COMMUNITY AND ECOLOGY: SLAG, SOIL, PLANTS AND WILDLIFE

Ample Opportunity: A Community Dialogue 3

Saturday, August 2, 1997

Introduction: The Community and Ecology Workshop placed more emphasis on direct interaction between the advisors and participants. There were two site tours in the morning: one led by scientists John Oyler and John Buck which crossed the slag plateau and one through the stream valley with ecologists from the Carnegie Museum of Natural History. The afternoon workshop was organized around a series of exhibitions prepared by the advisors, a kind of 'ecology fair'. A guest advisor, Chris Logelin of Advanced Technology Systems ("ATS"), was added at the last minute to address questions associated with slag toxicity. ATS is the Urban Redevelopment Authority's risk assessment consultant. Roundtable topics addressed: (1) Public Access and Habitat Corridor, (2) Vegetation, Habitat and Environmental Education, and (3) Soil, Slag and Geology.

Review: Participants were becoming familiar with the workshop format. Some audience members came for the tours, or the discussion separately. The major change in approach, the ecology fair, appeared successful although it was hard to ascertain if the information provided in one-on-one discussion was as widely shared as if it were a group presentation. The new approach facilitated in-depth discussions for audience members with increasing sophistication about the specific issues.
Attendance: 100

Advisors:
John Buck, *Soil Scientist with Civil & Environmental Consultants, Inc.*
Mr. Buck has designed successful direct (soil-less) revegetation plans for coal refuse, coal spoil, slag, and coal fly ash disposal sites, including approximately 100 acres of a barren slag disposal site using locally available sewage sludge. Mr. Buck also designed and implemented a plan to vegetate a conspicuous 0.7 acre barren slope on the Nine Mile Run slag heap in 1986.

John Decker, *Assistant Professor of Architecture at Carnegie Mellon University.*
Professor Decker also is trained as a Landscape Architect and is currently working on the development of innovative computer modeling tools for urban planning.

Court Gould, *Consultant for the Wildlife Habitat Council, and Director of the Three Rivers Habitat Partnership.*
Most recently, Mr. Gould was Executive Director of the Audubon Society of Western Pennsylvania at Beechwood Farms. Previously, he worked for the Air & Waste Management Association and was a policy analyst for Allegheny County.

Indira Nair, *Department of Engineering and Public Policy, Carnegie Mellon University.*
Ms. Nair is an award-winning educator at the University. She was a Faculty Advisor for an undergraduate systems class in the Spring of 1997 which produced the report, "Nine Mile Run: A Study of the Reclamation and Sustainable Redevelopment of a Brownfield Site."

Henry Prellwitz, *Ph.D. candidate in Geology at the University of Pittsburgh.*
Mr. Prellwitz's thesis topic is a geochemical and environmental study of the Nine Mile Run slag area.

Kirk Savage, *Public Art Historian at the University of Pittsburgh, formerly worked in land-use planning for the California Coastal Commission and the California Coastal Conservancy.*
His book, *Standing Soldiers, Kneeling Slaves: Race, War, and Monument in 19th-Century America* is forthcoming from Princeton University Press.

Chuck Tague, *Publisher of The Nature Observer News.*
Mr. Tague is a naturalist with expertise in birds and owls, and is actively involved in education programs from child to adult level.

