Koeleria macrantha (Ledeb) Schultes</td>
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<td>Marsh Muhly</td>
<td>Muhlenbergia racemosa (Michx) BSP</td>
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<tr>
<td>Plains Muhly</td>
<td>Muhlenergia cuspidata (Torrey) Rydb</td>
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<td>Switchgrass</td>
<td>Panicum virgatum L</td>
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<td>Reed Canary Grass</td>
<td>Phalaris arundinacea L</td>
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<tr>
<td>Fowl Meadow Grass</td>
<td>Poa palustris L</td>
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<td>Little bluestem</td>
<td>Schizachyrium scoparium (Michx)</td>
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<td>Indian Grass</td>
<td>Sorghastrum nutans (L) Nash</td>
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<tr>
<td>Cord grass</td>
<td>Spartina pectinata Link</td>
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<tr>
<td>Tall dropseed,rough dropseed</td>
<td>Sporobolus asper (Mihx) Kunth</td>
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<tr>
<td>Prairie Dropseed</td>
<td>Sporobolus heterolepis (Gray) Gray</td>
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<tr>
<td>Porcupine Grass</td>
<td>Stipa spartea Trin</td>
</tr>
<tr>
<td>Green Needlegrass</td>
<td>Stipa viridula Trin</td>
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Glossary of Forestry Terms
Acre: An area of land containing 43,560 square feet, roughly the size of a football field, or a square that is 208 feet on a side. A “forty” of land contains 40 acres and a “section” of land contains 640 acres.

All-aged: An uneven-aged stand that represents all ages or age classes from seedlings to mature trees.

Annual ring: Trees in climates where growths stops or slows during portion of the year will form annual rings which can be read to determine tree age and growth. The science of dendrochronology studies tree rings to infer knowledge about past climatic conditions, based on the fact that trees will form wider annual rings during seasons when growing conditions are favorable and narrow rings when not. Annual rings are highly visible in species that form less dense wood during favorable growing conditions early in the season and denser wood 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 means the cross sectional area of a tree at a point 4.5 feet above the ground line expressed in square feet. The sum of all the trees on an acre is a measure of the density of the population of trees growing on the acre and is useful for making forest management decisions. A helpful way to think of basal area is to imagine all the trees on an acre cut off with 4.5 foot stumps. Basal area on the acre could be measured by measuring and totaling the cross sectional area of all stumps. Fortunately, it is not necessary to cut trees to measure basal area. It 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 these levels.

Board foot: A unit of measure wood 1” thick and 1 foot on each side equaling 1/12 cubic foot of wood. In practice, a board foot seldom contains 1/12 of a cubic foot due to loss from surfacing such as planning and sanding. For example, an 8 foot 2x4 would be said to have 5 and 1/3 board feet, but would actually be more like 4.08 board feet after losses from surfacing.

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

Canker: An imperfection on the trunk, limb or twig of a tree caused by an organism that kills a part of the tree’s tissue. Canker causing organisms sometimes exist in some sort of a balance with the host, never killing enough tissue to cause death. Cankers tend to weaken trees to eventually break.
**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 re-growth of certain valuable tree species which need a lot of sunlight to grow, such as oaks and walnut. Clearcutting also confers certain benefits for many wildlife species.

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

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

**Coppice:** All trees in the previous stand are cut and the majority of regeneration is from sprouts or roots suckers. Coppice selection-only selected stems of merchantable size are cut at each felling, giving uneven-aged stands. Coppice with reserves- reserve trees are retained to attain goals other than regeneration.

**Cord:** A unit of measure of wood that is equivalent to a pile of round wood 4 feet wide, 8 feet long and 4 feet high. A cord contains 128 cubic feet of wood and space.

**Cover type:** Expressed as the tree species having the greatest 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:** Natural stands of trees start out with thousands of trees per acre. Planted stands may contain 500 to 1500 trees per acre. At maturity, due to constraints of space, nutrient availability and the increased size of individual trees, there can be only 50 to 70 trees per acre. 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 or wildlife values, but are almost always selected on an economic basis. In Iowa selected trees would mostly likely consist of walnut and red and white oak. Selected trees would be straight with long, clear boles and would be the trees bringing the best dollar return upon maturity.

**Crown:** Refers to that part of the tree consisting of limbs, branches, twigs and leaves; in other words, the top of the tree.

**Cruise:** A survey of forest land to locate timber and estimate its quantity by species, products, size, quality, or other characteristics.

**Cubic foot:** A wood volume measurement. A cubic foot of wood contains approximately six to 10 usable board feet of wood. A cord of wood equals 128 cubic feet.

**Cull:** Refers to a tree having no commercial value, usually from having rot, holes, large knots or being crooked rather than from being too small or of a non-merchantable species. It is important to note that a cull, though having no commercial value may have wildlife, aesthetic or other value.
**Cultural practice:** The manipulation of vegetation to meet objectives of controlling stand composition or structure, such as site improvement, forest tree improvement, increased regeneration, increased growth, or measures to control insects or disease.

**D.B.H.:** Stands for diameter at breast high. Always taken as 4.5 feet above the ground, that being a convenient height at which to measure a tree’s diameter. For trees on a slope, dbh is taken at 4.5 feet from the ground on one of the two sides of the tree that is at right angles to the direction of slope.

**Defect:** An imperfection in a tree making it less desirable for some purpose. The term is commonly used to refer to some imperfection that will reduce the value of a tree or log for a product, resulting in reduced monetary value.

