

National Park Service
U.S. Department of the Interior

Northeast Region
Philadelphia, Pennsylvania



Vegetation Classification and Mapping at Allegheny Portage Railroad National Historic Site

Technical Report NPS/NER/NRTR—2007/079



ON THE COVER

Allegheny Hardwood Forest in Allegheny Portage Railroad National Historic Site.
Photograph by: Ephraim Zimmerman.

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March 2007

U.S. Department of the Interior
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Philadelphia, Pennsylvania

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This report was accomplished under Cooperative Agreements 4560A0019 and H4506060766, with assistance from the NPS. The statements, findings, conclusions, recommendations, and data in this report are solely those of the author(s), and do not necessarily reflect the views of the U.S. Department of the Interior, National Park Service.

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Please cite this publication as:

Perles, S. J., G. S. Podneisinski, E. A. Zimmerman, E. Eastman, and L. A. Sneddon. 2007. Vegetation Classification and Mapping at Allegheny Portage Railroad National Historic Site. Technical Report NPS/NER/NRTR—2007/079. National Park Service. Philadelphia, PA.

Table of Contents

	Page
Figures.....	v
Tables.....	viii
Appendixes	ix
Acknowledgments.....	x
Executive Summary	xi
Introduction.....	1
General Background	1
Park-specific Information	2
Project Area	4
Location and Regional Setting.....	4
Park Environmental Attributes	4
Materials and Methods.....	8
Planning and Scoping	8
Preliminary Data Collection and Review of Existing Information.....	8
Aerial Photography Acquisition and Processing	8
Photointerpretation.....	9
Field Data Collection and Classification	10
Field Survey	13
Vegetation Classification and Characterization.....	15
Vegetation Map Preparation	16
Accuracy Assessment	17
Positional Accuracy Assessment	17
	iii

Thematic Accuracy Assessment	17
Results.....	23
Vegetation Classification and Characterization.....	23
Vegetation Association Descriptions	26
Vegetation Map Production	100
Accuracy Assessment	100
Positional Accuracy	100
Thematic Accuracy	100
Project Deliverables	104
Discussion	105
Vegetation Classification and Characterization.....	105
Vegetation Map Production	107
Recommendations for Future Projects.....	107
Literature Cited	109

Figures

	Page
Figure 1. Location of Allegheny Portage Railroad National Historic Site in Blair and Cambria counties on the Hollidaysburg, Cresson, Nanty Glo, and Geistown, PA 1:24,000 USGS topographic quad maps.	5
Figure 2. Vegetation cover types and Anderson level II categories (modified) for Allegheny Portage Railroad National Historic Site (ALPO).	12
Figure 3. Locations of vegetation plots sampled in Allegheny Portage Railroad National Historic Site (ALPO) for vegetation classification and mapping.	14
Figure 4. Ground control points used to calculate horizontal positional accuracy of the Allegheny Portage Railroad National Historic Site (ALPO) mosaics.	18
Figure 5. Locations of 134 thematic accuracy assessment sampling points in Allegheny Portage Railroad National Historic Site.	21
Figure 6. Dendrogram interpreted from the two-way indicator species analysis (TWINSpan) results, showing 16 vegetation associations in Allegheny Portage Railroad National Historic Site (ALPO). The plots that were determined through the results evaluation to be misclassified by this analysis are labeled in italics and are shown correctly classified. The branches of the dendrogram in which the misclassified plots were originally incorrectly located are marked with asterisks (*).	24
Figure 7. Ordination diagram from the non-metric multidimensional ordination analysis (NMS) showing 16 vegetation associations in Allegheny Portage Railroad National Historic Site (ALPO).	25
Figure 8. Dry Eastern Hemlock - Oak Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.26). August 2005. NAD 1983 / UTM easting 711995, northing 4477990.	30
Figure 9. Dry Eastern Hemlock - Oak Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.35). August 2005. NAD 1983 / UTM easting 715451, northing 4476794.	30
Figure 10. Eastern Hemlock - Northern Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.20). August 2005. NAD 1983 / UTM easting 708593, northing 4480927.	34
Figure 11. Eastern Hemlock - Northern Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.47). August 2005. NAD 1983 / UTM easting 710159, northing 4479324.	35

Figure 12. Eastern Hemlock - Tuliptree - Birch Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.28). August 2005. NAD 1983 / UTM easting 712578, northing 4477561.....	40
Figure 13. Northern Red Oak - Mixed Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.10). August 2005. NAD 1983 / UTM easting 706729, northing 4482059.....	45
Figure 14. Northern Red Oak - Mixed Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.75). August 2005. NAD 1983 / UTM easting 714891, northing 4476636.....	46
Figure 15. Allegheny Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.25). August 2005. NAD 1983 / UTM easting 710938, northing 4478463.	51
Figure 16. Allegheny Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.53). August 2005. NAD 1983 / UTM easting 708003, northing 4480716.	52
Figure 17. Northern Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.22). August 2005. NAD 1983 / UTM easting 709785, northing 4479964.....	57
Figure 18. Northern Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.48). August 2005. NAD 1983 / UTM easting 710086, northing 4479495.....	57
Figure 19. Tuliptree - Beech - Maple Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.38). August 2005. NAD 1983 / UTM easting 682124, northing 4470650.	61
Figure 20. Tuliptree - Beech - Maple Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.49). August 2005. NAD 1983 / UTM easting 709330, northing 4480379.	62
Figure 21. Modified Successional Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.1). August 2005. NAD 1983 / UTM easting 707197, northing 4481360.	66
Figure 22. Modified Successional Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.29). August 2005. NAD 1983 / UTM easting 715457, northing 4476594.	67
Figure 23. Conifer Plantation in Allegheny Portage Railroad National Historic Site (plot ALPO.65). August 2005. NAD 1983 / UTM easting 713118, northing 4477375.....	71
Figure 24. Sugar Maple Floodplain Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.23). August 2005. NAD 1983 / UTM easting 710441, northing 4478724.	75
Figure 25. Sugar Maple Floodplain Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.66). August 2005. NAD 1983 / UTM easting 713227, northing 4477350.	75

Figure 26. Alder Riverine Shrubland in Allegheny Portage Railroad National Historic Site (plot ALPO.39). August 2005. NAD 1983 / UTM easting 681825, northing 4470023.....	78
Figure 27. Reed Canarygrass Riverine Grassland in Allegheny Portage Railroad National Historic Site (plot ALPO.32). August 2005. NAD 1983 / UTM easting 715611, northing 4476547.....	82
Figure 28. Japanese or Giant Knotweed Herbaceous Vegetation in Allegheny Portage Railroad National Historic Site (plot ALPO.41). August 2005. NAD 1983 / UTM easting 682042, northing 4470513.....	86
Figure 29. Wet Meadow in Allegheny Portage Railroad National Historic Site (plot ALPO.19). August 2005. NAD 1983 / UTM easting 707301, northing 4481367.	90
Figure 30. Wet Meadow in Allegheny Portage Railroad National Historic Site (plot ALPO.77). August 2005. NAD 1983 / UTM easting 713162, northing 4477345.	90
Figure 31. Successional Old Field in Allegheny Portage Railroad National Historic Site (plot ALPO.17). August 2005. NAD 1983 / UTM easting 707038, northing 4481316.....	94
Figure 32. Successional Old Field in Allegheny Portage Railroad National Historic Site (plot ALPO.62). August 2005. NAD 1983 / UTM easting 707677, northing 4481573.....	95
Figure 33. Sparsely Vegetated Cliff in Allegheny Portage Railroad National Historic Site (plot ALPO.24). August 2005. NAD 1983 / UTM easting 710458, northing 4478596.....	99
Figure 34. Vegetation associations and Anderson level II categories (modified) for Allegheny Portage Railroad National Historic Site (ALPO).....	101

Tables

	Page
Table 1. Summary of key information for the Allegheny Portage Railroad National Historic Site mosaics.....	10
Table 2. Number of polygons, total mapped hectares, mapped hectares within the park boundary, and number of plots sampled for vegetation cover types and Anderson level II categories (modified) at Allegheny Portage Railroad National Historic Site (ALPO).....	11
Table 3. Relationship between Anderson level II category (modified) map labels and the Anderson level I and II classifications.....	11
Table 4. Thematic accuracy assessment (AA) sampling strategy for Allegheny Portage Railroad National Historic Site. Refer to the Vegetation Map Production section within the Results section for discussion of the mosaics.....	19
Table 5. Correlations (r values) between measured variables and the two axes calculated in the non-metric multidimensional ordination analysis (NMS).	26
Table 6. Number of polygons, total mapped hectares, and mapped hectares within the park boundary for vegetation associations and Anderson level II categories (modified) at Allegheny Portage Railroad National Historic Site (ALPO).....	102
Table 7. Contingency matrix and calculated errors for the thematic accuracy assessment of the vegetation association map of Allegheny Portage Railroad National Historic Site.	103
Table 8. Summary of products resulting from the Allegheny Portage Railroad National Historic Site vegetation classification and mapping project.....	104

Appendixes

	Page
Appendix A. Aerial photograph interpretation keys to vegetation cover types, vegetation associations, and Anderson level II categories (modified) at Allegheny Portage Railroad National Historic Site.....	113
Appendix B. Vegetation plot sampling form.....	123
Appendix C. Plants observed in Allegheny Portage Railroad National Historic Site during vegetation plot and thematic accuracy assessment sampling.	126
Appendix D. Dichotomous field key to the vegetation associations of Allegheny Portage Railroad National Historic Site.....	135
Appendix E. Accuracy assessment data form.....	140
Appendix F. Index of representative photographs of vegetation classification sampling plots in Allegheny Portage Railroad National Historic Site.....	142
Appendix G. Bibliography for global vegetation descriptions from the National Vegetation Classification System.....	146

Acknowledgments

We would like to thank the following people for their time and assistance with this project. Kathy Penrod of the National Park Service provided us with previous research conducted at Allegheny Portage Railroad National Historic Site, applicable GIS files, information on ongoing management practices, and access for sampling within the park. John Kunsman and Susan Klugman of the Pennsylvania Natural Heritage Program contributed their valuable botanical and GIS expertise to this project. Robert Coxe, Jessica McPherson, Charles Bier, Alice Doolittle, and Steve Grund, also from the Pennsylvania Natural Heritage Program, previously worked on inventory and mapping projects at Allegheny Portage Railroad National Historic Site. Ery Largay and Mary Russo of NatureServe developed the crosswalks to the National Vegetation Classification System. The contributions of all these individuals are greatly appreciated.

Executive Summary

Vegetation classification and mapping was conducted at Allegheny Portage Railroad National Historic Site, creating a current digital geospatial vegetation database for the park. Sixteen vegetation associations, Alder Riverine Shrubland, Allegheny Hardwood Forest, Conifer Plantation, Dry Eastern Hemlock - Oak Forest, Eastern Hemlock - Northern Hardwood Forest, Eastern Hemlock - Tuliptree - Birch Forest, Japanese or Giant Knotweed Herbaceous Vegetation, Modified Successional Forest, Northern Hardwood Forest, Northern Red Oak - Northern Hardwood Forest, Reed Canarygrass Riverine Grassland, Sparsely Vegetated Cliff, Successional Old Field, Sugar Maple Floodplain Forest, Tuliptree - Beech - Maple Forest, and Wet Meadow, that occur within the park were identified and described in detail. These vegetation types are strongly influenced by the varied environmental settings and land use history of the park.

The most abundant association in Allegheny Portage Railroad National Historic Site is Allegheny Hardwood Forest, covering over half (52%) of the park area. This association is the most common forest type in the Summit Level section of the Main Unit of the park and is typical in northern and western Pennsylvania on higher elevations of the Allegheny Plateau. Northern Hardwood Forest is the second most common vegetation association within the park (17% of the park area). The higher quality examples of these two forest types occur in the Main Unit to the north and west of the Hollidaysburg Reservoir.

Several other forest associations occur scattered throughout the park within these two common forest types. Three hemlock - hardwood types are differentiated from each other by their environmental setting and the species of co-dominant hardwoods. Dry Eastern Hemlock - Oak Forest occurs on dry upper slopes and is co-dominated by oaks, including chestnut oak (*Quercus prinus*). Eastern Hemlock - Tuliptree - Birch Forest, co-dominated by tuliptree (*Liriodendron tulipifera*) and birches (*Betula* spp.), is restricted to ravines and streamsides. Eastern Hemlock - Northern Hardwood Forest is more common (6% of the park area) than the other two hemlock types. It occurs in areas where hemlock mixes with the two common hardwood forest types, and is co-dominant with maples (*Acer* spp.), birches, and black cherry (*Prunus serotina*).

Northern Red Oak - Northern Hardwood Forest also occurs in patches throughout the park; however, this association was often misclassified during the classification analyses and reported very low errors of commission and omission during accuracy assessment. This was caused by the patchy and inconsistent distribution of northern red oak (*Quercus rubra*) and other oaks (*Quercus* spp.) within the Allegheny Hardwood Forest and Northern Hardwood Forest. The other association that reported a low error of omission was Tuliptree - Beech - Maple Forest. This association is most abundant in the Staple Bend Unit, where tuliptree colonized the mesic slopes after they were cleared. The errors were caused by difficulties with aerial photography interpretation and the great variation in the composition of the hardwood forests due to previous logging and disturbances.

The forest types in the Staple Bend Unit are generally of lower quality, compared with the forests at higher elevations in the Main Unit. Much of the Staple Bend Unit contains dense infestations of Japanese knotweed (*Polygonum cuspidatum*), giant knotweed (*Polygonum*

sachalinense), or the hybrid of those two species (*Polygonum x bohémica*). All of the mapped occurrences of Japanese or Giant Knotweed Herbaceous Vegetation are located within the Staple Bend Unit.

Three associations are associated with riparian habitats along rivers, streams, and drainages. Alder Riverine Shrubland occurs in one small patch along the Little Conemaugh River in the Staple Bend Unit. The Main Unit contains a single occurrence of Reed Canarygrass Riverine Grassland along small drainages in the southeast corner of the unit. Wet Meadow occurs in a few locations within the Main Unit where herbaceous and graminoid vegetation surrounds small drainages. Sugar Maple Floodplain Forest covers more area than the previous two associations at the Main Unit, but is limited in extent to areas surrounding Blair Gap Run. Nine Sparsely Vegetated Cliff sites are shown in the vegetation association map; however, there may be additional cliffs in the park that were not captured by the map.

Due to previous disturbances and land use history, Modified Successional Forest, Conifer Plantations, and Successional Old Field are fairly common associations in the park, especially in the southeastern corner of the Main Unit. These vegetation types are a direct result of previous disturbances. They typically contain invasive species and often occur as mosaics with other disturbed or successional associations.

A map showing the locations of vegetation associations in the park was created, following the USGS/NPS Vegetation Mapping Program protocols (TNC and ESRI 1994a, b, c). These vegetation associations were also crosswalked to the National Vegetation Classification System in order to provide a regional and global context for the park's vegetation. A dichotomous field key was developed for these vegetation associations to assist with field recognition and classification. This project documents the vegetation associations of Allegheny Portage Railroad National Historic Site based on 2003 aerial photography and 2005 field sampling, and completes one of 12 basic inventory data sets for the park.

Keywords: vegetation association, vegetation classification, vegetation mapping, Allegheny Portage Railroad National Historic Site

Introduction

General Background

One of the goals of the National Park Service's Inventory and Monitoring Program is to provide the information and expertise needed by park managers for effective, long-term management of the natural resources held in trust (NPS 2003). The program recommends that 12 basic natural resource inventories be developed for each park that contains significant natural resources. These inventories provide crucial baseline information needed for proper park natural and cultural resource stewardship. A map of each park's vegetation, based on aerial photography less than five years old, is one of the 12 inventories recommended by the program (NPS 2003). To ensure that vegetation mapping is standardized across the National Park Service (NPS), The Nature Conservancy, in conjunction with NatureServe, the Federal Geographic Data Committee, and the Ecological Society of America Vegetation Subcommittee, developed a protocol for creating vegetation maps in national parks. This protocol was adopted by the United States Geological Survey (USGS)/NPS Vegetation Mapping Program as the standard (TNC and ESRI 1994a, b, c) and has been implemented at Allegheny Portage Railroad National Historic Site by the Pennsylvania Natural Heritage Program (PANHP).

The goal of the mapping effort at Allegheny Portage Railroad National Historic Site was to produce an up-to-date digital geospatial vegetation database for the park and to provide a plant species list, a dichotomous key for vegetation associations, and descriptions of the vegetation associations in the park. Baseline information on plant community composition and rarity is critical to developing desired conditions and park management goals relating to native plant communities, nonnative plant and insect species, and effects of deer browse and other disturbances. The identification and description of plant communities also provide habitat information important to understanding associated organisms, including animals, protozoans, bacteria, and fungi. A map of vegetation communities may allow inferences about the location and abundance of species that are characteristic of each community.

This report also describes the park's vegetation in the context of a national and regional vegetation classification. The Nature Conservancy, in conjunction with NatureServe, the Federal Geographic Data Committee, and the Ecological Society of America Vegetation Subcommittee, developed the National Vegetation Classification System (NVCS) in order to standardize vegetation classification and facilitate the comparison of vegetation types throughout the United States and internationally. The NVCS is a systematic approach to classifying existing natural vegetation using physiognomics and floristics. This classification system has a hierarchical structure (Grossman et al. 1998).

The basic unit of vegetation classification in the NVCS is the association. An association is defined as a plant community type that is relatively homogeneous in composition and structure and occurs in a uniform habitat. For example, Central Appalachian Hemlock - Northern Hardwood Forest is a common forest type on slopes and ravines in the northeastern United States. Associations are also assigned global rarity ranks that indicate their conservation status and relative risk of extirpation (Grossman et al. 1998). Associations from the NVCS are often equivalent to communities in state-specific vegetation classifications such as the Terrestrial and

Palustrine Plant Communities of Pennsylvania (Fike 1999). Therefore, NVCS associations can be crosswalked with communities in these state classifications.

Several associations that share one or more dominant or characteristic species can be grouped to form an alliance. Alliances are generally more wide-ranging geographically than associations, covering multiple habitats and broader species composition. For example, the Central Appalachian Hemlock - Northern Hardwood Forest association mentioned previously is grouped with other similar hemlock-dominated forest associations into the Eastern Hemlock - Yellow Birch Forest Alliance. An association with a unique species composition or environmental niche can be assigned to its own alliance, such that the alliance only contains one association instead of multiple associations.

One level above alliance is the formation, representing vegetation types that share a common physiognomy within broadly defined environmental factors (Grossman et al. 1998). For example, Mixed needle-leaved evergreen - cold-deciduous forest is a common formation that encompasses numerous mixed forest types in the northeastern and midwestern United States, including the Eastern Hemlock - Yellow Birch Forest Alliance mentioned above.

Park-specific Information

In the early 19th century, the Allegheny Mountains presented a formidable barrier to transportation between the eastern seaboard and the country's interior. The Allegheny Portage Railroad, a series of inclined planes connected by level sections of track, was an innovative solution to this problem and was crucial in opening the interior to settlement and commerce. The portage railroad traversed the mountainous region between Hollidaysburg and Johnstown, forming the crucial link between the Eastern and Western Divisions of the Pennsylvania Mainline Canal, a larger system of canals linked by sections of railroad that transported goods and people between Philadelphia and Pittsburgh. Construction of the Allegheny Portage Railroad began in 1831, and it operated between 1834 and 1854, until new technologies on the Pennsylvania Railroad made the inclined plane system obsolete (NPS 2006).

To traverse the mountains via the portage, canal boat sections were floated onto railroad cars. Then the cars were hauled over a series of 10 inclined planes by cables attached to stationary engines. On the level sections of track in between the inclines, the cars were pulled by horses or locomotives. This process was reversed on the other side of the mountains in order to lower the cars back down to the canal.

This technological wonder reduced the time needed to traverse the mountains from 3 days to 6 hours.

Though the Allegheny Portage Railroad was not a successful long-term solution to the country's transportation needs, it served as an important testing ground for new transportation technologies, including the wire cable that eventually was used in the construction of the Brooklyn Bridge (NPS 2006).

The Allegheny Portage Railroad National Historic Site preserves the remnants of this unusual transportation system. The park covers approximately 518 ha (1,280 ac) and consists of two

units: the Main Unit and the Staple Bend Tunnel Unit. The Main Unit (approximately 434 ha [1,072 ac]) contains the Visitor Center, the historic Lemon House, Engine House #6 Exhibit Shelter, the Skew Arch Bridge, a picnic area, and hiking trails. The Staple Bend Tunnel Unit (approximately 84 ha [208 ac]) contains a hiking and biking trail on the historic railroad trace that leads to and through the Staple Bend Tunnel (NPS 2006).

A shapefile of the park's boundary was obtained from North Carolina State University's Center for Earth Observation in spring 2004. This shapefile was modified by the PANHP to reflect a recent land transfer that altered the park's boundary. The modified shapefile is an estimation of the park's boundary based on information from the park's resource manager, therefore, the modified boundary is not necessarily accurate. All maps in this report used this modified shapefile to depict the park's boundary.

Project Area

Location and Regional Setting

The Allegheny Portage Railroad National Historic Site is located in southwestern Pennsylvania, in Blair and Cambria counties (Figure 1). The Main Unit is located approximately 19.3 km (12 mi) west of Altoona, and falls within the Hollidaysburg, PA and Cresson, PA 1:24,000 USGS topographic quad maps. The Staple Bend Tunnel Unit is located approximately 6.4 km (4 mi) east of Johnstown on the Nanty Glo, PA and Geistown, PA 1:24,000 USGS topographic quad maps.

The Main Unit of the park spans the Allegheny Front, the dividing line between the Appalachian Mountain section of the Ridge and Valley physiographic province and the Allegheny Mountain section of the Appalachian Plateau physiographic region. The Appalachian Mountain section of the Ridge and Valley physiographic province is characterized by intensely folded and faulted bedrock, forming numerous narrow, parallel ridges and valleys with striking wind and water gaps cutting through the resistant rock ridges. The Staple Bend Tunnel Unit occurs solely in the Allegheny Mountain section of the Appalachian Plateau physiographic region that is characterized by long, orderly anticlinal ridges separated by broad synclinal valleys (Schultz 1999).

The predominant natural vegetation in the environs of Allegheny Portage Railroad National Historic Site is Appalachian Oak Forest and Northern Hardwood Forest. The Appalachian Oak Forest is typically dominated by white oak (*Quercus alba*) and northern red oak (*Quercus rubra*), with sugar maple (*Acer saccharum*), sweet birch (*Betula lenta*), bitternut hickory (*Carya cordiformis*), American beech (*Fagus grandifolia*), and tuliptree (*Liriodendron tulipifera*) as associates. The Northern Hardwood Forest is typically dominated by sugar maple, American beech, sweet birch, yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), and black cherry (*Prunus serotina*) (Cuff et al. 1989).

Park Environmental Attributes

The Allegheny Portage Railroad was built to overcome an environmental obstacle. Many environmental factors, such as geology, topography, soils, and hydrology, influenced the construction of the inclined planes. These environmental attributes also influence the types and distribution of vegetation within Allegheny Portage Railroad National Historic Site.

