Comparison of Different Growing Treatments for Herbaceous Woodland Plants
Wildlife Preservation Fund Grant #14-007W

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PROJECT OBJECTIVES

The overall goal of this project was to research the best restoration practice for native woodland herbaceous plants to establish and reproduce thereby benefiting the habitat for non-game wildlife.

Specific objectives of this project were to:

1. To remove non-native and invasive trees (black locust, black alder and Siberian elm, and Russian mulberry), shrubs (honeysuckle and autumn olive) and herbaceous plants of garlic mustard using D-HNC staff and volunteers.
2. To create brush piles and burn piles using removed non-native and invasive plants with the assistance of D-HNC staff and volunteers.
3. To plant native woodland trees and shrubs with D-HNC staff and volunteer groups.
4. To plant herbaceous plants using four treatments: Burned area with potted plants, unburned area with potted plants, burned area with bare root plants and unburned area with bare roots plants with D-HNC staff and volunteers.
5. To monitor establishment of herbaceous planting with D-HNC staff and volunteers.
6. To educate the public about non-native and invasive plant removal and the use of native plants.

COMPLETED PROJECT DESCRIPTION

Before this project started, the areas to be restored were over taken with garlic mustard, honeysuckle and invasive and non-native trees. With the help of volunteers second year garlic mustard was pulled, honeysuckle was cut, brush piles were made and wildlife boxes were erected. Douglas-Hart staff sprayed herbicide, cut non-native trees and burned brush piles. Burned and unburned plots were staked out. After invasive and non-native vegetation was removed, native plants were planted. Eighty three trees and shrubs of 28 species were planted in areas near the plots. Two hundred tree seedlings obtained from a no cost tree program were also planted. A total of 382 herbaceous plants were planted of 12 different species. These plants were planted in 4 different treatment plots: burned areas with potted plants, unburned areas with potted plants, burned areas with bare root plants and unburned areas with bare root plants. Mortality, number of leaves, flowers and fruits were counted for 10 weeks in the spring/summer. The landscape of the project areas has changed for the better with the removal of non-native plants and the addition of native plants.

INTRODUCTION

The Douglas-Hart Nature Center (D-HNC) was once an agricultural field that was taken out of production in the 1970's. A wide variety of woodland species both native and non-native were planted. D-HNC has been actively removing and restoring the woodland to what it would

have looked like Pre-European settlement. The temperate deciduous forest is the dominant forest present in this part of Illinois. It consists of 4 layers, upper canopy trees, secondary canopy trees, a shrub layer and a herbaceous layer.

Public education encouraging land owners to remove invasive species has increased. D-HNC like many other land management organizations utilizes volunteers for non-native/invasive removal, thus lowering the cost. Once invasive species have been removed from a site, seed from the seedbank has a chance to germinate. Unfortunately, the seed that will germinate tends to be undesirable vegetation. Constant monitoring and planting of native plants is needed to ensure invasives do not reclaim the land. A site such as D-HNC that at one time was so infested with invasives cannot rely on the seedbank to produce desirable vegetation and so the largest cost of a restoration project is the cost of the native plant material. Trees and shrubs can be obtained at low or no cost governmental programs and can successfully establish. There is limited availability of herbaceous plants in no or low cost programs. Limited opportunities to obtain transplants from partnering community members are used; however, many native spring ephemeral woodland wildflowers (herbaceous woodland plants) need to be purchased to ensure diversity. Two growing techniques are used for transplanting mature herbaceous plants, potted plants and bare root plants. There are significant cost differences between techniques. Establishment and reproduction (spreading) is important in any restoration project and the cost/benefit is not known about these two growing techniques.

Temperate deciduous forests are adapted to fire. Fire is a common restoration management technique. It is also not known if burning before transplanting has a positive or negative effect on the establishment and reproduction of herbaceous plants.

The overall goal of this project was to research the best restoration practice for native woodland herbaceous plants to establish and reproduce thereby benefiting the habitat for non-game wildlife.

