Natural Resource Damages Settlement Projects at the Fernald Preserve

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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 m^2 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 m^2, with adjacent forest establishment. Grading and forest establishment will take place

within a 305 000 m^2 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~~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 I~~, Table II~~Table II~~, and Table III~~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 IVTable 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					
Acer rubrum	Red maple	FAC	tree	5	2- to 3-inch B&B
Acer saccharum	Sugar maple	FACU-	tree	14	2- to 3-inch B&B
Carya laciniosa	Shellbark hickory	FAC	tree	12	2- to 3-inch B&B
Quercus bicolor	Swamp white oak	FACW+	tree	7	2- to 3-inch B&B
Quercus palustris	Pin oak	FACW	tree	15	2- to 3-inch B&B
Quercus rubra	Red oak	FACU-	tree	20	2- to 3-inch B&B
Ulmus americana	American elm	FACW-	tree	7	2- to 3-inch B&B
Other Plantings – 1000/acre					
Acer saccharinum	Silver maple	FACW	tree	750	bare root
Aesculus glabra	Ohio buckeye	FACU+	tree	75	1- to 3-gallon
Asimina triloba	Pawpaw	FACU+	small tree	150	1- to 3-gallon
Carpinus caroliniana	Blue-beech	FAC	small tree	50	1- to 3-gallon
Carya cordiformis	Bitternut hickory	FACU+	tree	50	1- to 3-gallon
Celtis occidentalis	Hackberry	FACU	tree	150	bare root
Cephalanthus occidentalis	Buttonbush	OBL	shrub	150	1- to 3-gallon
Cornus amomum	Silky dogwood	FACW	shrub	150	1- to 3-gallon
Fagus grandifolia	American beech	FACU	tree	75	1- to 3-gallon
Lindera benzoin	Spicebush	FACW-	shrub	150	1- to 3-gallon
Liriodendron tulipifera	Tulip tree	FACU	tree	600	bare root
Quercus imbricaria	Shingle oak	FAC	tree	75	1- to 3-gallon
Quercus macrocarpa	Bur oak	FAC-	tree	75	1- to 3-gallon
Platanus occidentalis	Sycamore	FACW-	tree	750	bare root
Rosa palustris	Swamp rose	OBL	shrub	150	1- to 3-gallon
Rubus allegheniensis	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				
Acer saccharinum	Silver maple	FACW	tree	100
Aesculus glabra	Ohio buckeye	FACU+	tree	100
Cercis canadensis	Redbud	FACU-	small tree	100
Cornus amomum	Silky dogwood	FACW	shrub	100
Nyssa sylvatica	Black-gum	FAC	tree	100
Quercus bicolor	Swamp white oak	FACW+	tree	100
Quercus imbricaria	Shingle oak	FAC	tree	100
Quercus macrocarpa	Bur oak	FAC-	tree	100
Quercus palustris	Pin oak	FACW	tree	100
Platanus occidentalis	Sycamore	FACW-	tree	100
Rubus allegheniensis	Common blackberry	FACU-	shrub	150
Salix nigra	Black willow	FACW+	tree	100
Sambucus canadensis	Common elderberry	FACW-	shrub	150
Ulmus americana	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				
Acer saccharum	Sugar maple	FACU-	Tree	100
Aesculus glabra	Ohio buckeye	FACU+	Tree	100
Celtis occidentalis	Hackberry	FACU	Tree	100
Cercis canadensis	Redbud	FACU-	small tree	100
Corylus americana	American hazel	FACU-	Shrub	100
Fagus grandifolia	American beech	FACU	Tree	100
Liriodendron tulipifera	Tulip tree	FACU	Tree	100
Quercus rubra	Red oak	FACU-	Tree	100
Rubus allegheniensis	Common blackberry	FACU-	Shrub	250
Rhus glabra	Smooth sumac	[UPL]	Shrub	250
Tilia americana	American basswood	FACU	Tree	100
Viburnum prunifolium	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)
Acer negundo	Box elder	FAC+	tree	17.15	2	0.10
Acer saccharum	Sugar maple	FACU-	tree	6.93	223	11.15
Aesculus glabra	Ohio buckeye	FACU+	tree	3.30	30	1.50
Asimina triloba	Pawpaw	FACU+	small tree	1.04	191	9.55
Celtis occidentalis	Hackberry	FACU	tree	6.48	24	1.20
Euonymus atropurpureus	Burning-bush	FACU	shrub	0.64	1	0.05
Fagus grandifolia	American beech	FACU	tree	1.52	5	0.25
Fraxinus americana	White ash	FACU	tree	25.40	5	0.25
Gleditsia triacanthos	Honey locust	FAC-	tree	39.37	2	0.10
Quercus bicolor	Swamp white oak	FACW+	tree	88.90	1	0.05
Ulmus americana	American elm	FACW-	tree	7.01	21	1.05
Viburnum prunifolium	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 m^2 = 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 m^2, 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 m^2 are available for seeding. An adjacent former rail bed, with an area of 65 000 m^2, will be included within the restoration project.

Table V. Triangle Area: Mesic Prairie Grass Mix.

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

Table VI. Triangle Area: Mesic Prairie Forb Mix.

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