

# Pierce Cedar Creek Institute Natural Area Management Plan

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## **I. Introduction**

Pierce Cedar Creek Institute (PCCI), is comprised of 661 acres in Sections 19 and 30 of Baltimore and Hope Townships, Barry County, Michigan. The Institute is situated in a recessional moraine which provides a physical setting for a great variety of ecosystems. Approximately 45% of the 661 acres of Institute property is upland forest, 43% is wetland (of which over one-half is fen), about 10% is upland field and constructed prairie, and 2% is open water. There are nearly 7 miles of hiking trails on the Institute's property.

The main parcel of the Institute's property was purchased from Dr. H. Lewis and Jean Batts, who bought the initial piece of the property in 1952 to protect it from development. Dr. Batts was a visionary conservationist, prominent, internationally known environmentalist, and co-founder of the Kalamazoo Nature Center and the Environmental Defense Fund. Prior to the Batts' ownership of this property, the majority of the land suitable for agricultural use was farmed. Although a strong advocate for conserving and preserving agricultural land, Batts quickly took all but about 70 acres of his property out of production, using it instead as a bird sanctuary and family vacationing location. Batt's vision to preserve the property by taking it out of agricultural production and insisting that it be placed under a conservation easement, made the property suitable for Willard and Jessie Pierce's vision of creating an environmental institute where people could come and learn about and experience the wonders of nature in Barry County. Willard and Jessie Pierce purchased the property in 1998. Gary, their son, who is a botanist and expert in wetlands construction and management, moved back from New York to help his parents create their vision. Pierce Cedar Creek opened its doors to the public in February 2001.

## **II. Purpose**

PCCI's natural resources are the main attraction for visitors and researchers and are maintained and improved for the purpose of interpreting the natural environment and the relationship people have to it. The goals of PCCI's land management are to produce and maintain natural areas that are:

- Healthy and ecologically diverse—demonstrated by vigorous activity or production, with diverse and numerous interactions between system components, and resilience (the system's capacity to maintain structure and function in the presence of stress).
- Natural-appearing with minimal evidence of human structures (no incompatible uses that degrade sensitive site resources)
- Composed of biological communities primarily consisting of species historically native to this region of Michigan (Considerable effort will be required to control numerous non-native and invasive species)

- Inhabited by animals in balance with vegetation
- Generally characterized by natural events such as: the natural succession of historically native species, natural plant and animal population cycles, natural erosion, fire, and windstorms
- Accessible to researchers and the local community for interpretive and educational experiences.

The purpose of this Management Plan is to act as a guide for future management and land use decisions regarding Pierce Cedar Creek Institute. This plan identifies the resources to be protected, those that require restoration and rehabilitation, specific action plan and anticipated results. This Management Plan should be considered a working document and should be reviewed and revised annually by the Land Steward to monitor the progress and development of management decisions regarding the natural areas of Pierce Cedar Creek Institute.

### **III. Mission Statement**

The mission of Pierce Cedar Creek Institute is “to promote environmental education, research, preservation, and appreciation of the natural world”. This management plan will help the Institute staff manage and conserve the ecological and scenic character of the area, while offering a variety of research, educational, and recreational uses for the enjoyment of the general public.

### **IV. Historical Land Use**

According to the *1880 History of Allegan and Barry Counties, Michigan with Illustrations and Biographical Sketches of Their Prominent Men and Pioneers*, the first real written account of the natives that lived in the area was from 1671. The Ottawa and Pottawatomie, both tribes belong to the Algonquin race, were using the land as winter grounds. During this time, there were large, old growth stands of oak-hickory and beech-maple forests that rolled over the land. These forest stands were maintained by periodic burning started either by naturally occurring phenomenon or through prescribed burning carried out by the Native Americans. Refer to Appendix A for a map of the pre-settlement vegetation of the PCCI property.

On August 29, 1821, under the supervision of General Cass of the United States Army, the Native American tribes of this area gave up their property rights in exchange for cash. The property now located in Section 30 was first purchased by land speculators (Joseph R. Williams, Joseph Beckust, and Henry B. Norton) in 1836. The property currently located in Section 19 was purchased by actual settlers, not land speculators, in about 1850. The historical land patents show that Peter L. Cain, Jesse Russell, Amos Brewster (for whom Brewster Lake is named), and Solomon and Benjamin Stanton were the first to purchase the property in section 19 from the federal government. These original property owners farmed the land for corn and wheat and had limited amounts of livestock (cows, oxen, sheep, and pigs) grazing

the property. Records indicate that former owner, Samuel Weeks, purchased 160 acres of the property in the 1860's to be used for lumbering. It was sometime after this date, too, that a saw mill was installed on Cedar Creek.

By 1873, there were 10 separate agricultural owners in sections 19 and 30. As these smaller farms began to expand, the presence of horses and haying practices become more prevalent on the property. In 1910, the farms on PCCI's property were still in production and were rather productive. At this time, grazing from cattle, horses, and sheep was concentrated on portions of the property south of Cloverdale Rd (the area that is currently the NW prairie and campus area). Corn, wheat, oats, and alfalfa were grown on what is now called the MidW and SW prairie plantings.

After this period of relative stability and of larger market farming, the land began to trade hands a little more quickly, though it stayed as agriculture land until the 1950's. The growth of these farms was likely hindered by how secluded the property is from any major metropolitan areas, as well as the rolling landscape, which makes large-scale agriculture very difficult to accomplish.

Dr. H. Lewis Batts began to purchase parcels of land (totaling 555 acres) in sections 19 and 30 in 1952. His goal was to create a bird sanctuary and vacation haven for his family. As a result, he had all but 70 acres of agricultural land taken out of production. Dr. Batts hired a groundskeeper to watch over the property while he was away and to keep the property in good condition. It was likely this groundskeeper who planted the ornamental and domestic landscape plants (such as apple trees, pine trees, hostas, peonies, daylilies, and autumn olive) located near Batt's cottage and the head of the Blue Trail. Since the Willard and Jessie Pierce Foundation purchased the property in 1998, the property has been placed under a conservation easement and has been actively managed as a refuge for native wildlife species.

#### Property Acquisitions:

- In 1998, Dr. Batts agreed to sell his 555-acre property to the Pierce Foundation for the development of the Institute, as long as it was placed in a conservation easement with the Southwest Michigan Land Conservancy and was dedicated to environmental education.
- The Little Grand Canyon, 50 acres, was purchased at a Stanton auction, October 9, 1998. 20 acres on Mud Lake, off Cloverdale Road, was also purchased at the auction.
- The Hyla House property, 13 acres, was purchased from the Rolfe family in March 1999.
- The Burpee property, 43 acres, was purchased in July 2003, and the Mud Lake property was sold.

## **V. Ecological Site Description and Natural Features**

### **A. Topography and Soil Types**

The topography of Pierce Cedar Creek Institute's property is a direct result of the last period of glaciation known as the Wisconsinian. This glacial period covered the landscape with ice. The two lobes of this ice that impacted our landscape were the Lake Michigan lobe (which followed the course of present-day Lake Michigan) and the Saginaw lobe (which flowed NE to SW from the Saginaw Bay area). These lobes left the present-day Kalamazoo moraine which extends from Hastings south and east through Marshall to Devil's Lake in Lenawee County. As the glacial ice melted, the glacial outwash and post-glacial alluvium formed what is now present-day Cedar Creek and "The Little Grand Canyon" (located at the noncontiguous 50 acre parcel NE of Brewster Lake). Brewster Lake is also a result of this melting ice and is the remnant depression left by a melting block of ice formally known as a kettle lake. The remainder of the property is composed of coarse-textured glacial till and glacial erratic. This overall composition gives rise to our associated wetland and upland areas. Refer to Appendix E for a topographic map of the property.

The most predominant soil types on PCCI's property are: Houghton muck, Marlette loam, Perrinton loam, and Tekenink fine sandy loam. Houghton muck is a very poorly drained soil type that has moderately slow to moderately rapid permeability and very slow (ponded) surface run-off. At PCCI, Houghton muck is found along the perimeter of Brewster Lake and in all areas surrounding waterways. Marlette loam consists of gently rolling, well-drained soils with moderately slow permeability and medium surface run-off. This soil type can be found along the eastern and northern portions of the Red Trail, along the upland portions of the Blue Trail and White Trail, the southern half of the Yellow Trail, and along small extents of the Orange Trail. Perrinton loam is similar to Marlette loam but has slower permeability. Perrinton loam is primarily located in the areas of fallow farm field that have been converted to prairie habitat. Tekenink fine sandy loam is composed of well-drained soil with moderate permeability and slow surface run-off. At PCCI, this soil type is found within the North Prairie planting and extends east towards Brewster Lake. Refer to Appendices C and D for soil texture and soil type maps of the property.

## B. Natural Communities (refer to Appendix B for Stewardship unit map)

### 1. Open Uplands

The open upland communities of PCCI include agricultural fields, old-field, savanna, prairie (constructed), and sand prairie habitats. The agricultural fields of PCCI are located at the noncontiguous “Little Grand Canyon” property as well as the property where Hyla House and Meadow Lodge are located. Currently the only agricultural practice taking place in the open upland habitats is mowing of the agricultural fields to harvest hay and to discourage the encroachment of woody invasive plants.

Old-field habitats are located north of the MidEast prairie planting and east of the SE1 prairie planting (refer to Appendix F for a map and historical information about the prairie plantings). These open fields are thought to be former savanna/immature oak- hickory forest and were in agricultural production until the early 1950’s. The Institute will be converting all old fields into oak savanna, short grass prairie, or tall grass prairie as time and funding allows. Remnant savanna habitat is located west of the MidWest prairie planting, NE and SE of the Green Trail Prairie planting, and NW of the future North Wet Lab Prairie planting.

Currently, over 70 acres of prairie habitat has been planted in the NW corner of the property as well as the areas surrounding the campus and driveway. Traditional, mesic prairies are predominantly treeless, grassy plains consisting of native plants (grasses and wildflowers) on level to gently rolling terrain. Dominant plants include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparius*), prairie cordgrass (*Spartina pectinata*), and assorted wildflowers.

Mesic sand prairies are native grasslands growing on deep, sandy soils, which are prone to summer drought but sometimes inundated in early spring. At the Institute, a degraded form of this plant community is located on the Burpee parcel (within the White Trail loop) and makes excellent habitat for breeding reptiles (i.e. box turtles—a special concern species in Michigan). The dominant species are little bluestem (*Schizachyrium scoparius*), big bluestem (*Andropogon gerardii*), and Pennsylvania sedge (*Carex pensylvanica*).

### 2. Open Wetlands

The open wetland communities at PCCI are best described as prairie fen habitat. A prairie fen is a wetland community dominated by sedges, grasses, and occasional shrubs and is typically located on sapric peat.

Prairie fens are typically flowing with groundwater rich in calcium and magnesium carbonates. One of the distinct vegetation zones of the prairie fen is sedge meadow which is dominated by sedges, grasses, forbs, and low shrubs. At the Institute, the prairie fen is located along the shores of Brewster Lake, in the immediate vicinity of Cedar Creek, along the NE property boundary, and on the southeastern most portion of the cedar swamp habitat. Dominant plants in the Institute's prairie fen include: tussock sedge (*Carex stricta*), grass-of-parnassus (*Parnassia palustris*), Canada goldenrod (*Solidago canadensis*), tall goldenrod (*Solidago gigantea*), tall sunflower (*Helianthus giganteus*), swamp thistle (*Cirsium muticum*), and various asters (*Aster* spp.). Other important plant species include nodding and shining ladies'-tresses (*Spiranthes cernua* and *S. lucida*), large and small yellow lady slippers (*Cypripedium parviflorum* var. *pubescens* and *C. parviflorum* var. *makasin*), and showy lady slippers (*Cypripedium reginae*). Bordering the sedge meadow along the eastern shore of Brewster Lake is a shrub-carr community of tamarack (*Larix laricina*), dogwood (*Cornus* spp.), poison sumac (*Toxicodendron vernix*), blueberry (*Vaccinium* spp.), and shrubby cinquefoil (*Potentilla fruticosa*).