Specific objectives of this project were:

1. To remove non-native and invasive trees (black locust, black alder and Siberian elm, and Russian mulberry), shrubs (honeysuckle and autumn olive) and herbaceous plants of garlic mustard using D-HNC staff and volunteers.
2. To create brush piles and burn piles using removed non-native and invasive plants with the assistance of D-HNC staff and volunteers.
3. To plant native woodland trees and shrubs with D-HNC staff and volunteer groups.
4. To plant herbaceous plants using four treatments: Burned area with potted plants, unburned area with potted plants, burned area with bare root plants and unburned area with bare roots plants with D-HNC staff and volunteers.
5. To monitor establishment of herbaceous planting with D-HNC staff and volunteers.
6. To educate the public about non-native and invasive plant removal and the use of native plants.

MATERIALS AND METHODS

Three areas throughout the woodland were restored as part of this grant. Areas are visible to visitors along the woodland walking trial.

Removal was done from summer 2013 to spring 2014. Removal of plants was done by both D-H staff and volunteers. A number of different invasives were found in the area and their removal methods are as follows. All spraying of herbicide was done by D-HNC staff or volunteers who have an herbicide license. Garlic mustard first year plants were foliar sprayed with a 5% Glyphosate solution. Garlic mustard second year plants were pulled in the spring and

early summer before seed set. Garlic mustard plants were placed under a tarp and then composted. Honeysuckle plants were cut and stump sprayed using a 30% Glyphosate solution. Smaller honeysuckle plants, where the stumps would have gotten lost before they could have been sprayed were foliar sprayed with a 5% Glyphosate solution. Non-native and invasive trees were cut and sprayed with 30% Glyphosate. Brush piles were made from cut trees and honeysuckle for wildlife and to burn. Burning of brush piles took place when weather conditions were favorable in the winter. After burning took place, plots were staked out. The burned areas were measured and a measured square in burned area was staked out, and an equally sized non-burn area was staked adjacent to the burned plot. Please see Figure 1 for approximate measurements and locations. Plots were labeled with 4 treatments. Burned with potted plants, Unburned with potted plants, Burned with bare root plants and Unburned with bare root plants.

Planting of native plants was done in spring 2014. Please see Table 1 for list of plants used in planting. Volunteers along with D-H staff planted 83 total native trees and shrubs of 28 different species. Trees and shrubs will be monitored for mortality for a couple years. To make monitoring easier, flags were used. Each tree and shrub had their own flag with the name of the plant written on it and growing conditions (sun and moisture requirements), blue flags were used for shrubs and green flags for trees. Two hundred tree seedlings obtained from a no cost tree program were also planted.

For the herbaceous plants a total of 382 plants were planted. There were twelve different species planted. Each plant species had thirty-two plants planted, sixteen of them were bare root and sixteen of them where potted. For a few of the species only potted plants or bare root plants where available. If the plants came bare root only than half of them were potted to establish roots and above ground vegetation for two weeks and then planted. If the plants came as potted plants, they were taken out of their pots, cut back and made into bare root. Eight plants were planted in each of the 4 treatments. Weekly measurements of the herbaceous plants were recorded for numbers of leaves, flowers and fruits. Measurements were taken for ten weeks. At ten weeks, most of the plants had gone dormant for the season. All plants were planted with a little stake to make monitoring easier.

Throughout the grant timeframe we had a total of 89 volunteers giving 267 hours helping to complete this project. This does not include hours that interns and paid D-H staff worked in project area. We had many different volunteer groups help including, youth/high school volunteers, staff and students from Eastern Illinois University, Embrass Volunteer Stewards, boy scouts, girl scouts and clubs from Eastern Illinois University and Lake Land College. We had several community volunteer days and an Earth Day Celebration to involve community volunteers.

RESULTS

Observations about individual plant species were made from the weekly averages for number of leaves, flowers, and fruit. Unless otherwise noted potted plants were transplanted in the ground with no flowers or fruits and bare are root plants had no above ground vegetation. *Sanguinaria canadensis* (Bloodroot) produced no flowers. Overall the bare root plants in the burned plot had the highest number of recorded leaves. Based on number of leaves in bloodroot, the bare root plants established quicker than the potted plants. *Mertensia virginica* (Virginia Bluebells) bare root plants did not establish above ground this year. This species died back soon after planting and so it was hard to tell which treatment was best. *Arisaema triphyllum* (Jack-in-the-Pulpit), bare root plants did not establish above ground. Potted plants that were planted in the burn area produced fruit whereas the plants planted in the unburned area did not. Bare root plants of *Asarum canadense* (Wild Ginger) did not establish above ground. Potted plants produced fruit in only the burned plot.

