Management Plan for the Recovery of Schweinitz's Sunflower (*Helianthus schweinitzii*) at Surratt Road (Conservation area)

Davidson County, North Carolina

Report submitted to:

U.S. Fish and Wildlife Service
Raleigh Field Office, North Carolina

N.C. Department of Transportation
PDEA/ONE
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I. Introduction and Project Summary

In 1991, the U.S. Fish and Wildlife Service listed Schweinitz's (*Helianthus schweinitzii*) sunflower as endangered. At that time, the Service detailed the reasons for listing *H. schweinitzii,* some of which are habitat destruction, loss of known populations, fire suppression and alteration of native habitat, residential and industrial development, roadside and utility right-of-way maintenance, and transportation improvement. All known occurrences in North Carolina were documented as existing within 60 miles of Charlotte (Service, 1994).

Currently, there are nineteen *H. schweinitzii* sites protected in North Carolina. In North Carolina, these sites are protected through state and local land trusts, the State of North Carolina, the U.S. Forest Service, and the North Carolina Zoological Park (NCZP). For a site to qualify as an U.S. Fish and Wildlife Service Recovery Site, it must have a management plan under implementation. Recovery management plans are written for only ten of the nineteen protected sites (Bates, 2003). The purpose of this project is to complete a recovery management plan for the existing population from Surratt Road in Davidson County; this site is intended to qualify as an U.S. Fish and Wildlife Service Recovery Site for Schweinitz's sunflower.

II. Justification of Transplantation of *H. schweinitzii*

The U.S. Fish and Wildlife Service (USFWS) recognizes that some development-related impacts to federally listed species cannot be avoided, and consequently there is an occasional need to transplant stems or entire populations of federally listed plant species out of project areas into protected sites. Accordingly, in an effort to save the existing Surratt Road *H. Schweinitzii* population from being extirpated during future roadway improvement activities (Division 9 paving project), this population has been transplanted to the adjacent land parcel.

Additionally, the rare companion species Georgia aster (*Symphyotrichum georgianum)* was identified well within the impact zone of the road-paving project and has been transplanted to the parcel. The Georgia aster is classified as a candidate species for federal listing, a threatened species in North Carolina, and has a state rating of S2 and global rating of G2G3 (NCDENR, 2006).

DOT acquired the 156.85-acre parcel from property owner Dr. Truesdale during the first quarter of 2005 as a conservation site. The site will serve to mitigate projected impacts to *H. schweinitzii* and *S. georgianum* from the widening of US 52 in Rowan County (R-2903) and paving of SR 2529 (Surratt Road). The site is situated in an undeveloped area.

The overall objective of this transplant site is to support the recovery objective to create a self-sustaining population to facilitate the reclassification from endangered to threatened species, followed by delisting (Service, 1994).

Specifically, the transplantation is occurring in a habitat adjacent to the original *H. schweinitzii* and *S. georgianum* site because it is comparable to the species known habitat. Selecting a site that duplicates the original habitat increases the chance for recovery success.

III. Site Description: Pre-existing biotic conditions

In 2002, the NC Plant Conservation Program described the parcel adjacent to Surratt Road as follows (Bates, 2003):

