

Natural Resource Damages Settlement Projects at the Fernald Preserve -12316

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ABSTRACT

This paper describes the development and implementation of two ecological restoration projects at the Fernald Preserve that are funded through a CERCLA natural resource damage settlement. The Paddys Run Tributary Project involves creation of vernal pool wetland habitat with adjacent forest restoration. The Triangle Area Project is a mesic tallgrass prairie establishment, similar to other efforts at the Fernald Preserve. The goal of the Fernald Natural Resource Trustees is to establish habitat for Ambystomatid salamander species, as well as grassland birds. Planning and implementation of on-property ecological restoration projects is one component of compensation for natural resource injury. As with the rest of the Fernald Preserve, ecological restoration has helped turn a DOE liability into a community asset.

INTRODUCTION

The Fernald Preserve is situated on a 45 million m² tract of land, approximately 29 km northwest of Cincinnati, Ohio. The site is located near the unincorporated communities of Ross, Fernald, Shandon, and New Haven in Hamilton County. It is a former uranium-processing facility that was shut down in 1991. Since then, the site has undergone extensive remediation pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Remedial activities and subsequent ecological restoration have converted the site from an industrial production facility to an undeveloped park, encompassing wetlands, prairies, and forest. Upon completion of large-scale soil remediation and waste disposition in the fall of 2006, the site was successfully transitioned to the U.S. Department of Energy (DOE) Office of Legacy Management.

Sitewide ecological restoration was driven by several factors, including stakeholder input, regulatory compliance, and the negotiated settlement of a long-standing natural resource damage claim under Section 107 of CERCLA. DOE and the Ohio Environmental Protection Agency (Ohio EPA) signed a Consent Decree in November 2008 that finalized the natural resource damage claim, which was originally filed in 1986. A portion of the Consent Decree required DOE to pay \$13.75 million to compensate for natural resource injury by restoring, replacing, or acquiring equivalents of the natural resources at or near the Fernald Preserve. Following finalization of a Funds Utilization Plan in February 2010, the Fernald Natural Resource Trustees (Trustees)—DOE, Ohio EPA, and the U.S. Department of the Interior—agreed to implement several ecological restoration projects at the Fernald Preserve. The Trustees began planning and designing the Paddys Run Tributary Project and the Triangle Area Project in 2010. Each of these projects is detailed below.

PADDYS RUN TRIBUTARY PROJECT

The Paddys Run Tributary Project involves the creation of a vernal pool, measuring nearly 11,000 m², with adjacent forest establishment. Grading and forest establishment will take place within a 305 000 m² project area, located along Paddys Run Road. Topography and hydrological conditions allow for potential vernal pool establishment at the project area. In addition to the vernal pool, three planting areas are proposed, as shown in Table I. Previous ecological restoration activities within this portion of the Fernald Site have shown that wetland creation is appropriate within the proposed location.

The goal of this project is to create vernal pool breeding habitat for Ambystomatid salamanders within a contiguous forest community. In the Midwestern United States, a vernal pool is a small, shallow wetland with fluctuating water levels that reach a maximum volume in the spring and dry out during the year, is fishless, and provides breeding habitat for unique species of woodland amphibians and/or macroinvertebrates [1] Certain species are considered indicators of vernal pools including fairy shrimp (*Eubranchipus spp.*), wood frogs (*Rana sylvatica*), and Ambystomatid salamanders (*Ambystoma spp.*)[2]. Ambystomatid salamanders such as the marbled salamander (*Ambystoma opacum*) and the spotted salamander (*A. maculatum*) are vernal pool breeders and show a high fidelity to their natal pool, thus making habitat alteration a significant threat to species success.

The proposed project location is within the migration footprint for several Ambystomatid salamanders located in an adjacent off-property woodlot, according to research conducted by Ohio EPA [3; 4]. This wet forest has been used as a reference for determining the size and location of the vernal pool, along with the proposed woody species diversity and density listed in the tables below. Ambystomatid species using the adjacent reference woodlot include Marbled, Spotted, Jefferson (*A. jeffersonianum*), and Smallmouth salamanders (*A. texanum*). The nearest known population of Marbled salamanders is over 50 km away [3], showing the unique quality of this habitat and the need for protection/expansion. The reference site's protection is precarious due to the private ownership of these woodlands. This restoration project aims to expand the wet woodland habitat onto the perpetually protected federal property.

Table I, Table II, and Table III provide planting templates for the planting areas. Vegetation installation, deer fence construction, and seeding are to take place pursuant to the Fernald Preserve Restored Area Maintenance Plan [5].