Phlox divaricata (Wild Sweet William) had established above ground plants in the potted and bare root, burned areas and the unburned areas. Potted plants regardless of whether they were in the burned or unburned treatments produced the most seed. *Uvularia grandiflora* (Bellwort) had potted plants establish above ground. The potted plants in the unburned plots produced the most seed. *Trillium recurvatum* (Trillium) bare root plants did not establish above ground. Only the potted plants in the unburned treatment produced flowers but they did not produce seed. *Geranium maculatum* (Wild Geranium) had both potted and bare root plants establish above ground. Only the potted plants produced seeds and out of those the plants in the burned treatment produced a greater number of fruits. *Stylophorum diphyllum* (Celandine Poppy) had both potted and bare root plants establish above ground. Potted plants were the only ones that set seed. Potted plants in the burn treatment produced more fruits than those in the unburned treatments. *Erythronium albidum* (White Trout Lily) only had plants that established in the potted plants and of those none of them produced seed. *Hydrastis canadensis* (Golden Seal) had the most leaves and seeds set in the potted plants in the burn treatment. *Smilacina racemosa* (False Solomon's Seal) only had above ground establishment in potted plants of those none of them produced seed.

DISCUSSION

Our results can be seen as inconclusive. Since this was an establishment year many of the plants did not flower. Instead this year they worked on establishing their root system and root reserves so that they could survive until the next spring. Plants need longer period to establish seed spread than just one growing season. A better indicator will be continued monitoring that will happen over the next several years in the spring.

Bare root plants sometimes will have above ground vegetation established their first year, however if conditions are not ideal or they were planted to late they will not produce above ground vegetation the first year and instead establish their root system for the following growing season. Most of our bare root plants did not establish above ground in their fist season.

Each individual species is different, but since plants were monitored once a week only, it was hard to tell if the leaves, flowers or fruits that were there one week and gone the next were because of herbivory or due to natural dormancy of the plants and seed dispersal. There was some fluctuation in the numbers of leaves, flowers and fruits from week to week, this is do again in part to the natural life cycle of the plant with regard to dormancy and seed dispersal and/or herbivory.

When numbers of leaves, flowers and fruits were counted, we visually inspected the plants for damage due to herbivory and for any tracks made in the dirt. No evidence of critter herbivory was observed.

The start of this project was weather dependable, which could have had a negative effect on the plants. Planting was done at end of April because of weather conditions. In future studies, if the weather is favorable it would be good to plant the species earlier. Data was not collected on average rainfall or temperature for the time of the study. The collection of this data would be important if we had weather extremes.

Of all of the factors that we recorded, fruit set can be seen as the most important because that is what helps with establishment and spread. Although limited seed was set this year, plants that did flower usually did produce fruit. This is an encouraging because once the plants have a full year to establish and will be in the ground at the beginning of the growing season we should see some good flowering and seed set.

Although it is hard to make generalizations, when comparing just the burned and unburned treatments, the burned areas with the potted plants produced more fruit than unburned areas using potted plants.

With the results that were obtained this year, no conclusions can be drawn as to whether planting bare root or potted plants are better, because there is a cost difference in the price of bare root verses potted plants results of the future monitoring of this project will be important to anyone working on a restoration project with a limited budget.

SUMMARY

This project took areas at the Douglas-Hart Nature Center woodland and with the help of volunteers removed invasive species that had taken over the areas. The area was replanted with native plants. Brush piles were burned and plots were created to test out different treatments. Four treatments were tested using herbaceous woodland plants. The treatments were burned areas with potted plants, unburned areas with potted plants, burned areas with bare root plants unburned areas with bare root plants. Brush piles and wildlife boxes were constructed in the area. Weekly, herbaceous plants were monitored for numbers of leaves, flowers and fruits. Results were inconclusive since some plants did not establish above ground vegetation. However, there was evidence of flowering and seed set in some species. This is a good sign that in future years spread and establishment will be likely. Continued monitoring of these areas will be important so that the over 10,000 visitors can enjoy a restored woodland. Once conclusive results are achieved in the coming years, this information will be important to land owners, as there is a cost difference between the price of potted plants and bare root plants.

PROMOTION OF PRJECT

To promote the public about the project, an article was in the Journal-Gazette and Times Courier and in our quarterly newsletter, the Nuthatch News. Please see attached articles.

MISCELLANEOUS

Many more pictures were taken of the site before after and during the project with and without volunteers. Please let me know if you would like more.

