VEGETATION MANAGEMENT ALTERNATIVES
FOR
WILDERNESS PARK

DRAFT

INTRODUCTION

The focus for this document is providing alternatives for manipulating the vegetation within Wilderness Park.

Though all the previous studies have stated the basic historical data, it is important to briefly include the same information in this document. Wilderness Park was established in 1972 and is owned by Lancaster County. There are 1,475 acres in the park.

The purposes for the park (as stated by the Ecosystem Report of Wilderness Park by EA Engineering, Science, and technology, Inc.) are:

- $ Providing low cost flood protection for Lincoln;
- $ Providing public access to a natural area;
- $ Providing education regarding the interaction of natural populations with urban development
- $ Providing a historical, cultural, and archaeological record of the area; and
- $ Establishing a model for greenspace areas that could be replicated in other parts of the County

Numerous studies have been done addressing Wilderness Park. From those studies, a map of various vegetation types was developed. (See attached map). Any disagreement with the description and spatial location of the types of vegetation within Wilderness Park must be referred to the authors of the enclosed vegetation map. This DRAFT plan simply accepts the vegetation types and descriptions from the previous studies and uses that information to develop a variety of management alternatives.

The existing vegetation map was scanned into a computer. The acreage for each unit was determined from the scanned images however, as with any technology, there may be errors. The actual size of the units is as accurate as the ability for the computer program to calculate the area of irregular shaped polygons.

DISCUSSION OF SOME GENERAL ECOLOGICAL PRINCIPLES

It is important to understand what will happen within the Park without management.

Doing nothing is a form of management. However, doing nothing does not equate with nothing changing. Doing nothing in Wilderness Park, i.e. letting nature takes its course, will result in some very specific changes.

The grassland areas will be invaded by shrubs and trees. Gradually, the trees will become thick and a small diameter (sapling 1"-4") woodland will develop. Sapling woodlands are generally very dense with large numbers of stems/acre. Very dense shade in the forest floor allows only extremely shade tolerant plants to grow in the shade. The forest floor tends to be bare of a forb or shrub component.

The sapling forest condition ever so gradually begins moving into a pole size (4"-11") stand. More sunlight reaches the forest floor and shade tolerant forbs and shrubs begin establishing. Since hackberry is the most shade tolerant native tree, hackberry seedlings establish in large numbers.

Trees continue growing and with time, the pole size trees grow and a mature (11"+) forest environment develops. In a mature forest, a rich forest floor community of shade tolerant plants develops beneath the mature tree canopy.

The dominant tree regeneration will be hackberry because it is shade tolerant. Bitternut hickory also is shade tolerant and in places where bitternut hickory is close, the hickory will occupy a similar role as hackberry. However, bitternut hickory has an extremely limited distribution within the park, therefore the area of bitternut hickory reproduction will most likely be limited to a minor component of the Park.

Eventually, trees get old and die. In a mature forest in eastern Nebraska, the opening in the canopy created by the death of large mature tree is usually occupied by the advanced hackberry reproduction. Given a long time frame without disturbances, forests in eastern Nebraska gradually become dominated by hackberry.

It is important to realize there are realistic, expected and unexpected disturbances that could (and probably will) happen. These disturbances impact the species composition.

Predictable disturbances include Dutch elm disease, flooding, wildfire, and the impact of deer and rabbits. Natural oak regeneration is only going to get established in open fields where there is full sunlight. In those open fields, acorns sprout each year but the seedlings are eaten by deer and rabbits resulting in very little oak reproduction.

Elms are often a major component in the sapling stage forest but between sapling and pole size is when major loss occurs from Dutch elm disease. The openings in the canopy allows other species to become part of the woodland canopy.

Flooding will occur in Wilderness Park. Eventually major flooding will create major changes in

the stream channel such as cutting new channels and abandoning old channels. Trees will be destroyed leaving new areas for colonization by new and different vegetation.

The introduction of exotic woody plant species into Wilderness Park is occurring and in the future this could have a major impact on the previously described succession within the forest. One would expect an increase in the amount and kind of exotic plant species invading Wilderness Park as suburban landscapes get closer to the Park.