Spanning the Allegheny Front, the Main Unit is underlain (from east to west) by Devonian, Mississippian, and Pennsylvanian age bedrock in parallel bands trending from southwest to northeast. The bedrock ranges in age from approximately 370 million years old (Devonian Brallier and Harrell formations) to about 310 million years old (Pennsylvanian Glenshaw Formation). Geologic formations in the Main Unit are described below in order from east (oldest) to west (youngest). The Brallier and Harrell formations on the eastern end of the Main Unit are predominantly shale with occasional-to-rare thin beds of siltstone and sandstone, which were formed on the side slopes and bottom of a deep marine basin. The Scherr Formation

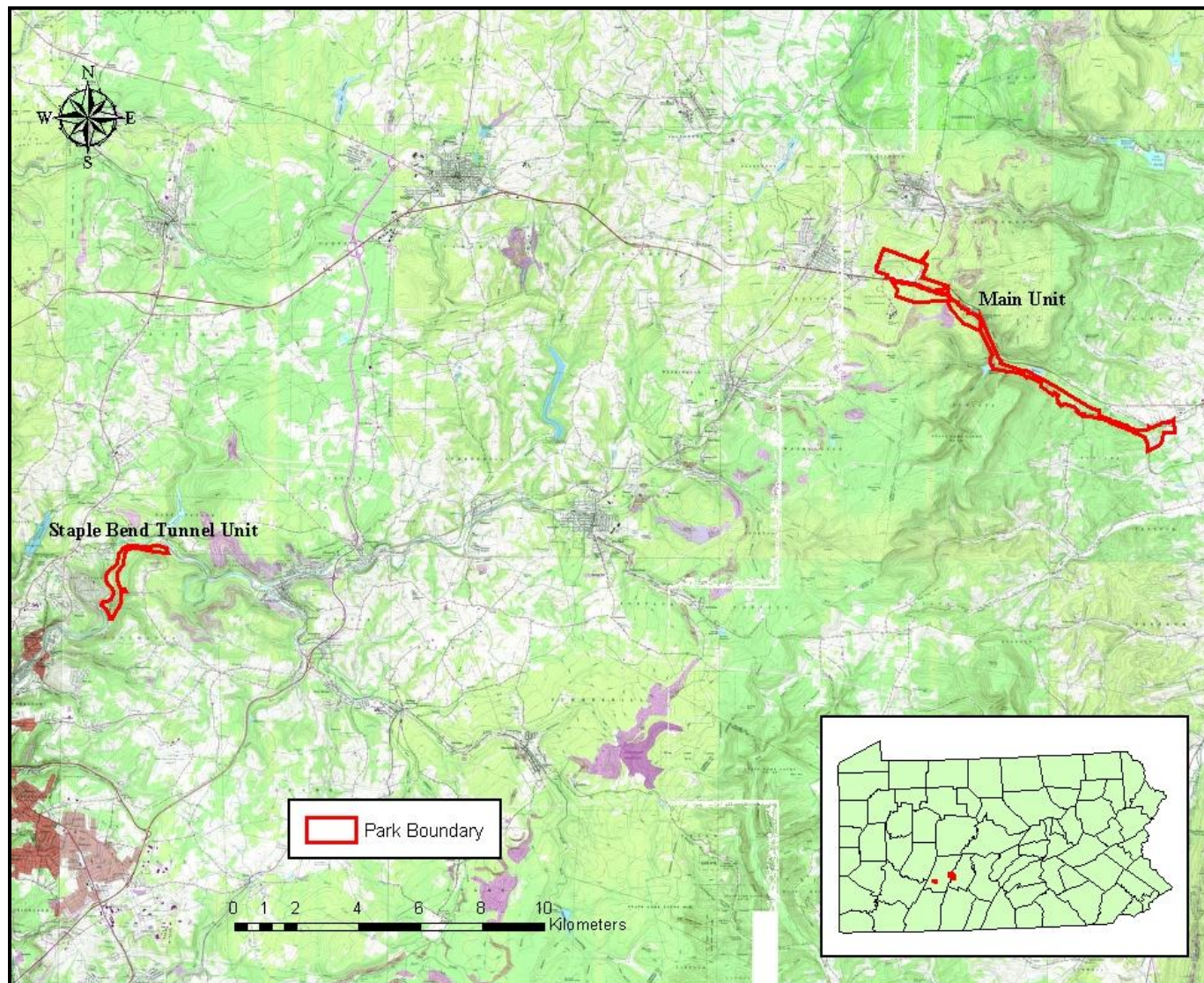


Figure 1. Location of Allegheny Portage Railroad National Historic Site in Blair and Cambria counties on the Hollidaysburg, Cresson, Nanty Glo, and Geistown, PA 1:24,000 USGS topographic quad maps.

consists of sandstone, siltstone, and some shale derived from the outer edge of a deltaic system spreading from east to west. The Foreknobs and Catskill formations are mainly sandstone and siltstone with some shale and conglomerate, and represent both deltaic-fluvial as well as shoreline deposits. The surficial exposures of the Devonian formations (Brallier, Harrell, Scherr, Foreknobs, and Catskill) occur in parallel bands extending from the eastern boundary of the Main Unit to Muleshoe Curve. The Rockwell Formation represents a transition between the Devonian and Mississippian age strata. The Rockwell Formation consists primarily of sandstones, with some interbedded siltstone and shale, derived from fluvial deposits of low-gradient, high-sinuosity rivers and shallow marine deposits in bays and estuaries. The Mississippian Burgoon Formation consists of coarse-grained, cross-bedded sandstone, believed to have been deposited by high-gradient braided streams. The Mauch Chunk Formation consists of mudstone, siltstone, and sandstone derived from low-gradient alluvial plain deposits. The Mauch Chunk Formation may also include some interbedded shales and limestones. The surficial exposure of the Mississippian formations (Rockwell, Burgoon, and Mauch Chunk) occurs between the Muleshoe Curve and the Stone Bridge in the Main Unit. The Pennsylvanian Pottsville Formation consists of sandstone and conglomerate sandstone with minor thin beds of shale, claystone, siltstone, limestone, and coal. Pottsville Formation sandstone and conglomerate is derived from fluvial sand deposits, while shale, siltstone, and limestone reflect shallow marine transgressions. The coal beds reflect interfluvial peat deposits. The Pennsylvanian Allegheny Formation is a complex of interbedded sandstone, shale, limestone, claystone, and coal formed in delta plain and marginal marine environments. The furthest west geologic stratum in the Main Unit is the Pennsylvanian Glenshaw Formation, which consists of several marine shale beds and minor interbedded sandstone, limestone, and coal strata. The Glenshaw Formation beds were formed during a series of marine transgressions where the depositional environment varied from shallow inland sea to delta plain to alluvial plain. The surficial exposure of the Pennsylvanian sediments (Pottsville, Allegheny, and Glenshaw) occurs under the Summit Level section of the Main Unit (Schultz 1999).

The elevation of the Main Unit gradually rises from 335 m (1,100 ft) on the eastern boundary near the town of Foot of Ten to 745 m (2,440 ft) at the western boundary near the town of Cresson. The soils of the Main Unit are predominantly channery to extremely stony silt loams and loams. Berks-Weikert channery silt loam is the most common soil on the eastern end of the unit. In the central portion of the unit, Laidig extremely stony loam is the predominant soil. Buchanan extremely stony silt loam is common on the eastern end of the Main Unit, along with Cookport and Ernst very stony loams, Berks channery silt loam, and Hazelton very stony loam. The soils on gentle slopes and surrounding drainageways tend to be mapped as Ernst silt loam, Armagh silt loam, Wharton silt loam, Blairton silt loam, and Udifluvents-Dystrochrepts complex (USDA, NRCS 2004a, b).

The Main Unit is located on the dividing ridge between two major watersheds, the Ohio River watershed and the Chesapeake Bay watershed. The headwaters of Little Conemaugh River originate from just southwest of the park boundary. The Little Conemaugh River eventually flows into the Lower Allegheny and Monongahela rivers, which flow into the Ohio River. The streams that originate in and flow through the park empty into the Susquehanna River and, eventually, the Chesapeake Bay. The headwaters of Bradley Run flow north out of the western end of the unit towards the West Branch of the Susquehanna River. Blair Gap Run is the

prominent stream that runs through the Main Unit because the Allegheny Portage Railroad followed Blair Gap. The headwaters of Blair Gap Run are located in the western end of the Main Unit, and the stream flows out of the park at its eastern boundary, eventually flowing into the Juniata River and then the Susquehanna River. Blair Gap Run is considered a high quality mountain stream and supports a cold water fishery (NPS 2006).

The Staple Bend Tunnel Unit encompasses a curving side slope along the Little Conemaugh River. This unit is underlain primarily by the Pennsylvanian Pottsville and Allegheny formations. The Mauch Chunk Formation underlies the eastern tip of the unit (Schultz 1999). These formations are described above. The elevation within the unit ranges from approximately 400 m (1,300 ft) near the river to 490m (1,600 ft) in the southeastern corner of the unit. Laidig soils and Cookport and Ernst very stony loams are the common soils, although portions of the unit are mapped as strip mine, mine dumps, and industrial dumps (USDA, NRCS 2004b). Small seeps and intermittent streams and drainages flow downslope through the unit to the Little Conemaugh River. The National Park Service is currently working to remediate the acid mine drainage which pollutes these drainages (NPS 2006).

Materials and Methods

Planning and Scoping

Several steps were taken to prepare for the mapping and classification of vegetation at Allegheny Portage Railroad National Historic Site. A planning and review meeting was held on February 13, 2004 with ecologists from the Pennsylvania Natural Heritage Program, National Park Service staff, and NatureServe staff. The project timeline, access issues, park boundary changes, resource management priorities, current vegetation management, and applicable previous research conducted at the park were discussed. In addition, reconnaissance of the park's vegetation types was conducted in March 2005 to estimate the number and distribution of vegetation associations in the park.

Preliminary Data Collection and Review of Existing Information

Previous studies conducted at Allegheny Portage Railroad National Historic Site were obtained from the park's natural resource manager and reviewed for information pertinent to the park's vegetation. These reports included previous vegetation cover type mapping, inventories of invasive plant species, and inventories of amphibian, reptile, bird, and native rare plant species (Melton 1982, WPC 2003, Yahner et al. 2001, Yahner and Ross 2006). In addition, shapefiles containing digital information on bedrock geology, soils, streams, watersheds, park boundaries, and roads were obtained and reviewed.

Aerial Photography Acquisition and Processing

Allegheny Portage Railroad National Historic Site is made up of two non-contiguous, widely separated geographic areas. Therefore, two digital orthophoto mosaics were produced. One (ALPO_A) covers the western portion of the park (Staple Bend Tunnel Unit) and the other (ALPO_B) covers the eastern portion of the park (Main Unit). Color infrared, stereo pair, 1:6,000 scale aerial photography for both mosaics was acquired in a single flight on April 13, 2003, during leaf-off conditions, by Kucera International. Some of the photography was overexposed and, at the request of the National Park Service, Kucera International scanned the photos at 1,200 dpi and color balanced and adjusted them. The NPS accepted these scanned images and sent them to North Carolina State University (NCSU). Upon receipt at NCSU, the image files were counted to make sure that none were missing, then placed in the air photo archive maintained at NCSU for the NPS Northeast Region Inventory & Monitoring Program. Associated data and information provided by Kucera International, and also stored in the air photo archive, include the airborne GPS/IMU files, the camera calibration certificate for the camera, and the hardcopy flight report for the photography that crosswalks the airborne GPS/IMU data to the photo frame numbers.

The ALPO_A and ALPO_B mosaics were produced from 11 and 73 color infrared air photos, respectively, scanned at 1,200 dpi with 24-bit color depth. For each mosaic, scanned images of the relevant air photos were imported into ERDAS IMAGINE (.img) format where a photo block was created using airborne GPS and IMU data that Kucera International supplied with the aerial photography. Each photo block was manipulated until it could be triangulated with a root mean

square error of less than 1. At this point, single frame orthophotos (one for each air photo) were generated within IMAGINE and exported to IMAGINE .lan format. Then the .lan files were imported into ER Mapper's native (.ers) format, and an ER Mapper algorithm was created which contains the color balancing information and the cutlines created for each of the final mosaics. In ER Mapper, band interleaved by line (.bil) image and header files for each mosaic were generated, the .bil images were imported into IMAGINE .img format, and, finally, the .img images were compressed using MrSID software with a 20:1 compression ratio.

One metadata record for the mosaics was prepared according to current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler program (MP) to locate errors and omissions (USGS 2004). After all errors and omissions were corrected, MP was used to generate final TXT, HTML, and XML versions of the metadata record which are stored in the air photo archive. Key information for the mosaics is summarized in Table 1.

Photointerpretation

After receiving the digital orthophoto mosaic from NCSU, ecologists at the PANHP developed a vegetation cover type map that identified broad vegetation types. The vegetation cover types were differentiated based on vegetation structure, leaf phenology, and hydrologic regime because these characteristics can be easily identified through aerial photograph interpretation. This map was developed as a guide over which the vegetation sampling efforts would be distributed.

The vegetation cover type map was created through aerial photograph interpretation. Aerial photograph interpretation is the act of visually examining aerial photographs in order to identify objects, in this case vegetation types (Avery 1978). The diapositive photographs (color infrared, stereo pair, hard copy photographs) were examined through a stereoscope, which provides the viewer with a three-dimensional view of the photographs. The digital orthophoto mosaic was also examined onscreen in ArcView 3.2 (ESRI 1992–2000). In addition, digital topographic quad maps were examined in ArcView 3.2. Using information gathered from the diapositives, the mosaic, and the topographic maps, polygons representing different vegetation types and land uses were identified. These polygons were digitized onscreen using ArcView 3.2. Polygons that represented vegetation were attributed with vegetation cover types (Table 2).

Polygons that represented other land uses, such as buildings and roads, were attributed with map labels modified from the Anderson level II categories (Anderson et al. 1976). Table 3 lists the modified Anderson level II categories used in the cover type map and shows the relationship between these map labels and the Anderson level I and level II classifications. The Anderson classification was modified in order to provide more specific information to the park and to avoid photointerpretation of human uses of various building types. For example, instead of Transportation, Communications, and Utilities, the map label Transportation Corridor was used for all roads and highways, while ALPO Trace was used to label location of the historic portage. Also, the use of specific buildings within and adjacent to the park was not distinguished by Residential, Commercial, Industrial, etc, but rather labeled with the generic map unit, Built-up Land. Given the focus on vegetation mapping in this project, it was inappropriate to spend additional time mapping building uses and testing the accuracy of such map attributes.

Table 1. Summary of key information for the Allegheny Portage Railroad National Historic Site mosaics.

Title of metadata record:	Allegheny Portage Railroad National Historic Site Color Infrared Orthorectified Photomosaic (ERDAS IMAGINE 8.6 .img and MrSID formats)
Publication date of mosaics (from metadata):	September 15, 2004
Date aerial photography was acquired:	April 13, 2003 (leaf-off)
Vendor that provided aerial photography:	Kucera International
Scale of photography:	1:6,000
Type of photography:	Color infrared, stereo pairs
Number of air photos delivered:	84 (11 air photos were used to create the ALPO_A mosaic; 73 air photos were used to create the ALPO_B mosaic)
Archive location of air photos, airborne GPS/IMU files, Center for Earth	North Carolina State University
Observation camera calibration certificate, and hard copy flight report:	
Scanning specifications:	1,200 dpi, 24-bit color depth
Horizontal positional accuracy of mosaics:	1.18 meters, meets Class 1 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	55
Method of calculating positional accuracy:	Root Mean Square Error (RMSE)
Archive location of mosaics and metadata:	North Carolina State University, Center for Earth Observation
Format(s) of archived mosaics:	.img (uncompressed); MrSID (20:1 compression)

To determine which vegetation cover type or modified Anderson level II category should be assigned to each polygon, an aerial photography interpretation key (Appendix A) was used. The resulting vegetation cover type map (Figure 2) identified 342 map polygons each labeled with a vegetation cover type or a modified Anderson level II category (Table 2). The number of total mapped hectares listed in Table 2 is larger than the size of the park because the mapped polygons extend beyond the park boundary. This vegetation cover type map was used to guide vegetation plot sampling in the park.

Field Data Collection and Classification

All vegetation plot sampling followed the USGS/NPS Vegetation Mapping Program protocols (TNC and ESRI 1994b). The protocol suggests that each vegetation association should have been sampled at least three times in order to capture the naturally occurring variation within the park. If each of the vegetation cover types listed in Table 2 represented only one association in Allegheny Portage Railroad National Historic Site, the minimum number of plots needed would have been 34. This assumed that areas labeled with modified Anderson level II categories would not be sampled, and that for cover types with less than three polygons, one plot would be placed in each polygon. However, it is more likely that some cover types represent multiple associations. Alternatively, a few of the vegetation cover types assigned to the map may actually

Table 2. Number of polygons, total mapped hectares, mapped hectares within the park boundary, and number of plots sampled for vegetation cover types and Anderson level II categories (modified) at Allegheny Portage Railroad National Historic Site (ALPO).

	Number of Polygons	Total Mapped Hectares	Mapped Hectares within Park Boundary	Number of Plots Sampled
Vegetation Cover Type				
Cliff	3	0.33	0.19	2
Deciduous Forest	146	470.52	314.01	28
Deciduous Shrubland	5	2.47	2.04	2
Deciduous Woodland	18	24.89	18.76	6
Evergreen Forest	7	3.57	1.10	1
Evergreen Woodland	4	1.57	1.50	2
Grassland	40	48.97	38.10	5
Mixed Evergreen - Deciduous Forest	34	95.28	74.55	14
Mixed Evergreen - Deciduous Woodland	2	2.99	2.95	2
Saturated Herbaceous Vegetation	5	2.43	2.29	4
Temporarily Flooded Deciduous Forest	17	24.12	17.50	10
Temporarily Flooded Deciduous Shrubland	1	0.44	0.44	1
Temporarily Flooded Mixed Evergreen - Deciduous Forest	1	4.72	0.17	0
Anderson Level II Category (modified)				
ALPO Trace	10	16.87	15.70	0
Built-up Land	21	24.21	11.57	0
Pond	8	1.46	1.45	0
River	1	3.33	0.38	0
Stream	4	3.68	1.68	0
Transportation Corridor	15	28.99	12.72	0
Total	342	760.83	517.48	77

Table 3. Relationship between Anderson level II category (modified) map labels and the Anderson level I and II classifications.

Anderson Level II (modified) Map Label	Anderson Level I	Anderson Level II	Anderson Level II Number
ALPO Trace	Urban or Built-up Land	Transportation, Communications, and Utilities	14
Built-up Land	Urban or Built-up Land	Residential	11
		Commercial and Services	12
		Industrial	13
		Industrial and Commercial Complexes	15
		Mixed Urban or Built-up Land	16
		Other Urban or Built-up Land	17
Pond	Water	Lakes	52
		Reservoirs	53
River	Water	Streams and Canals	51
Stream	Water	Streams and Canals	51
Transportation Corridor	Urban or Built-up Land	Transportation, Communications, and Utilities	14

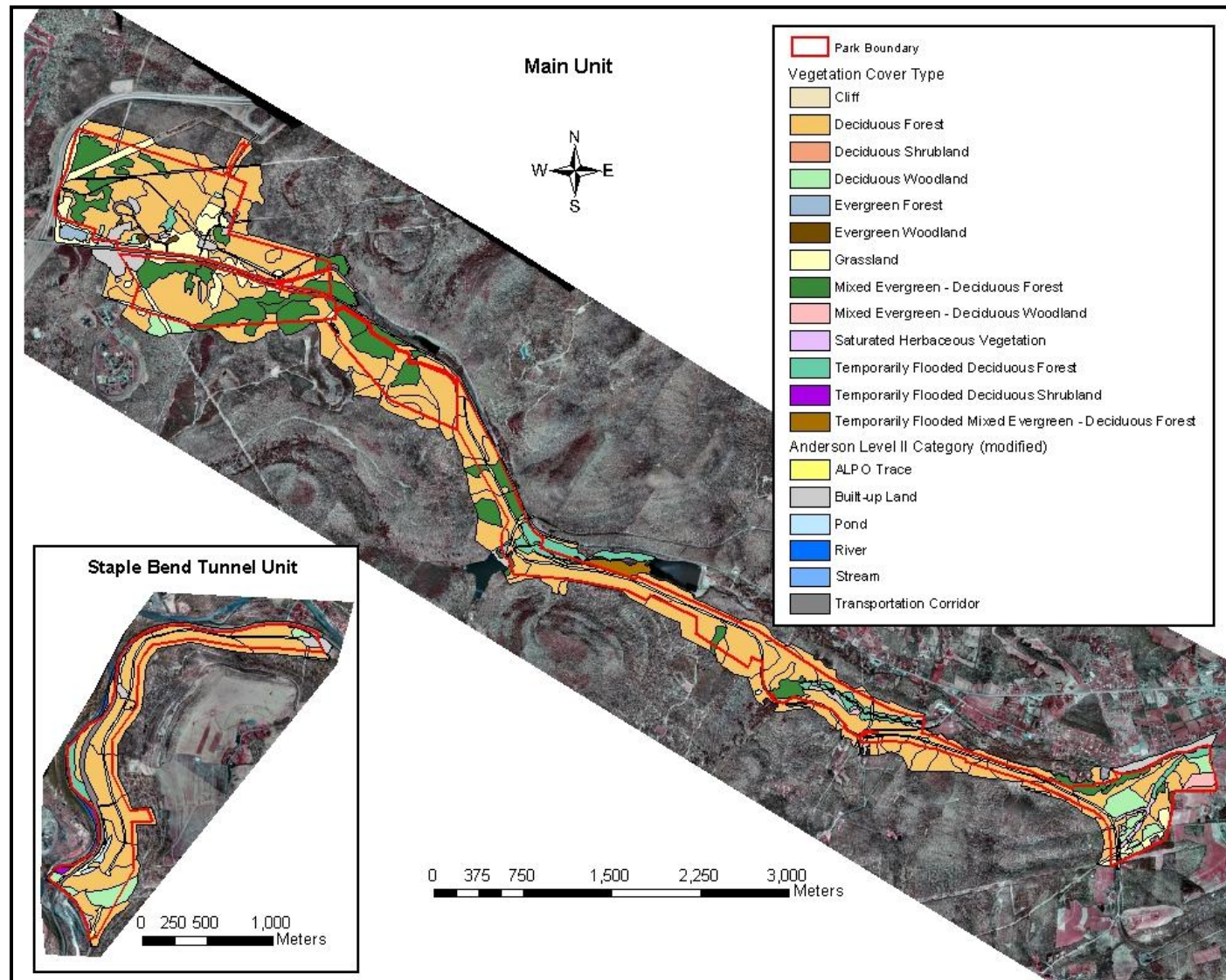


Figure 2. Vegetation cover types and Anderson level II categories (modified) for Allegheny Portage Railroad National Historic Site (ALPO).

represent a single association. This occurs because of significant variation in vegetation structure and leaf phenology caused by past land use, natural resource management, and environmental setting. Regardless, the vegetation cover type map is a useful guide to determine the intensity, distribution, and location of vegetation sampling. Based on the cover type map, our initial reconnaissance of the park, and vegetation mapping efforts at other parks, we estimated that 80 plots was the approximate number needed to sufficiently capture the range of vegetation types. Eighty polygons representing different aerial photograph signatures and vegetation cover types were then selected for sampling.

Field Survey

Within each polygon selected for sampling, a plot was established in an area that was most representative of the existing vegetation association (Mueller-Dombois and Ellenberg 1974). All vegetation data were collected following NatureServe's accepted natural heritage sampling protocols (Strakosch-Walz 2000), with 20-m x 20-m plots in forests and woodlands, 10-m x 10-m plots in shrublands, and 5-m x 5-m plots in herbaceous vegetation. The plot sampling data form used in this project is shown in Appendix B. Abbreviated instructions for completing this form and definitions of the fields can be found in the USGS/NPS Vegetation Mapping Program: Field Methods for Vegetation Mapping manual (TNC and ESRI 1994b). The vegetation was visually divided into eight strata: emergent trees (variable height), tree canopy (variable height), tree subcanopy (>5m in height), tall shrub (2-5m), short shrub (<2m), herbaceous, non-vascular, and vines. The percent cover was estimated for each species in each stratum using modified Braun - Blanquet cover classes (Strakosch-Walz 2000). Specimens of species that were not identifiable in the field were collected for later identification. In addition to floristic information, the following environmental variables were recorded at each plot: slope, aspect, topographic position, hydrologic regime, soil stoniness, average soil texture, and soil drainage. Any unvegetated area of the plot was characterized by the exposed substrate. Notes were taken on the plot representativeness of the surrounding vegetation and any other significant environmental information, such as landscape context, herbivory, stand health, recent disturbance, or evidence of historic disturbance. The vegetation profile and topographic position were sketched in cross-section to represent the location and setting of the plot. A digital photograph of each plot was also taken. The location of each plot was recorded with a Trimble GeoXM global positioning system (GPS) unit, with the datum set to North America 1983 (Conus) and the coordinate system set to Universal Trans-Mercator (UTM) zone 17.

Plot sampling was conducted in August 2005. The diversity of vegetation types, especially within the Deciduous Forest cover type, was less than originally estimated; therefore, only 77 plots were sampled in total (Figure 3). All vegetation types were sampled over a range of environmental variables. The distribution of plots by vegetation cover type is shown in Table 2. One vegetation cover type, Temporarily Flooded Mixed Evergreen - Deciduous Forest, was not sampled because its one mapped polygon was primarily outside the park's boundary and it contained a mosaic of two forest types already adequately sampled.