**Den tree:** A tree that has a hole in its stem that can be used as shelter by wildlife such as birds and mammals.

**Disturbance:** Any event, either natural or human induced, that alters the structure, composition, or functions of an ecosystem. Examples include forest fires, insect infestation, 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 imber harvest) to mature forest consisting primarily of long-lived species such as sugar maple and white pine. 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 (e.g. fire, windstorm, or timber harvest). Examples of early successional forest tree species are aspen, paper birch, and jack pine. Each stage of succession provides different benefits 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.

**Floodplain Forest:** 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 periodically.

**Forest:** A forest is an ecosystem, an association of plants and animals. Trees are its dominant feature. They provide many of the benefits of forests like habitat, quality water, recreation, climatic amelioration and wood products. The plants and animals that make up a forest are inter-dependent and often essential to its integrity.
**Forester:** A professional engaged in the science and profession of forestry—note foresters are commonly credentialed 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; the requirements for credentialing differ and usually include earning a baccalaureate degree in forestry, sometimes equivalent experience, and usually passing a comprehensive examination.

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

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

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

**Forest inventory:** A set of objective sampling methods designed to quantify the spatial distribution, composition, and rates of change of forest parameters within specified levels of precision for the purposes of management. The listing (enumeration) of data from such a survey-synonym cruise, forest survey—note inventories may be made of all forest resources including trees and other vegetation, fish, insects, and wildlife, as well as street trees and urban forest trees—see dynamic sampling, point sampling.

**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:** A practice in which the quality of a residual forest stand is improved by removing less desirable trees and large shrubs to achieve the desired stocking of the best quality trees or to improve the reproduction, composition, structure, condition, and 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 the crop trees.

**Game species:** In this plan, game species include those terrestrial species that are hunted and trapped.

**Gap:** The space occurring in forest stands due to individual tree or groups of trees mortality or blown down. Gap management uses timber harvest methods to emulate this type of forest spatial pattern.
**Geographic information system (GIS):** Computer software used to manipulate, analyze, and visually display inventory and other data and prepare maps of the same 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:** Hardwood as opposed to softwood is a relative term. Hardwoods are generally defined as the woods of deciduous trees, i.e., trees which shed their leaves in the winter.

**Harvesting vs. silvicultural treatment:** The meanings of these two terms are often confused by lay people and sometimes by professionals. Many silvicultural treatments involve harvesting, but not all harvesting is silvicultural treatment. Harvesting is a silvicultural treatment. Harvesting is a silvicultural treatment when its purpose is to shape the residual stand or to affect regeneration. Often the two purposes are accomplished simultaneously. Of course, harvesting can be done simply to remove an existing crop, but this is not management and therefore the operation cannot be called a silvicultural treatment.

**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 ills, 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 controlling (managing) the composition and structure of forest land. For example, to protect land from erosion, to maintain wildlife habitat, to grow wood for profit, etc.

**Management objectives:** Defined conditions for the property, or segments of property(e.g. stands or management units), that will achieve management goals. For example, maintenance of continuous forest cover may be the only objective if watershed protection is the primary goal. Another objective may be to grow tree species with highest yields in order to maximize returns from wood production.

**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 and the intended use.
Merchantable timber: Trees or stands having the size, quality, and condition suitable for marketing under a given economic condition, even if not immediately accessible for logging.

Mesic: Moderately moist.

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

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. These groups of native plants form recognizable units, such as an oak forest, prairie, or marsh that tend to reoccur over space and time. Native plants communities are classified and described by physiognomy, hydrology, landforms, soils, and natural disturbance regimes (e.g., wild fires, wind storms, normal flood cycles).

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

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

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

Non-game species: In this plan, non-game species include amphibians, reptiles, and those mammal 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 in diameter at a point 4.5 feet above the ground. In referring to a stand of trees the upper limit holds, however, when referring to processed round wood, pieces larger than 12.9 inches in diameter could be correctly referred to as poles.

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.

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 fire line 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. Several years after pruning the resulting wound will have grown over and the wood that grows over the site of the former branch will be clear, that is knot free. Pruning is a component of FSI.

**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.

**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 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 habitat factor will create new habitat that will be of higher quality for wildlife.

**Riparian:** Related to, living, or located in conjunction with a wetland, on the bank of a river or stream but also at the edge of a lake.

**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.

**Rotation age:** The period of years between when a forest stand (i.e., primarily even-aged) is established (i.e., regeneration) and when it receives its final harvest. This time period is an administrative decision based on economics, site conditions, growth rates, and other factors.

**Round wood.** Wood products that are used in their original form, only being cut to length. Includes firewood, posts, and pulpwood and similar products.

**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. When a tree has grown to a diameter of a 3.5 inches in diameter at a point 4.5 feet above the ground it is no longer a sapling, having become a pole.

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

**Savanna:** Natural grassland, generally with a scattering of trees or shrubs.

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

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

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

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

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

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

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

**Selection harvest:** A method of harvesting whereby individual trees are selected for harvest. A characteristic is that the form and appearance of the forest is maintained and the site is not exposed to sunlight and weathering. This scheme favors a tree species which tolerate shading such as maple and basswood. It also benefits certain wildlife 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. Tolerant species tolerate shade, while intolerant species require full sunlight.

**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 reseed the area. After the new stand is well established, the residual trees are harvested. This method is used to regenerate species not tolerate of shading.
**Shelterwood harvest:** A harvest cutting in which trees in the harvest area are removed in a series of two or more cuttings to allow the establishment and early growth of new seedlings under partial shade and protection of older trees. Produces an even-aged forest.

