Title: **Thomas Mill Ravine Restoration Project**

Author: **Chris Dartley, Urban and Community Forestry Intern**

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Abstract:

This paper describes the restoration work done on the Thomas Mill Ravine, part of the Wissahickon section of Fairmount Park. This area of the Park like most others is greatly affected by urban pressures such as erosion, soil compaction, pollution, invasive exotic vegetation, and deer browsing. Today, human intervention is necessary in order to sustain a balanced mix of native plant and animal species. Restoration to the Wissahickon section of the Park began in 1997 by the Fairmount Park Commission's Natural Lands Restoration and Environmental Education Program (NLREEP). Restoration plans were prepared by the Patrick Center for Environmental Research at the Academy of Natural Sciences of Philadelphia. From these master plans, Arboretum supporters, Ron and Roberta Berg along with staff of the Morris Arboretum selected the Thomas Mill Ravine as a suitable restoration site. It was chosen primarily due to its high visibility and because the site was being seriously degraded by exotic invasives.

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INTRODUCTION

The Wissahickon Valley Park is a unique urban park that comprises more than 1,426 acres. The park is part of the larger Fairmount Park system, which encompasses one-tenth of the land in Philadelphia. The city and suburbs surround Wissahickon Valley Park, yet it is home to hundreds of species of plants, animals, and insects. The park's extensive trail system attracts thousands of visitors each week for hiking, horseback riding, running, and biking.

Unfortunately, the park's natural areas have been deteriorating due to urban pressures such as erosion, soil compaction, pollution, invasive exotic vegetation, and deer browsing. Today, human intervention is necessary in order to sustain a balanced mix of native plant and animal species within the Wissahickon Valley ecosystem. Restoration within Wissahickon Valley Park began in 1997 by the Fairmount Park Commission's Natural Lands Restoration and Environmental Education Program (NLREEP). This program was established in 1997 through a $26.6 million grant from the William Penn Foundation. NLREEP ecological restoration programs have utilized thousands of volunteers and emphasize education and stewardship (NLREEP).

The Wissahickon Valley Park restoration plans were prepared by the Patrick Center for Environmental Research at the Academy of Natural Sciences of Philadelphia. The plans include an assessment of existing conditions, restoration goals and guiding principles, and recommendations for a total of 452 high priority restoration sites. From these master plans, Arboretum supporters, Ron and Roberta Berg along with staff of the Morris Arboretum selected the Thomas Mill Ravine as a suitable restoration site. The site was selected in April 2001 and work began later that spring.

THE PROCESS OF ECOLOGICAL RESTORATION

Ecological restoration is defined as the return of an ecosystem to a close approximation of its natural condition prior to disturbance. The goal is to recreate a natural, functioning, self-sustaining system that is indistinguishable from the ecological landscape in which it occurs. The restored ecosystem should simulate the natural condition before it was damaged, or some other native ecosystem appropriate for the new conditions of the landscape. The repaired ecosystem should be stable and require a minimum of human input after the initial efforts. (National Resource Council 1992)

The first step in any restoration project is the development of a restoration plan. The plan should begin with an ecological assessment and should include goals and objectives, schedules, budgets, and monitoring protocols. Site selection was the first step in planning the Thomas Mill Ravine Restoration Project. The next step was to complete an ecological evaluation of the entire Thomas Mill Ravine area. The ecological evaluation includes an inventory of the native plant communities, invasive species, soil conditions, hydrology, wildlife and recreational uses.

Several types of forest communities were identified within the Thomas Mill Ravine, including an upland forest composed mainly of oak and tulip poplar. Further down the trail is a forest dominated by beeches and hickories and also a north facing hemlock grove. The covered bridge is at the bottom of the trail and is an area considered a riparian forest.

Once each area was assessed, it was decided which sites would be assigned the highest priority for restoration. The head of the Thomas Mill Trail, at Chestnut Hill and Seminole Avenues, was chosen due to its high visibility and because the site was being seriously degraded by exotic invasives. The covered bridge was another high visibility site and was chosen to highlight best management practices in riparian areas. Other less disturbed areas along the Thomas Mill Trail were given lower priority and are being addressed when time and resources are available.