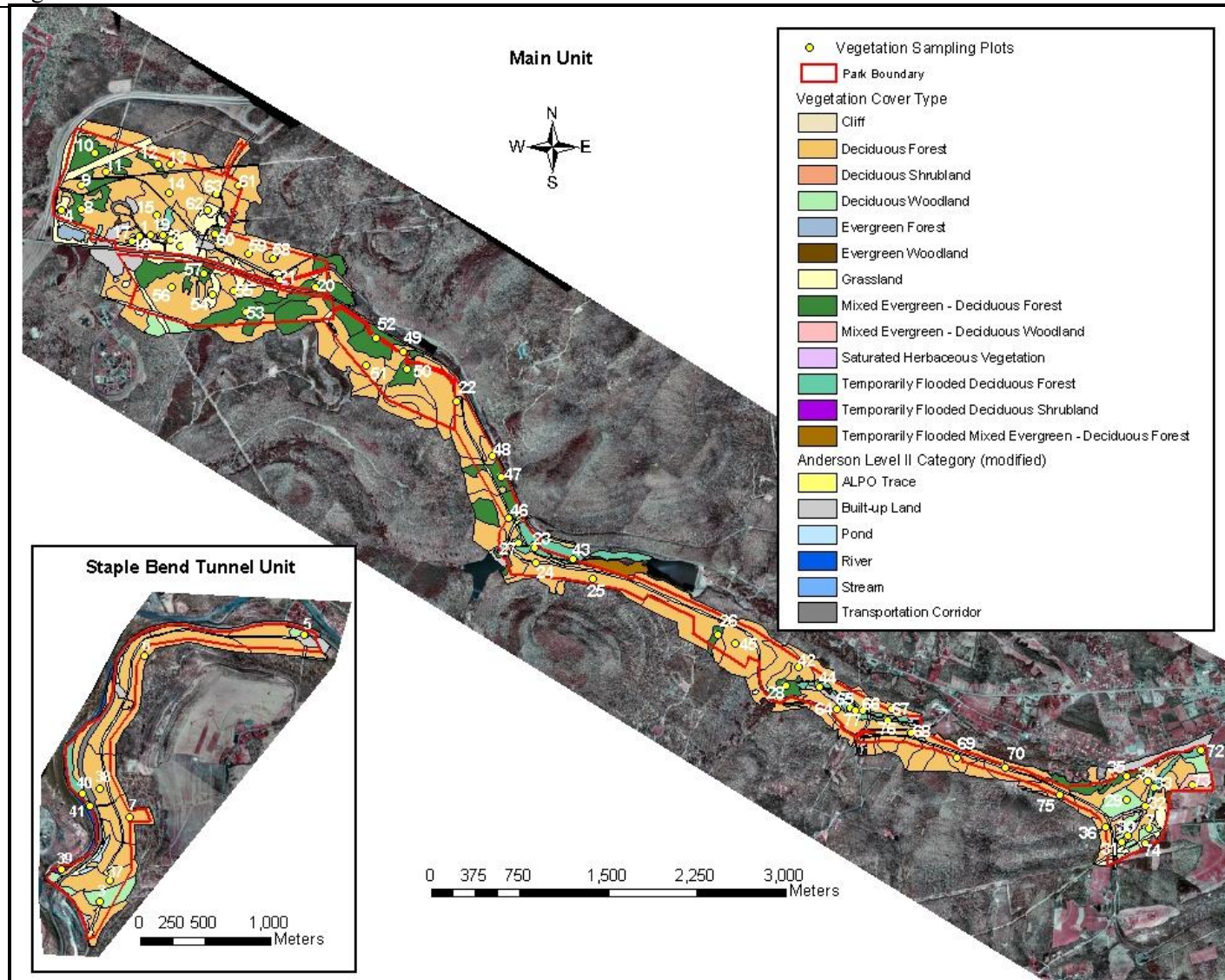


Figure 3. Locations of vegetation plots sampled in Allegheny Portage Railroad National Historic Site (ALPO) for vegetation classification and mapping.

Vegetation Classification and Characterization

Data from the 77 vegetation plots were entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform during September 2005. In the PLOTS 2.0 database, species were assigned standardized codes based on the *PLANTS Database, Version 3.5* developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA, NRCS 2006). For this report, some common names listed in the *PLANTS Database, Version 3.5* were changed to reflect the common names typically used by ecologists and resource managers in this region. The common and scientific names of plants observed during the vegetation plot sampling are listed in Appendix C. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus level and are therefore listed in the appendix as such. Environmental variables and species' percent cover data were exported from the PLOTS database into Excel in order to be manipulated into a format compatible with PC-ORD version 4.0 Multivariate Analysis software (McCune and Mefford 1999).

The vegetation plot data were analyzed using several multivariate statistical techniques available in the PC-ORD software. Different techniques were employed to provide multiple lines of evidence from which to interpret the results. For a detailed discussion of the statistical techniques used in this study refer to McCune and Grace (2002). To classify the plot data into vegetation associations, a two-way indicator species analysis (TWINSPAN) was performed using the percent cover of species data. TWINSPAN successively divides the plots into groups that are similar in species composition (Hill and Gauch 1979). A non-metric multidimensional ordination analysis (NMS) was also performed using both the percent cover of species and the environmental variables from the plots. NMS is an ordination technique well suited to non-normal data sets (Kruskal and Wish 1978). In this analysis, Sorensen distance measure, a random starting configuration, and a stability criterion of 0.005 were employed. Forty runs were performed with the real data, with a maximum of 400 iterations. A multi-response permutation procedure (MRPP) was also performed on the plots' environmental variables to determine if the differences between the vegetation associations classified by the TWINSPAN and NMS were statistically significant. Sorensen distance measure was used in the MRPP.

Based on these analyses, park-specific local vegetation associations were identified and described in detail. These vegetation associations were then crosswalked to the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999) and the National Vegetation Classification System (NVCS) (NatureServe 2006). The NVCS was developed by ecologists of the Natural Heritage Program network and The Nature Conservancy after many years of literature review, data collection, and data analysis. This collaborative effort culminated in the publication of *International Classification of Ecological Communities: Terrestrial Vegetation of the United States* (Grossman et al. 1998). The International Classification of Ecological Communities, now known as the International Vegetation Classification, of which the NVCS is a subset, has been revised and refined since 1998, and is now managed by NatureServe in continued collaboration with the network of Natural Heritage Programs. The classification is housed in the Biotics database and is updated regularly (NatureServe 2006). The upper levels of the NVCS were adopted as a standard by the Federal Geographic Data Committee to support the production of uniform statistics on vegetation at the national level (FGDC 1996). The

USGS/NPS Vegetation Mapping Program of the National Park Service adopted the alliance level, and where possible, the association level, as the mapping unit for national parks.

Based on the aforementioned analyses, the park-specific local vegetation associations were qualitatively compared to existing associations in the National Vegetation Classification System by searching for alliances sharing similar dominant species, as well as physiognomy and environmental setting. Total floristic composition was used to determine the appropriate association within the alliance. Global information on the associations from the NVCS was then appended to the local descriptions to provide resource managers with a broader context for the vegetation in the park.

Each vegetation association was assigned a common name based on the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999). If no appropriate name existed in Fike (1999), the National Vegetation Classification System common name was used, or a park-specific common name was created for successional and cultural vegetation types not easily handled by Fike (1999) or the NVCS.

A park-specific dichotomous key was created for the vegetation associations to guide accuracy assessment and for use by park natural resource managers and others (Appendix D). A dichotomous key is a tool for identifying unknown entities, in this case, vegetation associations. It is structured by a series of couplets, two statements that describe different, mutually exclusive characteristics of the associations. Choosing the statement that best fits the association in question leads the user to the correct association. The dichotomous key should be used in conjunction with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate.

Vegetation Map Preparation

Following the vegetation data analysis, the vegetation cover type map was edited and refined to develop an association-level vegetation map. Using ArcView 3.2, polygon boundaries were revised onscreen based on the plot data and additional field observations. Each polygon was assigned one of 16 vegetation associations based on plot data, field observations, aerial photography signatures, and topographic maps. An aerial photograph interpretation key for the vegetation associations and Anderson level II categories (modified) is located in Appendix A.

Twenty-four polygons were labeled as mosaics of two associations because both types were present in the polygons and clear boundaries between the two associations could not be delineated. The majority of the polygons were mosaics of successional or disturbed types such as Modified Successional Forest, Successional Old Field, Conifer Plantation, and Japanese or Giant Knotweed Herbaceous Vegetation. Eastern Hemlock - Tuliptree - Birch Forest, Sugar Maple Floodplain Forest, Allegheny Hardwood Forest, and Wet Meadow were identified in mosaics for six polygons. After the vegetation association map was completed, the thematic accuracy of the map was assessed.

Accuracy Assessment

Two sources of potential error in the vegetation map are: 1) horizontal positional accuracy, in which a location on the photomosaic does not accurately align with the same location on the ground due to errors in orthorectification or triangulation; and 2) thematic accuracy, in which the vegetation type assigned to a particular location on the map does not correctly represent the vegetation at the same location in the park due to mapping error. The USGS/NPS Vegetation Mapping Program protocols (TNC and ESRI 1994c) were followed to assess the positional and thematic accuracies of the Allegheny Portage Railroad National Historic Site vegetation map.

Positional Accuracy Assessment

For purposes of horizontal positional accuracy assessment, the mosaics were treated as a single entity because the photography was acquired in a single flight, with the same camera, and with one set of airborne GPS/IMU data. Well-defined positional accuracy ground control points were placed throughout all quadrants of each mosaic in ArcMap (ESRI 1999–2000). Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the mosaic as a background. These maps and plots were used to locate the ground control points in the field. For each plotted ground control point, field staff noted any alterations to the locations in the field and then recorded the coordinates with a Trimble Pro XR/XRS or GeoXT. Mapped ground control points that were physically inaccessible were also noted. The field crew correctly located and collected accuracy assessment data at 58 ground control points. The coordinate data were collected with real time GPS and post-processed with differential correction using Pathfinder Office software. Prior to calculating accuracy, three ground control points, identified as outliers with SAS's JMP program, were removed. For each of the remaining 55 points, the field-collected "true" or "reference" GPS coordinates were compared to the coordinates obtained from the mosaics viewed in ArcMap. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy assessment calculation formula is based on root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center 1999). Figure 4 shows the distribution of these 55 ground control points within the western (ALPO_A) and eastern (ALPO_B) portions of the park and surrounding area.

Thematic Accuracy Assessment

The thematic accuracy of the vegetation map was assessed by the Pennsylvania Natural Heritage Program. A stratified random sampling approach was used, distributing the sampling effort across the 16 vegetation associations (Table 4). Polygons labeled with modified Anderson level II categories were not included in the thematic accuracy assessment sampling. The polygons labeled as mosaics were grouped with the association that was the least abundant between the two associations in the mosaic (Table 4). The number of samples per association varied according to the rarity of the vegetation type, both in terms of number of polygons and polygon size. The following rules were used to determine the number of points assigned to each association (TNC and ESRI 1994c):

Scenario A: The class is abundant. It covers more than 50 hectares of the total area and consists of at least 30 polygons. In this case, it is recommended that 30 polygons

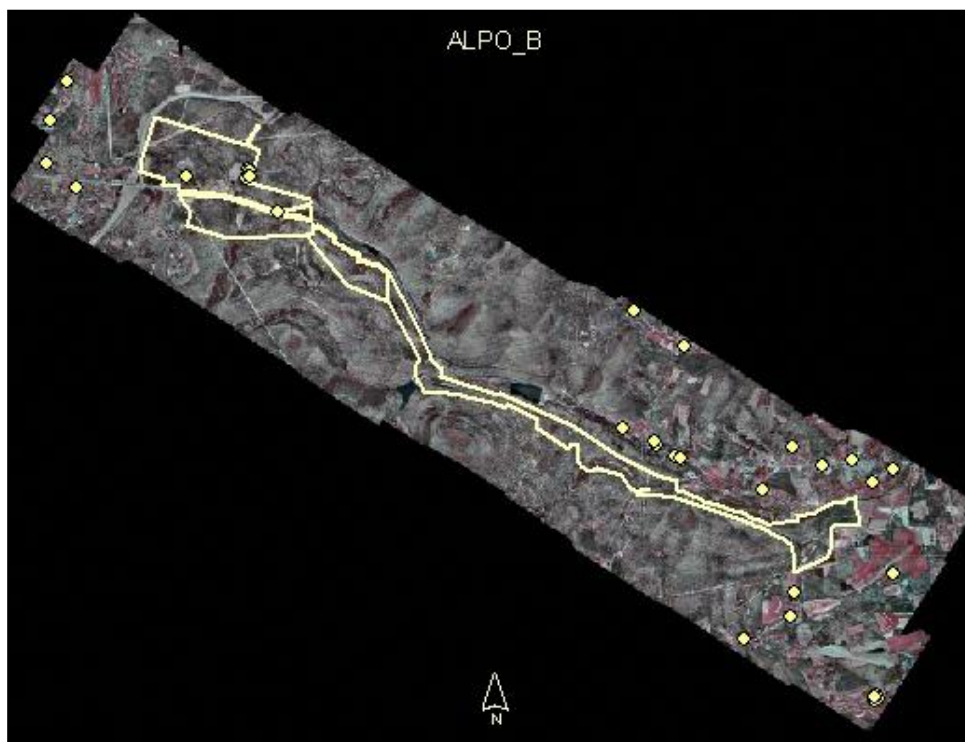


Figure 4. Ground control points used to calculate horizontal positional accuracy of the Allegheny Portage Railroad National Historic Site (ALPO) mosaics.

Table 4. Thematic accuracy assessment (AA) sampling strategy for Allegheny Portage Railroad National Historic Site. Refer to the Vegetation Map Production section within the Results section for discussion of the mosaics.

Vegetation Association	Number of Polygons	Mapped Hectares within Park Boundary	Number of AA Points Recommended by Protocol ¹	Number of AA Points Sampled
Alder Riverine Shrubland	1	0.44	1	1
Allegheny Hardwood Forest includes mosaic of: Allegheny Hardwood Forest and Successional Old Field	24	173.25	20	22
Conifer Plantation includes mosaics of: Conifer Plantation and Successional Old Field, and Modified Successional Forest and Conifer Plantation	9	3.98	5	5
Dry Eastern Hemlock - Oak Forest	3	6.48	3	3
Eastern Hemlock - Northern Hardwood Forest	15	28.92	5	5
Eastern Hemlock - Tuliptree - Birch Forest includes mosaic of: Eastern Hemlock - Tuliptree - Birch Forest and Sugar Maple Floodplain Forest	2	3.82	2	2
Japanese or Giant Knotweed Herbaceous Vegetation includes mosaic of: Modified Successional Forest and Japanese or Giant Knotweed Herbaceous Vegetation	4	7.05	4	4
Modified Successional Forest includes mosaic of: Modified Successional Forest and Successional Old Field	31	43.33	20	20
Northern Hardwood Forest	16	73.27	20	20
Northern Red Oak - Northern Hardwood Forest	21	46.50	5	10
Reed Canary Grass Riverine Grassland	1	1.58	1	1
Sparsely Vegetated Cliff	7	0.63	5	5
Successional Old Field	35	35.06	20	21
Sugar Maple Floodplain Forest	7	8.09	5	5
Tuliptree - Beech - Maple Forest	10	36.96	5	5
Wet Meadow includes mosaics of: Modified Successional Forest and Wet Meadow, and Successional Old Field and Wet Meadow	7	1.93	5	5
Total	193	471.29	126	134

¹The Nature Conservancy and Environmental Systems Research Institute. 1994 (c). NBS/NPS Vegetation Mapping Program: Accuracy Assessment Procedures. 71pp. Report to the National Biological Survey and the National Park Service. Arlington, VA and Redlands, CA. <http://biology.usgs.gov/npsveg/standards.html>. Last accessed 17 March 2005

be selected at random from the set of the association's polygons. One sampling point will be randomly assigned to each of the 30 selected polygons.

Scenario B: The association is relatively abundant. It covers more than 50 hectares of the total area but consists of fewer than 30 polygons. In this case, it is recommended that 20 polygons be selected at random from the set of the association's polygons, and that one sampling point be randomly assigned to each of the 20 selected polygons. If the association contains less than 20 polygons, some polygons will contain multiple sampling points. The number of sampling points assigned to each polygon is determined by the relative area of that polygon compared with the other polygon in that association.

Scenario C: The association is relatively rare. It covers less than 50 hectares of the total area but consists of more than 30 polygons. In this case, it is recommended that 20 polygons be selected at random from the set of the association's polygons. One sampling point will be randomly assigned to each of the 20 selected polygons.

Scenario D: The class is rare. It has 5–30 polygons and covers less than 50 hectares of the area. In this case, it is recommended that five polygons be selected at random from the set of the association's polygons. One sampling point will be randomly assigned to each of the five selected polygons.

Scenario E: The association is very rare. It has fewer than five polygons and occupies less than 50 hectares of the total area. In this case, it is recommended that one sampling point be randomly assigned to each polygon.

Scenarios B, C, D, and E were used in the sampling design. Scenario A was not used for this sampling design because no association met the criteria of that scenario. The number of sampling points for Northern Red Oak - Northern Hardwood Forest was doubled from that recommended by the protocol in order to better assess the accuracy of that type. In order to randomly select the polygons in Scenarios B, C, and D, the Create Random Selection tool in Hawth's Analysis Tools was used in ArcGIS (Beyer 2004, ESRI 1999–2000). For all of the scenarios, the Generate Random Points tool in Hawth's Analysis Tools was used to randomly determine the location of the sampling points in the polygons. Three additional sampling points were added to the original sampling plan for a total of 134 sampling points (Table 4). The locations of the 134 thematic accuracy assessment sampling points are shown in Figure 5.

In June 2006, each accuracy assessment point was located in the field using a Trimble GeoXM global positioning system (GPS) unit, with the datum set to North America 1983 (Conus) and the coordinate system set to Universal Trans-Mercator (UTM) zone 17. The vegetation association at that location was then determined using the dichotomous key and the detailed vegetation descriptions. The minimum area of observation around the sampling point was a circle with a radius of 50 m. The accuracy assessment data form used in this study is shown in Appendix E. Data from the 134 accuracy assessment points were then entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform during August 2006. In the PLOTS database, species were assigned standardized codes based on the *PLANTS Database, Version 3.5*

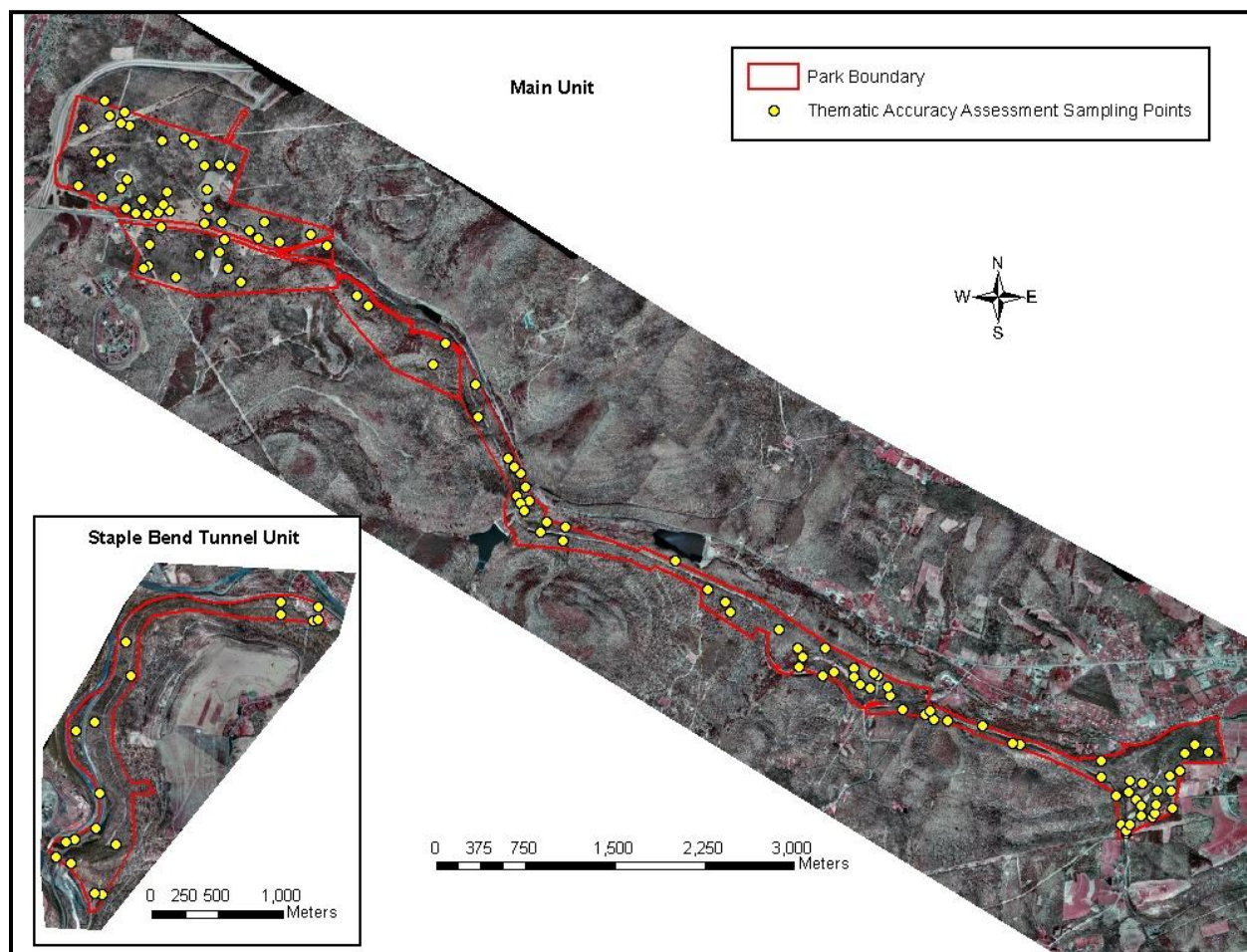


Figure 5. Locations of 134 thematic accuracy assessment sampling points in Allegheny Portage Railroad National Historic Site.

(USDA, NRCS 2006). For this report, some common names listed in the PLANTS database were changed to reflect the common names typically used by ecologists and resource managers in this region. The common and scientific names of plants observed during thematic accuracy assessment sampling are listed in Appendix C. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus level and are therefore listed in the appendix as such.

The thematic accuracy was then tabulated using a contingency matrix that compared the mapped vegetation associations with the actual vegetation associations observed in the field. Overall percent accuracy and the Kappa index were calculated. Overall percent accuracy was calculated by dividing the number of correctly classified accuracy assessment points by the total number of accuracy assessment points. The Kappa index is the preferred method of reporting overall thematic accuracy because it takes into account that a certain number of correct classifications will occur by chance (Foody 1992). The USGS/NPS vegetation mapping protocol requires that the Kappa index of vegetation association maps exceed 80% (TNC and ESRI 1994c).

Errors of omission and errors of commission were also calculated for each vegetation association. Both of these errors are calculated by dividing the number of correctly classified points in one association by the total number of points sampled in that association. Errors of omission indicate the probability that an accuracy assessment point classification will be correct and are calculated by mapped vegetation type. Errors of commission indicate the probability that a mapped vegetation type actually represents the vegetation on the ground. This error is calculated by observed vegetation type. The errors of omission and errors of commission for mapped vegetation associations should exceed 80%, according to the USGS/NPS Vegetation Mapping Protocol (TNC and ESRI 1994c).

Results

Vegetation Classification and Characterization

The vegetation associations of Allegheny Portage Railroad National Historic Site were classified using TWINSpan and NMS analyses. The results of these two analyses were evaluated and compared to the Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999), the National Vegetation Classification System, vegetation classifications at nearby national parks, and the ecologists' field experiences at Allegheny Portage Railroad National Historic Site. Based on this evaluation, the dendrogram of the TWINSpan results was interpreted (Figure 6). The evaluation determined that 12 of the 77 plots were misclassified in the original dendrogram output. Northern Red Oak - Northern Hardwood Forest did not group well in this analysis and contained five of the 12 misclassifications. Because of this result, the number of sampling points assigned to Northern Red Oak - Northern Hardwood Forest in the thematic accuracy assessment was doubled in order to determine if this type occurs in the park. The other seven misclassifications occurred in the Wet Meadow, Conifer Plantation, Sugar Maple Floodplain Forest, Allegheny Hardwood Forest, and Tuliptree - Beech - Maple Forest associations.

