

Green Hills Wildlife Preserve

Master Plan Report

Platte County Parks and Recreation



Green Hills Wildlife Preserve

February 25, 2004

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Acknowledgements

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Chapter 1. Project Introduction

Platte County has a rich natural and cultural history which includes the Green Hills Wildlife Preserve and the historic Day Cabin sites. Green Hills Wildlife Preserve is located in unincorporated south eastern Platte County, Township 50/51 North, Range 33 West, Section 6/31, between the communities of Parkville and Riverside, Missouri. The preserve is 45.5 acres and is bounded by residences on the north, south, and west, and by Parkdale Road, Green Hills Road, and residences on the east, including the 2.75 acre life estate belonging to Ms. Dorothy Day. Parkville Nature Sanctuary and White Alloe Creek Conservation Area are located two miles northeast and Platte County's proposed Southeast Area



Fig. 1.1 Location of Green Hills Preserve in relation to nearby parks.

Park is located one-half mile northeast of the preserve (see figure 1-1).

With the Missouri River providing the western boundary of the county travelers had easy access to the area. Shortly after the Lewis and Clark expedition in 1804-1806, French and Canadian fur trappers established trading relations with Native American tribes in the area. In



Early immigrants traveling up the Missouri River.



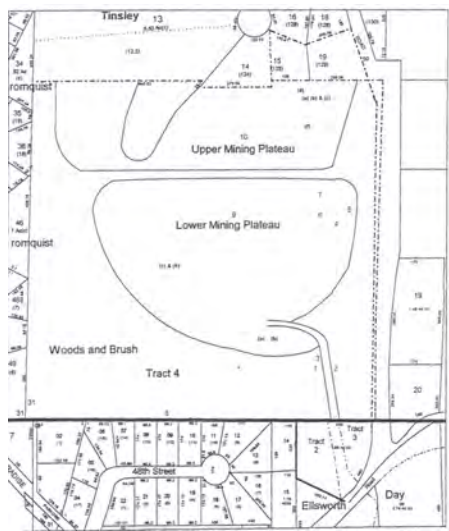
Day Cabin in 1912



Day Cabin in 2003

1822 or 1823, a French aristocrat named Francois Chouteau set up a fur trading post due east of the preserve on Randolph Bluffs. This occurred prior to Platte County becoming part of the state of Missouri.

The first abstract of title including both of these sites was recorded on April 1, 1846. The sale of an 80 acre tract was made by the United States of America to Joshua Bollinger. The Green Hills Wildlife Preserve was previously referred to as the “Roberts Estate” named for the second owner, George Roberts. Diverse owners and ownership interests created a colorful history for this area. During the 1940s to 1950s the site was reported to be heavily quarried for limestone. Evidence of this activity is still visible in the overburden or spoil piles, the cut out banks along the north and east sides of the property, and in the frame remnants of a scale house. After



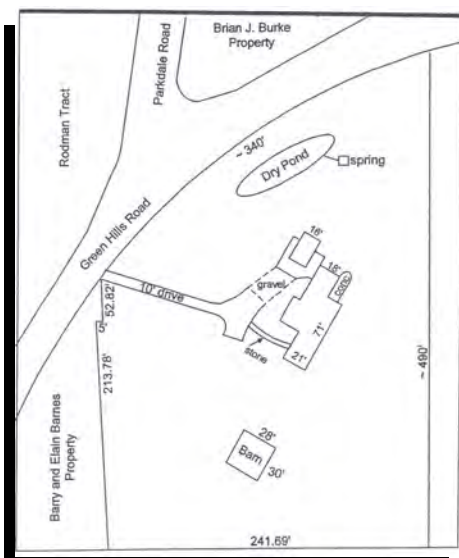
Green Hills historic site use plan prepared by Ed Pate & Associates.

the limestone quarry ceased operation the land was left idle. Meanwhile, housing developed around the edges of the property.

The historic Day Cabin is a "corner-locking cabin" estimated to have been built around 1820. The 2.74 acre cabin site was purchased in 1912 as part of 19.56 acres purchased by George and Emma Day, Ms. Dorothy Day's grandparents. The cabin was likely built by fur trappers and traders during the boom of trapping around 1820. The cabin remains in excellent condition today thanks

to the care and restoration efforts of Ms. Day.

To learn more about the cultural history of these sites refer to the Section 106 Cultural Resource Investigation Report prepared for Platte County Parks and Recreation in 2002 by K&K Environmental.



*Historic Day Cabin current site use plan
prepared by Ed Pate & Associates*

Chapter 2. Master Planning Process

Platte County recognized the significance and importance of conserving the Green Hills Wildlife Preserve in their Parks and Recreation Master Plan. The plan identified the preserve as a beautiful natural area that includes interesting historical elements and listed the preserve for immediate acquisition upon funding availability. By coordinating dedicated tax funding for parks with receipt of funding through Missouri's Land and Water Conservation Fund (assistance provided by Akin Gordon Cowger), Platte County was able to acquire the preserve in 2002.

Establishment of a steering committee began with requests for diverse representation from people throughout the surrounding communities and the county. Nine people became the Green Hills steering committee, including Ms. Dorothy Day, a long time proponent of the preserve.

The first steering committee meeting took place at the Parkville Train Depot on February 26, 2003. The committee

was given an update by Park Department staff on property acquisition, the master plan process, and the projected time table for completion of the master plan.

To increase the committee's familiarity with the preserve a site visit was conducted on April 30, 2003. Committee members were able to see many of the property's features during this site visit.



Steering committee touring the wildlife preserve.

A public open house was held at City Hall in Parkville on June 23, 2003. Site analysis and two conceptual plans were presented at the open house. It was very well attended and valuable input was obtained from the public about the history and future of the park.

The final steering committee meeting took place on August 5, 2003. At this meeting the committee provided input on the master plan, park uses including amenities, and phasing priorities. Ev-

everyone was in consensus about the function of the preserve as a natural area and that public use be maintained through passive recreational activities.

The final conceptual plan was presented to the County Park Board for review and recommendation on September 23, 2003. The Board approved the plan with a recommendation to reevaluate the parking for the potential to add parking spaces and a pull-out for buses.

The Master Plan with the final conceptual plan, main entrance parking and support facilities, site opportunities, management and recreational amenities recommendations, and implementation plan was presented to the County Commission for review and adoption on October 9, 2003.



Ground breaking ceremony for Green Hills Wildlife Preserve.

Chapter 3. Natural Resource Assessment

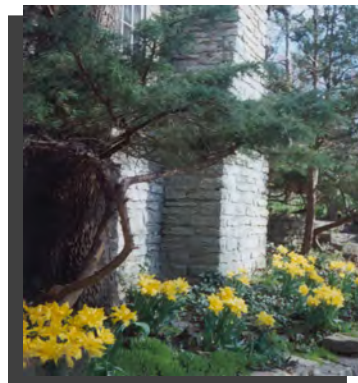
The purpose of this site assessment and natural features inventory is to create a base of information on natural communities and other major topographic features currently present within the project area. The assessment seeks to gain a better understanding of the riparian zones, topographic features, and vegetative cover present throughout the site. Land planning decisions such as which areas to preserve and which to improve, based on the results from the assessment. This information is not intended as a comprehensive natural resources inventory.

Information Gathering

Before conducting the on-site assessment aerial photographs, topographic maps, and soil survey maps were gathered from existing sources. This information was used to gain a preliminary understanding of site features, vegetative cover types, and disturbance patterns likely to be encountered.

The following natural features criteria were used to evaluate resources throughout the area:

- ❖ **Slopes and Soils:** slopes are categorized with soil types. This type of assessment can help highlight areas that are prone to erosion and less suitable for development.
- ❖ **Vegetative Cover:** Assessment of current land use provides a preliminary inventory of current vegetation including trees, shrubs, and herbaceous plants. The vegetative cover can be used to determine sensitive areas for protection during development planning.



Natural and man-made features within the site, the 1820's cabin.

❖ **Watersheds and Riparian**

Zones: These areas are critical for managing natural stormwater runoff as well as providing valuable corridors for wildlife.

❖ **Site Accessibility:** Assess existence of public access for pedestrians and vehicles, parking, and utilities. The presence or absence of these relates directly to the amount of infrastructure the site will need and can support.

The Green Hills Wildlife Preserve lies within the Big Rivers and the Glaciated Plains Natural Divisions. The Big Rivers natural division comprises about five per-

cent of the state. It includes the floodplains and terraces of the largest rivers, primarily the Missouri and Mississippi, but also the lower Grand and the lower Des Moines.

Soils are mostly allu-

marshes, sloughs, islands, sand and mud bars, oxbow ponds, and rivers. Bedrock is generally covered with alluvial deposits. In presettlement times, and until drastic channel modification began in the early 1900s, the Missouri River was a braided stream with many chutes, sloughs, islands, and channels.

The Glaciated Plains natural division is defined primarily by differences in soils, biota, geographic position, river drainages, and presettlement vegetation. It is characterized by loess-dominated topography and soils resulting from the influence of the Kansan stage of Pleistocene glaciation. It is also considered to have the driest climate in the state. In presettlement times, over half of the section was prairie which occupied much of the stream drainages and the uplands. Deciduous forest occurred along some of the drainages. Streams are low-gradient, turbid, and variable in water levels. Steep loess mounds along the Missouri River are a striking feature of this section.

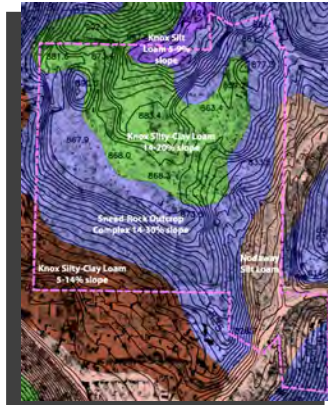
Missouri's Natural Divisions



Soils are mostly alluvial, deep, and productive. Presettlement natural features included mesic to wet prairie, bottomland and upland forests,

Soil Classification

A majority of the soils present on this site are within the Knox-Snead association. This association consists of deep and moderately deep, moderately sloping to steep, well drained and moderately well drained soils that formed in loess (a fine-grained material composed of silt-sized particles deposited by wind) and in residuum of shale and limestone. The remaining soil type is part of the Nodaway-Colo-Wiota association. This association contains deep, nearly level, moderately well drained, poorly drained, and well drained soils that formed in alluvium (deposits by running water) on floodplains and terraces.



Historic soils present on site prior to quarry operation.

Vegetation - Historic

Presettlement terrestrial vegetation within the Upper Missouri section of the Big Rivers division was about one-third prairie. Seaside crowfoot (*Ranunculus cymbalaria* Pursh) and spurge (*Euphorbia glyptosperma* Engelm.) are two plants that are generally restricted to this section.

Soil Type	% Slope	Permeability	Surface Runoff	Shrink - Swell Potential	Natural Fertility Organic Matter Content
Snead Rock Outcrop 10F*	14 - 30	Slow	Rapid	High	Low/Moderate
Nodaway Silt Loam 39**		Moderate	Slow	Moderate	High/Moderate
Knox Silt Loam 54C2	5 - 9	Moderate	Medium	Moderate	High/Low
Knox Silty Clay Loam 55D3	5 - 14	Moderate	Rapid	Moderate	Medium/Low
Knox Silty Clay Loam 55E3	14 - 20	Moderate	Rapid	Moderate	Medium/Low

* Seasonal high water table at a depth of 2 to 3 ft. in winter/spring.

** Seasonal high water table at a depth of 3 to 5 ft. in winter.

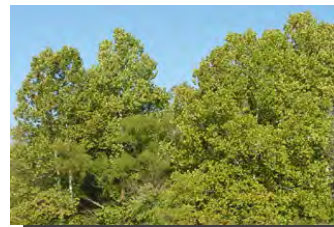
Fig. 3.1 Soil association characteristics.

Reed (*Phragmites communis* Trin.), great bulrush (*Scirpus acustus* Muhl.), and dock (*Rumex mexicanus* Meisn.) are characteristic plants.

Presettlement prairie vegetation had elements of the Great Plains such as hairy and blue grama (*Boutelona hirsuta* Lag. and *B. gracilis* [HBK] Lag.), large-flowered penstemon (*Penstemon grandiflorus*), soapweed (*Yucca glauca*), and downy painted cup (*Castilleja sessiliflora*). Forest vegetation included oaks (White-*Quercus alba*, Northern Red-*Q. rubra*), hickories (Shagbark-*Carya ovata*), and other mixed deciduous species of trees (Sugar Maple-*Acer saccharum*) and shrubs (Rough-leaved Dogwood-*Cornus drummondii*).

There are three natural communities that were historically abundant within the Glaciated Plains Natural Division and that still occur to some degree within the preserve. They are upland-mesic forest, dry-mesic savanna, and dry-mesic prairie. The following is a description of each natural community:

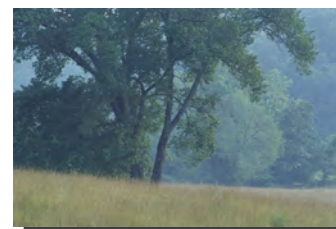
Upland-Mesic Forest occurs throughout the state but most abundantly in the Glaciated Plains Natural Division.



Forest with dense tree cover greater than 80%.

This is a mixed deciduous forest consisting of a closed (nearly 100%), tall (90-140 ft.) tree canopy and a well developed understory (See figure 3-5). Dominant plants include northern red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), white oak (*Quercus alba*), basswood (*Tilia americana*), and pawpaw (*Asimina triloba*).

Dry-Mesic Savanna is widespread throughout the Glaciated Plains Natural Division where it is associated with prairie.



Savanna - native grassland with 10-50 % tree cover.

rie streams and hilly terrain. The typical vegetation is an open (10-50%), medium height (30-60 ft.) oak-hickory tree canopy (See figure 3-6). Understory vegetation is generally absent. The remaining ground cover consists of mixed grasses and herbaceous plants similar to those found in dry-mesic prairies. Dominant plants include bur oak (*Quercus macrocarpa*), shingle oak (*Q. imbricaria*), post oak (*Q. stellata*), white oak (*Q. alba*), big bluestem (*Andropogon gerardii*), and little bluestem (*Schizachyrium scoparium*).

Dry-Mesic Prairie is widespread throughout the Glaciated Plains Natural Division where it is generally associated



Native prairie grasses.

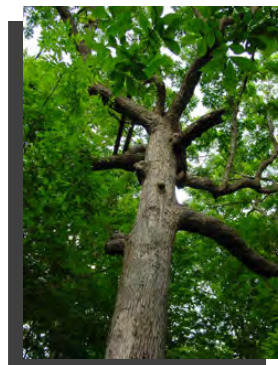
with mesic prairies and at the base of steep loess hills where it is associated with

dry prairies. Vegetation is exclusive of trees, rarely includes shrubs and is dominated by grasses intermixed with a few herbaceous species (See figure 3-7). Dominant plants include little bluestem (*Schizachyrium scoparium*) and Indiangrass (*Sorghastrum nutans*).

Vegetation - Existing

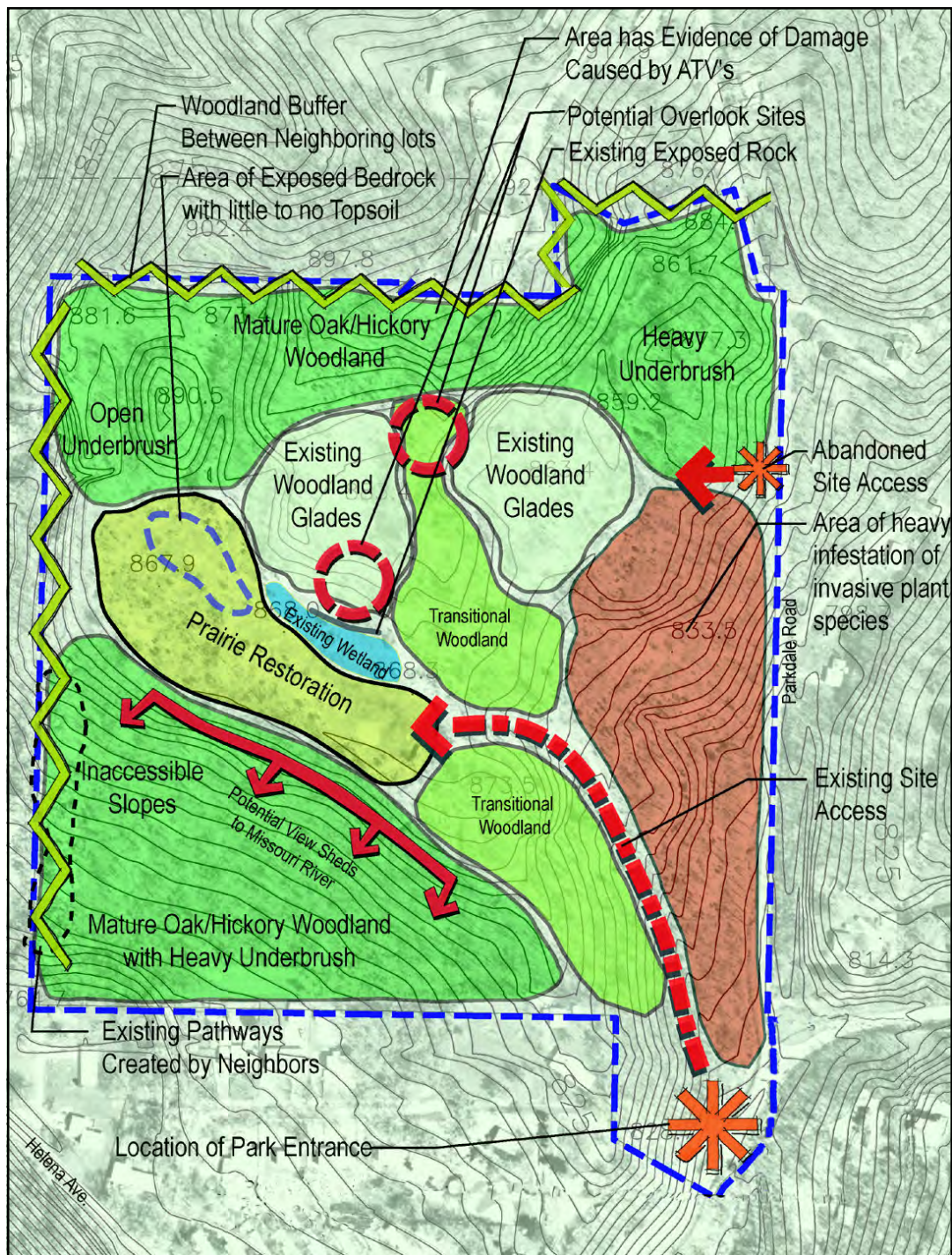
The site assessment map (figure 3-1) shows five general habitat types. The types include:

Mature Oak/Hickory Woodland is present along the north edge and the southwest corner of the property. Veg-



Mature Chinquapin oak.

etation within this area is representative composite of the upland-mesic forest and



Examples of vegetative communities within the Green Hills Wildlife Preserve.