Areas selected for restoration were degraded to some extent, but native species were present in most layers of the forest canopy. Because native species were present, the need for a reference site was deemed unnecessary. A reference ecosystem serves as a dynamic model for planning a restoration project and later for its evaluation. Typically, the reference represents a point of advanced development that lies somewhere along the intended trajectory of the restoration (SER). In other words, the restored ecosystem is supposed to emulate the attributes of the reference, and project goals and strategies are developed in light of that expectation.

An ecological trajectory (Fig. 1) describes the developmental pathway of an ecosystem through time. In restoration, the trajectory begins with the unrestored ecosystem and progresses towards the desired state of recovery, which is exemplified by the reference site. Determining when a restoration is complete is highly subjective. Some attributes of a restored ecosystem are:

- An assemblage of native species that occur in the surrounding landscape and provide appropriate community structure
- Invasive exotics have been removed to the greatest practical extent
- Ecosystem is capable of sustaining reproducing populations of native species
- Ecosystem is sufficiently resilient to normal periodic stresses
- Restored ecosystem functions normally for its ecological stage of development

Over the past two decades, invasive non-native plants have come to be recognized as one of the most serious ongoing causes of species decline and native habitat degradation (Antonio & Meyerson 2002). The introduction of these non-natives is fueled by the search for new and unusual plants for the garden. This has led to the introduction of species from around the world. These plants are termed exotics because they have been introduced from a foreign country. Most exotic species are not invasive, but several escapees from the garden are seriously compromising the health and diversity of the Wissahickon. The unique shape of the park, with its valleys penetrating far into the surrounding city make the park easily accessible to surrounding residents, but also create many inroads for invasive plants.

THE THREAT FROM INVASIVES

Many invasive species are ecological pioneers and colonizers which, once introduced, quickly establish themselves in ecologically disturbed communities. Invasive species typically displace native flora due to faster growth rates, efficient dispersal mechanisms, and tolerance for a wider range of conditions. Invasive species often lack natural predators and diseases, which control populations in their native environments. As the diversity and populations of native plants decrease, so do the variety of habitats and food sources available for wildlife.
A small number of invasive plants are "native," meaning they occurred in Pennsylvania before settlement by Europeans but became aggressive after the landscape was altered.

The greatest concern when removing exotic invasives is the unforeseen negative consequences that may result. Management plans that include removal of exotic organisms need to be linked with a post-removal revegetation plan.

One of the larger projects that occurred involved a collaborative effort between the Morris Arboretum, Fairmount Park, and PECO. The project involved the removal of a swath of Norway maples at the head of the Lavender Trail, by the Chestnut Hill and Seminole Avenues entrance to the Wissahickon. Before the project was initiated, signage was posted at the entrances to the Lavender Trail. This information alerted the public that a major tree removal would take place and why. Doing so provided the public with information about the project and allowed for public comment.

THOMAS MILL RAVINE PROJECT DESCRIPTION

At the head of the Lavender Trail mature Norway maples (*Acer platanoides*) and trees-of-heaven (*Ailanthus altissima*) were shading out all but a few non-native understory shrubs. Norway maples produce large amounts of viable seed, and young saplings grow quickly in the low light conditions encountered on the forest floor. It is also believed that the roots of the Norway maple excrete an allelopathic chemical that inhibits the growth of any other species that try to germinate or become established under its canopy. The tree-of-heaven also produces a great amount of seed, but tends to colonize the edge habitat of a forest. *Ailanthus* trees become reproductive at ten to twenty years, but younger shoots may produce fruits. Female trees may produce several hundred inflorescences per year, and at maturity an inflorescence contains hundreds of seeds (Hunter 1995). A single tree can produce up to a million seeds per year. Most *Ailanthus* seeds are viable, even those that have overwintered on the tree. Fruits are winged, containing a single light seed. The fruits mature in late summer and are dispersed by wind throughout fall, winter, and even during the following spring. Germination ranges from 14 to 75 percent. Because its seeds do not remain dormant for more than a year, Ailanthus does not have a persistent soil seedbank. This area was monitored for the reintroduction of invasives and resulted in the removal of Ailanthus seedlings and stump re-sprouts on a weekly basis until late fall of 2003.