The NMS analysis recommended a two-dimensional ordination (Figure 7). For each axis, $p=0.0196$ in which p is equal to the proportion of randomized runs in which the stress is less than or equal to the observed stress. Stress in NMS analysis is calculated based on the distances between data points in the ordination space as compared to the same distances in higher-dimensionality space (McCune and Grace 2002). The cumulative r^2 for the two axes was 0.571. Table 5 lists several environmental and physiognomic variables that showed strong correlations with the axes. As would be expected from these correlations, forests tended to fall in the right side of the ordination; whereas, woodlands and shrublands tended to occur in the central section of the diagram. Herbaceous vegetation tended to fall in the left side of the diagram. Within the forest group, mixed evergreen - cold-deciduous forests occurred on the far right side of the ordination and cold-deciduous forested fell in the middle and right side of the diagram. In general, palustrine associations tended to fall in the lower half of the diagram while terrestrial associations tended to fall in the middle and upper half of the diagram (Figure 7). Figure 7 shows the ordination diagram with the plots grouped into vegetation associations as determined by the evaluation.

Based on these analyses and the evaluation of the results, it was determined that the vegetation at Allegheny Portage Railroad National Historic Site can be described by 16 vegetation associations: Dry Eastern Hemlock - Oak Forest, Eastern Hemlock - Northern Hardwood Forest, Eastern Hemlock - Tuliptree - Birch Forest, Northern Red Oak - Northern Hardwood Forest, Tuliptree - Beech - Maple Forest, Northern Hardwood Forest, Allegheny Hardwood Forest, Sugar Maple Floodplain Forest, Conifer Plantation, Modified Successional Forest, Successional Old Field, Alder Riverine Shrubland, Japanese or Giant Knotweed Herbaceous Vegetation, Wet Meadow, Reed Canarygrass Riverine Grassland, and Sparsely Vegetated Cliff. The MRPP indicated that the differences between the 16 associations were statistically significant ($p=0.03$, $A=0.10$, $T=-2.17$).

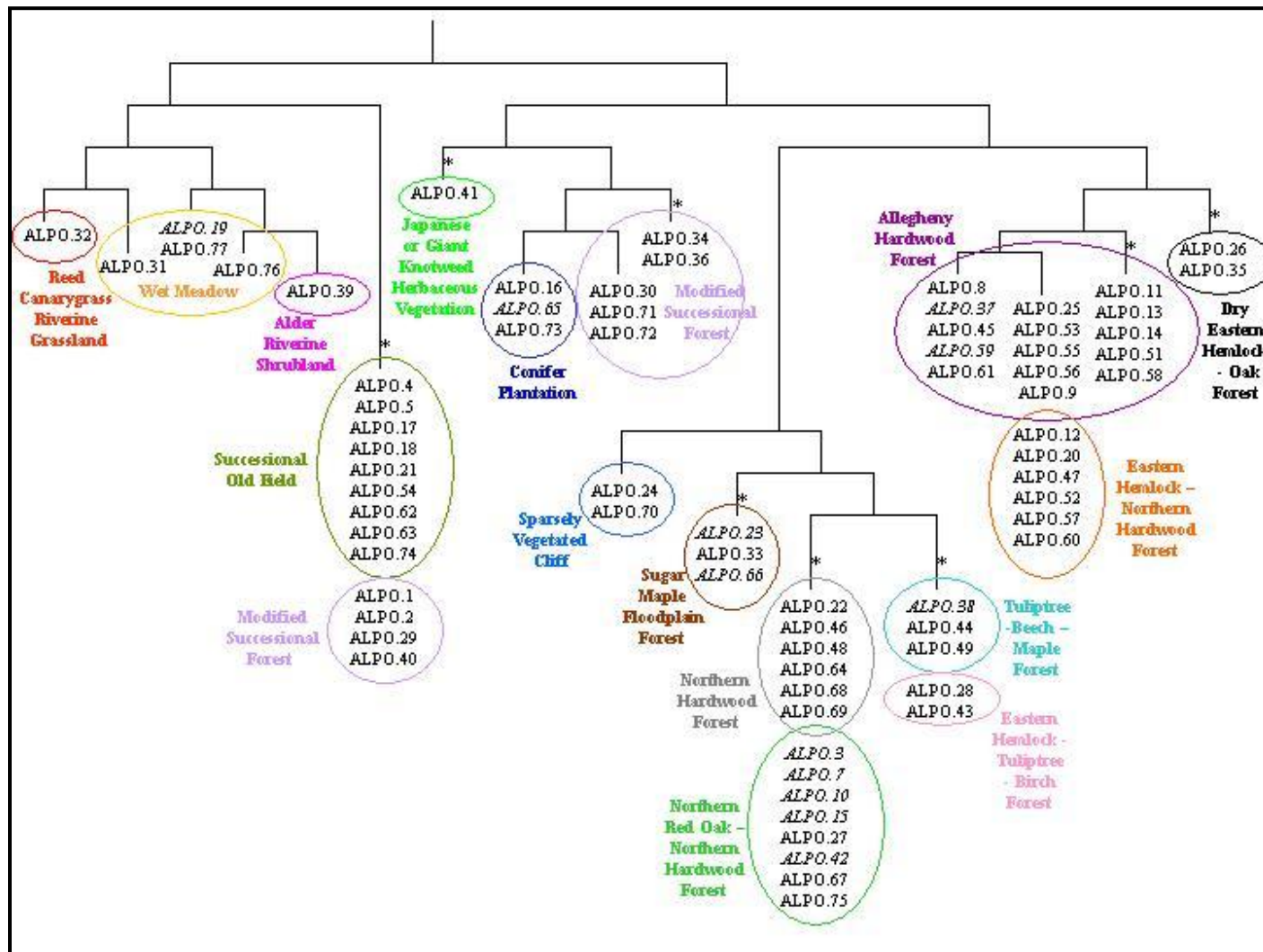


Figure 6. Dendrogram interpreted from the two-way indicator species analysis (TWINSpan) results, showing 16 vegetation associations in Allegheny Portage Railroad National Historic Site (ALPO). The plots that were determined through the results evaluation to be misclassified by this analysis are labeled in italics and are shown correctly classified. The branches of the dendrogram in which the misclassified plots were originally incorrectly located are marked with asterisks (*).

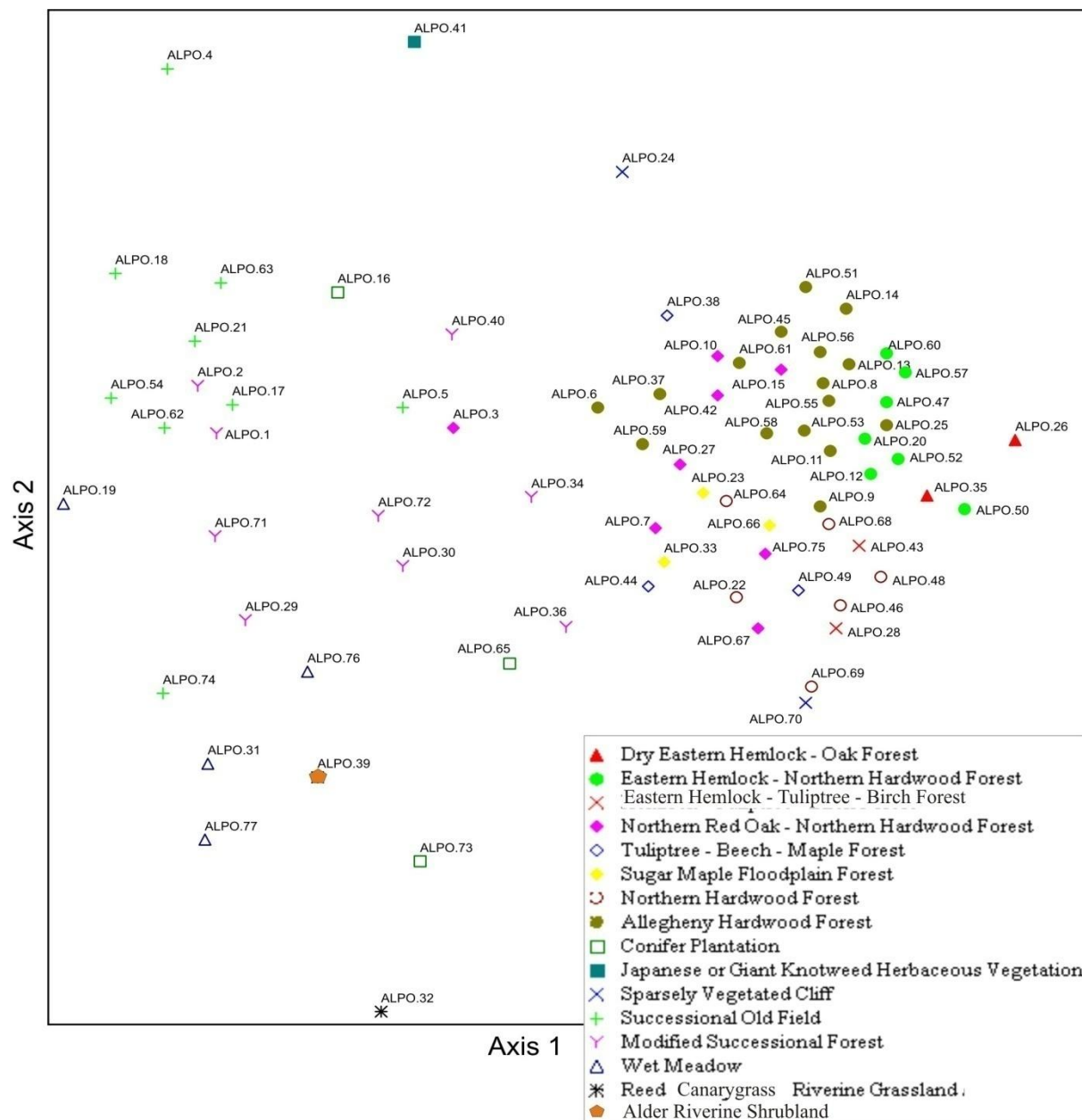


Figure 7. Ordination diagram from the non-metric multidimensional ordination analysis (NMS) showing 16 vegetation associations in Allegheny Portage Railroad National Historic Site (ALPO).

Table 5. Correlations (r values) between measured variables and the two axes calculated in the non-metric multidimensional ordination analysis (NMS).

Measured Variable	Axis 1	Axis 2
Percent cover of tree canopy	0.871	0.012
Percent cover of subcanopy	0.698	-0.051
Percent cover of herbaceous layer	-0.554	0.084
Unvegetated Surface in Plot		
Percent cover of litter	0.590	0.012
Percent cover of wood	0.598	0.123

Vegetation Association Descriptions

Detailed local descriptions for 16 vegetation associations were written based on plot data, photographs of each plot, thematic accuracy assessment data, and the ecologists' field observations at Allegheny Portage Railroad National Historic Site. These vegetation associations were then crosswalked to Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999) and the NVCS. Detailed local and global descriptions of the vegetation associations follow. Representative photographs of each vegetation type are provided after each description. An index of these photos is located in Appendix F. A bibliography for the sources cited in the global vegetation descriptions from the NVCS is provided in Appendix G. A list of the 318 plants found during the vegetation plot sampling and thematic accuracy assessment sampling is located in Appendix C.

A dichotomous key was also developed for these 16 vegetation associations (Appendix D). The dichotomous key should be used in conjunction with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate. This key and the detailed vegetation association descriptions were used in the thematic accuracy assessment and may be used by park resource managers and others to identify vegetation associations in the park.

COMMON NAME (PARK-SPECIFIC): DRY EASTERN HEMLOCK - OAK FOREST

SYNONYMS

NVC English Name: Eastern Hemlock - (Chestnut Oak, White Oak, Northern Red Oak, Scarlet Oak) - (Sweet Birch) / Mountain Laurel Forest
NVC Scientific Name: *Tsuga canadensis* - *Quercus (prinus, alba, rubra, coccinea)* - (*Betula lenta*) / *Kalmia latifolia* Forest
NVC Identifier: CEGLO06923

LOCAL INFORMATION

Environmental Description: This forest association occurs on moderately steep to steep upper slopes that are often north-facing. This type is located on extremely stony soils such as those in the Berks-Weikert and Laig series. This forest association occurs on sandstones and siltstones of the Catskill, Brallier and Harrell formations.

Vegetation Description: The characteristic canopy for this forest association is dominated or codominated by eastern hemlock (*Tsuga canadensis*), composing >25% relative cover of the stand in the canopy and subcanopy combined. Oaks (*Quercus* spp.), predominantly northern red oak (*Quercus rubra*) or chestnut oak (*Quercus prinus*), are codominant. Other oak species may be present, including black oak (*Quercus velutina*) and white oak (*Quercus alba*). Other canopy associates include sweet birch (*Betula lenta*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), and blackgum (*Nyssa sylvatica*). Canopy trees range in height from 15–25 m and typically cover 75–95% of the stand. Subcanopy trees extend 10–15 m in height and cover 40–80% of the area. The canopy species are also typically found in the subcanopy. The tall-shrub layer is variable; it can be absent or dense. Common species include great rhododendron (*Rhododendron maximum*), eastern hemlock, striped maple (*Acer pensylvanicum*), American beech (*Fagus grandifolia*), mountain laurel (*Kalmia latifolia*), and American witch-hazel (*Hamamelis virginiana*). The short-shrub and herbaceous layers are typically very sparse (<5% cover) and contain seedlings of the canopy trees, Blue Ridge blueberry (*Vaccinium pallidum*), mapleleaf viburnum (*Viburnum acerifolium*), serviceberry (*Amelanchier* spp.) and Indianpipe (*Monotropa uniflora*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree canopy	Broad-leaved deciduous tree	<i>Betula lenta</i> , <i>Quercus prinus</i> , <i>Quercus rubra</i>
Tree subcanopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Quercus rubra</i>
Tall shrub/sapling	Needle-leaved shrub	<i>Tsuga canadensis</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i>
Tall shrub/sapling	Broad-leaved evergreen shrub	<i>Rhododendron maximum</i>

Characteristic Species: *Monotropa uniflora*, *Quercus prinus*, *Quercus rubra*, *Tsuga canadensis*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	S4	2	Dry white pine (hemlock) - oak forest	Fike 1999

Local Range: This forest association is common on north-facing upper slopes in the park.

Classification Comments: This forest association is identified by the codominance of *Tsuga canadensis* and *Quercus* spp., each covering >25% relative cover in the canopy and subcanopy combined. *Liriodendron tulipifera* is absent or a minor component of the stand.

Other Comments: Because of the xeric setting, the hemlocks in this forest association are at the greatest risk of mortality if infested with hemlock woolly adelgid.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.26, ALPO.35.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	<i>Tsuga canadensis</i> - <i>Liriodendron tulipifera</i> Forest Alliance (A.413)
Alliance (English name)	Eastern Hemlock - Tuliptree Forest Alliance
Association	<i>Tsuga canadensis</i> - <i>Quercus</i> (<i>prinus</i> , <i>alba</i> , <i>rubra</i> , <i>coccinea</i>) - (<i>Betula lenta</i>) / <i>Kalmia latifolia</i> Forest
Association (English name)	Eastern Hemlock - (Chestnut Oak, White Oak, Northern Red Oak, Scarlet Oak) - (Sweet Birch) / Mountain Laurel Forest
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This association is a hemlock - mixed oak forest which often occurs on steep northern or northwestern exposures. Soils are usually very stony to extremely stony sandy loam. Canopy species include *Tsuga canadensis* (25–90%), *Quercus prinus* (10–50%), and 0–10% each of *Quercus alba*, *Quercus rubra*, *Quercus coccinea*, *Acer rubrum*, *Liriodendron tulipifera*, *Betula lenta*, *Sassafras albidum*, and *Fagus grandifolia*. Shrub layers can be absent or sparse due to dense shading by hemlock, with *Hamamelis virginiana*, *Rhododendron maximum*, and/or *Kalmia latifolia*, and virtually no ground cover. In other sites, a single dense or multiple open strata of ericaceous species can develop, including *Rhododendron maximum*, *Kalmia latifolia*, *Gaylussacia baccata*, and *Vaccinium pallidum*.

Environmental Description: This association is a hemlock - mixed oak forest which often occurs on steep northern or northwestern exposures. Soils are usually very stony to extremely stony sandy loam.

Vegetation Description: Canopy species include *Tsuga canadensis* (25–90%), *Quercus prinus* (10–50%), and 0–10% each of *Quercus alba*, *Quercus rubra*, *Quercus coccinea*, *Acer rubrum*, *Liriodendron tulipifera*, *Betula lenta*, *Sassafras albidum*, and *Fagus grandifolia*. Shrub layers can be absent or sparse due to dense shading by hemlock, with *Hamamelis virginiana*, *Rhododendron maximum*, and/or *Kalmia latifolia*, and virtually no ground cover. In other sites, a

single dense or multiple open strata of ericaceous species can develop, including *Rhododendron maximum*, *Kalmia latifolia*, *Gaylussacia baccata*, and *Vaccinium pallidum*.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus prinus</i>
Tree subcanopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Betula lenta</i> , <i>Quercus prinus</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i>
Tall shrub/sapling	Broad-leaved evergreen shrub	<i>Rhododendron maximum</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Gaylussacia baccata</i> , <i>Vaccinium pallidum</i>

Characteristic Species: *Quercus prinus*, *Tsuga canadensis*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.

States/Provinces: NJ, PA.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap).

CONSERVATION STATUS

Rank: GNR (7-Nov-2000).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Description based on A. Windisch's Picatinny Arsenal Hemlock-Mixed Oak-(Heath) Cool Sub-Mesic forest description (TcQf).

Similar Associations: Information not available.

Related Concepts: Information not available.

SOURCES

Description Authors: A. Windisch.

References: Eastern Ecology Working Group n.d., Fike 1999, Perles et al. 2006.



Figure 8. Dry Eastern Hemlock - Oak Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.26). August 2005. NAD 1983 / UTM easting 711995, northing 4477990.



Figure 9. Dry Eastern Hemlock - Oak Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.35). August 2005. NAD 1983 / UTM easting 715451, northing 4476794.

**COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK - NORTHERN
HARDWOOD FOREST**

SYNONYMS

NVC English Name: Eastern Hemlock - Yellow Birch - Black Cherry / Great Rhododendron Forest
NVC Scientific Name: *Tsuga canadensis* - *Betula alleghaniensis* - *Prunus serotina* / *Rhododendron maximum* Forest
NVC Identifier: CEG006206

LOCAL INFORMATION

Environmental Description: This association occurs in ravines, on mid- to lower slopes, and around drainages. Slope varies from nearly level to, more typically, moderately steep or steep (10–70%). Steep slopes are often northwest- to northeast-facing. This forest type occurs over shale in the Mach Chunk and Glenshaw formations, as well as over sandstone in the Rockwell and Allegheny formations. Soils are typically loams or silt loams, often channery or extremely stony (e.g., Laidig, Cookport, Ernst, Wharton, Berks, Weikert, and Gilpin soil series).

Vegetation Description: This association is dominated by eastern hemlock (*Tsuga canadensis*) with red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), yellow birch (*Betula alleghaniensis*), sweet birch (*Betula lenta*), and/or sugar maple (*Acer saccharum*) as codominants. The canopy ranges from 15 to 25 m in height with canopy cover usually greater than 70%. The subcanopy is usually 10 to 15 m in height and varies in total cover from moderately dense (25%) to dense (70%). The subcanopy is often dominated by eastern hemlock with the same hardwood associates as in the canopy. Other associated species include cucumber-tree (*Magnolia acuminata*) and striped maple (*Acer pensylvanicum*). The tall- and short-shrub layers typically are sparse to absent (<25% cover), consisting of scattered seedlings and saplings of canopy tree species. The herbaceous layer is variable. It can be sparse (less than 25% total cover), consisting of scattered ferns and herbs. The herbaceous layer can also contain dense patches of ferns, primarily intermediate woodfern (*Dryopteris intermedia*) and eastern hayscented fern (*Dennstaedtia punctilobula*). Other common herbaceous species are mountain woodsorrel (*Oxalis montana*), Jack in the pulpit (*Arisaema triphyllum*), sweet white violet (*Viola blanda*), Indian cucumber (*Medeola virginiana*), Canadian blacksnakeroot (*Sanicula canadensis*), and starflower (*Trientalis borealis*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Prunus serotina</i> , <i>Fagus grandifolia</i>
Tree subcanopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> , <i>Betula alleghaniensis</i> , <i>Fagus grandifolia</i>
Herb (field)	Forb	<i>Oxalis montana</i>
Herb (field)	Fern or fern ally	<i>Dennstaedtia punctilobula</i> , <i>Dryopteris intermedia</i>

Characteristic Species: *Acer rubrum*, *Acer saccharum*, *Betula alleghaniensis*, *Betula lenta*, *Dryopteris intermedia*, *Fagus grandifolia*, *Prunus serotina*, *Tsuga canadensis*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	S4	2	Hemlock - (white pine) - northern hardwood forest	Fike 1999

Local Range: This forest association is common throughout the park in mesic environments.

Classification Comments: This forest association is identified by the codominance of *Tsuga canadensis* (>25% relative cover in the canopy and subcanopy combined) with *Acer* spp., *Betula* spp., *Fagus grandifolia*, and *Prunus serotina* as associates. In this association *Liriodendron tulipifera* and *Quercus* spp. are absent or a minor component of the stand.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.12, ALPO. 20, ALPO.47, ALPO.50, ALPO.52, ALPO.57, ALPO.60.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	<i>Tsuga canadensis</i> - <i>Betula alleghaniensis</i> Forest Alliance (A.412)
Alliance (English name)	Eastern Hemlock - Yellow Birch Forest Alliance
Association	<i>Tsuga canadensis</i> - <i>Betula alleghaniensis</i> - <i>Prunus serotina</i> / <i>Rhododendron maximum</i> Forest
Association (English name)	Eastern Hemlock - Yellow Birch - Black Cherry / Great Rhododendron Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

GLOBAL DESCRIPTION

Concept Summary: This hemlock forest of the central Appalachian Mountains and High Allegheny Plateau occurs on acidic, mesic sandy loams and sands of glacial till or sandstone in rocky ravines to occasionally flats or moderately steep slopes of any aspect. This is a closed-canopy, late-successional, mixed forest dominated by *Tsuga canadensis* with associated canopy species, including *Acer saccharum*, *Prunus serotina*, *Betula alleghaniensis*, and *Fagus grandifolia*. Other associates include *Acer rubrum*, *Betula lenta*, *Carya* spp., *Pinus strobus*, *Quercus alba*, *Quercus rubra*, *Ulmus americana*, and *Ostrya virginiana*. The variable shrub layer consists of *Corylus cornuta*, *Diervilla lonicera*, *Hamamelis virginiana*, *Viburnum lantanoides*, and ericaceous species *Kalmia latifolia*, *Rhododendron maximum*, and *Vaccinium pallidum*. The herbaceous layer may include *Anemone quinquefolia*, *Cornus canadensis*, *Dryopteris carthusiana*, *Maianthemum canadense*, *Medeola virginiana*, *Mitchella repens*, *Oxalis montana*, *Trientalis borealis*, *Trillium grandiflorum*, *Trillium erectum*, and *Viola* spp. *Rhododendron maximum*, *Sambucus racemosa* (= *Sambucus pubens*), and the abundance of *Prunus serotina* in the canopy differentiate this from other associations of this alliance.

Environmental Description: This hemlock forest of the central Appalachian Mountains and High Allegheny Plateau occurs on acidic, mesic sandy loams and sands of glacial till or sandstone in rocky ravines to occasionally flats or moderately steep slopes of any aspect.

Vegetation Description: This is a closed-canopy, late-successional, mixed forest dominated by *Tsuga canadensis* with associated canopy species including *Acer saccharum*, *Prunus serotina*, *Betula alleghaniensis*, and *Fagus grandifolia*. Other associates include *Acer rubrum*, *Betula lenta*, *Carya* spp., *Pinus strobus*, *Quercus alba*, *Quercus rubra*, *Ulmus americana*, and *Ostrya virginiana*. The variable shrub layer consists of *Corylus cornuta*, *Diervilla lonicera*, *Hamamelis virginiana*, *Viburnum lantanoides*, and ericaceous species *Kalmia latifolia*, *Rhododendron maximum*, and *Vaccinium pallidum*. The herbaceous layer may include *Anemone quinquefolia*, *Cornus canadensis*, *Dryopteris carthusiana*, *Maianthemum canadense*, *Medeola virginiana*, *Mitchella repens*, *Oxalis montana*, *Trientalis borealis*, *Trillium grandiflorum*, *Trillium erectum*, and *Viola* spp.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> , <i>Betula alleghaniensis</i> , <i>Fagus grandifolia</i> , <i>Prunus serotina</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Corylus cornuta</i> , <i>Hamamelis virginiana</i> , <i>Sambucus racemosa</i>
Tall shrub/sapling	Broad-leaved evergreen shrub	<i>Rhododendron maximum</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Corylus cornuta</i> , <i>Hamamelis virginiana</i> , <i>Sambucus racemosa</i>
Short shrub/sapling	Broad-leaved evergreen shrub	<i>Rhododendron maximum</i>
Herb (field)	Forb	<i>Maianthemum canadense</i>
Herb (field)	Fern or fern ally	<i>Dryopteris carthusiana</i>

Characteristic Species: *Prunus serotina*, *Rhododendron maximum*, *Tsuga canadensis*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.