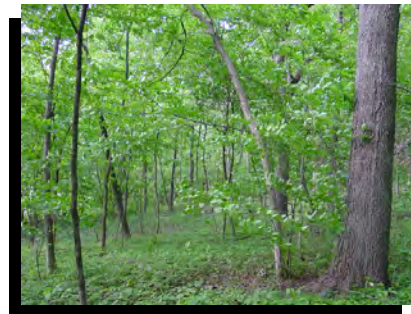
Transitional woodland at main entrance gate.

Existing woodland glade.

Prairie wildflowers.

Mature woodland on the south side of prairie restoration area.

dry-mesic savanna consisting of a moderately dense (65-90%) tree canopy, few understory plants, and a ground cover of herbaceous plants. The tree canopy includes northern red oak (*Quercus rubra*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*) and hackberry (*Celtis occidentalis*). The understory is dominated by pawpaw (*Asimina triloba*) and grey dogwood (*Cornus drummondii*). Ground cover consists of tick trefoil (*Desmodium glutinosum*), buckbrush (*Symphoricarpos orbiculatus*), moonseed (*Menispermum canadense*), Virginia creeper (*Parthenocissus quinquefolia*), Jack-in-the-pulpit (*Arisaema atrorubrens*), wild ginger (*Asarum canadense*) poison ivy (*Rhus toxicodendron*), with shrub



Open understory in mature oak/hickory woodland.

honeysuckle (*Lonicera maackii*) along the outer edges.

Transitional Woodlands can be found along the south side of the existing gravel access road and in the center between the woodland glade areas. This vegetation has a more open canopy (10-50%) and is comprised of cottonwood (*Populus deltoides*), shingle oak (*Quercus imbricaria*), redbud (*Cercis canadensis*), American and slippery elm (*Ulmus*

americana and *U. rubra*), riverbank grape (*Vitis riparia*), poison ivy (*Rhus toxicodendron*), tick trefoil (*Desmodium glutinosum*), shrub honeysuckle (*Lonicera maackii*), buckbrush (*Symphoricarpos orbiculatus*), grey dogwood (*Cornus drummondii*), sericea lespedeza (*Lespedeza sericea*), ragweed (*Ambrosia trifida*), and multi-flora rose (*Rosa multiflora*).

Existing Woodland Glades occur within the central portion of the property at the core of the quarry operation area. The soils within these areas are very shallow with large areas of exposed rock. Ground cover vegetation is sparse, consisting of heath asters (*Aster pilosus*), ragweed (*Ambrosia trifida*), Queen Anne's lace (*Daucus carota*), grey dogwood (*Cornus drummondii*), yellow clover (*Trifolium agrarium*), poison ivy (*Rhus toxicodendron*). The glade areas are gradually being invaded by honey locust (*Gleditsia triacanthos*), red cedar (*Juniperus virginiana*), shrub honeysuckle (*Lonicera maackii*), and

grey dogwood (*Cornus drummondii*).

Prairie Restoration is located along the southern section of the central quarry area. Due to the past removal of vegetation, soil, and rock for the quarry operation, this area has had the least plant growth. Vegetation is extremely sparse consisting largely of herbaceous plants and grasses.

Invasive/Exotic Plant Area is most predominantly located along the east side of the property. During operation of the quarry this area was used to load stone.



Large shrub-like poison ivy.

The woody vegetation is dominated by Japanese honeysuckle (*Lonicera japonica*) and shrub honeysuckle (*Lonicera maackii*).

Watersheds and Riparian Zones

The Wildlife Preserve lies within the Rush Creek Watershed. All streams and creeks within this watershed flow south to the Missouri River. Because the majority of the preserve consists of upland topography, the area has limited water resources. The water resources found on this site include:

Gravel Wash Streambed: occupies smaller streams and rivers with more rug-

ged topography. These streams generally have a steeper gradient in which floodwaters rapidly drain downstream. Vegetation present is quite variable consisting of shrubs dominating the understory and a sparse mixture of grasses, vines, and herbaceous plants providing the remaining ground cover (See figure 3-17). Vegetative species usually occur within zones along the gravel wash.

A tributary of Burlington Creek flows along the eastern boundary of the Wildlife Preserve. This is an intermittent, gravel wash stream that periodically floods Green Hills and Parkdale Roads during large rainfall events.

Ground Water Seepage: this type of natural community is distinguished from other wetlands in that soils are saturated by ground water of which the source and volume vary greatly. The soil moisture gradient exhibits seasonal fluctuations. Seepages may occur in narrow valley basins or on gentle to steep slopes of hills. They may also appear as distinct



Gravel streambed with well-vegetated streambanks.



Wetland vegetation resulting from presence of seep.

plant communities within glades, savannas, prairies, or as openings within forests. Natural communities occupying this type of habitat reflect water and

soil chemistry present and are described based on acidity, salinity, topography, water flow, and vegetation. The dominant vegetation consists of common cattails (*Typha sp.*), horsetail and scouring rush (*Equisetum spp.*), and cottonwood (*Populus deltoides*).

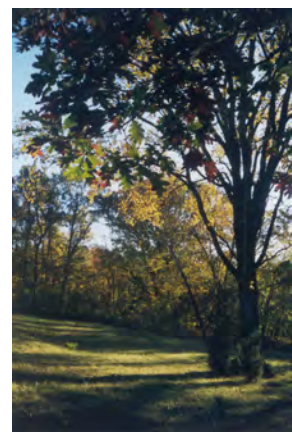


Groundwater seepage along north edge of prairie restoration.

An area located along the north side of the prairie restoration site is representative of a groundwater seep where the soil moisture exhibits seasonal fluctuations and the plant

community is unique to the area. Vegetation found throughout this seep consists of sedge species (*Carex sp.*), smartweed (*Polygonum punctatum*), and cattails

(*Typha latifolia*). During spring and fall rainy seasons, water accumulates and begins to flow east from the main seep to the gully that runs along the north side of the entrance road.



Integration of native and cultivated landscapes.

Site Accessibility

The Preserve's primary entrance is located in the Southeast corner due south of the intersection of Green Hills and Parkdale Roads. A relatively flat area at this entrance location can accommodate some off-street parking and public support facilities (shelter, restroom, interpretive signs). The site currently has electricity but does not have potable water.

Chapter 4. Site Opportunities

Habitat Restoration and Management

The Green Hills Wildlife Preserve presents an incredible opportunity for restoration and management of a diverse range of wildlife habitats. The amount of time and resources necessary to restore or manage these various habitats is dictated by their current condition. Through a cooperative partnership with the Missouri Department of Conservation, restoration efforts have already begun to take place on the property.

Prairie Restoration

Because the open area in the center of the property most closely represents a dry-mesic prairie, management efforts are focusing on restoring plants and grasses that would have occurred within this type of habitat. The Platte County Parks and Recreation Department in cooperation with the Missouri Department of Conservation used Wildlife and Conservation Restoration Grant funds from the Mis-

souri Department of Conservation to seed the prairie restoration area with native grasses and wildflowers in the spring of 2003. The seed mix used consisted of the following seed types:

WILDFLOWERS

Lead plant (*Amorpha canescens*)

Aromatic aster (*Aster oblongifolius*)

Sky blue aster (*A. oolentangiensis*)

Prairie Coreopsis (*Coreopsis palmate*)

Plains coreopsis (*C. tinctoria*)

White prairie clover (*Dalea candida*)

Purple prairie clover (*D. purpurea*)

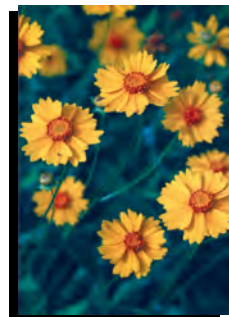
Pale purple coneflower (*Echinacea pallida*)

Rose verbena (*Glandularia Canadensis*)

Silky aster (*Aster sericeus*)

Rough blazing star (*Liatris aspera*)

Wild bergamot (*Monarda fistulosa*)



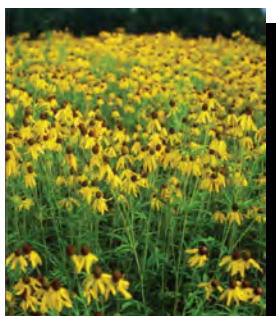
Coreopsis



Rose Verbena



River Oats Little Bluestem



Grey-head Coneflower

Gray-head coneflower (*Ratibida pinnata*)

Blue sage (*Salvia azurea*)

Black-eyed susan (*Rudbeckia hirta*)

Smooth aster (*Aster laevis*)

Widow's cross (*Sedum pulchellum*)

Rigid goldenrod (*Solidago rigida*)

Ohio spiderwort (*Tradescantia ohioensis*)

GRASSES

Sideoats grama (*Bouteloua curtipendula*)

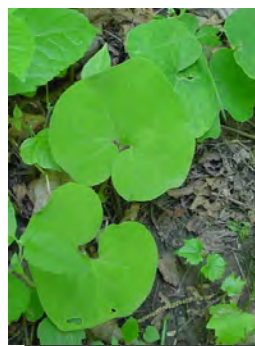
River oats (*Chasmanthium latifolium*)

Little bluestem (*Schizachyrium scoparium*)

Wild rye (*Elymus sp.*)


Mature Woodlands

Management within these areas will need to focus on selective removal of understory vegetation (buckbrush, multi flora rose, poison ivy) resulting in a more open understory. The open understory will be suitable for more native woodland plants including but not limited to Jack-in-the Pulpit, wild ginger, bloodroot (*Sanguinaria canadensis*), dutchman's breeches (*Dicentra cucullaria*), violets (*Viola sp.*), and trilliums (*Trillium sp.*).



Wild ginger in mature open woodland.

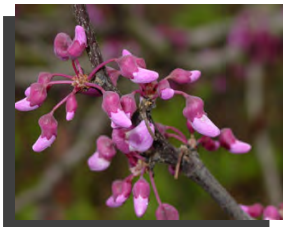
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Transitional Woodland

Initially, management will need to focus on removal of exotic and invasive plant species and smaller, less desirable trees (honey locust, elm, box elder, red cedar). These areas offer the opportunity to demonstrate vegetative succession, especially in relation to the glade and prairie areas. If managed for successional plants, larger trees should be removed while smaller trees and shrubs are allowed to grow.



Redbud blossoms.

Woodland Glades

These areas provide the opportunity to manage a unique and rare habitat type in this part of Missouri. The thin soils will not readily support vegetation other than grasses and wildflowers. The cedars and various trees which have been able to

grow within these areas should be removed. A seed mix similar to the prairie



Spider milkweed common to dry, rocky areas.

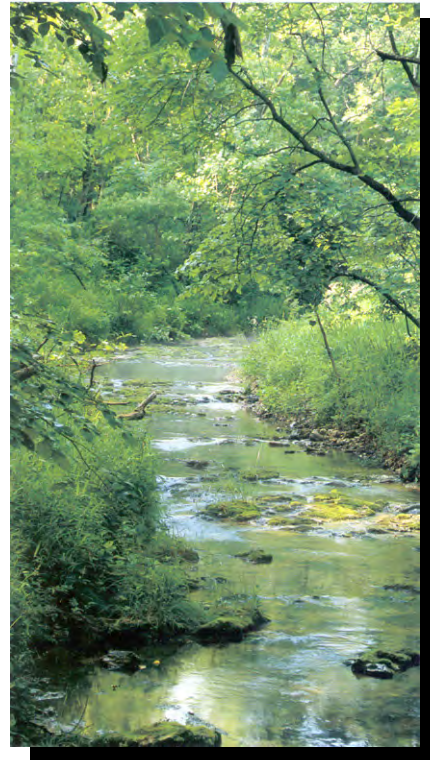
mix can be used to add some plant diversity within these glades.

Groundwater Seep and Gravel Wash Stream

The water levels within the main seep are seasonally dependent. To increase the potential for maintaining water and providing a more permanent wetland or wet prairie area, the west end of the seep should be evaluated. If appropriate, soil could be removed from this area to add depth and width. Once water levels have been established, additional wetland type plant materials like sedges, rushes, and possibly arrowhead or pickerelweed, can be added. This area can also be used to

provide stormwater runoff management that is currently being channeled along the entrance road.

The stream that flows along the east side of the property should be managed to maintain a variety of native trees and shrubs to assist in maintaining streambank stability. Shrub honeysuckle prevalent along the woodland edge should be removed whenever possible as long as its removal doesn't compromise the stability of the streambank.



High quality stream with native vegetation.

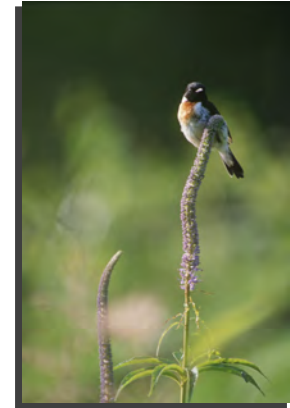
Recreation

The Wildlife Preserve presents unique natural, historical and cultural recreation opportunities. The primary use will be passive recreation in the form of hiking trails, bird watching and wildlife viewing, and cultural history. Due to the passive nature of the recreational opportunities the preserve will offer, the entrance parking and support facilities will be the only major structural improvements to the preserve. Many of the habitat management recommendations will directly benefit the use of this area for bird watching and wildlife viewing. To facilitate such uses, limestone screening trails (ADA accessible) and mulched trails, boardwalks, benches, overlook platforms, and inter-

pretive signs will be provided in a phased approach according to availability of funding.

Throughout implementation of the master plan partnerships with organizations such as the Parkville Nature Sanctuary, Audubon Society, Kansas City Wildlands, and the

Missouri Department of Conservation will provide opportunities to expand programs linking the preserve and the historic Day cabin to a network of diverse, nature and outdoor recreational opportunities. Trail projects throughout the region such as MetroGreen, the Missouri Riverfront Trail (See figure 4-7), and English Landing Park have the potential to



Bird watching is a popular outdoor activity for all ages.

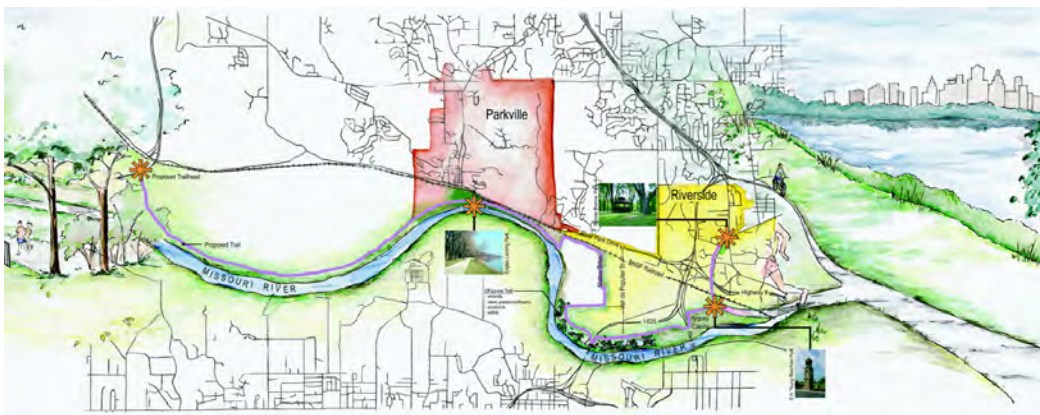



figure 4-1 Missouri Riverfront Trail.



increase future public use and accessibility to the preserve and provide alternative parking options.

Chapter 5. Implementation

Many of the improvements listed within this section of the master plan such as trails, observation areas, and parking space will take place throughout multiple phases. Implementation of the Land and Water Conservation Fund (LWCF) grant requirements will be followed by improvements to the preserve and the adjoining Day property as funding becomes available.

Phase I - The emphasis for Phase I will be meeting the LWCF requirements for improvements to the primary entrance.

Phase II - will focus on improvements to the gravel entrance road, prairie and wetland plantings, and additional trails.

Phase III - will focus on mulching of primary and secondary trails, interpretive signs, and creation of an outdoor classroom area.

Phase IV -will evaluate additional parking opportunities and entrances of a security gate and parking lot at the secondary ADA site located on Parkdale

Road north of the primary entrance.

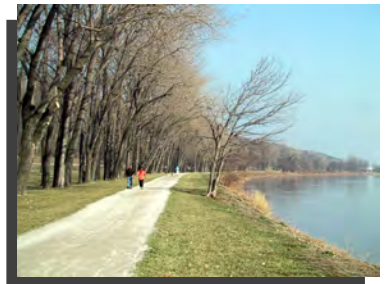
Future Phase - will focus on the improvements to the historic Day Cabin, and an outdoor classroom facility.

All implementation phases will include habitat management components focused on removing exotic and invasive vegetation and other management items mentioned within the habitat management segment of the site opportunities chapter.

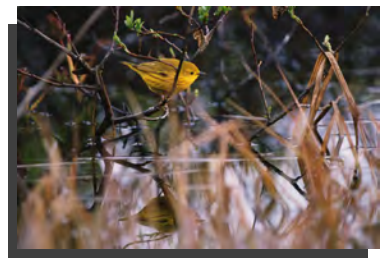
Native plant materials are listed within each phase to allow for estimating costs. If opportunities to obtain these plant materials become available outside of County funding, they should be evaluated in relation to the master plan and utilized whenever possible.



Children and adults enjoy "getting their feet wet".



Walking and hiking trails are very popular in Platte County



Bird watching is a fun way to learn about nature

Phase I - Entrance

Approximate cost: \$90,641

The steep topography of the preserve and the close proximity to the perennial stream (tributary of Burlington Creek), Green Hills Road, and Parkdale Road make locating a primary entrance, facilities, and parking lot a challenging task. In addition, a major condition of the LWCF grant is that the entrance improvements meet ADA guidelines.