After the removals were completed, a dense planting of native trees and shrubs was installed. Planting locations have been mapped and a database of species is kept so that results of the project can be monitored. Information gleaned from monitoring can be used in making better informed management decisions on future projects. Factors like ample soil moisture over the summer ensured the survival of a majority of the plants that were installed. Increased light conditions may also have been responsible for the appearance of many red oak (*Quercus rubra*) saplings this fall. The locations of the oak saplings have been flagged and will be monitored for deer browse.

SOIL CONDITIONS

A further concern at this site is soil conditions. The soils in hardwood forests developed in the absence of earthworms. Without worms, fallen leaves decompose slowly, creating a spongy layer of organic matter. This layer is the natural growing environment for native woodland plants. It also provides habitat for ground-dwelling animals and helps prevent soil erosion (Burton). Invading earthworms eat the leaves that create the organic layer and are

capable of altering the soil pH. Existing trees survive, but tree seedlings perish, along with many ferns and wildflowers. Some species return after the initial invasion, but others disappear. In areas heavily infested by earthworms, soil erosion and leaching of nutrients may reduce the productivity of forests. While this issue in not addressed in the restoration project, it is a factor that will effect forest regeneration in this area long after the restoration is completed.

The "Rockery" is one of the many spots in the Wissahickon where Wissahickon schist was mined. The area is cool and shady and was plagued by non-natives including burning bush (*Euonymus alatus*), *Viburnum* spp. and Japanese barberry (*Berberis thunbergii*). The invasives were removed and several redbuds (*Cercis canadensis*) were planted. Christmas fern (*Polystichum acrostichoides*) was present in fair numbers on the steep slope so an array of forbs was planted to complement them.

Just below the 'Rockery' an unnamed trail splits off of the Lavender Trail and quickly drops down toward the Wissahickon Creek. Where these trails diverged became a cut-off for hikers and the area became severely eroded as a result. Soil was brought in and a rock wall was built to hold the soil in place. The area was planted with ferns, fenced off, and signage was posted about why the project had occurred. Routine trail work is completed with the help of volunteers, and projects completed include the shoring up tail edges and the installation and repair of waterbars.

The Covered Bridge is considered a riparian area. Riparian areas occur next to the banks of streams, lakes, and wetlands, and include both the stream-edge and the adjacent upland vegetation that exerts an influence on it. Streamside vegetation protects water quality, stabilizes streambanks, regulates stream temperatures, and provides a continual source of woody debris to the stream channel. Organisms from overhanging vegetation provide food for aquatic organisms and bordering trees while leaves and twigs that fall into streams are the primary nutrient source that drives aquatic ecosystems. Riparian areas frequently contain the highest number of plant and animal species found in forests, and provide critical habitats, home ranges, and travel corridors for wildlife. Biologically diverse, these areas maintain ecological linkages throughout the forest landscape, connecting hillsides to streams and upper headwaters to lower valley bottoms. There are no other landscape features within the natural forest that provide the natural linkages of riparian areas (Delaware Division of Soil and Water Conservation)

The covered bridge is one of the most scenic locations within the Wissahickon Valley Park. It is a popular destination and consequently foot traffic has caused both soil compaction and erosion in the lawn areas surrounding it. To alleviate these affects the mowed areas were reduced in size and replaced with meadow plantings. By reducing the mowed area, storm-water runoff will be reduced as will the subsequent erosion. The size of the meadow areas will again be increased in size in the Spring of 2004 as part of a joint project between Morris Arboretum and the Wissahickon Garden Club.

