SECTION III: NATURAL RESOURCES ASSESSMENT

Purpose, Approach and Methods

Purpose

The purpose of this natural resources assessment was to compile information supporting efforts by the Mount Washington Community Development Corporation and its partners to implement a comprehensive and sustainable green infrastructure for the area. The assessment provides new insight into the natural resources of the Mount Washington community. This information will help anchor decisions in a realistic understanding of the potential and limitations of the area's ecology and physical character. At the same time, this on-the-ground assessment offers guidance for long term management of the area's green resources for the benefit of current and future inhabitants of the region.

The Study Area is based on six major green spaces identified in the original Emerald Link Scope and includes other lands that are adjacent to or otherwise important for access or linkage within the Study Area. The six key green spaces are the following:

- Grandview Park
- The Saddle
- The Grand View Scenic Byway
- The Duquesne Heights Greenway
- Olympia Park
- Mount Washington Park

The full extent of the Study Area is composed of public and private lands, including the original Emerald Link parcels, adjacent undeveloped lands, public rights-of-way and Grandview Avenue itself. Sections based on the six major green spaces are provided for reference and will be referred to by name when necessary. See Map "Study Area Segments."

Approach

The assessment began with the compilation of the information already available from numerous sources including the recently completed report commissioned by the City Planning Department, *An Ecological and Physical Investigation of Pittsburgh Hillsides* (Allegheny Land Trust, 2002), and GIS (Geographical Information System) data available on the web. Aerial photography was also used to identify landscape features and linkage. Based on this compiled information, the Western Pennsylvania Conservancy staff determined which data would be gathered on site. The effort was designed to provide the types of information that would help the CDC and its partners set priorities and focus activities.

During field assessment activities, WPC focused on collecting data that would better define land cover based on the vegetative composition and structure (i.e. forest, shrubland, grassland) and cultural land uses (i.e. commercial, transportation and residential areas, etc.). The fieldwork also included efforts to identify features (e.g. trash or obstacles) and linkages (i.e. trails) not evident on aerial photos. Land cover mapping, based upon plant communities, provides the basic ecological description of the Study Area. Areas of similar vegetative cover were identified and mapped and then classified based on the structural class of vegetation (tree, shrub, grass) or land use type

(transportation, residential, etc.). This organization of the landscape is important for management, restoration and planning activities throughout the Study Area. While plant community types fall broadly into patches dominated by forest, woodland, shrubland or herbaceous species, a more detailed description is needed for proper management of open, undeveloped patches dominated by herbaceous species. Therefore, all undeveloped lands within the Study Area were further identified and classified based on dominant species. Because Mount Washington is primarily an urban area, few cover type (community type) patches were consistent with those described in *Terrestrial and Palustrine Plant Communities of Pennsylvania* (Fike, 1999).

Data Collection Methods

Photo Interpretation

Black and white leaf-off digital ortho-photos of one-meter resolution were obtained from the Southwestern PA Commission and the Pittsburgh Department of City Planning. One-meter resolution color infrared photos (leaf on) were obtained from the Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey. A shapefile was created in ArcGIS 9.0 (ESRI 2004) consisting of polygons that represented areas of consistent plant cover for the entire Mount Washington area. These polygons (or habitat patches) were each attributed with one of six vegetation types: forest, woodland, shrubland, developed, transportation/utility corridor, or "other."

Field Assessment of Cover Types

Between June 15th and July 7th 2005, WPC staff visited each of the land cover patches occurring on or partly on publicly owned land. Private property was visited if access was permitted. Ecologists identified and recorded dominant species by stratum: **canopy** (dominant tree cover), **sub-canopy** (generally, saplings and trees of small stature beneath the canopy), **shrub** (seedling trees and shrub species) and **herbaceous** (non-woody annual and perennial plants) layers. WPC staff also noted the condition of the areas and recorded information on invasive species cover, unique features, use and potential use (including restoration potential). GPS coordinates were taken for each sampling point in each patch to document the location where data were collected. Populations of major non-native species that staff observed during fieldwork were recorded, along with preliminary notes regarding size and density of these populations. (See Appendix B.)

Based on the field visits and photo interpretation, staff identified and described site-specific vegetation associations based on dominant species and condition for the Study Area. The plant community map was further edited and refined in ArcGIS based on the field observations. Each polygon was assigned a plant community type or cultural (human-made) cover type based on the combination of field observations, aerial photography signatures and topographic maps.

Trails

In a second phase of field visits, staff walked, evaluated and mapped (using GPS) all trails, paths and frequently utilized access points. Information on width, surface, slope, features and condition were collected. (See Appendix B.) Trails were mapped by segment; each segment defined by a unique combination of the above information. Significant changes in slope, surface, or width dictated that a new segment be created. Therefore, depending upon the application, the data can be queried by each or a combination of any of those variables. The resulting data are used to represent the current use and pattern of use for the properties that make up the greenway. All GPS data were post-process corrected for error in satellite signal giving a high degree of mapping accuracy (less than two, and often less than one meter error).

Features

During evaluation of land cover and mapping of trails, staff also collected information and coordinates for features of note. Such features included seepages, landslides, trash, abandoned vehicles, important views and additional features that were thought to be important in the design and management of various aspects of the Study Area. These features are mapped and those data are also available in the report and electronically as GIS files.

Mapping

All maps for this report were produced using ArcGIS 9.0 software. Sources for and structure of the data are contained within the metadata files associated with the individual layers. These files are included on CD with this report.

Findings of Assessment

Soils

Much of the Study Area lies on moderate to severe slopes. The steepest portions, while not precluding access, do impose substantial obstacles to most uses. The Study Area is primarily situated on Dormont silt loam, soils of the Gilpin Upshur complex, and Gilpin-Weikert. All soils of steep slopes and drainages along the Emerald Link ranked moderate to severe for erosion and were rated as severely limiting for development (*Hillsides Study* citing *US Department of Agriculture 1981 Soils Survey of Allegheny County, PA* p. 95 and Maps P. 72). Soils atop Mount Washington are primarily of the Urbanland-Guernsey complex that have been altered significantly and are covered with streets, parking areas, buildings and other urban infrastructure. The Guernsey soil areas have been altered during construction activities. The lower slopes adjacent to the Monongahela River are Gilpin-Upshur complex and the flats are composed of soils of the Urbanland-Culleoka complex. See Table 1 and Map "Soils of Mount Washington." As the urban type above, these soils have been altered significantly and are covered with urban infrastructure.

This basic soils description is far too limited for making final decisions on certain types of restoration or development on Mount Washington. Given its long industrial history, it is likely that even soils described on the county survey as being intact and not in the urban category have likely been disturbed, perhaps to a significant degree, by past construction, mining or coal processing. Conversely, as may be true of Chatham Village (based on the plant communities and lack of visible spoil areas), rating as "urban" soils may mask relatively undisturbed areas of soil.

The disturbance of soils is important whether the question is how to go about reforesting or reclaiming vegetation, or whether to allow a building permit on a specific location. For many activities, it is likely that more detailed soils assessments will be needed, particularly for decisions about restoration or construction on the steeper sections of the Study Area. For instance, pollution, soil compaction or hidden rubble and fill could hinder efforts to reestablish native species.

Slopes

The majority of the Study Area is situated on the severely sloping hillsides of Mount Washington. The steepness of the Study Area hillsides factor heavily in their undeveloped state. The map "Areas of Steep Slope in Mount Washington" depicts areas with slopes greater than 25 percent within the Study Area. Development has been concentrated at the top of Mount Washington and developed lands within the Study Area occur primarily on these high flat areas. Slopes are greatest along the Monongahela River.

TABLE 1. Soils Types and Characteristics

Soil Association	Parent Materials	Description	Ratings for development	Appropriate Land Use
GQF Gilpin-Upshur complex, very steep	SILTSTONE, SHALE, AND SANDSTONE; CLAY SHALE AND IN PLACES INTERBEDDED WITH THIN LAYERS OF SILTSTONE.	Gilpin: MODERATELY DEEP, WELL DRAINED SOILS ON UPLANDS. UPSHUR: DEEP, WELL-DRAINED SOILS ON UPLANDS.	Severe limitations for development due to slope.	Woodland and wildlife habitat.
DoD - Dormont silt loam, 15 to 25 percent slopes	RESIDUUM AND COLLUVIUM CONSISTING OF SHALE, SILTSTONE AND SOME LIMESTONE	Dormont: MODERATELY WELL DRAINED SOILS ON UPLANDS..	Severe limitations for development due to slope.	None listed.
GSF - Gilpin, Weikert, and Culleoka shaly silt loams, very steep	WEATHERED FROM SILTSTONE OR SANDSTONE. WEATHERED FROM SILTSTONE, SHALE, AND SANDSTONE.	CULLEOKA: MODERATELY DEEP, WELL DRAINED SOILS ON UPLANDS. GILPIN: MODERATELY DEEP, WELL DRAINED SOILS ON UPLANDS. WEIKERT: SHALLOW, SOMEWHAT EXCESSIVELY DRAINED SOILS ON UPLANDS.	Severe limitations for development due to slope.	Woodland and wildlife habitat.

Source: Newbury, R.L. Belz, D.J. and Grubb, R.C. 1981. Soil Survey of Allegheny County, PA

Land Cover

The Study Area is a narrow band, approximately 450 acres, of predominately undeveloped public and privately owned land around the north, west and south-facing slopes of Mount Washington. Of the 450 acres, 65.9% (or 296.55 acres) is forested (defined as having >50% canopy cover of tree species). 13.9% (or 63.56 acres) is woodland (defined as having <50% canopy cover of tree species); 2.7 % (or 12.53 acres) is shrubland (defined as having <50% cover of tree species and predominance of shrub species and tree species <25 feet tall); and 1.5 % (or 6.7 acres) is open (dominated by herbaceous species). Approximately 15% of the area (70.2 acres) is considered developed land and includes gravel and paved roads, vegetated utility rights-of-way, recreational fields, and residential and commercial properties. Less than 1% or about 3 acres is sparsely vegetated cliff. (See Figure 3. General Cover Types.)

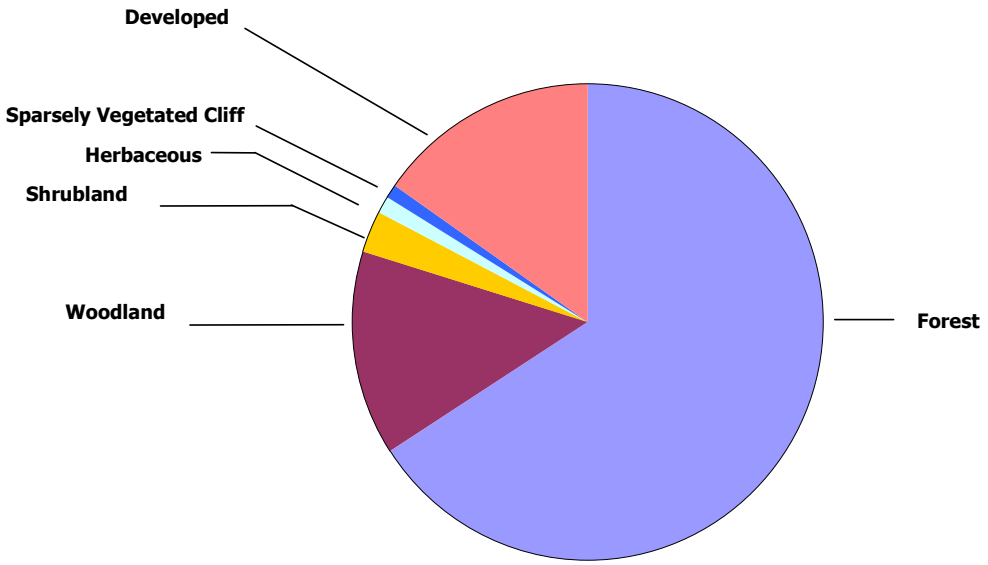


Figure 3. General Landcover Types of Mount Washington Study Area

Cover types are also presented in Map "General Cover Types." Details of the general cover types within each segment are provided in Appendix C.