### 3. Forested Wetlands

The forested wetland communities of PCCI include both mixed conifer swamps (northern white cedar and tamarack) and mixed deciduous swamps. A mixed conifer swamp is a minerotrophic-forested peatland. These swamps are often situated on glacial outwash drainageways, at stream headwaters in end moraines, in kettle-hole depressions, or coarse end moraine topography. The ground layer of conifer swamp can be especially diverse in sedges, ferns, orchids, forbs, liverworts, and mosses. At the Institute, the mixed conifer swamps are found in the floodplain of Cedar Creek.

A mixed deciduous swamp is a forested wetland community consisting of a variety of deciduous trees such as: red maple (*Acer rubrum*), black ash (*Fraxinus nigra*), yellow birch (*Betula alleghaniensis*), American elm (*Ulmus americana*), silver maple (*Acer saccharinum*), alternate-leaf dogwood (*Cornus alternifolia*), and swamp white oak (*Quercus bicolor*). Mixed deciduous swamps are often flooded seasonally and may be more or less dry in late summer and fall. Fundamental disturbance factors affecting this natural community include seasonal flooding and windthrow. At PCCI, the mixed deciduous swamps are located along the southeastern property border and in the area between the Blue Trail and the White Trail.

#### 4. Young Forest

The young forest habitats at PCCI were likely dry southern forest and dry-mesic southern forest prior to European settlement. These fire-adapted communities are dominated by oak and mixed hardwood species and are typically located on sandy or sandy loam soil. At PCCI, young forest habitats are located northeast of Batt's cottage along the end moraine, along the eastern property line near Cloverdale Rd., and the area surrounding the prairie fen along the shores of Brewster Lake. Common trees found in this plant community are: black oak (*Quercus velutina*), red oak (*Quercus rubra*), white ash (*Fraxinus Americana*), bitternut hickory (*Carya cordiformis*), black cherry (*Prunus virginiana*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), American elm (*Ulmus americana*), and American beech (*Fagus grandifolia*).

#### 5. Old Growth Forest

The old growth forests at PCCI are typical mesic and dry-mesic southern forests. Mesic southern forests are composed of hardwood trees (with few oak species) on moist ground having a loamy soil texture. At the Institute, the largest old growth forest is the "beech-maple" forest surrounded by conifer swamps south of Cloverdale Rd. along the Blue Trail. Several examples of minimally disturbed dry-mesic southern forests are found on the property. This forest type is typically dominated by oaks. The examples found at PCCI are dominated by red oak (*Quercus rubra*). A small old growth forest is found in the SW corner of the property just north of the Blue Trail and east of the Orange Trail. In addition, two small old growth forests dominated by mixed hardwoods can be found along the northern property line. Canopy associates include white ash (*Fraxinus americana*), tulip tree (*Liriodendron tulipifera*), white oak (*Quercus alba*), and basswood (*Tilia americana*). Muscledwood (*Carpinus caroliniana*), and ironwood (*Ostrya virginiana*) are common in the subcanopy.

#### 6. Open Water

The open water communities found at PCCI include Brewster Lake, Cedar Creek, ephemeral ponds, and human-constructed retention ponds.

- a. Brewster Lake: Brewster Lake is a small (approximately 13 acre) inland lake of glacial origin (a typical "kettle hole" lake). It has been isolated from any industrial use, agricultural activity, or public access since at least 1952. The lake has been classified as a meso-eutrophic lake and has been the subject of substantial

scientific research. At its deepest point, Brewster Lake is 28 feet deep.

- b. Cedar Creek: Cedar Creek runs through the Institute's property and is a third order cold-water trout stream and tributary to the Thornapple River.
- c. Ephemeral Ponds: Ephemeral ponds are depressions which temporarily hold water on poorly drained soils. Ephemeral ponds require sufficient catchment area for recharge; contours to hold water long enough to balance losses to infiltration or evaporation; and impervious soils to hold water. In contrast to most ponds and lakes, ephemeral ponds often have no in-flowing or out-flowing streams. One pond is located north of Brewster Lake, another is located at the south end of the SE prairie, and a third is located just northwest of the Yellow Trail/Blue Trail intersection.
- d. Retention Ponds: The Institute has two retention ponds west of the Visitor Center Parking lot. These retention ponds are man-made ponds where storm-water is directed and held before the water enters Cedar Creek.

### C. Non-native/Invasive species

The most-threatening non-native and invasive plants found on the property include:

- autumn olive (*Elaeagnus umbellata*)
- spotted knapweed (*Centaurea maculosa*)
- garlic mustard (*Alliaria petiolata*)
- purple loosestrife (*Lythrum salicaria*)
- multiflora rose (*Rosa multiflora*)
- Eurasian milfoil (*Myriophyllum spicatum*)
- Phragmites (*Phragmites australis*)
- Canada thistle (*Cirsium ravenens*)
- crown vetch (*Coronilla varia*)
- black locust (*Robinia pseudoacacia*)
- white mulberry (*Morus alba*)
- sweet white clover (*Melilotus alba*)
- narrow-leaved cat-tail (*Typha angustifolia*)

Several moth species have been introduced to PCCI and the general vicinity and may be threats to native insects and the health of the herbaceous layer in general: *Noctua pronuba* (population sizes have been expanding since 2000), *Apamea uninamis* (sod feeding invasive), and *Lymantria dispar*, the gypsy moth is only an occasional threat to defoliation events at PCCI.

## D. Rare Species Occurrences

Pierce Cedar Creek Institute is home to 24 reported animal species and 1 documented, naturally occurring plant species classified as endangered, threatened, or “special concern” status:

- Indiana Bat (*Myotis sodalis*)
- Eastern Massasauga Rattlesnake (*Sistrurus catenatus*)
- Black Rat Snake (*Elaphe obsoleta*)
- Blandings Turtle (*Emys blandingii*)
- Eastern Box Turtle (*Terrapene carolina*)
- Spotted Turtle (*Clemmys guttata*)
- American Bittern (*Botaurus lentiginosus*)
- Bald Eagle (*Haliaeetus leucocephalus*)
- Cooper’s Hawk (*Accipiter cooperii*)
- Red-shouldered Hawk (*Buteo lineatus*)
- Cerulean Warbler (*Dendroica cerulea*)
- Grasshopper Sparrow (*Ammodramus savannarum*)
- Henslow’s Sparrow (*Ammodramus henslowii*)
- Frosted Elfin (*Callophrys irus*)
- Henry’s Elfin (*Callophrys henrici*)
- Ottoe Skipper (*Hesperia ottoe*)
- Persius Duskywing (*Erynnis persius*)
- Laura’s Snaketail (*Stylurus laurae*)
- Ginseng (*Panax quinquefolius*)
- *Dargida rubripennis* (Lepidoptera Noctuidae)
- *Macrochilo bivitatta* (Lepidoptera Noctuidae)
- *Pediasia abnaki* (Lepidoptera Pyralidae)
- *Papaipema speciosissima* (Lepidoptera Noctuidae; MNFI, special concern)
- *Meropleon ambifusca* (Lepidoptera Noctuidae; MNFI, special concern)

## VI. Management of Natural Areas

### A. Open Uplands

1. **Status:** The open upland natural areas that are currently being extensively managed at PCCI include savanna, sand prairie, and constructed prairies. Other open upland areas include agricultural and fallow fields, which are mowed to discourage the encroachment of non-

native/invasive plants. Each of these open upland habitats were created by past human activities such as farming and grazing and show signs of human settlement. The open upland natural areas contained within PCCI are not heavily used by the general public and are managed on a routine basis (invasive plant removal, prescribed fire, mowing, etc.). A minimal amount of disturbance may occur each growing season as a result of research projects. There are invasive species such as spotted knapweed, garlic mustard, autumn olive, multiflora rose, mulberry, etc. that need to be managed/controlled to preserve the native biodiversity of the open upland habitats.

2. **Goals:** To preserve and enhance the ecological diversity of the prairie/savanna management units by minimizing the impacts of human activities and invasive plants /animals. The fallow fields and agricultural fields will ultimately be transformed into constructed prairies by planting them with grass and wildflower species native to Michigan. Whenever feasible, only local genotype seed will be introduced into these plantings. The open upland habitats will specifically be managed to protect and accommodate eastern massasauga rattlesnakes, Henslow's sparrows, and any other rare/protected species discovered in this particular habitat. In addition, a goal will be to increase the plant diversity of the constructed prairies over time so that they more closely resemble naturally occurring prairies.

3. **Management Strategies:**

- Introducing frequent prescribed fire (and/or mowing) to protect and enhance plant species diversity and to prevent the encroachment of trees and shrubs. (Refer to Appendix I for specific timeline for performing prescribed fires).
- Monitoring and prompt/sustained control of all non-native/invasive species that threaten diversity and community structure. (Refer to Appendix G and H for specific instructions and timelines for mechanical and chemical control of invasive plants).
- Continuing to administer the Quality Deer Management program to control the density of deer that pose a threat to the forb diversity within the open upland natural communities.
- Possible removal of select trees located in hedgerows between prairie restorations to accommodate rare grassland species such as Henslow's sparrows and prairie voles, which require large uninterrupted areas of grassland.

4. **Quality Site Indicators:**

1. Substantial fuel to carry fire
2. Presence of prairie indicator species

3. Relative absence of woody species and aggressive weeds
4. Diversity of native plants and animals
5. Permanent (or seasonal) populations of *Dargida rubripennis*, a prairie obligate moth species detected on the property in 2010. Resident status of this species at PCCI (and Michigan in general) is not known.

## B. Open Wetlands

1. **Status:** The open wetland (prairie fen) natural area located on the Institute's property is not heavily used by the general public and appears to be in a relatively healthy state with no obvious signs of human impact outside of student research activity and the introduction of non-native plants. The presence of invasive species such as autumn olive, purple loosestrife, multiflora rose, and narrow-leaved cattail has been detected and will need to be actively managed.
2. **Goals:** To preserve the ecological diversity of the prairie fen habitat by minimizing the impacts of human activities and invasive plants /animals. The prairie fen habitat will specifically be managed to protect rare and protected species not limited to: eastern massasauga rattlesnakes, Blandings and spotted turtles, lady slipper wildflowers, and two rare moth species known to exist in the prairie fen habitat (*Chortodes enervate* and *Ortholepis baloghi*).
3. **Management Strategies:**
  - Implementing various land use planning efforts (i.e. eliminating nutrient additions and contaminants from septic tanks, drain fields, herbicide, and agricultural run-off, etc.) to protect groundwater reserves within the property boundaries.
  - Reintroducing prescribed fire to prairie fen and adjacent upland habitat. Refer to Appendix N for detailed prescribed fire guidelines within eastern massasauga rattlesnake habitat.
  - Reducing the density of non-native/invasive shrubs and trees through manual and chemical control. Refer to Appendices G and H for specific instructions and timelines for mechanical and chemical control of invasive plants.