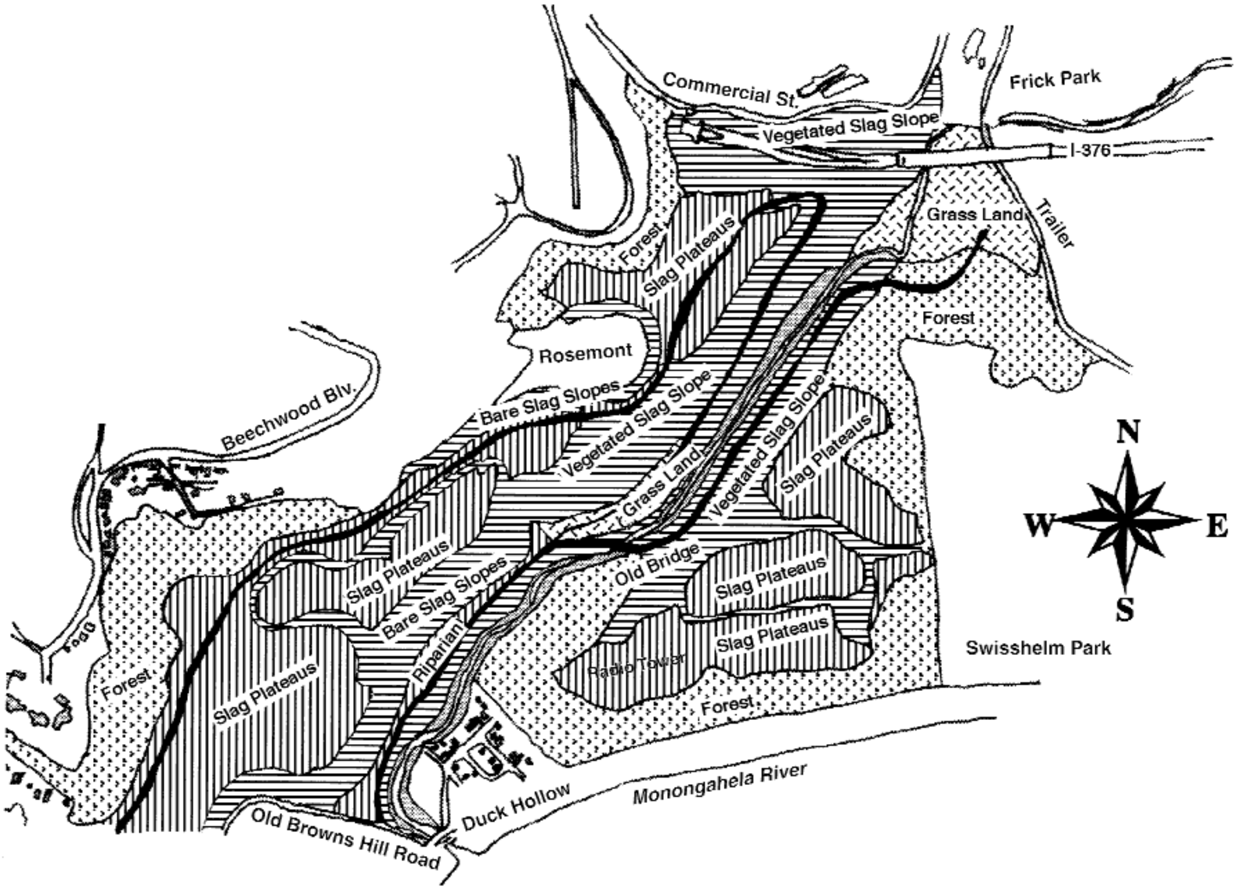
Sue Thompson, *Assistant Curator, Section of Botany, Carnegie Museum of Natural History.*
Dr. Thompson has professional interests in plant systematics, plant-insect interactions, and documentation of plant biodiversity. Another project with which Dr. Thompson is involved is a habitat survey of the Southcentral Pennsylvania barrens.

The relationship between living things and their environment is the subject of ecology, a term coined less than 100 years ago from two Greek words that mean "the study of home." The term is an apt one, for all living things have their own particular homes in nature, to which they are tied by many invisible strands. These strands are the various physical conditions found on the surface of this wrinkled and constantly changing planet.

—Peter Farb, *Ecology*

Hop tree, *Ptelea trifoliata* listed in the Pennsylvania Wild Plant Conservation Act

Types of Vegetation in Nine Mile Run



Grass Land: Areas of herbs and grasses without significant woody vegetation (grass, goldenrod, teasel, thistle).

Forest: Areas covered by trees with a distinctive understory and forest floor component, including both disturbed and relatively undisturbed forests (oaks, maples, elms, tulip tree, spice bush).

Vegetated Slag slopes: Areas of slag and soil debris with varying slopes and attendant development from short woody plant (successional species: aspen, sumac, box elder, locust, honeysuckle, grapes).

Riparian: Plant growth along the stream and in the stream valley, including trees, shrubs and grasses (willow).

Bare Slag Slopes: Very little plant growth

Slag Plateaus: Areas of slag and soil debris with varying slopes and attendant development from short woody plants (succession species).