Detailed Cover Types

Forest

The predominant land cover type within the Study Area is forest (see Table 2 and Map "Specific Cover Types"). The structure and species composition of the forests within the Study Area are the result of a combination of natural plant succession (natural, ecosystem-driven patterns of plant establishment and growth), current and past attempts at landscaping and urban forestry, and the introduction of invasive plant species, intentionally and unintentionally, into the flora of the region. Five different forest types were identified within the Study Area based on dominant canopy tree species. (See Table 2 and Figure 4. Specific Types of Forest.)

TABLE 2. Acres and Percent of Detailed Cover Types in Study Area

Detailed Cover Type	Total Acres	Percent of Study Area
Black locust-black cherry-ash-Norway maple forest	148.49	32.42
Norway maple forest	72.19	15.76
Successional woodland	62.52	13.65
Oak mixed hardwoods forest	52.26	11.41
Developed	23.48	5.13
Black cherry oak mixed hardwood forest	21.24	4.64
Maintained lawn	19.94	4.35
Successional shrubland	12.53	2.74
Athletic field	11.53	2.52
Transportation corridor	8.81	1.92
White ash mixed hardwoods forest	7.38	1.61
Successional herbaceous opening	6.72	1.47
Utility right-of-way	4.55	0.99
Sparsely vegetated cliff	3.41	0.75
Maintained lawn with overstory	2.03	0.12
Maple oak woodland	1.04	0.23
Total	458.11	100.00

Some of the highest quality examples of forest within the Study Area, situated in the Mount Washington Park and Olympia Park/Chatham Village sections, were set aside early in the 1900's as parkland. Other forests are the result of natural succession following abandonment of agriculture (pastureland) or clearing. Many plant species in forest patches of the Study Area are considered early successional species, often termed "pioneer" species for their ability to colonize disturbed areas (such as cleared areas or abandoned fields). The current plant composition suggests that a large portion of the Study Area experienced significant disturbances such as forest clearing, grazing of livestock, and disturbances to the soil and substrate including removal of topsoil, and dumping of fill, mining debris, and construction rubble. Pioneer species are also defined by their intolerance of shaded conditions and are therefore not found in mature, well-established, closed-canopy forests where little light is available for plant growth. Numerous sections of forest in the Study Area are composed

predominately of non-native invasive plant species and ground-cover vegetation is often sparse. Norway maple dominates nearly one quarter of the forest patches within the Study Area. Additionally, another 50 percent of the forested landscape has Norway maple present (See Figure 4). All types but the **Oak-mixed hardwoods forests** most likely developed on created, modified or disturbed sites (i.e. following clear-cutting, on filled areas, or where human activity has severely modified the landscape). Non-native species often dominate these forest types due to their ability to colonize disturbed areas.

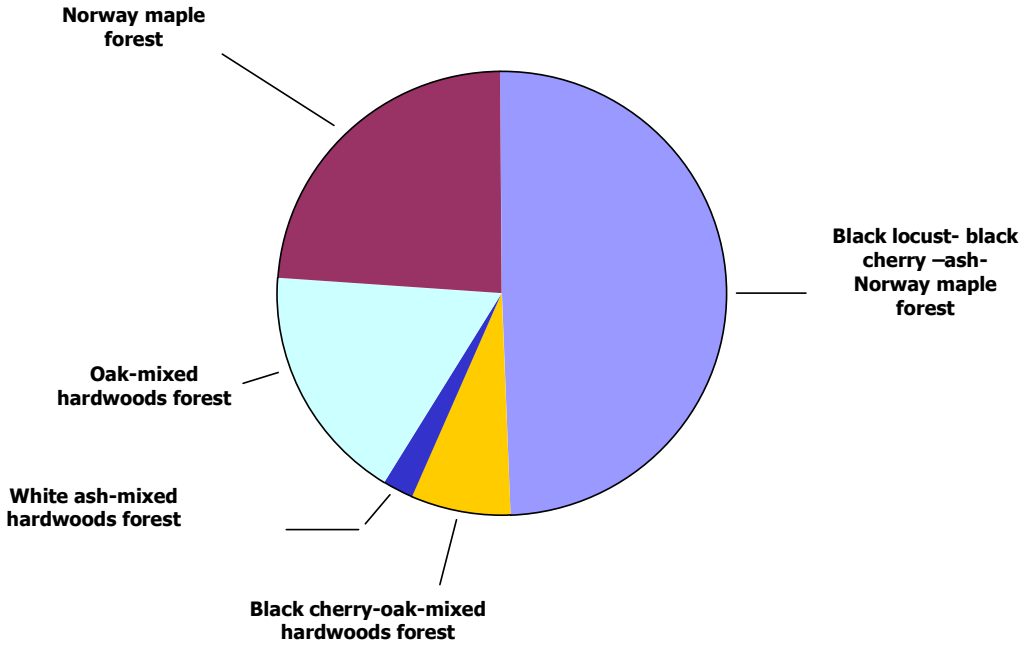


Figure 4. Detailed Types of Forest of Mount Washington

The following is a description of the dominant species in each mapped community type, depicted in the Map "Specific Cover Types."

The **Black locust-black cherry-ash-Norway maple forest** canopy is diverse and includes black locust (*Robinia pseudoacacia*), black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), Norway maple (*Acer platanoides*) and tree-of-heaven (*Ailanthus altissima*). Common shrubs include box-elder (*Acer negundo*), and honeysuckles (*Lonicera spp.*). The herbaceous layer varies depending largely on the density of the overstory. In openings and under more open canopies, black snake root (*Eupatorium rugosum*), white avens (*Geum canadense*), jumpseed (*Polygonum virginianum*), jewel weed (*Impatiens pallida*), and enchanter's nightshade (*Circaea lutetiana*) are common native species in this type along with several non-native species including Japanese knotweed (*Polygonum cuspidatum*), dock (*Rumex obtusifolius*), bentgrass (*Agrostis spp.*), and garlic mustard (*Alliaria petiolata*). Oriental bittersweet (*Celastrus orbiculatus*), Japanese honeysuckle (*Lonicera japonica*), and grape (*Vitis spp.*) are common vine species. Both Oriental bittersweet and Japanese honeysuckle are considered highly invasive species

Norway maple forests are defined by predominance of Norway maple. There are over 70 acres of this type making up nearly 16% of the Greenway. This type differs from the **Black locust - black cherry-ash-Norway maple forest** by a near absence of all other canopy tree species and only a few hearty species in the shrub and herbaceous layers. A dense canopy of Norway maple results in very shaded understory conditions allowing only the most shade-tolerant plants to grow. Garlic mustard (*Alliaria petiolata*) is one species able to tolerate low light conditions and is often found within most Norway maple forest areas along with a few other hearty native and non-native shrub and herbaceous species.

Black cherry-oak-mixed hardwood forest patches make up nearly five percent of the Emerald Link Greenway (21.2 acres) and differ from the **Black locust-black cherry-ash-Norway maple forest** by their higher density of Red oak (*Quercus rubra*), White oak (*Q. alba*), and black oak (*Q. velutina*) in the overstory. While black cherry and oaks dominate the forest canopy, non-native species are abundant and these patches are often weedy in appearance. Norway maple and black locust may be present, but are not dominant in the canopy. The presence of oaks in the overstory may indicate that the canopy of these areas was less disturbed in recent years, or simply, oak species were more abundant in these areas. Other than the overstory layer, the plant composition is similar to that of the **Black locust-black cherry-ash-Norway maple forest** indicating that these areas probably experienced a substantial amount of disturbance.

A single patch of **White ash-mixed hardwoods forest** (7.4 acres or 1.6% of the total Study Area) is found on the south end of Mount Washington Park. This forest type is dominated by white ash (*Fraxinus americana*) and includes mature white oak, black cherry, black locust, and pignut hickory (*Carya glabra*) as associates in the canopy. While white ash is a co-dominant in many of the more successional types, this patch was differentiated from the **Black locust-black cherry-ash-Norway maple forest** by the absence of Norway maple. Similarly to the **Black cherry-oak-mixed hardwood forest,** this type has most likely sustained significant disturbance events such as timbering or grazing. Shrub and herbaceous species composition was similar to that of the **Black locust-black cherry-ash-Norway maple forest.**

Oak mixed hardwoods forests patches total just over 50 acres (11.4%) in the Study Area. Trees in this type appear to be older and the forests less disturbed than those types previously described. The forest patches are dominated by red and white oak (*Quercus rubra* and *Q. alba*), sugar maple (*Acer saccharum*) and/or black cherry. The best examples of mature oak-dominated forest patches are found in the Olympia Park/Chatham Village area and in Mount Washington Park. The shrub and herbaceous layers within these mature forest communities generally show more diversity and are less often dominated by non-native invasive plants. Common shrubs in the understory are black haw (*Viburnum prunifolium*) and arrow-wood (Viburnum recognitum). Ground flora differs among forested patches within this type. The understory flora of the **oak-mixed hardwood** patches at Chatham Village Forest is rich and contains a number of species common to naturally occurring red oak mixed-hardwood forests Pennsylvania (Fike 1999). These include Solomon's seal (*Polygonatum pubescens*), false solomon's seal (*Smilacina racemosa*), and May apple (*Podophyllum peltatum*). However, patches of this type existing at Mount Washington Park do not exhibit the same diversity in shrub and herbaceous species, most-likely due to over-filling of soil dumped or pushed during the development of Mount Washington. Additionally, these patches contained a substantially higher proportion of Norway maple and black locust than those in the Olympia Park/Chatham Village Section suggesting a higher degree of disturbance of the canopy, allowing non-native and pioneer species to establish.

Woodlands

Woodlands of the Study Area are vegetated areas where canopy-sized trees make up less than 50% of the plant cover. The remainder is composed of shrub species, seedlings and saplings, trees of short stature, grasses and herbs. Over 62 acres (13.7%) of the Study Area is composed of the **Successional woodland** vegetation type (See Table 2) dominated by "pioneer" tree species. Species composition varies considerably among the **Successional woodland** patches, but, for the most part, these areas resemble the **Black locust-black cherry-ash-Norway maple-forest** in composition. However, canopy cover is much lower, resulting in a greater percent composition of herbaceous species that require more light for growth, except in woodland patches where seedling/sapling Norway maples dominate the shrub-layer (and therefore restrict light available to the groundcover). Shrub species include box elder (*Acer negundo*), honeysuckles (*Lonicera spp.*), hawthorns (*Crataegus sp.*), sumac (*Rhus typhina*), and seedling and shrub-sized trees common to the **Black locust-black cherry-ash-Norway maple-forest**. Common herbaceous species in woodland patches include white snakeroot (*Eupatorium rugosum*), jewel weed (*Impatiens sp.*), avens (*Geum spp.*), sanicle (*Sanicula gregaria.*), and goldenrods (Solidago spp.). Non-native plants make up a considerable proportion of the herbaceous layer. Nightshade (*Solanum dulcamara*), curly dock (*Rumex obtusifolius*), burdock (Arctium sp.), bentgrass (*Agrostis spp.*), coltsfoot (*Tussilago farfara*), smartweed (*Polygonum caespitosum*), thistles (*Cirsium spp.*), garlic mustard (*Alliaria petiolata*), fescue (*Festuca sp.*), orchard grass (*Dactylis glomerata*), crown vetch (*Coronilla varia*), clovers (Trifolium sp.), and Japanese knotweed (*Polygonum cuspidatum*). Along Grandview Avenue, trees in the **Successional woodland** patches are periodically cut to maintain views of the city, favoring species tolerant of this type of manipulation.

An additional woodland type (**Maple-oak woodland**) makes up just over one acre (.23% of the Emerald Link Area) in a small drainage and lower slope west of Chatham Village. Seedling sugar maples dominate the shrub layer of this type and there are fewer non-native species in this small, narrow bottomland than in the previously described type. The herbaceous layer is dominated (almost exclusively) by Virginia waterleaf (*Hydrophyllum virginianum*).