Eventually, there will be a wildfire in Wilderness Park. One would expect the most likely location for wildfires is in the grassland areas. Once started, however, the wildfire may burn into woodland environments.

Unexpected disturbances such as tornados or outbreaks of unknown insects/diseases could also impact the expected successional processes within the Park. These disturbances aren't predictable; i.e. they may or may not ever happen, therefore it is impossible to address them in this plan, however it is still important to realize unexpected disturbances can and do occur.

The above description depicts the progression of forest development from old fields to mature forest leading to a hackberry dominated woodland. With the above succession process in mind, one can visualize how each vegetation type described on the vegetation map is simply one of the stages along this described successional continuum.

DESCRIPTION OF VEGETATION TYPES

The State of Nebraska requires control of certain noxious plants: musk thistle, leafy spurge, Canada thistle, plumeless thistle, spotted knapweed, diffuse knapweed, and purple loosestrife. While there are other plants considered exotic and invasive, they do not have to be controlled by any law. According to previous studies of Wilderness Park, musk thistle and leafy spurge exist within the Park and require regular management efforts.

A broad view of the vegetation map created for Wilderness Park reveals there are wetlands, grasslands, and 3 recognized forest types: Riparian, Bur oak, and Mixed woods. Within the forests, there are young stands of trees in the sapling stage, and mature stands. Also, an area of Riparian forest once used as a park is distinguished from other riparian forest units because of the highly modified condition of the vegetation.

The vegetation units are arranged in the sequence of succession: from the most open to the mature forest. Vegetation units have been combined based upon the similarities on the successional scale because the management is similar.

Wetlands

All of the areas designated as wetlands (estimated to be 45 acres; 3% of the park) are associated with old channels of Salt Creek; i.e. oxbows. Some of these oxbows have been created as a result of natural meanders and others the result of channel straightening. The hydrologic connection to Salt Creek or other water sources of both types of oxbows would have to be determined to access the frequency of inundation. It was noted while on site some are still connected by a swale and during high enough flows still have water reach them. Some may be influenced by ground water, others were artificially cutoff from the channel during channel straightening, road and bridge construction. Some oxbows also appear to have outlet structures limiting the amount of water that can be retained in them. Obviously all would be inundated during a flood. In the report "Analysis and Critique of the Ecosystem Report" which indicated historically the channel entrenchment of Salt Creek may be in excess of 300% deeper in places than it was prior to settlement results in less frequent out of bank flows concentrating the creeks energy in the channel.

It is important to note that streams are ever changing. Taking a large landscape size picture of Wilderness Park with a long-term time frame, one should envision Salt Creek meandering within the park creating new channels and leaving old channels that become new wetlands. In the portions of the park where the channel has been straightened, over time, Salt Creek will begin to scour the creek banks from side to side as the creek disperses its energy re-establishing meanders. If a management goal is to promote the formation of a meandering stream that will eventually create new oxbow wetlands within these straightened stream reaches, bank stabilization, hard points or other structures that protect the creek bank or redirect flows away from the bank should not be installed unless to protect the infrastructure of roads, bridges, railroads and utilities. Although, properly placed structures could be designed to accelerate meandering.

After evaluating the hydrologic connections of each oxbow, and the determination of a management goal to promote more frequent inundation or sustained standing water, the following options could be explored and a determination made on the feasibility of each one.

1. Excavate to deepen oxbows to hold more water.
2. Excavate a swale to allow water to flow into the oxbows during high in-channel flows.
3. Install a pipe or conduit to direct flow into the oxbows during high-in channel flows.
4. Reconnect the oxbows with Salt Creek that were created when the channel was straightened.
5. Install wells to pump water into the oxbows using solar/wind power sources.
6. Modify outlets to hold more water by installing a riser or stop log structure.
7. Use treated storm water from the adjacent and impending developments to augment the hydrologic budget for the oxbow wetlands.
8. Use treated storm water to create additional wetlands in suitable areas of the park.
9. Install grade stabilization structures in the Salt Creek channel to stop down cutting of the channel increasing the frequency of out of bank flows.