Table 1: Native Plants used for planting in Spring 2014.
Herbaceous plants were purchased with grant monies. Tree and shrubs were obtained through a no cost DNR tree program or purchased using D-HNC funds.

Herbaceous Plants
Arisaema triphyllum (Jack-in-the-Pulpit)
Asarum canadense (Wild Ginger)
Erythronium albidum (White Trout Lily)
Geranium maculatum (Wild Geranium)
Hydrastis canadensis (Golden Seal)
Mertensia virginica (Virginia Bluebells)
Phlox divaricata (Wild Sweet William)
Sanguinaria canadensis (Bloodroot)
Smilacina racemosa (False Solomon's Seal)
Stylophorum diphyllum (Celandine Poppy)
Trillium recurvatum (Trillium)
Uvularia grandiflora (Bellwort)

Shrubs
Amelanchier arborea (Juneberry)
Cornus alternifolia (Pagoda Dodwood)
Euonymus atropurpureus (Wahoo)
Hydrangea arborescens (Smooth Hydrangea)
Hydrangea quercifolia (Oak-Leaf Hydrangea)
Lindera benzoin (Spicebush)
Lonicera prolifera (Yellow Honeysuckle)
Prunus virginiana (Chokecherry)
Rhus aromatica (Fragrant Sumac)
Rhus glabra (Smooth Sumac)
Sambucus pubens (Red Elderberry)
Symphoricarpos orbiculatus (Coralberry)
Viburnum lentago (Nannyberry)
Viburnum trilobum (American Cranberry)

Trees
Aesculus glabra (Ohio Buckeye)
Asimina triloba (Paw Paw)
Carpinus caroliniana (Blue Beech)
Carya cordiformis (Bitternut Hickory)
Cercis canadensis (Redbud)
Cornus stolonifera (Red Osier Dogwood)
Corylus americana (American Filbert)
Nyssa sylvatica (Sourgum)
Prunus americana (American Plum)
Quercus alba (White Oak)
Quercus macrocarpa (Bur Oak)
Quercus palustris (Pin Oak)
Quercus rubra (Red Oak)
Sassafras albidum (Sassafras)

Table 2: Average number of leaves in all treatments.

Sanguinaria canadensis (Bloodroot)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
1.6	2.5	0	0
1.9	1.9	3.5	0.6
2	2.4	3.8	1.1
1.9	1.3	4.5	1.3
1.9	0.5	3.1	0.9
1.8	0.2	2.4	1
1.5	0.3	2	1.25
1	0.1	1.9	2.3
0.9	0.1	1.8	1
1	0.1	1.1	0.8

Mertensia virginica (Virginia Bluebells)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
3.8	3.8	0	0
2.6	2.6	0	0
1.5	1.8	0.1	0
1.6	2.4	0	0
1.4	0.5	0	0
0	0.4	0	0
0	0.1	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Arisaema triphyllum (Jack-in-the-Pulpit)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
1	1.4	0	0
4	2.8	0	0
3.8	2.6	0	0
3	4	0	0
2.6	2.6	0	0
2.6	1.5	0	0
1.5	1.3	0	0
0.8	1.5	0	0
0	0	0	0
0	0	0	0

Asarum canadense (Wild Ginger)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
1.8	1.6	0	0
1.6	1.9	0	0
1.9	1.5	0	0
1.9	1.6	0	0
2.1	1.8	0	0
2.1	1.5	0	0
1.9	1.4	0	0
1.9	1.4	0	0
1.6	1.4	0	0
1.6	1.4	0	0

Phlox divaricata (Wild Sweet William)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
79.9	78.3	0	0
32.3	33.6	0	0
37.3	38.8	0	0
34.8	40.2	5.3	30.2
25	36	8.3	37
27	43	15.5	45
31	43	18	42
26.3	52	15	43
27	52	17	43
28	52	15.6	38.8

Uvularia grandiflora (Bellwort)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
24.1	31	0	0
21.9	22	0	0
22	16.7	3.8	21
14.5	12.2	0	0
16	12	0	0
13.9	11.4	0	0
10.5	10.1	0	0
9.6	8.8	0	0
11	5.6	0	0
8.9	3	0	0