Introduction

To begin this dialogue background document, we have assembled a series of questions and answers concerning community access (for people and other living things) and educational possibilities for the site. To promote a better understanding of the site issues, we have compiled a series of questions (and partial answers) that discuss the fundamental components of the site which have shaped its character and use over time — the geology, soils, slag, plants and wildlife.

Overview

The stream of Nine Mile Run flows through the watershed, and into the Monongahela River. An old photograph shows how wide and flat the valley was in the past. In 1923, the Duquesne Slag Company began to buy land in the valley, and dumped 20 million tons of slag over the next 50 years. We all know the Nine Mile Run site is no longer a pristine natural area. Two large slag piles rise sharply, and the stream of Nine Mile Run is still polluted with sewage. In 1972 the last slag was dropped, and the area became a large undeveloped open space for over 20 years. Nature has been slowly returning to the slag slopes, migrating from adjacent natural-soil hill sides and Frick Park.

Nine Mile Run is one of the biggest undeveloped areas in Pittsburgh. Coming to the site for the first time provides visitors with numerous questions and impressions. The view along the valley from the slag plateau and up the slopes from Duck Hollow presents very different experiences. What is the gray substance at the site? Where did it come from? When and why did it happen? Questions differ depending on each visitor's previous experiences. Some of the questions are easily answered, others indicate the need for more study and assessment. The ultimate goal of this workshop of the Nine Mile Run Greenway Project's "Ample Opportunity: A Community Dialogue" program is to provide an objective process for the discussion of issues and goals for greenway/public space development on post-industrial properties (steel mill manufacturing or refuse sites).

Spring 1986: Another element of the remediation plan involved surface remediation and application of seeds. A mixture of mushroom compost and fertilizers was laid down by volunteers working in bucket brigade style. Black locust, grasses, wildflowers, buckwheat and birdsfoot trefoil seeds were spread in seed form. The image on the right shows the same site six years later. Note the 12 foot high black locust established from seed.

I. Public Access

Slag: The refuse from the melting of metals or the reduction of ores.

How is Nine Mile Run a community?
The Nine Mile Run valley has been buried with **slag,** polluted by sewage, and criss-crossed by urban development. Yet it remains a vital community, inhabited not only by people who use it for recreation but by a diverse array of plants and wildlife. We use the term community in the broadest sense to encompass human beings and the other living things with which we share space. It is often easy to forget, in the midst of a city, that humanity and nature are always interwoven; our survival ultimately depends on theirs. Nine Mile Run teaches us that even if we pollute, transform, and bury nature, we still remain a part of it — part of a larger "web of life."

How has the community used Nine Mile Run in the past?
Nine Mile Run has had a variety of industrial and recreational uses over the past 150 years. Salt and natural gas were extracted in the 19th century, while in the early 20th century the site became home to a hunting club and a golf course. When Duquesne Slag began to dump in the 1920s, some of these recreational uses were driven out and a great deal of wildlife habitat was destroyed. However, plants, animals, and people have adapted to the changing conditions and have continued to find ways to inhabit or use the site.

How is the site being used now?
People use the site in many, often surprising, ways: for birdwatching, fishing, hunting, gardening, dog walking, hiking, jogging, mountain biking, motorbiking, and even partying. The relatively open, unregulated quality of the site enables a multiplicity of uses, some of which would be inappropriate or even illegal in a traditional public park setting. Even now there are obvious conflicts between certain uses (e.g., motorbiking and birdwatching). As this list indicates, many of the human uses are already dependent on the continuing presence of plants and wildlife at the site.

What are the possibilities for the future?
The Urban Redevelopment Authority (URA) plans to build a residential development on the slag plateaus of the Nine Mile Run valley. The future possibilities for continuing community use of the site depend in part on development decisions that are still pending—in particular, how much of a greenway will remain, and where it will be located. The possibilities also depend on the design and use of the public space, in other words, what mix of habitat, recreation, educational initiatives, and other uses will be accommodated. Not all the possible uses may be equally desirable, nor are they always compatible with one another. One of the major goals of this workshop is to open a dialogue with the community on these future possibilities, to see what mix of human and ecological uses is appropriate and desirable in this vital community resource.