Shrublands

There are no naturally occurring shrublands within the Study Area. The shrub-dominated areas are the result of periodic pollarding and coppicing (cutting and trimming and subsequent regrowth) of various tree and shrub species that are kept in a perpetual shrub state, in many cases to maintain views or rights-of-way. This treatment has given an advantage to certain species, particularly the native box elder, staghorn sumac (*Rhus typhina*), and black locust, and the non-natives, especially Norway maple and tree-of-heaven. The shrublands in the Study Area are essentially modified forests. These patches identified as shrublands make up nearly three percent (12.5 acres). Species composition is similar to that of the **Successional woodland** patches.

Open/Herbaceous Patches

Patches dominated by herbaceous plants other than the intentionally developed type (lawns, athletic fields, mowed areas along major roads) make up nearly an acre and a half of the Emerald Link area (6.7 acres). These sites were, for the most part, isolated from developed areas and dominated by non-native grasses and Japanese knotweed. Most of these areas receive little or no maintenance, but may have been recently abandoned developed areas, park land, or unmaintained open areas. Pioneer species quickly colonize newly disturbed areas adjacent to major roads, abandoned building sites, recently cleared areas and disturbed hillsides soon after a landslide event. In most cases, sumac and tree-of-heaven were present but did not dominate the cover of these patches. Species present may include nightshade (*Solanum dulcamara*), curly dock (*Rumex obtusifolius*), burdock (*Arctium sp.*), bentgrass (*Agrostis spp.*), coltsfoot (*Tussilago farfara*), smartweed (*Polygonum caespitosum*), thistles (*Cirsium spp.*), garlic mustard (*Alliaria petiolata*), fescue (*Festuca sp.*), orchard grass (*Dactylis glomerata*), crown vetch (*Coronilla varia*), clovers (*Trifolium sp.*), and Japanese knotweed (*Polygonum cuspidatum*).

Cliffs

There were two patches classified as "sparsely vegetated cliffs," totaling nearly three and a half acres (0.75%). They represent extremely steep-to-vertical patches of bedrock, created where major highways and tunnels were built. Plant species composition was not assessed in these areas.

Invasive Species

Non-native plants are widespread in Eastern North America and represent 37% of the floral composition of Pennsylvania (Rhoads and Klein 1993). While not all non-native plant species were identified and recorded during the assessment, the percentage of non-native plants is most likely higher for open spaces in Mount Washington than for the Pennsylvania average due to their location in a primarily urban setting. Not all non-native plant species pose a threat to native species and the ecology of the area. There are many ornamental species planted in residential yards that do not readily "escape" from cultivation due to their slow growth. For example, tulips (*Tulipa* sp.), daffodils (*Narcissus* spp.), and lilacs (*Syringa sp.*) do not spread rapidly into natural areas. In addition there are a number of non-native species (such as lawn grasses) present only in abandoned fields and

waste areas that are poor competitors in forested ecosystems and therefore do not pose a great threat to native plant populations in this geographic region.

There are, however, several non-native plant species with the ability to alter ecosystem structure and function and therefore pose significant threats to native plants and ecosystems of the Mount Washington hillsides. These non-native plants are considered invasive species because they display rapid growth and the ability to establish themselves over large areas, greatly impacting native species populations and ecological site quality. Non-native invasive species have the potential to spread into more natural areas and displace native species, ultimately reducing the site's diversity. They can alter habitat for native bird, mammal, and invertebrate species; alter frequency and intensity of natural fires; alter natural pattern of plant succession; alter native plant-animal associations such as pollination and seed dispersal; alter site hydrology, soil and water chemistry, moisture holding capacity; and increase erosion (http://www.nps.gov/plants/alien/bkgd.htm). There are several definitions, species fact sheets, and information regarding non-native invasive plant species found on the National Park Service web site (http://www.nps.gov/plants/alien/bkgd.htm).

Since the Mount Washington Study Area is situated in an urban landscape, it is not surprising that non-native plant species are common and often dominate plant community patches. One area with a conspicuously low number of non-native plant species was the in the oak forests of Chatham Village (see community descriptions and discussion above).

The following are the major non-native species recorded during fieldwork for this study. These species should be considered as targets for possible management actions. Many of these species were intentionally planted in residential yards and along streets adjacent to and surrounding the Study Area, but have thrived in the open spaces of Mount Washington due to the species' high tolerances to pollution, soil compaction, poor soils, and periodic disturbance on hillsides.

Norway maple is a dominant overstory tree in forests of the Study Area and is one of the more abundant trees planted along the streets of Pittsburgh. The heavily shaded understory conditions beneath the Norway maple canopy are too dark for native understory and groundcover species, and the widespread expansion of this species has led to an extremely sparse herbaceous layer. In areas dominated by non-natives, there is often more bare soil and less organic material than in areas dominated by native plants. There is relatively little holding the soil of steep slopes other than the roots of the Norway maple and rainfall and run-off may lead to greater soil erosion.

Tree of heaven is another tree species found in urban areas that is most problematic in recently disturbed areas. Once established, it is difficult to control because of the high seed production (35,000 seeds per tree per year) and ability to sprout vigorously from the roots (http://www.nps.gov/plants/alien/fact/aial1.htm). While not a strong competitor in mature closed canopy forests, tree-of-heaven easily establishes in forest openings and more disturbed forest patches (e.g. following landslides) areas within the Emerald Link.

Oriental bittersweet is an aggressive invasive vine found present in most habitat patches of the Mount Washington Emerald Link area. It grows on and over other species killing them by preventing photosynthesis, up-rooting, and girdling (http://www.nps.gov/plants/alien/fact/ceor1.htm). Its presence may hinder establishment of tree species and slows natural succession from woodlands to forests.

Garlic mustard (Alliaria petiolata) is a non-native herbaceous species that may outcompete native herbaceous species, especially spring ephemerals (those that complete their entire reproductive cycle in the spring), by monopolizing resources in the understory (http://www.nps.gov/plants/alien/fact/alpe1.htm). Because of this, it may be the only herbaceous

species present in groundcover layer of Mount Washington forests. After spending its first year as a rosette of basal leaves, the second year plants grow rapidly and produce thousands of seeds by June. Large white tailed deer populations contribute to widespread garlic mustard invasions by trampling/disturbing the soil and preferentially browsing native plants (http://www.nps.gov/plants/alien/fact/alpe1.htm).

Woodlands, shrublands, and unmaintained herbaceous areas within the Study Area represent the most problematic sites in terms of invasive species management due to their openness and periodic treatment (cutting, coppicing, clearing) or in some cases abandonment. Several species of non-native shrubs and small trees are abundant in these patches. ***Multiflora rose*** is able to persist in abandoned fields as the canopy closes above it, and in these situations it may slow the growth of later-successional woody species (Rhoads and Block 2002; Myster and Pickett 1990, 1992). ***Japanese barberry*** is present in most patch types. This species is commonly planted as a hedge and can establish in openings and beneath a forest (Ehrenfeld 1997). ***Bush honeysuckles*** (*Lonicera morrowii, L. maackii*) are also common to openings. As with multiflora rose and Japanese barberry, bush honeysuckle tolerates shade with reduced flowering and seed production (Rhoads and Block 2002) and establishes in thinned forest edges and fragmented closed-canopy systems (Brothers and Spingarn 1992, Cadenasso and Pickett 2001). ***Common and glossy buckthorns*** (Rhamnus cathartica, R. frangula) are abundant in woodlands and forests in the Mount Washingtion Park area and may threaten the higher quality mixed oak forest patches. ***Wineberry*** (*Rubus phoenicolasius*) is another invasive non-native shub abundant in woodland and shrubland patches of Mount Washington that spreads quickly and displaces native species especially in successional areas and along forest edges (http://www.nps.gov/plants/alien/fact/ruph1.htm). While it was found rarely in closed canopy forests of the Emerald Link, dense thickets of wineberry may hinder reforestation efforts. **Japanese honeysuckle** is a vine noted for its ability to adapt to shaded conditions (Carter and Teramura 1988, Schweitzer and Larson 1999). It is common to the groundcover throughout much of the Emerald Link Greenway. **Obtuse leaved privit** (*Ligustrum obtusifolium*) is commonly planted as a hedge in residential yards. This species, like most invasives produces large quantities of seed, which are distributed by birds. Privet has naturalized extensively in disturbed areas and forms dense stands that shade-out native woody and herbaceous species (Rhodes and Block 2002). **Autumn olive** (*Elaeagnus umbellata*) is a non-native shrub traditionally used as a source for wildlife habitat and forage as well as planted as herbaceous cover on severely disturbed sites (Rhodes and Block 2002). The species' nitrogen fixing capabilities enables it to thrive in poor soils. Individual shrubs create heavy shade, suppressing establishment of native plants. They quickly produce seed and resprout vigorously after cutting (Rhodes and Block 2002). **Japanese knotweed** (*Polygonum cuspidatum*) is a tall (over six feet) herbaceous plant that spreads quickly in dense thickets in openings or disturbed areas (http://www.nps.gov/plants/alien/fact/pocu1.htm) excluding native vegetation. It is particularly problematic in woodlands and shrublands in the Mount Washington area where periodic maintenance has disturbed the overstory and in recent landslide areas where it is able to rapidly colonize newly open ground. Once established, it is very persistent and difficult to remove.

Features

Views, Recreational Opportunities and Destinations

During its survey, the study team noted and mapped dozens of features representing prime view points of the Pittsburgh skyline, the West End, and the Monongahela and Ohio Rivers; hiking trails and stairways; athletic fields and playgrounds, and other structures.

Views

As one of the highest points in the city, Mount Washington provides spectacular views of much of downtown Pittsburgh. Viewing platforms along Grandview Avenue allow opportunities for observing both the cityscape and natural areas from several angles.

The object of the identified views and significant overlooks is the cityscape of Downtown Pittsburgh, the three rivers, and surrounding landscape composed of urban forests and residential areas. Views of the mountain in the spring, summer and fall months are particularly striking with many roads, past scars and other distractions hidden by foliage. Likewise, views of the city from parts of Mount Washington are punctuated with green and are more lush during the growing season. However, winter offers an expanded viewshed and open views that are obscured the rest of the year by vegetation (see Figure 5. Major Viewing Areas Documented During Natural Resources Field Assessment).

View of Downtown Pittsburgh from The Saddle -- *photo by WPC Staff*

Figure 5. Major Viewing Areas Documented During Natural Resources Field Assessment

Parks, Playgrounds and Athletic Fields

Three major city parks are situated within the Study Area: Grandview Park, Olympia Park, and Mount Washington Park. Olympia and Mount Washington Parks contain publicly accessible athletic fields, basketball courts, play structures, and picnic shelters. All are maintained. A privately owned and managed baseball diamond sits adjacent to the old Duquesne Heights Greenway off of Greenleaf Avenue. Also, a small soccer field sits between Bigbee Street and Grandview Park. Other private playgrounds exist within the Study Area and several playgrounds associated with public and private schools are present nearby but were not included in the Assessment.

Grandview Park and Olympia Park contain the largest area of maintained public park land with picnic shelters and restroom facilities. The maintained area in Grandview Park, situated above the cliffs of the Monongahela River and consisting of regularly maintained lawn and scattered oak and maple trees, is an important meeting place for community members because of the panoramic view of the Pittsburgh skyline. Like the viewing platforms along Grandview Avenue, this area represents a significant tourism destination. An old band shell/stage and amphitheater provides additional cultural opportunities. This structure is in need of repair and updating to improve its run-down and dated appearance.