> The habitat adjacent to Surratt Road supports three natural communities. These include Piedmont Monadnock Forest, Dry Oak-Hickory Forest, and Xeric Hardpan Forest. Pockets of the Xeric Hardpan Forest exist on the south facing slopes that are adjacent to the Road, which occur on upland flat and slightly sloping topography. Tree shrub species that are characteristic of Xeric Hardpan Forest that were noted on the site include *Quercus phellos* (Willow oak), *Quercus velutina* (Black oak), *Ulmus alata* (Winged elm), *Cercis canadensis* (Redbud), *Juniperus virginiana* (Red cedar), *Quercus stellata* (Post oak), *Pinus echinata* (Short-leaf pine), *Fraxinus americana* (American ash*), Carya carolinae-septentrionalis* (Carolina shagbark hickory), *Carya glabra* (Pignut hickory), *Quercus alba* (White oak), *Vaccinium aboreum* (Sparkleberry), and *Rosa carolina* (Wild rose). Examples of herb species noted in the vicinity of the Xeric Hardpan Forest include *Pteridium aquilinum* (Bracken fern), *Danthonia sericea* (Silky oat-grass), *Carex caroliniana* (A sedge), *Scleria oligantha* (A nutrush), *Coreopsis major* (A coreopsis), *Panicum anceps* (A panic grass), *Oenothera sp.* (An Evening primrose), *Vitis rotundifolia* (Muscadine), *Melica mutica* (Melica grass), *Eupatorium rotundifolium* (A Thoroughwort), and *Scutellaria intergrifolia* (A skullcap). Numerous piedmont prairie/savanna companion species already exist in the community. The dominance of grasses and forbs in the herb layer provide a seed source for restoration. There are minimal amounts of exotic, invasive species that occur on this site. *Lonicera japonica* (Japanese honeysuckle) occurs in a low area, along an intermittent tributary near Surratt Road. The remainder of the site, that was observed, was fairly free of invasive species. (see Appendix I)

IV. Site Survey Data

Ranked Site Preference:

Immediately adjacent habitat containing the same ecological characteristics _x_
Documented extant population on protected site ___
Documented historic location on a protected site ___
Not a known historic location, but within historic geographic range with similar physical and biological features ___

Transplant Site Ownership and Security:

Public land: Protected __ Protection mechanism __ Unprotected _x *
Private land: Protected ___ Protection mechanism and by whom ____

Potential threats after reintroduction (e.g., trail building or maintenance, fire rotation schedule, structures, etc.) invasive/exotic plants; trespass (poaching)
Adjacent land disruption or threats logging
Acquire all required permits and/or landowner permission Y
Landowner kept fully apprised of reintroduction status Y

*Deed restrictions to maintain *H. schweinitzii* habitat will be developed for the conservation area once the parcel is transferred out of NCDOT ownership

Transplant Site Characteristics:
Location: Beaver Dam Creek/Glady Fork Macrosite
Latitude: 353334N
Longitude: 0800627W
GPS coordinates and system: GATE 1: 800654W, 353342N (DMS); GATE 2: 800646W, 353340N (DMS)
Site disturbance history: logging, farming, dirt roads
Land management practices: N/A

Edaphic conditions:
Soil type: Herndon silt loam and Enon very stony loam; future transplant site is Uwharrie stoney silt loam
Soil texture: Clayey and rocky soil textures
Hydrology: Aquatic __ Seasonally flooded __ Mesic __ Xeric _x_ Other
What cogeners are present with which rare plant introduction might hybridize?
Helianthus microcephalus, and H. divaricatus

V. Species Information

Species Biology and Plant Material
Species Identification: *Helianthus* Linnaeus
Scientific name: *Helianthus schweinitzii*
Common name(s): Schweinitz's sunflower

Species Status
Natural Heritage: Global G2 State S3 Federal: E State: E
Other states in which taxon occurs and S-ranks if available: South Carolina; S1

Reason(s) for rarity
Habitat loss or degradation _x_ Specialized habitat _x_
Reduced reproduction ____ Pathogen(s) ____ Herbivory ___
Other Transportation Improvement, Fire suppression; Maintenance

Previous known reintroduction or reintroduction attempts
Examples include, but not limited to: Wysner Mountain, Montgomery Co.; Okeweemee Woodland, Montgomery Co.; Hanging Rock State Park, Stokes Co.; Uwharrie National Forest, Montgomery Co.

General Life History Traits

Duration: Annual ____ Perennial _x_ Obligate biennial ____ Facultative biennial
"Intermittent vegetative dormancy" __TBD_____ Other ____
Habit: Herb _x_ Shrub __ Tree __ Vine __ Epiphyte __ Other
If hemi- or obligately parasitic, list host(s) __N/A__
Saprophytic _no_
Clonal _x_

Role in ecosystem (e.g., keystone species, host plant, nectar plant, etc.)
Piedmont prairie indicator species_____

Reproductive Biology

Phenology: flowering
Vegetative emergence: early spring
Vegetative duration: first frost
Duration of: anthesis 2-3 months stigma receptivity _____
Fruit maturation time and duration unknown