States/Provinces: MD?, NJ:S1S2, NY, PA, VA?, WV.

Federal Lands: NPS (Allegheny Portage Railroad).

CONSERVATION STATUS

Rank: GNR (31-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations:

Betula alleghaniensis - (*Tsuga canadensis*) / *Rhododendron maximum* / *Leucothoe fontanesiana*
Forest (CEGL007861).

Thuja occidentalis / *Carex eburnea* - *Pellaea atropurpurea* Woodland (CEGL002596).

Tsuga canadensis - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043).

Related Concepts:

Eastern hemlock-yellow birch-black cherry forest (CAP pers. comm. 1998) ?

SOURCES

Description Authors: Eastern Ecology Group.

References: Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Fike 1999, Harrison 2004, Perles et al. 2006, TDNH unpubl. data.



Figure 10. Eastern Hemlock - Northern Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.20). August 2005. NAD 1983 / UTM easting 708593, northing 4480927.



Figure 11. Eastern Hemlock - Northern Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.47). August 2005. NAD 1983 / UTM easting 710159, northing 4479324.

COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK - TULIPTREE - BIRCH FOREST

SYNONYMS

NVC English Name: Eastern Hemlock - (American Beech, Appalachian Basswood) / Umbrella Magnolia Forest

NVC Scientific Name: *Tsuga canadensis* - (*Fagus grandifolia*, *Tilia americana* var. *heterophylla*) / *Magnolia tripetala* Forest

NVC Identifier: CEGLO08407

LOCAL INFORMATION

Environmental Description: This association is restricted to the bottoms of ravines on the Udifluvents-Dystrochrepts soil complex, a group of soils that occur on the floodplains of areas that drain over acidic rock. It occurs on the slight slopes that tend to have an eastern aspect. The bedrock is typically sandstone from the Catskill Formation. This forest occurs on the rocky floodplains that surround the creeks and drainages at the topographic low point of ravines.

Vegetation Description: This association is characterized by the codominance of eastern hemlock (*Tsuga canadensis*) and tuliptree (*Liriodendron tulipifera*), with sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), and sweet birch (*Betula lenta*) as associates. Other occasional canopy species include white ash (*Fraxinus americana*), American basswood (*Tilia americana*), and American elm (*Ulmus americana*). The canopy varies from 15 to 20 m in height with canopy cover usually about 90%. The subcanopy is typically dominated by one or more of the canopy species, although eastern hop-hornbeam (*Ostrya virginiana*) may also be present. The subcanopy ranges from 10 to 15 m in height with a total cover of approximately 30 to 60% of the stand. The tall- and short-shrub layers are typically sparse (<15% cover). They contain saplings and seedlings of the canopy tree species, especially eastern hemlock, as well as shrub species such as striped maple (*Acer pensylvanicum*), northern spicebush (*Lindera benzoin*), and occasionally great rhododendron (*Rhododendron maximum*). The herbaceous layer is sparse to moderately dense (10–40% cover) and contains violets (*Viola blanda*, *Viola striata*, *Viola cucullata*, *Viola rotundifolia*), New York fern (*Thelypteris noveboracensis*), intermediate woodfern (*Dryopteris intermedia*), eastern hayscented fern (*Dennstaedtia punctilobula*), and white wood aster (*Eurybia divaricata*). The exotic species oriental ladythumb (*Polygonum caespitosum*) can also be abundant. The herbaceous flora can be diverse and include white baneberry (*Actaea pachypoda*), Jack in the pulpit (*Arisaema triphyllum*), crinkleroot (*Cardamine diphylla*), Canadian woodnettle (*Laportea canadensis*), hairy Solomon's seal (*Polygonatum pubescens*), and sessileleaf bellwort (*Uvularia sessilifolia*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> , <i>Fagus grandifolia</i> , <i>Liriodendron tulipifera</i>
Tree subcanopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> , <i>Acer rubrum</i> , <i>Betula alleghaniensis</i>

Herb (field) Fern or fern ally *Dennstaedtia punctilobula*, *Thelypteris noveboracensis*

Characteristic Species: *Acer rubrum*, *Acer saccharum*, *Betula alleghaniensis*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Tsuga canadensis*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	State Rank	Confidence	State Name	Reference
PA	S3	2	Hemlock - tuliptree - birch forest	Fike 1999

Local Range: This association is likely restricted to the floodplain of drainages running through the bottom of ravines.

Classification Comments: This forest association is identified by the codominance of *Tsuga canadensis* and *Liriodendron tulipifera*, each covering >25% relative cover in the canopy and subcanopy combined. *Quercus* spp. are absent or a minor component of the stand.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.28, ALPO.43.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	<i>Tsuga canadensis</i> - <i>Liriodendron tulipifera</i> Forest Alliance (A.413)
Alliance (English name)	Eastern Hemlock - Tuliptree Forest Alliance
Association	<i>Tsuga canadensis</i> - (<i>Fagus grandifolia</i> , <i>Tilia americana</i> var. <i>heterophylla</i>) / <i>Magnolia tripetala</i> Forest
Association (English name)	Eastern Hemlock - (American Beech, Appalachian Basswood) / Umbrella Magnolia Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

GLOBAL DESCRIPTION

Concept Summary: This association represents mixed forests of lower slopes, coves, etc. dominated by *Tsuga canadensis* and mesic hardwood species, occurring in the Cumberland Mountains, the Cumberland Plateau of Kentucky and Tennessee, the Southern Ridge and Valley of Tennessee, and the Central Appalachians and Western Allegheny Plateau of West Virginia and potentially southwestern Pennsylvania. It may range into extreme northwestern Georgia and northeastern Alabama, Deciduous associates, which may vary widely in relative frequency, include *Fagus grandifolia*, *Tilia americana* var. *heterophylla*, *Liriodendron tulipifera*, *Betula alleghaniensis*, *Betula lenta*, *Quercus rubra*, *Fraxinus americana*, *Carya ovata*, and *Magnolia acuminata*. The relative proportion of *Tsuga* and the various hardwood species may vary greatly; individual stands may be strongly dominated by *Tsuga*, or *Tsuga* may share dominance

with one or more of the hardwoods. *Aesculus flava* and/or *Magnolia tripetala* may be present in the canopy or subcanopy, respectively, but these characteristic species may not be dominant in the particular stratum. Some important shrubs include *Rhododendron maximum* (which may dominate shrub layers of some stands), *Rhododendron catawbiense* (within its range), *Ribes cynosbati*, *Asimina triloba*, *Viburnum acerifolium*, and the lianas *Aristolochia macrophylla* and *Smilax rotundifolia*. Ferns are diverse and abundant. Mesic herbaceous components include *Dryopteris marginalis*, *Dryopteris intermedia*, *Thelypteris noveboracensis*, *Polystichum acrostichoides*, *Asplenium rhizophyllum*, *Athyrium filix-femina*, *Arisaema triphyllum*, *Asarum canadense*, *Carex plantaginea*, *Chimaphila maculata*, *Goodyera pubescens*, *Hepatica nobilis* var. *acuta*, *Maianthemum racemosum*, *Mitchella repens*, *Phacelia bipinnatifida*, *Sanguinaria canadensis*, *Tiarella cordifolia*, and *Trillium* spp.

Environmental Description: This forest occurs in coves, valleys, bases of cliffs, and lower slopes. Soils are typically derived from slope alluvium and colluvium, composed of acidic shales, siltstones, and sandstones; the soils typically have a high stone content (Martin 1975).

Vegetation Description: This association is dominated by *Tsuga canadensis* and mesic hardwood species. Deciduous associates, which may vary widely in relative frequency, include *Fagus grandifolia*, *Tilia americana* var. *heterophylla*, *Liriodendron tulipifera*, *Betula alleghaniensis*, *Betula lenta*, *Quercus rubra*, *Fraxinus americana*, *Carya ovata*, and *Magnolia acuminata*. The relative proportion of *Tsuga* and the various hardwood species may vary greatly; individual stands may be strongly dominated by *Tsuga*, or *Tsuga* may share dominance with one or more of the hardwoods. *Aesculus flava* and/or *Magnolia tripetala* may be present in the canopy or subcanopy, respectively, but these characteristic species may not be dominant in the particular stratum. Some important shrubs include *Rhododendron maximum* (which may dominate shrub layers of some stands), *Rhododendron catawbiense* (within its range), *Ribes cynosbati*, *Asimina triloba*, *Viburnum acerifolium*, and the lianas *Aristolochia macrophylla* and *Smilax rotundifolia* (Caplenor 1965). Ferns are diverse and abundant. Mesic herbaceous components include *Dryopteris marginalis*, *Dryopteris intermedia*, *Thelypteris noveboracensis*, *Polystichum acrostichoides*, *Asplenium rhizophyllum*, *Athyrium filix-femina*, *Arisaema triphyllum*, *Asarum canadense*, *Carex plantaginea*, *Chimaphila maculata*, *Goodyera pubescens*, *Hepatica nobilis* var. *acuta*, *Maianthemum racemosum*, *Mitchella repens*, *Phacelia bipinnatifida*, *Sanguinaria canadensis*, *Tiarella cordifolia*, and *Trillium* spp. At the northern limit of this association, some more southern species will be absent (e.g., *Maianthemum racemosum*, *Rhododendron catawbiense*, *Phacelia bipinnatifida*, *Halesia tetraptera*) (J. Fike pers. comm.). One variant of this association is apparently dominated by *Tsuga canadensis* and *Betula alleghaniensis*, with *Tilia americana* var. *heterophylla* and *Oxydendrum arboreum* (Caplenor 1965).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i>
Tree canopy	Broad-leaved deciduous tree	<i>Betula alleghaniensis</i> , <i>Betula lenta</i> , <i>Liriodendron tulipifera</i> , <i>Tilia americana</i> var. <i>heterophylla</i>
Tall shrub/sapling	Broad-leaved evergreen shrub	<i>Rhododendron maximum</i>
Herb (field)	Fern or fern ally	<i>Dryopteris intermedia</i> , <i>Dryopteris marginalis</i>

Characteristic Species: *Aesculus flava*, *Arisaema triphyllum*, *Dryopteris intermedia*, *Dryopteris marginalis*, *Fagus grandifolia*, *Magnolia tripetala*, *Rhododendron maximum*, *Tilia americana* var. *heterophylla*, *Tsuga canadensis*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs in the Cumberland Mountains and Cumberland Plateau of Kentucky and Tennessee, the Southern Ridge and Valley of Tennessee, and the Central Appalachians of West Virginia and possibly southwestern Pennsylvania. It may range into extreme northwestern Georgia and northeastern Alabama. Occurrences in the Interior Low Plateau are rare and of limited extent.

States/Provinces: AL?, GA?, KY, PA, TN, VA, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Big South Fork, Cumberland Gap, Obed); USFS (Daniel Boone).

CONSERVATION STATUS

Rank: G4 (5-Apr-2000).

Reasons: Occurrences are threatened by the hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This forest is known from the Rock Creek Research Natural Area in the Daniel Boone National Forest, Kentucky (Winstead and Nicely 1976). It is also found at Lilley Cornet Woods in eastern Kentucky (Martin 1975). Some Tennessee occurrences include Fall Creek Falls State Park (Caplenor 1965) and Savage Gulf in the South Cumberland Recreation Area (Quartermann et al. 1972). There is at least one disjunct occurrence of a mesic ravine with *Tsuga canadensis* in the Eastern Highland Rim of DeKalb County, Tennessee (222Eb), which would be accommodated here. The substrate at this site is siliceous limestone of the Mississippian Fort Payne Formation, immediately underlain by upper Ordovician limestones. This association is better defined in the southern part of its range. In the Western Allegheny Plateau of West Virginia, there is some conceptual overlap with *Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043), in particular a subtype of this "(1) steep-walled sandstone gorges and talus, where *Hydrangea arborescens*, *Kalmia latifolia*, and *Dryopteris marginalis* may be indicative." Classification difficulties may be encountered where the potential ranges of these two types could overlap (e.g., in parts of Kentucky, Pennsylvania, and West Virginia).

Similar Associations:

Liriodendron tulipifera - *Betula lenta* - *Tsuga canadensis* / *Rhododendron maximum* Forest (CEGL007543).

Tsuga canadensis - (*Liriodendron tulipifera*, *Fagus grandifolia*) / (*Magnolia macrophylla*, *Ilex opaca*) / *Polystichum acrostichoides* Forest (CEGL004767).

Tsuga canadensis - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043).

Related Concepts:

Hemlock-basswood Community (Caplenor 1965) ?
Hemlock-yellow birch Community (Caplenor 1965) ?
Rich hemlock - mesic hardwoods forest (Fike 1999) ?

SOURCES

Description Authors: M. Pyne, mod. R. White.

References: Caplenor 1965, Fike 1999, Fike pers. comm., Martin 1975, Perles et al. 2006, Quarterman et al. 1972, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Winstead and Nicely 1976.



Figure 12. Eastern Hemlock - Tuliptree - Birch Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.28). August 2005. NAD 1983 / UTM easting 712578, northing 4477561.

COMMON NAME (PARK-SPECIFIC): **NORTHERN RED OAK - NORTHERN
HARDWOOD FOREST**

SYNONYMS

NVC English Name: **Northern Red Oak - Sugar Maple - Tuliptree Forest**
NVC Scientific Name: ***Quercus rubra* - *Acer saccharum* - *Liriodendron tulipifera* Forest**
NVC Identifier: **CEGL006125**

LOCAL INFORMATION

Environmental Description: This association occurs on gentle to moderate slopes with variable aspect and topographic position. The underlying bedrock can be sandstone from the Allegheny, Catskill, Foreknobs or Rockwell formation, siltstone from the Scherr Formation, or shale from the Glenshaw Formation. Soils are typically channery silt loams; this forest is most commonly associated with the Berks soil series, and less often with the Weikert, Cookport, Ernst, and Laidig series.

Vegetation Description: In this association, northern red oak (*Quercus rubra*) and other oaks (*Quercus* spp.) compose >25% relative cover in all of the canopy layers combined. Typical canopy associates include black cherry (*Prunus serotina*), red maple (*Acer rubrum*), and sugar maple (*Acer saccharum*). Other occasional canopy species include bitternut hickory (*Carya cordiformis*), shagbark hickory (*Carya ovata*), chestnut oak (*Quercus prinus*), white oak (*Quercus alba*), sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*), white ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), tuliptree (*Liriodendron tulipifera*), and eastern hemlock (*Tsuga canadensis*). The canopy is typically 65–85% closed and usually 15–20 m in height. A subcanopy is usually discernible with 30 to 70% total cover and ranging from 10 to 15 m in height, depending on the stand. The subcanopy is also dominated by northern red oak, red maple, sugar maple, and black cherry. Disturbed stands may contain sassafras (*Sassafras albidum*), white ash, and black locust (*Robinia pseudoacacia*) as canopy or subcanopy associates. However, other common subcanopy species include Allegheny serviceberry (*Amelanchier laevis*), American hornbeam (*Carpinus caroliniana*), and eastern hop-hornbeam (*Ostrya virginiana*). The tall- and short-shrub layers vary from moderately dense to dense (30–80% total cover) and are variable in composition. The shrub layers often contain one or more of the following: striped maple (*Acer pensylvanicum*), American witch-hazel (*Hamamelis virginiana*), northern spicebush (*Lindera benzoin*), hawthorn (*Crataegus* sp.), mapleleaf viburnum (*Viburnum acerifolium*), Allegheny blackberry (*Rubus allegheniensis*), and Japanese barberry (*Berberis thunbergii*), along with saplings and seedlings of the species listed in the canopy and subcanopy layers above. The herbaceous layer is highly variable, usually with less than 50% total cover, although dense patches of ferns can occur. Characteristic herbs include New York fern (*Thelypteris noveboracensis*), intermediate woodfern (*Dryopteris intermedia*), eastern hayscented fern (*Dennstaedtia punctilobula*), white wood aster (*Eurybia divaricata*), sessileleaf bellwort (*Uvularia sessilifolia*), cinnamon fern (*Osmunda cinnamomea*), Swan's sedge (*Carex swanii*), wreath goldenrod (*Solidago caesia*), and sweet white violet (*Viola blanda*). Vines are typically present in low abundance; characteristic species are roundleaf greenbrier (*Smilax rotundifolia*), eastern poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus rubra</i> , <i>Acer rubrum</i> , <i>Prunus serotina</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> , <i>Acer rubrum</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> , <i>Lindera benzoin</i> , <i>Hamamelis virginiana</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> , <i>Lindera benzoin</i>
Herb (field)	Forb	<i>Eurybia divaricata</i>
Herb (field)	Graminoid	<i>Carex swanii</i>
Herb (field)	Fern or fern ally	<i>Dryopteris intermedia</i> , <i>Thelypteris noveboracensis</i>

Characteristic Species: *Acer pensylvanicum*, *Acer rubrum*, *Acer saccharum*, *Dryopteris intermedia*, *Hamamelis virginiana*, *Lindera benzoin*, *Prunus serotina*, *Quercus rubra*, *Thelypteris noveboracensis*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	S5	1	Red oak - mixed hardwood forest	Fike 1999

Local Range: This forest association is common throughout the park in a variety of environmental settings.

Classification Comments: This association is characterized by *Quercus* spp. (typically *Quercus rubra*) covering >25% relative cover in all layers of the canopy combined. *Tsuga canadensis* and *Liriodendron tulipifera* are absent or minor associates, such that each compose <25% relative cover in the canopy.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.3, ALPO.7, ALPO.10, ALPO.15, ALPO.27, ALPO.42, ALPO.67, ALPO.75.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus rubra</i> - (<i>Acer saccharum</i>) Forest Alliance (A.251)
Alliance (English name)	Northern Red Oak - (Sugar Maple) Forest Alliance
Association	<i>Quercus rubra</i> - <i>Acer saccharum</i> - <i>Liriodendron tulipifera</i> Forest
Association (English name)	Northern Red Oak - Sugar Maple - Tuliptree Forest
Ecological System(s):	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563) Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

GLOBAL DESCRIPTION

Concept Summary: This red oak - sugar maple community is found primarily in the Allegheny Plateau and Appalachian Mountain regions of the United States, as well as on the northern Piedmont north to the Hudson Valley, with possible extensions east and west of those areas. It is typically found in coves, on moist north- and east-facing slopes and on well-drained flats. Soils are slightly acidic and of intermediate fertility. Stands contain a closed-canopy tree layer. *Acer saccharum*, *Liriodendron tulipifera*, *Quercus alba*, and *Quercus rubra* are the leading dominant or characteristic species. *Acer rubrum*, *Carya ovata*, *Carya alba* (= *Carya tomentosa*), *Carya glabra*, *Nyssa sylvatica*, *Quercus coccinea*, *Quercus prinus*, and *Quercus velutina* are possible associates. A wide variety of more mesic associates, such as *Betula alleghaniensis*, *Betula lenta*, *Fagus grandifolia*, *Magnolia acuminata*, and *Fraxinus americana*, occur in some areas. In addition to *Acer saccharum* reproduction, some understory species may include *Carpinus caroliniana*, *Cercis canadensis*, and *Ostrya virginiana*. Shrub and vine species include *Amelanchier laevis*, *Amelanchier arborea*, *Cornus* spp., *Hamamelis virginiana*, *Lindera benzoin*, *Viburnum acerifolium*, *Viburnum dentatum* var. *lucidum*, and *Vitis riparia*. Ericaceous shrubs, such as *Kalmia latifolia*, *Vaccinium angustifolium* and *Vaccinium pallidum*, may also be present. The ground layer species are highly variable but include *Caulophyllum thalictroides*, *Ageratina altissima*, *Dennstaedtia punctilobula*, *Podophyllum peltatum*, *Maianthemum racemosum* (= *Smilacina racemosa*), *Medeola virginiana*, *Thelypteris noveboracensis*, *Dryopteris marginalis*, *Actaea* spp., and *Uvularia sessilifolia*.

Environmental Description: Stands are typically found in coves, on moist north- and east-facing slopes, and on well-drained flats. Soils are slightly acid and of intermediate fertility (Anderson 1982, Reschke 1990, Fike 1999).

Vegetation Description: Stands of this red oak - sugar maple forest contain a closed-canopy tree layer. *Acer saccharum*, *Liriodendron tulipifera*, *Quercus alba*, and *Quercus rubra* are the leading dominants. *Acer rubrum*, *Carya ovata*, *Carya alba* (= *Carya tomentosa*), *Nyssa sylvatica*, and *Quercus velutina* are possible associates. *Liriodendron* dominance may indicate a past disturbance history, and *Carya* spp. may share dominance in some stands. There is evidence (Fleming 1999) that *Castanea dentata* may have been important in these stands prior to its demise. A wide variety of more mesic associates, such as *Betula alleghaniensis*, *Betula lenta*, *Fagus grandifolia*, and *Fraxinus americana*, could occur but are negligible in dominance. In addition to *Acer saccharum* reproduction, some understory species may include *Carpinus caroliniana*, *Cercis canadensis*, and *Ostrya virginiana*. Shrub and vine species include *Amelanchier laevis*, *Amelanchier arborea*, *Cornus* spp., *Hamamelis virginiana*, *Lindera benzoin*, *Viburnum acerifolium*, *Viburnum dentatum* var. *lucidum*, and *Vitis riparia*. Ericaceous shrubs, such as *Kalmia latifolia*, *Vaccinium angustifolium* and *Vaccinium pallidum*, may also be present. The ground layer species are highly variable but include *Caulophyllum thalictroides*, *Dennstaedtia punctilobula*, *Podophyllum peltatum*, *Maianthemum racemosum* (= *Smilacina racemosa*), *Medeola virginiana*, *Thelypteris noveboracensis*, and *Uvularia sessilifolia*.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus alba</i> , <i>Quercus rubra</i> , <i>Acer saccharum</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Acer saccharum</i>
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Viburnum acerifolium</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Vaccinium angustifolium</i> , <i>Vaccinium pallidum</i>
Herb (field)	Forb	<i>Podophyllum peltatum</i>
Herb (field)	Fern or fern ally	<i>Dennstaedtia punctilobula</i>

Characteristic Species: *Acer saccharum*, *Carpinus caroliniana*, *Caulophyllum thalictroides*, *Liriodendron tulipifera*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This red oak - sugar maple community is found primarily in the Allegheny Plateau and Appalachian Mountain regions of the United States, with possible extensions east and west of those areas, ranging from southeastern New York and New Jersey, and west to Pennsylvania, West Virginia, and southeast Ohio.

States/Provinces: CT, NJ, NY, OH, PA, WV?

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Fort Necessity, Friendship Hill).

CONSERVATION STATUS

Rank: GNR (31-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: According to Anderson (1982) in Ohio, where this community is found in the southeastern unglaciated plateau region, it is differentiated from the oak-maple type, *Quercus alba* - *Quercus rubra* - *Quercus prinus* - *Acer saccharum* / *Lindera benzoin* Forest (CEGL002059), and the Appalachian oak forest type, *Quercus prinus* - *Quercus (alba, coccinea, velutina)* / *Viburnum acerifolium* - (*Kalmia latifolia*) Forest (CEGL005023), by the substantial presence (over 20% canopy or basal area) of *Liriodendron tulipifera* and insignificant amounts of *Fagus grandifolia* or other mesic tree species. This type concept may overlap considerably with that of the oak-maple type, *Quercus alba* - *Quercus rubra* - *Quercus prinus* - *Acer saccharum* / *Lindera benzoin* Forest (CEGL002059). Braun (1950, e.g., p. 140) reports stands similar to this type in the Shawnee Hills and Mammoth Cave area of Kentucky, as well as other Interior Low Plateau sites. In New York, this type is reported primarily from the southeastern part of the State (Reschke 1990).

Similar Associations:

Acer saccharum - *Quercus rubra* - *Carya (glabra, ovata)* / *Ageratina altissima* - *Bromus pubescens* Forest (CEGL008517)--for similar vegetation in Virginia.

Fagus grandifolia - *Quercus alba* - *Quercus rubra* Forest (CEGL006377).

Quercus alba - (*Quercus rubra*, *Acer saccharum*, *Fagus grandifolia*) / *Aesculus flava* Forest (CEGL007233)--is a related type to the south and west.