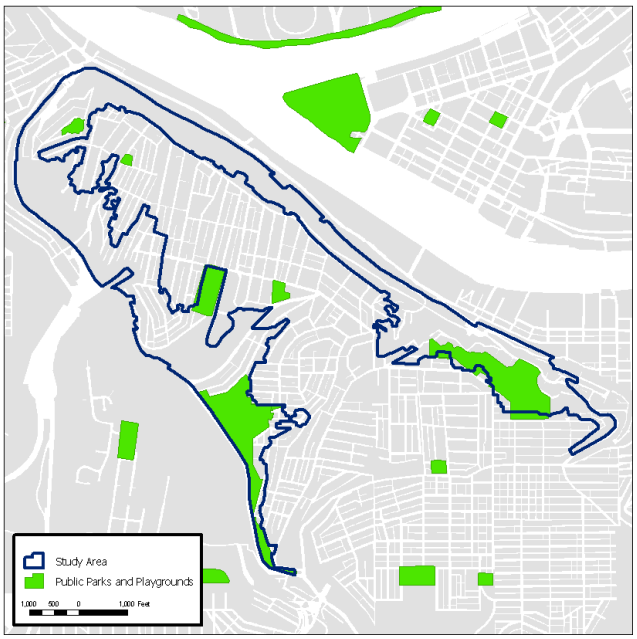


Figure 6. Parks and Playgrounds

Destinations

The two major historical features representing significant tourism destinations are the Duquesne and Monongahela inclines within the Grandview Avenue Section and the historic planned community and property of Chatham Village, adjacent to Olympia Park. These destinations also happen to be directly in the vicinity of the Study Area. As the focus of this assessment was natural resources, a complete inventory of social and cultural destinations such as restaurants, schools, churches or businesses was not undertaken.

Trails

The trail system within the Study Area is quite localized to individual segments. Very few trails, official or not, run between sections of the Study Area. Streets represent the primary form of pedestrian linkage throughout the Study Area. Trails that have been noted are those that are maintained as open and passable through use by people, bicycles, off-road vehicles (ORV), animals or some combination of the above. The apparent primary use was not distinguished, although certain uses may be noted for any given trail segment. (See Map "Trails.")

For the most part, existing trails were easily walked with no major hazards or obstacles. However a number of trails were steep, many eroding badly, especially those that were created by and receive high use from ORVs (primarily in the Duquesne Heights Greenway section). Some pose potential safety issues if they were publicized and used by the general public.

Grandview Park, Mount Washington Park, and the old Duquesne Heights Greenway present the greatest opportunity for development of hiking and mountain biking trails. The trails through Grandview and Mount Washington Park are very well established, but many are overgrown, eroded, or compromised in some. Additionally, there is little signage and trail information in the developed areas of these two city parks**.** There was evidence of the Student Conservation Association's volunteer efforts to improve some portions of trails in these segments. However, there is still significant need for trail improvement and maintenance and a comprehensive recreation plan to organize trail construction and maintenance efforts.

Few trails within the Duquesne Heights Greenway are "official." Though some are kept open by use, generally these paths are not maintained. Fences and signs are, for the most part, dilapidated and overgrown and do not direct people to any activity or interaction within the larger greenway. Access points to these unofficial trails are unmarked and trails often begin and end in residential yards, utility rights-of-way, overgrown sections of the Greenway or at precipitous overlooks. There is little logic to these passages and in the cases where ORV use is high, numerous overlapping loops create a confusing pattern for those seeking to follow one trail through the Duquesne Heights Greenway. Many of the "un-official" trails cross private land. Currently, there are no available directions or maps that show the extent of trails or describe trail features or destinations.

Obstacles and Problem Areas

The presence of trash, abandoned vehicle bodies, steep drops and difficult trail surfaces pose threats to users of the open spaces. See Map "Trails with Obstacles." Included in this category are water discharge points or seepages. Seepage areas may represent natural discharge of groundwater, runoff from points above or sanitary sewage system problems. They are noted on the map as information that would be useful particularly in the efforts to improve trails and safe pedestrian passage through the Study Area. In addition to documenting positive features of the area, we noted and mapped features that represented obstacles to pedestrian movement, trash piles and waste areas, and hazards that may threaten human safety.

Tires dumped in Duquesne Heights Greenway
-- photo by WPC Staff

Forest Quality and Contiguity

One of the biggest ecological assets of the Study Area is its high percentage of forest cover. In some places, the width of the forested areas spans more than 300 meters, giving these sections at least the possibility of achieving "interior" forest status. A buffer zone of over 100 meters from the forest edges is needed to minimize the impact of opportunistic edge species (such as cats, raccoons, etc.) on species less adapted to edges and the predators that use them. See "Interior Forest" map. However, due to the many fragmenting features (roads, trails, utility rights of way), there is relatively little land in the Study Area that could be considered to have interior forest conditions. Furthermore, these patches, while possibly spanning a width of greater than 300 meters, are themselves a mix of early successional and longer-lived species. Structurally and functionally, these larger patches may not serve as interior forest. Significant effort and time would be required to create "interior forest" conditions in the Study Area.

The forests of the Study Area support numerous bird species, provide stop-over locations for migrants and offer breeding habitat for others. Many common species of wildlife, including deer, turkey, raccoons and others are frequently sited on Mount Washington. However, many taxa (including insects, reptiles and amphibians) are largely not assessed. In the case of birds, a group of animals often considered sensitive to the structural conditions of habitat, breeding success has not been documented. This would be of particular interest in terms of the interior nesting species that typically do not have high breeding success where large amounts of edge are present. Still, many of the species identified on Mount Washington are likely breeding and producing young. (See Appendix D.)

Because the Study Area forests are separated from other forested areas beyond Mount Washington by roads, utility rights-of-way, development and many other non-vegetated land uses, the forests of Mount Washington sit as an island of habitat. Other forested hillsides like those associated with the Seldom Seen Greenway are similarly isolated. Also, little connection to the rivers exists, the closest being the small, forested drainages that end at conduits moving water under the infrastructure running up and down the Monongahela River.

Reconnecting the forests of Mount Washington to areas beyond the escarpment itself would be exceedingly difficult. However, opportunities do exist to improve and connect portions of the forests on the mountain and thereby improve ecological linkages. It may be possible to develop better pedestrian linkages to places off the mountain, but most will require use of surface streets for the purpose. Still, this avenue is worth pursuing and adding some habitat value in those linkages may be possible.

Pedestrian Access and Connections

Trails, stairways, and interior sections of the Study Area receive varying degrees of use that appears to be primarily by local residents. Given the structure, condition and extent of the trails and the lack of signage, it is of no surprise that those unfamiliar with the access points and system of trails would not be inclined to use these paths. Destinations, although not a prerequisite for the enjoyment of walking trails, do help to attract visitors and encourage movement through an area. Without information about potential destinations, few people will venture onto the existing trails. Currently, navigating from one end of the Study Area to the other is not possible without spending a significant time on city streets or traversing ravines or forested areas without established trails.

As mentioned previously, the trail system within the Study Area is quite localized to individual segments. There are very few official or unofficial trails that run between segments; city streets represent the primary forms of pedestrian linkage throughout the greenway. Through fieldwork and GIS analysis, WPC staff were able to determine a route of potential pedestrian movement through the Study Area utilizing trails or other passages on public land. The "Pedestrian Link Trails" map depicts one route currently available to pedestrians without crossing private land, major obstacles (such as ravines and busy streets), or sections of forest or woodland without established trails (official or unofficial). The result of the analysis was a continuous loop from the east end of Grandview Park to the top of Mount Washington Park. There are several additional loops and spur routes that provide access to Downtown Pittsburgh via Sycamore Street or McArdle Roadway, and to the West End, via Greenleaf Avenue. Given the severe slope of the Grandview Avenue Section, pedestrian movement in this area is limited to the sidewalk of Grandview Avenue.

While movement through the Study Area via the identified route makes use of many of the established trails in Grandview Park and the Saddle Segments, the route makes very little use of public open space of the Duquesne Heights Greenway and Mount Washington Park. Because of obstacles including private land and the lack of established trails in certain public parcels, the delineated route takes users relatively far away from the Duquesne Heights Greenway.

In addition to the "Pedestrian Link Trails" Map depicting the major route currently available through the Study Area, the field and GIS analysis identified 11 points at which actions can be undertaken to improve pedestrian movement through sections of the Study Area, truly "linking" the sections by establishing a continuous route through all sections (see "Opportunities to Increase Pedestrian Linkages" map). These potential links can be grouped into the following categories for general reference:

(1) planning and constructing trails through public parcels where no trails exist
(2) obtaining right-of-way easements or purchasing privately owned parcels
(3) establishing pedestrian access to PennDOT managed rights-of-way
(4) establishing passage/bypass around obstacles (steep slopes, cliffs or ravines) to pedestrian movement. (See Recommendation #7 and Pilot Project #6.)

Management Recommendations

At the core of these recommendations is the long-term process of restoration and establishment of linkages—ecological and human. A strong commitment to the process coupled with modest but consistent funding will be the key to the sustained effort necessary to achieve desired goals. Simple and reasonable goals should be articulated and progress conveyed regularly to the public. Progress will be incremental; therefore small successes should be celebrated and used to maintain momentum. Pilot projects (described in the next section) have been identified based on ease of implementation, likelihood of success, and visibility.

1. Promote Ecologically Informed Vision and Management Goals

Background, Concepts, and Broad Goals

For Mount Washington, the 20th century represented a time of recovery from the previous century of resource extraction and urbanization. Vegetation became reestablished, mostly through natural succession, although numerous landscaping efforts took place with varying degrees of success. As the escarpment greened and forest grew back, subsequent generations came to regard Mount Washington and the other similarly recovering hillsides of Pittsburgh as characteristic of an unusually green city. However, the vision that guided the revegetation of Mount Washington was generally social (Olmstead), aesthetic (garden groups), or economic (city economic analysis) in focus. The ecological factors were not fully understood or appreciated, and no comprehensive management goals were established to guide its restoration. In addition major events such as the Great Depression and changes in political leadership frequently altered the plans and ideas that were developed for Mount Washington.

With improved data about existing conditions and an updated understanding about the value and importance of maintaining healthy ecosystems, it is now possible to bring a new level of environmental awareness to the efforts to enhance green space on Mount Washington. The current effort combines concerns about the quality of habitat, aesthetics, access and safety. These factors are themselves linked and interconnected: focus on improving habitat quality will involve many aspects of natural resource management, infrastructure maintenance, and development standards and practices. In turn all of these factors combine to create an improved experience for users of the entire area.

The desire to provide connection along the arc of the Study Area is apparent in the conceptual name first applied to the Study Area: the "Emerald Link". The steep and predominately vegetated slopes of Mount Washington appear as an already united feature and, to some extent, that is the case. However, the actual connections, whether ecological or human, are limited. Many features including utility rights-of-way, roads, highly disturbed ground and dense patches of weedy plants create barriers to movement and connection. Although the vegetated, largely undeveloped landscape is a valuable asset, a number of factors will need to be addressed to improve movement and access. These are:

- Lack of ecological connection with rivers and adjacent forested areas;
- Limited areas of "interior" forest;
- Many low diversity natural communities;
- Few attractions or destinations other than the Grandview promenade;

- Limited and confusing access to large sections of the Study Area.

If Mount Washington is to enjoy a green infrastructure that extends beyond the narrow strip of highly desirable views, widespread appreciation and understanding of the many values – natural, historic and otherwise – of a larger connected green area will be needed. The city of Pittsburgh, various community partners, businesses and agencies with strong ties to the area need to share a common vision. That vision will need to be conveyed to planners, developers, funders and the public at large. The "Emerald Link" project and related Grandview Scenic Byway project are excellent starts in this direction.

Currently, much of the proposed Byway Park falls under the management authority of the city and several other public entities. These various agencies maintain a limited number of trails, trim vegetation, mow park lawns, update formal park facilities, assure general public safety, and the like. However, the forests and woodlands that make up a large portion of the Study Area receive little attention and many areas adjacent to more developed or maintained areas suffer from miscellaneous, unguided forms of manipulation. Restoring some of the components that were part of the historical ecological landscape of Mount Washington and the Three Rivers Valley will require a concerted, long-term effort.