Trillium recurvatum
(Trillium)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
1.5	1.5	0	0
1.5	3.6	0	0
0	1.5	0	0
0	1.1	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Geranium maculatum (Wild Geranium)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
5.4	4.9	0	0
4.4	4.4	1.6	1.5
3.3	4.6	3.6	3.4
4	5.8	0	0
3.9	4.8	5	4.9
4.4	4.5	5.7	4.5
4.8	5.1	6.4	5.3
4.8	4.6	8	6
5.4	5	8	7.4
6	6	8.8	6.8

Stylophorum diphyllum (Celandine Poppy)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
13.9	14	0	0
13.8	12	5.1	1.4
14.4	10.3	7.4	2
19.6	24.4	0	0
10.8	10.5	6.3	2.1
9.6	8.6	6.5	2.1
4.5	10.1	7.5	1.5
3.6	8	7.1	2.3
4	3.8	8.6	2.1
3.6	3.6	8.9	2.3

Erythronium albidum (White Trout Lily)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
2	1.4	0	0
11.9	4.5	0	0
9.1	3.3	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Hydrastis canadensis (Golden Seal)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
2.5	1.6	0	0
2.2	1.3	0	0
1.9	1.5	0.5	0
2.6	2	0.8	0
2.3	1.5	1	0
7	1	0.6	0
2.5	1	0.8	0
2.3	1.6	0.8	0
1.4	0.5	1	0
1.3	0.5	0.8	0

Smilacina racemosa (False Solomon's Seal)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
9.1	1.4	0	0
11.9	4.5	0	0
9.1	3.3	0	0
8.3	9.3	0	0
7.9	2.3	0	0
2.6	2.3	0	0
9.6	2.3	0	0
8.4	2.3	0	0
7	2.3	0	0
6.9	2.3	0	0

Table 3: Average number of flowers in all treatments.

Sanguinaria canadensis (Bloodroot)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0.3	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0.1	0	0	0
0.1	0.3	0	0
0.1	0	0	0
0.2	0.4	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
11.5	37.5	0	0
2.9	1.6	0	0
0	0	0	0
12.25	9.4	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned -Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0.4	0	0
0	0.3	0	0
0	0.1	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	3.8	0	0
0.9	1.8	0	0
0	0.1	0	0
1	0.4	0	0
0	0.1	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0.5	3	0	0
0.4	0.1	0	0
0.5	0.1	0	0
0.1	0.1	0	0
0.5	0.8	0	0
0	0	0	0
0	0	0.1	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0.1	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0.1	0	0	0
2.3	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Table 4: Average number of fruits in all treatments.

Sanguinaria canadensis (Bloodroot)

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0.1	0	0	0
0.1	0	0	0
0.1	0	0	0
0.1	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0.1	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0.3	2	0	0
0.5	1	0	0
0.4	1.1	0	0
0.1	0.5	0	0
0	0.3	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0.4	0	0	0
0.4	0.4	0	0
0.1	0.4	0	0
0.1	0.1	0	0
0.1	0.8	0	0
0.1	0.3	0	0
0	0.1	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0.5	0.1	0	0
2.6	2.8	0	0
2.4	2.1	0	0
1.6	1.4	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