What is a greenway?
A greenway is a corridor of open space covered with some form of vegetation. Greenways vary greatly in scale. Some greenways follow streams shorelines or wetlands. While others follow old railways, ridgetops or other land based features. Greenways can provide

Pittsburgh Greenway Map—including parks, cemeteries, hillsides, and greenway. (From the 1980 brochure *Greenways for Pittsburgh,* produced by the Department of City Planning with funding assistance provided by the Richard King Mellon Foundation.)

recreation, alternative transportation, habitat for wildlife or simply natural beauty.

Pittsburgh's parks and cemeteries are historic greenways that have been used for generations. In the 1980s the city established a greenway program that was designed to consolidate publicly owned wooded slopes into continuous belts of land assigned to Parks and Recreation. Five such greenways were created, the most recent in 1989.

Nine Mile Run offers the unique opportunity to extend the existing greenway of Frick Park and Homewood Cemetery to the Monongahela River. This vast interconnected expanse of park, woodland, and riparian corridor would become the single largest greenway in the city.

What are the likely major impacts to the greenway?

This is impossible to answer with any specificity right now. The size and placement of the housing development and the ultimate regrading of the site is still under discussion. The master plan clearly shows a roadway which will cut across the valley putting part of the stream in culvert. While roads can provide access and parking within the greenway, they can also divide and separate habitats and trails. Nearby Frick Park has one major roadway into it, but none through it. Schenley Park, on the other hand, has numerous roadways through it.

PennDot is currently planning the Mon-Fayette Expressway, and one of the suggested possible routes would follow the north shore of the river and cut across the mouth of Nine Mile Run as an elevated highway.

Composition and pH of a slag particle (Buck 1997)

II. Geology, Soil and Slag

To understand the possibilities for future community use, we must first understand the natural and human processes that have shaped the site and will shape any future greenway. Here we focus on the geology and soils of the site, including the slag which is now such a major part of the land formation.

What is the geological history of Nine Mile Run?
The bedrock that underlies the Nine Mile Run slag area consists of nearly horizontal layers of sandstone, shale, siltstone, claystone, limestone, and coal. These beds were deposited about 300 million years ago, under tropical climatic conditions similar to those seen in the present day Amazon River delta:

- the sandstone layers represent a river environment,
- the limestone a shallow marine deposit,
- the coal beds are a result of the decay and fossilization of plant material in vast swamps, and
- the siltstone, shale, and claystone beds were formed in a large river delta.

Evidence for these depositional environments is found in the plant and animal fossil records these rock layers show. The Nine Mile Run stream valley, along with Fern Hollow valley in Frick Park, was formed by stream erosion starting 15,000 to 20,000 years ago and continuing to the present time.

What soil types are found in Nine Mile Run?
There are three major soil types found in the Nine Mile Run slag area. These include: 1) clay-rich soils derived from direct weathering of the bedrock, 2) sand-rich soils found in the streambed and floodplains of Nine Mile Run, and 3) any soils that result from the weathering of slag. Because of the vast scope of geological time, little soil has formed as a result of slag weathering. (Geological time is often recorded in thousands of years.)

Refractory brick: brick designed to withstand high temperatures, used in steel furnaces and replaced with great regularity.

What is slag?
In producing steel, iron ore is introduced into a blast furnace along with limestone and coke. The limestone decomposes and melts into a slag that removes phosphorous and sulfur impurities from the liquid iron. It has been widely used in the construction industry. In its current state at Nine Mile Run, it is not toxic. You can walk on it, ride on it, and touch it without risk. The reason is that metals such as chromium and nickel are contained in the slag but trapped inside its rock structure, much as they are in nature. Risk may arise if the slag is pulverized or crushed so that certain metals are released in the form of airborne dust.

Assessment: Exploration, quantification, evaluation and import.

Testing of the slag at Nine Mile Run[1] has shown that it contains various metals. Particular concern has been focused on the presence of chromium, arsenic, cadmium, and nickel. The presence of chromium in the slag is not unusual due to the presence of chrome in **refractory brick** (brick designed to withstand high temperatures, used in steel furnaces and replaced with great regularity). However, there are two types of chromium; hexavalent chromium presents a greater risk to the human population as a cancer producing substance. Test results[2]

[1] "Phase II Environmental Site Assessment, Nine Mile Run Slag Area, Pittsburgh Pa. November 1995," Chester Environmental Ground Water Technology, Advanced Technology Systems, *et al.*

[2] "Risk Assessment/Assessment Cleanup Plan, Nine Mile Run Slag Area, Pittsburgh Pa." Draft, June 1997. Advanced Technology Systems Inc.

indicate that levels of hexavalent chromium at Nine Mile Run are at or below the detection limit and will not pose a health risk to anyone working or living on the site.