Achieving this project's goal will take decades. As stated above, the species mix and quantities in the vegetation tables below were produced using the adjacent wet forest as a reference site (Table IV/Table IV. Reference-Site Woody Vegetation Summary). The reference site species list was supplemented with woody vegetation that is characteristic of vernal pools in Ohio [6]. Over 400 stems per hectare were surveyed within the reference site, including only 10 trees with a diameter at breast height (DBH) measurement exceeding 10 cm. A two-tiered planting strategy is planned. For Planting Area A, a light density (8 trees/hectare) of large tree plantings will be installed, along with a heavy density of other plantings (small container-grown and bare-root seedlings). Woody vegetation establishment will be concentrated around the constructed vernal pool, with the intent of creating canopy closure as quickly as possible. For Planting Areas B and C, planting activities will be limited to bare-root seedling installation. Eradicating existing cool-season grasses will likely increase the establishment of volunteer woody vegetation.

Table I. Template for Planting Area A.

Species	Common Name	Wetland Indicator ^a	Form	Qty	Size
Large Trees – 20/acre					
<i>Acer rubrum</i>	Red maple	FAC	tree	5	2- to 3-inch B&B
<i>Acer saccharum</i>	Sugar maple	FACU-	tree	14	2- to 3-inch B&B
<i>Carya laciniosa</i>	Shellbark hickory	FAC	tree	12	2- to 3-inch B&B
<i>Quercus bicolor</i>	Swamp white oak	FACW+	tree	7	2- to 3-inch B&B
<i>Quercus palustris</i>	Pin oak	FACW	tree	15	2- to 3-inch B&B
<i>Quercus rubra</i>	Red oak	FACU-	tree	20	2- to 3-inch B&B
<i>Ulmus americana</i>	American elm	FACW-	tree	7	2- to 3-inch B&B
Other Plantings – 1000/acre					
<i>Acer saccharinum</i>	Silver maple	FACW	tree	750	bare root
<i>Aesculus glabra</i>	Ohio buckeye	FACU+	tree	75	1- to 3-gallon
<i>Asimina triloba</i>	Pawpaw	FACU+	small tree	150	1- to 3-gallon
<i>Carpinus caroliniana</i>	Blue-beech	FAC	small tree	50	1- to 3-gallon
<i>Carya cordiformis</i>	Bitternut hickory	FACU+	tree	50	1- to 3-gallon
<i>Celtis occidentalis</i>	Hackberry	FACU	tree	150	bare root
<i>Cephalanthus occidentalis</i>	Buttonbush	OBL	shrub	150	1- to 3-gallon
<i>Cornus amomum</i>	Silky dogwood	FACW	shrub	150	1- to 3-gallon
<i>Fagus grandifolia</i>	American beech	FACU	tree	75	1- to 3-gallon
<i>Lindera benzoin</i>	Spicebush	FACW-	shrub	150	1- to 3-gallon
<i>Liriodendron tulipifera</i>	Tulip tree	FACU	tree	600	bare root
<i>Quercus imbricaria</i>	Shingle oak	FAC	tree	75	1- to 3-gallon
<i>Quercus macrocarpa</i>	Bur oak	FAC-	tree	75	1- to 3-gallon
<i>Platanus occidentalis</i>	Sycamore	FACW-	tree	750	bare root
<i>Rosa palustris</i>	Swamp rose	OBL	shrub	150	1- to 3-gallon
<i>Rubus allegheniensis</i>	Common blackberry	FACU-	shrub	600	bare root

^a Positive or negative signs indicate a tendency toward higher (+) or lower (-) occurrence within a category.

Abbreviations:

B&B = balled and burlapped

FAC = facultative

FACU = facultative upland

FACW = facultative wetland

OBL = obligate wetland

Qty = quantity

Table II. Template for Planting Area B.