CONCLUSION

Ecological restoration is a long-term commitment requiring knowledge, financial resources and countless hours from dedicated volunteers. Although significant progress has been made, we have much greater plans for the Thomas Mill Ravine. The restoration process began with the proper planning and assessment, and during implementation, new methods have been developed from site monitoring. Restoration projects take years to complete and their success is extremely subjective. Through constant monitoring, we can better determine if we are making

progress in meeting our objectives and accomplishing our goals. Our goal is to make the Thomas Mill Ravine an example of the beauty and natural vegetation that can be restored to the Wissahickon Valley and a showcase for restoration within Fairmount Park.

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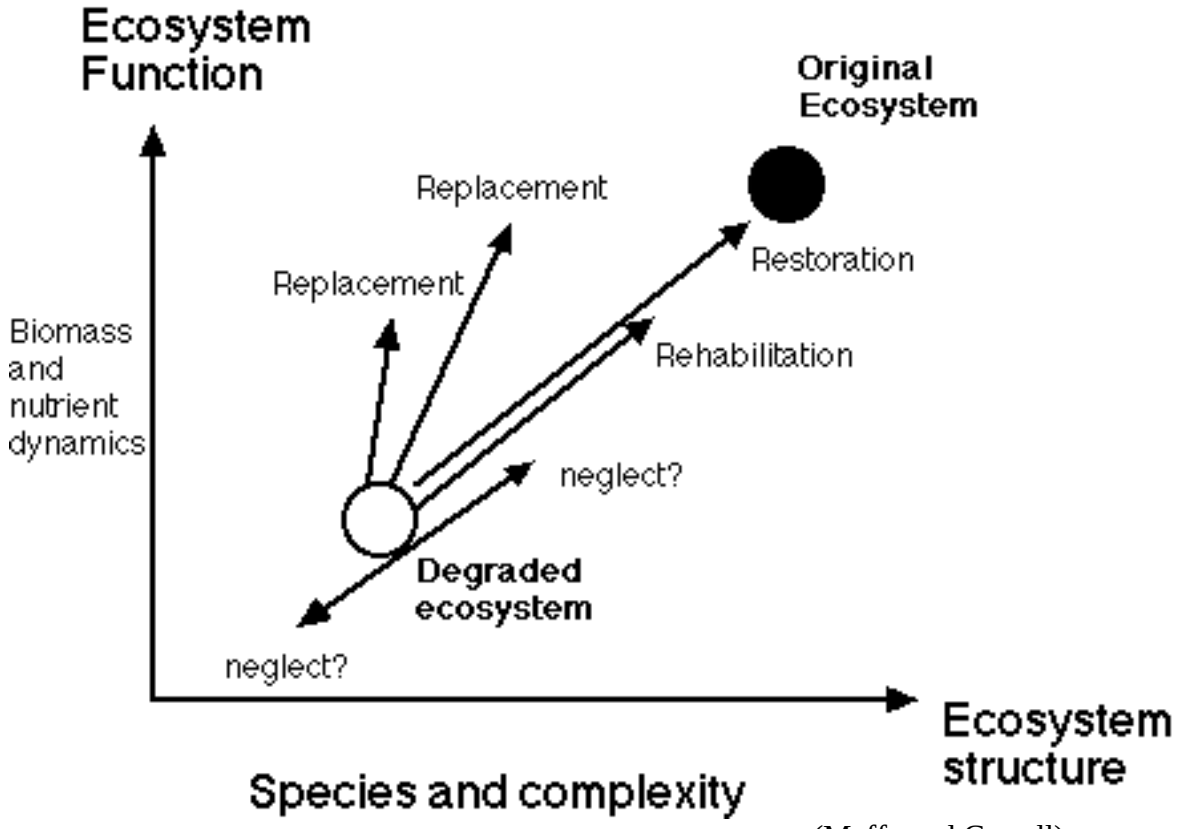
NLREEP Overview
http://www.nlreep.org/

Dennis Burton, Director of Land Restoration Schuykill Center for Environmental Education
http://www.wvnps.org/earthworms.html

Delaware Division of Soil and Water Conservation: Delaware's Riparian Buffers
http://www.dnrec.state.de.us/dnrec2000/Library/RIPARIANBUFFERS1.PDF

Figure 1.



(Meffe and Carroll)