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

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

**Silvicultural prescription:** Specific steps prescribed to achieve specific management objectives. Examples: If the management objectives is to maintain an oak component in a mixed stand, the silvicultural prescription may include opening up the forest canopy to initiate the establishment of seedlings of shade-intolerant oaks. If undesirable species are dominating the canopy and a desirable species is becoming in the understory, the silvicultural prescription may be to remove over story trees to release the suppressed species. Thinning and planting are other examples.

**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 left a logging operation. Though of little or no commercial value, they can be very valuable wildlife resources.

**Softwood.** Generally considered to be the wood of conifers, although the wood of some conifers is harder than some hardwoods. See the definition of hardwood for a further explanation.

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

**Stumpage:** According to Webster, the value of standing timber. Also, the timber itself or the right to cut it.
Succession: The natural replacement, over time, of one plant community with another.

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

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 own needs.

Thinning: A silvicultural treatment made to reduce the density of trees within a forest stand primarily 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 (very high stems per acre) stands to provide more growing space for crop trees that will be harvested in future years.

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 range.

Tolerance (shade tolerance): A plant’s ability to tolerate conditions under a forest canopy. Normally thought of as tolerance to low light conditions, but other understory conditions, such as root competition for water and nutrients, are also factors.

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

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

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

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

Uneven-aged stand: A stand with trees of three or more distinct age classes, either intimately 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 methods.
**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.

**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 more desirable 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 only 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. This habitat factor will favor early successional vegetation for wildlife benefiting from edge cover.
Threatened and Endangered Species
Threatened and Endangered Species
Forests and prairies are either full-time or part-time homes to many threatened and endangered species and species of concern. The lakes, streams and rivers that are contained or flow through these state lands are home to additional species. Maintaining or enhancing the habitat for protected species is always a concern and management activities are modified to address concerns. For example, while managing for the continuation of prairies may require periodic burning, not all the acres in an area are burned at the same time. Additionally, harvesting is generally conducted during the winter when disturbance to plant and animal species is minimized.

Areas are checked for known occurrences of protected or special species. When warranted, a specialist will conduct a site visit in the spring and summer. This information is then added to the growing database of knowledge.

“Endangered species” means any species of fish, plant life, or wildlife which is in danger of extinction throughout all or a significant part of its range. “Threatened species” means any species which is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range. “Special concern species” means any species about which problems of status or distribution are suspected, but not documented, and for which no special protection is afforded under state rules.

The following is a list of currently known species across the state. Some may be found on the Loess Hills State Forest. All are equally important and are accommodated when known to exist on a Forest, or if the correct habitat is present for them to exist.

The vastness of this list is not indicative of mismanagement. It is important to note that many species on this list are rare because: a) they are at the edge of their range (i.e.: desert species in Western Iowa) or their habitat requirements are so specific that their needs can only be met in a few areas.

Endangered animal species:

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
</tr>
<tr>
<td>Indiana Bat</td>
<td>Myotis sodalis</td>
</tr>
<tr>
<td>Plains Pocket Mouse</td>
<td>Perognathus flavescens</td>
</tr>
<tr>
<td>Red-backed Vole</td>
<td>Clethrionomys gapperi</td>
</tr>
<tr>
<td>Spotted Skunk</td>
<td>Spilogale putorius</td>
</tr>
<tr>
<td><strong>Birds</strong></td>
<td></td>
</tr>
<tr>
<td>Red-shouldered Hawk</td>
<td>Buteo lineatus</td>
</tr>
<tr>
<td>Northern Harrier</td>
<td>Circus cyaneus</td>
</tr>
<tr>
<td>Peregrine Falcon</td>
<td>Falco peregrinus</td>
</tr>
<tr>
<td>Piping Plover</td>
<td>Charadrius melodus</td>
</tr>
<tr>
<td>Common Barn Owl</td>
<td>Tyto alba</td>
</tr>
<tr>
<td>Least Tern</td>
<td>Sterna antillarum</td>
</tr>
<tr>
<td>Bald Eagle</td>
<td>Haliaeetus leucocephalus</td>
</tr>
<tr>
<td>King Rail</td>
<td>Rallus elegans</td>
</tr>
<tr>
<td>Short-eared Owl</td>
<td>Asio flammeus</td>
</tr>
</tbody>
</table>
## Fish

<table>
<thead>
<tr>
<th>Fish</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Sturgeon</td>
<td>Acipenser fulvescens</td>
</tr>
<tr>
<td>Pallid Sturgeon</td>
<td>Scaphirhynchus albus</td>
</tr>
<tr>
<td>Pugnose Shiner</td>
<td>Notropis anogenus</td>
</tr>
<tr>
<td>Weed Shiner</td>
<td>Notropis texanus</td>
</tr>
<tr>
<td>Pearl Dace</td>
<td>Semotilus margarita</td>
</tr>
<tr>
<td>Freckled Madtom</td>
<td>Noturus nocturnus</td>
</tr>
<tr>
<td>Bluntnose Darter</td>
<td>Etheostoma chlorosomum</td>
</tr>
<tr>
<td>Least Darter</td>
<td>Etheostoma microperca</td>
</tr>
</tbody>
</table>

## Reptiles

<table>
<thead>
<tr>
<th>Reptiles</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Mud Turtle</td>
<td>Kinosternon flavescens</td>
</tr>
<tr>
<td>Wood Turtle</td>
<td>Clemmys insculpta</td>
</tr>
<tr>
<td>Great Plains Skink</td>
<td>Eumeces obsoletus</td>
</tr>
<tr>
<td>Copperbelly Water Snake</td>
<td>Nerodia erythrogaster neglecta</td>
</tr>
<tr>
<td>Western Hognose Snake</td>
<td>Heterodon nasicus</td>
</tr>
<tr>
<td>Copperhead</td>
<td>Agkistrodon contortrix</td>
</tr>
<tr>
<td>Prairie Rattlesnake</td>
<td>Crotalus viridis</td>
</tr>
<tr>
<td>Massasauga Rattlesnake</td>
<td>Sistrurus catenatus</td>
</tr>
</tbody>
</table>