Recommendations

1. Work closely with the city departments, particularly the Pittsburgh Department of Public Works which oversees the Parks Department, to incorporate key ecological principles into all the management efforts on Mount Washington. Specifically, work to apply DPW's new green space management principles to Mount Washington green spaces. (See Section IV, Table 3.)
2. Work with the DPW to assure dedicated staff to care for any expanded Mount Washington green space.
3. Create forums for promoting key ecological approaches to the management of the green infrastructure (invite prominent professionals from the fields of restoration, urban forestry, ecology, landscape design and related areas). Use these to reach out to the city and other key parties and partners to build the ecological understanding behind the Byway Park proposal.
4. Sponsor events that highlight the essential values and amenities of the proposed Byway Park and utilize the parks, trails, businesses and features within the community to do so. Use these events to build appreciation and support among various potential partners.
5. Involve community groups and local businesses and institutions in pilot projects (see Section V) and provide opportunities for ongoing community interaction and discussion. Use these to build skills, experience and a steady but measured pace of work on protection, restoration and improved management of Mount Washington's green spaces.

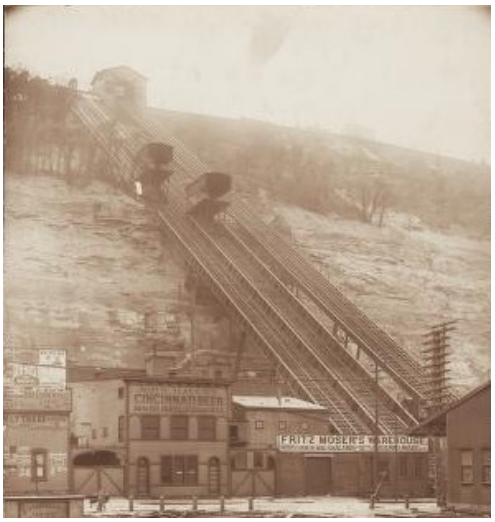
2. Restore Forests

Background, Concepts, and Broad Goals

By the mid-1800's, increasing industrialization and extractive uses had decimated the forests that once blanketed the slopes of Mount Washington (Pittsburgh Chronicle, 1846). Photographs from the early 1900s show large sections of open soil and largely unvegetated

hillsides. The fact that these same slopes are today mostly green and mostly forested is not a testament to intentional restoration plans and projects, although a number of efforts have been planned over the years. Rather, today's forest is a result of natural vegetation succession. Nonetheless, the transformation to again green hillsides is clearly an aesthetic boon and helps to paint the picture of Pittsburgh as a "green" city – both as a natural attribute of vegetation and a strategy for development. Opportunities to improve the current state of these forested areas are the focus of these recommendations.

Many of the plants and animals that live in our region evolved in a predominantly forested landscape. Those species that depend upon the interior conditions of forests (forest habitats with at least 100 meters from the forest edge) are especially important targets of conservation as the landscape is increasingly fragmented by human activities. The environmental functions of forests are many. Trees and all vegetation within a forest intercept and slow precipitation before it contacts the ground. The leaf litter and humic layers that form in healthy forests absorb water and help accommodate the rate at which soils can absorb moisture. Additionally, forests serve important thermoregulatory functions as they shade the ground, reflect heat and help to retain moisture at ground level. This function is particularly important in urban areas where a large part of the constructed landscape absorbs and radiates heat.



Mount Washington Incline c. 1900
Bare slopes were created by construction and industrial uses.
--Carnegie Museum of Art Collection of Photographs

The forests and woodlands within the Study Area serve all these functions. However, their full potential is constrained by their small size, lack of contiguity and poor quality. While some of these functions can be improved through better management of open spaces, others are limited by physical constraints and cultural aesthetics, among those being the maintenance of views.

Many open areas within the Study Area are associated with urbanized or maintained landscapes such as abandoned developments, utility rights-of-way, eroding slopes or road cuts and edge habitats. Restoration of forest may or may not be possible due to land use (e.g., trees and shrubs are deliberately controlled for height beneath power lines) or the site conditions (e.g. open, steep or rocky road cuts). However, these areas should be managed and vegetated wherever possible with appropriate plant species (see Landscaping with Native Plants and Management of Maintained Areas sections).

While there are great challenges to management of these areas, there are a number of degraded or urbanized areas that could be reforested or united with existing forest to create larger patches of contiguous forestland. In addition, many areas that are currently wooded but do not have sufficient cover or the characteristic structure of forests are good targets for restoration. Likewise, areas that have been maintained in a park-like condition with cutting or mowing are good candidates for restoring as more functional forest. Protecting and enhancing

the quality of what is present and developing a larger core area of forest will better maintain species habitat. Creation of corridors linking natural community patches restores more natural patterns of plant and animal movement. Pilot Project # 1 focuses on restoring core habitat.

Overall, the goals of forest restoration are to increase interior forest area and distance from edge habitats, improve the health and long-term viability of existing forests, and create corridors of forested habitat to provide linkage to other portions of green space.

Forest can be further categorized by condition and managed to improve habitat quality. For instance, forests with high percentages of invasives in the overstory can be slowly transformed to include a higher proportion and diversity of native trees. Those forested areas dominated by native trees and plants can be managed to maintain their present characteristics. Initiating consistent policies, such as replacing downed trees only with natives, coupled with a gradual, selective removal of invasive trees, would allow a transformation of composition while maintaining a high level of canopy cover. Many forested areas lack groundlayer vegetation (low growing herbaceous plants). Establishing groundlayer vegetation may be difficult and require soil amendment, terracing, slopes stabilization or some combination of all three. Seeding and planting should be a part of any revegetation strategy. Protection from deer may be necessary for successful revegetation.

Recommendations

The recommendations for forest restoration are subdivided partially by segment to highlight specific opportunities. For many of the areas identified below, we make references to forest health monitoring, control of invasive species and amendment of soils. Forest health monitoring can cover a number of parameters including individual tree health, structure, and presence of non-native invasive species. A trained forester may be needed to supply guidance and/or perform assessments. Invasive species control is also an activity that is best guided by an experienced practitioner although volunteer efforts are often key to the long-term success of the effort.

Segment Strategies:

Forests of the Duquesne Heights

The slopes of Duquesne Heights wrap around the western end of Mount Washington and form a contiguous forested corridor between the north-facing (front) and south-facing (back) sides of the escarpment. Although not wide enough to contain interior forest, it does nonetheless represent an important habitat linkage. Increasing forest cover at the edges of this segment (by converting grasslands and shrublands to forests) could increase interior conditions (see Figure 7 "Potential Interior Forest through Reforestation of Buffer Area "). Given the steepness of the slopes, this area is difficult to traverse; where the land is topographically accessible, the configuration of ownership along the upper slope does not allow access without trespass.

Management of and access to this area would benefit greatly from consolidation of public parcels into a larger, more easily managed tract. To facilitate access, acquisition of easements or outright acquisition of large privately owned parcels

within the segment adjacent to publicly owned land (6-J-5, 6-N-210) would be desirable. This would also be the first step in limiting ORV use and encouraging more sustainable use of this area.

The forests in the Duquesne Heights section would benefit most from a long-term management policy aimed at achieving a more native composition, increasing structural diversity (improved ground-layer and regeneration of overstory), and generally increasing canopy coverage to at least 70% in all sections. Key strategies can be summarized as follows:

- Consolidate public parcels into larger parcels;
- Limit ORV use/abuse with barriers, signage and patrol;
- Control invasive, non-native species;
- Develop planting plan using native plant species, stabilize slopes, amend soil as necessary;
- Reforest open areas to increase interior forest area (See Figure 7. "Potential Interior Forest Area").

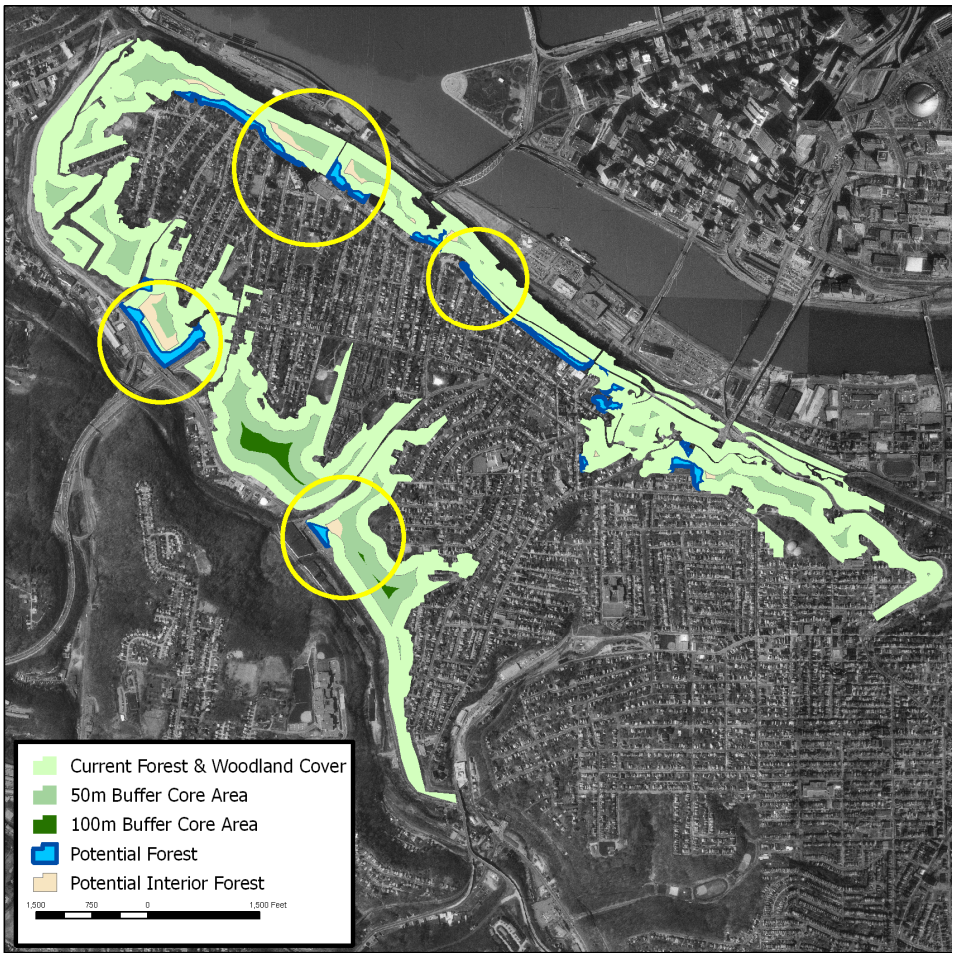


Figure 7. Potential Interior Forest through Reforestation of Buffer Area

Oak Forests of Olympia Park/Chatham Village

As mentioned, the forests of this section are the most mature and well-developed forests within the Study Area. They provide an excellent model for restoration work and offer a good example of the recovery potential within other areas on Mount Washington. This is not to say that restoration issues are less relevant here, however. Access to these forests is good. With increased outreach to the public will come more visitation and the need to direct activities and define areas of use. Management and stewardship activities will be crucial to maintaining and improving the health of these forests. Also, this section contributes to the few areas within the study area that have the potential of supporting interior forest.

Although important in all areas where management programs are instituted, monitoring of forest health will be key in this section. Two components of this management are controlling invasive species and ensuring that there is successful and continuing regeneration of overstory tree species. The section of disturbed forest that lies on the opposite side of the drainage from the Chatham forests is a restoration priority to buffer and build the potential interior forests related to this area (see Pilot Projects below).

Initial and ongoing consultation with ecological professionals will be needed to develop detailed plans and protocols to begin this work. Chatham Village and its residents will be important partners for all work focused on this area. In addition to being part of a larger network of volunteers and stewards, they have a very personal stake in area surrounding the Village. Specific actions include:

- Partner with residents of Chatham Village to conduct stewardship activities such as:
    - invasive plant removal projects
    - trail maintenance
    - forest restoration of landslide-prone eastern area along highway 51;
- Work with Chatham Village to replace invasive ornamental species with non-invasive alternatives (i.e. replace Privet hedges with Myrica hedge, see section on use of natives in landscaping);
- Develop appropriate signage and access for walkers on trails through forested area;
- Jointly develop recreational easement language to allow visitors access to property.