The vegetation of the wetlands has been addressed in previous documents, therefore it is not addressed here. The vegetation in wetlands can be burned and grazed however, mowing often is

not feasible because wet soils prevent machinery from entering the site. Some of the wetlands could be managed in such a way as to be surrounded by grasses and forbs, trees or a combination of both.

Early Successional (aka Grasslands)

There are four vegetation units that are predominately open grasslands totaling about 635 acres (43% of Wilderness Park). Each unit is described below and management options for the units are discussed.

Pre [European] Settlement Prairie

An area of approximately 5 acres (.5% of the park) is indicated with white color as being prairie pre dating settlement by Europeans. The site is a dry upland knob with sandstone close to the surface therefore soil is thin.

This dry upland sandy site creates a unique complex of plant species not typically associated with the tallgrass prairie ecosystem in eastern Nebraska. Chances are the vegetation on the sandy knob was considerably different from the "undisturbed", pre-European settlement vegetation surrounding the sandy knob.

All previous studies and plans have concluded the prairie area should be managed as grassland, therefore, other management options need not be discussed.

Additional observations: The woodland directly adjacent to the prairie is stunted reflecting the shallowness of the soil. It is very likely the entire upland sandstone knob was grassland but the stunted trees have invaded into the prairie site.

Cutting the stunted trees adjacent to the prairie along with burning would allow the original prairie vegetation to reappear. This would expand the size of the unique dry upland prairie by considerable area.

A second management alternative is to cut most of stunted trees leaving a few trees as individuals or clumps of 2-5 individuals. Then follow the cutting with prescribe burning to create a dry savannah.

Old Agricultural Fields

Old agricultural fields is a vegetative type indicated on the attached map with gold color and is estimated to be about 450 acres (30% of the park). According to the EA Engineering study, the fields were used for cropland and have converted to brome either naturally or they were planted to brome. Trees and shrubs are invading the fields at different rates.

Old Pasture Fields and Re-established Prairie (sic)

Two shades of brown on the attached map were used to delineate fields used for pasture and fields planted to native warm season grasses. The two shades of brown are so close that it is difficult to distinguish. Also, it really doesn't make a difference because the description of the two vegetation types is very similar. Therefore these two vegetation types are combined. There is about 180 acres (12% of the park) with these designations.

According to EA Engineering, the reestablished areas were planted with big bluestem, little bluestem, sideoats grama, Indiangrass, and switchgrass in the1960's and 1970's. A prescribe burn was accomplished in 1980.

The fields are mostly grass however invasion by woody plants including cedar, dogwood, green ash, Siberian elm, American plum, American elm, slippery elm, honeylocust, et al. is occurring. Smooth brome is common along with typical invading forbs such as goldenrod, ragweed, sunflowers, roundheaded lespedeza, sweet clover, red clover, alfalfa, et al.

Managing to Retain Open Grasslands

Option I: Grassland can be burned to retard the invasion by woody plants.

Option II: Haying/mowing is an option for managing grassland.

Option III: Grazing with livestock would require fencing of the area but grasslands benefit from grazing.

Option IV: Manual/mechanical tree removal also would help retard the invasion of woody plants.

Option V: Herbicides could be sprayed to kill woody plants, however, broadcast applications of herbicides would also kill some of the forbs.

Option VI: Combinations of these options might be needed. For example, mechanical or manual tree removal might require application of herbicides directly to the freshly cut stumps to kill the woody plants. Honeylocust is a prolific sucker sprouter and removing the main stem without treating the stump can result in many honeylocust sprouts throughout the grassland area.

Another example is mowing combined with burning. Mowing reduces the height of the fuel which allows prescribe burning to be much easier to control.

Promoting Native Grass Communities

Smooth bromegrass is an introduced cool season species common in most reestablished grassland areas. There are several methods to deter bromegrass and at the same to promote native grasses.

Option I: Kill the existing bromegrass with herbicide and plant a diverse mixture of native species of grasses including native cool season grasses, native warm season grasses, forbs, sedges, and other components of the native prairie ecosystem.

Option II: Repeated prescribe burning when bromegrass is most susceptible to damage from fire (usually when bromegrass is in the boot stage). A slow process of invasion by native species will take place.

Option III: Combinations of Option I and II .