In terms of the other metals found in the Nine Mile Run slag, none of the cadmium or nickel concentrations exceed residential standards established by Pennsylvania. In other words, if the same concentration of these materials were found in someone's backyard there would be no risk to human health. The level of arsenic is below the most recent health standard established by the state. In addition, the concentrations of arsenic are also within the state's background range.

A risk **assessment** of the site,[3] following Environmental Protection Agency (EPA) and State Department of Environmental Protection (DEP) guidelines, indicates that the risks to human health for individuals working on the site, living on the site or living near the site are below those which the EPA would find acceptable. It is unlikely that those persons would experience adverse health affects.

Geologist, Henry Prellwitz, soil scientist John Buck, and a community member examine an excavated area of slag.

Steam rises from the slag on the northern end of the property.

III. Soil, Slag and Plants

The Nine Mile Run slag disposal site (NMR) has often been described as a barren "moonscape," or, simply a "dump." Although the slag does not support the robust vegetation typical of undisturbed soils in the area, many adapted plant communities (and associated animal communities) do thrive at the site. Thus, the NMR slag is a "soil" supporting adapted plant communities.

To provide a framework to visualize the opportunities to vegetate the NMR greenway, we will provide a broad definition of soil that includes slag and other alternative growing media. To that end, we will first discuss universal requirements of soils as systems that support the growth of plants, then discuss limitations to plant growth on the NMR slag, and finally address means of meeting plant requirements while minimizing the need to import soil and other non-renewable resources.

[3] Ibid.

What do plants need to survive?
• Absence of intolerable physical stress (e.g., landslides)
• Absence of intolerable chemical stress **(phytotoxicity)**
• Soil that retains water (storage) to help plants avoid drought
• Adequate nutrient availability
• Soil that is penetrable by roots, stable support (anchorage)
• Free exchange of soil gases with the atmosphere (aeration)

Every soil (and alternative growing medium) has assets and deficits with regard to the above plant-support criteria. In response to the range of soil conditions, particular plant species have evolved adaptations to less than ideal soil conditions. Adapted plant communities have sprung up on the NMR slag.

It is important to note that although non-ideal soils can support plant growth, it comes at the expense of species diversity[4] (different kinds of plants living in one place). Soils that present more stress to plants tend to be colonized by plants that are specially adapted to those conditions, resulting in lower species diversity than possible in "ideal" soils.

Phytotoxicity: Poisonous to plants

Why is species diversity important?
The simpler (less diverse) an ecosystem is, the greater the opportunity for disruption of one kind or another. Consider mono-systems like orchards where stability is maintained by active pest and nutrient management. We do not want to create a greenway that is easily threatened, disrupted, or in need of extensive maintenance.

What are the effects of slag on the existing plant life?
• Steepness and associated "creep" (downward movement of slag)
• Fused slag impenetrable by plant root
• Poor water holding capacity
• Poor nutrient availability (the alkalinity raises **pH**)

pH: Measure of acidity/alkalinity on a scale between 1 and 14. Greater than 7=alkalinity; less than 7=acidity.

Is there anything about slag that is good for plants?
• NMR slag is not toxic to plants or beneficial microorganisms.
• Slag is an excellent growing media for adapted species when enhanced by nutrient addition, mulching, and seeding.