4. **Quality Site Indicators:**
  1. Relative absence of woody species and aggressive weeds such as autumn olive, narrow-leaved cattails, phragmites, and purple loosestrife.
  2. Presence of hummock formation, shrubby cinquefoil, fine-leaved sedges, and intact hydrology
  3. Regular disturbance (fire) that helps to maintain diversity and floristic quality found on site.
  4. Healthy/stable populations of eastern massasauga rattlesnakes and other rare species documented at the site.
  5. Healthy/stable populations of the following moth species (Lepidoptera: Noctuidae) as suggested by Dr. John Wilterding: (*Macrochilo bivitatta*, *Photedes panetela*, *Meropleon ambifusum*, *Meropleon diversicolor*, *Plusia venusta*, *Plusia putnami*, *Capsula laeta*, *Capsula oblonga*, *Caleana reniformis*, *Papaipema speciosissima*, *Bellura densa*; *Leucania multilinea*, *Leucania linita*, *Xylomoia chagnoni*, and *Diachrysia balluca*).

### C. Forested Wetlands

1. **Status:** The forested wetland communities (northern cedar swamp, tamarack swamp, and deciduous swamp) contained within Pierce Cedar Creek Institute are not heavily used by the general public and appear to be in a healthy state with no obvious signs of human impact (outside of student research activity). However, the tamarack swamp seems to be suffering from an infestation of insects, possibly the native larch sawfly larvae. In addition, the forested wetland areas will need to be actively managed to reduce the number of deer negatively impacting the habitat.
2. **Goals:** To preserve the ecological diversity of the wetland habitats by minimizing the impacts of human activities and invasive plants and animals and to maintain the natural hydrology and natural cycles found within this system.
3. **Management Strategies:**
  - Continuing to administer the Quality Deer Management program to control the density of deer, which pose a major threat to the natural regeneration of cedar in the conifer swamps.
  - Removing only portions of fallen trees that span hiking trails. No other harvesting of timber will occur.

- Monitoring and prompt/sustained control of all non-native/invasive species that threaten diversity and community structure. Refer to Appendices G and H for specific instructions and timelines for mechanical and chemical control of invasive plants.
- Monitoring unauthorized social trails along stream banks that may result in bare soil susceptible to erosion.
- Allowing natural processes [beaver flooding, windthrow, insect outbreak (i.e. native larch sawfly and eastern larch beetle), senescence, etc.] to operate unhindered. Nest and den trees, snags, and woody debris will be maintained in stands where they exist.
- Maintaining the fire regime in surrounding upland habitat to reduce the presence of red maple within the forested wetland natural communities.

4. **Quality Site Indicators:**

1. Relative absence of aggressive weeds
2. Intact hydrology
3. Presence of healthy white cedars and tamaracks in coniferous wetlands

**D. Young Forest**

1. **Status:** These former timber and agricultural production areas are among the most degraded/lowest quality areas of PCCI's property. The ultimate goal would be to have these areas develop into healthy mixed hardwood/oak-hickory forest types.
2. **Goals:** To improve the ecological integrity of the young forest habitats by increasing biodiversity, eliminating non-native species, and by directing the successional processes towards a mature, old growth forest.
3. **Management Strategies:**
  1. Providing appropriate low-intensity fire disturbance to sustain advanced oak regeneration and keep oak pathogens and invertebrate acorn predators at low levels. Maintaining a fire regime will also deter succession of shade-tolerant species and encroachment by invasive shrubs and trees.
  2. Potential thinning/selective harvest or girdling of trees (i.e. red maple) to promote long-term forest health.

3. Introducing plant species common to this type of natural community type on an as-needed basis.
  4. Long-term monitoring and removal of invasive species within these areas.
  5. Allowing natural processes such as fire, windthrow, insect outbreaks, senescence, pathogens, etc. to operate unhindered.
4. **Quality Site Indicators:**
1. Relative absence of aggressive weeds
  2. High diversity of tree species including a relatively small percentage of ash trees that could be potentially impacted by EAB.
  3. Plant biodiversity and floristic quality that is similar to undisturbed natural areas.

## E. Old Growth Forest

1. **Status:** All of the old growth beech/maple, oak, and mixed hardwood forests have suffered some degree of ecological degradation. It is difficult to determine all of the impacts that these areas sustained in the past. However, they all likely suffered some selective logging or were completely clear-cut in the past. In addition, some of the areas were likely used for grazing cattle, horses, and sheep. It is important to note that the one disturbance that these areas did not sustain is plowing. This has left much of the soil structure intact, as well as provided a seed source for the maintenance of the under-story.
2. **Goals:** To preserve the ecological integrity of the old growth forest habitats by minimizing the impacts of human activities and invasive plants/animals. This area will specifically be managed to preserve the integrity of the spring ephemeral/wildflower populations by implementing a Quality Deer Management program.
3. **Management Strategies:**
  - Allowing natural processes (windthrow, insect outbreak, senescence, etc.) to operate unhindered. No timber harvesting will take place other than the removal of downed trees for trail maintenance purposes.
  - In old growth areas, where oak and hickory were historically predominant, red maple will be controlled as necessary through selective harvesting and prescribed fire.

- Monitoring and prompt and sustained control of all non-native/invasive species that threaten diversity and community structure. Refer to Appendices G and H for specific instructions and timelines for mechanical and chemical control of invasive plants.
  - Ecological assessment of old growth habitat that will include a complete list of all plant species present within this habitat.
  - Continuing to implement a Quality Deer management program to control the density of deer, which pose a major threat to the natural regeneration of old growth forest habitat.
4. **Quality Site Indicators:**
1. Oak, beech, and sugar maple seedlings
  2. Fine fuels (i.e. Pennsylvania sedge) and oak leaf litter
  3. Ecologically balanced red maple population

## F. Open Water

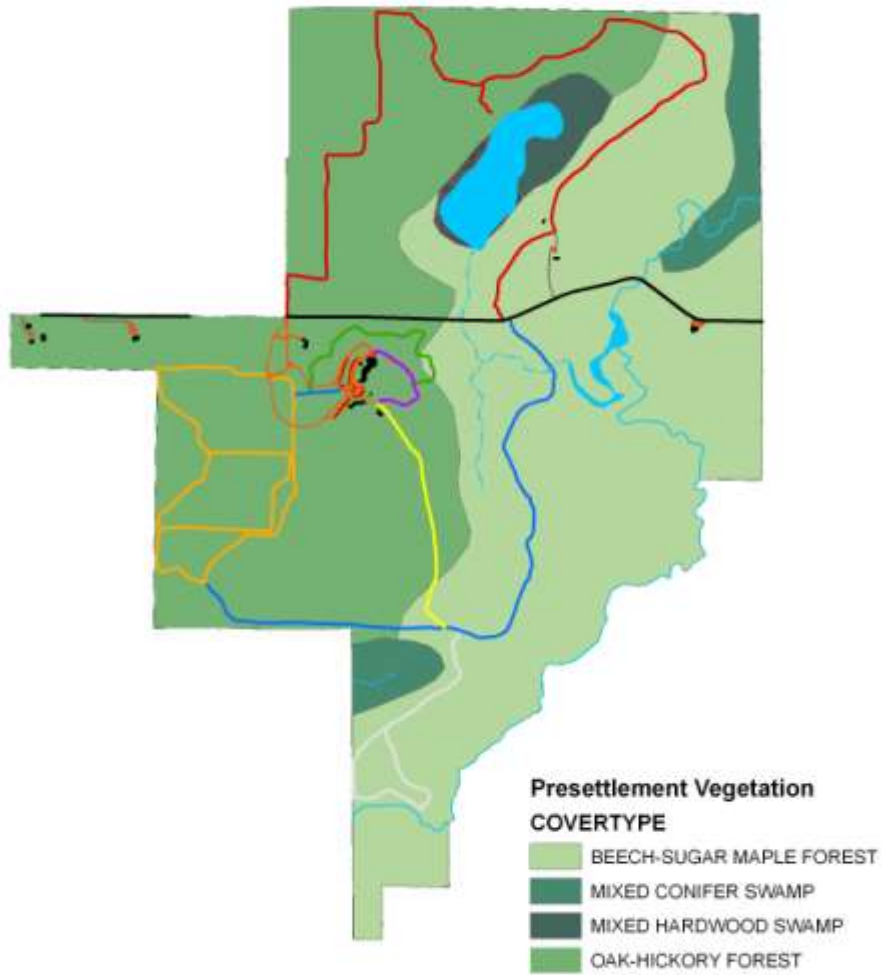
1. **Status:** The open water communities (Brewster Lake, Cedar Creek, ephemeral ponds, and retention ponds) located at PCCI are not heavily used by the general public and appear to be in a healthy state with no obvious signs of human impact. The entire watershed of Brewster Lake exists within PCCI's property borders, which provides control over nutrient inputs, contaminants, and pollution run-off that could potentially contaminate the lake and groundwater. At this time, there are no aquatic invasive plants that need to be controlled in Brewster Lake, Cedar Creek, or the ephemeral ponds. However since Eurasian milfoil was discovered in the retention ponds in the Spring of 2009, precautions need to be made to ensure that the milfoil populations do not spread to the other aquatic habitat types found on the property.
2. **Goals:** To preserve the ecological integrity of the Institute's aquatic habitats by minimizing the impacts of human activities and invasive plants/animals. Cedar Creek should specifically be managed to protect Laura's snaketail dragonfly which is a special concern species.
3. **Management Strategies:**
  1. Monitoring and control of aquatic invasive plant species at each of the open water habitats.

2. Maintaining and enforcing fishing restrictions on Brewster Lake  
Refer to Appendix L for detailed fishing policy.
  3. Maintaining and enforcing research and public use policies  
concerning Brewster Lake and Cedar Creek. Refer to Appendices  
J and K for detailed public use and research policies.
4. **Quality Site Indicators:**
1. Relative absence of aggressive weeds
  2. Diversity of pollution sensitive macroinvertebrates and fish  
species.
  3. Intact hydrology
  4. Presence of nesting pair of osprey on or near osprey nesting  
platform located at Brewster Lake.