Quercus alba - *Quercus rubra* - *Quercus prinus* - *Acer saccharum* / *Lindera benzoin* Forest (CEGL002059).

Quercus prinus - *Quercus (alba, coccinea, velutina)* / *Viburnum acerifolium* - (*Kalmia latifolia*) Forest (CEGL005023).

Quercus rubra - *Acer saccharum* - *Tilia americana* var. *heterophylla* - *Aesculus flava* - (*Cladrastis kentukea*) Forest (CEGL007698).

Quercus rubra - *Tsuga canadensis* - *Liriodendron tulipifera* / *Hamamelis virginiana* Forest (CEGL006566).

Related Concepts:

Dry-Mesic Inland Mixed Oak Forest, mixed oak-hardwood type (Breden 1989) ?

SOURCES

Description Authors: D. Faber-Langendoen, mod. E. Largay.

References: Anderson 1982, Braun 1950, Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Fike 1999, Fleming 1999, Lundgren 2001, Metzler and Barrett 2001, Reschke 1990.



Figure 13. Northern Red Oak - Mixed Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.10). August 2005. NAD 1983 / UTM easting 706729, northing 4482059.



Figure 14. Northern Red Oak - Mixed Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.75). August 2005. NAD 1983 / UTM easting 714891, northing 4476636.

COMMON NAME (PARK-SPECIFIC): ALLEGHENY HARDWOOD FOREST

SYNONYMS

NVC English Name: Sugar Maple - Yellow Birch - Black Cherry Forest

NVC Scientific Name: *Acer saccharum* - *Betula alleghaniensis* - *Prunus serotina* Forest

NVC Identifier: CEGLO06045

LOCAL INFORMATION

Environmental Description: This common association is the matrix forest in the Summit Level portion of the Main Unit, although it is also found in other sections of the park. It typically occurs on mid- to upper slopes or on level sites at high topographic position. This forest type is most often found on level or gently sloping sites, however, it can occur on steeper slopes. Soils are typically very stony loams and silt loams such as those found in the Cookport, Ernst, Buchanan, Berks, Weikert, Hazelton, Gilpin, and Laidig series. This association occurs primarily over the Allegheny and Glenshaw formations, although it can occur over other formations. The composition and structure of this association are variable and strongly influenced by past disturbances, both natural and anthropogenic. Sites that were open pastures or old homesteads tend to be dominated by black cherry (*Prunus serotina*). It is believed that sites that have been logged or experienced storm damage tend to be dominated by red maple (*Acer rubrum*).

Vegetation Description: In this association, red maple and/or black cherry are usually the canopy dominants, occasionally with one or both of these species having high relative cover (>50%). Numerous associate species can be present, depending on site conditions and land-use history. American beech (*Fagus grandifolia*) can be a prominent associate. Other common canopy associates include northern red oak (*Quercus rubra*), cucumber-tree (*Magnolia acuminata*), sweet birch (*Betula lenta*), sugar maple (*Acer saccharum*), and hickories (*Carya glabra*, *Carya ovata*). Disturbed or degraded stands of this association may contain white ash (*Fraxinus americana*), black locust (*Robinia pseudoacacia*), or bigtooth aspen (*Populus grandidentata*) as prominent components of the canopy. This association is characterized by closed canopies (total cover 70–80%) with canopy height ranging from 15 to 20 m. The subcanopy is typically dominated by red maple or black cherry, although American beech, eastern hemlock (*Tsuga canadensis*), sugar maple, and striped maple (*Acer pensylvanicum*) can also be common. The subcanopy layer varies in height from 10 to 15 m with total cover ranging from 20 to 60%. The tall-shrub layer is variable, though it is typically either sparse (15–30% cover) or dense (60–80% cover). American beech, American witch-hazel (*Hamamelis virginiana*), striped maple, or northern spicebush (*Lindera benzoin*) may be dominant in the tall-shrub layer with saplings of the canopy and subcanopy trees as associates. Disturbed or degraded stands of this association may contain hawthorns (*Crataegus* spp.) or the invasive species multiflora rose (*Rosa multiflora*) in the tall- or short-shrub layers. The short-shrub layer is similarly variable, with total cover ranging from 5 to 60%. Striped maple is often abundant in the short-shrub layer, along with American witch-hazel, northern spicebush, and seedlings of American beech, black cherry, red maple, and other canopy species. Allegheny blackberry (*Rubus allegheniensis*) is another common associate in the short-shrub layer. The herbaceous layer often contains dense ferns (>60% total cover), however, some stands may contain a sparse ground layer (<20% cover). Eastern hayscented fern (*Dennstaedtia punctilobula*) and intermediate woodfern (*Dryopteris intermedia*) are typical dominants (often with 25–50%

cover). Common associates include New York fern (*Thelypteris noveboracensis*), sweet white violet (*Viola blanda*), jumpseed (*Polygonum virginianum*), white edge sedge (*Carex debilis*), Jack in the pulpit (*Arisaema triphyllum*), Swan's sedge (*Carex swanii*), white snakeroot (*Ageratina altissima* var. *altissima*), flattened oatgrass (*Danthonia compressa*), and whitegrass (*Leersia virginica*). In disturbed or degraded stands, the exotic species oriental ladythumb (*Polygonum caespitosum*) may be abundant.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Prunus serotina</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Prunus serotina</i> , <i>Fagus grandifolia</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Fagus grandifolia</i> , <i>Acer pensylvanicum</i> , <i>Hamamelis virginiana</i> , <i>Lindera benzoin</i> ,
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> , <i>Hamamelis virginiana</i> , <i>Lindera benzoin</i> , <i>Fagus grandifolia</i> , <i>Prunus serotina</i>
Herb (field)	Fern or fern ally	<i>Dennstaedtia punctilobula</i> , <i>Dryopteris intermedia</i>

Characteristic Species: *Acer pensylvanicum*, *Acer rubrum*, *Dennstaedtia punctilobula*, *Dryopteris intermedia*, *Fagus grandifolia*, *Hamamelis virginiana*, *Lindera benzoin*, *Magnolia acuminata*, *Prunus serotina*, *Quercus rubra*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	S4	1	Black cherry - northern hardwood forest	Fike 1999

Local Range: This common association is the matrix forest in the Summit Level portion of the Main Unit, although it is also found in other sections of the park.

Classification Comments: This association contains some variability in the canopy composition, although the association is characterized by dominance by *Acer rubrum* and/or *Prunus serotina* (occasionally strong dominance). *Acer saccharum* does not constitute more relative cover than either *Acer rubrum* or *Prunus serotina*. The canopy of this type does not contain significant cover (>25% relative cover) of any of the following species: *Quercus* spp., *Liriodendron tulipifera*, and *Tsuga canadensis*. If any of those species are prominent in the canopy, choose a different association in the park.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.6, ALPO.8, ALPO.9, ALPO.11, ALPO.13, ALPO.14, ALPO.25, ALPO.37, ALPO.45, ALPO.51, ALPO.53, ALPO.55, ALPO.56, ALPO.58, ALPO.59, ALPO.61.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)

Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Acer saccharum</i> - <i>Betula alleghaniensis</i> - (<i>Fagus grandifolia</i>) Forest Alliance (A.216)
Alliance (English name)	Sugar Maple - Yellow Birch - (American Beech) Forest Alliance
Association	<i>Acer saccharum</i> - <i>Betula alleghaniensis</i> - <i>Prunus serotina</i> Forest
Association (English name)	Sugar Maple - Yellow Birch - Black Cherry Forest
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This northern hardwood forest of the Allegheny Plateau and Central Appalachian Mountains occurs on moderate to deep, acidic to circumneutral loams or loamy sands, mesic to wet-mesic and nutrient-rich soils, on flat to moderate slopes. A thick layer of fallen leaves often occurs. In the glaciated portion of the range, this vegetation occurs on glacial tills, and in the unglaciated portion on sandstone or shale of northern slopes and high elevations. *Prunus serotina* is an important canopy component, with *Acer saccharum*, *Betula alleghaniensis*, and *Fagus grandifolia*. Other associates include *Acer rubrum*, *Fraxinus pennsylvanica*, *Ostrya virginiana*, *Pinus strobus*, *Quercus rubra*, and *Tsuga canadensis*. Conifers contribute less than 25% cover, in general. The shrub layer consists of *Acer pensylvanicum*, *Corylus cornuta*, *Hamamelis virginiana*, *Lonicera canadensis*, and *Viburnum acerifolium*. Herbs include *Dennstaedtia punctilobula*, *Lycopodium* spp., *Aralia nudicaulis*, *Chimaphila maculata*, *Clintonia borealis*, *Lycopodium* spp., *Maianthemum canadense*, *Oxalis montana*, *Pteridium aquilinum*, and *Streptopus lanceolatus* var. *roseus* (= *Streptopus roseus*).

Environmental Description: In the main portion of its range, this community occurs on glacial tills or on higher-elevation sites underlain by sandstone or shale. Stands are generally associated with deep, acidic to circumneutral loams or loamy sands on flat to moderate, mesic slopes. Forest-floor habitats are often characterized by thick leaf litter. In Virginia, this association is generally restricted to cool slopes over 900 m (3000 feet) on Allegheny Mountain and over 1070 m (3500 feet) elsewhere. Mean elevation of 19 plot-sampled stands in Virginia is 1090 m (3575 feet). In the Allegheny Mountains, it occupies a variety of slope positions and aspects. At disjunct sites further south, stands typically occupy middle to upper, north-facing slopes. Site moisture conditions range from mesic to submesic. Soils are extremely acidic (mean pH=3.9), with low base status. Virtually all Virginia sites supporting this community have a history of intensive logging and subsequent fires in the early part of the twentieth century. On sites that were cut using narrow-gauge railroads and steam-powered cable skidders, pit-and-mound scars are extensive (Fleming and Moorhead 1996).

Vegetation Description: The type encompasses closed-canopy deciduous forests generally dominated by *Acer saccharum*, *Betula alleghaniensis*, and *Fagus grandifolia*. In addition, *Prunus serotina* is a prominent associate that increases in importance following logging and other disturbances. Additional woody and herbaceous associates reported from throughout the range include *Acer rubrum*, *Quercus rubra*, *Pinus strobus*, *Tsuga canadensis*, *Acer pensylvanicum*, *Corylus cornuta*, *Hamamelis virginiana*, *Lonicera canadensis*, *Viburnum acerifolium*, *Dennstaedtia punctilobula*, *Lycopodium* spp., *Maianthemum canadense*, *Oxalis montana*, and *Clintonia borealis*.

In Virginia, *Acer saccharum*, *Prunus serotina*, *Quercus rubra*, and *Acer rubrum* are the most abundant canopy trees, while *Betula alleghaniensis* is an infrequent component. *Fagus*

grandifolia, *Betula lenta*, and *Fraxinus americana* are frequent, though rarely co-dominant canopy associates. Canopy composition varies occasionally to nearly pure *Acer saccharum*. Lower woody layers are usually open, patchy, and dominated mostly by *Acer pensylvanicum*, *Acer saccharum*, and *Fagus grandifolia*. The herb layers of many stands are characterized by patch-dominance of *Dennstaedtia punctilobula*. Other more- or- less constant or characteristic herbaceous species are *Anemone lancifolia*, *Arisaema triphyllum*, *Carex appalachica*, *Carex digitalis*, *Carex leptoneura*, *Milium effusum*, *Polystichum acrostichoides*, *Solidago curtisii*, *Thelypteris noveboracensis*, *Viola blanda*, and *Viola rotundifolia*.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> , <i>Fagus grandifolia</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i>
Herb (field)	Fern or fern ally	<i>Dennstaedtia punctilobula</i>

Characteristic Species: *Acer saccharum*, *Anemone lancifolia*, *Carex leptoneura*, *Dennstaedtia punctilobula*, *Fagus grandifolia*, *Milium effusum*, *Prunus serotina*, *Viola blanda*, *Viola hastata*.

Other Noteworthy Species: *Carex arctata*, *Certhia americana*, *Oporornis philadelphia*, *Schizachne purpurascens*, *Sphyrapius varius*.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The principal range of this community type is the Allegheny Plateau region of southern New York and northern Pennsylvania, extending south along the high Allegheny Mountains of Maryland, Virginia, and West Virginia. In Virginia, the type is widespread only on Allegheny Mountain in northwest Highland County, but occurs locally in disjunct, high-elevation areas of the Ridge and Valley, Cumberland Mountains and, very rarely, the northern Blue Ridge.

States/Provinces: MD, NY, PA, VA:S2, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap); USFS (George Washington, Jefferson).

CONSERVATION STATUS

Rank: G4 (28-Sep-2001).

Reasons: Although the total geographic range of this association is not large, it is a matrix forest community and covers large areas in the Allegheny Plateau region and Allegheny Mountains.

CLASSIFICATION INFORMATION

Status: Nonstandard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations:

Betula alleghaniensis - *Fagus grandifolia* - *Aesculus flava* / *Viburnum lantanoides* / *Eurybia chlorolepis* - *Dryopteris intermedia* Forest (CEGL007285)--less *Prunus serotina*, and prevalence of several key southern Appalachian species, e.g., *Aesculus flava*, *Eurybia chlorolepis* (= *Aster chlorolepis*), *Ageratina altissima* var. *roanensis*, *Carex lucorum* var. *australucorum*, *Prenanthes roanensis*, and *Eupatorium steelei*.

Betula alleghaniensis - *Quercus rubra* / *Acer* (*pensylvanicum*, *spicatum*) / *Dryopteris intermedia* - *Oclemena acuminata* Forest (CEGL008502).

Related Concepts:

Prunus serotina - *Acer saccharum* - *Fagus grandifolia* / *Carex digitalis* - (*Dennstaedtia punctilobula*) Forest (Fleming and Coulling 2001) =

Prunus serotina - *Quercus rubra* / *Dennstaedtia punctilobula* - *Carex digitalis* Association (Fleming and Moorhead 1996) ?

Black Cherry - Maple: 28 (Eyre 1980) B

Maple-beech-birch-cherry northern hardwoods (matrix) (CAP pers. comm. 1998) ?

SOURCES

Description Authors: G. Fleming.

References: Braun 1950, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Fowells 1965, Harrison 2004, Lundgren 2001, NatureServe n.d., VDNH 2003.

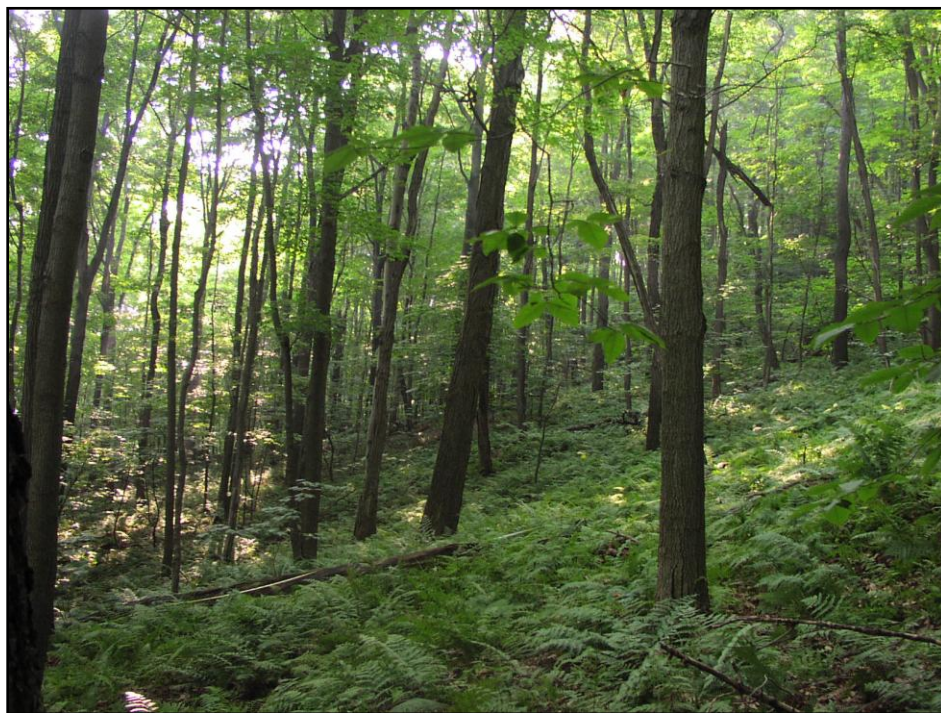


Figure 15. Allegheny Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.25). August 2005. NAD 1983 / UTM easting 710938, northing 4478463.



Figure 16. Allegheny Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.53). August 2005. NAD 1983 / UTM easting 708003, northing 4480716.

COMMON NAME (PARK-SPECIFIC): NORTHERN HARDWOOD FOREST

SYNONYMS

NVC English Name: Sugar Maple - Yellow Birch - Black Cherry Forest

NVC Scientific Name: *Acer saccharum* - *Betula alleghaniensis* - *Prunus serotina* Forest

NVC Identifier: CEGLO06045

LOCAL INFORMATION

Environmental Description: This common forest type occurs throughout the park on low and midslopes. The slope varies from nearly level (2%) to extremely steep (90%). Aspect is similarly variable. The best examples of this type in the park are found on the steep northeast-facing slopes between the stone bridge and the Muleshoe Curve. Soil pH in this area is often near 7.0, indicating calcareous influence on the soil. The bedrock is typically sandstone, siltstone and shale from a variety of formations. Soils are usually channery or extremely stony silt loams, such as found in the Berks, Weikert, Laidig, Buchanan, Gilpin, and Leck Kill soil series.

Vegetation Description: This association is characterized by the dominance of sugar maple (*Acer saccharum*) covering at least 25% relative cover of the canopy and subcanopy combined. In some stands, sugar maple is the clear dominant covering 50–75% of the canopy and subcanopy. Common canopy associates include red maple (*Acer rubrum*), black cherry (*Prunus serotina*), northern red oak (*Quercus rubra*), American basswood (*Tilia americana*), sweet birch (*Betula lenta*), and yellow birch (*Betula alleghaniensis*). Occasional associates are tuliptree (*Liriodendron tulipifera*) and hickories (*Carya cordiformis*, *Carya ovata*). Black locust (*Robinia pseudoacacia*) and white ash (*Fraxinus americana*) can occur as associates in disturbed stands. The canopy is usually closed (total cover 70–90%) and 15 to 25 m in height, depending on local site condition. The subcanopy is typically dominated by sugar maple; other prevalent species include striped maple (*Acer pensylvanicum*), eastern hemlock (*Tsuga canadensis*), eastern hop-hornbeam (*Ostrya virginiana*), and the canopy species. The subcanopy ranges in height from 10 to 15 m and in cover from moderate (30%) to dense (80%). The tall-shrub layer is also variable (15–70% cover). The tall-shrub layer is often strongly dominated by striped maple or sugar maple, although American witch-hazel (*Hamamelis virginiana*) and red maple may also be common. The short-shrub layer generally has sparse to moderate total cover (5–45%). Typical short shrubs include seedlings and saplings of canopy and subcanopy species, especially striped maple and sugar maple, as well as common elderberry (*Sambucus nigra* ssp. *canadensis*), northern spicebush (*Lindera benzoin*), and blackberries / raspberries (*Rubus allegheniensis*, *Rubus occidentalis*). The herbaceous layer varies in cover from 20 to 70% total cover and is often more diverse than other forest types in the park. The herbaceous layer often has a significant cover of ferns, especially intermediate woodfern (*Dryopteris intermedia*), marginal woodfern (*Dryopteris marginalis*), Christmas fern (*Polystichum acrostichoides*), eastern hayscented fern (*Dennstaedtia punctilobula*), and New York fern (*Thelypteris noveboracensis*). Other common species are sweet white violet (*Viola blanda*), Jack in the pulpit (*Arisaema triphyllum*), white wood aster (*Eurybia divaricata*), Canada mayflower (*Maianthemum canadense*), grove bluegrass (*Poa alsodes*), hairy Solomon's seal (*Polygonatum pubescens*), sessileleaf bellwort (*Uvularia sessilifolia*), broad looseflower sedge (*Carex laxiflora*), wreath goldenrod (*Solidago caesia*), and white snakeroot (*Ageratina altissima* var. *altissima*). The

invasive species Japanese stilt grass (*Microstegium vimineum*) can be present in this type. Summer grape (*Vitis aestivalis*) is a commonly occurring vine at low abundance in this type.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer saccharum</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> , <i>Acer saccharum</i> <i>Hamamelis virginiana</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> , <i>Acer saccharum</i>
Herb (field)	Forb	<i>Arisaema triphyllum</i> , <i>Viola blanda</i>
Herb (field)	Fern or fern ally	<i>Dryopteris intermedia</i> , <i>Dryopteris marginalis</i>

Characteristic Species: *Acer pensylvanicum*, *Acer saccharum*, *Betula alleghaniensis*, *Betula lenta*, *Dryopteris intermedia*, *Dryopteris marginalis*, *Prunus serotina*, *Quercus rubra*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	S4	2	Northern hardwood forest	Fike 1999

Local Range: Northern Hardwood Forest: This association is one of the matrix forest types for the park and therefore occurs commonly throughout. The best examples of this type in the park are found on the steep northeast-facing slopes between the stone bridge and the Muleshoe Curve.

Classification Comments: Northern Hardwood Forest: The association can be identified by the dominance of *Acer saccharum* in the canopy and subcanopy, often mixed with other hardwoods. *Acer rubrum* and *Prunus serotina* each do not have more relative cover than *Acer saccharum*. *Quercus* spp., *Tsuga canadensis*, and *Liriodendron tulipifera* do not have greater than 25% relative cover. This type is not restricted to floodplains as is the Sugar Maple Floodplain Forest.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: Northern Hardwood Forest: ALPO.22, ALPO.46, ALPO.48, ALPO.64, ALPO.68, ALPO.69.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Acer saccharum</i> - <i>Betula alleghaniensis</i> - (<i>Fagus grandifolia</i>) Forest Alliance (A.216)
Alliance (English name)	Sugar Maple - Yellow Birch - (American Beech) Forest Alliance
Association	<i>Acer saccharum</i> - <i>Betula alleghaniensis</i> - <i>Prunus serotina</i> Forest
Association (English name)	Sugar Maple - Yellow Birch - Black Cherry Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)

GLOBAL DESCRIPTION

Concept Summary: This northern hardwood forest of the Allegheny Plateau and Central Appalachian Mountains occurs on moderate to deep, acidic to circumneutral loams or loamy sands, mesic to wet-mesic and nutrient-rich soils, on flat to moderate slopes. A thick layer of fallen leaves often occurs. In the glaciated portion of the range, this vegetation occurs on glacial tills, and in the unglaciated portion on sandstone or shale of northern slopes and high elevations. *Prunus serotina* is an important canopy component, with *Acer saccharum*, *Betula alleghaniensis*, and *Fagus grandifolia*. Other associates include *Acer rubrum*, *Fraxinus pennsylvanica*, *Ostrya virginiana*, *Pinus strobus*, *Quercus rubra*, and *Tsuga canadensis*. Conifers contribute less than 25% cover, in general. The shrub layer consists of *Acer pensylvanicum*, *Corylus cornuta*, *Hamamelis virginiana*, *Lonicera canadensis*, and *Viburnum acerifolium*. Herbs include *Dennstaedtia punctilobula*, *Lycopodium* spp., *Aralia nudicaulis*, *Chimaphila maculata*, *Clintonia borealis*, *Lycopodium* spp., *Maianthemum canadense*, *Oxalis montana*, *Pteridium aquilinum*, and *Streptopus lanceolatus* var. *roseus* (= *Streptopus roseus*).

Environmental Description: In the main portion of its range, this community occurs on glacial tills or on higher-elevation sites underlain by sandstone or shale. Stands are generally associated with deep, acidic to circumneutral loams or loamy sands on flat to moderate, mesic slopes. Forest-floor habitats are often characterized by thick leaf litter. In Virginia, this association is generally restricted to cool slopes over 900 m (3000 feet) on Allegheny Mountain and over 1070 m (3500 feet) elsewhere. Mean elevation of 19 plot-sampled stands in Virginia is 1090 m (3575 feet). In the Allegheny Mountains, it occupies a variety of slope positions and aspects. At disjunct sites further south, stands typically occupy middle to upper, north-facing slopes. Site moisture conditions range from mesic to submesic. Soils are extremely acidic (mean pH=3.9), with low base status. Virtually all Virginia sites supporting this community have a history of intensive logging and subsequent fires in the early part of the twentieth century. On sites that were cut using narrow-gauge railroads and steam-powered cable skidders, pit-and-mound scars are extensive (Fleming and Moorhead 1996).