Self-pollinating ____ Outbreeding ____ Mixed-Mating ____ Apomictic ____
Other _____ Unknown __x____

Self-incompatible ____ Self-compatible ____
Monecious _x_ Dioecious ____ Other _____

Vegetative reproduction: importance (rate 0-5, unimportant to very important) 3
Mechanism __tuberous roots break off and form new plants_____

Flower visitors: _*Hymenoptera* (bees); *Coleopteria* (beetles)_____
Pollinators: _ *Hymenoptera* (bees); *Coleopteria* (beetles)_____

Are pollinators present at transplant site? Yes (Document possible pollinators from extant sites.) pollinators are present at adjacent plant donor site

Propagule dispersal mechanism:

Primary: Wind ___ Water ___ Animal(s) (list) _x_ Gravity ___ Other
Secondary: Wind ___ Water ___ Animal(s) (list) ___ Gravity _x_ Other
If propagule animal dispersed, are these present Y (species are unknown, but present at adjacent plant donor site; likely animals are small birds and rodents).
Effective population size unknown. (Determine from extant populations if possible. If this is not known, include this analysis in the reintroduction methodology.)

VI. Plant Material and Source

____(Surratt Road donor population)*

Are all required permits and landowner permission granted? None needed.

Whole plants __ Seeds/Spores _x_ vegetative part(s) roots_____
Number of individuals planted 2091 (roots)_ If dioecious, sex ratio

_____
Propagule source (use attached Center for Plant Conservation seed collection guidelines)

From existing population adjacent to reintroduction site 2091_ Collection date 11/14/06 to 1/19/07

From other population _none_ Distance from transplant site _local_

Is propagule source from stored germplasm? No Collection date ____

Proportion of seed collection accession used see below_____
Element occurrence #(s) 124

Was the entire population removed from the donor site (Is the donor population expected to be extirpated or remain extant)? 98% of the roadside population was transplanted into the conservation area. It is anticipated that the remaining plants will survive after roadwork is complete and that seed bank germination may bolster the roadside population.

Other information In addition to the roots that were transplanted into the conservation area, an undetermined number of seeds were collected from the donor population and were scattered into the conservation area (estimated at a few thousand)._____

Demography of donor population:
0% Adult non-reproductive
95 % Adult reproductive
5% Juvenile

Population density: 523 clumps (roots) per acre (very rough estimate)
Population distribution: clumped
Edaphic conditions: disturbed, maintained roadside
Solid texture: clayey/rocky
Hydrology: Aquatic ____ Seasonally flooded ____ Mesic ____ Xeric _x__

* Information from US 52 donor population will be added at a later date.

VII. Management Protocol

1. **Site Clearing**

Beginning in May of 2006, the initial site clearing was conducted by employees from the NCDOT Project Development & Environmental Analysis Office of Natural Environment (PDEA/ONE) and North Carolina Zoological Park. Tulip poplar, sweet gum and red maple seedlings and saplings were targeted for removal using hand tools within a roughly

10-acre area located between the third and fourth gates along Surratt Road. Larger trees of these species were cut using chain saws. Most stumps were treated with a herbicide to prevent re-growth. A few of the larger trees were treated with a "hack-and-squirt" method to reduce shading while providing snags for birds and wildlife. The goal of the tree removal was to create patchy openings within the forest and "Piedmont prairie" habitat. Initially, three areas were targeted for tree clearing, known as the east, central and western clearings. The eastern clearing has been abandoned for now, as it was outside of the pre-existing dirt roads that were used to establish the firebreaks. The central and western clearings are separated by a small stand of short-leaf pine (*Pinus echinata*). The tree clearing continued throughout the spring**.** The percent openness created by the clearing has not been determined yet, as more clearing may occur. Treatment of Wisteria and tree of heaven (*Ailanthus altissima*) also took place within the tract using a cut-and-squirt method as well as hand pulling for the Wisteria. The Wisteria and the tree of heaven are found inside gate four of the tract. Japanese stilt grass (*Microstegium vimineum*) growing on the south side of Surratt Road was also sprayed to minimize the movement of seeds to the inside of the tract.