Oak Forests of Mount Washington Park

This area features one of the better examples of mature forest on Mount Washington. Similar to the Chatham Village forests, the two key management efforts here will involve controlling invasive species and ensuring that there is adequate and continuing regeneration of overstory tree species. Mount Washington Park does not have the same potential for contributing to interior forest given that it is more isolated by surrounding land uses.

This section does not have the strong community ties and stewardship opportunities that are possible for the Chatham forests. However, both ecological consultation and stewardship will be essential for work to proceed. Several areas of sub-optimal

forest (canopy closure less than 70% and large populations of invasive species) lie along the upslope edges of Mount Washington Park and should be considered for restoration following the process detailed in the section on pilot projects. Key activites include:

- Monitor for health, invasive species, regeneration success of overstory tree species;
- Plant native tree and shrub species and protect plantings and native volunteers with fencing or tree tubes;
- Partner with local residents to conduct stewardship activities
    - invasive plant removal projects
    - trail maintenance;
- Amend soil as necessary;
- Develop list of replacement plans and policies (see landscaping using natives recommendation);
- Control non-native species.

All Other Forested and Woodland Patches

Many other areas classified as forest or woodland are not as mature or structurally complete as those in Mount Washington Park or Chatham Village and will require larger and more intensive efforts directed toward improving regeneration of overstory species, controlling invasive species and increasing native plant diversity. Those areas adjacent to patches of contiguous forest, especially those holding interior forest, should receive priority for restoration work. Action areas include:

- Monitor for health, invasive species, regeneration success;
- Plant native tree and shrub species and protect plantings and preferred native plants with fencing or tree tubes;
- Amend soil as necessary;
- Develop list of replacement plans and policies (see landscaping using natives recommendation);
- Control non-native species.

Shrublands

For the most part, the shrublands that are the focus of management within the study area are those that will be maintained to accommodate views, recreation or slope stability control. These areas can be considered from a landscape design point of view (bloom times, configuration, texture, etc.) as well as for functional aspects. In some cases, establishment of wooded or forested conditions may be desirable and for those instances, forests restoration strategies need to be employed. Basic activities include:

- Define desired structure & goals and evaluate specific maintenance needs;
- Develop list of replacement plants (see landscaping using natives recommendation) including replacing trees with size-appropriate shrubs;
- Protect plantings as necessary;
- Protect native regeneration, monitor for health, control invasives as necessary.

Herbaceous Areas

Herbaceous areas include a broad range of land uses that will need to be evaluated on a case-by-case basis. However, the same basic set of principles of favoring natives, controlling invasive plants and reducing maintenance cost all apply here. A number of places, such as those along the edge of the slope immediately above Route 51 in Mount Washington Park could be considered for a more natural planting enhancement with warm season grasses and meadow plants. For conversion of areas dominated by herbaceous vegetation to shrubland or forests, the same approaches as mentioned above would apply. Basic activities include:

- Define use and maintenance needs;
- Maximize use of natives, emphasizing low maintenance species;
- Control invasives;
- Stabilize slopes and amend soils as necessary;
- Plant trees and shrub species; protect plantings with fencing or tube structures;
- Plant and seed native groundlayer vegetation;
- Monitor for success.

Herbaceous area above Route 51, Mount Washington Park. This is an area that could benefit from plantings with native plants.

--Photo by WPC staff

 # 3: Control Non-Native Invasive Species

Background, Concepts, and Broad Goals

Many of the non-native species identified in our assessment were intentionally planted in the Emerald Link Greenway sections and in adjacent residential yards and streets. Some non-native plant species do not present a threat to native plant diversity. A number of these species, however, show high tolerances to pollution, compaction, poor soils and periodic disturbance and that makes them ultra-competitive on the disturbed hillsides of Mount Washington. These species are considered "non-native invasive" plants.

Control options for non-native invasive plant species range from hand pulling and mowing to cutting and use of herbicides. Large-scale removal of invasive species such as Norway maple and many other non-native trees may be prohibitively costly. Without proper planning, removal of invasives may actually create more environmental problems (i.e., erosion), as these plants may often constitute the majority of plant species at a site.

The most effective strategies for management and removal of invasive plant species will likely involve combinations of mechanical, chemical and (where available) biological approaches in an integrated pest management framework (National Park Service, 1996). Control of any invasive plant species should be followed as soon as possible by planting of native species. Herbicide applications should be timed to minimize damage to native plants—for example during late fall and early spring if a targeted invasive species has a longer growing season than native plants (Rhoads and Block 2002). Management strategies will have to be

selected based on the life history of specific species and the specific natural communities in which they are established. Strategies should be continuously evaluated for effectiveness as they are implemented.

Recommendations

- Work with the city and other partners to develop and implement overall policies and strategy for controlling invasive plants within the Study Area.
    - Focus first on high quality areas (and surrounding habitats) where control would have maximum benefit.
    - Start at the edges of priority sites, then work into the interior spaces.
    - Outline basic practices such as removing target invasives systematically and routinely as feasible.
    - Use only native plants of the appropriate height and characteristics for plantings, and target specific invasives such as tree of heaven, Japanese knotweed, garlic mustard and Norway maple seedlings.
- Develop a basic map showing areas of infestation. Categorize by species and level of action needed. Utilize volunteers if possible to identify and map infestations of invasives. Acquire experience through implementation of modest, strategic projects.
- Start with public parcels, but initiate partnerships with private landowners to encourage best practices and offer assistance with invasives control in key locations.

Specific management recommendations for the most widespread invasives within the Emerald Link Greenway follow:

- ***Bush honeysuckles*** (*Lonicera morrowii, L tatarica, L. maackii*) are able to re-sprout from roots or remaining vegetation left behind after cutting or pulling; while these measures can be effective for small infestations, sites should be monitored afterwards to prevent reestablishment. Glyphosate and triclopyr are effective applied to the leaves in 2% solution or cut stems in 20-25% solution (Rhoads and Block 2002).
- ***Multiflora rose*** (*Rosa multiflora*) seedlings can be pulled by hand, but larger plants may require chains or cables and a tractor, and dense thickets will need heavy machinery; the roots must be removed to prevent resprouting. Regular mowing can also be effective. Herbicide treatment of cut stems (with glphosate or triclopyr) is recommended as the most effective treatment by Rhoads and Block (2002).
- ***Japanese barberry*** (*Berberis thunbergii*) can be pulled, using gloves, and mowing will reduce proliferation but not prevent regrowth. Leaf application of 2% glyphosate or triclopyr, or application of a 25% solution of the same herbicides to cut stems is also recommended (Rhoads and Block 2002).
- ***Japanese knotweed*** (*Polygonum cuspidatum*) spreads vegetatively as well as by wind dispersal of its small, buoyant seeds. Persistent cutting may be enough to control small infestations, but mechanical attempts at removal will not work in the long term because of the regenerative ability of knotweed rhizomes. NPS research at Penn State showed good results for foliar application of glyphosate plus sticker-spreader in early June followed by a second application in late August (Rhoads and Block 2002).
- ***Garlic mustard*** (*Alliaria petiolata*) may be controlled by hand pulling or cutting, though this is labor-intensive and less effective against large infestations. All plant materials should be removed from the site after cutting or pulling, since flowering plants can still produce seeds after being uprooted; mechanical removal must continue

for several years until the seed bank is emptied. Annual mowing or prescribed burning are effective for larger populations (Rhoads and Block 2002).

- ***Obtuse-leaved border privet*** (*Ligustrum vulgare*) seedlings can be pulled by hand or a weed wrench can be used to remove larger plants. Mowing or cutting is effective, although it will resprout. Herbicides can be used effectively to control privet; glyphosate and triclopyr are recommended. Either can be used in water as a foliar application or to treat cut stumps. Treatment of the basal 12–15 inches of woody stems with 25% triclopyr in oil is another alternative (Rhoads and Block 2002).
- ***Autumn olive*** (*Eleagnus umbellata*) seedlings and sprouts can be pulled by hand and the roots should be removed completely. Because cutting or fire alone results in thicker, denser growth upon resprouting, use of chemical herbicides are required to remove larger individuals. Glyphosate can be used to control larger plants. Foliar application of glyphosphate is effective. In areas where other desirable species are present, the herbicide should be applied to freshly cut stumps to minimize damage to other plants (Rhoads and Block 2002).
- ***Wineberry*** (*Rubus phoenicolasius*) can be pulled by hand or by using a 4-prong spreading fork. Cane fragments should be removed completely from the soil and branches with fruits should be bagged. Canes and all other plant material can be composted (http://www.nps.gov/plants/alien/fact/ruph1.htm).
- ***Oriental bittersweet*** (*Celastrus orbiculatus*) vines can be pulled out by the roots by hand. Glyphosphate has been shown to be effective, especially when the herbicide has been applied following mowing or cutting. Vines should be bagged and landfilled or at least left in a bag long enough to kill the seeds (http://www.nps.gov/plants/alien/fact/ceor1.htm).
- ***Common buckthorn*** /Glossy buckthorn (*Rhamnus frangula/R. catharica*) can be removed by mechanical (cutting) and chemical (triclopyr 1:4 herbicide:water mix or glyphosphate 1:5 water herbicide mix) means. A combination of cutting and herbicide application to cut stumps has been effective. Use of fire is also effective where applicable (http://www.nps.gov/plants/alien/fact/rhca1.htm).
- ***Japanese honeysuckle*** *(Lonicera japonica)* Repeated pulling of entire vines and root systems may be effective. Hand pull seedlings and young plants when the soil is moist, holding low on the stem to remove the whole plant along with its roots. A 2.5% rate of glyphosate (e.g., Rodeo for wetlands; Roundup for uplands) mixed with water and an appropriate surfactant, to foliage from spring through fall. Treatment in the fall, when many non-target plants are going dormant, is best (http://www.nps.gov/plants/alien/factmain.htm).
- ***Norway maple*** (*Acer platanoides*) To control existing stands, manual, mechanical and chemical means are available. Seedlings can be pulled by hand and small to large trees can be cut to the ground, repeating as necessary to control any re-growth from sprouts. Glyphosate and triclopyr herbicides have been successfully used to control Norway maple (http://www.nps.gov/plants/alien/pubs/midatlantic/acpl.htm).
- ***Tree of heaven*** *(Ailanthus altissima)* can be best controlled by manual removal of young seedlings. However, the entire root must be removed or it may resprout. It may take several trimmings and cuttings to remove larger saplings. Girdling (manually cutting away bark and cambium tissues around the trunks) is an effective and relatively inexpensive method for killing larger stems. Use of Glyphosate, either sprayed onto the leaves or painted onto a freshly cut stump will kill the plant (http://www.nps.gov/plants/alien/factmain.htm).

4: Manage Maintained Landscapes

Background, Concepts, and Broad Goals

While the predominant cover type of the Mount Washington area is forest, several areas within the greenway are maintained as non-forest cover types (woodlands, shrublands, grasslands) for a variety of purposes. Woodland, grassland and shrubland patches within the Study Area area can be categorized as: utility and transportation corridors, yards, open (park) areas, athletic fields, and those areas manipulated to preserve views of the city from the top of Mount Washington.

Utility corridors and transportation rights-of-way represent two different types of maintained areas. Both are linear patches consisting of extremely modified, and often non-native vegetation. While the species present in these areas are often similar, the relative composition and successional state differ between these two cultural landscape types due to differences in the length of time between disturbances by maintenance. In the Study Area, these patches range from minimally maintained shrublands beneath power lines and on top of gas and water lines to regularly maintained grass-dominated patches along streets on Mount Washington. The former consist of native and non-native shrub and herbaceous species identified in the patch vegetation community descriptions. The later are predominantly herbaceous plant-dominated patches maintained several times during the growing season and are similar in composition to the yards and athletic fields mentioned above.