Vegetation Description: The type encompasses closed-canopy deciduous forests generally dominated by *Acer saccharum*, *Betula alleghaniensis*, and *Fagus grandifolia*. In addition, *Prunus serotina* is a prominent associate that increases in importance following logging and other disturbances. Additional woody and herbaceous associates reported from throughout the range include *Acer rubrum*, *Quercus rubra*, *Pinus strobus*, *Tsuga canadensis*, *Acer pensylvanicum*, *Corylus cornuta*, *Hamamelis virginiana*, *Lonicera canadensis*, *Viburnum acerifolium*, *Dennstaedtia punctilobula*, *Lycopodium* spp., *Maianthemum canadense*, *Oxalis montana*, and *Clintonia borealis*.

In Virginia, *Acer saccharum*, *Prunus serotina*, *Quercus rubra*, and *Acer rubrum* are the most abundant canopy trees, while *Betula alleghaniensis* is an infrequent component. *Fagus grandifolia*, *Betula lenta*, and *Fraxinus americana* are frequent, though rarely co-dominant canopy associates. Canopy composition varies occasionally to nearly pure *Acer saccharum*. Lower woody layers are usually open, patchy, and dominated mostly by *Acer pensylvanicum*, *Acer saccharum*, and *Fagus grandifolia*. The herb layers of many stands are characterized by patch-dominance of *Dennstaedtia punctilobula*. Other more- or- less constant or characteristic herbaceous species are *Anemone lancifolia*, *Arisaema triphyllum*, *Carex appalachica*, *Carex digitalis*, *Carex leptoneura*, *Milium effusum*, *Polystichum acrostichoides*, *Solidago curtisii*, *Thelypteris noveboracensis*, *Viola blanda*, and *Viola rotundifolia*.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> , <i>Fagus grandifolia</i> , <i>Prunus serotina</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i>

Characteristic Species: *Acer saccharum*, *Anemone lancifolia*, *Carex leptoneura*, *Dennstaedtia punctilobula*, *Fagus grandifolia*, *Milium effusum*, *Prunus serotina*, *Viola blanda*, *Viola hastata*.

Other Noteworthy Species: *Carex arctata*, *Certhia americana*, *Oporornis philadelphia*, *Schizachne purpurascens*, *Sphyrapius varius*.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The principal range of this community type is the Allegheny Plateau region of southern New York and northern Pennsylvania, extending south along the high Allegheny Mountains of Maryland, Virginia, and West Virginia. In Virginia, the type is widespread only on Allegheny Mountain in northwest Highland County, but occurs locally in disjunct, high-elevation areas of the Ridge and Valley, Cumberland Mountains and, very rarely, the northern Blue Ridge.

States/Provinces: MD, NY, PA, VA:S2, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap); USFS (George Washington, Jefferson).

CONSERVATION STATUS

Rank: G4 (28-Sep-2001).

Reasons: Although the total geographic range of this association is not large, it is a matrix forest community and covers large areas in the Allegheny Plateau region and Allegheny Mountains.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations:

Betula alleghaniensis - *Fagus grandifolia* - *Aesculus flava* / *Viburnum lantanoides* / *Eurybia chlorolepis* - *Dryopteris intermedia* Forest (CEGL007285)--less *Prunus serotina*, and prevalence of several key southern Appalachian species, e.g., *Aesculus flava*, *Eurybia chlorolepis* (= *Aster chlorolepis*), *Ageratina altissima* var. *roanensis*, *Carex lucorum* var. *austrolucorum*, *Prenanthes roanensis*, and *Eupatorium steelei*.

Betula alleghaniensis - *Quercus rubra* / *Acer* (*pensylvanicum*, *spicatum*) / *Dryopteris intermedia* - *Oclemena acuminata* Forest (CEGL008502).

Related Concepts:

Prunus serotina - *Acer saccharum* - *Fagus grandifolia* / *Carex digitalis* - (*Dennstaedtia punctilobula*) Forest (Fleming and Coulling 2001) =

Prunus serotina - *Quercus rubra* / *Dennstaedtia punctilobula* - *Carex digitalis* Association (Fleming and Moorhead 1996) ?

Black Cherry - Maple: 28 (Eyre 1980) B

Maple-beech-birch-cherry northern hardwoods (matrix) (CAP pers. comm. 1998) ?

SOURCES

Description Authors: G. Fleming.

References: Braun 1950, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Fowells 1965, Harrison 2004, Lundgren 2001, VDNH 2003.



Figure 17. Northern Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.22). August 2005. NAD 1983 / UTM easting 709785, northing 4479964.



Figure 18. Northern Hardwood Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.48). August 2005. NAD 1983 / UTM easting 710086, northing 4479495.

COMMON NAME (PARK-SPECIFIC): TULIPTREE - BEECH - MAPLE FOREST

SYNONYMS

NVC English Name: American Beech - Sweet Birch - Tuliptree - Sugar Maple Forest

NVC Scientific Name: *Fagus grandifolia* - *Betula lenta* - *Liriodendron tulipifera* - *Acer saccharum* Forest

NVC Identifier: CEGLO06296

LOCAL INFORMATION

Environmental Description: This association occurs on gentle to slightly steep low and midslopes throughout the park. Soils vary from sandy loam on creek floodplains to gravelly and channery loams and silt loams on midslopes. Sandstone is the typical bedrock found in the Allegheny, Catskill, and Burgoon formations. This vegetation type often occurs on sites with a history of disturbance from agriculture, silviculture or natural disturbance.

Vegetation Description: This association is dominated by tuliptree (*Liriodendron tulipifera*) and sugar maple (*Acer saccharum*), often with red maple (*Acer rubrum*), black cherry (*Prunus serotina*), sassafras (*Sassafras albidum*), American beech (*Fagus grandifolia*), and American elm (*Ulmus americana*) as associates. The canopy is usually 15 to 25 m in height with greater than 70% canopy closure. The subcanopy is typically 10 to 15 in height with total cover of 30 to 60%. Typical subcanopy trees are sugar maple, red maple, American hornbeam (*Carpinus caroliniana*), and American beech. The tall-shrub layer is 2 to 5 m in height with cover varying from 30 to 70%. Common tall shrubs include northern spicebush (*Lindera benzoin*), American witch-hazel (*Hamamelis virginiana*), and occasional saplings of the canopy trees. The short-shrub layer is less than 2 m in height and may vary from sparse (10% cover) to moderately dense (40% cover). This layer usually contains northern spicebush, American witch-hazel, striped maple (*Acer pensylvanicum*), blackberries / raspberries (*Rubus allegheniensis*, *Rubus occidentalis*), and seedlings of the canopy trees. The invasive shrubs multiflora rose (*Rosa multiflora*) and Japanese barberry (*Berberis thunbergii*) may also be present. The herbaceous layer typically has 10 to 50% total cover. Typical herbaceous species include intermediate woodfern (*Dryopteris intermedia*), sweet white violet (*Viola blanda*), New York fern (*Thelypteris noveboracensis*), colonial bentgrass (*Agrostis capillaris*), grove bluegrass (*Poa alsodes*), Jack in the pulpit (*Arisaema triphyllum*), eastern star sedge (*Carex radiata*), eastern hayscented fern (*Dennstaedtia punctilobula*), and American pokeweed (*Phytolacca americana*). The exotic species oriental ladythumb (*Polygonum caespitosum*) can also be abundant. Vines are typically present in low abundance; characteristic species are summer grape (*Vitis aestivalis*), Virginia creeper (*Parthenocissus quinquefolia*), eastern poison ivy (*Toxicodendron radicans*), and roundleaf greenbrier (*Smilax rotundifolia*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> , <i>Acer rubrum</i> , <i>Acer saccharum</i> , <i>Prunus serotina</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Acer saccharum</i> , <i>Carpinus caroliniana</i> , <i>Fagus grandifolia</i>
Tall Shrub/sapling	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i> , <i>Lindera benzoin</i>
Short Shrub/sapling	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i> , <i>Lindera benzoin</i>

Herb (field)	Forb	<i>Viola blanda</i>
Herb (field)	Graminoid	<i>Agrostis capillaris</i> , <i>Poa alsodes</i>
Herb (field)	Fern or fern ally	<i>Dryopteris intermedia</i> , <i>Thelypteris noveboracensis</i>

Characteristic Species: *Acer saccharum*, *Dryopteris intermedia*, *Hamamelis virginiana*, *Lindera benzoin*, *Liriodendron tulipifera*, *Prunus serotina*, *Viola blanda*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	S4	2	Tuliptree - beech - maple forest	Fike 1999

Local Range: This association occurs throughout the park on mesic midslopes and shallow ravines.

Classification Comments: This vegetation type is identified by the prominence of *Liriodendron tulipifera* (>25% relative cover in all the canopy layers combined). *Quercus* spp. and *Tsuga canadensis* are absent or minor components of the stand (<25% relative cover in all the canopy layers combined).

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.38, ALPO.44, ALPO.49.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Fagus grandifolia</i> - <i>Acer saccharum</i> - (<i>Liriodendron tulipifera</i>) Forest Alliance (A.227)
Alliance (English name)	American Beech - Sugar Maple - (Tuliptree) Forest Alliance
Association	<i>Fagus grandifolia</i> - <i>Betula lenta</i> - <i>Liriodendron tulipifera</i> - <i>Acer saccharum</i> Forest
Association (English name)	American Beech - Sweet Birch - Tuliptree - Sugar Maple Forest
Ecological System(s):	Northeastern Interior Dry-Mesic Oak Forest (CES202.592)

GLOBAL DESCRIPTION

Concept Summary: This mid- to lower slope deciduous forest of the mid-Atlantic region occurs on deep soils that are not strongly acidic. The tree canopy is characterized by a mixture of *Liriodendron tulipifera*, *Fagus grandifolia*, *Acer saccharum*, *Betula lenta*, and other associated species, including *Acer rubrum*, *Nyssa sylvatica*, and *Carya alba* (= *Carya tomentosa*). The subcanopy is characterized by *Carpinus caroliniana*, *Cornus florida*, and *Ostrya virginiana*. *Magnolia acuminata* may occur in the western portion of the range. Common species of the shrub layer include *Hamamelis virginiana* and *Lindera benzoin*. The herbaceous layer is characterized by *Podophyllum peltatum*, *Sanguinaria canadensis*,

Botrychium virginianum, *Dicentra cucullaria*, *Dicentra canadensis*, *Allium tricoccum*, and *Claytonia virginica*.

Environmental Description: This vegetation occurs on middle to lower slopes on moderately deep soils that are not extremely acidic.

Vegetation Description: The tree canopy is characterized by a mixture of *Liriodendron tulipifera*, *Fagus grandifolia*, *Acer saccharum*, *Betula lenta*, and other associated species, including *Acer rubrum*, *Nyssa sylvatica*, and *Carya alba* (= *Carya tomentosa*). The subcanopy is characterized by *Carpinus caroliniana*, *Cornus florida*, and *Ostrya virginiana*. Common species of the shrub layer include *Hamamelis virginiana* and *Lindera benzoin*. The herbaceous layer is characterized by *Podophyllum peltatum*, *Sanguinaria canadensis*, *Botrychium virginianum*, *Dicentra cucullaria*, *Dicentra canadensis*, *Allium tricoccum*, and *Claytonia virginica*.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> , <i>Fagus grandifolia</i> , <i>Liriodendron tulipifera</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Carpinus caroliniana</i> , <i>Cornus florida</i> , <i>Ostrya virginiana</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i> , <i>Lindera benzoin</i>
Short Shrub/sapling	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i> , <i>Lindera benzoin</i>
Herb (field)	Forb	<i>Podophyllum peltatum</i>
Herb (field)	Fern or fern ally	<i>Botrychium virginianum</i>

Characteristic Species: *Acer saccharum*, *Allium tricoccum*, *Betula lenta*, *Botrychium virginianum*, *Carpinus caroliniana*, *Claytonia virginica*, *Cornus florida*, *Dicentra cucullaria*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Ostrya virginiana*, *Podophyllum peltatum*, *Sanguinaria canadensis*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is currently described primarily from Pennsylvania and is also documented in New Jersey. It may occur in Maryland.

States/Provinces: MD?, NJ, PA.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Friendship Hill, Morristown).

CONSERVATION STATUS

Rank: GNR (6-Dec-2004).

Reasons: More information is required to determine the range and rank of this vegetation type.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: This description is based on the tuliptree - beech - maple forest of Fike (1999). More information is required to determine the range of this type.

Similar Associations:

Fagus grandifolia - *Acer saccharum* - *Liriodendron tulipifera* Unglaciaded Forest (CEGL002411)--also contains *Liquidambar styraciflua*, *Asimina triloba*, *Carya cordiformis*, and *Betula lenta* is absent.

Fagus grandifolia - *Acer saccharum* Glaciaded Midwest Forest (CEGL005013)--has a shrub layer characterized by *Diervilla lonicera*, *Euonymus obovatus*, *Lonicera canadensis*, and *Betula lenta* is absent.

Fagus grandifolia - *Betula lenta* - *Quercus (alba, rubra)* / *Carpinus caroliniana* Forest (CEGL006921)--lacks *Acer saccharum*, and *Quercus* spp. are more important.

Related Concepts: Information not available.

SOURCES

Description Authors: J. Fike and L. A. Sneddon, mod. E. Largay.

References: Eastern Ecology Working Group n.d., Fike 1999, Perles et al. 2006.



Figure 19. Tuliptree - Beech - Maple Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.38). August 2005. NAD 1983 / UTM easting 682124, northing 4470650.



Figure 20. Tuliptree - Beech - Maple Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.49). August 2005. NAD 1983 / UTM easting 709330, northing 4480379.

COMMON NAME (PARK-SPECIFIC): MODIFIED SUCCESSIONAL FOREST

SYNONYMS

NVC English Name: Black Cherry - Tuliptree - Red Maple - White Ash Forest

NVC Scientific Name: *Prunus serotina* - *Liriodendron tulipifera* - *Acer rubrum* - *Fraxinus americana* Forest

NVC Identifier: CEG006599

LOCAL INFORMATION

Environmental Description: This forest type occurs on former agricultural or pasture land and other disturbed or degraded environmental settlements. These forests are often young and resulted from the colonization of old agricultural fields by woody species. Recent disturbance or abundant invasive species give these forest stands a weedy character. It is unlikely that these stands will succeed to a natural plant community dominated by native species. These disturbed forests are usually located on moderately well-drained to well-drained soils such as silt loams from the Armagh, Blairton, and Ernst series, and very stony loams from the Cookport, Berks, Weikert and Laidig series. The underlying bedrock can be siltstone, sandstone or shale.

Vegetation Description: The species composition and vegetation structure of this forest type are extremely variable between and within sites. The type is characterized by early-successional or weedy tree species and an abundance of invasive species and vines. Forests are typically young, with canopy and subcanopy trees extending from 6–20 m in height and covering 30–90% of the stand. The canopy and subcanopy can be dominated by one or more of the following species: black locust (*Robinia pseudoacacia*), white ash (*Fraxinus americana*), black walnut (*Juglans nigra*), sassafras (*Sassafras albidum*), black cherry (*Prunus serotina*), eastern white pine (*Pinus strobus*), apple (*Malus* sp.), and hawthorns (*Crataegus* spp.). The invasive species tree-of-heaven (*Ailanthus altissima*) may be present in the canopy or subcanopy. The variable tall-shrub layer (10–60% cover) can contain saplings of the canopy trees, northern spicebush (*Lindera benzoin*), and American witch-hazel (*Hamamelis virginiana*). The invasive shrubs multiflora rose (*Rosa multiflora*), Morrow's honeysuckle (*Lonicera morrowii*), and border privet (*Ligustrum obtusifolium*) can be abundant in the tall- or short-shrub layers. The short-shrub layer is typically dense (50–70% cover) and contains multiflora rose, Allegheny blackberry (*Rubus allegheniensis*), black raspberry (*Rubus occidentalis*), bristly dewberry (*Rubus hispidus*), staghorn sumac (*Rhus hirta*), and seedlings of the canopy tree species. The herbaceous layer may be sparse or dense (20–95% cover) and has variable species composition influenced by local hydrology, land-use history, and available seed sources. Common species include wrinkleleaf goldenrod (*Solidago rugosa*), smooth brome (*Bromus inermis*), white snakeroot (*Ageratina altissima* var. *altissima*), common cinquefoil (*Potentilla simplex*), sweet vernalgrass (*Anthoxanthum odoratum*), colonial bentgrass (*Agrostis capillaris*), flat-top goldentop (*Euthamia graminifolia*), orchard grass (*Dactylis glomerata*), deertongue (*Dichanthelium clandestinum*), calico aster (*Symphotrichum lateriflorum* var. *lateriflorum*), wild basil (*Clinopodium vulgare*), common yellow oxalis (*Oxalis stricta*), jumpseed (*Polygonum virginianum*), and white avens (*Geum canadense*). In stands with high vine cover (up to 70% cover), the vegetation structure can be degraded by the weight of the vines pulling down trees and shrubs. Common vines include Virginia creeper (*Parthenocissus quinquefolia*), eastern poison ivy (*Toxicodendron radicans*), and summer grape (*Vitis aestivalis*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Fraxinus americana</i> , <i>Juglans nigra</i> , <i>Robinia pseudoacacia</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Rosa multiflora</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Rosa multiflora</i>
Herb (field)	Vine/Liana	<i>Parthenocissus quinquefolia</i> , <i>Toxicodendron radicans</i>
Herb (field)	Forb	<i>Ageratina altissima</i> var. <i>altissima</i> , <i>Solidago rugosa</i>
Herb (field)	Graminoid	<i>Anthoxanthum odoratum</i> , <i>Bromus</i> <i>inermis</i>

Characteristic Species: *Acer rubrum*, *Fraxinus americana*, *Juglans nigra*, *Parthenocissus quinquefolia*, *Prunus serotina*, *Rhus hirta*, *Robinia pseudoacacia*, *Rosa multiflora*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	NA	NA	no crosswalk	Fike 1999

Local Range: This variable forest type is common in the park, particularly in areas that were formerly used for agriculture or pasture and other disturbed or degraded sites.

Classification Comments: Modified Successional Forest is highly variable in species composition and vegetation structure; however, it is identifiable by the abundance of early-successional or weedy tree species, invasive species, and vines. These forests will probably not succeed to a community dominated by native plants.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.1, ALPO.2, ALPO.29, ALPO.30, ALPO.34, ALPO.36, ALPO.40, ALPO.71, ALPO.72.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Prunus serotina</i> - <i>Acer rubrum</i> - <i>Amelanchier canadensis</i> - <i>Quercus</i> spp. Forest Alliance (A.237)
Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	<i>Prunus serotina</i> - <i>Liriodendron tulipifera</i> - <i>Acer rubrum</i> - <i>Fraxinus</i> <i>americana</i> Forest
Association (English name)	Black Cherry - Tuliptree - Red Maple - White Ash Forest
Ecological System(s):	Central Appalachian Dry Oak-Pine Forest (CES202.591)

Northeastern Interior Dry-Mesic Oak Forest (CES202.592)

GLOBAL DESCRIPTION

Concept Summary: This early-successional woody vegetation of the northeastern United States occurs on sites that have generally been cleared for agriculture. Environmental setting varies, but generally sites are dry-mesic to mesic, with small seepage inclusions in some examples. Physiognomy of this vegetation is highly variable, ranging from closed forest, open forest, tall dense shrubland, to more open tall shrubland. Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species may include *Prunus serotina*, *Liriodendron tulipifera*, *Fraxinus americana*, and *Acer rubrum*. Other associates can include *Juglans nigra*, *Sassafras albidum*, *Betula populifolia*, *Juniperus virginiana*, *Acer negundo*, *Acer saccharinum*, *Ailanthus altissima*, *Ulmus americana*, *Quercus* spp., *Betula lenta*, *Amelanchier* spp., and *Robinia pseudoacacia*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris*, *Rubus allegheniensis*, *Rubus phoenicolasius*, or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica*, *Lonicera japonica*, *Rhamnus cathartica*, *Crataegus* spp., *Rosa multiflora*, and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin.

Environmental Description: This vegetation occurs on sites that have been cleared for agriculture or otherwise heavily modified in the past. Generally sites are dry-mesic and may have small seepage inclusions in some examples.

Vegetation Description: Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species may include *Prunus serotina*, *Liriodendron tulipifera*, *Fraxinus americana*, and *Acer rubrum*. Other associates can include *Juglans nigra*, *Sassafras albidum*, *Betula populifolia*, *Juniperus virginiana*, *Acer negundo*, *Acer saccharinum*, *Ailanthus altissima*, *Ulmus americana*, *Quercus* spp., *Betula lenta*, *Amelanchier* spp., and *Robinia pseudoacacia*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris*, *Rubus allegheniensis*, *Rubus phoenicolasius*, or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica*, *Lonicera japonica*, *Rhamnus cathartica*, *Crataegus* spp., *Rosa multiflora*, and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Fraxinus americana</i> , <i>Liriodendron tulipifera</i> , <i>Prunus serotina</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i>
Tall shrub/sapling	Broad-leaved deciduous tree	<i>Carpinus caroliniana</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Lindera benzoin</i>

Characteristic Species: *Acer rubrum*, *Fraxinus americana*, *Liriodendron tulipifera*, *Prunus serotina*, *Robinia pseudoacacia*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is currently described from Pennsylvania but is of broader distribution in the northeastern U.S.

States/Provinces: NJ, NY, PA.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Fort Necessity, Friendship Hill, Gettysburg, Johnstown Flood, Morristown, Valley Forge).

CONSERVATION STATUS

Rank: GNA (ruderal) (29-Nov-2004).

Reasons: This vegetation is modified by human activity and not of conservation concern.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: This vegetation is broadly defined and varies widely in composition across its range, presenting a classification challenge at the alliance level.

Similar Associations:

Robinia pseudoacacia Forest (CEGL007279).

Related Concepts: Information not available.

SOURCES

Description Authors: L. A. Sneddon.

References: Eastern Ecology Working Group n.d., Fike 1999, Perles et al. 2006c, Perles et al. 2006.



Figure 21. Modified Successional Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.1). August 2005. NAD 1983 / UTM easting 707197, northing 4481360.



Figure 22. Modified Successional Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.29). August 2005. NAD 1983 / UTM easting 715457, northing 4476594.

COMMON NAME (PARK-SPECIFIC): CONIFER PLANTATION

SYNONYMS

NVC English Name: Pine species Planted Forest

NVC Scientific Name: *Pinus* spp. Planted Forest

NVC Identifier: CEGLO06313

LOCAL INFORMATION

Environmental Description: This forest type typically is located on flat or gently sloping sites in a variety of topographic settings. The plantations can occur on a diversity of soils and bedrock formations. The age of the plantation trees and the management history have significant effects on the species composition and vegetation structure of the stand.

Vegetation Description: The conifer plantations in Allegheny Portage Railroad National Historic Site are characterized by an open canopy (30–65% absolute cover) dominated by red pine (*Pinus resinosa*) or Norway spruce (*Picea abies*). Associate tree species in the canopy and subcanopy can vary widely depending on environmental conditions and stand history. Some common associates are black locust (*Robinia pseudoacacia*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), and oaks (*Quercus* spp.). The tall-shrub layer is often well-developed (>60% cover). When present, it can contain southern arrowwood (*Viburnum dentatum* var. *lucidum*), northern spicebush (*Lindera benzoin*), red maple, gray dogwood (*Cornus racemosa*), and white ash (*Fraxinus americana*). The short-shrub layer is often sparse (<30% cover). Common species are Morrow's honeysuckle (*Lonicera morrowii*), white ash, red maple, northern spicebush, blackberries / raspberries (*Rubus allegheniensis*, *Rubus occidentalis*), hawthorns (*Crataegus* spp.), and the invasive shrubs Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*). The composition of the ground layer is extremely variable and is influenced by local environmental conditions and past management of the stand. The herbaceous layer can resemble an Old Field or a Wet Meadow depending on the site hydrology. Some common ground layer species include sweet vernalgrass (*Anthoxanthum odoratum*), fowl mannagrass (*Glyceria striata*), colonial bentgrass (*Agrostis capillaris*), common gypsyweed (*Veronica officinalis*), intermediate woodfern (*Dryopteris intermedia*), whitegrass (*Leersia virginica*), orchard grass (*Dactylis glomerata*), oriental ladythumb (*Polygonum caespitosum*), and green bulrush (*Scirpus atrovirens*). However, many other species may be present.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Picea abies</i> , <i>Pinus resinosa</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Fraxinus americana</i> , <i>Robinia pseudoacacia</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Cornus racemosa</i> , <i>Lindera benzoin</i> , <i>Viburnum dentatum</i> var. <i>lucidum</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Berberis thunbergii</i> , <i>Lonicera morrowii</i>

Characteristic Species: *Fraxinus americana*, *Picea abies*, *Pinus resinosa*, *Robinia pseudoacacia*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	NA	NA	no crosswalk	Fike 1999

Local Range: This forest type occurs in isolated patches throughout the park where pines or spruce were planted.