The culvert located at the preserve entrance on Green Hills Road has been listed by the Parkville Special Road District for repair/replacement. However, as of August 2003 the Special Road Dis-

trict stated that they have no immediate plans to make these repairs or changes to the culvert or the road. Therefore, the conceptual plan for parking and entry facilities has been designed to maximize available space given the present location of the culvert. The LWCF grant requires that there be two regular parking spaces and one ADA accessible parking space. The design shows the opportunity for additional parking spaces and a bus pull-out to meet future needs (See figure 5-1).

Entry facilities adjoining the parking lot will include an ADA accessible 16'x20' shelter and restroom. The restroom facility will utilize a waterless composting

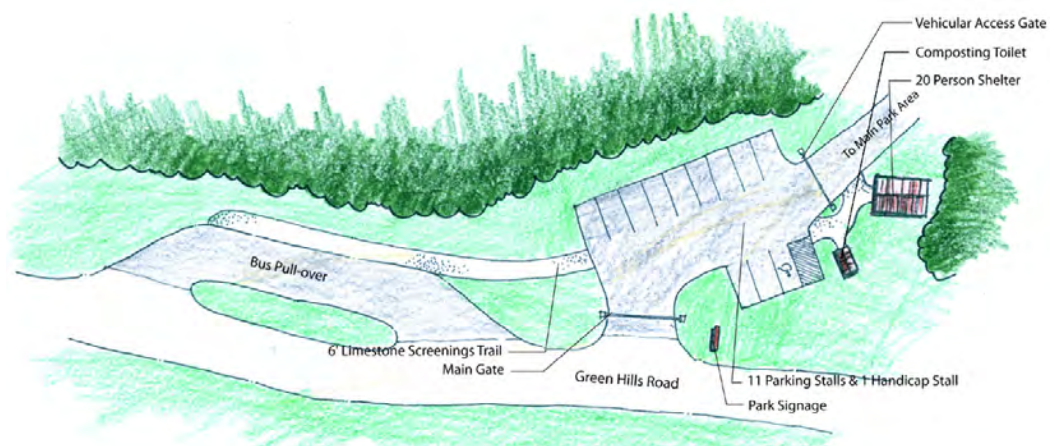


figure 5-1 Conceptual Plan - Main entrance parking and support facilities

system due to the absence of potable water at this site. If needed, electricity is available at the entry. Other amenities included within this phase are park and historical signs, a split-rail fence, benches, trash receptacle, trails, and bird feeders.

Phase II - Central Prairie and Wetland

Approximate cost: \$155,112

This phase of improvements will include a ten foot wide gravel trail providing ADA and Park Department access from the entry up to the native plant restoration area, expansion and improvements to the existing wetland seep area, ADA accessible trails and boardwalks throughout the prairie and wetland areas, interpretive signs, and benches for the



Phase II showing prairie restoration and trail system.

proposed overlooks. The trail will also function as an access road for maintenance vehicles.



Conceptual wetland pool design.

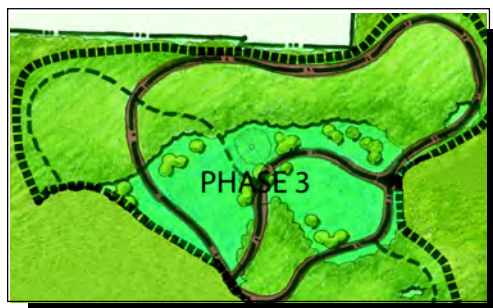
Phase III - North Area Trails

Approximate cost: \$57,591

Phase III includes many of the mulched trails that will traverse some of the steeper topography within the site. Location and installation of an outdoor classroom within the prairie restoration



Boardwalks provide a unique trail experience



Phase III trail system and outdoor classroom.

area will be part of this phase of development. The outdoor classroom will be designed and placed such that it is functional with minimal impact to the habitats being restored/managed. The function of this classroom will be to provide educational opportunities for youth and adults within a natural setting.

Phase IV - Potential Parking and Maintenance Access

Approximate cost: \$23,953

This phase proposes additional parking at the northern trail entrance on Parkdale Road. Improvements to Parkdale Road would be necessary to accommodate a parking lot at this location due to limited driving sight distance. The

steep topography of this section of the preserve will limit the size of the parking lot. This location will be developed to provide the Park Department with maintenance and emergency access to the northern part of the preserve. This location also provides the opportunity to develop a trail head with potential for future trail linkage to the proposed Southeast Area Park.



Phase IV provides potential for additional parking and maintenance access.

Future Phase - Historic Day Cabin Site

Approximate cost: Undetermined

The historic Day Cabin is currently held in a life estate by Ms. Dorothy Day. Future improvements will be made to the south wing to facilitate use of the cabin for natural and cultural history related programs. The cabin site will also be considered for location of another outdoor classroom facility.



South wing of Day cabin

Implementation Phase Cost Estimate

PHASE 1 - Opinion of Probable Cost	UNIT	QUANTITY	UNIT COST	TOTAL
* SHELTER (16' x 20')	EA	1 @	\$ 19,000.00	\$ 19,000.00
PARK SIGN	EA	1 @	\$ 4,000.00	\$ 4,000.00
RELOCATE EXISTING GATE	EA	1 @	\$ 1,000.00	\$ 1,000.00
* 6" GRAVEL PARKING / ROAD SURFACE	SF	3800 @	\$ 4.00	\$ 15,200.00
CLIVUS COMPOSTING TOILETS	EA	1 @	\$ 25,000.00	\$ 25,000.00
6' LIMESTONE SCREENING TRAIL	SY	50 @	\$ 12.00	\$ 600.00
NATIVE GRASS SEEDING	AC	0.5 @	\$ 2,200.00	\$ 1,100.00
* TRASH RECEPTACLE	EA	1 @	\$ 350.00	\$ 350.00
NATIVE PLANT MATERIAL (ALLOWANCE)	LS	1 @	\$ 5,000.00	\$ 5,000.00
* BIRD FEEDERS	EA	3 @	\$ 40.00	\$ 120.00
* SPLIT RAIL FENCE	LF	200 @	\$ 6.70	\$ 1,340.00
* HISTORICAL INFORMATION SIGN	EA	1 @	\$ 1,000.00	\$ 1,000.00
* BENCHES	EA	3 @	\$ 400.00	\$ 1,200.00

(*) DENOTES LAND, WATER, AND CONSERVATION FUND REQUIREMENT

10 %Contingency	\$	7,491.00
PH 1 - Subtotal	\$	82,401.00
Design / Engineering	\$	8,240.10
PH1 - TOTAL	\$	90,641.10

PHASE 2 - Opinion of Probable Cost	UNIT	QUANTITY	UNIT COST	TOTAL
GRAVEL PARK ROAD (10' WIDTH)	LF	1200 @	\$ 40.00	\$ 48,000.00
8' WIDE BOARDWALKS	LF	60 @	\$ 200.00	\$ 12,000.00
6' LIMESTONE SCREENINGS TRAIL	SY	2066 @	\$ 12.00	\$ 24,792.00
INTERPRETIVE KIOSK	LS	1 @	\$ 2,400.00	\$ 2,400.00
OVERLOOKS WITH BENCHES	EA	2 @	\$ 5,000.00	\$ 10,000.00
UNDERBRUSH CLEARING	LS	1 @	\$ 3,000.00	\$ 3,000.00
INTERPRETIVE SIGNS (ALLOWANCE)	LS	1 @	\$ 3,000.00	\$ 3,000.00
WETLAND EXPANSION AND IMPROVEMENT	LS	1 @	\$ 20,000.00	\$ 20,000.00
NATIVE PLANT MATERIAL (ALLOWANCE)	LS	1 @	\$ 5,000.00	\$ 5,000.00

10 %Contingency	\$	12,819.20
PH 2 - Subtotal	\$	141,011.20
Design / Engineering	\$	14,101.12
PH 2 - TOTAL	\$	155,112.32

PHASE 3	UNIT	QUANTITY		UNIT COST	TOTAL
6' MULCHED PRIMARY TRAIL	LF	1500	@	\$ 10.00	\$ 15,000.00
3' MULCHED SECONDARY TRAIL	LF	1400	@	\$ 6.00	\$ 8,400.00
6' LIMESTONE SCREENINGS TRAIL	SY	433	@	\$ 12.00	\$ 5,196.00
INTERPRETIVE SIGNS (ALLOWANCE)	LS	1	@	\$ 3,000.00	\$ 3,000.00
UNDERBRUSH CLEARING	LS	1	@	\$ 6,000.00	\$ 6,000.00
OUTDOOR CLASSROOM	LS	1	@	\$ 5,000.00	\$ 5,000.00
NATIVE PLANT MATERIAL (ALLOWANCE)	LS	1	@	\$ 5,000.00	\$ 5,000.00

10 %Contingency \$ 4,759.60

PH 3 - Subtotal \$ 52,355.60

Design / Engineering \$ 5,235.56

PH 3 - TOTAL \$ 57,591.16

PHASE 4	UNIT	QUANTITY		UNIT COST	TOTAL
PARK SIGN	EA	1	@	\$ 2,000.00	\$ 2,000.00
SECURITY GATE	EA	1	@	\$ 2,000.00	\$ 2,000.00
6" GRAVEL ROAD / PARKING SURFACE	SF	1000	@	\$ 4.00	\$ 4,000.00
UNDERBRUSH CLEARING	LS	1	@	\$ 3,000.00	\$ 3,000.00
6' LIMESTONE SCREENINGS TRAIL	SY	233	@	\$ 12.00	\$ 2,796.00
3' MULCHED SECONDARY TRAIL	LF	1000	@	\$ 6.00	\$ 6,000.00

10 %Contingency \$ 1,979.60

PH 4 - Subtotal \$ 21,775.60

Design / Engineering \$ 2,177.56

PH 4 - TOTAL \$ 23,953.16

TOTAL	\$ 11,340.00
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APPENDICES

- A CONCEPT PLANS
- B INFORMATION SOURCES
- C EXOTIC AND INVASIVE PLANT MANAGEMENT

Age Group	Percentage
18-24	12%
25-34	28%
35-44	22%
45-54	18%
55-64	15%
65-74	10%
75-84	8%
85+	5%



BeeBalm Spiderwort Trailhead Bench and Trail



Trail Signage



Trail Path



Trail Marker



Shelter Example

Green Hills Master Plan

Concept Plan 2



Appendix B

Information Sources

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Appendix C

Exotic and Invasive Plant Management

Honey Locust

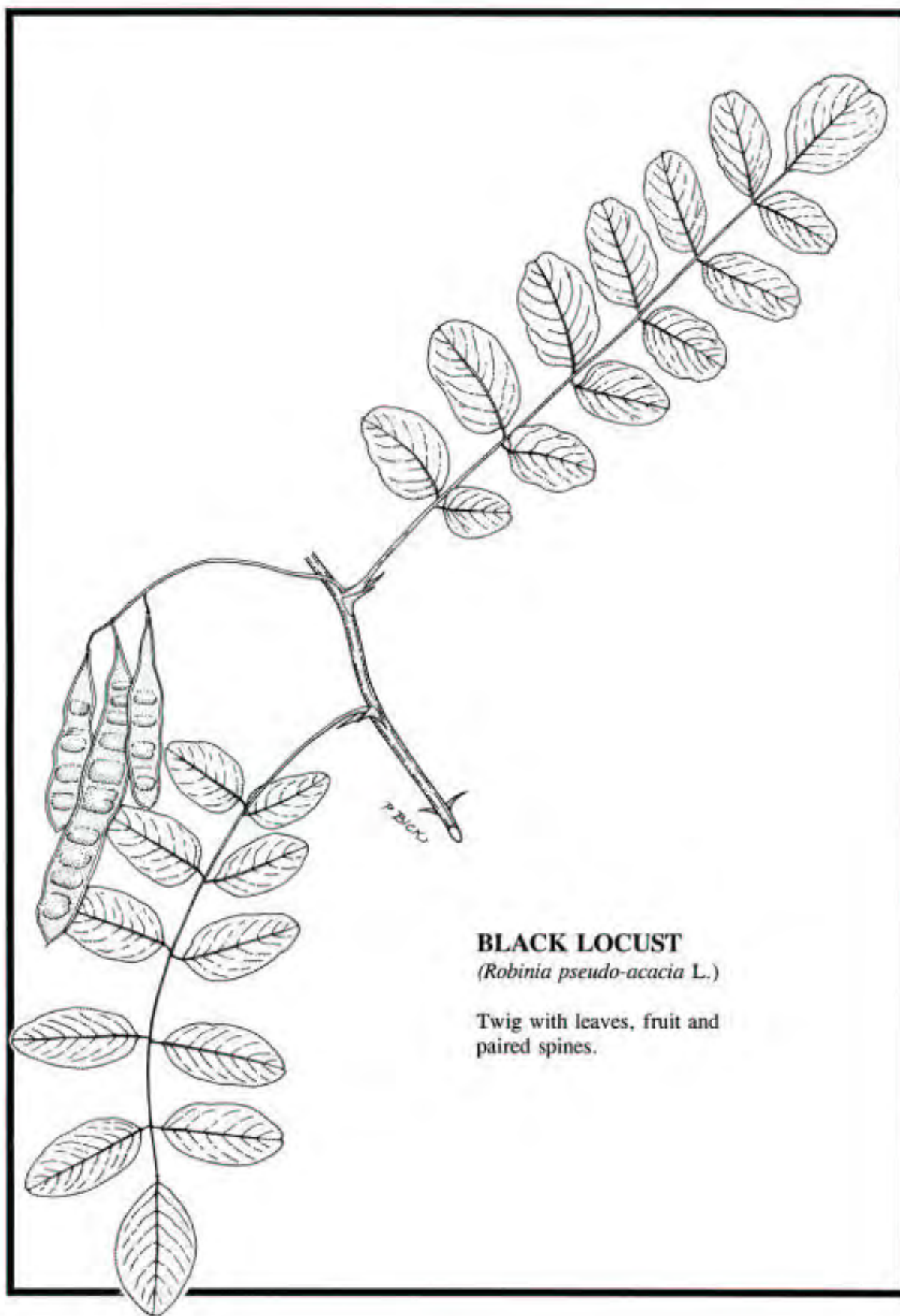
Bush Honeysuckle

Japanese Honeysuckle

Multiflora Rose

Musk Thistle

Sericea Lespedeza



BLACK LOCUST
(*Robinia pseudo-acacia* L.)

Twig with leaves, fruit and
paired spines.

VEGETATION MANAGEMENT GUIDELINE

Black Locust (*Robinia pseudo-acacia* L.)

NOTE: Although the following guideline is written for black locust, the control methods will also be effective for honey locust (*Gleditsia triacanthos* L.). Honey locust can be controlled more easily than black locust using the methods outlined below because it does not readily form root sprouts.

SPECIES CHARACTER

DESCRIPTION

Black locust has pinnately compound leaves that have an odd number of leaflets, with 1 leaflet at the tip. A pair of short, sharp spines occur where the leaf is attached to the strong, zigzag stem. The alternate branches lack a terminal bud. The fragrant, drooping, white, pea-like flowers each have a yellow blotch on the uppermost petal (standard), and occur in clusters that appear in May and June and develop into smooth fruit pods (legumes) up to 4 inches (10.2 cm) long, containing 4-8 seeds. In the fall its foliage turns a greenish-yellow. Black locust is a fast growing tree that attains heights over 100 feet. It puts out underground root suckers which may extend a long way, and which is a good method of propagation. Seedlings and sprouts exhibit rapid growth and heavy spines that occur in pairs. The seeds are toxic and children have been reportedly poisoned from chewing the licorice-like roots and inner bark. This is considered the most durable wood of any species in N. America. It is used in making fence posts, tree nails, rungs of ladders and policeman's clubs. It has high fuel value > 1 cord nearly equals 1 ton of anthracite coal.

SIMILAR SPECIES

This member of the legume family (Fabaceae) is distinguished by its pinnately compound leaves with up to 21 oval, smooth-edged leaflets, together with the pairs of spines where the leaf is attached to the stem. Black locust should be accurately identified before attempting any control measures. If identification of the species is in doubt, the plant's identity should be confirmed by a knowledgeable individual and /or by consulting appropriate books.

DISTRIBUTION

The natural distribution of black locust originally centered on the lower Appalachian Mountain slopes of the southeastern United States with outliers north along the slopes and forest margins of southern Illinois, Indiana, and Missouri. Planted extensively for its nitrogen-fixing

capability and hardwood qualities, black locust has been reported to be the most widely planted North American tree. Also, it is planted extensively to provide nectar for honeybees and to provide wooden fence posts. Due to its successful reproduction by root suckering, black locust (including many cultivated forms) has become naturalized throughout much of the New and Old Worlds.

HABITAT

This tree occurs in a variety of disturbed habitats including pastures, degraded woods, thickets, old fields, roadsides and other rights-of-way. It has become naturalized in upland forests, prairies, and savannas.

LIFE HISTORY

Black locust grows best in humid climates, although it has been introduced in many parts of the world where the climate is much drier. Black locust is a prolific seed-producer but seedlings are not common; few seeds germinate because of the impermeable seed coat. Most natural reproduction is vegetative by means of root suckering and stump sprouting. Root suckers arise spontaneously from the extensive root system of trees as young as 4-5 years old. Productivity of root suckers increases in full sun, in open areas, and in sandy loamy soils. They are interconnected by fibrous roots to form groves of trees with oldest plants in the center and youngest on the periphery.

EFFECTS UPON NATURAL AREAS

Black locust invades dry or moist open woodlands, stream valleys, pastures, thickets and roadsides. It can be found in upland forest natural areas where it becomes established along ridgetop logging roads, at old homesites, or in openings following natural tree fall. Eroded areas along streams also provide potential habitat for seedling establishment.

CONTROL RECOMMENDATIONS

RECOMMENDED PRACTICES IN NATURAL COMMUNITIES OF HIGH QUALITY

Black locust is difficult to control due to its rapid growth and clonal spread. Mowing and burning largely have proven only temporarily effective due to the tree's ability to spread vegetatively. As a result, management has concentrated on chemical control with variable success. Whatever control measure is adopted, a follow-up treatment is usually necessary.

Cutting

Spread of black locust can be hindered by repeated cutting during the growing season. All stems should be cut, and new stems that appear subsequently should also be removed in the same growing season. This treatment will probably need to be repeated for several years to achieve adequate control. Annual haying may be adequate to control first year seedlings and prevent spreading in prairie communities.