## VII. Appendices

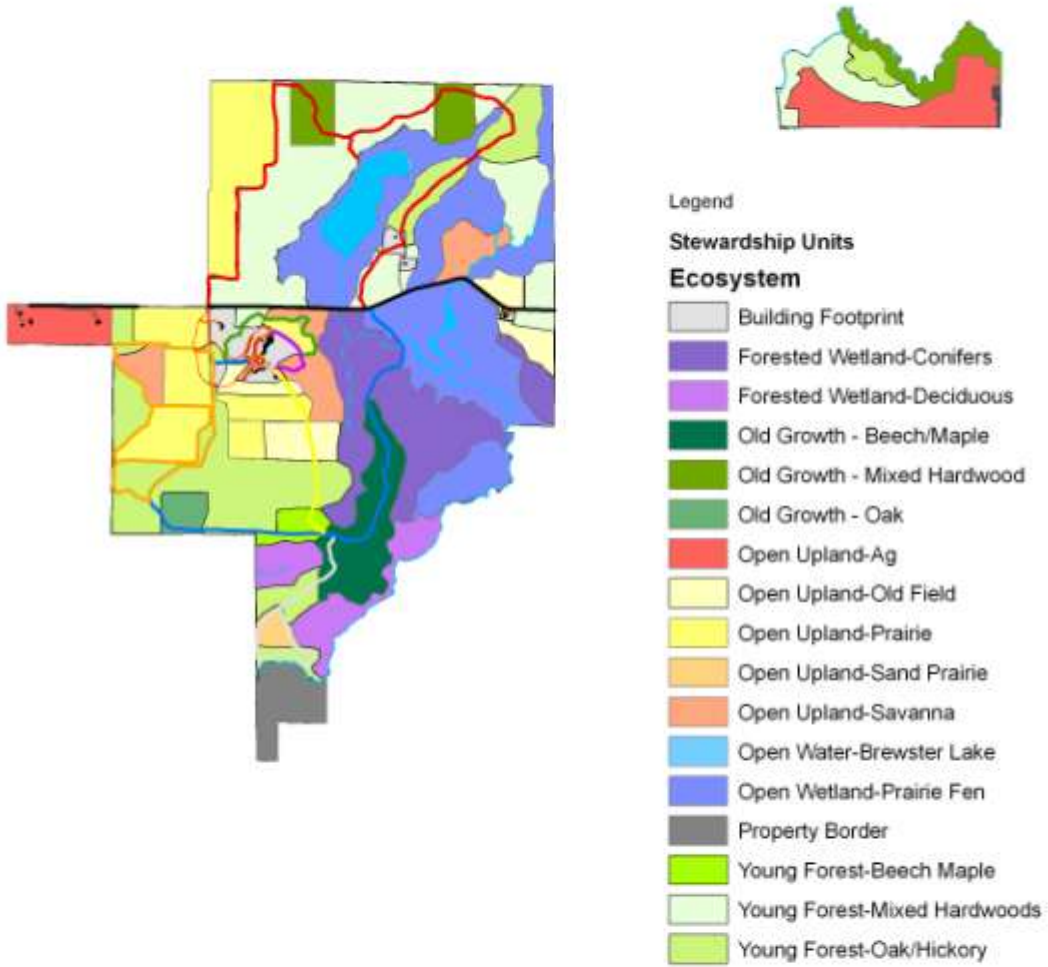
### Appendix A: Pre-settlement Vegetation Map