Site clearing was conducted by hand to avoid impacts from driving heavy equipment into the conservation area (soil compaction, rutting, and introduction of invasive weeds). Additional clearing is anticipated for early 2007.

I. Responsible Party: NCDOT PDEA / ONE and NCZP

II. Management Activity: Utilized hand clearing and judicious herbicide application to remove excessive vegetation present on site. Left selected trees for wildlife food and shade. Some ground level woody vegetation will be eradicated by the prescribed burn.

The cleared plots are locatable by GPS coordinates taken at the estimated center point (see map-Appendix II & III).

2. Controlled Burns

The U.S. Forest Service conducted the initial site burn on December 18, 2006. The next scheduled burn is anticipated for April 2008. Prescribed burns will be conducted every two to three years.

I. Responsible Party: North Carolina Forest Service – City of Denton, Davidson County office under paid agreement and supervision of NCDOT staff. (Jon Albertson and Nancy Blackwood, County Rangers)

II. Management Activity: Conduct a safe, controlled burn according to written burn prescription thus reducing woody competition and debris and providing a fertile site for future planting.

Fire is critical to the target species because the *H. schweinitzii* requires abundant overhead light to successfully maintain its population (Barden, 1996).

All firebreaks were cleared by hand by NC Zoo and NCDOT staff. This was done with the intent to avoid impacts from driving heavy equipment into the conservation area.

3. Transplanting of *H. Schweinitzii*

I. Responsible Party: NCDOT PDEA / ONE and NCZP

II. Management Activity: Relocated *H. Schweinitzii* from Surratt Road ROW to adjacent parcel and plant locally collected seeds

In November and December of 2006 the NCDOT PDEA / ONE, North Carolina Zoological Park, and volunteers extracted and relocated *H. schweinitzii* and Georgia aster (*Symphyotrichum georgianum*) from the Surratt Road State right-of-way to designated plots within the parcel—plots A, B, C, C2, D, E, F, F2, G, H, I, and J. Transplant work took place on 11/14, 11/15, 11/30, 12/6, and 12/7 of 2006. Transplant areas were cleared of leaves and duff with rakes, so that the controlled burn would not affect the roots. Seeds from the sunflowers, asters, and companion species were collected on 11/14. The last roots were dug up on 12/7; these were healed over temporarily within the conservation area and were planted on 1/19/07. All the Georgia aster seeds were taken to the NC Botanical Garden, where they will be tested for viability and sprouted. Any asters successfully germinated will be returned to the Surratt Road conservation area once they are mature. All of the remaining seeds that were collected from along the road were mixed and scattered within the conservation area on 1/19/07, after the controlled burn had been conducted. They were scattered in areas where none of the roots had been planted, to allow for comparative monitoring.

The table below documents the tally of stems and clumps transplanted and the specific plot location on the site:

Table 1. Plantings at Surratt Road Conservation Area, winter 2006

PLOT ID	# of H. schweinitzii roots	# of holes used	# of H. schweinitzii clumps	# of S. georgianum clumps
A	39	39	1	5
B	44	44	2	6
C,C2	248	232	0	1
D	424	361	0	74
E	126	126	0	4
F,F2	376	376	0	0
G	50	50	0	0
H	302	270	0	0

I	397	379	3	0
J	79	79	0	0
TOTAL	**2085**	**1956**	**6**	**90**

Other plantings included *Baptista tinctoria*, , *Vernonia acaulis*, *Amorpha schwerinii* seedlings (four), Indian grass, and mixed grass clumps.
A total of 2091* Schweinitz's sunflowers and 90** Georgia asters were transplanted.

*839 *Helianthus schweinitzii* stems were estimated to be growing along the road on 9/04/2002 and 1624 stems on 10/24/2006.

**30+ *Symphyotrichum georgianum* stems were estimated to be growing along the road on 10/24/2006.

To establish floral diversity within the site, the following seed mixes were collected and scattered in the proximity of the *H. schweinitzii* relocation sites—beaked panic grass (*Panicum anceps*), Indian grass (*Sorghastrum nutans*), gama grass (*Tripsacum dactyloides*), split-beard (*Andropogon ternarius*), purpletop (*Tridens flava*), Maryland goldenaster (*Chrysopsis mariana*), Virginia wildrye (*Elymus virginicus*) and all *Helianthus* species –*H. schweinitzii, H. microcephalus*, and *H. divaricatus*.