Herbicides

Best success with herbicides has resulted from basal bark application of herbicides to live standing trees. This should be done when trees are small and thin-barked (6 inches or less DBH). It is not as effective on larger trees. This method minimizes resprouting from roots and stumps when applied between mid-July and the end of December. Remedy (a formulation of triclopyr) is recommended at a 2% solution in diesel fuel. Spray basal part of brush or trees to a height of 15 to 20 inches above the ground. Thoroughly wet all basal bark areas, including crown buds and ground sprouts. A thorough spraying that includes spraying until run-off at the ground line is noticed is necessary to hinder resprouting. Applications in periods of dry weather will aid in root control.

Basal bark treatment with Garlon 4 (triclopyr) can also be effective, although resprouting has occurred in at least one instance with this treatment. Two to 2 1/2 oz. of Garlon 4 is added to one gallon of diesel fuel. Follow same directions as with Remedy. Great care should be exercised to avoid getting any of the mixtures on the ground near the target plant since some nontarget species may be harmed. Diesel fuel may kill vegetation around the target tree. Avoid using triclopyr if rain is forecast for the following 1-4 days; otherwise runoff will harm nontarget species.

Pelleted herbicides are discouraged because leaching could occur, affecting native woody plants. A variety of sprays are available for foliage or cut stump treatment, but these methods will probably require more follow-up treatments than the basal bark applications.

Krenite (a formulation of forsamine ammonium) is a non-volatile, contact, brush herbicide, applied as a spray to leaves usually during the 2-month period before fall coloration. Krenite should be applied only in July-September. Thorough coverage with a soft water carrier is required and a nonionic surfactant will improve results. A 1% solution applied as a foliar spray is effective. Krenite inhibits bud expansion in the spring, and control effects are not seen until the following spring. Slight regrowth may occur the following season but saplings will die during summer. Follow label recommendations to obtain best results; minimize drift. Care should be taken to avoid contacting non-target species.

Garlon 3A (a formulation of triclopyr) is a selective translocated herbicide that can be applied as a foliar or cut-surface treatment. Cut-surface treatment provides a high level of control of tree root systems, especially for suckering species such as black locust. Cut-surface application can be made during any season of the year, but application during the dormant season reduces the potential for drift injury. Undiluted or diluted Garlon 3A at a rate of 50% water can either be sprayed on the cut surface using a hand sprayer or else wiped on the cut surface using a sponge applicator (sponge-type paint applicators can be used). Either a stump or a girdle can be used for the cut surface. Girdles around the stem can be made quickly, using a chainsaw. Application should be within a few hours of cutting, adhering closely to label precautions and directions.

Crossbow may be sprayed on cut stumps at a 1% or 1.5% rate in the early fall, well before freezing. This kills small saplings, however suckering, partial greenup of treated trees and germination of seed may continue for a couple of years.

Glyphosate (trade name Roundup) can be foliar-sprayed on black locust leaves as a control when trees are actively growing. For good control, all leaves on all shoots should be treated. Roundup should be applied by hand sprayer at a 1/2 to 1 1/2 % solution (0.6 to 2 oz. of Roundup/gallon of clean water). Spray coverage should be uniform and complete. **Do not spray so heavily that herbicide drips off the target species.**

Black locust stems can be cut at the base with brush-cutters, chainsaws or hand tools, followed by treating the stump with a 20% solution of Roundup. While the Roundup label recommends a 50-100% concentration of herbicide for stump treatment, a 20% concentration has proven effective. The herbicide should be applied either by spraying individual stumps using a hand held sprayer or by wiping each stump with a sponge applicator. Treatment should occur immediately after cutting for best results. Application in late summer, early fall, or the dormant season has proven effective.

Glyphosate is a nonselective herbicide, so care should be taken to not let it come in contact with nontarget species. **Foliar spray of glyphosate should not be used in high quality areas because of problems with spraying nontarget species.**

In general, foliar spray application of herbicides should not be used in high quality areas because of potential damage to nontarget plants. Herbicide application to cut stumps or cut surfaces is preferred in high-quality natural areas because this minimizes damage to nontarget plants.

Any herbicide should be applied while backing away from the treated area to avoid walking through the wet herbicide. By law, herbicides only may be applied according to label directions. As mentioned earlier, follow-up treatments are usually necessary because of black locust's prolific sprouting and rapid growth.

Biological Control

The locust borer, *Megacylline robiniae*, can cause serious injury and disfigurement to black locust. No information is available, however, on the use of the borer as a control method.

RECOMMENDED PRACTICES ON LANDS OTHER THAN HIGH-QUALITY NATURAL AREAS

Dozing

Dozing may be practical consideration on some sites. A black locust planting of 300 plants was established in 1963 at the Elsberry Plant Materials Center near Elsberry, Missouri. Removal of the mature stand occurred in about 1987. Bulldozing, piling, and burning of trees followed by cultivation and planting to soybeans effectively eliminated root sprouts and seed germination. Monitor dozed sites for sprouting from roots or seed germination and follow-up with mechanical or chemical treatment. Roundup, Krenite, or Garlon may be used to treat any sprouts that appear.

Aerial application

Aerial spraying with Krenite works well on degraded sites having dense, tall infestations.

FAILED OR INEFFECTIVE PRACTICES

Tordon RTU (picloram) is a premixed general use herbicide labeled for cut-surface applications only. This herbicide kills treated black locust stems, but vigorous sprouts develop from roots. Stump treatments that do not effectively control the tree's root system may necessitate several additional years of foliar treatment of root sprouts. Tordon RTU has high soil mobility and persistence, and is no longer labelled for use on sandy soils.

Girdling kills the black locust stem that is girdled, but it does not prevent the formation of suckers.

Mowing areas around mature trees where seed pods have dropped seems to promote seed germination.

Fire kills the main stems but prolific sprouting results.

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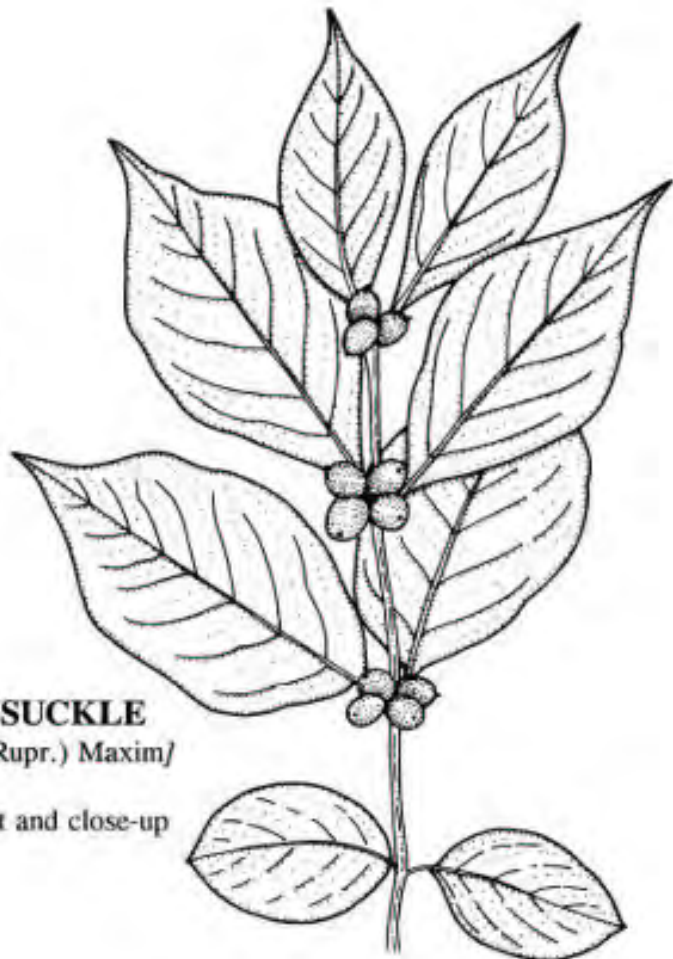
A. MORROW'S HONEYSUCKLE
(Lonicera morrowii Gray)

Leafy twig with fruit.



B. AMUR HONEYSUCKLE
[Lonicera maackii (Rupr.) Maxim]

Leafy twig with fruit and close-up
 of flowers.



VEGETATION MANAGEMENT GUIDELINE

Bush Honeysuckles: Morrow's and Amur Honeysuckle [*Lonicera morrowii* Gray and *L. maackii* (Rupr.) Maxim.]

SPECIES CHARACTER

DESCRIPTION

The two species of honeysuckle shrubs planted (Morrow's and Amur) that cause the more frequently observed invasive problems will be referred to collectively as bush honeysuckles. Bush honeysuckles grow to heights of 6-20 feet (1.8-6 meters). They are deciduous, with opposite, entire leaves, and often the older branches are hollow. Differences between individual species of non-native honeysuckles are dependent on the presence of pubescence on leaves and flowers and the length of flowers and their stems. Bush honeysuckles flower during May and June. Amur and Morrow's honeysuckle flowers are both white, fading to yellow as they age. Fruits are red and are found in pairs in the axils of the leaves.

SIMILAR SPECIES

Bush honeysuckles are easily separated from native honeysuckle species by their stout, erect shrub growth. All native species are "woody twiners" that are vine-like in nature. Japanese honeysuckle, an exotic, is also a twiner. See page 63 for its description. Native honeysuckle species are grape honeysuckle (*Lonicera reticulata*), yellow honeysuckle (*Lonicera flava*), and limber honeysuckle (*Lonicera dioica*). However, a shrub should be accurately identified as a bush honeysuckle before attempting any control measures. If identification of the species is in doubt, the plant's identity should be confirmed by a knowledgeable individual and/or by consulting appropriate books.

DISTRIBUTION

Bush honeysuckles are native to Asia. These species were introduced to North America in the late 1800s and 1900s. Morrow's honeysuckle and Amur honeysuckle are now known from northern and central Missouri. Although the distribution of these plants is predominately near larger urban areas, where they are used as ornamentals, rural infestations are common when the species are used to improve wildlife habitat.

HABITAT

Bush honeysuckles have a broad tolerance to a variety of moisture regimes and habitats. Most natural communities are susceptible to invasion by one or both of the species. Often the source of the invasion comes from a planting or from a highly disturbed successional community in which the honeysuckle has flourished. Both Morrow's and Amur honeysuckle frequently escape into woodlands, and Morrow's honeysuckle is sometimes found along roadsides as well. Wetlands, prairie, and forested communities are all affected. Habitat disturbance appears to facilitate introduction of these species, but native habitats without previous disturbance are also subject to invasion.

LIFE HISTORY

The spread of bush honeysuckle is generally accomplished by birds. Fruits are consumed readily upon ripening during summer. Bush honeysuckle plants commonly are found growing under tall shrubs or trees that act as perch areas for birds. Seeds appear to need a cold stratification period in order for the seed to break dormancy. Seedlings establish in areas of sparse herbaceous vegetation and can tolerate moderate shade. It is suspected that bush honeysuckles may produce allelopathic chemicals that enter the soil and inhibit the growth of other plants, preventing native plants from competing with the shrub. Shading by bush honeysuckle may also limit the growth of native species. Bush honeysuckles leaf out before many native species and hold their foliage until November.

EFFECTS UPON NATURAL AREAS

Bush honeysuckles will invade a wide variety of native habitats with or without previous disturbances. Affected natural communities in Illinois include: lake and stream banks, marsh, fens, sedge meadow, wet and dry prairies, savannas, floodplain and upland forest. Mesic upland and bottomland forests in Missouri are known to contain invasive stands.

CONTROL RECOMMENDATIONS

Control measures may enlist one or more of the following techniques: prescribed burning, hand pulling of seedlings, cutting, and herbicide treatments.

A recently introduced pest, the European Honeysuckle aphid, somewhat controls flower and fruit production in some of the bush honeysuckles. Heavy infestations cause tips of branches to form "witches brooms" or deformed twigs. This often greatly reduces fruit production. Native ladybug beetles, however, have been noted to control this aphid.

RECOMMENDED PRACTICES IN NATURAL COMMUNITIES OF HIGH QUALITY

In fire-adapted communities, spring prescribed burning will kill seedlings and kill the tops of mature plants. Bush honeysuckles readily resprout and repeated fires are necessary for adequate control. It may be necessary to burn annually or biennially for five years or more for effective control.

Seedlings may be hand-pulled when soils are moist. All of the root should be removed or resprouting will occur. Physical removal by hand-pulling smaller plants or grubbing out large plants should not be used in sensitive habitats. Open soil and remaining root stocks will result in rapid reinvasion or resprouting of honeysuckles and other exotics.

Bush honeysuckle stems can be cut at the base with brush-cutters, chainsaws or hand tools. After cutting, a 20% solution of glyphosate should be applied to the cut stump either by spraying the stump with a low pressure hand-held sprayer or wiping the herbicide on the stump with a sponge applicator to prevent resprouting. Glyphosate is available under the tradenames Roundup and Rodeo, products manufactured by Monsanto. While the Roundup and Rodeo labels recommend a 50-100% concentration of herbicide for stump treatment, a 20% concentration of Roundup has proven effective. It is not known if this lesser concentration is effective for Rodeo also. Rodeo can be used in wetlands and over open water, but Roundup is only labelled for use in non-wetlands. Herbicides should be applied to the cut stump immediately after cutting for best results. Application in late summer, early fall, or the dormant season has proven effective. Some resprouting may occur with a follow up treatment being necessary. Glyphosate is non-selective so care should be taken to avoid contacting non-target plants. The wood of bush honeysuckles is very tough and easily dulls powertool blades.

Underplanting of native species following honeysuckle removal may be necessary to reestablish a desirable composition of groundcover, shrubs, and understory trees. This may also minimize the risk of reinvasion by shrub honeysuckles and other exotics.

RECOMMENDED PRACTICES ON LANDS OTHER THAN HIGH-QUALITY NATURAL AREAS

Methods given above for high-quality natural communities are also effective and preferred on buffer and disturbed sites. When an area with bush honeysuckle lacks sufficient fuel to carry a fire, herbicides may be necessary to obtain control.

In dry, upland areas, a foliar spray of 1% Roundup (glyphosate) will control seedlings. A 1-1/2% foliar spray of Roundup just after plant blooming in June will control mature shrubs. Application should occur from late June to just prior to leaf color changes in fall. The herbicide should be applied while backing away from treated areas so as not to walk through

the wet herbicide.

In areas near water, a foliar spray of 1% Rodeo (glyphosate) with Ortho-X27 spreader, will control seedlings. Application should occur from late June to just prior to changes in leaf color in the fall. Foliar application of a 1-1/2% solution of Rodeo (2 oz. Rodeo/gallon clean water) will kill mature plants if all foliage is sprayed. This control method usually requires less labor but more herbicide.

In addition, Krenite controls bush honeysuckle when applied according to label instructions.

Any treatment should be rechecked in following years for reinvasion. Glyphosate is a nonselective herbicide and care should be taken to avoid contacting nontarget plants with herbicide. Do not spray so heavily that herbicide drips off the target species. By law, herbicides only may be applied according to label instructions.

FAILED OR INEFFECTIVE PRACTICES

The herbicide Garlon does not control bush honeysuckle.

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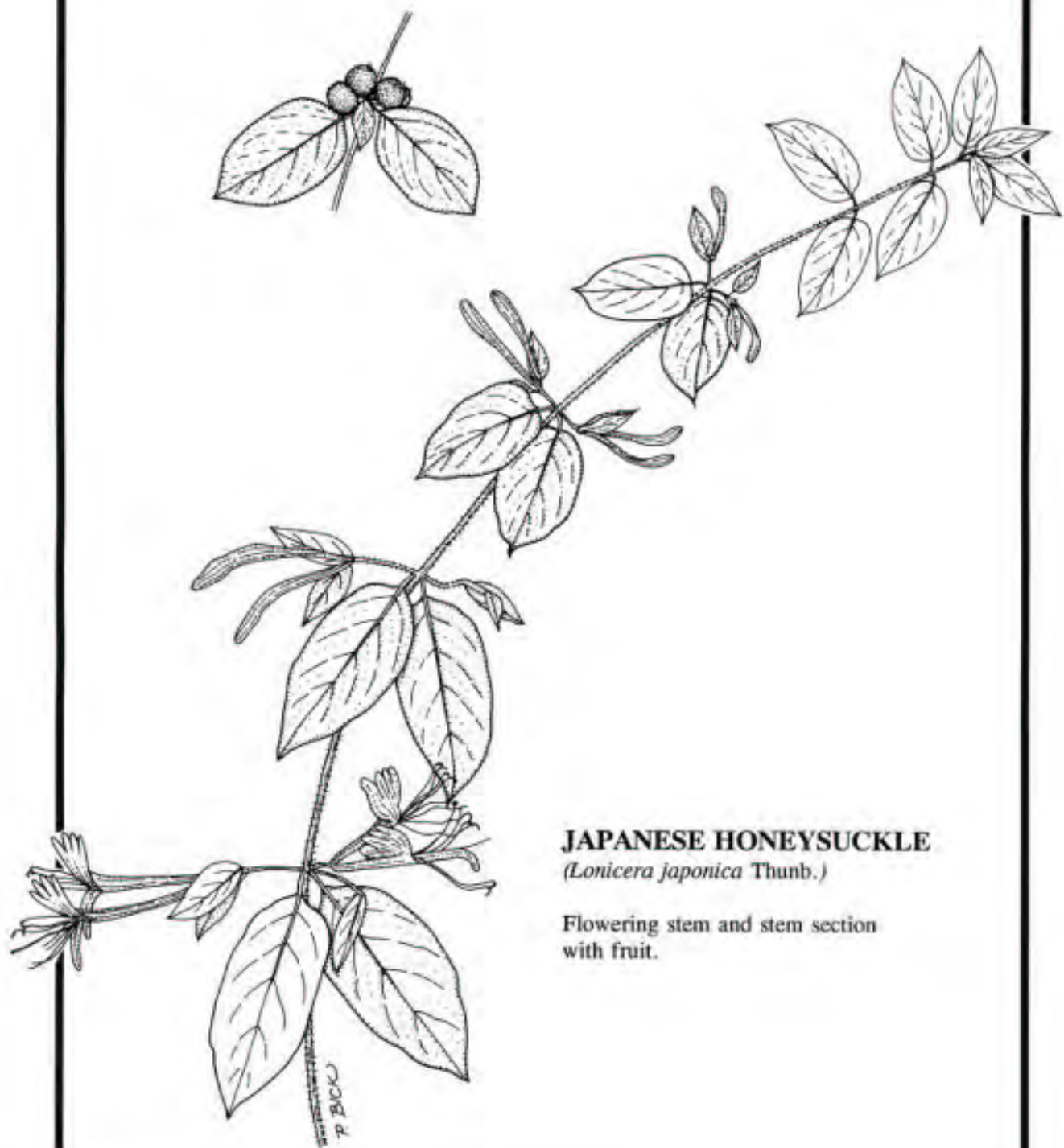
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JAPANESE HONEYSUCKLE
(*Lonicera japonica* Thunb.)