## Amphibians

<table>
<thead>
<tr>
<th>Amphibians</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue-spotted Salamander</td>
<td>Ambystoma laterale</td>
</tr>
<tr>
<td>Crawfish Frog</td>
<td>Rana areolata</td>
</tr>
</tbody>
</table>

## Butterflies

<table>
<thead>
<tr>
<th>Butterflies</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakota Skipper</td>
<td>Hesperia dacotae</td>
</tr>
<tr>
<td>Ringlet</td>
<td>Coenonympha tullia</td>
</tr>
</tbody>
</table>

## Land Snails

<table>
<thead>
<tr>
<th>Land Snails</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa Pleistocene Snail</td>
<td>Discus macclintocki</td>
</tr>
<tr>
<td>Minnesota Pleistocene Ambersnail</td>
<td>Novisuccinea new species A</td>
</tr>
<tr>
<td>Iowa Pleistocene Ambersnail</td>
<td>Novisuccinea new species B</td>
</tr>
<tr>
<td>Frigid Ambersnail</td>
<td>Catinella gelida</td>
</tr>
<tr>
<td>Briarton Pleistocene Vertigo</td>
<td>Vertigo briarensis</td>
</tr>
<tr>
<td>Bluff Vertigo</td>
<td>Vertigo meramecensis</td>
</tr>
<tr>
<td>Iowa Pleistocene Vertigo</td>
<td>Vertigo new species</td>
</tr>
</tbody>
</table>

## Fresh Water Mussels

<table>
<thead>
<tr>
<th>Fresh Water Mussels</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectacle Case</td>
<td>Cumberlandia monodonta</td>
</tr>
<tr>
<td>Slippershell</td>
<td>Alasmidonta viridis</td>
</tr>
<tr>
<td>Buckhorn</td>
<td>Tritogonia verrucosa</td>
</tr>
<tr>
<td>Ozark Pigtoe</td>
<td>Fusconaia ozarkensis</td>
</tr>
<tr>
<td>Bullhead</td>
<td>Plethobasus cyphus</td>
</tr>
<tr>
<td>Ohio River Pigtoe</td>
<td>Pleurobema sintoxia</td>
</tr>
<tr>
<td>Slough Sandshell</td>
<td>Lampsis teres</td>
</tr>
<tr>
<td>Yellow Sandshell</td>
<td>Lampsis teres anodontoides</td>
</tr>
<tr>
<td>Higgin’s-eye Pearly Mussel</td>
<td>Lampsis higginis</td>
</tr>
</tbody>
</table>
### Threatened animal species:

**Mammals**
- Least Shrew: *Cryptotis parva*
- Southern Bog Lemming: *Synaptomys cooperi*

**Birds**
- Long-eared Owl: *Asio otus*
- Henslow’s Sparrow: *Ammodramus henslowii*

**Fish**
- Chestnut Lamprey: *Ichthyomyzon castaneus*
- American Brook Lamprey: *Lampetra appendix*
- Grass Pickerel: *Esox americanus*
- Blacknose Shiner: *Notropis heterolepis*
- Topeka Shiner: *Notropis topeka*
- Western Sand Darter: *Ammocrypta clara*
- Black Redhorse: *Moxostoma duquesnei*
- Burbot: *Lota lota*
- Orangethroat Darter: *Etheostoma spectabile*

**Reptiles**
- Slender Glass Lizard: *Ophisaurus attenuatus*
- Common Musk Turtle: *Sternotherus odoratus*
- Blanding’s Turtle: *Emydoidea blandingii*
- Ornate Box Turtle: *Terrapene ornata*
- Diamondback Water Snake: *Nerodia rhombifera*
- Western Worm Snake: *Carphophis amoenum vermis*
- Speckled Kingsnake: *Lampropeltis getulus*

**Amphibians**
- Mudpuppy: *Necturus maculosus*
- Central Newt: *Notophthalmus viridescens*
- Butterflies: *Oarisma powesheik*
- Powesheik Skipperling: *Problem byssus*
- Mulberry Wing: *Poanes massasoit*
- Silvery Blue: *Glaucopsyche lygdamus*
- Baltimore: *Euphydryas phaeton*

**Snails**
- Midwest Pleistocene Vertigo: *Vertigo hubrichti*
- Occult Vertigo: *Vertigo occulta*

**Fresh Water Mussels**
- Cylinder: *Anodontaferussacianus*
- Strange Floater: *Strophitus undulatus*
- Creek Heelsplitter: *Lasmigona compressa*
- Purple Pimpleback: *Cyclonaias tuberculata*
- Butterfly: *Ellipsaria lineolata*
- Ellipse: *Venustaconcha ellipsoides*
Special concern animal species:

**Mammals**
Southern Flying Squirrel  
Glaucomys volans

**Birds**
Forester’s Tern  
Sterna forsteri
Black Tern  
Chlidonias niger

**Fish**
Pugnose Minnow  
Notropis emiliae
Pirate Perch  
Aphredoderus sayanus

**Reptiles**
Smooth Green Snake  
Opheodrys vernalis
Bullsnake  
Pituophis catenifer sayi

**Butterflies**
Dreamy Duskywing  
Erynnis icelus
Sleepy Duskywing  
Erynnis brizo
Columbine Duskywing  
Erynnis luciliius
Wild Indigo Duskywing  
Erynnis baptisiae
Ottoe Skipper  
Hesperia ottoe
Leonards Skipper  
Hesperia l. leonardus
Pawnee Skipper  
Hesperia leonardus pawnee
Beardgrass Skipper  
Atrytone arogos
Zabulon Skipper  
Poanes zabulon
Broad-winged Skipper  
Poanes viator
Sedge Skipper  
Euphyes dion
Two-spotted Skipper  
Euphyes bimacula
Dusted Skipper  
Atrytonopsis hianna
Salt-and-pepper Skipper  
Amblyscirtes hegon
Pipevine Swallowtail  
Battus philenor
Zebra Swallowtail  
Eurytides marcellus
Olympia White  
Euchloe olympia
Purplish Copper  
Lycaena helioydes
Acadian Hairstreak  
Satyrium acacidum
Edward’s Hairstreak  
Satyrium edwardsii
Hickory Hairstreak  
Satyrium caryaevorum
Striped Hairstreak  
Satyrium liparops
Swamp Metalmark  
Calephelis mutica
Regal Fritillary  
Speyeria idalia
Baltimore  
Euphydryas phaeton ozarkae
**Endangered, threatened, and special concern plants.** The natural resource commission, in consultation with scientists with special knowledge and experience, determined the following plant species to be endangered, threatened, or of special concern in Iowa.

*Endangered plant species:*

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pale false foxglove</td>
<td>Agalinus skinneriana</td>
</tr>
<tr>
<td>Blue giant-hyssop</td>
<td>Agastache foeniculum</td>
</tr>
<tr>
<td>Bearberry</td>
<td>Arctostaphylos uva-ursi</td>
</tr>
<tr>
<td>Black chokeberry</td>
<td>Aronia melanocarpa</td>
</tr>
<tr>
<td>Eared milkweed</td>
<td>Asclepias engelmanniana</td>
</tr>
<tr>
<td>Mead’s milkweed</td>
<td>Asclepias meadi</td>
</tr>
<tr>
<td>Narrow-leaved milkweed</td>
<td>Asclepias stenophylla</td>
</tr>
<tr>
<td>Ricebutton aster</td>
<td>Aster dudosus</td>
</tr>
<tr>
<td>Large-leaved aster</td>
<td>Aster macrophyllus</td>
</tr>
<tr>
<td>Schreber’s aster</td>
<td>Aster schreberi</td>
</tr>
<tr>
<td>Fern-leaved false foxglove</td>
<td>Aureolaria pedicularia</td>
</tr>
<tr>
<td>Matricary grape fern</td>
<td>otrychium matricariifolium</td>
</tr>
<tr>
<td>Poppy mallow</td>
<td>Callirhoe triangulata</td>
</tr>
<tr>
<td>Cordroot sedge</td>
<td>Carex chordorrhiza</td>
</tr>
<tr>
<td>Large-bracted corydalis</td>
<td>Corydalis curvisilqua</td>
</tr>
<tr>
<td>Silky prairie-clover</td>
<td>Dalea villosa</td>
</tr>
<tr>
<td>Swamp-loosestrife</td>
<td>Decodon verticallatus</td>
</tr>
<tr>
<td>Northern panic-grass</td>
<td>Dichanthelium boreale</td>
</tr>
<tr>
<td>Roundleaved sundew</td>
<td>Drosera rotundifolia</td>
</tr>
<tr>
<td>False mermaid</td>
<td>Floerkea proserpinacoidies</td>
</tr>
<tr>
<td>Bog bedstraw</td>
<td>Galium labradoricum</td>
</tr>
<tr>
<td>Povertygrass</td>
<td>Hudsonia tomentosa</td>
</tr>
<tr>
<td>Northern St. Johnswort</td>
<td>Hypericum boreale</td>
</tr>
<tr>
<td>Pineweed</td>
<td>Hypericum gentianoides</td>
</tr>
<tr>
<td>Winterberry</td>
<td>Ilex verticillata</td>
</tr>
<tr>
<td>Black-based quillwort</td>
<td>Isoetes melanopoda</td>
</tr>
<tr>
<td>Water-willow</td>
<td>Justicia americana</td>
</tr>
<tr>
<td>Dwarf dandelion</td>
<td>Krigia virginica</td>
</tr>
<tr>
<td>Cleft conoea</td>
<td>Leucoespora multifida</td>
</tr>
<tr>
<td>Whiskbroom parsley</td>
<td>Lomatium foeniculaceum</td>
</tr>
<tr>
<td>Running clubmoss</td>
<td>Lycopodium clavatum</td>
</tr>
<tr>
<td>Bog clubmoss</td>
<td>Lycopodium inundatum</td>
</tr>
<tr>
<td>Annual skeletonweed</td>
<td>Lygodesmia rostrata</td>
</tr>
<tr>
<td>Water marigold</td>
<td>Megalodonta beckii</td>
</tr>
<tr>
<td>Northern lungwort</td>
<td>Mertensia paniculata</td>
</tr>
<tr>
<td>Bigroot pricklypear</td>
<td>Opuntia macrorhiza</td>
</tr>
<tr>
<td>Clustered broomrape</td>
<td>Orobanche fascilulata</td>
</tr>
<tr>
<td>Ricegrass</td>
<td>Oryzopsis pungens</td>
</tr>
<tr>
<td>Cinnamon fern</td>
<td>Osmunda cinnamomea</td>
</tr>
<tr>
<td>Purple cliffbrake</td>
<td>Pellaea atropurpurea</td>
</tr>
<tr>
<td>Arrow arum</td>
<td>Peltandra virginica</td>
</tr>
</tbody>
</table>
Pale green orchid
Eastern prairie fringed orchid
Clammyweed
Crossleaf milkwort
Purple milkwort
Jointweed
Douglas’ knotweed
Three-toothed cinquefoil
Canada plum
Frenchgrass
Pink shinleaf
Prickly rose
Meadow spikemoss
Rough-leaved goldenrod
Bog goldenrod
Yellow-lipped ladies-tresses
Pickering morning-glory
Rough-seeded fameflower
Waxy meadowrue
Long beechfern
Large-leaved violet
Rusty woodsia
Yellow-eyed grass