In addition to receiving *H. schweinitzii* from Surratt Road, the conservation area is also planned to receive *H. schweinitzii* (EO 06) from NC 52 in Rowan County. These plants make up a population occurring along the roadsides of NC 52, Old Beatty Ford Road and SR 2350 in the vicinity of Gold Hill, Rowan County. The project is to be widened on the existing location due to its proximity to the railroad, airport and rock quarry nearby, causing direct impacts to a large portion of the population. In 2002, NCDOT and NC Plant Conservation Program (NCPCP) staff counted approximately 397 flowering stems in 12 subpopulations.

It is anticipated that *H. schweinitzii* seed collection will begin in 2007 from the Gold Hill population. The seeds will be placed at the Surratt Road conservation area well away from the other sunflower plantings, so the populations can be monitored separately. A natural opening just over the ridge line on the southern side of the property will be expanded slightly and will be the repository for the Gold Hill seeds. When the *H. schweinitzii* roots are dug (closer to the highway expansion date), they will be placed in a "garden" type setting, a small area inside gate three that was plowed (by unknown sources) in early 2006 in the center of the property. (See map in Appendix II for the location of these areas.) It is hoped that this method will allow for intensive seed production and collection to expand and/or augment *H. schweinizii* populations in the conservation area.

4. Monitoring

Monitoring of the transplants will be conducted by NCDOT and NCZP staff. In addition to counting the numbers of *H. schweinitzii* and *S. georgianum*, goss plots will also be monitored to track overall vegetation changes (if any). Both goss plots are located within the controlled burn area. One goss plot is within an area where the tree clearing has occurred, the other is just outside the cleared area. Each population transplanted within the conservation area will be monitored annually for at least five years, after which the NC Zoological Park will take over the long-term management of the conservation area. Deed restrictions will be placed so that the site will be maintained for *H. schweinitzii* and other rare companion species in perpetuity.

I. Responsible Party: NCDOT-PDEA/ONE and NCZP

II. Management Activity: Unconstrained species survey, goss plot monitoring, point-intercept monitoring.

Bates suggest the following procedure to document the counts of the target species when monitoring (2004):

> Count the number of clumps, stems per clump, and number of heads per stem. Once the total number of stems reaches 1,000, then eliminate stems per clump and count only the number of clumps and flowering stems. Determine the mean number of stems per clump based on several years of data. Use this number to estimate total number of stems. Refer to *Schweinitz's sunflower (Helianthus schweinitzii) Monitoring Form*. When counting clumps, place a survey flag near each clump, take a photograph of the subpopulation, and then remove flags. Barden (1994) notes that the demographic bottleneck for Schweinitz's sunflower is apparently the maturation of the seedling-sized plants (less than 10 cm in height) into reproductive individuals (50-200 cm in height). Each year, note the presence of seedlings and herbivory on seedlings. Monitor seed plots to determine percent germination and seedling survivorship.

Documentation of the success of management activities is a crucial component of any good adaptive natural resource management plan. Future management activities will be questionable and certainly less effective without adequate, clear baseline data from which to draw conclusions and make decisions. A focus on the following three objectives should allow for proper monitoring to occur:

- All management activities should be documented in detail.
- Survivorship data on transplanted species should be collected, assessed and analyzed annually.
- Monitoring data should be standardized and be as quantitative in nature as possible so annual measurements will be statistically comparable.

With these objectives in mind, it is recommend that one general – unconstrained species survey - and two specific types of data collection protocols be employed: point-intercept

monitoring and belt-transect monitoring (Daves and Seriff, 2003). Unconstrained species surveys are simply utilized to document all plant species and animal species present on site and to track the ongoing success of populations of rare species annually. These "walk through" surveys can be conducted more than once per year but should be conducted at least annually. Point-intercept and goss plot monitoring allow for percent cover change and change in species composition to be documented over time. Each of these protocols provides effective monitoring and requires a limited investment of time and resources to conduct. Monitoring should be conducted each August (point-intercept and goss plot) and September (unconstrained species survey) and data collection can be completed within 2 -3 days.