Flowering stem and stem section
with fruit.

VEGETATION MANAGEMENT GUIDELINE

Japanese Honeysuckle (*Lonicera japonica* Thunb.)

SPECIES CHARACTER

DESCRIPTION

Japanese honeysuckle is a semi-evergreen vine in Missouri, often holding its leaves late into winter. Leaves are ovate and 1.5-3.2 inches (4-8 cm) long. White to yellow tubular flowers form in pairs in the leaf axils from May-June. The 2-3 seeded fruits are small (5-6 mm long) and black.

SIMILAR SPECIES

Japanese honeysuckle is separated easily from the native honeysuckle vines by its leaves. Leaves near tips of the vines of Japanese honeysuckle are opposite and not united, while leaves of native honeysuckles (3 species) are united at the base, forming a single leaf surrounding the stem. Trumpet or coral honeysuckle is another non-native vine that occasionally escapes from cultivation in the Midwest, but it is not an aggressive species. The leaves near the tips of the vine of trumpet honeysuckle are united at the base as in our native species. It may be distinguished from the native vines as well as from Japanese honeysuckle by its red flowers. Japanese honeysuckle should be accurately identified before attempting any control measures. If identification of the species is in doubt, the plant's identity should be confirmed by a knowledgeable individual and/or by consulting appropriate books.

DISTRIBUTION

Japanese honeysuckle is native to Japan, introduced to the U.S. in 1806 for horticultural ground-cover purposes. It was slow to escape and did not become widely established over the eastern U.S. until the early 1900's. It presently occurs as far north as Illinois and Michigan, from Texas to Florida, and north to Massachusetts, New York and Ohio. In Missouri, the species is most abundant in the southeastern counties, but it occurs sporadically throughout most of the rest of the state. Bitter winter temperatures appear to limit its establishment.

HABITAT

Japanese honeysuckle readily invades open natural communities, often by seed spread by birds. An aggressive colonizer of successional fields, this vine also will invade mature forest and open woodlands such as post oak flatwoods and pin oak flatwoods. Forests with either natural or unnatural openings are often invaded by Japanese honeysuckle when birds drop seeds into

these light gap areas. Old homesites frequently harbor Japanese honeysuckle and provide a seed source for spread into the surrounding landscape. Deep shading reduces the amount of invasion.

LIFE HISTORY

Japanese honeysuckle climbs and drapes over native vegetation, shading it out. It is capable of completely covering herbaceous and understory plants, and climbing trees to the canopy. The semi-evergreen condition of this honeysuckle allows for growth both prior to and after dormancy of other deciduous plants. The prolific growth covers and smothers vegetation present including understory shrubs and trees in forested communities. Although this prolonged growth period is beneficial to the plant, it is also beneficial in controlling the plant. Vegetative runners are most prolific in the open sun and will resprout where touching the soil, forming mats of new plants. This honeysuckle will display little growth under moderate shade. In deep shade, runners develop but often die back. Flowering and seed development are heaviest in open-sun areas. Seedling establishment and growth is slow in the first 2 years of development of a new honeysuckle colony.

EFFECT UPON NATURAL AREAS

This aggressive vine seriously alters or destroys the understory and herbaceous layers of the communities it invades, including prairies, barrens, glades, flatwoods, savannas, floodplain and upland forests. It may become established in forested natural areas when openings are created from treefalls or when natural features allow a greater light intensity in the understory. Japanese honeysuckle also may alter understory bird populations in forest communities.

CURRENT STATUS

Missouri natural areas in the Crowley's Ridge area have suffered from Japanese honeysuckle invasion. The species is well-established at numerous other Missouri sites and will surely be a continuing problem for land managers.

CONTROL RECOMMENDATIONS

Initial effort in areas of heavy and light infestation

Efforts to control Japanese honeysuckle infestations have included the following methods: mowing, grazing, prescribed burning and herbicides. While grazing and mowing reduce the

spread of vegetative stems, prescribed burns or a combination of prescribed burns and herbicide spraying appears to be the best way to eradicate this vine.

In fire-adapted communities, spring prescribed burns greatly reduced Japanese honeysuckle coverage and crown volume. Repeated fires reduced honeysuckle by as much as 50% over a single burn. A previously burned population of honeysuckle will recover after several years if fire is excluded during this time. By reducing honeysuckle coverage with fire, refined herbicide treatments may be applied, if considered necessary, using less chemical.

Because Japanese honeysuckle is semi-evergreen, it will continue to photosynthesize after surrounding deciduous vegetation is dormant. This condition allows managers to detect the amount of infestation, and allows for treatment of the infestation with herbicides without damage to the dormant vegetation.

Glyphosate herbicide (tradename Roundup) is the recommended treatment for this honeysuckle. A 1.5-2% solution (2-2.6 oz of Roundup/gallon water) applied as a spray to the foliage will effectively eradicate Japanese honeysuckle. The herbicide should be applied after surrounding vegetation has become dormant in autumn but before a hard freeze (25 deg. F). Roundup should be applied carefully by hand sprayer, and spray coverage should be uniform and complete. **Do not spray so heavily that the herbicide drips off the target species.** Retreatment may be necessary for plants that are missed because of dense growth. Although glyphosate is effective when used during the growing season, use at this time is not recommended in natural areas because of the potential harm to nontarget plants. Foliar application of herbicides will be less effective prior to early summer (July 4) because early season shoot elongation will limit the transfer of chemical to the root system. Glyphosate is non-selective, so care should be taken to avoid contacting nontarget species. Nontarget plants will be important in recolonizing the site after Japanese honeysuckle is controlled.

Crossbow, a formulation of triclopyr and 2,4-D, is also a very effective herbicide that controls Japanese honeysuckle. Crossbow should be mixed according to label instructions for foliar application and applied as a foliar spray. It may be applied at dormant periods, like glyphosate, and precautions given above for glyphosate should be followed when using Crossbow. Either herbicide should be applied while backing away from the treated area to avoid walking through the wet herbicide. Garlon 3A and Garlon 4 (triclopyr) are also effective in foliar applications. By law, herbicides only may be applied according to label instructions and by licensed herbicide applicators or operators when working on public properties.

Mechanical cutting of aerial vines, followed by cut-surface herbicide treatment can be effective and minimizes the risk of spray drift. Undiluted Garlon 4 or a 20% solution of Roundup should be applied to cut stems immediately following cutting.

Maintenance control

In fire-adapted communities, periodic spring burning should control this species.

FAILED OR INEFFECTIVE PRACTICES

Mowing limits the length of Japanese honeysuckle vines, but will increase the number of stems produced.

Grazing may have the same effects as mowing, but is less predictable due to uneven treatment given by browsing animals.

Herbicides that have given poor control results or that are more persistent in the environment than other types are picloram, annitrole, aminotriazole, atrazine, dicamba, dicamba & 2,4-D, 2,4-D, DPX 5648, fenac, fenuron, simazine & triclopyr.

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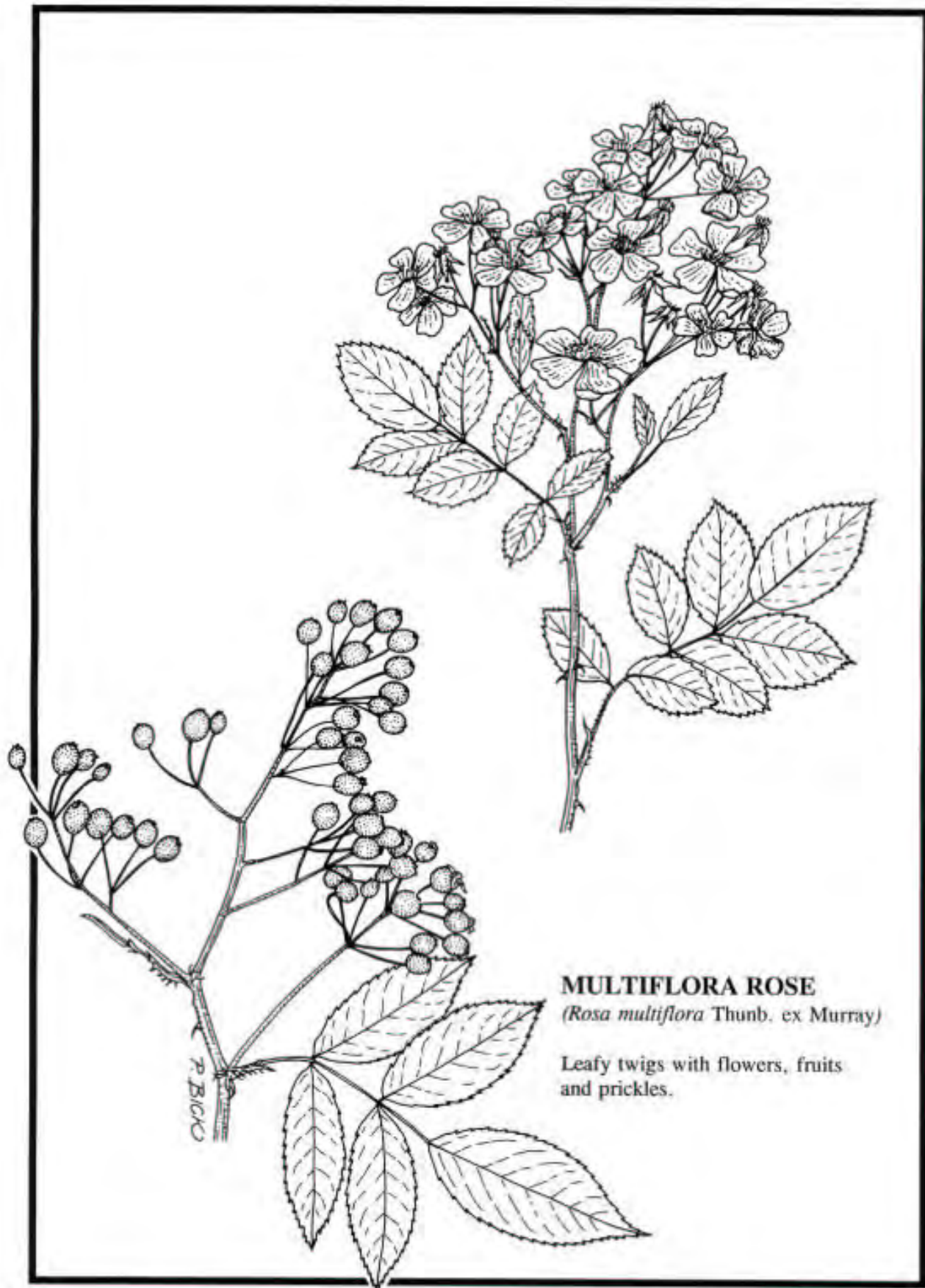
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MULTIFLORA ROSE

(*Rosa multiflora* Thunb. ex Murray)

Leafy twigs with flowers, fruits
and prickles.

VEGETATION MANAGEMENT GUIDELINE
Multiflora Rose (*Rosa multiflora* Thunb. ex Murray)

SPECIES CHARACTER

DESCRIPTION

Multiflora rose is a medium height, thorny, bushy shrub with a more spreading than erect growth form. Leaves are born alternately on the stems and divided into 5-11 leaflets (usually 7-9). Each leaflet is broadly oval and toothed along its margin. Clusters of numerous, white flowers, 3/4 - 1-1/2 inches (1.9-3.8 cm) across, bloom in late spring. The fruits are small, firm, red hips that may remain on the plant well into winter. Older rose shrubs may obtain a height of 15 feet (4.6 meters) or more with a root crown diameter of 8 inches (20 cm).

SIMILAR SPECIES

Multiflora rose can be distinguished from Missouri's native roses by the presence of a feathery or comb-like margin on the narrow stipules (a green, leaf like structure found at the base of each leaf stalk). Missouri's native rose species all have stipules at the base of the leaf stalk, but their stipules do not have feathery margins. Multiflora rose can also be distinguished from most native roses by the fact that its styles are fused together into a column. The native roses, except prairie rose (*Rosa setigera*) have separate styles. Multiflora rose should be accurately identified before attempting any control measures. If identification of the species is in doubt, the plant's identity should be confirmed by a knowledgeable individual and/or by consulting appropriate books.

DISTRIBUTION

Multiflora rose was originally introduced to the East Coast from Japan in 1886 as rootstock for cultivated roses. In the 1930's the U.S. Soil Conservation Service advocated use of multiflora rose in soil erosion control. Experimental plantings were conducted in Missouri and Illinois, and as recently as the late 1960's, many state conservation departments were distributing rooted cuttings to landowners. It was planted in the Midwest for living fences and soil conservation. Managers recognized that plantings of this thorny, bushy shrub provided excellent escape cover and a source of winter food for wildlife. The species soon spread and became a serious invader of agricultural lands, pastures, and natural communities from the Midwest to the East Coast.

HABITAT

Multiflora rose occurs in successional fields, pastures, and roadsides. It also may occur in

dense forests, particularly near natural disturbances such as treefall gaps and along streambanks. It has a wide tolerance for soil, moisture, and light conditions; but it does not grow well in standing water.

LIFE HISTORY

Multiflora rose is named for the clusters of many white flowers born on this perennial bramble during May or June. The flowers develop into small, hard fruits called hips that remain on the plant throughout winter. The great majority of plants develop from seeds remaining in the soil relatively close to plants from which they were produced. Birds and mammals also consume the hips and can disperse them greater distances. Rose seeds may remain viable in the soil for 10-20 years. Multiflora rose also spreads by layering, i.e., where tips of canes touch the ground and form roots, and by plants that arise from shallow roots.

EFFECTS UPON NATURAL AREAS

Multiflora rose readily invades prairies, savannas, open woodland, and forest edges. It is a thorny, bushy shrub that can form impenetrable thickets or "living fences" and smother out other vegetation. It is a serious pest species throughout the eastern United States.

CURRENT STATUS

There are probably no counties in Missouri where multiflora rose cannot be found today. The species was designated a noxious weed by Missouri state law in 1983. As such, Missouri counties may adopt a law that requires mandatory control of multiflora rose.

CONTROL RECOMMENDATIONS

RECOMMENDED PRACTICES IN NATURAL COMMUNITIES OF HIGH QUALITY

Pulling, grubbing, or removing individual plants from the soil can only be effective when all roots are removed or when plants that develop subsequently from severed roots are destroyed. These approaches are most practical for light, scattered infestations.

In fire-adapted communities, a routine prescribed burn program will hinder invasion and establishment of multiflora rose.

Research indicates that 3-6 cuttings or mowings per growing season for more than one year can achieve high plant mortality. Such treatment may need to be repeated for 2-4 years. Increased mowing rates (+6/season) did not increase plant mortality. In high quality

communities, repeated cutting is preferred over mowing, because repeated mowing will damage native vegetation as well as multiflora rose.

Cutting stems and either painting herbicide on the stump with a sponge applicator (sponge-type paint applicators can be used) or spraying herbicide on the stump with a low pressure hand-held sprayer kills root systems and prevents resprouting. Roundup herbicide (a formulation of glyphosate) has been effective in controlling multiflora rose when used as a 10-20% solution and applied directly to the cut stump. Although the Roundup label recommends a higher concentration for cut-stump treatment (50-100%), this lower concentration has proven effective. With this technique, herbicide is applied specifically to the target plant, reducing the possibilities of damaging nearby, desirable vegetation. Cut-stump treatment is effective late in the growing season (July-September), and also during the dormant season. Dormant season application is preferred because it will minimize potential harm to nontarget species. Glyphosate is a nonselective herbicide, so care should be taken to avoid contacting nontarget species. Both glyphosate and piclorum (Tordon RTU) are recommended for controlling established plants.

In addition, Triclopyr (tradename Garlon 3A) can be applied to cut stems or canes for selective control of multiflora rose. Garlon 3A diluted in water at a rate of 50% can be sprayed, using a hand sprayer, to the cut surface. Application should be within minutes of cutting. Use of Garlon 3A is best done in the dormant season to lessen damage to nontarget species. Great care should be exercised to avoid getting any of the herbicide on the ground near the target plant since some nontarget species may be harmed. Avoid using Triclopyr if rain is forecast for the following 1-4 days; otherwise runoff will harm nontarget species. By law, herbicides may only be applied according to label directions.

RECOMMENDED PRACTICES ON LANDS OTHER THAN HIGH-QUALITY NATURAL AREAS

Repeated cutting, as discussed above, is effective. For large populations on severely disturbed areas, mowing can be substituted for cutting individual plants. However, mowing multiflora rose can result quickly in flat tires. On mowers, filling tires with foam is recommended.

Fosamine (tradename Krenite) can be applied as a foliar spray in a 2% solution plus 0.25% surfactant (2-1/2 ounces of Krenite plus one-half ounce surfactant per gallon of water). The Krenite S formulation contains the appropriate amount of surfactant. Coverage of foliage should be complete. Krenite should be applied only in July-September. No effects will be observed during the autumn season following application. Slight regrowth may occur the following season but canes will die during the summer. Fosamine kills only woody species and is non-volatile, therefore it is the preferred foliar spray treatment.

Dicamba (tradename Banvel) is an effective foliar spray that is less preferred than Krenite. Banvel is selective against broadleaf plants, so care must be taken to avoid contacting

desirable, broadleaf vegetation. It can be applied as a foliar spray in a 1% solution (1 ounce of Banvel per gallon of water). Though this solution can be applied any time during the growing season, best results are obtained during May and June when plants are actively growing and flowering, following full leaf-out. One-half ounce of a surfactant should be added when treating dense foliage and, to enhance control in late season applications, complete coverage of all green leaves should be achieved. **Do not spray Krenite or Dicamba so heavily that herbicide drips off the target species. Foliar spray of herbicides should only be used in less sensitive areas because of problems with contacting nontarget species.**

Glyphosate (tradename Roundup) is an effective foliar spray when applied as a 1% solution to multiflora rose plants that are flowering or in bud. Roundup is not a preferred chemical treatment, however, because it is nonselective and the selective herbicides mentioned above are effective. Nevertheless, Roundup can be used as a foliar spray during the growing season on severely disturbed sites if care is taken to avoid contacting nontarget plants. Roundup should not be used as a foliar spray during the growing season in high-quality natural areas because it can result in damage to nontarget species. Roundup is useful as a foliar spray for alien plants that remain green and retain their leaves after native vegetation is dormant or senescent. Multiflora rose does not fit this description adequately and is controlled most effectively when treated during the growing season.