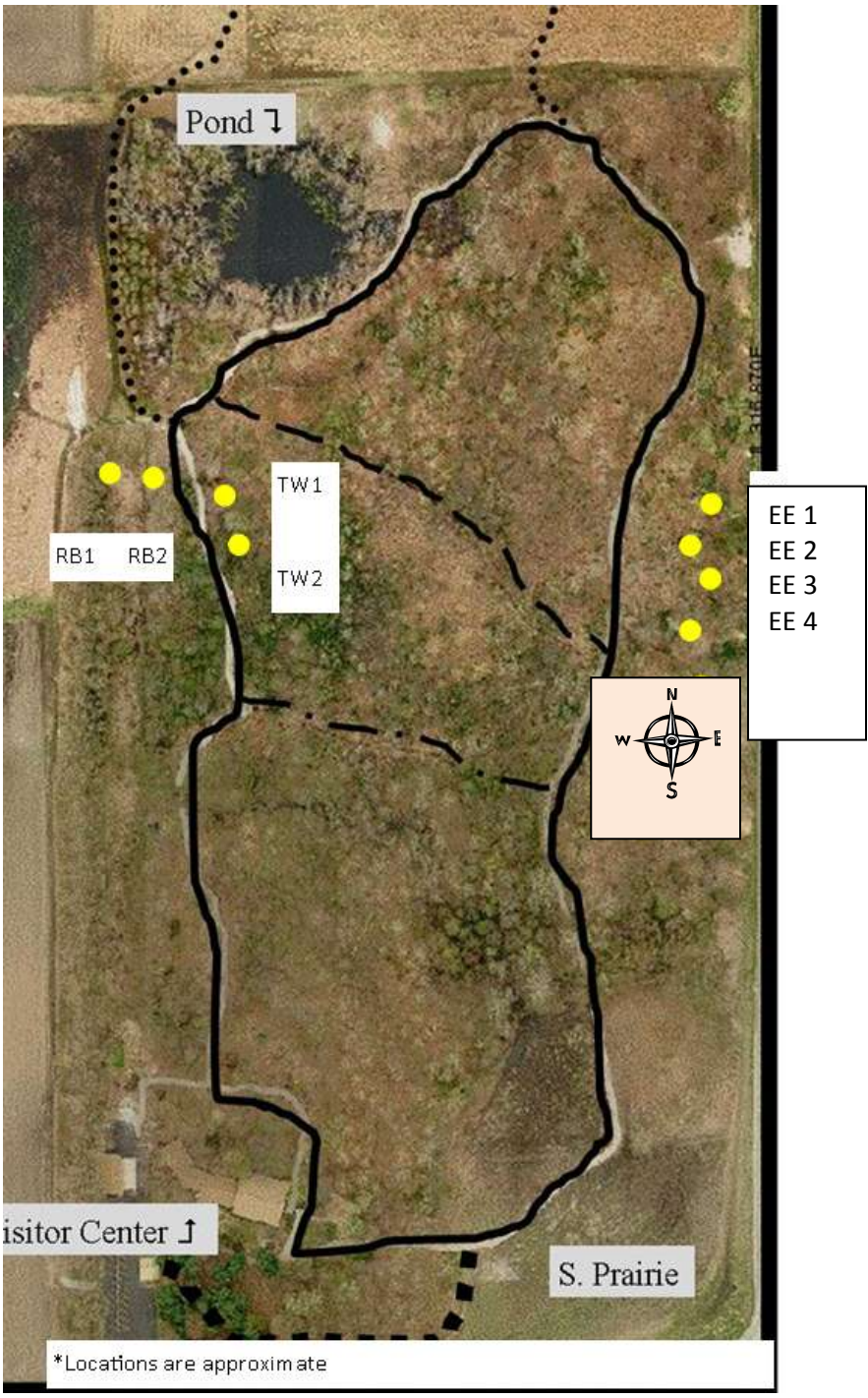
Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
1	1.4	0	0
1.8	1.9	0	0
2	2.1	0	0
1.6	1.4	0	0
1.5	0.5	0	0
0.3	0.5	0	0
0.1	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0.1	0	0	0
0	0	0	0
0	0	0	0
0.1	0	0	0
0.1	0	0	0
0.1	0	0	0
0	0	0	0

Burned-Potted	Unburned-Potted	Burned-Bare Root	Unburned-Bare Root
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Figure 1: Approximate measurements and location of treatment plots.



Species planted:

1. *Sanguinaria canadensis*- Bloodroot
2. *Mertensia virginica*- Virginia Bluebells
3. *Arisaema triphyllum*- Jack-in-the-Pulpit
4. *Asarum canadensis*- Wild Ginger
5. *Phlox divaricata*- Woodland Phlox
6. *Uvularia grandiflora*- Yellow Bellwort
7. *Trillium recurvatum*- Trillium
8. *Geranium maculatum*- Wild Geranium
9. *Stylophorum diphyllum*- Celadine Poppy
10. *Erythronium albidum*- White Trout Lily
11. *Hydrastis canadensis*- Goldenseal
12. *Smilacina racemosa*- False Solomon's Seal

Species 1-3 were planted in the RB sites
Species 4-6 were be planted in the TW sites
Species 7-12 were be planted in the EE sites

Appx. Plot Size:

RB1-56 ft^2 and 56 ft^2
RB2- 100 ft^2 and 100 ft^2
TW1- 163 ft^2 and 163 ft^2
TW2- 130 ft^2 and 130 ft^2
EE1- 132 ft^2 and 132 ft^2
EE2- 210 ft^2 and 210 ft^2
EE3- 120 ft^2 and 120 ft^2
EE4- 121 ft^2 and 121 ft^2

Volunteers helping to plant trees and shrubs.