5. Ongoing Invasive Species and Woody Plant Control

Invasive species and woody plants will be controlled by using prescribed burns, careful herbicide use (mainly for invasives) and cutting stems. Prescribed burns will also reduce the subcanopy and shrub layers. It will also be important to monitor for encroachment of exotic species into the *H. schweinitzii* transplant areas over time and address as needed.

I. Responsible Party: NCDOT-PDEA/ONE and NCZP

II. Management Activity: Monitor site once per year for exotic, invasive species and control utilizing mechanical or chemical methods as needed based on specific species being treated. This should occur once per year in the early summer (May/June).

Special attention and care must be taken at all times to avoid spray impact on the remaining trees and any transplant areas. DO NOT allow sprays to drift to desirable plants.

6. Reporting

Responsible Party: NCDOT-PDEA/ONE and NCZP

Annual monitoring reports should be provided to the US Fish and Wildlife Service, NC Plant Conservation Program, NC Natural Heritage Program.

Resources and Cited Literature

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Appendix I

Species List for Surratt Road

Date reported: 06/08/2006
Reported by: Pete Diamond & Moni Bates, NC Zoological Park
Mary Frazer, NCDOT Office of Human Environment

*denotes exotic, invasive species

Canopy, Subcanopy, and Shrub Layer

Acer rubrum (Red maple)
Ailanthus altissima (Tree-of-heaven)*
Albizia julibrissin (Mimosa)*
Alnus serrulata (Tag alder)
Amelanchier arborea (Serviceberry)
Calycanthus floridus (Sweet-shrub)
Carpinus caroliniana (Ironwood)
Carya glabra (Pignut hickory)
Carya tomentosa (Mockernut)
Celtis sp. (A Hackberry)
Cercis canadensis (Redbud)
Chionanthus virginicus (Fringe tree)
Cornus florida (Flowering dogwood)
Diospyros virginiana (Persimmon)
Euonymus americanus (Strawberry bush)
Fraxinus americana (White ash)
Fraxinus pennsylvanica (Red ash)
Gaylussacia frondosa (Dangleberry)
Hamamelis virginiana (Witchhazel)
Hypericum hypericoides (St. Andrew's cross)
Hypericum prolificum (Shrubby St. John's wort)
Hypericum stragulum (A St. John's wort)
Ilex opaca (American holly)
Ilex verticillata (Winterberry)
Juniperus virginana (Red cedar)
Ligustrum sinenesis (Privet)*
Liquidambar styraciflua (Sweet gum)
Liriodendron tulipifera (Tulip tree)
Nyssa sylvatica (Black gum)
Oxydendrum arboreum (Sourwood)
Pinus echinata (Short-leaf pine)
Pinus virginiana (Virginia pine)
Prunus serotina (Black cherry)
Quercus alba (White oak)
Quercus coccinea (Scarlet oak)
Quercus falcata (Southern red oak)
Quercus montana (Chestnut oak)
Quercus phellos (Willow oak)
Quercus stellata (Post oak)
Rhododendron periclymenoides (Wild azalea)
Rhus copallina (Winged sumac)
Robinia pseudo-acacia (Black locust)
Rubus sp. (A Blackberry)
Sambucus canadensis (Elderberry)
Sassafras albidum (Sassafras)
Ulmus alata (Winged elm)
Ulmus rubra (Slippery elm or Red elm)
Vaccinium arboreum (Sparkleberry)
Vaccinium stamineum var. stamineum (Common deerberry)
Viburnum prunifolium (Black haw)

Vines

Bignonia capreolata (Cross-vine)
Campsis radicans (Trumpet vine)
Desmodium rotundifolium (Roundleaf tick-trefoil)
Dioscorea villosa (Wild yam)