Threatened plant species:

Northern wild monkshood
Round-stemmed false foxglove
Nodding wild onion
Fragrant false indigo
Virginia snakeroot
Woolly milkweed
Showy milkweed
Forked aster
Rush aster
Flax-leaved aster
Water parsnip
Kittentails
Bog birch
Pagoda plant
Leathery grapefern
Little grapefern
Sweet Indian-plantain
Poppy mallow
Pipsissewa
Golden saxifrage
Dayflower

Platanthera flava
Platanthera leucophaea
Polansia jamesii
Polygala cruciata
Polygala polygama
Polygonella articulata
Polygonum douglasii
Potentilla tridentata
Prunus nigra
Psoralea onobrychis
Pyrola asarifolia
Rosa acicularis
Selaginella eclipes
Solidago patula
Solidago uliginosa
Spiranthes lucida
Stylosa pickeringii
Talinum rugospermum
Thalictrum revolutum
Thelypteris phegopteris
Viola incognita
Woodsia ilvensis
Xyris torta

Aconitum noveboracense
Agalinus gattingerii
Allium cernuum
Amorpha nana
Aristolochia serpentaria
Asclepias lanuginosa
Asclepias speciosa
Aster furcatus
Aster junciformis
Aster linariifolius
Berula erecta
Besseya bullii
Betula pumila
Blephilia ciliata
Botrychium multifidum
Botrychium simplex
Cacalia suaveolens
Callirhoe alcaeoides
Chimaphila umbellata
Chrysosplenium iowense
Commelina erecta
Spotted coralroot
Bunchberry
Golden corydalis
Pink corydalis
Showy lady’s-slipper
Slim-leaved panic-grass
Jeweled shooting star
Glandular wood fern
Marginal shield fern
Woodland horsetail
Slender cottongrass
Yellow trout lily
Queen of the prairie
Blue ash
Black huckleberry
Oak fern
Green violet
Twinleaf
Creeping juniper
Intermediate pinweed
Hairy pinweed
Prairie bush clover
Twinflower
Western parsley
Wild lupine
Tree clubmoss
Rock clubmoss
Hairy watercress
Bog buckbean
Winged monkeyflower
Yellow monkeyflower
Partridge berry
Pinesap
Small sundrops
Little pricklypear
Royal fern
Philadelphia panic-grass
Slender beardtongue
Hooker’s orchid
Northern bog orchid
Western prairie fringed orchid
Purple fringed orchid
Pink milkwort
Silverweed
Shrubby cinquefoil
Pennsylvania cinquefoil
One-sided shinleaf
Meadow beauty
Corallorhiza maculata
Cornus canadensis
Corydalis aurea
Corydalis sempervirens
Cypripedium reginae
Dichanthelium linearifolium
Dodecatheon amethystinum
Dryopteris intermedia
Dryopteris marginalis
Equisetum sylvaticum
Eriophorum gracile
Erythronium americanum
Filipendula rubra
Fraxinus quadrangulata
Gaylussacia baccata
Gymnocarpium dryopteris
Hybanthus concolor
Jeffersonia diphylla
Juniperus horizontalis
Lechea intermedia
Lechea villosa
Lespedeza leptostachya
Linnaea borealis
Lomatium orientale
Lupinus perennis
Lycopodium dendroideum
Lycopodium porophyllum
Marsilea vestita
Menyanthes trifoliata
Mimulus alatus
Mimulus glabratus
Mitchella repens
Monotropa hypopitys
Oenothera perennis
Opuntia fragilis
Osmunda regalis
Panicum philadelphicum
Penstemon gracilis
Platanthera hookeri
Platanthera hyperborea
Platanthera praeclara
Platanthera psycodes
Polygala incarnata
Potentilla anserina
Potentilla fruticosa
Potentilla pensylvanica
Pyrola secunda
Rhexia virginica
Beaked rush  
Northern currant  
Shining willow  
Bog willow  
Low nutrush  
Buffaloberry  
Scarlet globemallow  
Slender ladies-tresses  
Oval ladies-tresses  
Hooded ladies-tresses  
Spring ladies-tresses  
Rosy twisted-stalk  
Fameflower  
Large arrowgrass  
Small arrowgrass  
Low sweet blueberry  
Velvetleaf blueberry  
False hellebore  
Kidney-leaved violet  
Oregon woodsia  

Rhynchospora capillacea  
Ribes hudsonianum  
Salix lucida  
Salix pedicellaris  
Scleria verticillata  
Shepherdia argentea  
Sphaeralcea coccinea  
Spiranthes lacera  
Spiranthes ovalis  
Spiranthes romanzoffiana  
Spiranthes vernalis  
Streptopus roseus  
Talinum parviflorum  
Triglochin maritimum  
Triglochin palustre  
Vaccinium angustifolium  
Vaccinium myrtilloides  
Veratrum woodii  
Viola renifolia  
Woodsia oregano  