PCCI Presettlement Vegetation



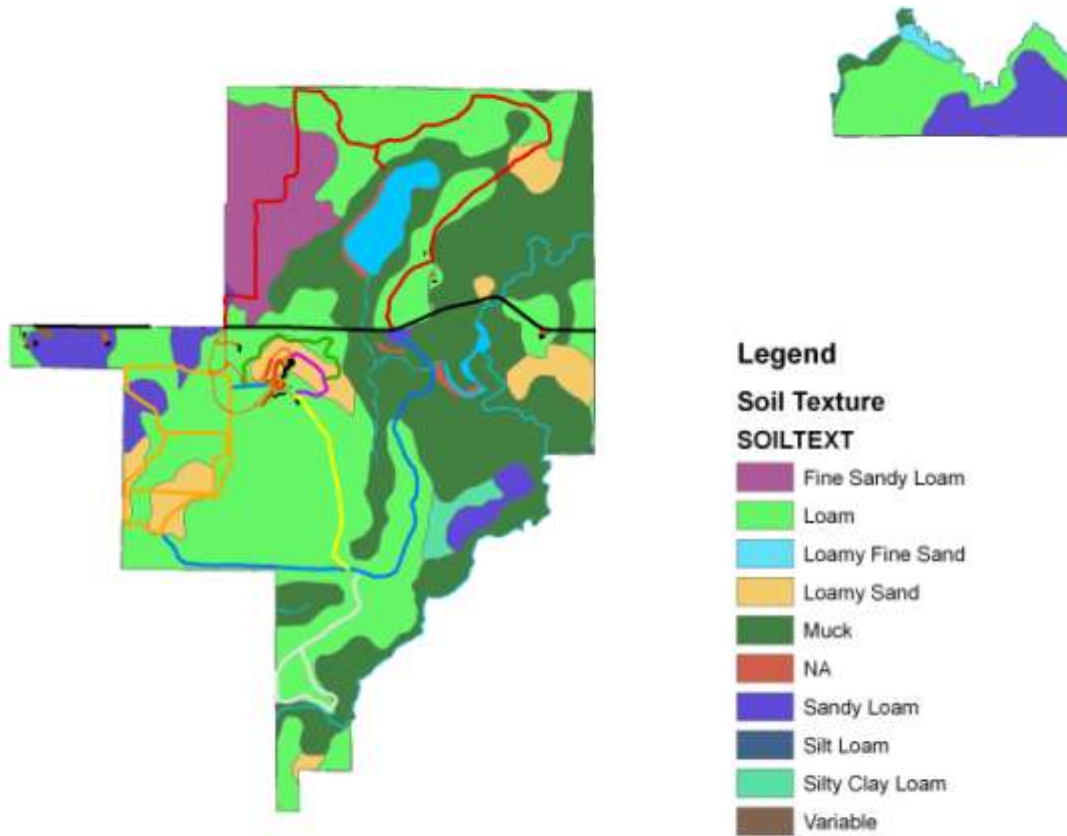
## Appendix B: Stewardship Units Map

### PCCI Stewardship Units



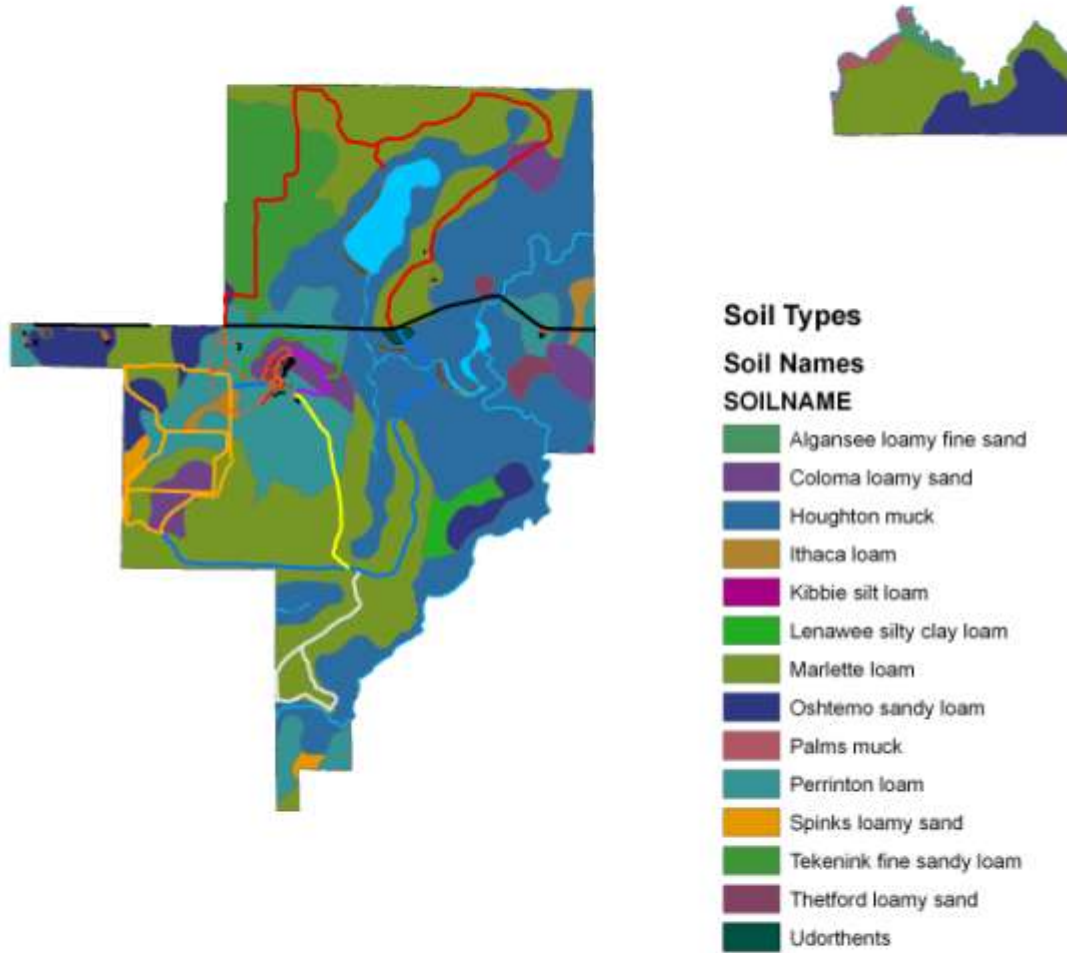
## Appendix C: Soil Texture Map

PCCI Soil Texture Map



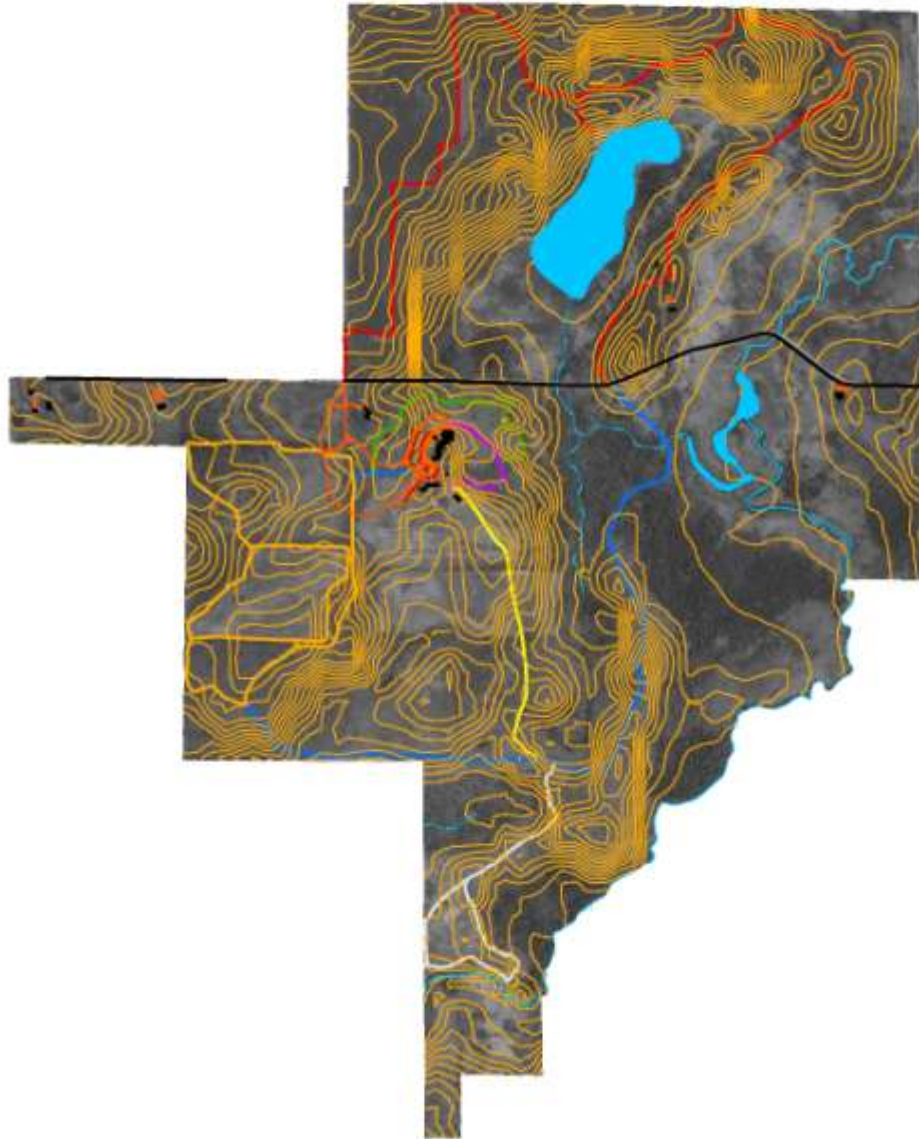
## Appendix D: Soil Type Map

PCCI Soil Type Map

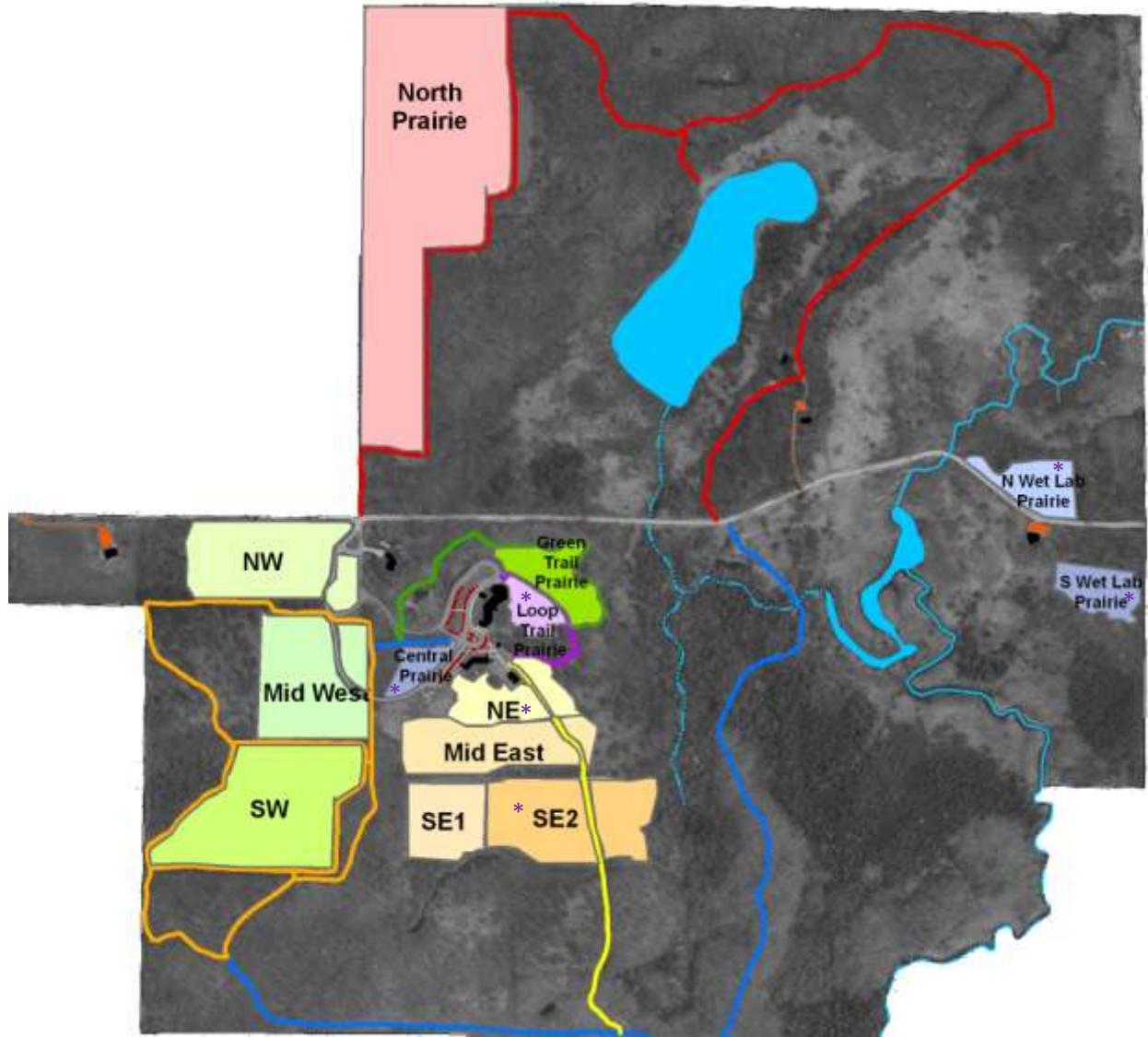


Appendix E: Topographic Map

PCCI Topographic Map  
5' DEM derived contours



## Appendix F: Prairie Plantings Map, History, and Species Lists



\* = proposed/future planting

**North prairie:** 29 acres

**Planting history:** Planted in Spring 2005 with native grass seed from Prairie Moon Nursery. Planted in November 2009 with Michigan genotype wildflower seed from Michigan Wildflower Farm with some substitutions from Prairie Moon Nursery when requested quantities were not available.

**Burning history:** Unsuccessful (<10%) burn attempt in Spring 2007 (not sufficient fuel)

Native Grass and Wildflower Species Planted in N Prairie Planting			
Common Name	Scientific Name	Common Name	Scientific Name
Big Bluestem	<i>Andropogon gerardii</i>	Hairy Beard-tongue	<i>Penstemon hirsutus</i>
Indian Grass	<i>Sorghastrum nutans</i>	Yellow Coneflower	<i>Ratibida pinnata</i>
Switch Grass	<i>Panicum virgatum</i>	Black-eyed Susan	<i>Rudbeckia hirta</i>
Canada Wild Rye	<i>Elymus canadensis</i>	New England Aster	<i>Aster novae-angliae</i>
Lead Plant	<i>Amorpha canescens</i>	Common Spiderwort	<i>Tradescancia ohioensis</i>
Butterfly Weed	<i>Asclepias tuberosa</i>	Hoary Vervain	<i>Verbena stricta</i>
White Wild Indigo	<i>Baptisia leucantha</i>	Golden Alexander	<i>Zizia aurea</i>
Lanceleaf Coreopsis	<i>Coreopsis lanceolata</i>		
Purple Coneflower	<i>Echinacea purpurea</i>		
Rattlesnake-Master	<i>Eryngium yuccifolium</i>		
Rough Blazing Star	<i>Liatris aspera</i>		
Wild Blue Lupine	<i>Lupinus perennis</i>		
Wild Bergamot	<i>Monarda fistulosa</i>		

**NW prairie:** 9.8 acres

**Planting history:** Planted in Spring 2004 with Michigan genotype seed provided by Pheasants Forever.

**Burning history:** Burned prior to planting in Spring 2004 and in Spring 2009

Native Grass and Wildflower Species Planted in NW Prairie Planting				
Common Name	Scientific Name		Common Name	Scientific Name
Big Bluestem	<i>Andropogon gerardii</i>		New England Aster	<i>Aster novae-angliae</i>
Little Bluestem	<i>Schizachyrium scoparius</i>		Prairie Blazing Star	<i>Liatris pycnostachya</i>
Canada Wild Rye	<i>Elymus canadensis</i>		Wild Bergamot	<i>Monarda fistulosa</i>
Switch Grass	<i>Panicum virgatum</i>		Butterfly Weed	<i>Asclepias tuberosa</i>
Indian Grass	<i>Sorghastrum nutans</i>		Stiff Goldenrod	
Side Oats Grama	<i>Bouteloua curtipendula</i>		Rattlesnake Master	<i>Eryngium yuccifolium</i>
Black-eyed Susan	<i>Rudbeckia hirta</i>		Boneset	<i>Eupatorium perfoliatum</i>
Common Evening Primrose	<i>Oenothera biennis</i>		Lance Leaf Coreopsis	<i>Coreopsis lanceolata</i>
Ox-Eye Sunflower	<i>Heliopsis helianthoides</i>		Showy Tick Trefoil	<i>Desmodium canadense</i>
Grey-headed Coneflower	<i>Ratibida pinnata</i>		Blue Vervain	<i>Verbena hastata</i>

**MidWest prairie\*\*:** 8.6 acres

**Planting history:** Planted in Fall 2001 with native seed from Ernst Conservation Seeds.

**Burning history:** Burn attempt (<10% =unsuccessful) Spring 2004, successful burn in 2006, Burn: April 2011 (>95% complete)

Native Grass and Wildflower Species Planted in MidWest Prairie Planting				
Common Name	Scientific Name		Common Name	Scientific Name
Big Bluestem	<i>Andropogon gerardii</i>		Prairie Blazing Star	<i>Liatris pycnostachya</i>
Little Bluestem	<i>Schizachyrium scoparius</i>		Wild Blue Lupine	<i>Lupinus perennis</i>
Canada Wild Rye	<i>Elymus canadensis</i>		Wild Bergamot	<i>Monarda fistulosa</i>
Switch Grass	<i>Panicum virgatum</i>		Common Evening Primrose	<i>Oenothera biennis</i>
Indian Grass	<i>Sorghastrum nutans</i>		Hairy Beard Tongue	<i>Penstemon hirsutus</i>
Prairie Cordgrass	<i>Spartina pectinata</i>		Grey-headed Coneflower	<i>Ratibida pinnata</i>
Sand Dropseed	<i>Sporobolus Dryptandrus</i>		Black-eyed Susan	<i>Rudbeckia hirta</i>
Lead Plant	<i>Amorpha canascens</i>			
Indian Hemp	<i>Apocynum cannabinum</i>			
Butterfly Weed	<i>Asclepias tuberosa</i>			
Showy Tick Trefoil	<i>Desmodium canadense</i>			
Ox-Eye Sunflower	<i>Heliopsis helianthoides</i>			
Round-headed Bush Clover	<i>Lespedeza capitata</i>			

**SW prairie\*\*:** 13.6 acres

**Planting history:** Planted Spring 2002 with native seed from Ernst Conservation Seeds. Supplemented with seed collected from property in April 2008

**Burning history:** unsuccessful burn attempted in 2004, burned for first time Spring 2008

Native Grass and Wildflower Species Planted in SW Prairie Planting			
Common Name	Scientific Name	Common Name	Scientific Name
Big Bluestem	<i>Andropogon gerardii</i>	Prairie Blazing Star	<i>Liatris pycnostachya</i>
Little Bluestem	<i>Schizachyrium scoparius</i>	Wild Blue Lupine	<i>Lupinus perennis</i>
Canada Wild Rye	<i>Elymus canadensis</i>	Wild Bergamot	<i>Monarda fistulosa</i>
Switch Grass	<i>Panicum virgatum</i>	Common Evening Primrose	<i>Oenothera biennis</i>
Indian Grass	<i>Sorghastrum nutans</i>	Hairy Beard Tongue	<i>Penstemon hirsutus</i>
Prairie Cordgrass	<i>Spartina pectinata</i>	Grey-headed Coneflower	<i>Ratibida pinnata</i>
Sand Dropseed	<i>Sporobolus Dryptandrus</i>	Black-eyed Susan	<i>Rudbeckia hirta</i>
Lead Plant	<i>Amorpha canascens</i>	Brown-eyed Susan	<i>Rudbeckia triloba</i>
Indian Hemp	<i>Apocynum cannabinum</i>		
Butterfly Weed	<i>Asclepias tuberosa</i>		
Showy Tick Trefoil	<i>Desmodium canadense</i>		
Ox-Eye Sunflower	<i>Heliopsis helianthoides</i>		
Round-headed Bush Clover	<i>Lespedeza capitata</i>		

**NE prairie:** 4 acres

**Planting history:** not yet planted (awaiting funding)

**Burning history:** burned Spring 2003, Spring 2006, and Fall 2011

**MidEast prairie:** 6 acres

**Planting history:** planted in Spring 1999 with native seed from Ernst Conservation Seeds

**Burning history:** burned Spring 2003, Spring 2006 and Fall 2011.

Native Grass and Wildflower Species Planted in MidEast Prairie Planting				
Common Name	Scientific Name		Common Name	Scientific Name
Big Bluestem	<i>Andropogon gerardii</i>		Prairie Blazing Star	<i>Liatris pycnostachya</i>
Little Bluestem	<i>Schizachyrium scoparius</i>		Wild Blue Lupine	<i>Lupinus perennis</i>
Canada Wild Rye	<i>Elymus canadensis</i>		Wild Bergamot	<i>Monarda fistulosa</i>
Switch Grass	<i>Panicum virgatum</i>		Common Evening Primrose	<i>Oenothera biennis</i>
Indian Grass	<i>Sorghastrum nutans</i>		Hairy Beard Tongue	<i>Penstemon hirsutus</i>
Prairie Cordgrass	<i>Spartina pectinata</i>		Grey-headed Coneflower	<i>Ratibida pinnata</i>
Sand Dropseed	<i>Sporobolus Dryptandrus</i>		Black-eyed Susan	<i>Rudbeckia hirta</i>
Lead Plant	<i>Amorpha canescens</i>		Brown-eyed Susan	<i>Rudbeckia triloba</i>
Indian Hemp	<i>Apocynum cannabinum</i>			
Butterfly Weed	<i>Asclepias tuberosa</i>			
Showy Tick Trefoil	<i>Desmodium canadense</i>			
Ox-Eye Sunflower	<i>Heliopsis helianthoides</i>			
Round-headed Bush Clover	<i>Lespedeza capitata</i>			

SE<sub>1</sub> prairie: 4 acres

**Planting history:** planted in 1999 with native seed from Ernst Conservation Seeds (no-till drill). Supplemental broadcast seeding (\*) occurred on November 9, 2010 after Rx burn.