Converting Grassland to Forests

Option I:One option for managing grassland vegetation is to do nothing. If you do nothing, woody plants (trees and shrubs) will invade; i.e. the grassland will eventually become shrubs and the shrubs will be followed by a forest. This is already taking place in the old agricultural fields.

Option II:Rather than allowing nature to provide the tree species, trees could be planted thereby allowing selection of the species of trees. This would be one way accomplishing bur oak regeneration. Details for planting trees and programs for assisting with the cost of tree planting can be addressed in greater detail if this option is chosen.

To have a successful tree planting in Wilderness Park, trees will need to be protected from deer and rabbit damage.

Option III:Another way of converting the grassland into a forest is to disk. Disking the soil at different times of the year would promote the establishment of different species of trees. For example by timing the disking with the dissemination of cottonwood and willow seed in June, a cottonwood/willow forest would be created.

Also disking would allow for artificial seeding of desired species.

Sapling Stands (aka “Successional” Woodlands)

Approximately 18% (270 acres) of Wilderness Park is the sapling stage. This combines the tree plantings in old agricultural fields and the natural regeneration of the three forest types: riparian, bur oak, and mixed woods. The units are best described as open areas (i.e. old agricultural fields,

pastures, and flood zones) that have developed far enough on the successional scale to create a sapling stand.

Tree Plantings in Old Agricultural fields

Trees were planted in 7% of the park (120 acres) in some of the old agricultural fields. According to the EA Engineering study, species planted include autumn olive, Russian olive, black locust, swamp white oak, pin oak, cottonwood, silver maple, Austrian pine, sycamore, ash, and willow.

Some of the tree species planted are not adapted to the type of soils and some of the tree species are susceptible to diseases or insect problems, therefore they are growing quite slowly. Because some of the planted species are growing slowly, other invading species such as cottonwood, elms, cedar, hackberry, green ash, honeylocust, silver maple et al are actually outgrowing the planted trees. Once overtopped, many of the planted trees that are doing poorly will die and no longer be part of the forest.

Bur Oak Successional (sic)

Two areas are delineated as having bur oak reproduction (6" or less). These areas total 20 acres (1% of the park). Bur oak are present but are not necessarily the dominant species. Other associated species include elms, green ash, honeylocust, and mulberry.

Riparian Successional (sic)

Two areas are delineated as riparian reproduction totaling 100 acres (7% of the park). Species associated with these wet sites include willow, cottonwood, silver maple, green ash, honeylocust, and downy hawthorn. The sites are generally located between wetlands and streams.

Mixed Woods Successional (sic)

These three units delineated on the map are described as green ash and elms. The areas total 30 acres (2% of the park).

Mature Forests

Approximately 1/3 (480 acres) of Wilderness Park is considered mature forest of the four forest types: bur oak, riparian, mixed, and highly modified riparian. These areas are best described as dominated by large diameter trees with an almost complete overhead canopy and a well developed complement of understory vegetation.

Bur Oak Mature and Bur Oak Mature Pre-[European] Settlement

Mature bur oak woodlands compose 300 acres (20% of the park). Within the 300 acres most of the area (250 acres; 17% of the park) is considered to have existed as bur oak forest before Europeans settled Lancaster County. However, there is considerable debate

if the bur oak were in a forest environment or a savannah. This plan does not discuss the issues of that debate.

The bur oak trees are generally large diameter and associated with hackberry, green ash, and black walnut. Sites designated as mature pre-settlement bur oak includes Kentucky coffetree very limited amount of bitternut hickory in one site, eastern wahoo, and downy hawthorn.

As the oaks die, hackberry is about the only reproduction beneath the forest canopy. (Bitternut hickory may be part of the advanced reproduction in the understory where parent hickory trees are present to provide seed. Generally, this is an extremely small part of the Park.) In the mature bur oak woodlands, domination by hackberry is very close in time. In some places, hackberry already is the dominant large tree.

Riparian Mature and Riparian Mature pre-[European] Settlement

Approximately 50 acres (3% of the park) are designated as mature riparian forest with 10 acres of those acres (.6% of the park) considered to pre date settlement by Europeans. Species include cottonwood, willows, silver maple, green ash, honeylocust, and boxelder. The large size of cottonwood, silver maple, or honeylocust was used to distinguish areas considered pre-settlement.