So what has to be done if we are to grow plants in slag?
Successful vegetation establishment requires a combination of the following: 1) introduction of species adapted to soil conditions, and 2) modification of soils to allow a wider range of species to become established. To that end, the soil treatment options include the following:
• Regrading slag to reduce slag/soil creep.
• Breaking up fused slag (by bulldozer) to increase root penetration
• Mixing materials into the slag to improve water retention. Water retention amendment systems could be temporary, lasting long enough to establish plants with deep root systems, or permanent, widening the range of species.
• Adding fertilizers, chemical additives, and/or organic nutrient sources (e.g. compost, manure) to improve nutrient availability.
• Introducing nitrogen-fixing plants (legumes) to naturally maintain nitrogen fertility. Examples include: clovers, birdsfoot trefoil, black

[4]Species diversity is important for a variety of reasons. It provides the most potential habitat for attendant wildlife, it provides a diversity of experience for the greenway audience, and it has proven to be the most tolerant of catastrophic natural events.

locust, and bristley locust.
• Covering or “capping” the slag with topsoil, or use of slag/soil mixtures as growing media.
• Heavy mulching to minimize erosion, shelter seed and seedlings, and reduce moisture losses.
• Use of adapted plant species, and a **successional process** (starting with fast growing plants and transitioning over time to more desirable species).

IV. Habitat and Vegetation

What are the essential elements for wildlife habitat?
Habitat = food, water and shelter. Habitat is the place that birds, mammals, amphibians, reptiles, fish, insects, and other invertebrate live and the environment where each of them finds at least the minimum requirements for its existence.

What kind of wildlife are we likely to find in Nine Mile Run?
The best information on this to date is found in a search of literature on Frick Park. The best is found in the doctoral thesis, “The Ecology of a City Park, Frick Park, Pittsburgh, Pennsylvania” by Dr. William LeRoy Black. Dr. Black identified species of plants and other living things found in Frick Park in 1947:

Introduced plant (species)	42
Native plants	201
(134 species were observed on NMR in 1996)	
Moss and lichens	4
Birds observed (species)	107
Birds nesting	41
Mammals (species)	13
Amphibians and reptiles	6
Fish (families)	0
Insects (families)	78
Other invertebrate studied (kind)	12

Wild turkey, white tailed deer, and mocking birds were not identified in 1947. They are commonly seen in both Frick Park and the Nine Mile Run site today.

Successional growth: A natural transition from the early pioneer weedy species to the hardy large-growth climax forests. Successional growth as a management process utilizes naturally occurring growth to remediate soils, mitigating the costs and effort necessary to create an environment that can support a climax forest. Successional growth also provides some interesting ecosystem education opportunities.
Successional species: A species which is succeeded or displaced by another, which is assumed to be of higher value.

Dr. Black also identified five issues that are still relevant to the area:

1. Remove the contaminants in Nine Mile Run, and prevent their return.
2. Increase the amount of water available to plants and animals by:
   (a) blocking the passage of surface streams into sewers,
   (b) building artificial pools and check dams, and
   (c) constructing trails and other works without interference to watertables.
3. Replant as much of the original type of flora as possible; introduce other plants to take the place of the native flora that will not survive; and remove no dead trees or underbrush because they provide additional escape and nesting cover.
4. Control or stop human traffic in those areas susceptible to erosion and abnormal wear and tear by:
   (a) temporarily closing off areas,
   (b) removing trails from critical slopes and areas of sensitive or tenuous plant growth, and
   (c) planting dense shrubbery along the trails, especially at the loops, to discourage "short cuts."
5. Institute nature recreation programs in individual city parks to make individuals conservation conscious; and intensify nature education of children in schools and parks throughout the city, with special emphasis on leaving everything just as it is. (The Frick Park Nature Center had been established with funding provided by Helen Clay Frick in the 1930s.)

Climax species: Native hardwood trees (oaks, basswood, etc.) with a mixed understory.

What kind of vegetation do we find in the Nine Mile Run valley?

The Nine Mile Run area contains a mosaic of vegetation types, heavily influenced by the activities of man over many decades, including remnants of native vegetation types to areas almost completely devoid of plant growth. Five basic vegetation types occur in the Nine Mile Run area:

Riparian: Plant growth along the stream and in the stream valley, including trees, shrubs, herbs, and grasses.
Meadow: Areas of herbs and grasses without significant woody vegetation.
Forest: Areas covered by trees with a distinctive understory and forest floor component, including both disturbed and relatively undisturbed forests.
Slag Slopes: Areas of slag and soil debris with varying slopes and attendant development from short, woody plants **(succession species)** to bare (fused) slag.
Slag Plateaus: Areas of slag with little humus (decomposing plant material or topsoil) with only scattered grasses and pioneer species.