**Burning history:** Burned for first time on November 9, 2010.

Native Grass and Wildflower Species Planted in SE <sub>1</sub> Prairie Planting				
Common Name	Scientific Name		Common Name	Scientific Name
Big Bluestem	<i>Andropogon gerardii</i>		Prairie Blazing Star	<i>Liatriis pycnostachya</i>
Little Bluestem	<i>Schizachyrium scoparius</i>		Wild Blue Lupine	<i>Lupinus perennis</i>
Canada Wild Rye	<i>Elymus canadensis</i>		Wild Bergamot	<i>Monarda fistulosa</i>
Switch Grass	<i>Panicum virgatum</i>		Common Evening Primrose	<i>Oenothera biennis</i>
Indian Grass	<i>Sorghastrum nutans</i>		Hairy Beard Tongue	<i>Penstemon hirsutus</i>
Prairie Cordgrass	<i>Spartina pectinata</i>		Grey-headed Coneflower	<i>Ratibida pinnata</i>
Sand Dropseed	<i>Sporobolus Dryptandrus</i>		Showy Tick Trefoil	<i>Desmodium canadense</i>
Lead Plant	<i>Amorpha canascens</i>		Ox-Eye Sunflower	<i>Heliopsis helianthoides</i>
Indian Hemp	<i>Apocynum cannabinum</i>		Round-headed Bush Clover	<i>Lespedeza capitata</i>
Butterfly Weed	<i>Asclepias tuberosa</i>		Black-eyed Susan	<i>Rudbeckia hirta</i>
Rattlesnake Master*	<i>Eryngium yuccifolium</i>		Compass Plant*	<i>Silphium laciniatum</i>
Butterfly Milkweed*	<i>Asclepias tuberosa</i>		Prairie Dock*	<i>S. terebinthinaceum</i>
False White Indigo*	<i>Baptisia alba</i>		Bottlebrush Grass*	<i>Elymus hirtix</i>
Prairie Smoke*	<i>Geum triflorum</i>		False Sunflower*	<i>Heliopsis helianthoides</i>
Thimbleweed*	<i>Anemone cylinaria</i>		Nodding Wild Onion*	<i>Allium cernuum</i>
Gray-headed Coneflower*	<i>Ratibida pinnata</i>		Prairie Blazing Star*	<i>Liatriis pycnostachya</i>
Showy Tick Trefoil*	<i>Desmodium canadense</i>		Western Sunflower*	<i>Helianthus occidentalis</i>
Purple Coneflower*	<i>Echinacea purpurea</i>		Penstemon*	<i>Penstemon hirsutus</i>
Little Bluestem*	<i>Schizachyrium scoparium</i>		Big-leaved Aster*	<i>Aster macrophyllus</i>
Bee Balm*	<i>Monarda fistulosa</i>		Bluestem Goldenrod*	<i>Solidago caesia</i>
Black-eyed Susan*	<i>Rudbeckia hirta</i>		Early Goldenrod*	<i>S. arguta</i>
Indian Grass*			Swamp Milkweed*	<i>Asclepias incarnata</i>
Big Bluestem*	<i>Andropogon gerardii</i>		Culver's Root*	<i>Veronicastrum</i>

			<i>virginicum</i>
Switch Grass*	<i>Panicum virgatum</i>		
Canada Wild Rye*	<i>Elymus canadensis</i>		

**SE<sub>2</sub> prairie:** 8 acres

**Planting history:** not yet planted (awaiting funding)

**Burning history:** N/A

**Green Trail Prairie:** 5.5 acres

**Planting history:** planted with Michigan genotype grass seed from Native Connections and Designs by Nature in Spring 2009 following burn. Michigan genotype wildflower seed from Michigan Wildflower Farm was planted by spreader and cultipacker on December 1, 2010.

**Burning history:** burned prior to planting in Spring 2009

Native Grass and Wildflower Species Planted (Seed) in Green Trail Prairie Planting			
Common Name	Scientific Name	Common Name	Scientific Name
Big Bluestem	<i>Andropogon gerardii</i>	Wild Blue Lupine	<i>Lupinus perrenis</i>
Little Bluestem	<i>Schizachyrium scoparius</i>	Horsemint	<i>Monarda punctata</i>
Sideoats Grama	<i>Bouteloua curtipendula</i>	Purple Prairie Clover	<i>Petalostemum purpureum</i>
Prairie Dropseed	<i>Sporobolus heterolepis</i>	Black-eyed Susan	<i>Rudbeckia hirta</i>
Nodding Wild Onion	<i>Allium cernuum</i>	Round-leaved Ragwort	<i>Senecio obovatus</i>
Lead Plant	<i>Amorpha canescens</i>	Stiff Goldenrod	<i>Solidago rigida</i>
Long-fruited Anemone	<i>Anemone cylindrica</i>	Ohio spiderwort	<i>Tradescantia ohioensis</i>
Thimbleweed	<i>Anemone virginiana</i>	Hoary vervain	<i>Verbena stricta</i>
Butterfly Milkweed	<i>Asclepias tuberosa</i>		
New Jersey Tea	<i>Ceanothus americanus</i>		
Lance-leaf Coreopsis	<i>Coreopsis lanceolata</i>		
Rattlesnake Master	<i>Eryngium yuccifolium</i>		
Flowering Spurge	<i>Euphorbia corollata</i>		

<b>Plugs Planted into Green Trail Prairie Planting on September 17, 2010</b>		
<b>Qty (plugs)</b>	<b>Common Name</b>	<b>Scientific Name</b>
190	Sideoats Grama	<i>Bouteloua curtipendula</i>
190	Prairie Dropseed	<i>Sporobolus heterolepis</i>
190	June Grass	<i>Koeleria macrantha</i>
76	Horsemint	<i>Monarda punctata</i>
76	Round-leaved Ragwort	<i>Packera obovata</i>
38	Lupine (freebie)	<i>Lupinus perennis</i>
38	pale purple coneflower (freebie)	<i>Echinacea pallida</i>
38	Western blazing star (freebie)	<i>Liatris sp.</i>
38	Showy Goldenrod	<i>Solidago speciosa</i>
38	Purple Prairie Clover	<i>Dalea purpurea</i>
38	Penstemon	<i>Penstemon grandiflorus</i>
38	Sky Blue Aster	<i>Aster azureus</i>
38	Sand Tickseed	<i>Coreopsis lanceolata</i>
38	Early Goldenrod	<i>Solidago juncea</i>
38	Black-eyed Susan	<i>Rudbeckia hirta</i>
38	Harebell	<i>Campanula rotundifolia</i>
38	Lead plant	<i>Amorpha canescens</i>
8	White wild indigo	<i>Baptisia lactea</i>
10	Butterfly milkweed	<i>Asclepias tuberosa</i>
8	False boneset	<i>Brickellia eupatorioides</i>
6 quart	Cream False Indigo	<i>Baptisia bracteata</i>
4 quart	New Jersey Tea	<i>Ceanothus americanus</i>
2 quart	Smooth Sunflower	<i>Helianthus laevigatus</i>

<b>Plugs Added to Green Trail Prairie Planting on June 26, 2011</b>		
<small>(provided by Dave/Micah Warners)</small>		
<b>Qty (plugs)</b>	<b>Common Name</b>	<b>Scientific Name</b>
20	Hairy beardtongue	<i>Penstemon hirsutus</i>
25	Brown-eyed susan	<i>Rudbeckia tribola</i>
7	Thimbleweed	<i>Anemone cylindrica</i>
6	Stiff goldenrod	<i>Solidago rigida</i>
2	Showy goldenrod	<i>Solidago speciosa</i>
5	Rattlesnake master	<i>Eryngium yuccifolium</i>
3	Smooth blue aster	<i>Aster laevis</i>

<b>Plugs Added to Green Trail Prairie Planting on September 20, 2011</b> (provided by Hidden Savanna Nursery)		
<b>Qty (plugs)</b>	<b>Common Name</b>	<b>Scientific Name</b>
38	Nodding wild onion	<i>Allium cernuum</i>
38	Lead plant	<i>Amorpha canescens</i>
38	Thimbleweed	<i>Anemone cylindrica</i>
38	Butterfly Milkweed	<i>Asclepias tuberosa</i>
38	Sky Blue Aster	<i>Aster azureus</i>
38	White Wild Indigo	<i>Baptisia alba</i>
38	Wild Blue Lupine	<i>Lupinus perennis</i>
38	Prairie Ragwort	<i>Packera plattensis</i>
38	Black-eyed Susan	<i>Rudbeckia hirta</i>
38	Stiff Goldenrod	<i>Solidago rigida</i>
38	Prairie Dropseed	<i>Sporobolus heterolepis</i>
38	Hoary Vervain	<i>Verbena stricta</i>

**Loop Trail Prairie:** 1.5 acres

**Planting history:** not yet planted (awaiting funding)

**Burning history:** N/A

**Central Prairie:** 0.5 acres

**Planting history:** not yet planted (awaiting funding)

**Burning history:** N/A

**North Wet Lab Prairie:** 2.5 acres

**Planting history:** not yet planted (awaiting funding)

**Burning history:** N/A

**South Wet Lab Prairie:** 2.5 acres

**Planting history:** not yet planted (awaiting funding)

**Burning history:** Spring 2007

\*\*The planting records for the MW and SW prairies are “sketchy” as the information was derived from hand-scribbled notes created by Gary Pierce, Jim Bruce, and another unknown individual. To the best of my knowledge it appears that the exact species mix that were ordered for the two 1999 plantings (SE<sub>1</sub> and MidEast prairie plantings) were also used for these two plantings. The MidWest, SW, MidEast, and SE<sub>1</sub> prairie plantings were part of a WHIP partnership (Barry Conservation District—Steve Bare and Jim Bruce) that originated in 1999 and culminated in 2002.