Mixed Woods Mature

Only 2% of the park (30 acres) is designated as a mature mixed woods and none of this area is considered to have existed previous to European settelement. "Everything and anything from silver maple to bur oak with a heavy understory" is the description of this one site.

Highly Modified Mature Riparian

In the past, 100 acres (7% of theWilderness park) was managed as a park with mowed understory, etc. Sycamore, ponderosa pine, Austrian pine, swamp white oak, tulip poplar, Ohio buckeye, lilac and flowering crabapple were planted among the existing open forest of hackberry and bur oak.

Converting Forests to Grassland

Whether an early successional field being invaded by trees or a mature forest, the first step of converting a forest to a grassland is removing the trees. Once the trees are killed, follow one of the options in the section on Retaining Grasslands for recommendations on management of the newly created non forested area.

Option I:Trees can be killed with prescribe fire. Over time, repeated annual prescribe fire will convert a forest to a grassland.

Option II:A second alternative for killing trees is with a bulldozer or manually (chainsaw, etc). Clearcutting a forest is the first step in converting a woodland to a grassland. Harvesting the large oaks, walnut, hackberry, etc would generate potentially substantial income for use in managing the Park.

Following logging, the tops of the trees could be open to firewood harvesting. Eventually, there would be very little woody material remaining, therefore it would be easy to begin managing as a grassland.

Option III:A third alternative is to apply herbicides. Aerial spraying a hardwood forest can kill much of the broadleaf vegetation. While the trees, shrubs, and even understory plants may die, there would still be a tremendous amount of standing dead woody material on the site. This woody material would greatly retard the ability to manage the area as grassland.

Following herbicide application, some type of additional substantial management would be needed to ready the site to be a grassland. Either mechanical removal of the dead material or prescribe burning to remove the dead material would be needed.

If mechanical removal is selected as the management alternative, it is common to pile the woody material and burn the piles. Caution should be used on brush pile burning because the intense heat from the burning can seriously impact the fertility of the soil. Soil can be sterilized by the intense heat then little will grow on the site.

Creating Savannahs

Option I:The fastest way to create savannah is to start with a forest. Remove the majority of the trees leaving only the few individual specimen plants considered desirable. Follow the tree removal with annual prescribe burning for several years to convert understory vegetation from forested species to grassland species.

Where trees are large, removal can be accomplished with appropriate logging. Rather than clearcutting, simply mark the trees for removal and make sure the logger leaves unmarked trees. Logging will generate income for managing the Park.

Where trees are small diameter as in sapling size stands, firewood harvesting may be the most feasible. Marking leave trees with paint will save the desirable individual specimen plants. Harvesters then can cut all the other trees.

The Nebraska Game and Parks is using these techniques on several areas they own from the Pine Ridge to the Southeast corner of the state.

Option II:Prescribe burning has been tried in several states as a way of converting forests to savannah, however it has had limited success. The fire kills all the trees, or none. It

appears the technical details for using fire to create savannahs just isn't clearly understood, yet, but it is still a possible alternative for creating savannahs.

Option III:Another alternative tried in some states is to start with relatively open grassland and plant individual specimen trees. The trees need to be protected from deer, rabbits, and fire.

Promoting Bur Oak Reproduction

There are three major reasons bur oak is not reproducing in Wilderness Park. First, bur oak is extremely intolerant of shading, therefore, acorns that sprout beneath a canopy of trees will not survive. Second, young bur oak are favored food for deer and rabbits. Even when acorns sprout in open fields where there is adequate sunlight, deer and rabbits eat the seedlings, thereby preventing any survival.

Third, when a bur oak sprouts in open grassland and survives being eaten by deer and rabbits, the oak must compete with other faster growing species such as elms, green ash, etc. Often, the oak loses the competition for sunlight and becomes overtopped by the other faster growing species. Once overtopped, bur oak dies. Given these problems, the following are possible ways of establishing bur oak:

Option I:Find natural bur oak reproduction in open fields and protect the seedlings with caging. Once protected from deer and rabbits, then remove any competing vigorous species (elms, ash, etc).