Power line right-of-way, Duquesne Heights Greenway

--Photo by WPC staff

Athletic fields and other maintained open areas in parks and parcels developed for organized recreation represent limited options for use of native plants. Grasses used for lawns and sports fields are predominantly non-native cool season grasses such as Kentucky bluegrass (*Poa pratensis*) and fescues (*Festuca spp.*) and often escape into non-maintained or natural areas.

Viewing areas are surrounded by patches of vegetation dominated by native and non-native shrubs and tree species kept in a perpetual shrubland state to allow views of the city from Grandview Avenue. Current management activities required to maintain views from observation decks and along Grandview Avenue and in Grandview Park are costly and require yearly maintenance. While the current management technique of coppicing (lopping off the tops of trees) ensures a view of the city, the results, like a haircut, are temporary and have resulted in artificial areas of shrubland. The practice encourages species able to tolerate periodic cutting and results in plants with an unkempt weedy appearance particularly in winter and spring months.

Landscaping Using Native Species

The use of native vegetation carries with it a number of advantages: superior longevity and adaptability, potentially lower cost and less likelihood of problems with aggressive behavior. Additionally, use of natives helps to define the uniqueness of a region and a place. There are many non-native cultivars that grow well and do not exhibit aggressive behavior that are used routinely in the landscaping industry. However, the ability of these plants to survive for long periods of time and reproduce may be limited, especially if they are chosen for their non-invasive behavior. All things being equal, the choice to favor natives is no more difficult than selecting non-natives.

Rhodes and Block (2002) suggest the following replacements for common non-native landscaping shrubs. All are found in local nurseries, although they may be slightly harder to find than the common non-natives and may be slightly more expensive.

Native species used to replace non-natives planted as hedges (2 ft. to 10 ft.).

To replace non-native hedge species such as privet, winged euonymus, multiflora rose, and Japanese barberry:

winterberry holly (*Ilex verticillata*)
inkberry holly (*Ilex glabra*)
New Jersey tea (*Ceanothus americanus*)
bayberry (*Myrica pensylvanica*)
wild hydrangea (*Hydrangea aborescens*)
ninebark (*Physocarpus opulifolius*)
silky dogwood (*Cornus racemosa)*
nannyberry (*V. lentago*)
red chokeberry (*Aronia arbutifolia)*
black chokeberry *(A. melanocarpa*)
pasture rose (*Rosa carolina*)
wild rose (*R. virginiana*)
swamp rose (*R. palustris*)
arrow-wood (*Viburnum dentatum, V. recognitum*)

Native species used to replace non-natives planted for attractive flower and fruit displays.

To replace bush honeysuckle, autumn olive, and other species traditionally used for flower or fruit displays, many native shrubs can provide attractive alternatives and serve as food for birds and other wildlife:

winterberry holly (*Ilex verticillata*)
red chokeberry (*Aronia arbutifolia)*
black chokeberry *(A. melanocarpa*)
bayberry (*Myrica pensylvanica*)
arrow-wood (*Viburnum recognitum or V. dentatum*)
wild hydrangea (*Hydrangea arborescens*)
ninebark (*Physocarpus opulifolius*)
spicebush (*Lindera benzoin)*
blackhaw *(Viburnum prunifolium)*
silky dogwood (*Cornus racemosa)*
buttonbush (*Cephalanthus occidentalis*)

Recommendations

- Develop a comprehensive landscape planting plan for the area within 20 meters from the edge of Grandview Avenue (see "Defining Views" recommendation below). The area surrounding the viewing decks and overlooks along Grandview Avenue and in Grandview Park are primarily shrublands and woodlands maintained through cutting and trimming of various tree species, particularly the native box elder, sumac, and black locust and non-native Norway maple and tree-of-heaven. Replacing these native and non-native tree species with small native trees and shrubs that do not grow large enough to obscure the view will save labor costs by eliminating the need for annual or semi-annual cutting, and facilitate the establishment of native species.

- Improve vegetation health, structure and aesthetics in utility rights-of-way (ROW). Three aspects of ROW management to target for improvement are: 1) control of widespread invasive plants, 2) more targeted control of interfering vegetation, and 3) use of native plants for cover.

  Utilities manage their rights-of-way to allow easy inspection and access. Trees and large shrubs are often not compatible with these activities. However, utility ROW can be managed more sustainably and sensitively. Utility managers are often amenable to changes in management if their basic responsibilities and needs can be met. Limiting use of herbicides (now broadly used in ROWs), and substituting hand cutting with limited, plant-by- plant herbicide application could target the plants of concern—large-growing woody plants—and allow other plants to remain throughout the year. Invasive trees and shrubs can be controlled during scheduled maintenance using the same approach. For those ROW with erosion issues, native seed mixes formulated for southwestern Pennsylvania are available and can be used to enhance habitat, control erosion and improve appearance.

- Favor native plants; avoid invasives. There are few natives that can adequately replace the traditional turf species. However, park managers should be encouraged to use native plants or non-invasive cultivars in landscape plantings surrounding parks and athletic fields. For example, white pine (*Pinus strobus*) could be used for windbreaks instead of the somewhat invasive, non-native Norway spruce (*Picea abies*). Native tree and shrub species should be used whenever possible (see "Landscaping Using Native Plants" recommendation below) and plants identified as invasive species in this report and elsewhere should be avoided in all new landscape designs.

- Where possible, establish nurseries for future planting needs and material. Keeping stock on hand for various projects will save money, time and ensure that the species (and genotypes) desired will be available.

- Seek out plants and seeds from local stock (local genotypes) and identify reliable sources for such material. Numerous sources are available for plants grown from local seed sources. Again, with time and planning, some basic set of plants can be maintained in nurseries and can be supplemented with outside stock.

- Utilize warm season grasses for certain non-intensive use areas. It is difficult to replace the function and durability of turf grass, but in some areas dense, non-

native turf is not required. Native warm season grasses would provide superior wildlife habitat, cover and forage. For erosion-prone areas, warm season grasses and native herbs could be the long-term cover goal while shorter-lived species like annual rye (Elymus annuus) can be used to establish initial cover.

5: Define and Manage Views

Background, Concepts, and Broad Goals

A viewshed can be most simply described as the area that is visible from a particular point of view. There are numerous considerations to take into account when analyzing the significance of the view from any area, including the accessibility of the point of view, the area that the view covers, and the quality of the view. Also, elements of a view can be categorized as long, medium and short range views; each contributes to the overall experience and impression that a person receives from a view.

From its high elevation, Mount Washington provides a view of much of downtown Pittsburgh and many landmarks and points of interest. It allows viewing of both the cityscape and natural environs from several angles. Views of the city are extremely important to Mount Washington both culturally and economically.

In the Allegheny Land Trust's *Hillsides Report*, it was found that:

> …Studies show Americans' consistent environmental preference for views of natural landscapes (Nasar 1999). The scenic quality of landscape views is highly correlated with the 'unspoiled' character of natural environments. The hillside slopes heightens the aesthetic impact of the views because they occupy so much of the visual field. Wooded slopes create Pittsburgh's 'green walls', which terminate view corridors throughout the city as well as form backdrops for panoramic vistas….

The views from Mount Washington have been identified in Pittsburgh's zoning code as "contributing to the aesthetic and cultural value of the city" (http://www.alleghenylandtrust.org/Hillsides/FnlHillsidesCommRprt.pdf).

Although panoramic views are the main attraction for visitors to the front side of Mount Washington, other interesting and more discrete views exist. Some are seasonal—obscured by vegetation during the growing season but opening up to fairly spectacular views later in the season. Such opportunities should be considered for creating interest in the less used portions of the Study Area.

Mount Washington is also one of the most dominant green spaces seen from downtown. It sets a context for views from the Point, from downtown high residences, from many major office buildings and a variety of cultural locations in the center of the city and on the city's North Side.

Recommendations

- Develop a comprehensive landscape planting plan for the area within 20 meters from the edge of Grandview Avenue using native small trees, shrubs, and herbaceous plants that will not obscure the view, will provide year-round color, and will hold soils and help stabilize slopes. This will improve seasonal appearance of the Mount Washington hillsides from all vantage points and result in a more sustainable landscape and viewing opportunity A plan for removing controlling non-native plants and tall-growing native trees (i.e. box elder, sumac) should be included in the landscaping plan.
- Identify other viewing opportunities, including those mentioned in this report, and use the information to help prioritize the development of trails, signage and other destinations. Develop a map of unique views and use it as the basis for literature promoting the proposed Byway Park and its destinations. Such a publication could become quite popular and serve part of a larger guide to the proposed park.
- Work with homeowners and businesses to develop sustainable view designs and plantings. Just as with the Grandview overlook, a successful example set by a visible landowner or business could go a long way to generate interest in newer ways to approach landscaping.

 # 6: Stabilize Slopes

Background and Concepts

Substantial areas of fill, poorly managed stormwater, and clearing or lack of established (woody) vegetation combine to create very challenging situations for stabilizing slopes and checking erosion within the Study Area.

Stabilizing fill is inherently difficult and vegetation may be hard to establish depending upon the chemistry and physical characteristics of the material. Runoff from roads, parking lots and buildings is often conducted through pipes or swales onto steep hillsides where already existing problems are compounded. Areas where vegetation is lacking or has failed to establish are vulnerable to erosion and more catastrophic failures. Alleviating as many compounding factors as possible through focused management should lead to more stable conditions in a number of areas.

Landslide on the north face of Mount Washington
Spring 2005 *-- Photo by WPC staff*

Many areas on Mount Washington and in the Study Area are held in place by substantial, engineered structures and other areas could benefit from engineered intervention. However, there are opportunities to improve conditions, at least on a smaller scale, which should be considered in combination with other management efforts.

The very nature of these slopes, in combination with past use and current development, makes for a relatively fragile and slow-to-recover environment. The sections that involve substantial infrastructure, like roads and inclines, require engineered solutions to remain stable. Other sections have recovered vegetation but little organic material. Many areas are compromised by runoff and directed drainage from miscellaneous development or roads.

Compaction, poor soil quality and pollutants in fill, rubble, and debris from coal mining may reduce the success of attempts to establish native plant populations. Additionally, although the establishment of vegetation will, in most cases, add stability to slopes and check erosion, unconsolidated soils and fill may be too deep and inherently unstable to allow root penetration into more consolidated substrate. Such "islands" of bound together materials can slide and move over consolidated material or bedrock, especially when soils are saturated. A more detailed investigation of soils may help determine where restoration may likely be successful without significant remediation to the soils.

Opportunities to stabilize and revegetate slopes with minimal engineering or structural intervention exist. However, any such project would benefit greatly from consultation with soil scientists and/or geologists to better understand the substrate and issues within a project area. Overall, keeping excess and channelized stormwater away from slopes, focusing on improving soils and increasing the coverage of vegetation, and, in some cases, terracing or recontouring of unstable sections are options to address slope issues.

Controlling Storm Water and Runoff

Water can erode surface material, resulting in soil loss and channelization. Saturation of subsurface material can cause landslides. These effects are exacerbated when slopes lack cohesiveness due to overburden of unconsolidated (fill) material and/or lack of vegetation that can absorb water and put down roots. Also, slopes that lack organic material, as do many in sections of the Study Area, conduct water rapidly downhill, absorbing much less than those areas with ground layer vegetation and humic layers.

Approaches to Low Impact Development (LID) have gained recognition within the planning and development community for addressing the big issues related to stormwater management (Hager, 2003). Most approaches focus on improving the ability of development to handle water on site by either absorbing it or retaining for some amount of time and releasing it slowly.