Species	Common Name	Wetland Indicator ^a	Form	Qty
Bare-Root Seedlings – 1000/acre				
<i>Acer saccharinum</i>	Silver maple	FACW	tree	100
<i>Aesculus glabra</i>	Ohio buckeye	FACU+	tree	100
<i>Cercis canadensis</i>	Redbud	FACU-	small tree	100
<i>Cornus amomum</i>	Silky dogwood	FACW	shrub	100
<i>Nyssa sylvatica</i>	Black-gum	FAC	tree	100
<i>Quercus bicolor</i>	Swamp white oak	FACW+	tree	100
<i>Quercus imbricaria</i>	Shingle oak	FAC	tree	100
<i>Quercus macrocarpa</i>	Bur oak	FAC-	tree	100
<i>Quercus palustris</i>	Pin oak	FACW	tree	100
<i>Platanus occidentalis</i>	Sycamore	FACW-	tree	100
<i>Rubus allegheniensis</i>	Common blackberry	FACU-	shrub	150
<i>Salix nigra</i>	Black willow	FACW+	tree	100
<i>Sambucus canadensis</i>	Common elderberry	FACW-	shrub	150
<i>Ulmus americana</i>	American elm	FACW-	tree	100

^a Positive or negative signs indicate a tendency toward higher (+) or lower (-) occurrence within a category.
Abbreviations: FAC = facultative, FACU = facultative upland, FACW = facultative wetland, Qty = quantity

Table III. Template for Planting Area C.

Species	Common Name	Wetland Indicator ^a	Form	Qty
Bare-Root Seedlings – 1000/acre				
<i>Acer saccharum</i>	Sugar maple	FACU-	Tree	100
<i>Aesculus glabra</i>	Ohio buckeye	FACU+	Tree	100
<i>Celtis occidentalis</i>	Hackberry	FACU	Tree	100
<i>Cercis canadensis</i>	Redbud	FACU-	small tree	100
<i>Corylus americana</i>	American hazel	FACU-	Shrub	100
<i>Fagus grandifolia</i>	American beech	FACU	Tree	100
<i>Liriodendron tulipifera</i>	Tulip tree	FACU	Tree	100
<i>Quercus rubra</i>	Red oak	FACU-	Tree	100
<i>Rubus allegheniensis</i>	Common blackberry	FACU-	Shrub	250
<i>Rhus glabra</i>	Smooth sumac	[UPL]	Shrub	250
<i>Tilia americana</i>	American basswood	FACU	Tree	100
<i>Viburnum prunifolium</i>	Black-haw	FACU	Shrub	100

^a Positive or negative signs indicate a tendency toward higher (+) or lower (-) occurrence within a category.
Abbreviations: FACU = facultative upland, UPL = obligate upland, Qty = quantity

Table IV. Reference-Site Woody Vegetation Summary.

Species	Common Name	Wetland Indicator ^a	Form	Average DBH (cm)	Qty	Density (ind/100 m ²)
<i>Acer negundo</i>	Box elder	FAC+	tree	17.15	2	0.10
<i>Acer saccharum</i>	Sugar maple	FACU-	tree	6.93	223	11.15
<i>Aesculus glabra</i>	Ohio buckeye	FACU+	tree	3.30	30	1.50
<i>Asimina triloba</i>	Pawpaw	FACU+	small tree	1.04	191	9.55
<i>Celtis occidentalis</i>	Hackberry	FACU	tree	6.48	24	1.20
<i>Euonymus atropurpureus</i>	Burning-bush	FACU	shrub	0.64	1	0.05
<i>Fagus grandifolia</i>	American beech	FACU	tree	1.52	5	0.25
<i>Fraxinus americana</i>	White ash	FACU	tree	25.40	5	0.25
<i>Gleditsia triacanthos</i>	Honey locust	FAC-	tree	39.37	2	0.10
<i>Quercus bicolor</i>	Swamp white oak	FACW+	tree	88.90	1	0.05
<i>Ulmus americana</i>	American elm	FACW-	tree	7.01	21	1.05
<i>Viburnum prunifolium</i>	Black-haw	FACU	shrub	0.99	11	0.55
				Totals:	516	25.80

^a Positive or negative signs indicate a tendency toward higher (+) or lower (-) occurrence within a category.

Abbreviations

FAC = facultative

FACU = facultative upland

FACW = facultative wetland

ind/100 m² = number of individuals per 100 square meters

Qty = quantity

TRIANGLE AREA PROJECT

Following a walkdown of the Triangle Area, a former pasture area, at the Fernald Preserve, the Trustees determined that the area is an optimal candidate for prairie establishment. The Triangle Area, which measures 287 000 m², is similar in setting and community to adjacent on-property grasslands that were successfully converted to mesic tallgrass prairie.