Volunteers helping to plant trees and shrubs.

Volunteers dressed as “green guardians” to help plant at our Earth Day celebration.

Volunteers helping to plant trees and shrubs.

Volunteers helping to plant trees and shrubs.

A volunteer removing honeysuckle in an area that will be planted.

Volunteers pulling garlic mustard and removing honeysuckle in an area that will be planted.

Example of plants in a burned treatment plot.

Example of plants in an unburned treatment plot.

Example of treatment plot marker.

Volunteers planting herbaceous plant in various treatment plots.

Volunteers planting herbaceous plant in various treatment plots.

Example of plot after planting.

The following are pictures of some select species growing in treatment plots.

Uvularia grandiflora (Bellwort)

Arisaema triphyllum (Jack-in-the-Pulpit)

Hydrastis canadensis (Golden Seal)

Sanguinaria canadensis (Bloodroot)

Asarum canadense (Wild Ginger)

Phlox divaricata (Wild Sweet William)

Munchkin Nursery & Gardens, LLC
323 Woodside Dr. NW
Depauw, IN 47115-9039
Phone 812 633-4858 **genebush@munchkinnursery.com**
www.munchkinnursery.com

Douglas-Hart Nature Center
Attn: Marissa Grant

Invoice

16	Sanguinaria canadensis	@10.00	$ 160.00
32	Arisaema triphyllum	@10.00	$ 320.00
16	Asarum canadensis	@10.00	$ 160.00
16	Uvularia grandiflora	@10.00	$ 160.00
32	Trillium recurvatum	@10.00	$ 320.00
16	Stylophorum diphyllum	@10.00	$ 160.00
32	Erythronium albidum	@10.00	$ 320.00
16	Hydrastis canadensis	@10.00	$ 160.00
32	Smilacina racemosa	@10.00	$ 320.00
10	Dicentra cucullaria	@10.00	$ 100.00
10	Arisaema dracontium	@10.00	$ 100.00

$2280.00-Plants total
$12.00 + 228 plants x $1.25= $297.00-shipping and handling

$2280--$ 912.00 – 40% discount plants =$1368.00-total for plant material

$1368.00+$297
$1664.50 Total Order

$832.00 50% deposit to secure order.

Ship March /April 2014

Thank You for Your Order

Invoice

Date
10/21/13
Invoice #
1291004
Bill To
Douglas Hart Nature Center
Marissa Grant
2204 Dewitt Ave. East
Mattoon IL 61938
217-235-4644
Ship To
Douglas Hart Nature Center
Marissa Grant
2204 Dewitt Ave. East
Mattoon, IL 61938
217-235-4644
Missouri Wildflowers Nursery, LLC
9814 Pleasant Hill Road
Jefferson City MO 65109
phone: (573) 496-3492
email: mowldflrs@socket.net
P.O. No. Terms
Net 30
Total
Balance Due
Subtotal
Sales Tax (0.0%)
Payments/Credits

Description Qty Rate Amount
SANGUINARIA CANADENSIS, BLOODROOT, 4.5" POT 16 6.00 96.00
MERTENSIA VIRGINICA, BLUEBELLS, 2" POT 32 2.12 67.84
ASARUM CANADENSE, WILD GINGER, 2" POT 16 2.12 33.92
PHLOX DIVARICATA, WILD SWEET WILLIAM, 2" POT 32 2.12 67.84
UVULARIA GRANDIFLORA, YELLOW BELLWORT, Bareroot 16 2.00 32.00
GERANIUM MACULATUM, WILD GERANIUM, 2" POT 32 2.12 67.84
STYLOPHORUM DIPHYLLUM, CELANDINE POPPY, 2" POT 32 2.12 67.84
HYDRASTIS CANADENSIS, GOLDEN SEAL, 4.5" POT 12 4.21 50.52
$483.80
$483.80
$483.80
$0.00
$0.00

Project expenditures paid for by funds other than the Special Wildlife Grant Funds

Paid with Douglas-Hart Funds
Delivery of plants from Missouri Wildflowers Nursery $250
Shipping and handling of plants from Munchkin Nursery $297
Trees and shrubs $1604

Total: $2151

In-kind and items on hand from Douglas-Hart
Loppers
Herbicide
Lumber for wildlife boxes
Shovels
Gloves
Flags