PROPOSED BIOLOGICAL CONTROLS

No effective biological controls that are currently considered feasible in natural communities are known. Rose rosette disease (RRD) is a fatal disease of multiflora rose and some cultivated roses, first described in the 1940s. The disease is caused by a virus-like particle transmitted by an eriophyid mite (*Phyllocoptes fructiphilus* K.). During past drought years, mite populations built up and RRD spread through much of the Midwest. The disease kills infected roses within two to three years and has already reduced weed populations in some areas. Pruning of multiflora rose will encourage succulent growth, which is more susceptible to mite infestation. Pruning may be practical in areas where RRD is present to encourage the spread of the disease. However, RRD may also infect native roses and plums, as well as commercially important plants in the rose family such as apples, some types of berries, and ornamental roses.

The rose seed chalcid (*Megastigmus aculeastus* var. *nigroflavus*), a small wasp-like insect also imported from Japan, attacks developing seed of several rose species. By destroying large amounts of seed, the chalcid limits new infestations. Research on the impact on cultivated roses along with studies on environmental limitations are currently being conducted. Both RRD and the rose seed chalcid have been documented in Missouri, but not in all counties. Once more is known about the biology of these two control agents, RRD and the rose seed chalcid could provide effective control of multiflora rose in areas where other methods are not feasible or are undesirable.

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MUSK THISTLE
(*Carduus nutans* L.)

Stem section with leaf
and flower head.

VEGETATION MANAGEMENT GUIDELINE

Musk Thistle (*Carduus nutans* L.)

SPECIES CHARACTER

DESCRIPTION

Musk thistle is a large biennial, growing to 6 feet (1.8 m.) tall. Its flowerheads are rose-purple, up to 2 1/2 inches (7 cm.) wide and are mostly solitary and nodding at the tips of the branches. At the base of each flowerhead are numerous, spine-tipped involucre bracts, 1/8" - 3/8" (2 - 8 mm) broad, that are curved away from the heads. The leaves are of two types. One type forms basal rosettes during the first year, which overwinter, staying green, and killing any plants underneath. These are deeply-lobed leaves, growing up to 10 inches (25 cm) long and 4 inches (10 cm.) wide, and possessing a prominent, nearly white midrib. The upright flowering stalk grows during the second year, producing smaller, very spiny leaves. Stems are commonly winged with spiny leaf tissue.

SIMILAR SPECIES

Musk thistle resembles several other thistles that are found in Missouri. Curly thistle or welshed thistle (*Carduus crispus*), the most closely related Missouri thistle, can be distinguished by its smaller flowerheads 0.5 - 1.0 in. (1.5 - 2.5 cm broad), narrower involucre bracts 1/8 inch (2mm, or less broad), and by its clustered flowerheads that are ascending rather than nodding.

Other Missouri thistles, including bull thistle (*Cirsium vulgare*), field thistle (*Cirsium discolor*), tall thistle (*Cirsium altissimum*), and Canada thistle (*Cirsium arvense*), can be distinguished from musk thistle by the fine bristles that are attached to the seeds. Musk thistle has unbranched bristles whereas the thistles in the genus *Cirsium* have feathery or plume-like bristles. The thistles in the genus *Cirsium* also tend to have smaller flower heads than does musk thistle. Canada thistle (see page 27), also a noxious weed in Missouri, occurs in thick colonies because it is a perennial with creeping rootstocks. Biennial species like musk thistle die after flowering and therefore do not usually occur in dense colonies.

Musk thistle should be accurately identified before attempting any control measures. If identification of the species is in doubt, the plant's identity should be confirmed by a knowledgeable individual and/or by consulting appropriate books.

DISTRIBUTION

Musk thistle is a native of Europe that was introduced into the U.S. as early as the 1850's. It has become widely naturalized in the U.S. and Canada. In this country, it occurs in at least 40

of the mainland states from the East to the West Coast. Kansas and Nebraska are reported to have the most serious infestations. In Missouri, musk thistle is widespread and probably occurs in most counties today.

HABITAT

Musk thistle is found in waste ground, old fields, pasture, and along roads and railroads. It has become a major weed in range and pasture land, a nuisance pest along rights-of-way, and a potential weed in land placed in conservation reserve programs. It can invade native grasslands, even where existing dense prairie vegetation exists. Glade communities are also likely areas for establishment of musk thistle, especially those with grazing histories and with inadequate buffers of natural land.

LIFE HISTORY

Musk thistle is variable in its flowering strategy, acting as a biennial, a winter annual, or an annual. Plants typically overwinter as rosettes and send up flowering stalks the following spring. Flowering can occur from early June through October. Seeds mature and can begin dispersing within 7 to 10 days of flowering. As many as 11,000 seeds per plant may be produced. Most seeds fall near the parent plant and can remain viable for as long as ten years.

Musk thistle infestations are economically important in agricultural systems because they compete with crops for light, space, nutrients, and water. The plants spiny tissue renders it unsuitable for livestock.

CURRENT STATUS

Musk thistle has been formally designated a noxious weed by Missouri law. As such, all landowners are required to control the plant if it is growing on their property. Control is considered to be prevention of seed production. County prosecuting attorneys are required to notify offending landowners in a prescribed manner before leveeing penalties.

CONTROL RECOMMENDATIONS

RECOMMENDED PRACTICES IN NATURAL COMMUNITIES OF HIGH QUALITY

Cultural, mechanical, biological and chemical control methods have all been used on musk thistles with varying degrees of success in different parts of the country.

-Cultural and Mechanical Methods: Musk thistle favors abandoned fields and overgrazed pastures. Rotationally grazed or deferred pasture is less susceptible to infestation than heavily grazed pastures. Although some investigators report thistle populations declined rapidly as natural succession proceeded, others report populations that persisted for twelve years in an unmanaged area.

Hand-cutting or mowing can provide control if repeated over a period of years. Hand-cutting with a sharpened shovel should insure that lateral as well as the terminal bud on the root crown are destroyed. A labor-intensive hand chopping at ground level just before flowering eliminated musk thistle at Konza Prairie, Kansas from a 350-acre pasture. The plants are apparently less likely to regrow if allowed to bolt before hand chopping the root crown. Mowing should also be timed to occur just prior to flowering.

-Biological Controls: Two exotic weevils, the flower head weevil, (*Rhinocyllus conicus*), and the rosette weevil, (*Trichosiromus horridus*) were purposely introduced from Europe and have become established in Missouri and at least ten other states. These biological control agents aid in reducing populations of the thistle. In areas of Missouri where the weevils have been present for the longest period of time (1976-1992), an 80-90% reduction in thistle population has occurred. These weevils are increasing and dispersing naturally. They have also been collected for recolonization throughout the state. As of 1992, flower head weevils were established and widely distributed in 65 counties, whereas the rosette weevil is presently known from 25 counties. Recent recolonizations of the rosette weevil (1990-1992) have been made in 13 additional counties. An integrated pest management system has been developed utilizing knowledge of thistle and weevil life cycles. This program encourages survival of the weevils through a harmonious use of herbicides and mechanical control methods.

Biological control methods are intended to establish a balance between predator and target species. As a population of thistle is diminished by the weevils, weevil numbers decline. This allows the thistle to rebound and the weevil numbers to again increase. This scenario of fluctuating thistle and weevil populations does not totally eliminate musk thistle. If the thistle is eradicated from a site by herbicide application or other means, then the predator weevils will also be lost. Then future colonization of the site by musk thistle will require reintroduction of weevils or other means of treatment.

Two studies have addressed the effect of herbicides on biological control agents. In Montana, the effect of 2,4-D on *Rhinocyllus conicus* varied with weevil density. As larval populations increase, survival decreased. A Virginia study found that treatment with 2,4-D did not adversely affect either *Rhinocyllus conicus* or *Trichosiromus horridus*.

RECOMMENDED PRACTICES ON LANDS OTHER THAN HIGH-QUALITY NATURAL AREAS

-Chemical Controls: The effectiveness of chemical control is influenced by the weather and the stage of growth of the thistle at the time of application. Chemical control of all types is most effective in the rosette stage and least effective when musk thistle is in flower. By law, herbicides may only be applied according to label directions.

Due to its low cost, 2,4-D ester at 2-4 lb/a (4.48 kg/ha) is the most commonly used herbicide. Application can be made aerially, with a tractor-mounted sprayer, with a backpack sprayer, or in granular form. Effectiveness depends on application when temperatures are not too cool and when it is not too dry. This may limit its use in early spring applications or in fall applications in some areas. 2,4-D is most effective when applied 10-14 days before bolting in the spring. 2,4-D is less effective than picloram or dicamba after plants have bolted.

Dicamba can be used to allow treatment earlier in the spring than 2,4-D. Dicamba at the rate of 1 lb/a provided the same control as 2 lb/a of 2,4-D in one study. Dicamba at 0.5 lb/a (0.6 kg/ha) provided between 90 and 100 percent control in the year of treatment for three successive years, but residual control in the second and third years fell to 36% or less. Spring applications of dicamba (.25 lb/a) in combination with 2,4-D ester (0.5 lb/a) gave 97% control by the fall of the same year.

Picloram alone or in combination with either 2,4-D or dicamba gives the best late-season control but is more expensive and carries more restrictions. These include restrictions on use near groundwater and on the season of use. Reports of effective use of picloram vary in recommended rates from .27 lb/a (0.3 kg/ha) to 0.5 lb/a (.56 kg/ha). The greatest attraction of picloram is that it provides excellent control during the cool, dry autumn season when neither 2,4-D nor dicamba is as effective, and when non-targeted vegetation is less susceptible. Although picloram overcomes the effects of weather, it does not fully overcome the effect of growth stage. Control of dense, even height, bolted plants using picloram in a ropewick applicator was effective, but control was poor when plants were of varying heights. Concomitant with its greater effectiveness, picloram presents a greater risk of damaging non-target species. Damage to cool-season grasses was reported in a study using higher concentrations of picloram (1 lb/a).

FAILED OR INEFFECTIVE PRACTICES

Mowing, brushhogging, and spraying when thistles are in full bloom is ineffective. Cutting the stems does not kill the plant at this stage. Stems will regrow and still flower and seed. Similarly, if herbicide application does not kill the plant, which is not too uncommon, regrowth and seeding will occur.

Fire has not been effective as a method for directly controlling musk thistle. It is difficult to generate enough heat to kill the thistle's root crown and fire-scarred plants can bolt, flower, and fruit.

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PERSONAL COMMUNICATION

- Ben Puttler. 1992. Department of Entomology. University of Missouri, Columbia.



P. BICK



SERICEA LESPEDEZA

[*Lespedeza cuneata* (Dum.-Cours.) Don]

Mid-stem section with leaves and fruit.

Upper stem with leaves and flowers.

VEGETATION MANAGEMENT GUIDELINE

Sericea Lespedeza [*Lespedeza cuneata* (Dum.-Cours.) Don]

SPECIES CHARACTER

DESCRIPTION

Sericea lespedeza is an introduced perennial legume. It has erect, herbaceous to somewhat woody stems, standing 3 to 6 feet (0.8-2 m.) high, with many erect, leafy branches which are green to ashy in color. The compound leaves are composed of three leaflets, with leaflets varying in length from 1/4" to 1" (0.8 - 2.5 cm). The lower leaves have petioles, but the upper leaves are nearly sessile. The leaflets are much longer than wide, tapering to the base, and wider above the middle, narrowing abruptly to a small sharp point. Flowers are in clusters of mostly 2-3 in upper leaf axils. The corollas measure from 1/4 to 3/8 inches (7-9 mm.) long and are a pale creamy-yellow with conspicuous purple or pink markings. Its myriads of fruits are oval, and up to 1/8 inch (3 mm.) wide.

SIMILAR SPECIES

The pale creamy-yellow flowers are smaller than those of the native species, *L. capitata* and *L. hirta*, which also have cream-colored or yellowish flowers. The base of the standard (the upper petal of the flower) of sericea lespedeza has two broad purplish-rose-colored streaks on the inside of the center portion. The flowers of *L. capitata* and *L. hirta* occur in clusters of three to many (20-25), and the stem hairs of these two native species are spreading rather than being appressed to the stem as in sericea lespedeza.

DISTRIBUTION

Sericea lespedeza is a native of eastern Asia. It was first introduced in southern United States, and has now become naturalized from Maryland, Virginia, Tennessee, Missouri, and Texas, north to Pennsylvania, Ohio, Michigan, Illinois and Oklahoma. The first recorded collection of sericea lespedeza in Missouri was made in 1938. It has been introduced into various areas as a soil cover for erosion control, for soil improvement, as food and cover for bob-white, wild turkey, and other wildlife, and to a lesser extent, for forage and hay.

HABITAT

Sericea lespedeza grows in woodlands, thickets, fields, prairies, disturbed open ground, borders of ponds and swamps, meadows, and especially along roadsides. It shows great resistance to summer drought and an ability to form a dense stand on sterile, steep, or eroded

slopes. Where it has invaded grasslands, sericea lespedeza is unpalatable compared to native species because of tannins present in its tissues.

LIFE HISTORY

Sericea lespedeza produces growth in the spring (mid to late April) from root crown buds at the base of last year's stems. Flowering begins in late July and can continue through October. As flowering progresses, root reserves are increased; a fact that has implications for use of translocated herbicides. Seeds are dispersed in the fall and are reported to remain viable for twenty or more years. Birds may play a role in seed dispersal, and certainly the species is spread by haying of infested fields.

CURRENT STATUS

Since its introduction into Missouri this century, sericea lespedeza has been widely planted and has become naturalized in most if not all Missouri counties. Numerous stands that are well-established along roadways will continue to provide a source for spreading into surrounding, more natural habitats. Sericea lespedeza is designated a noxious weed in several Kansas counties.

CONTROL RECOMMENDATIONS

Options available for control of sericea lespedeza include management, mechanical, and chemical methods. There are no biological controls approved for sericea lespedeza at this time other than grazing.

Management: Rangelands can be managed to control sericea lespedeza by burning, grazing, and fertilization. Prescribed burning of native grass in the late spring followed by intensive grazing with mature cattle will increase utilization on sericea lespedeza. Grazing infested sites with sheep and goats will provide effective control. Pastures should be properly fertilized and grazed during April and May to reduce the occurrence of sericea lespedeza.

Fire has been used on non-rangeland infestations with some success. Late spring burns (May 15 to the end of June) may be effective if a fire will carry through the area at that time. Seed dormancy of sericea lespedeza can be broken by prescribed burning but resulting seedlings may be less viable. Breaking seed dormancy by burning may be preferable to allowing natural processes to accomplish this, since a persistent, long-lived seed bank may add new plants to the site for years to come. By forcing more seeds to germinate, following up with a mechanical or chemical treatment may have more long-term effects.

Mechanical: Root reserves of sericea lespedeza increase during flowering with a low point in the cycle at the flower bud stage. This low point provides a vulnerable stage at which to use mechanical control. Mowing in the flower bud stage for 2 to 3 consecutive years should reduce the vigor of sericea lespedeza.

Chemical:

-Rangeland control: Treatments containing triclopyr (e.g. Garlon 3A, Garlon 4) or metsulfuron (e.g. Ally, Escort) have been shown to be the most effective herbicides for sericea lespedeza control. Triclopyr at 0.5 lbs. acid equivalent/acre or metsulfuron at 0.3 oz. product/acre can provide effective control of sericea lespedeza treated during the vegetative stage prior to branching or during flowering. Ground application of herbicides should be in 10 to 20 gallons of solution per acre to insure adequate coverage.

-Spot applications: Application of herbicides using backpack sprayers has been effective for small or scattered infestations. Foliar applications of 2,4-D amine or glyphosate (tradename Roundup) have been effective at normal concentrations for foliar treatments. See herbicide label directions for appropriate concentrations. Glyphosate is effective from mid-June until seed set. 2,4-D amine should be applied from late June until seed set. When using any herbicide, precautions should be taken to avoid contacting non-target species. **Do not spray so heavily that herbicide drips off the target species.** The herbicide should be applied while backing away from the treated area to avoid contacting wet herbicide. By law, herbicides only may be applied as per label instructions.

FAILED OR INEFFECTIVE PRACTICES

Prescribed burning alone may not be effective in controlling sericea lespedeza. Fire may actually enhance germinating of sericea lespedeza seed.

In rangeland situations, intensive, early stocking (doubling the normal stocking rate from May 1 to July 15 and then removing the livestock) with steers has not provided consistent utilization of sericea lespedeza.

2,4-D was not found to provide effective control for sericea lespedeza in rangeland applications.