Within all five of these vegetation types, both introduced and native plants occur, although in different proportions.

Quantified data: Data/information with real numerical values.

What kind of plants do we find at Nine Mile Run?

Many of the plant species found at Nine Mile Run are introduced plants and weeds, but a substantial proportion are species that are native to this area, including many native "weedy" species. The native weed species play an important role in a normal successional growth and include species such as staghorn sumac *(Rhus typhina)* and black locust

(Robinia pseudoacacia) that readily colonize bare open areas. In areas of Nine Mile Run, these plants compete with introduced successional species, such as the tree of heaven *(Ailanthus altissima)* which can even grow in cracks in sidewalks!

Relatively undisturbed forest areas of Nine Mile Run contain native hardwoods **(climax species)** such as the tulip-tree *(Lirodendron tulipifera),* basswood *(Tilia americana),* various species of oaks *(Quercus spp.)* and sugar maple *(Acer saccharum)* and a mixture of introduced and native species in the understory and forest floor. The dynamics of this mixture must be monitored to maintain this vegetation type within Nine Mile Run.

Are there any studies of the plant life underway?
Biologists from the Carnegie Museum of Natural History (CMNH) are presently conducting a study of plants and insects found in Nine Mile Run. Plants and insects are valuable tools for assessment of environmental quality and the general "health" of ecosystems. Plants, because they are immobile and thus impacted by whatever occurs on site, can often indicate subtle (or not so subtle) changes in environmental quality. Insects, because of their diversity and specific life patterns, are one of the best groups of creatures to look at when trying to understand land- or water-based ecosystems. Understanding the existing plants and insects on site today can help us set biologically-informed goals for reclaiming or replanting the slag slopes.

Later this summer, a temporary line will be drawn from one slag plateau, through the stream, to the adjoining slag plateau. This "transect" will provide biologists with an opportunity to sample the plant life and its transitions as it moves through the range of soil types and slopes on the property. The overall objective of this assessment is to provide plant specimen-based biological information that will be critical to informed conservation and land management decisions that will affect the development of the Nine Mile Run Greenway. Specific objectives include:

• a list of all plants in the area;
• assessment of the overall conditions affecting plant growth;
• provide contextual information, including historical perspectives from museum specimens and comparative data from similar less-disturbed areas;
• provide **quantified data** on ecological association between insects and the vegetation of Nine Mile Run;
• identify and provide assessment of species of special consideration or concern (e.g., rare, endangered, and threatened species);
• document the occurrence of pests and introduced plant species as well as comment on both present and potential pest problems; and
• provide resource data on the natural systems of Nine Mile Run and offer recommendations, linking the results of this survey to land-use practices.

Summary of Potential Greenway Remediations / REVEGETATION APPROACHES AND LIMITATIONS