This approach is thus consistent with ecological restoration taking place across the Fernald Preserve. Native grasses and forbs have been used for practically all restoration projects undertaken since 1998. Much research went into the development of plant and seed lists for restoration activities at the site. Tables V and VI provide the planned grass and forb mix for the Triangle Area. All species listed are native to southwestern Ohio. This region lies within a transition zone between the oak-hickory and beech-maple sections of the Eastern Deciduous Forest. Typically, vegetative communities are represented as a mosaic of oak-hickory and beech-maple forest types [7]. The Fernald Preserve is located approximately 161 kilometers (100 miles) south of the prairie ecotype that extends into western Ohio [8]. However, many prairie pockets were found extensively across southwestern Ohio. In addition, a large scale prairie and wetland restoration project that was undertaken just west of the Fernald Preserve

revealed that a large amount of native warm season grass and forb seed was present in the soil seed bank [9].

Prairie establishment within pasture areas requires extensive preparation work to minimize competition from cool-season grasses and weeds. The existing grass cover must be mowed, and glyphosate herbicide must be applied at least once. Optimally, several herbicide applications should be conducted. Seeding is planned to take place approximately 2 weeks following the last herbicide application, either in late spring or in the fall. Seeding would be accomplished with a tractor-pulled seed drill; additional broadcast seeding would take place for selected forbs. Approximately 130 000 m² are available for seeding. An adjacent former rail bed, with an area of 65 000 m², will be included within the restoration project.

Table V. Triangle Area: Mesic Prairie Grass Mix.

Scientific Name	Common Name	lb/acre
<i>Andropogon gerardii</i>	Big Bluestem	3
<i>Bouteloua curtipendula</i>	Side-oats grama grass	0.5
<i>Elymus canadensis</i>	Canada wild rye	10
<i>Lolium multiflorum</i>	Annual rye	5
<i>Panicum virgatum</i>	Switch grass	0.5
<i>Schizachyrium scoparium</i>	Little bluestem	3
<i>Sorghastrum nutans</i>	Indian grass	3
	Total lb/acre	25

Table VI. Triangle Area: Mesic Prairie Forb Mix.

Scientific Name	Common Name	oz/acre
<i>Asclepias tuberosa</i>	Butterfly-weed	2.00
<i>Aster laevis</i>	Smooth aster	0.50
<i>Aster novae-angliae</i>	New England aster	0.50
<i>Baptisia australis</i>	Blue false indigo	1.50
<i>Baptisia lactea</i>	White false indigo	1.50
<i>Chamaecrista fasciculata</i>	Partridge-pea	1.50
<i>Oesmodium canadense</i>	Canada tick-trefoil	1.00
<i>Echinacea purpurea</i>	Purple coneflower	1.00
<i>Eryngium yuccifolium</i>	Rattlesnake-master	1.00
<i>Eupatorium purpureum</i>	Purple Joe-Pye weed	0.25
<i>Euthamia graminifolia</i>	Flat-topped goldenrod	0.10
<i>Heliopsis helianthoides</i>	Smooth oxeye	1.00
<i>Lespedeza capitata</i>	Round-headed bush-clover	1.00
<i>Monarda fistulosa</i>	Wild bergamot	0.25
<i>Penstemon digitalis</i>	Foxglove beard-tongue	0.25
<i>Ratibida pinnata</i>	Gray-headed coneflower	1.00
<i>Rudbeckia hirta</i>	Black-eyed Susan	0.25
<i>Senna hebecarpa</i>	Northern wild senna	2.00
<i>Silphium laciniatum</i>	Compass plant	2.00
<i>Silphium perfoliatum</i>	Cup-plant	2.00
<i>Silphium terebinthinaceum</i>	Prairie dock	2.00
<i>Solidago rigida</i>	Stiff goldenrod	0.25
<i>Tradescantia ohiensis</i>	Ohio spiderwort	0.75
<i>Verbena stricta</i>	Hoary vervain	0.50
Total oz/acre		24.10

PROJECT IMPLEMENTATION

The Trustees authorized the implementation of the Paddys Run Tributary Project and the Triangle Area Project in August 2011. Resolution No. 13 releases funds from the settlement fund account to construct these projects, with a planned implementation in spring 2012. DOE added scope to the Legacy Management Support contract via a “work for others” baseline change proposal process in September 2011. Work will be planned and implemented by the LMS contractor, with oversight by DOE and the other Trustees.

PATH FORWARD

Field construction is scheduled to be conducted in spring 2012. Ecological monitoring will take place following installation, pursuant to the *Fernald Preserve Natural Resource Restoration Plan* [10]. The Trustees will jointly determine the extent of monitoring required. Restoration efforts at the Fernald Preserve are typically monitored for one or two years following construction in order to ensure proper vegetation establishment. Because of the specific goal of establishing Ambystomatid salamander habitat, the Trustees may decide to conduct additional amphibian monitoring at the Paddys Run Tributary project.

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