Option II:Collect acorns from native bur oak trees and plant the acorns in open fields. Protect sprouting seed and resulting seedlings with cages.

Option III:Collect acorns from native trees and find a nursery willing to grow the trees (possibly the Nebraska Statewide Arboretum). Plant the seedlings in open fields and protect with caging.

Option IV: In sapling stands, locate sapling bur oak and remove the competing trees. Releasing the established bur oak saplings from competition will ensure the saplings are part of the next mature forest. This is called forest thinning.

Option V:In areas of mature forest where other tree species are dominant and bur oak is not present, converting these areas to bur requires clearcutting followed with burning. Followup management must follow one of Options I thru III.

Option VI:Where mature bur oak is mixed with other tree species, removing all the non bur oak species followed by burning will create a savannah. Once a bur oak savannah is established, bur oak reproduction can occur if the remaining bur oak are spaced a minimum of 2 times the height of the tree. The average height of trees is around 60 feet,

therefore the openings in the savannah need to be no less than 120 feet wide to get bur oak reproduction.

DISCUSSION

Of the 1,475 acres in Wilderness Park, 50% is forested, 43% is open fields, 3% is wetlands, and the remaining 4% is roads, etc.

The forest areas are mostly mature woodlands. Of the 750 acres of forest, 64% are mature forests and 36% are sapling stands. Bur oak dominant woodlands composes 300 acres (20% of the park). Only 20 acres of the park is sapling bur oak and in that 1%, bur oak is not dominant; it is simply represented in the stand.

Riparian forest are the opposite of bur oak. Mature riparian forests (excluding the highly modified area of riparian forest) dominate 50 acres but there are 100 acres of young sapling riparian forests.

Much of the bur oak is near the end of the expected life span, therefore much of the bur oak woodland component can be expected to shift to hackberry woodland probably in the next 50-100 years. With very little sapling bur oak to replace the mature bur oak, there will be a major shift in forest types from a bur oak dominant forest to woodlands of hackberry.

A picture of the forest 100 years from now without major disturbances (which are almost certain to happen), would include 750 acres of forest with about 20 acres expected to have some bur oak. There would be 630 acres of hackberry dominated forest and about 100 acres of riparian dominated forest.

The 635 acres of open fields consists of only 5 acres (.7%) of remnant prairie. All of the remaining 99.3% of the open fields are old farm fields or pasture with a large amount of introduced bromegrass and invading trees and shrubs. It will take continuous management to keep the areas as open grassland.

If regenerating bur oak is priority, then it is likely there will need to be a reduction in the open grassland areas because it is in the grasslands where bur oak reproduction will most likely be successful.

SUMMARY

This plan accumulates the information from a variety of studies dealing with the vegetation in Wilderness Park and adds possible management techniques for manipulating the vegetation. It is unlikely there will be adequate funding to accomplish all the vegetation management in Wilderness Park. Choosing which of the vegetation units (on the enclosed map) will receive

management and which will not have active management needs to be part of a management plan for Wilderness Park.

A great written plan describing the potential management of the Park can be developed, but if there isn't any money dedicated to implementing the agreed upon management, then the vegetation will simply continue on the natural successional continuum. Grasslands will be invaded by forests, saplings grow into mature forests, and mature forests will gravitate toward a hackberry dominated complex.

The community of Lincoln and Lancaster County need to decide: Should the entire park be allowed naturally to become a mature hackberry forest? Should there be some open areas without forest? Should there be savannah? Should there be an emphasis on oak regeneration?

Management of Wilderness Park comes down to: **Where on the successional continuum do they want the vegetation of the park and who is going to pay for it?**

Plan Prepared By: Rich Lodes, NRD Forester, 109D Plant Industry Building, East Campus, UNL, Lincoln, NE 68583-0815, phone: (402) 472-3646

Dan Schulz, Resource Coordinator and Ariana Kennedy, Resource Conservationist, Lower Platte South NRD, 3125 Portia St., Lincoln, Ne 68501-3581 (402) 476-2729

Date Draft Plan Prepared: July, 2002