**Appendix G: Invasive Plant Control Timeline (2007-2015)**

<b>Year</b>	<b>Spring</b>	<b>Summer</b>	<b>Fall</b>
<b>2007</b>	GM-Cloverdale Rd. Prescribed burn: Wet Lab field, North prairie (unit 1), parking lot berms	SK-prairies and campus BL-prairies WM-prairies	AO-prairies and south trails P-Cloverdale Rd. and Wet Lab WSC-prairies and campus
<b>2008</b>	GM-Cloverdale Rd. and trails Prescribed burn: SW prairie and North prairie (unit 1)	SK-prairies and campus CT-prairies BL-prairies PL-prairies, Brewster Lake, fields, and ponds WM-prairies MR-prairies	AO-prairies and south trails P-Cloverdale Rd. and Wet Lab WSC-prairies and campus
<b>2009</b>	GM-Cloverdale Rd. and trails Prescribed burn: North prairie (units 2 and 3), NW prairie	SK-prairies and campus CT-prairies BL-monitor prairies PL-prairies, Brewster Lake, fields, and ponds WM-prairies MR-prairies	AO-prairies and south trails P-Cloverdale Rd. and Wet Lab WSC-prairies and campus
<b>2010</b>	GM-Cloverdale Rd. and trails Prescribed burn: Wet Lab field, SE prairie, berms	SK-prairies and campus CT-prairies BL-monitor prairies PL-prairies, Brewster Lake, fields, and ponds WM-monitor prairies MR-monitor prairies	AO-prairies and south trails P-monitor Cloverdale Rd. and Wet Lab WSC-prairies and campus
<b>2011</b>	GM-Cloverdale Rd. and trails Prescribed burn: MW, ME, and NE prairies/fields	SK-prairies and campus CT-prairies BL-monitor prairies PL-prairies, Brewster Lake, fields, and ponds WM-monitor prairies	AO-prairies and south trails P-monitor Cloverdale Rd. and Wet Lab WSC-prairies and campus

		MR-monitor prairies	
<b>2012</b>	GM-Cloverdale Rd. and trails Prescribed burn: SW and North (unit 1) prairies	SK-monitor prairies and campus CT-prairies BL-monitor prairies PL-prairies, Brewster Lake, fields, and ponds WM-monitor prairies MR-monitor prairies	AO-prairies and south trails P-Cloverdale Rd. and Wet Lab WSC-prairies and campus
<b>2013</b>	GM-Cloverdale Rd. and trails Prescribed burn: NW and North (units 2 and 3) prairies	SK-monitor prairies and campus CT-monitor prairies BL-monitor prairies PL-monitor prairies, Brewster Lake, fields, and ponds WM-monitor prairies MR-monitor prairies	AO-monitor prairies and south trails P-monitor Cloverdale Rd. and Wet Lab WSC-prairies and campus
<b>2014</b>	GM-monitor Cloverdale Rd. and trails Prescribed burn: Wet Lab field, SE prairie, and berms	SK-monitor prairies and campus CT-monitor prairies BL-monitor prairies PL-monitor prairies, Brewster Lake, fields, and ponds WM-monitor prairies MR-monitor prairies	AO-monitor prairies and south trails P-monitor Cloverdale Rd. and Wet Lab WSC-monitor prairies and campus
<b>2015</b>	GM-monitor Cloverdale Rd. and trails Prescribed burn: MW, ME, and NE prairies/fields.	SK-monitor prairies and campus CT-monitor prairies BL-monitor prairies PL-monitor prairies, Brewster Lake, fields, and ponds WM-monitor prairies MR-monitor prairies	AO-monitor prairies and south trails P-monitor Cloverdale Rd. and Wet Lab WSC-monitor prairies and campus
<b>2015+ (or as time permits)</b>	BL at Wet Lab and open fields, AO on North side trails, PL at Wet Lab and Cloverdale Rd. (monitor success of Galerucella beetle release), CT at open fields, WM at open fields, MR at trails and open fields, WSC at open fields, CV at prairies, trails and open fields.		

AO=Autumn Olive	GM = Garlic Mustard	SK = Spotted Knapweed
BL=Black Locust	MR = Multiflora Rose	WM = White Mulberry
CT= Canada Thistle	P = Phragmites	WSC = White Sweet Clover
CV=Crown Vetch	PL = Purple Loosestrife	

## Appendix H: Invasive Plant Control Techniques and Timing for PCCI

Scientific Name	Common Name	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
<i>Alliaria petiolata</i>	Garlic Mustard	Cf	Cf	Cf	Mh	Mh	Mh					Cf	Cf
<i>Centaurea maculosa</i>	Spotted Knapweed	Cf	Cf	P	P	Cf	Cbf, Mhs	Cbf, Mhs	Cbf, Mhs	Cf, Mhs	Cf, Mhs		
<i>Cirsium arvense</i>	Canada Thistle						Msh, Cf	Msh, Cf	Msh, Cf	Msh, Cf			
<i>Coronilla varia</i>	Crown Vetch				Cf	Cf	Cf						
<i>Elaeagnus umbellata</i>	Autumn Olive	Cc	Cc				Cc	Cc	Cc	Cc	Cc	Cc	Cc
<i>Lythrum salicaria</i>	Purple Loosestrife						Cbcf	Cbcf	Cbc				
<i>Melilotus alba</i>	W. Sweet Clover						Mb	Mh	Mbh				
<i>Phragmites australis</i>	Giant Reed								Cbf	Cbf			
<i>Robinia pseudoacacia</i>	Black Locust	Cd	Cd				Cd	Cd	Cd	Cd	Cd	Cd	Cd
<i>Rosa multiflora</i>	Multiflora Rose	Cc	Cc	P	P		Cc	Cc	Cc	Cc	Cc	Cc	Cc
<i>Morus alba</i>	White Mulberry			Ccd	Ccd	Ccd	Ccd	Ccd	Ccd	Ccd	Ccd	Ccd	

**P = prescribed burn**

**M = Mechanical; b = cut @ base, h = hand pull, s = cut below soil level**

**C = Chemical; b = bloody glove, c = cut stump treatment, d = drill and fill, f = foliar spray**

## Appendix I: Prescribed Fire Calendar

Date	Area	Acreage
Spring/Fall 2008	SW prairie N prairie (unit 1)	13.6 10
Spring/Fall 2009	N prairie (units 2 and 3) NW prairie Central field Green Trail field Berms	19 9.8 0.5 5.5 <2
Spring/Fall 2010	S Wet Lab field SE <sub>1</sub> and SE <sub>2</sub> prairies Prairie fen and upland habitat burn unit	6.5 4 97
Spring/Fall 2011	MW prairie ME prairie and NE field Loop Trail field	8.6 10 1.5
Spring/Fall 2012	SW prairie N prairie (unit 1) Central field	13.6 10 0.5
Spring/Fall 2013	N prairie (units 2 and 3) NW prairie Green Trail prairie	19 9.8 5.5
Spring/Fall 2014	N & S Wet Lab field SE <sub>1</sub> and SE <sub>2</sub> prairies Berms	6.5 4 <2
Spring/Fall 2015	MW prairie ME prairie and NE field Loop Trail field	8.6 10 1.5
Spring/Fall 2016	NW prairie SW prairie Central field	9.8 13.6 0.5
Spring/Fall 2017	N prairie (units 1) N & S Wet Lab field Green Trail prairie	19 4 5.5
Spring/Fall 2018	N prairie (units 2 and 3) SE <sub>1</sub> and SE <sub>2</sub> prairies Berms	10 6.5 <2
Spring/Fall 2019	MW prairie ME prairie and NE field Loop Trail field	8.6 10 1.5
Spring/Fall 2020	NW prairie SW prairie Central field	9.8 13.6 0.5

\*Burn bans and inclement weather will postpone burn plans by one year.

## Appendix J: Public Use Policy

### Rules and Regulations for Property Use:

- **The removal or disturbance of any plant, animal, or mineral is prohibited.** Leave what you find and allow others an opportunity of discovery.
- **Bikes, ATVs, and horseback riding are prohibited.** This will help to limit erosion and costly trail maintenance and to reduce conflicts between trail users. Strollers and wagons are permitted to assist small children on the trails.
- **Public swimming, wading, and the use of personal watercraft are prohibited on Brewster Lake and Cedar Creek.**
- **No fishing, hunting, trapping, or plant collecting except with written permission.** Please see Appendices K and L for specific rules and regulations pertaining to PCCI's fishing policy and quality deer management program.
- **Camping is prohibited.** Public campfires are only allowed with staff permission in the designated fire pits outside of the housing units. Picnic tables are available for public use but visitors are asked to properly dispose of their trash.
- **Personal vehicles are allowed only on authorized roads and parking areas.**
- **Do not feed wildlife or release wild or domestic animals on the property.** Doing so may introduce disease to the property and may otherwise alter and negatively affect the balance of the ecosystem.
- **Smoking and consuming alcoholic beverages is extremely restricted, and possessing illegal drugs is strictly prohibited on the entire property and in all the buildings.**
- **Possession and/or discharge of firearms, weapons, firework, and/or explosives are prohibited with the exception of bows and rifles used strictly for the quality deer management program.** To use bows and/or rifles as part of PCCI's quality deer management program, one must be selected for participation into the program and one must obtain an authorized permission slip to hunt the property.
- **All pets must be kept on a leash.** Dogs must be controlled in order to limit negative impacts on the environment and other visitors.
- **Clean up all pet waste on trails.** In addition to being unappealing, animal waste left on trails increases the nitrogen in the soil around the trail, giving the advantage to weeds over the native plants that evolved in nitrogen-poor soils.
- **Respect the rights of adjacent property owners.** Visitors must not trespass on property not owned by the Institute and must keep noise levels down to a reasonable level.

- **No littering and/or dumping.** Trash is unsightly and ruins others' outdoor experience. Studies have shown that trash discarded in the woods and prairies attracts scavenging birds and mammals that drive away or kill native birds.
- **Do not interfere with research projects and equipment.** The Institute serves as a research site for numerous university and professional research projects. The individuals working on these projects invest much time and effort into performing sound, accurate, and scientific research. Visitors must make every effort not to interfere with their work.

## **Appendix K: Research Policy**

### **Alcohol, Tobacco, and Drugs:**

- Pierce Cedar Creek Institute buildings and grounds are alcohol and drug free. Researcher is expected to honor the Institute's policies. Smoking is extremely restricted and only allowed outside, next to the Housing Unit and in Researcher's vehicle. Smoking is not allowed for the public.

### **Emergencies:**

- Barry County has enhanced 911 for fire, health, and police emergencies. Any 911 call must be reported immediately to the Facility Manager at 269-838-1409, or any Institute staff.
- On phones in the Wet Lab, Visitor Center, or Education Building, a 9 must be dialed to get an outside line, and then dial 911. On phones in Housing Unit and pay phones, simply dial 911.

### **Firearms/Hunting**

- Firearms are not allowed on the property except by special permission. Researchers should be aware that the Institute has a deer management program and allows hunting by special permission. The trails are closed from November 15 until December 23.

### **Office Space/Research Lab:**

- Researcher may request access to the Wet Lab for research purposes. Contact Matthew Dykstra at 269-721-4473 to arrange usage.
- Wireless internet service is available in the Visitor's Center, Wet Lab and Education Building.

### **Personal Property:**

- The Institute shall not be responsible for any loss or damage to personal property belonging to Researcher, staff, or guests. Each guest is responsible for his or her personal security and for the security of his or her possessions.
- Researcher shall be held responsible for lost, stolen, or damaged equipment and supplies belonging to the Institute. Please report any loss or damage promptly to the Facility Manager.

### **Research Projects:**

- No sampling will be performed on site at the Institute that is not clearly defined in the research application.
- Only biodegradable flags and marking tape may be used on Institute property. Upon completion of research, Researcher is expected to pull all flags and clean all marking tape, and remove any materials used or left on

the property for research purposes. Biodegradable material is required for instances when some of the flags or tape may be missed.