Special concern plant species:

Balsam fir  
Three-seeded mercury  
Three-seeded mercury  
Mountain maple  
Moschatel  
Water plantain  
Wild onion  
Amaranth  
Lanceleaf ragweed  
Saskatoon serviceberry  
Low serviceberry  
Raccoon grape  
Pearly everlasting  
Sand bluestem  
Broomsedge  
Purple angelica  
Purple rockcress  
Green rockcress  
Lakecress  
Fringed sagewort  
Common mugwort  
Pawpaw  
Curved aster  
Hairy aster  

Abies balsamea  
Acalypha gracilens  
Acalypha ostryifolia  
Acer spicatum  
Adoxa moschatellina  
Alisma gramineum  
Allium mutabile  
Amaranthus arenicola  
Ambrosia bidentata  
Amelanchier alnifolia  
Amelanchier sanguinea  
Ampelopsis cordata  
Anaphalis margaritacea  
Andropogon hallii  
Andropogon virginicus  
Angelica atropurpurea  
Arabis divaricarpa  
Arabis missouriensis  
Armoracia lacustris  
Artemisia frigida  
Artemisia vulgaris  
Asimina triloba  
Aster falcatus  
Aster pubentior
Prairie aster
Standing milkvetch
Bent milkvetch
Missouri milkvetch
Blue wild indigo
Yellow wild indigo
Prairie moonwort
Watershield
Buffalograss
Poppy mallow
Water-starwort
Grass pink
Low bindweed
Clustered sedge
Back’s sedge
Bush’s sedge
Carey’s sedge
Flowerhead sedge
Field sedge
Crawe’s sedge
Fringed sedge
Double sedge
Douglas’ sedge
Dry sedge
Thin sedge
Delicate sedge
Mud sedge
Hoplike sedge
Yellow sedge
Intermediate sedge
Backward sedge
Richardson’s sedge
Rocky Mountain sedge
Sterile sedge
Soft sedge
Deep green sedge
Tuckerman’s sedge
Umbrella sedge
Wild oats
Pink turtlehead
Fogg’s goosefoot
Missouri goosefoot
Coast blite
Bugbane
Hill’s thistle
Swamp thistle
Wavy-leaved thistle
Western clematis

Aster turbinellus
Astragalus adsurgens
Astragalus distortus
Astragalus missouriensis
Baptisia australis
Baptisia tinctoria
Botrychium campestre
Brasenia schreberi
Buchloe dactyloides
Callirhoe papaver
Callitriche heterophylla
Calopogon tuberosus
Calystegia spithamaea
Carex aggregata
Carex backii
Carex bushii
Carex careyana
Carex cephalantha
Carex conoidea
Carex crawei
Carex crinita
Carex diandra
Carex douglasii
Carex foena
Carex gracilescens
Carex leptalea
Carex limosa
Carex lupuliformis
Carex lurida
Carex media
Carex retroflexa
Carex richardsonii
Carex saximontana
Carex sterilis
Carex tenera
Carex tonsa
Carex tuckermanii
Carex umbellata
Chasmanthium latifolium
Chelone obliqua
Chenopodium foggii
Chenopodium missouriensis
Chenopodium rubrum
Cimicifuga racemosa
Cirsium hillii
Cirsium muticum
Cirsium undulatum
Clematis occidentalis
Blue-eyed Mary     Collinsia verna
Cancer-root      Conopholis americana
Fireberry hawthorn     Crataegus chrysocarpa
Red hawthorn        Crataegus coccinea
Two-fruit hawthorn   Crataegus disperma
Hawthorn            Crataegus pruinosa
Hawksbeard          Crepis runcinata
Prairie tea         Croton monanthogynus
Crotonopsis         Crotonopsis elliptica
Waxweed             Cuphea viscosissima
Dodder              Cuscuta indecora
Small white lady’s-slipper    Cypripedium candidum
Carolina larkspur    Delphinium carolinianum
Sessile-leaved tick trefoil    Desmodium sessilifolium
Fingergrass         Digitaria filiformis
Buttonweed          Diodia teres
Purple coneflower   Echinacea purpurea
Waterwort           Elatine triandra
Purple spikerush    Eleocharis atropurpurea
Green spikerush     Eleocharis olivacea
Oval spikerush      Eleocharis ovata
Dwarf spikerush     Eleocharis parvula
Few-flowered spikerush Elephantops purpurea
Wolf’s spikerush    Eleocharis pauciflora
Interrupted wildrye Eleocharis wolfii
Dwarf scouring rush Elymus interruptus
Ponygrass           Equisetum scirpoides
Tall cottongrass    Eragrostis reptans
Tawny cottongrass   Eriophorum angustifolium
Upland boneset      Eriophorum virginicum
Spurge              Eupatorium sessilifolium
Missouri spurge     Euphorbia commutata
Slender fimbristylis Euphorbia missurica
Umbrella grass      Fimbristylis autumnalis
Rough bedstraw      Fuirena simplex
Small fringed gentian Galium asperellum
Northern cranesbill Gentianopsis procera
Spring avens        Geranium bicknellii
Early cudweed       Geum vernum
Limestone oak fern   Gnaphalium purpureum
Bitterweed          Gymnocarpium robertianum
Hairy goldenaster   Helianthemum amarum
Common mare’s-tail  Heteranthera limosa
Canadian St. Johnswort Heteranthera reniformis
Drummond St. Johnswort Heterotheca villosa
White morning glory Hypericum drummondii
Ipomoea lacunosa
Sumpweed  
Alpine rush  
Toad rush  
Soft rush  
Green rush  
Edged rush  
Vasey’s rush  
Potato dandelion  
Pinweed  
Duckweed  
Creeping bush clover  
Silvery bladder-pod  
Wild flax  
Brook lobelia  
False loosestrife  
Crowfoot clubmoss  
Adder’s-mouth orchid  
Globe mallow  
Two-flowered melic-grass  
Ten-petaled blazingstar  
Millet grass  
Rock sandwort  
Naked mitrewort  
Scratchgrass  
Water milfoil  
Rough water milfoil  
Water milfoil  
Glade mallow  
Showy evening primrose  
Northern adders-tongue fern  
Louisiana broomrape  
Mountain ricegrass  
Gattinger’s panic-grass  
White beardtongue  
Cobaea penstemon  
Tube penstemon  
Cleft phlox  
Annual ground cherry  
Heart-leaved plantain  
Wood orchid  
Green fringed orchid  
Plains bluegrass  
Chapman’s bluegrass  
Weak bluegrass  
Bog bluegrass  
Meadow bluegrass  
Hairy Solomon’s-seal  
Large-leaved pondweed  