Ipomoea sp. (A Morning-glory)
Lespedeza repens (Smooth trailing lespedeza)
Lonicera japonica (Japanese honeysuckle)*
Lonicera sempervirens (Coral honeysuckle)
Diphasiastrum digitatum (Common running-cedar)
Parthenocissus quinquefolia (Virginia creeper)
Smilax glauca (A Greenbrier)
Smilax rotundifolia (A Greenbrier)
Toxicodendron radicans (Poison-ivy)
Vitis rotundifolia (Muscadine grape)
Wisteria sinensis (Chinese wisteria)*

Herbs

Acalypha sp. (A Three-seeded mercury)
Agalinis purpurea (An Agalinis)
Agrimonia pubescens (Downy agrimony)
Agrostis hyemalis (Small bentgrass)
Ambrosia artemisiifolia (Ragweed)
Anemone lancifolia (Lance-leaf anemone)
Anemone virginiana var. *virginiana* (Thimbleweed)
Amsonia tabernaemontana (Blue star)
Andropogon virginicus (Broom sedge)
Antennaria plantaginifolia (Plantain pussytoes)
Arthraxon hispidus var. hispidus (Basket grass)*
Asclepias tuberosa var. *tuberosa* (Common butterfly-weed)
Asclepias verticillata (Whorled milkweed)
Asplenium platyneuron (Ebony spleenwort)
Aster pilosus (Frost aster)
Athyrium asplenioides (Southern lady fern)
Aureolaria virginica (Downy oak-leach)
Baptisia tinctoria (Rattleweed)
Bidens aristosa (Midwestern tickseed-sunflower)*
Boehmeria cylindrica (False nettle)
Botrypus virginianus (Rattlesnake fern)
Carex complanata (A Sedge)
Carex crinita (A Sedge)
Carex howei (Howe's sedge)
Carex intumescens (A Sedge)
Carex lurida (A Sedge)
Chamaecrista fasciculata var. *fasciculata* (Common partridge-pea)
Chamaelirium luteum (Devil's-bit)
Chasmathium laxum (Slender spike grass)
Chimaphilia maculata (Striped wintergreen)
Chrysopsis mariana (Maryland Golden-aster)
Cirsium sp. (A Thistle)
Coreopsis major (A Coreopsis)
Danthonia sericea (An Oat grass)
Danthonia spicata (Poverty oat grass)
Daucus carota (Queen Ann's lace)*
Desmodium nudiflorum (Naked Tick-trefoil)
Desmodium spp. (Species of Tick-trefoil)
Dichanthelium spp. (Species of Witch-grass)
Dichanthelium lucidum (Bog witch-grass)
Diodia teres (Poorjoe)*
Elephantopus carolinianus (Leafy elephant's-foot)
Elephantopus tomentosus (An Elephant's-foot)
Elymus virginicus var. *virginicus* (Common Eastern wild-rye)
Endodeca serpentaria (Turpentine-root)
Eragrostis spectabilis (A Love grass)
Erigeron annuus (Annual fleabane)