GREENWAY SYSTEM COMPONENTS	DRIVING FACTORS	SPLIT PERSPECTIVE SCENARIO: EXISTING NMR CONDITION	SPLIT PERSPECTIVE SCENARIO: ORIGINAL MASTER PLAN
A. SLAG • The constraining factors on plant selection • Available revegetation/ remediation methods • Economic feasibility	Slope	Flat to very steep	Regrade all to 2 horizontal to 1 vertical.
	Water Retention	Poor	Proposed 30-36 inches deep soil remediation provides good water retention.
	Slag/Soil Remediation Methods	Existing soils vary from barren to poor on the slopes, good on the lower plateaus and very good in the remnant sections of shale and floodplain.	Soil/slag mixture to 36 inches, fertilization, seeding, root insulation.
B. VEGETATION • Utility of succession plants • Traditional park space vs. wildlife corridor • Developing biological standards for revegetating a slag dump	Planting Strategies	Slow natural colonization and succession.	Traditional landscaping with soil, other inputs to establish climax, vegetation community upon demand.
	Plant Types	A surprisingly high diversity and some very robust vegetation. Nitrogen-fixing forbes (e.g., sweetclover) and trees (e.g., locust and sumac) have advantage over other species.	Traditional and ornamental species, turfgrass in yards, native climax species to the extent possible.
C. HABITAT • Identify existing species • Wildlife corridor between Frick Park and the river • Human interface with wildlife	Habitat	A riparian (stream side) habitat plus relatively sparse shrubs/scrub and herbaceous habitat on slag pile. Old growth forest on undisturbed hillsides.	Radically regrade and culvert up to 1000 feet of stream. Potential loss of riparian habitat. Creation of some wetland habitat proposed. Preserve old growth forest on undisturbed hillsides.
D. PUBLIC ACCESS • Into and through property • Stream valley and attendant slopes	Public Access	Informal access to and through the site. Inadequate road crossings and trails in need of light maintenance.	Access into the property is good. Access through the property is interrupted by culvert and roadway. Separation between development users and through users.
E. WILDLIFE CORRIDOR	Effect of roads and culvert on wildlife corridor	Existing conditions are unimproved trails with some motorized vehicle use. Wildlife corridor function appears to be good with the passage of deer, turkey and at least one bear.	Riparian stream corridor and slopes interrupted by culvert and roadway.
F. HUMAN-NATURAL INTERFACE	Compatibility of recreation use and habitat	Existing recreation (hiking, biking, jogging) appears to be compatible with some motorized vehicle use. Motocross bikes and ATVs are somewhat disruptive of habitat.	Culverted plateau may provide for increased organized recreational use. Habitat value is potentially null.
G. ACCESS TO THE NINE MILE RUN STREAM CHANNEL	Riparian corridor access and trails	Currently difficult stream access, good trail access.	Riparian corridor is undermined. East-west trails improved.

ALTERNATIVE REMEDIATION OPTIONS

NO REGRADING	lighter—REGRADING—radical		REGRADING IMPACT
Existing flat to very steep. Mitigate danger on steep slopes with fences and planting.	Create short terraces for safety, access and storm water management. Terracing creates excess cut material.	Regrade all to 2 horizontal to 1 vertical	Construction-phase dust suppression issues. Post-construction revegetation starts from zero growth. Existing flora and fauna wiped off the site. No current standards for revegetation.
Apply veneer of water-retaining designer-soil. Experiment with drip irrigation or plateau stormwater management to speed succession.	Same as previous, potential for depth remediation. Excellent water retention.	Deep soil remediation means excellent water retention.	Improved water retention.
Fertilize, apply veneer of water-retaining designer-soil with aero-spreader. "Designer-backfill" for plantings. Inoculate plantings/seed.	Site-specific approach. Create on-site mix of soil/subsoil and slag up to 36 inches in depth.	Clean slate, strip mining equipment, potential for a deep soil remediation, providing excellent growing medium.	Expensive, but immediate significant improvement of the soil column.
Seeding using veneer of designer-soil and aero-spreader, plus spot planting using light excavation equipment.	Seeding, plus spot planting using light excavation equipment.	Seeding, plus spot planting. Fewer equip-ment. and irrigation limits. Cost is only mitigating factor.	Ease of access for replanting
Successional colonizing (e.g., locust) with spot planting or seeding of climax (e.g., oak) species to provide successional seed-source managed succession.	Same as previous, or more climax-oriented planting in a site-specific approach.	Successional or climax planting. Broader range of upland landscaping options.	Plant cost is the only mitigating factor.
Riparian (stream side) habitat protected. Slopes need to be managed for successional growth.	More existing habitat preserved with lighter grading than in radical regrading scheme. Potential for robust habitat forest planting.		Significant loss of riparian habitat due to the need to move excess slag into the valley, culverting the stream.
Access into the property and through the property is good.	Massive regrading means massive fill. Road through the property provides potential point of access and point of conflict. Good flat park potential.		Culvert/plateau provides good access to east-west travelers, but vertical interruption of north-south travel.
Probability for no interruption of riparian stream corridor.	Riparian habitat and north-south wildlife corridor access between Frick Park and the Monongahela severely interrupted. Light site-specific grading will produce less fill/culvert potential.		Roadway built on fill, wildlife corridor interruption, significant wildlife impacts.
Same as existing use.	New plateau created by fill provides recreational options that are not conducive to habitat.		Promotes recreational use while denying habitat values.
Same as existing condition, potential for new trails and access.	Riparian access is likely lost, north-south trails need redesign, direct east-west trail opportunities are created.		Introduces another massive artificial landform into the stream valley.