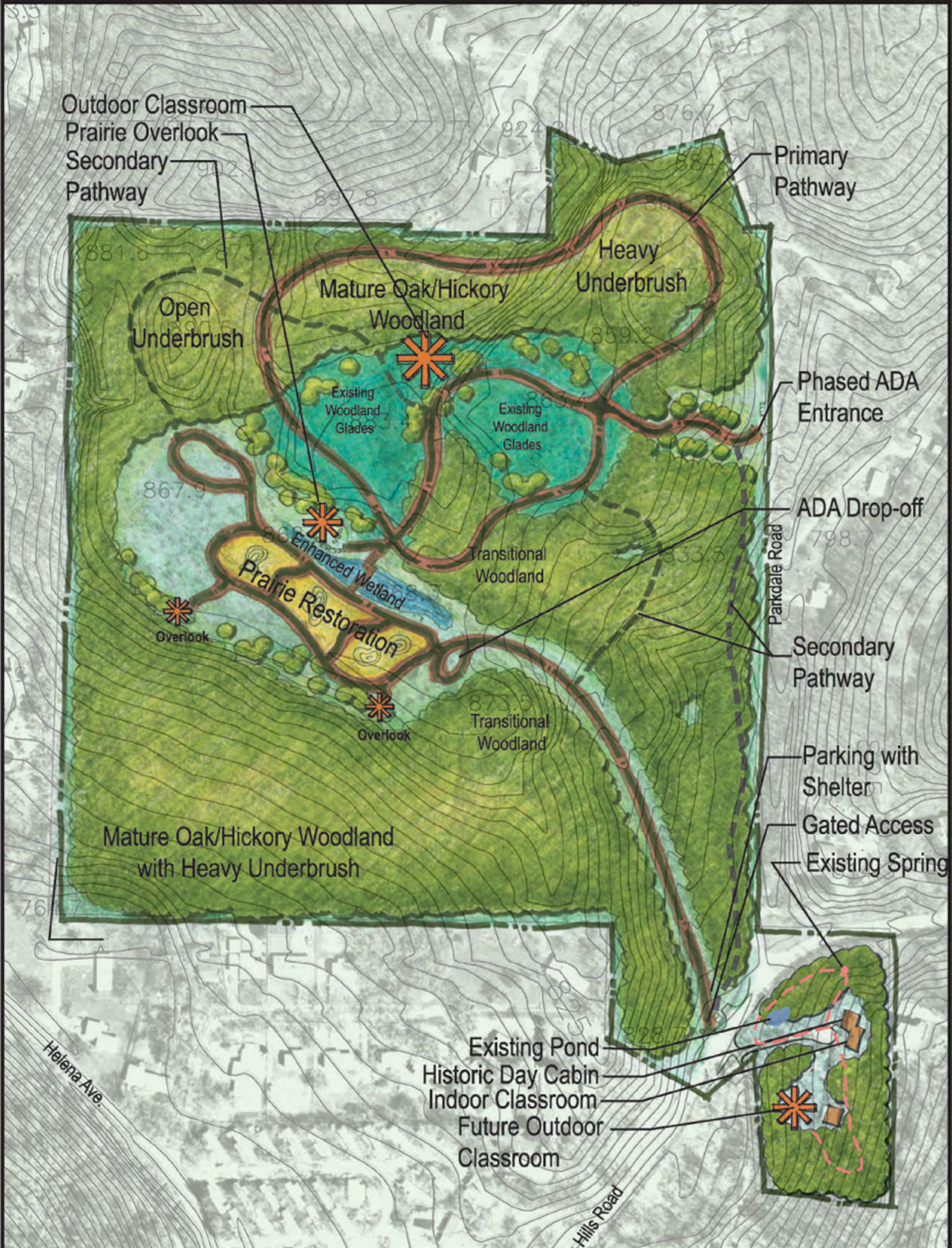
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PERSONAL COMMUNICATIONS

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- West, Andy. 1993. Division of Natural Heritage, Illinois Department of Conservation, Springfield, Illinois.



Conceptual Plan - site opportunities





Location

Green Hills Wildlife Preserve is located in unincorporated southern Platte County, Township 50/51 N, Range 33 W, Section 6/31, between the communities of Parkville and Riverside, Missouri. The preserve is 45.5 acres and is bounded by residences on the north, south, and west, and by Parkdale Rd and residences on the east, including the 2.75 acre life estate belonging to Mrs. Dorothy Day. Parkville Nature Sanctuary and White Alloe Creek Conservation Area are 2 miles northeast and Platte County's proposed SE Area Park is ¼ mile northeast of the preserve.



Location of Green Hills Preserve in relation to nearby parks.

Methodology

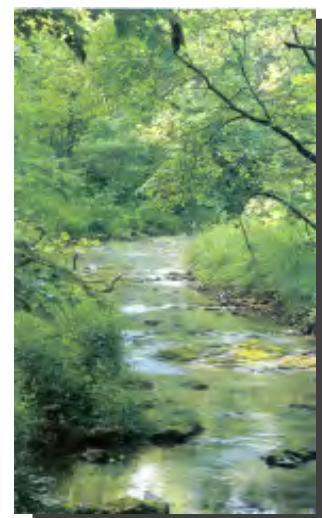
The purpose of this site assessment and natural features inventory is to create a base of information on natural communities and other major topographic features currently present within the project area. This assessment is to be used as a guide to define areas that should be designated for resource preservation and management, and for future development planning. With this goal in mind, the assessment was geared toward gaining a better understanding of the riparian zones, topographic features, and vegetative cover present throughout the site. This information is not intended as a comprehensive natural resources inventory but, to provide second tier site information for the above stated purpose.

Information Gathering

Before conducting the onsite assessment, aerial photographs, topographic maps, and soil survey maps were gathered from existing sources. This information was used to gain a preliminary understanding of site features, vegetative cover types, and disturbance patterns likely to be encountered.

The following natural features criteria were used to evaluate resources throughout the area:

- ❖ **Slopes and Soils:** slopes are categorized with soil types: This type of assessment can help highlight areas that are prone to erosion and less suitable for development.
- ❖ **Vegetative Cover:** Assessment of current land use provides a preliminary inventory of current vegetation including trees, shrubs, and herbaceous plants. The vegetative cover can be used to determine sensitive areas for protection during development planning.
- ❖ **Watersheds and Riparian Zones:** These areas are critical for managing natural stormwater runoff as well as providing valuable corridors for wildlife.



Natural Resource Inventory

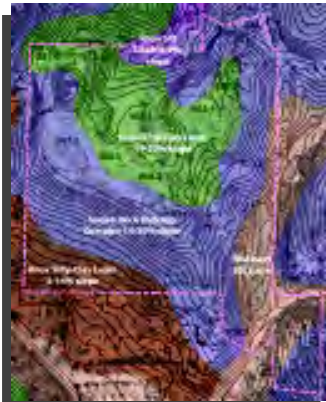
The Green Hills Wildlife Preserve lies within the Big Rivers and the Glaciated Plains Natural Divisions. The Big Rivers natural division comprises about 5 percent of the state. It includes the floodplains and terraces of the largest rivers, primarily the Missouri and Mississippi, but also the lower Grand and the lower Des Moines. Soils are mostly alluvial, deep, and productive. Presettlement natural features included mesic to wet prairie, bottomland and upland forests, marshes, sloughs, islands, sand and mud bars, oxbow ponds, and rivers. Bedrock is generally covered with alluvial deposits. In presettlement times, and until drastic channel modification began in the early 1900 s, the Missouri River was a braided stream with many chutes, sloughs, islands, and channels.



The Glaciated Plains natural division is based primarily on differences in soils, biota, geographic position, river drainages, and presettlement vegetation. It is characterized by loess-dominated topography and soils resulting from the influence of the Kansan stage of Pleistocene glaciation. It is also considered to have the driest climate in the state. In presettlement times, over half of the section was prairie which occupied much of the stream drainages and the uplands. Deciduous forest occurred along some of the drainages. Streams are low-gradient, turbid, and variable in water levels. Steep loess mounds along the Missouri River are a striking feature of this section.

Soil Classification

A majority of the soils present on this site are within the Knox-Snead association. This association consists of deep and moderately deep, moderately sloping to steep, well drained and moderately well drained soils that formed in loess (fine grained material, of silt-sized particles, deposited by wind) and in residuum of shale and limestone. The remaining soil type is part of the Nodaway-Colo-Wiota association. This association contains deep, nearly level, moderately well drained, poorly drained, and well drained soils that formed in alluvium (deposits by running water); on floodplains and terraces.



Historic soils present on site prior to quarry operation.

Soil Type	% Slope	Permeability	Surface Runoff	Shrink - Swell Potential	Natural Fertility Organic Matter Content
Snead Rock Outcrop 10F*	14 - 30	Slow	Rapid	High	Low/Moderate
Nodaway Silt Loam 39**		Moderate	Slow	Moderate	High/Moderate
Knox Silt Loam 54C2	5 - 9	Moderate	Medium	Moderate	High/Low
Knox Silty Clay Loam 55D3	5 - 14	Moderate	Rapid	Moderate	Medium/Low
Knox Silty Clay Loam 55E3	14 - 20	Moderate	Rapid	Moderate	Medium/Low

* Seasonal high water table at a depth of 2 to 3 ft. in winter/spring.

** Seasonal high water table at a depth of 3 to 5 ft. in winter.

Vegetation - Historic

Presettlement terrestrial vegetation within the Upper Missouri section of the Big Rivers division was about one-third prairie. Seaside crowfoot (*Ranunculus cymbalaria* Pursh) and spurge (*Euphorbia glyptosperma* Engelm.) are two plants that are generally restricted to this Section. Reed (*Phragmites communis* Trin.), great bulrush (*Scirpus acustus* Muhl.), and dock (*Rumex mexicanus* Meisn.) are characteristic plants.

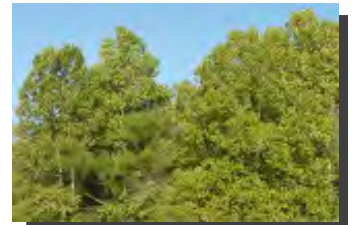
Presettlement prairie vegetation had elements of the Great Plains such as hairy and blue grama (*Boutelona hirsuta* Lag. and *B. gracilis* [HBK] Lag.), large-flowered penstemon (*Penstemon grandiflorus*), soapweed (*Yucca glauca*), and downy painted cup (*Castilleja sessiliflora*). Forest vegetation included oaks (White-*Quercus alba*, Northern Red-*Q. rubra*), hickories (Shagbark-*Carya ovata*), and other mixed deciduous species of trees (Sugar Maple-*Acer saccharum*) and shrubs (Rough-leaved Dogwood-*Cornus drummondii*).

There are 3 natural communities that were historically abundant within the Glaciated Plains Natural Division and that still occur to some degree within the preserve. These include:

Upland-Mesic Forest occurs throughout the state but most abundantly in the Glaciated Plains Natural Division. This is a mixed deciduous forest consisting of a closed (nearly 100%), tall (90-140 ft.) tree canopy and a well developed understory. Dominant plants include northern red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), white oak (*Quercus alba*), basswood (*Tilia americana*), and pawpaw (*Asimina triloba*).

Dry-Mesic Savanna is widespread throughout the Glaciated Plains Natural Division where it is associated with prairie streams and hilly terrain. The typical vegetation is an open (10-50%), medium height (30-60 ft.) oak-hickory tree canopy. Understory vegetation is generally absent. The remaining ground cover consists of mixed grasses and herbaceous plants similar to those found in dry-mesic prairies. Dominant plants include bur oak (*Quercus macrocarpa*), shingle oak (*Q. imbricaria*), post oak (*Q. stellata*), white oak (*Q. alba*), big bluestem (*Andropogon gerardii*), and little bluestem (*Schizachyrium scoparium*).

Dry-Mesic Prairie is widespread throughout the Glaciated Plains Natural Division where it is generally associated with mesic prairies and at the base of steep loess hills where it is associated with dry prairies. Vegetation is exclusive of trees, rarely includes shrubs and is dominated by grasses intermixed with a few herbaceous species. Dominant plants include little bluestem (*Schizachyrium scoparium*) and Indiangrass (*Sorghastrum nutans*).



Forest with dense tree cover > 80%.



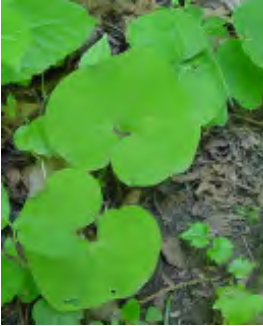
Savanna - native grassland with 10-50 % tree cover.



Native prairie grasses with little to no trees or shrubs.

Vegetation - Existing

The site assessment map (on facing page) shows 5 general habitat types. The types include:



Wild ginger in mature open woodland.

Mature Oak/Hickory Woodland is present along the north edge and the southwest corner of the property. Vegetation within this area is representative composite of the upland-mesic forest and dry-mesic savanna consisting of a moderately dense (65-90%) tree canopy, few understory plants, and a ground cover of herbaceous plants. The tree canopy includes northern red oak (*Quercus rubra*), white oak (*Quercus alba*), shagbark hickory (*Carya ovata*) and hackberry (*Celtis occidentalis*). The understory is dominated by pawpaw (*Asimina triloba*) and grey dogwood (*Cornus drummondii*). Ground cover consists of tick trefoil (*Desmodium glutinosum*), buckbrush (*Symphoricarpos orbiculatus*), moonseed (*Menispermum canadense*), Virginia creeper (*Parthenocissus quinquefolia*), Jack-in-the-pulpit (*Arisaema atrorubrens*), wild ginger (*Asarum canadense*) poison ivy (*Rhus toxicodendron*), with shrub honeysuckle (*Lonicera maackii*) along the outer edges.



Mature Chinquapin oak.

Transitional Woodlands can be found along the south side of the existing gravel access road and in the center between the woodland glade areas. This vegetation has a more open canopy (10-50%) and is comprised cottonwood (*Populus deltoides*), shingle oak (*Quercus imbricaria*), redbud (*Cercis canadensis*), American and slippery elm (*Ulmus americana* and *U. rubra*), riverbank grape (*Vitis riparia*), poison ivy (*Rhus toxicodendron*), tick trefoil (*Desmodium glutinosum*), shrub honeysuckle (*Lonicera maackii*), buckbrush (*Symphoricarpos orbiculatus*), grey dogwood (*Cornus drummondii*), sericea lespedeza (*Lespedeza sericea*), ragweed (*Ambrosia trifida*), and multi-flora rose (*Rosa multiflora*).

Existing Woodland Glades occur within the central portion of the property at the core of the quarry operation area. The soils within these areas are very shallow with large areas of exposed rock. Ground cover vegetation is sparse, consisting of heath asters (*Aster pilosus*), ragweed (*Ambrosia trifida*), Queen Anne's lace (*Daucus carota*), grey dogwood (*Cornus drummondii*), yellow clover (*Trifolium agrarium*), poison ivy (*Rhus toxicodendron*). The glade areas are gradually being invaded by honey locust (*Gleditsia triacanthos*), red cedar (*Juniperus virginiana*), shrub honeysuckle (*Lonicera maackii*), and grey dogwood (*Cornus drummondii*).



Large shrub-like poison ivy.

Prairie Restoration is located along the southern section of the central quarry area. Due to the past removal of vegetation, soil, and rock for the quarry operation, this area has had the least plant growth. Vegetation is extremely sparse consisting largely of herbaceous plants and grasses.

Invasive/Exotic Plant Area is most predominantly located along the east side of the property. During operation of the quarry this area was used to load stone. The woody vegetation is dominated by Japanese honeysuckle (*Lonicera japonica*) and shrub honeysuckle (*Lonicera maackii*).

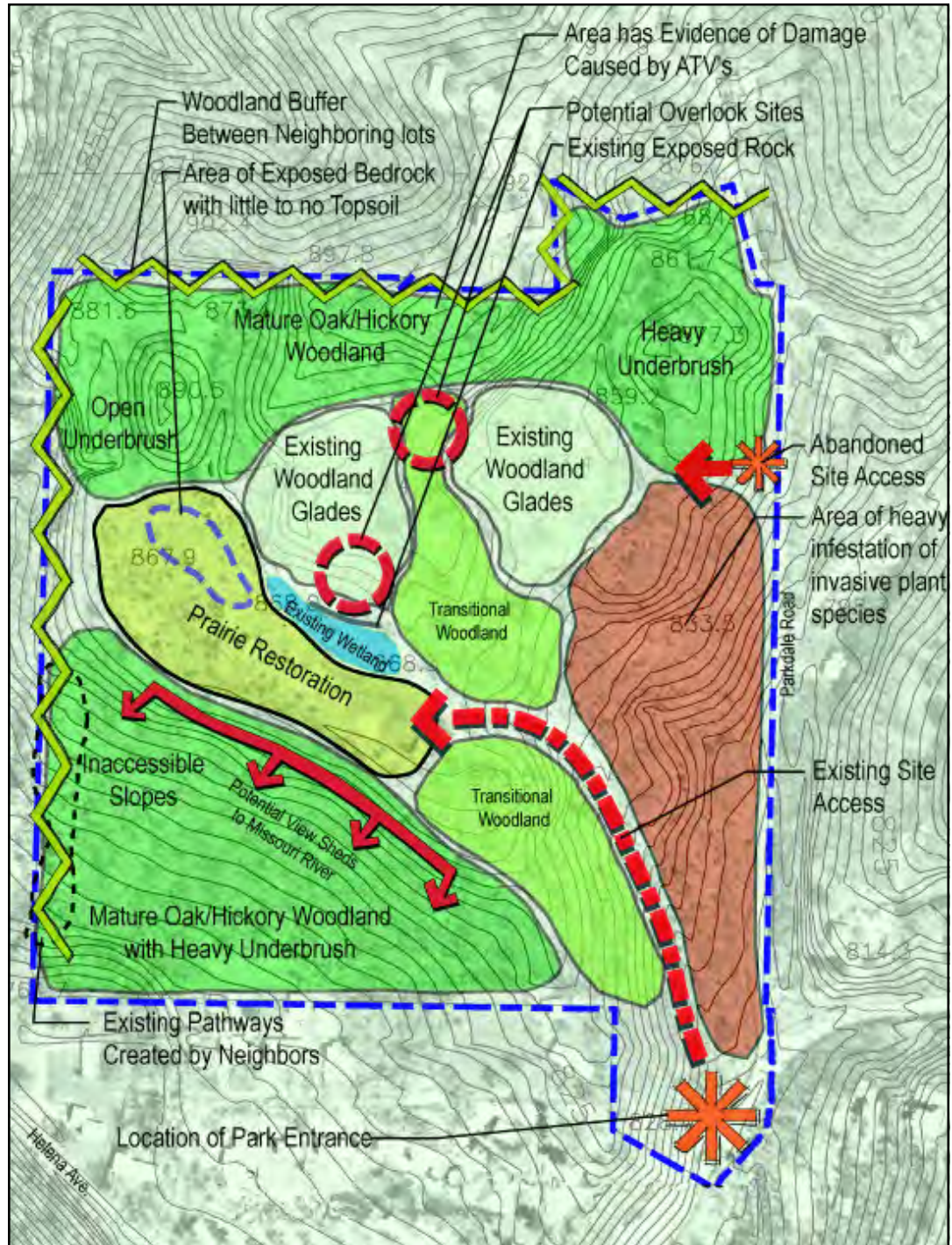


Mature woodland south side of prairie restoration area.

Open understory in mature oak/hickory woodland.

Transitional woodland at main entrance gate.

Existing woodland glade.



Site Assessment - existing plant communities.

Watersheds and Riparian Zones

The Wildlife Preserve lies within the Rush Creek Watershed. All streams and creeks within this watershed flow south to the Missouri River. Because the majority of the preserve consists of upland topography, the area has limited water resources. The water resources found on this site include:



Gravel streambed with well vegetated streambanks.

Gravel Wash Streambed occupies smaller streams and rivers with more rugged topography. These streams are generally higher gradient in which floodwaters rapidly drain downstream. Vegetation present is quite variable consisting of shrubs dominating the understory and a sparse mixture of grasses, vines, and herbaceous plants providing the remaining ground cover. Vegetative species usually occur within zones along the gravel wash.