Eupatorium capillifolium (Dog fennel)
Eupatorium hyssopifolium (A Thoroughwort)
Eupatorium rotundifolium (A Thoroughwort)
Eupatorium serotinum (Late Eupatorium)
Euphorbia corollata (Flowering spurge)
Fragaria virginiana (Strawberry)
Galium circaezans (A Bedstraw)
Gentiana villosa (A Gentian)
Geum canadense (An Avens)
Glyceria striata var. *striata* (Fowl mannagrass)
Goodyera pubescens (Rattlesnake plantain)
Gratiola virginiana (A Hedge-hyssop) questionable identification?
Helenium autumnale (Sneeze-weed)
Helianthus divaricatus (A Sunflower)
Helianthus microcephalus (Small-headed sunflower)
Helianthus schweinitzii (Schweinitz's sunflower)
Hexastylis arifolia (A Ginger)
Hieracium gronovii (Beaked hawkweed)
Hieracium venosum (Rattlesnake weed)
Houstonia purpurea (A Houstonia)
Houstonia pusilla (Tiny bluet)
Hypericum punctatum (St. John's-wort)
Hypoxis hirsuta var. *hirsuta* (Yellow-star grass)
Juncus effusus (Needle rush)
Kummerowia sp. (Korean-clover, Japanese clover)*
Lactuca floridana (Woodland lettuce)
Lespedeza cuneata (Sericea)*
Lespedeza virginica (A Lespedeza)
Leucanthemum vulgare (Chrysanthemum leucanthemum) – Oxeye daisy*
Lilium michauxii (Carolina lily)
Lobelia inflata (Indian-tobacco)
Lobelia puberula (A Lobelia)
Lobelia spicata (A Lobelia)
Lycopus virginicus (A Lycopus)
Microstegium virmineum (Japanese grass)*
Oenothera fruticosa (Sundrops)
Osmunda regalis var. *spectabilis* (Royal fern)
Panicum anceps (A Panicum)
Parthenium integrifolium (Wild quinine)
Paspalum sp. (A Paspalum, Crown grass, Beadgrass)
Penstemon australis (Southern beardtongue)
Polygonatum biflorum (Solomon's seal)
Polystichum acrostichoides (Christmas fern)
Potentilla canadensis (Five-fingers)
Prenanthes serpentaria (Lion's-foot)
Pseudognaphalium obtusifolium (Fragrant rabbit tobacco)
Pteridium acquilinum (Bracken fern)
Pycnanthemum tenuifolium (A Mountain-mint)
Rudbeckia fulgida (Common eastern coneflower)
Ruellia caroliniensis (Carolina wild-petunia)
Rhynchospora capitellata (Brownish beaksedge)
Sabatia angularis (Common marsh-pink)
Sagittaria latifolia (An Arrowhead)
Salvia lyrata (A Sage)
Scirpus cyperinus (Woolgrass bulrush)
Schizachyrium scoparium (Little blue stem)
Scirpus polyphyllus (A Bulrush)
Scleria oligantha (Few-flowered nutrush)
Scutellaria integrifolia A Skullcap)
Silphium compositum var. *compositum* (A Rosinweed)
Sisyrinchium mucronatum (Blue-eyed grass)
Solidago altissima var. *altissima* (Tall goldenrod)
Solidago erecta (A Goldenrod)
Solidago odora (A Goldenrod)

Solidago rugosa (A Goldenrod)
Sorghastrum nutans (Indian grass)
Sphenopholis sp. (A Wedgegrass)
Spiranthes sp. (A Ladies'-tresses)
Stylosanthes biflora (Pencil-flower)
Tridens flavus (Purple top)
Tripsacum dactyloides (Gamma grass)
Uvularia puberula var. *puberula* (Appalachian bellwort)
Verbesina occidentalis (Wingstem)
Vernonia acaulis (An Ironweed)
Vernonia noveboracensis (Ironweed)
Viola sp. (A Violet)
Woodwardia areolata (Netted chain fern)

Animal Species

Five lined racer
Green frog
Luna moth
Monarch butterfly
Ovenbird
Pine warbler
Red-eyed vireo
Tufted titmouse
Whip-poor-will
Yellow-bellied woodpecker

Appendix II

Surratt Road Conservation Site GIS Map
(Source: S:\BioSurveys\frazer\Surratt\Surratt_reduced\Surratt_map.mxd)

Appendix III

Surratt Road Transplant Plot Coordinates

Table 2. Plot coordinates (Latitude/Longitude Decimal degrees)

PLOT ID	Center point coordinate	
A	**X:** -80.1138700130682	**Y:** 35.5606261598024
B	**X:** -80.1137389499524	**Y:** 35.5605480658257
C	**X:** -80.1142031861738	**Y:** 35.5601092299
C2	**X:** -80.1141594365106	**Y:** 35.5602503488364
D	**X:** -80.1152621101943	**Y:** 35.559972436283
E	**X:** -80.1153284422643	**Y:** 35.5604104429022
F	**X:** -80.1150371619129	**Y:** 35.5609440179499
F2	**X:** -80.115032947532	**Y:** 35.561126244294
G	**X:** -80.1136700022019	**Y:** 35.5602628252695
H	**X:** -80.1150494575942	**Y:** 35.5599572792031
I	**X:** -80.1139817316922	**Y:** 35.5603510054771
J	**X:** -80.1153968753307	**Y:** 35.5606937447497