- Any alterations to Institute property required for research that are not clearly explained in the research application must be approved in writing prior to execution.
- Researchers are responsible for obtaining any and all appropriate state or federal permits for their research.
- Researchers will understand that there is a potential for dangerous and harmful situations due to the organisms and environment found at the Institute. The Researcher will use caution while performing field work.
- Researchers will use proper personal safety equipment when handling dangerous tools or chemicals.
- No equipment or disturbances may be left in the field. If the equipment or disturbance is part of a continuing or new research project, the researcher must fill out a new research application.

#### **Reporting and Publications:**

- Researchers will file an annual report to the Education Director that includes: a brief update of the project, a summary of the results for the year, and a list of data generated. The report will be due at a time agreed upon by the researcher and the Institute staff.
- All publications arising from work done on site or with samples from the Institute will acknowledge support from the Institute.
- Researcher will provide the Institute a copy of any publications of the research conducted on site to be held in the Institute's library. Some of the Researcher information may be placed on the Institute's website. The Institute will give Researcher credit when their material is used.

#### **Termination:**

- Either party may terminate this agreement by giving the other party written notice of the termination.
- Upon termination or expiration of this agreement, the Researcher shall vacate Housing within a reasonable amount of time and leave it in as good of condition as when the Researcher entered, ordinary wear and tear only accepted, and shall return all keys at time of departure.

#### **Vehicles:**

- Personal vehicles are not allowed on the trails at any time. If research equipment must be transported to sites on the property not accessible by roads, Researcher may request staff assistance with the use of Institute vehicles. Researchers may park in any of the parking lots by the Visitor Center and education building, wet lab, and also in the parking area behind the barn at Batt's Cottage.

## Appendix L: Fishing Policy

Pierce Cedar Creek Institute has the unique privilege of having a minimally disturbed, 13-acre kettlehole lake (Brewster Lake) and cold water stream (Cedar Creek) on its property. Since the entire shoreline of Brewster Lake is managed by PCCI, Brewster Lake has, to date, remained free of the aquatic invasive species that have threatened many of Michigan's lakes and streams. In order to protect Brewster Lake from exotic species such as Eurasian milfoil, rusty crayfish, and zebra mussels, PCCI staff has developed rather stringent best management practices for recreational fishing. It is our hope that anglers will view this fishing opportunity as a privilege and will make every effort to respect the integrity of the aquatic habitats found at PCCI. While Brewster Lake can provide many recreational opportunities, it is most valuable to wildlife and student researchers as a natural and minimally disturbed ecosystem.

### Rules and Regulations:

1. All Michigan DNR regulations and additional/more stringent PCCI regulations must be followed at all times.
2. All anglers (above the age of 16) must possess a legal fishing license.
3. Only current staff and current BFS students/faculty members are permitted to fish the property.
4. Current staff, board members, researchers, and faculty mentors will be permitted 3 guest passes during the PCCI fishing season (June 1<sup>st</sup> through August 31<sup>st</sup>). Hosts must accompany their guests while fishing the property. Guests need to be signed in on the fishing log in the Education Building office prior to fishing. Each guest pass is good for one 24-hour period.
5. All fish are "catch and release" with the exception of pan fish (i.e. black and white crappies, bluegill, green and hybrid sunfish, longear, pumpkinseed, redear, rockbass, and warmouth). Anglers must handle fish carefully to avoid injury to released individuals:
  - Quickly play and land fish-- do not fight fish to exhaustion.
  - Handle fish as little as possible and release them quickly-- unhook fish in water if possible.
  - Handle fish carefully to avoid injury-- be sure to avoid contact with the gills, and do not squeeze fish or remove protective slime.
  - Use only artificial lures
  - When a fish is deeply hooked, do not try to remove the hook and clip the leader instead.
6. Anglers can keep no more than 10 pan fish per day. All others must be released.
7. No live bait of any kind may be used. Only artificial bait and lures provided by the Institute are acceptable.

8. No lead sinkers, jigs, or other lead equipment may be used.
9. All broken fishing line and accidentally discarded lures must be retrieved immediately.
10. All anglers are expected to use PCCI issued equipment only—no personal poles, line, sinkers, lures, boats, waders, etc. PCCI fishing equipment may not leave the Institute's property for any reason other than repair. This equipment can be checked-out of the Wet Lab on a first-come-first-serve basis.
11. No watercraft except the PCCI rowboat and canoes may be used on Brewster Lake or Cedar Creek. PCCI boats may not be used on bodies of water outside of the property. Boat use for research purposes takes priority over boat use for recreational fishing.
12. No waders or hip boots are permitted in Brewster Lake or Cedar Creek unless provided by PCCI. The Institute's waders may not be used outside of PCCI property.
13. No capture netting may be used except for research purposes.
14. No unattended fishing devices such as traps, trot lines, jug rigs, etc. unless this equipment is being used for research purposes.
15. All persons riding in an Institute issued boat must wear a personal floatation device at all times.
16. Recreational anglers may only fish Brewster Lake or Cedar Creek during the Institute's Fishing Season (June 1<sup>st</sup> through August 31<sup>st</sup>) and during daylight hours. Fishing for research purposes may be allowed on a case-by-case basis during other times of the year/day.
17. All anglers must record all catches in the fishing log maintained in the Education Building office [name, date, # of fish caught, size, species and name(s) of guests fishing the property with a host will be recorded].
18. Violators of these rules and regulations will have their fishing privileges suspended or taken away. First offense will result in a 30-day suspension. Two-time offenders lose all fishing privileges for the remaining calendar year. Violations by guests result in a suspension or removal of fishing privileges for both the violator and their host.

## Appendix M. Deer Management Program Policy:

1. DNR hunting regulations must be followed at all times.
2. Hunters are responsible for purchasing deer permits [Additional Deer Management Assistance Permits (DMAPs) will be provided by PCCI on an "as needed" basis].\*
3. Every **unused** DMAP tag must be returned to PCCI when the hunter will no longer be hunting PCCI's property (by December 20<sup>th</sup> at the latest). If you know you will not be using the tag, please turn in ASAP so the DMAP can be issued to another hunter.
4. All hunters must have a valid hunting license and permission slip from the Institute and must carry these items along with picture ID at all times.
5. Hunters will be required to hunt the days and sites they are registered for and will not be able to hunt sites and dates that are already assigned to other hunters. In the case a hunter cannot hunt a day they reserved, they must notify the Facilities Manager (Rob Aicken: 269-838-1409 ) as soon as possible.
6. All side arms are strictly prohibited. No weapons, including either bows or firearms, are allowed in Institute buildings, parking lots, or within 300 feet of the Visitor Center complex.
7. Hunting is restricted to designated areas (assigned sites) and no hunting is allowed within 150 feet of trails or roads; within 350 feet of the Batts Cottage, Research Laboratory, or Resident Managers' home; or within 500 feet of the Visitor Center complex.
8. Hunters may only use the deer stands provided by the Institute and are not permitted to use personal stands. Hunters may not move stands to other locations without prior approval. Temporary blinds are permissible but must be removed from the property at the end of the day (or at the end of a consecutive day hunt at the same site) and must be located within 10 yards of one of the assigned tree stands. Hunters must also use safety straps when hunting from deer stands.
9. Hunters using firearms will be assigned to deer stand locations and must remain within 150 feet of their assigned stand while hunting.
10. Baiting deer is strictly prohibited.
11. Hunters are not permitted to use personal vehicles (trucks, cars, ORVs, etc.) on the property. All road vehicles must be parked in designated parking lots. If necessary, the Institute's mule will be available for harvesting deer. The mule is located at the Facility Manager's house and a sign-in/sign-out sheet (located at Wet Lab) must be filled out prior to using the mule.
12. The consumption of alcohol or illegal drugs is prohibited on all Institute property and will result in immediate loss of hunting privileges.
13. Smoking is prohibited on all Institute property.
14. Minors may hunt only if directly and immediately accompanied by their parent or guardian. Minors must possess a valid hunting license, be registered with the Institute, and must have a hunter safety certificate.
15. Unregistered friends and family members may not accompany registered hunters.
16. All instructions given by Michelle Skedgell, Jen Howell, or Rob Aicken whether verbal or in writing must be obeyed immediately.

17. All hunters must recognize that the primary purpose of the deer management program is to reduce the number of does on the property. Hunters are therefore required to use 2 doe permits before taking a buck off the property. If the opportunity presents itself, a hunter may harvest 4 consecutive does before harvesting 2 consecutive bucks. Bucks must have a minimum of 6 spikes to be harvested.
18. All hunters must realize that the primary purpose of the Pierce Cedar Creek Institute is ecological education and should expect to cooperate fully in achieving those purposes. Hunters may not hunt on the no-hunting days as these days will be reserved for outdoor education or research activities.
19. If a radio-collared deer is shot, please return the collar to the front desk of the Visitor Center.
20. When a deer is shot, it must be recovered before the hunter hunts another deer.
21. All hunters are required to fill out the deer check-in station log and must sign in and out during each of their assigned hunting dates. The check-in station is located at the Wet Lab and each hunter has been issued a key to access the locker (3<sup>rd</sup> locker on west side of building) where the check-in station is located.
22. Hunters are required to leave their hunting sites no more than one half hour after sunset. In the case that a shot deer still needs to be tracked, please notify Rob Aicken.

\*DMAPs do not count toward the seasonal limit of antlerless licenses. DMAPs are not to replace available antlerless licenses, but provide additional opportunities to hunt once hunters have reached their limit of antlerless deer licenses.

## **Appendix N: Guidelines for Introducing Prescribed Fire in Eastern Massasauga Rattlesnake Habitat.**

This document, adapted from the Michigan Department of Natural Resources' *Eastern Massasauga Rattlesnake Management Guidelines for Prairie Fen and Associated Oak Savanna Restoration in Michigan and Indiana* outlines a framework to promote the conservation and management of prairie fens and oak savannas to benefit numerous species of greatest conservation need, specifically the eastern massasauga rattlesnake (EMR). The following prescribed fire guidelines will be followed by PCCI to restore occupied EMR habitat.

### Prescribed Fire

Fire is a natural process that occurs in many natural communities, including prairie fens and other habitats occupied by the EMR. Fire in prairie fens serves to keep the vegetation open, reduce shrub and tree cover, reduce surface cover and encourage germination and reproduction of many plant species. Prescribed fire will be allowed in occupied habitat even though it has the potential to kill individual snakes because of positive impacts to their habitat. For example, at some sites, prescribed fire may be the preferred or only effective management treatment for invasive species. In addition, prescribed fire may be the best method to discourage woody growth for the purpose of maintaining critical habitat. The following guidelines will allow the Land Steward to enhance or increase suitability of EMR habitat while minimizing the potential loss of individual snakes.

1. Burning in occupied EMR habitat when snakes are generally inactive or before emergence is unrestricted. The inactive period for EMRs will be defined as November 1 through April 15.
2. Burns will be designed and conducted with the intent to minimize entrapping snakes between flame fronts. However, during a prescribed burn the burn boss may decide that perimeter ignition or a strip fire is necessary to protect human safety, structures, or property.
3. A scientific fire behavior model, such as the United States burn model, the Canadian burn model, or equivalent will be used to formulate a burn prescription for a maximum rate of spread no faster than 16 chains per hour (17.6 feet per minute) and an average rate of 10 chains per hour or less (11 feet per minute), except in known hibernacula areas.
4. Where hibernacula are known to be dense (greater than 5 hibernacula per acre), no burning is allowed from March 15 to May 15.
5. Fire breaks should be established during the inactive season or along existing fuel breaks (creeks, trails, roads).
6. "No burn" zones will be designated within each burn unit to ensure that EMRs (and other desirable species) are provided with a refuge, if needed.