Current management strategies include increasing permeability of traditionally impervious surfaces (e.g. parking lots); providing more opportunities for water infiltration adjacent to or within imperious areas (e.g. bioswales, raingardens); and capturing water for use or later release (rain barrels, cisterns). Some techniques are more easily applied to new development but retrofitting of existing facilities is possible. Below are some of these approaches and descriptions of their uses adapted from Hager (Hager, 2003):

* **Conservation and minimization** through narrower residential streets, reductions in impervious sidewalk area, additions of porous pavement or replacement of existing pavement with pervious structures, and creation of concave medians and landscaped traffic-calming features;

* **Conveyance** through grassed channels and bioretention channels, and disconnection of impervious areas to redirect runoff to vegetated areas;
* **Storage** to reduce peak discharge via pedestal sidewalks, rainwater capture and use (rain barrels), green roofs, and yard, curb, or subsurface storage;
* **Infiltration** through trenches and basins, and exfiltration devices;
* **Landscaping** measures such as bioretention cells, rain gardens, slope reduction, planter boxes, native ground cover, and green alleys.

The Study Area portion of Mount Washington drains into Saw Mill Run (a tributary to the Ohio River), the Ohio River or the Monongahela River (see Figure 8. "Watersheds"). The significance of this division in drainage lies in the stormwater management plan requirements that are attached to each of these drainages. For those sections of Mount Washington that drain to the Monongahela River, no on-site retention of water is necessary if stormwater can be successfully conveyed to conduits that take it down slope to Alcosan interceptors located along the river. For those sections of Mount Washington that drain to Saw Mill Run, on-site retention is required for any project contributing more than 5000 square feet of impervious surface (roofs, driveways, parking lots, etc.) (Dan Sentz, personal communication). Efforts applied to improving stormwater management within the Study Area need to take this point into consideration in the selection, promotion and design of projects.

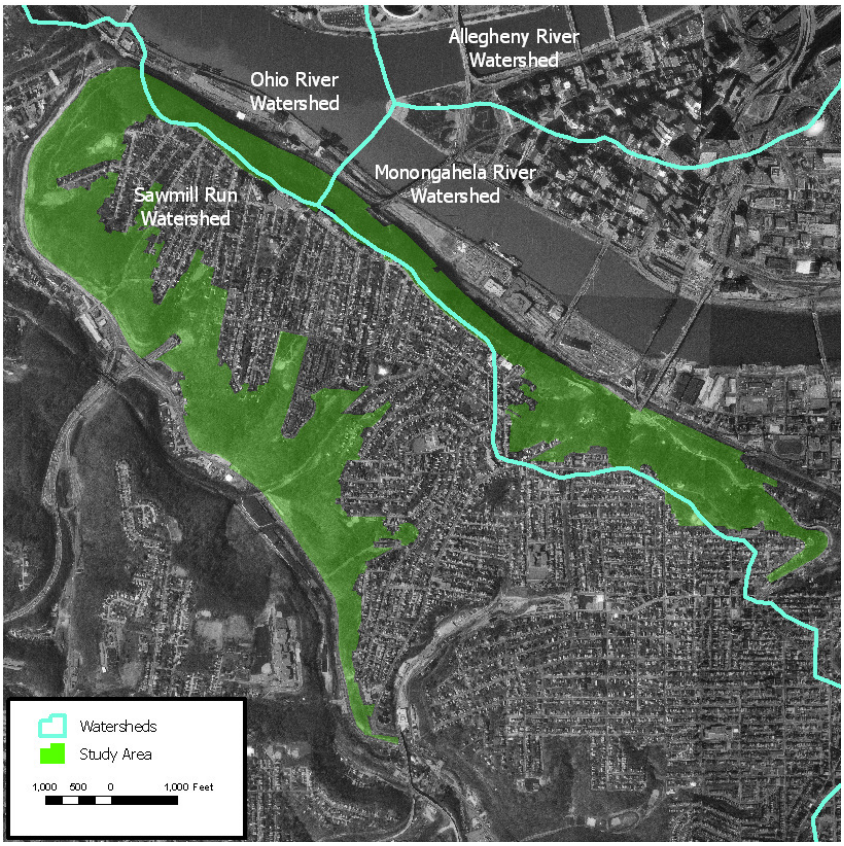


Figure 8. Watersheds of Mount Washington: Ohio River, Monongahela River, Saw Mill Run

Use of Organic Material (Compost) on Slopes

Bare, minimally vegetated slopes do not absorb or retain water to the same extent that those with developed organic layers and vegetative cover (http://yosemite.epa.gov/R10/ECOCOMM.NSF/0/456fc68f98abeb35882568800081c585?OpenDocument). The development of humic (organic) layers takes time as leaves and plant material accumulate and decay. Slopes are naturally difficult places for soil development and those within the Study Area pose exceptional challenges due to a combination of past disturbance and alkaline bedrock and sub-soils.

Supplementing areas with organic material in the form of compost has proved successful for a number of groups, including the Connecticut Department of Transportation (Connecticut Department of Environmental Protection, 2001.) Studies have demonstrated that compost applied to open soils reduces erosion and promotes the growth of vegetation (Connecticut Department of Environmental Protection, 2001.) The results in some cases are fairly dramatic and composted slopes can hold up very well even to large rainfall events.

The beauty of this approach lies in the ready availability of compost from city and municipal programs and the simplicity and safety with which the material can be used. Also, it can allow lot-by-lot improvements and involve homeowners and community groups. Consultation with regional groups who have used the technique would be very useful and allow site-specific techniques to be developed.

Aggressive Intervention

Thirty-five years ago, Griswold, Winters and Swain, landscape architects described various options for physical intervention in stabilizing slopes including cribbing, retaining walls, meshes and benching (Griswald, et al, 1970). Those are still options today, but there has been much work in the biotechnical engineering field oriented at substituting plantings for purely mechanical means of reinforcement. However, as was recommended by Griswold, et al, underlying causes of instability must be determined and alleviated. Engineering studies and consultation with professional geologists will be required in the cases where large-scale, persistent slope problems exist (landslides, bedrock collapse, etc.).

Recommendations

- Inventory the current stormwater management system and look for opportunities to rectify point flows (e.g. pipes discharging onto slopes) with better on-site approaches. Also, identify areas where stormwater is directly impacting slopes and slope stability.
- Encourage retrofitting of parking facilities and road rights-of-way to include bioretention technologies through the identification of funding partnerships and changes in city planning guidelines and review policies.
- Work with the development review process and developers to explore low-impact, on-site handling of stormwater.
- Integrate use of compost into slope planting projects including forest restoration and formalized landscaping.
- Identify properties and partner with landowners, public and private, where smaller-scale compost application and planting projects could be undertaken and showcased.
- Bring attention to highly unstable areas and develop proposals and funding possibilities for aggressive intervention incorporating innovative bioretention approaches.

7: Develop Pedestrian Linkages & Guidance

Background, Concepts, and Broad Goals

The desire to provide connection along the length of the Study Area is apparent in the conceptual name first applied to the greenway: the Emerald Link. From above, the predominately vegetated open spaces of Mount Washington appear as an already united green feature and, to some extent, that is the case. However, the actual connections, whether ecological or human, that exist are limited.

Many features including utility rights-of-way, roads, private property, steep slopes and ravines are barriers to access, movement and connection, as are the confusing and limited access points to many sections of the Study Area. There are few (known to the public) attractions or destinations other than those within the Grandview promenade. Additionally, safety is an issue. Dangerous traffic crossings and the presence of garbage, abandoned vehicles, steep drop-offs and difficult trail surfaces are present throughout the Study Area and threaten the safety of users.

The history of Mount Washington is a compelling one and is intimately tied to the natural resources that have made and continue to make it attractive. However, for residents and especially for visitors, there are few opportunities to encounter information about Mount Washington's history, particularly its natural history, environmental assets and future possibilities. Current nodes of contact such as the incline stations and Grandview Avenue viewing platforms do provide some exposure to the larger picture of Mount Washington, but these sites are vastly underutilized as entrees into richer information and deeper levels of interaction. Of course, additional services and activities will need to be developed over time, but some materials could be developed quickly to enhance interaction with the public.

Quality of habitat, aesthetics, access and safety are important factors in considering connection across the Study Area. Focus on improving habitat quality will involve many aspects of natural resource management, infrastructure maintenance, and development standards and practices. All of these factors combine to create the experience that greets users of the greenway. Improvement of these factors is critical in the success of any effort to provide valuable and valued linkage throughout the area.

Recommendations

- Establish a continuous route connecting all parts of the proposed Byway Park. Currently, surface streets would play a large role in the travel of someone desiring to traverse the area from one end to the other on known trails and publicly owned land. In many cases, trails run seamlessly between public and private holdings but without permission through agreements or easements, it would not be possible to declare a trail open to the public. A number of approaches will be needed, in various combinations, to develop a truly connected Byway Park. See "Pedestrian Link Trails" map.
    - plan and construct trails through public parcels where no trails exist;
    - obtain right-of-way easements, management agreements or outright ownership of privately owned parcels critical for linkage;
    - negotiate and establish pedestrian access to PennDOT managed rights-of-way;

    - establish safe pedestrian passage/bypass around hazards or obstacles such as steep slopes, cliffs or ravines.
- Develop and install proper signage showing the official continuous Byway Park route and the access points to trails. These signs should be well designed but flexible, keeping in mind that the official route will, hopefully, change over time as new sections are added and access issues are resolved. As the route can be moved closer to the wooded sections of the greenway, appropriate signs will need to be placed or added. The signage for the official route can be very simple, perhaps with a symbol or logo indicating the Byway Park and a directional indicator. The trail access points, in addition to the symbol/logo, should have a map or description of the trail and clearly showing destinations, features and return routes.
- Eliminate hazards and improve vigilance. Although no large dumps or unusual hazards were noted, there were many smaller dump sites and an assortment of trash scattered throughout the Greenway. Removing trash and hazards, especially associated with trails and potential trails, will much improve the appearance and improve the perception of care and safety.
- Local cleanup efforts, in partnership with local environmental organizations (PA Cleanways, Sierra Club, SCA, etc.), could focus on the following:
    - Work with local law enforcement and adjacent neighbors to prevent/control dumping of trash.
    - Work with local law enforcement and adjacent neighbors to limit ORV access on trails.
    - Establish areas where yard waste can be safely deposited and composted (keeping in mind applications as described in the Slope Stabilization recommendations).
    - Erect railings along steep cliffs and drop-offs, properly maintain trails stairs and sidewalks.
- Develop signage that depicts the natural, cultural and industrial history of Mount Washington and its special role in the overall development of Pittsburgh. Such signage would be of a more permanent nature than that used to mark accesses, trails and directions. Siting of signage will require thought and cooperation from numerous entities as these signs would be oriented to very public sections of the Greenway. Signage could:
    - Present the coal history of Mount Washington at select sites along the north face of Grandview Avenue where coal seams were visible prior to regrowth of vegetation.
    - Present economic history in relation to the inclines and utilize the views of industry and the river, as seen from the inclines, as points of departure for that information.
    - Point out cultural history at key sites such as Chatham Village and other cultural locations.
    - Highlight and discuss important ecological features at various sites to inform and build support for protection and improvement of environmental quality of Mount Washington's green resources. Specifically identify key environmental functions such as water retention, air quality, erosion control, temperature modulation, important habitat, etc.

Until access points are selected and legal access agreements are finalized, the ideal sites cannot be determined. Once the access points are clear, the selection of a preliminary set of sign points will be easy to make.

#8: Organize and Support a Community Stewardship Team

Given the need to sustain action on many of these recommendations for a long period of time, due to the cyclical nature of many of the proposed activities, and due to seasonal weather constraints, the CDC will need a committed group of stewards who understand the scope and purposes of this work and can generate long term support as needed in the community. This Stewardship team may consist of a combination of CDC staff, board and community volunteers, organized by task areas, and working in an interlinked fashion similar to the current parallel activities of the Open Space Task Force, Emerald Link committee and other CDC initiated groups. Such a team could help map and remove invasive species, build trails, identify best sign locations, clean trash and remove hazards from green spaces, plant and maintain restored areas among other possibilities.