A tributary of Burlington Creek flows along the eastern boundary of the Wildlife Preserve. This is an intermittent, gravel wash stream that periodically floods Green Hills and Parkdale Roads during large rainfall events. The culvert located at the preserve entrance on Green Hills Rd. has been listed by the Parkville Special Road District for repair/replacement. However, as of August 2003 the Special Road District stated that they have no immediate plans to make any repairs or changes to this culvert or the road.



Groundwater seep along north edge of prairie restoration.

Ground Water Seepage this type of natural community is distinguished from other wetlands in that soils are saturated by ground water of which the source and volume vary greatly. The soil moisture gradient exhibits seasonal fluctuations. Seepages may occur in narrow valley basins, or on gentle to steep slopes of hills. They may also appear as distinct plant communities within glades, savannas, prairies, or as openings within forests. Natural communities occupying this type of habitat reflect water and soil chemistry present and are described based on acidity, salinity, topography, water flow, and vegetation. The dominant vegetation consists of common cattails (*Typha sp.*), horsetail and scouring rush (*Equisetum spp.*), and cottonwood (*Populus deltoides*).



Wetland vegetation resulting from presence of seep.

An area located along the north side of the prairie restoration site is representative of a ground water seep where the soil moisture exhibits seasonal fluctuations and the plant community is unique to the area. Vegetation found throughout this seep consists of sedge species (*Carex sp.*), smartweed (*Polygonum punctatum*), and cattails (*Typha latifolia*). During spring and fall rainy seasons, water accumulates and begins to flow east from the main seep to the gully that runs along the north side of the entrance road. Overland runoff from the open area also tends to flow into this gully resulting in multiple gullies eroding alongside the road bed.



Site Management Opportunities

The Green Hills Wildlife Preserve presents an incredible opportunity for restoration and management of a relatively diverse range of wildlife habitats. The current condition of various areas will dictate the amount of time and resources necessary. Through a cooperative partnership with the Missouri Department of Conservation, restoration efforts have already begun to take place on the property.

Prairie

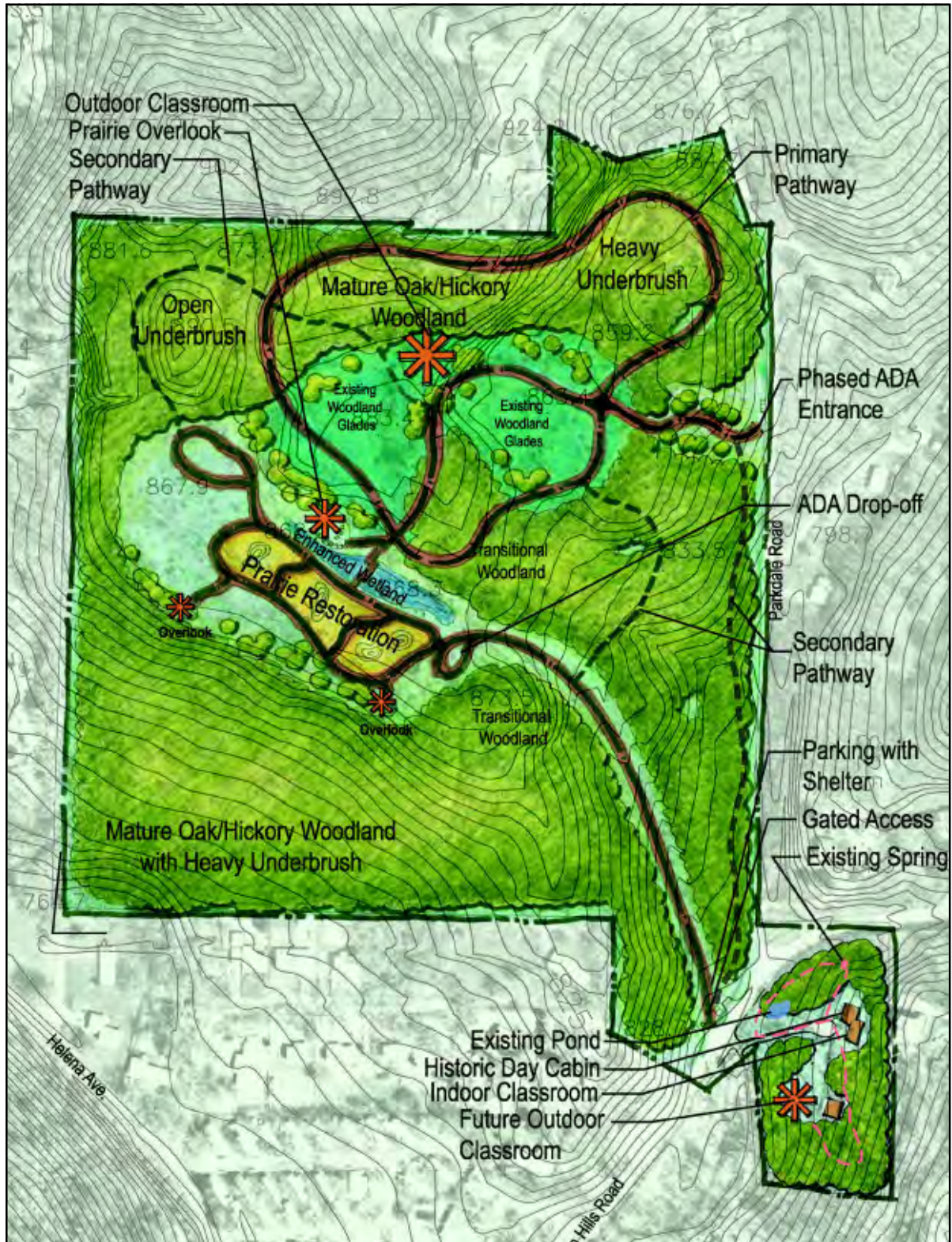
Because the open area in the center of the property most closely represents a dry-mesic prairie, management efforts are focusing on restoring plants and grasses that would have occurred within this type of habitat. The Platte County Parks and Recreation Department in cooperation with the Missouri Department of Conservation to use Wildlife and Conservation Restoration Grant funds from MDC to seed the prairie restoration area with native grasses and wildflowers in the spring of 2003.. The seed mix included:

WILDFLOWERS

Lead plant (<i>Amorpha canescens</i>)	Smooth aster (<i>Aster laevis</i>)
Aromatic aster (<i>Aster oblongifolius oolentangiensis</i>)	Sky blue aster (<i>Aster</i>
Silky aster (<i>Aster sericeus</i>)	Prairie Coreopsis (<i>Coreopsis palmate</i>)
Plains coreopsis (<i>Coreopsis tinctoria candida</i>)	White prairie clover (<i>Dalea</i>
Purple prairie clover (<i>Dalea purpurea</i>) (<i>Echinacea pallida</i>)	Pale purple coneflower
Rose verbena (<i>Glandularia Canadensis aspera</i>)	Rough blazing star (<i>Liatris</i>
Wild bergamot (<i>Monarda fistulosa</i>) (<i>Ratibida pinnata</i>)	Gray-head coneflower
Black-eyed susan (<i>Rudbeckia hirta</i>)	Blue sage (<i>Salvia azurea</i>)
Widow s cross (<i>Sedum pulchellum rigida</i>)	Rigid goldenrod (<i>Solidago</i>
Ohio spiderwort (<i>Tradescantia ohiensis</i>)	

GRASSES

Sideoats grama (<i>Bouteloua curtipendula latifolium</i>)	River oats (<i>Chasmanthium</i>
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Conceptual Plan - site opportunities.

Woodlands

Initially, woodland management will need to focus on removal of exotic and invasive plant species. Selective removal of smaller, less desirable trees (honey locust, elm, box elder, red cedar) and understory vegetation (buckbrush, multi flora rose, poison ivy) will result in a more open understory. This open understory will be suitable for more native woodland plants including but not limited to Jack-in-the Pulpit, wild ginger, bloodroot (*Sanguinaria canadensis*), dutchman s breeches (*Dicentra cucullaria*), violets (*Viola sp.*), and trilliums (*Trillium sp.*).

Site Opportunities

The Wildlife Preserve presents unique natural, historical and cultural recreation opportunities. The primary use will be passive recreation in the form of hiking trails, bird watching and wildlife viewing, cultural history. In order to accomplish these goals, efforts will need to be phased with an initial focus on creation of trails (use of surface types will be dependent upon ADA accessibility and the existing topography), design and implementation of an ADA accessible entrance parking lot, shelter and restroom facility. Future phases of development will include improvements to the adjoining Day property currently held in a life estate by Ms. Dorothy Day.

Project Phases

Many of the projects listed within this phasing plan will take place throughout multiple phases such as honeysuckle and understory brush removal and native seedlings/plantings. After meeting the requirements of the Land and Water Conservation Fund (LWCF), other major components for improvements to the area and the adjoining Day property will be phased in upon availability of funding.

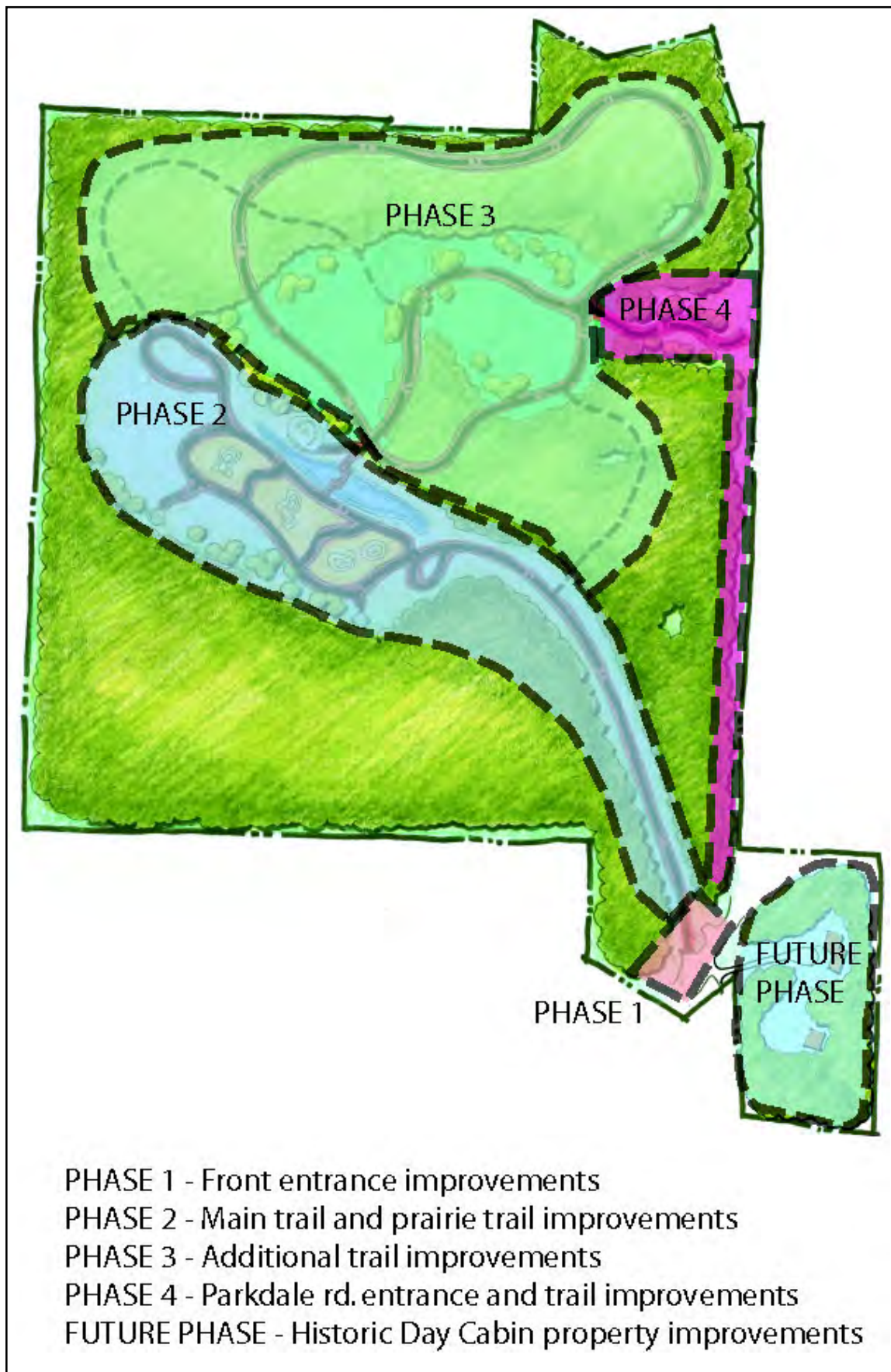
Phase I

The emphasis for Phase I will be the improvements to the primary entrance to the preserve. Funding for the parking lot, shelter, and other amenities denoted in the opinion of probable cost will be provided through the LWCF Grant the County received. Part of the LWCF grant requirement is that the entrance improvements will need to meet ADA guidelines.

Phase II

The focus of this phase will be improvements to the gravel entrance road up to the native plant restoration area, expansion and improvements to the existing wetland seep area, ADA accessible trails and boardwalks throughout this area, interpretive signs, and benches for proposed overlooks.

Phase III



Phasing of project goals and management opportunities.

OPINION OF PROBABLE COST:		CONCEPTUAL PLAN			
PROJECT:					
GREEN HILLS MASTER PLAN					
Prepared By Patti Banks Associates					
	UNIT	QUANTITY		UNIT COST	TOTAL
PHASE 1					
SHELTER (16' x 20')	EA	1 @		\$ 19,000.00	\$ 19,000.00
PARK SIGN	EA	1 @		\$ 4,000.00	\$ 4,000.00
RELOCATE EXISTING GATE	EA	1 @		\$ 1,000.00	\$ 1,000.00
6" GRAVEL PARKING / ROAD SURFACE	SF	3800 @		\$ 4.00	\$ 15,200.00
CLIVUS COMPOSTING TOILETS	EA	1 @		\$ 25,000.00	\$ 25,000.00
6' LIMESTONE SCREENING TRAIL	SY	50 @		\$ 12.00	\$ 600.00
NATIVE GRASS SEEDING	AC	0.5 @		\$ 2,200.00	\$ 1,100.00
TRASH RECEPTACLE	EA	1 @		\$ 350.00	\$ 350.00
NATIVE PLANT MATERIAL (ALLOWANCE)	LS	1 @		\$ 5,000.00	\$ 5,000.00
BIRD FEEDERS	EA	3 @		\$ 40.00	\$ 120.00
SPLIT RAIL FENCE	LF	200 @		\$ 6.70	\$ 1,340.00
HISTORICAL INFORMATION SIGN	EA	1 @		\$ 1,000.00	\$ 1,000.00
BENCHES	EA	3 @		\$ 400.00	\$ 1,200.00
(*) DENOTES LAND, WATER, AND CONSERVATION FUND REQUIREMENT					
		10 % Contingency			\$ 7,491.00
		PH 1 - Subtotal			\$ 82,401.00
		Design / Engineering			\$ 8,240.10
		PH1 - TOTAL			\$ 90,641.10

PHASE 2

GRAVEL PARK ROAD (10' WIDTH)	LF	1200 @		\$ 40.00	\$ 48,000.00
8' WIDE BOARDWALKS	LF	60 @		\$ 200.00	\$ 12,000.00
6' LIMESTONE SCREENINGS TRAIL	SY	2066 @		\$ 12.00	\$ 24,792.00
INTERPRETIVE KIOSK	LS	1 @		\$ 2,400.00	\$ 2,400.00
OVERLOOKS WITH BENCHES	EA	2 @		\$ 5,000.00	\$ 10,000.00
UNDERBRUSH CLEARING	LS	1 @		\$ 3,000.00	\$ 3,000.00
INTERPRETIVE SIGNS (ALLOWANCE)	LS	1 @		\$ 3,000.00	\$ 3,000.00
WETLAND EXPANSION AND IMPROVEMENT	LS	1 @		\$ 20,000.00	\$ 20,000.00
NATIVE PLANT MATERIAL (ALLOWANCE)	LS	1 @		\$ 5,000.00	\$ 5,000.00

10 %Contingency	\$	12,819.20
PH 2 - Subtotal	\$	141,011.20
Design / Engineering	\$	14,101.12
PH 2 - TOTAL	\$	155,112.32

PHASE 3

6' MULCHED PRIMARY TRAIL	LF	1500	@	\$ 10.00	\$ 15,000.00
3' MULCHED SECONDARY TRAIL	LF	1400	@	\$ 6.00	\$ 8,400.00
6' LIMESTONE SCREENINGS TRAIL	SY	433	@	\$ 12.00	\$ 5,196.00
INTERPRETIVE SIGNS (ALLOWANCE)	LS	1	@	\$ 3,000.00	\$ 3,000.00
UNDERBRUSH CLEARING	LS	1	@	\$ 6,000.00	\$ 6,000.00
OUTDOOR CLASSROOM	LS	1	@	\$ 5,000.00	\$ 5,000.00
NATIVE PLANT MATERIAL (ALLOWANCE)	LS	1	@	\$ 5,000.00	\$ 5,000.00

10 %Contingency	\$	4,759.60
PH 3 - Subtotal	\$	52,355.60
Design / Engineering	\$	5,235.56
PH 3 - TOTAL	\$	57,591.16

PHASE 4

PHASE 4					
PARK SIGN	EA	1	@	\$ 2,000.00	\$ 2,000.00
SECURITY GATE	EA	1	@	\$ 2,000.00	\$ 2,000.00
6" GRAVEL ROAD / PARKING SURFACE	SF	1000	@	\$ 4.00	\$ 4,000.00
UNDERBRUSH CLEARING	LS	1	@	\$ 3,000.00	\$ 3,000.00
6' LIMESTONE SCREENINGS TRAIL	SY	233	@	\$ 12.00	\$ 2,796.00
3' MULCHED SECONDARY TRAIL	LF	1000	@	\$ 6.00	\$ 6,000.00
	10 % Contingency				\$ 1,979.60
	PH 4 - Subtotal				\$ 21,775.60
	Design / Engineering				\$ 2,177.56
	PH 4 - TOTAL				\$ 23,953.16

FUTURE PHASE (Historic Day Cabin)

OUTDOOR CLASSROOM			@	N/A	UNDETERMINED
IMPROVEMENTS TO SOUTH WING OF CABIN			@	N/A	UNDETERMINED
TRAIL IMPROVEMENTS			@	N/A	UNDETERMINED

FUTURE PHASE - TOTAL **UNDETERMINED**

TOTAL	\$ 327,297.74
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