Iva annua  
Juncus alpinus  
Juncus bufonius  
Juncus effusus  
Juncus greenii  
Juncus marginatus  
Juncus vaseyi  
Krigia dandelion  
Lechea racemulosa  
Lemma perpusilla  
Lespedeza repens  
Lesquerella ludoviciana  
Linum medium  
Lobelia kalmii  
Ludwigia peploides  
Lycopus digitatum  
Malaxis unifolia  
Malvastrum hispidum  
Melica mutica  
Mentzelia decapetala  
Milium effusum  
Minuartia michauxii  
Mitella nuda  
Muhlenbergia asperifolia  
Myriophyllum heterophyllum  
Myriophyllum pinnatum  
Myriophyllum verticillatum  
Napaea dioica  
Oenothera speciosa  
Ophioglossum vulgatum  
Orobanche ludoviciana  
Oryzopsis asperifolia  
Panicum gattingeri  
Penstemon albidos  
Penstemon cobaea  
Penstemon tubiflorus  
Phlox bifida  
Physalis pubescens  
Plantago cordata  
Platanthera clavellata  
Platanthera lacera  
Poa arida  
Poa chapmaniana  
Poa languida  
Poa paludigena  
Poa wolfii  
Polygonatum pubescens  
Potamogeton amplifolius
Ribbonleaf pondweed
White-stemmed pondweed
Spiralled pondweed
Tussock pondweed
Vasey’s pondweed
Bird’s-eye primrose
Prionopsis
Mermaid weed
Dwarf cherry
Hortulan plum
Sand cherry
Lemon scurfpea
Crowfoot
Gmelin’s crowfoot
Buckthorn
Dwarf sumac
Northern gooseberry
Yellow cress
Swamp rose
Tooth-cup
Dewberry
Western dock
Widgeon grass
Prairie rose gentian
Sage willow
Sassafras
Tumblegrass
Schuchzeria
Sensitive briar
Hall’s bulrush
Prairie bulrush
Pedicelled bulrush
Smith’s bulrush
Torrey’s bulrush
Veiny skullcap
Wild stonecrop
Rock spikemoss
Butterweed
False golden ragwort
Knotweed bristlegrass
Virginia rockcress
Prairie dock
Burreed
Great plains ladies-tresses
Clandestine dropseed
Rough hedge-nettle
Needle-and-thread
White coralberry

Potamogeton epihydrus
Potamogeton praelongus
Potamogeton spirillus
Potamogeton strictifolius
Potamogeton vaseyi
Primula mistassinica
Prionopsis ciliata
Proserpinaca palustris
Prunus besseyi
Prunus hortulana
Prunus pumila
Psoralea lanceolata
Ranunculus circinatus
Ranunculus gmelinii
Rhamnus alnifolia
Rhus copallina
Ribes hirtellum
Rorippa sinuata
Rosa palustris
Rotala mosostris
Rubus hispidus
Rumex occidentalis
Ruppia maritima
Sabatia campestris
Salix candida
Sassafras albidum
Schedonaridus paniculatus
Schuchzeria palustris
Schrankia nuttallii
Scirpus hallii
Scirpus maritimus
Scirpus pedicellatus
Scirpus smithii
Scirpus torreyi
Scutellaria nervosa
Sedum ternatum
Selaginella rupestris
Senecio glabellus
Senecio pseudoaureus
Setaria geniculata
Sibara virginica
Silphium terebinthinaceum
Sparganium androcladum
Spiranthes magnicamporum
Sporobolus clandestinus
Stachys aspera
Stipa comata
Symphoricarpos albus
Eared false foxglove
Spiderwort
Humped bladderwort
Flat-leaved bladderwort
Small bladderwort
Valerian
American brookline
Marsh speedwell
Maple-leaved arrowwood
Black arrowwood
Black haw
Spurred violet
Lance-leaved violet
Macloskey’s violet
Pale violet
Summer grape
Frost grape
Tomanthera auriculata
Tradescantia virginiana
Utricularia gibba
Utricularia intermedia
Utricularia minor
Valeriana edulis
Veronica americana
Veronica scutellata
Viburnum acerifolium
Viburnum molle
Viburnum prunifolium
Viola adunca
Viola lanceolata
Viola macloskeyi
Viola striata
Vitis aestivalis
Vitis vulpine