Classification Comments: Conifer Plantations are distinguished from other forest types by the prominence of *Pinus resinosa* or *Picea abies* in the canopy.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.16, ALPO.65, ALPO.73.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Planted/Cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.)
Formation	Planted/cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.x.)
Alliance	<i>Pinus strobus</i> Planted Forest Alliance (A.98)
Alliance (English name)	Eastern White Pine Planted Forest Alliance
Association	<i>Pinus</i> spp. Planted Forest
Association (English name)	Pine species Planted Forest
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: These plantations consist of mature *Pinus strobus* or *Pinus sylvestris*, with other conifers sometimes present in smaller amounts, planted in post-agricultural fields and pastures. Associated canopy conifers include *Pinus resinosa*, *Picea abies*, or *Larix decidua*. The understory varies widely in its degree of development and may be virtually absent. Northern hardwoods typically dominate the sapling and seedling layers, and cover is proportional to the degree of canopy break-up or opening that has occurred. Common hardwoods include *Prunus serotina*, *Acer rubrum*, and *Fraxinus americana*. A tall-shrub layer may be present; common species (aside from smaller individuals of the hardwood saplings) include *Crataegus* spp., *Hamamelis virginiana*, and *Lindera benzoin*. Common short shrubs include *Viburnum dentatum* var. *lucidum*, *Vaccinium pallidum*, *Rubus hispidus*, and *Rubus flagellaris*. The species composition and abundance of the herbaceous layer vary widely due to variation in canopy tree species composition, stand stocking, and soil drainage. Herbaceous species include *Ageratina altissima* (= *Eupatorium rugosum*), *Dryopteris intermedia*, *Dryopteris carthusiana*, *Oxalis stricta*, *Potentilla simplex*, *Mitchella repens*, *Galium aparine*, *Galium asprellum*, *Brachyelytrum erectum*, and *Lycopodium digitatum* (= *Diphasiastrum digitatum*). Graminoid and forb species associated with disturbed areas, such as *Agrostis stolonifera*, *Dichanthelium clandestinum* (= *Panicum clandestinum*), *Dennstaedtia punctilobula*, and *Hypericum perforatum*, are often dominant in these communities. Vines such as *Toxicodendron radicans*, *Smilax glauca*, *Smilax rotundifolia*, *Vitis* spp., and *Parthenocissus quinquefolia* may be present, but not abundant, in these plantations. Disturbance from the silvicultural treatments and landscape fragmentation

leave these communities prone to invasion by exotic species, including *Lonicera tatarica*, *Berberis thunbergii*, and *Rosa multiflora*, which are locally abundant in places.

Environmental Description: These mature plantations are planted in post-agricultural fields and pastures.

Vegetation Description: These plantations consist of mature *Pinus strobus* or *Pinus sylvestris*, with other conifers sometimes present in smaller amounts, planted in post-agricultural fields and pastures. Associated canopy conifers include *Pinus resinosa*, *Picea abies*, or *Larix decidua*. The understory varies widely in its degree of development and may be virtually absent. Northern hardwoods typically dominate the sapling and seedling layers, and cover is proportional to the degree of canopy break-up or opening that has occurred. Common hardwoods include *Prunus serotina*, *Acer rubrum*, and *Fraxinus americana*. A tall-shrub layer may be present; common species (aside from smaller individuals of the hardwood saplings) include *Crataegus* spp., *Hamamelis virginiana*, and *Lindera benzoin*. Common short shrubs include *Viburnum dentatum* var. *lucidum*, *Vaccinium pallidum*, *Rubus hispidus*, and *Rubus flagellaris*. The species composition and abundance of the herbaceous layer vary widely due to variation in canopy tree species composition, stand stocking, and soil drainage. Herbaceous species include *Ageratina altissima* (= *Eupatorium rugosum*), *Dryopteris intermedia*, *Dryopteris carthusiana*, *Oxalis stricta*, *Potentilla simplex*, *Mitchella repens*, *Galium aparine*, *Galium asprellum*, *Brachyelytrum erectum*, and *Lycopodium digitatum* (= *Diphasiastrum digitatum*). Graminoid and forb species associated with disturbed areas, such as *Agrostis stolonifera*, *Dichanthelium clandestinum* (= *Panicum clandestinum*), *Dennstaedtia punctilobula*, and *Hypericum perforatum*, are often dominant in these communities. Vines such as *Toxicodendron radicans*, *Smilax glauca*, *Smilax rotundifolia*, *Vitis* spp., and *Parthenocissus quinquefolia* may be present, but not abundant, in these plantations. Disturbance from the silvicultural treatments and landscape fragmentation leave these communities prone to invasion by exotic species, including *Lonicera tatarica*, *Berberis thunbergii*, and *Rosa multiflora*, which are locally abundant in places.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus strobus</i> , <i>Pinus sylvestris</i>

Characteristic Species: *Pinus strobus*, *Pinus sylvestris*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.

States/Provinces: PA, VT.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Fort Necessity, Friendship Hill, Johnstown Flood, Marsh-Billings-Rockefeller).

CONSERVATION STATUS

Rank: GNA (modified/managed) (1-Dec-2004).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: This type is intended for plantations of mixed pines or pine mixed with other nonnative planted conifers.

Similar Associations:

Pinus strobus Planted Forest (CEGL007178)--monotypic white pine.

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Eastern Ecology Working Group n.d., Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006.



Figure 23. Conifer Plantation in Allegheny Portage Railroad National Historic Site (plot ALPO.65). August 2005. NAD 1983 / UTM easting 713118, northing 4477375.

COMMON NAME (PARK-SPECIFIC): SUGAR MAPLE FLOODPLAIN FOREST

SYNONYMS

NVC English Name: Sugar Maple / Eastern Hop-hornbeam / Bearded Shorthusk Forest

NVC Scientific Name: *Acer saccharum* / *Ostrya virginiana* / *Brachyelytrum erectum* Forest

NVC Identifier: CEG006504

LOCAL INFORMATION

Environmental Description: This association occurs on low floodplains surrounding creeks and drainages, often near old oxbows or former channels. These stands may flood occasionally, but the period of inundation is short. The soils appear to be alluvial in origin and include Ernst silt loam and the Udifluvents-Dystrochrepts soil complex. The underlying bedrock is siltstone of the Brallier and Harrell formations, or sandstone of the Foreknobs formation.

Vegetation Description: The dominant canopy tree in this association is sugar maple (*Acer saccharum*). Red maple (*Acer rubrum*) is a common associate and may be codominant in some stands. Other minor associate species include black cherry (*Prunus serotina*) and blackgum (*Nyssa sylvatica*). The canopy height varies from 15 to 20 m with total cover of approximately 70%. The subcanopy can vary from 10 to 15 m in height with total cover ranging from 40–50%. Sugar maple is often the dominant species in the subcanopy, although red maple, American hornbeam (*Carpinus caroliniana*), and American beech (*Fagus grandifolia*) are prominent associates. The tall-shrub layer is 2 to 5 m in height and is usually moderately dense (40–60% cover). The most characteristic tall shrubs are American hornbeam, American witch-hazel (*Hamamelis virginiana*), and eastern hop-hornbeam (*Ostrya virginiana*). The short-shrub layer, less than 2 m in height, typically covers around 30% of the stand. Common short-shrub species include northern spicebush (*Lindera benzoin*), American hornbeam, striped maple (*Acer pensylvanicum*), and seedlings of white ash (*Fraxinus americana*) and other canopy and subcanopy species. The invasive shrubs Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*) are often present in this association. The herbaceous layer is generally sparse (10–25% cover). Typical species include white wood aster (*Eurybia divaricata*), New York fern (*Thelypteris noveboracensis*), colonial bentgrass (*Agrostis capillaris*), Swan's sedge (*Carex swanii*), flattened oatgrass (*Danthonia compressa*), intermediate woodfern (*Dryopteris intermedia*), wreath goldenrod (*Solidago caesia*), sessileleaf bellwort (*Uvularia sessilifolia*), common cinquefoil (*Potentilla simplex*), and violets (*Viola blanda*, *Viola cucullata*). Vines are typically present in low abundance; characteristic species are roundleaf greenbrier (*Smilax rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), and eastern poison ivy (*Toxicodendron radicans*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Acer saccharum</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> , <i>Acer saccharum</i>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Carpinus caroliniana</i> , <i>Hamamelis virginiana</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Fraxinus americana</i> , <i>Lindera benzoin</i>
Herb (field)	Forb	<i>Eurybia divaricata</i> , <i>Potentilla simplex</i>
Herb (field)	Fern or fern ally	<i>Thelypteris noveboracensis</i>

Characteristic Species: *Acer rubrum*, *Acer saccharum*, *Carpinus caroliniana*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	NA	NA	no crosswalk	Fike 1999

Local Range: This association appears to be restricted primarily to the floodplains of small creeks and drainages.

Classification Comments: This association can be identified by the dominance of *Acer saccharum* in the canopy and subcanopy of forests occurring on the floodplains of small creeks. *Quercus* spp., *Tsuga canadensis*, and *Liriodendron tulipifera* are absent or a minor component of the stand.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.23, ALPO.33, ALPO.66.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	<i>Acer saccharum</i> - <i>Carya cordiformis</i> Temporarily Flooded Forest Alliance (A.302)
Alliance (English name)	Sugar Maple - Bitternut Hickory Temporarily Flooded Forest Alliance
Association	<i>Acer saccharum</i> / <i>Ostrya virginiana</i> / <i>Brachyelytrum erectum</i> Forest
Association (English name)	Sugar Maple / Eastern Hop-hornbeam / Bearded Shorthusk Forest
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: Flashy, sugar maple-dominated floodplain forests on high-gradient or submontane portions of major rivers in northern New England. Floods tend to be short-duration and high-disturbance events. Soils are alluvial sands or sandy loams over coarser substrates, sometimes interspersed with buried organic layers. *Acer saccharum* dominates the canopy, with other upland trees including *Quercus rubra* and *Betula alleghaniensis*. *Ostrya virginiana* is a common smaller tree. Shrubs are minor. The herb layer is lush, and features *Brachyelytrum erectum*, *Carex intumescens*, *Solidago caesia*, and *Danthonia spicata*. Unlike other floodplain forests, ferns are limited.

Environmental Description: Flashy, sugar maple-dominated floodplain forests on high-gradient or sub-montane portions of major rivers in northern New England. Floods tend to be short-duration and high-disturbance events. Soils are alluvial sands or sandy loams over coarser substrates, sometimes interspersed with buried organic layers.

Vegetation Description: *Acer saccharum* dominates the canopy, with other upland trees including *Quercus rubra* and *Betula alleghaniensis*. *Ostrya virginiana* is a common smaller tree. Shrubs are minor. The herb layer is lush, and features *Brachyelytrum erectum*, *Carex intumescens*, *Solidago caesia*, and *Danthonia spicata*. Unlike other floodplain forests, ferns are limited.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i>
Tree subcanopy	Broad-leaved deciduous tree	<i>Ostrya virginiana</i>
Herb (field)	Graminoid	<i>Brachyelytrum erectum</i>

Characteristic Species: *Acer saccharum*, *Brachyelytrum erectum*, *Ostrya virginiana*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: Currently described from Maine and New Hampshire.

States/Provinces: ME, NH, PA, VT.

Federal Lands: NPS (Allegheny Portage Railroad).

CONSERVATION STATUS

Rank: GNR (2-Jul-1999).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations: Information not available.

Related Concepts:

Acer saccharum/*Ostrya virginiana*/*Brachyelytrum erectum* var. *glabratum*, Type 4 (Sperduto and Crowley 2002a)?

SOURCES

Description Authors: S. C. Gawler.

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Gawler 2002, Perles et al. 2006, Sperduto and Crowley 2002a, Sperduto and Nichols 2004.



Figure 24. Sugar Maple Floodplain Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.23). August 2005. NAD 1983 / UTM easting 710441, northing 4478724.



Figure 25. Sugar Maple Floodplain Forest in Allegheny Portage Railroad National Historic Site (plot ALPO.66). August 2005. NAD 1983 / UTM easting 713227, northing 4477350.

COMMON NAME (PARK-SPECIFIC): ALDER RIVERINE SHRUBLAND

SYNONYMS

NVC English Name: Smooth Alder - Eastern Ninebark Shrubland
NVC Scientific Name: *Alnus serrulata* - *Physocarpus opulifolius* Shrubland
NVC Identifier: CEGLO06251

LOCAL INFORMATION

Environmental Description: This shrubland is found on sand and cobble bars within or adjacent to the active river channel. The association is subject to frequent flooding, high stream velocity and ice-scour since it occurs near the active stream channel.

Vegetation Description: The tall-shrub layer is moderately dense to dense (50–80% cover) and is dominated by European alder (*Alnus glutinosa*). European alder is also prominent in the sparse short-shrub layer (10–20% cover), along with silky dogwood (*Cornus amomum*) and spiraea (*Spiraea* spp.). The moderately dense (50–70% cover), diverse herbaceous layer contains many wetland species, such as jewelweed (*Impatiens capensis*), shallow sedge (*Carex lurida*), reed canarygrass (*Phalaris arundinacea*), common boneset (*Eupatorium perfoliatum*), mannagrasses (*Glyceria* spp.), Virginia water horehound (*Lycopus virginicus*), sensitive fern (*Onoclea sensibilis*), and roundleaf goldenrod (*Solidago patula*). The invasive species Japanese knotweed (*Polygonum cuspidatum*) and Japanese stilt grass (*Microstegium vimineum*) can be abundant in this association.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Alnus glutinosa</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Alnus glutinosa</i>
Herb (field)	Graminoid	<i>Phalaris arundinacea</i>

Characteristic Species: *Alnus glutinosa*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	NA	NA	no crosswalk	Fike 1999

Local Range: This association is typically found adjacent to the Little Conemaugh River in Allegheny Portage Railroad National Historic Site.

Classification Comments: This association is identified by the prominence of *Alnus* spp. near the active river channel.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.39.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d.)
Alliance	<i>Alnus serrulata</i> Temporarily Flooded Shrubland Alliance (A.943)
Alliance (English name)	Smooth Alder Temporarily Flooded Shrubland Alliance
Association	<i>Alnus serrulata</i> - <i>Physocarpus opulifolius</i> Shrubland
Association (English name)	Smooth Alder - Eastern Ninebark Shrubland
Ecological System(s):	Central Appalachian Floodplain (CES202.608) Central Appalachian Riparian (CES202.609)

GLOBAL DESCRIPTION

Concept Summary: This community is a floodplain alder thicket of the High Alleghenies and Western Allegheny Plateau regions. In the Central Appalachians these are shrub thickets dominated by *Alnus serrulata* along rivers and streams on rocky shoals and gravel bars. This shrub thicket of the Western Allegheny Plateau occurs on circumneutral to somewhat calcareous substrates. Soils are generally mineral with a thin organic layer. The vegetation typically occurs in a variety of environmental settings, including upland edge of marshes, adjacent to red maple wetlands, small upland depressions, and at the base of slopes. The canopy is characterized by *Alnus serrulata* and *Physocarpus opulifolius*, the latter generally contributing less cover in relation to *Alnus*. Woody associates include *Salix* spp., *Sambucus nigra* spp. *canadensis*, *Cornus amomum*, *Rhododendron viscosum*, *Decodon verticillatus*, *Cephalanthus occidentalis*, or *Ilex verticillata*. Herbaceous species may include *Osmunda regalis*, *Thelypteris palustris*, *Typha latifolia*, *Peltandra virginica*, or *Carex stricta*.

Environmental Description: In the Central Appalachians these are shrub thickets dominated by *Alnus serrulata* along rivers and streams on rocky shoals and gravel bars. This shrub thicket of the Western Allegheny Plateau occurs on circumneutral to somewhat calcareous substrates. Soils are generally mineral with a thin organic layer. The vegetation typically occurs in a variety of environmental settings, including upland edge of marshes, adjacent to red maple wetlands, small upland depressions, and at the base of slopes.

Vegetation Description: The canopy is characterized by *Alnus serrulata* and *Physocarpus opulifolius*, the latter generally contributing less cover in relation to *Alnus*. Woody associates include *Salix* spp., *Sambucus nigra* spp. *canadensis*, *Cornus amomum*, *Rhododendron viscosum*, *Decodon verticillatus*, *Cephalanthus occidentalis*, or *Ilex verticillata*. Herbaceous species may include *Osmunda regalis*, *Thelypteris palustris*, *Typha latifolia*, *Peltandra virginica*, or *Carex stricta*.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Alnus serrulata</i>
Herb (field)	Fern or fern ally	<i>Osmunda regalis</i> , <i>Thelypteris palustris</i>

Characteristic Species: *Alnus serrulata*, *Physocarpus opulifolius*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Riverine.

DISTRIBUTION

Range: Information not available.

States/Provinces: MD, NY, OH, PA, VA?, WV.

Federal Lands: NPS (Allegheny Portage Railroad).

CONSERVATION STATUS

Rank: G5 (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations: Information not available.

Related Concepts:

Alder-ninebark thickets (CAP pers. comm. 1998) ?

Speckled alder riverine shrubland (Perles et al. 2004) =

SOURCES

Description Authors: L. A. Sneddon.

References: CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Fike 1999, Harrison 2004, Perles et al. 2004, TNC and WPC 2004.



Figure 26. Alder Riverine Shrubland in Allegheny Portage Railroad National Historic Site (plot ALPO.39). August 2005. NAD 1983 / UTM easting 681825, northing 4470023.

**COMMON NAME (PARK-SPECIFIC): REED CANARYGRASS RIVERINE
GRASSLAND**

SYNONYMS

NVC English Name: Reed Canarygrass Eastern Herbaceous Vegetation
NVC Scientific Name: *Phalaris arundinacea* Eastern Herbaceous Vegetation
NVC Identifier: CEG006044

LOCAL INFORMATION

Environmental Description: This association is typically found along creeks and drainageways, often on poorly drained soils. These areas are exposed to occasional flooding, though the soil is often saturated.

Vegetation Description: This association is characterized by thick herbaceous and graminoid vegetation, strongly dominated by reed canarygrass (*Phalaris arundinacea*) which composes greater than 50% of the relative cover of the herbaceous layer. A varied mix of other herbaceous and graminoid species can also be present. Some common species are knotweeds (*Polygonum* spp.), touch-me-nots (*Impatiens* spp.), thoroughworts (*Eupatorium* spp.), cutgrasses (*Leersia* spp.), Canadian clearweed (*Pilea pumila*), smallspike false nettle (*Boehmeria cylindrica*), and wingstem (*Verbesina alternifolia*). A few scattered willows (*Salix* spp.) or dogwoods (*Cornus* spp.) may be present as short shrubs; however, their relative cover does not exceed 25%.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Graminoid	<i>Phalaris arundinacea</i>

Characteristic Species: *Phalaris arundinacea*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	S5	2	Bluejoint - reed canarygrass marsh	Fike 1999

Local Range: This association is occasionally found along creeks and drainageways in the park.

Classification Comments: Reed Canarygrass Riverine Grassland is distinguished from other palustrine types by the clear dominance of *Phalaris arundinacea*, composing >50% relative cover in the herbaceous layer.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.32.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)

Alliance	<i>Phalaris arundinacea</i> Seasonally Flooded Herbaceous Alliance (A.1381)
Alliance (English name)	Reed Canarygrass Seasonally Flooded Herbaceous Alliance
Association	<i>Phalaris arundinacea</i> Eastern Herbaceous Vegetation
Association (English name)	Reed Canarygrass Eastern Herbaceous Vegetation
Ecological System(s):	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018) North-Central Interior Floodplain (CES202.694) Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582)

GLOBAL DESCRIPTION

Concept Summary: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. It is native to the United States and Canada, but is now more widely distributed and abundant because of local introductions from both local and European populations. The introduced strains may be a more aggressive ecotype than native strains. Stands are found in both minerotrophic basin wetlands as well as river shores. It has been widely used as a forage and hay crop, especially in marshes and floodplains, and is used for wildlife food, for shoreline and ditch stabilization. Stands are dominated by *Phalaris arundinacea*, a 0.5- to 2-m tall perennial grass, which tends to occur in monocultures or associated with *Calamagrostis canadensis*. Other associates in the northeast include *Viburnum nudum*, *Alnus incana* or *Alnus serrulata*, *Viburnum dentatum*, and *Agrostis gigantea*. Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* can displace native species over time. Further work is required to resolve the natural versus introduced nature of this type in the southeast before a description can be completed.

Environmental Description: Stands are found in both minerotrophic basin wetlands as well as river shores. It has been widely used as a forage and hay crop, especially in marshes and floodplains, and is used for wildlife food, for shoreline and ditch stabilization (Barnes 1999).

Vegetation Description: Stands are dominated by *Phalaris arundinacea*, a 0.5–2 m tall perennial grass that is native to the United States and Canada, but which has also been introduced from European strains. The introduced strains may be a more aggressive ecotype than native strains (Barnes 1999). It tends to occur in monocultures or associated with *Calamagrostis canadensis*. Other associates in the Northeast include *Viburnum nudum*, *Alnus incana* or *Alnus serrulata*, *Viburnum dentatum*, and *Agrostis gigantea*. Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* can displace native species over time (Apfelbaum and Sams 1987, Barnes 1999, and references therein). Further work is required to resolve the natural versus introduced nature of this type in the Southeast before a description can be completed.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Graminoid	<i>Phalaris arundinacea</i>

Characteristic Species: *Phalaris arundinacea*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. It currently ranges from Virginia north to Vermont, east to Minnesota and south to Tennessee.

States/Provinces: CT, DE, IA, MA, MD, ME, MN, NH, NJ, NY, OH, ON, PA, RI, TN, VA, VT, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Effigy Mounds, Eisenhower, Gettysburg); USFWS (Assabet River, Great Meadows, Oxbow).

CONSERVATION STATUS

Rank: GNA (invasive) (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Type has a broad distribution; in fact, it is widespread throughout temperate areas of the northern hemisphere. It is native to the United States and Canada, but is now more widely distributed and abundant because of local introductions from both local and European populations (Apfelbaum and Sams 1987). It can invade a variety of habitats, suggesting that little unites these stands apart from the dominance of *Phalaris arundinacea*. However, that may be the only reasonable way to describe this type. This vegetation is documented from Shady Valley TNC Preserve, Johnson County, Tennessee, where it occupies channelized streams, impoundments, and fen restoration sites. In these examples, characteristic associates include *Juncus effusus*, *Carex lurida*, *Carex gynandra*, and *Alnus serrulata*.

Similar Associations:

Calamagrostis canadensis - *Phalaris arundinacea* Herbaceous Vegetation (CEGL005174).

Phalaris arundinacea Western Herbaceous Vegetation (CEGL001474).

Related Concepts:

Palustrine Persistent Emergent Wetland (PEM1) (Cowardin et al. 1979) ?

Reed canarygrass riverine grassland (Perles et al. 2004) ?

SNE low-energy riverbank community (Rawinski 1984) ?

Shallow Emergent Marsh (Thompson 1996) ?

Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?

Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

SOURCES

Description Authors: D. Faber-Langendoen.

References: Apfelbaum and Sams 1987, Barnes 1999, Cowardin et al. 1979, Edinger et al. 2002, Fike 1999, Metzler and Barrett 2001, Midwestern Ecology Working Group n.d., Perles et al. 2004, Perles et al. 2006, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, TDNH unpubl. data, TNC and WPC 2004, Thompson 1996, Thompson and Sorenson 2000.



Figure 27. Reed Canarygrass Riverine Grassland in Allegheny Portage Railroad National Historic Site (plot ALPO.32). August 2005. NAD 1983 / UTM easting 715611, northing 4476547.

**COMMON NAME (PARK-SPECIFIC): JAPANESE OR GIANT KNOTWEED
HERBACEOUS VEGETATION**

SYNONYMS

NVC English Name: Japanese Knotweed Temporarily Flooded Herbaceous Vegetation
NVC Scientific Name: *Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation
NVC Identifier: CEG008472

LOCAL INFORMATION

Environmental Description: This vegetation type occurs along the shoreline of the Little Conemaugh River. The substrate is typically sand and gravel bars adjacent to the river channel or on stony loam on the riverbanks. These sites are subject to occasional floods and scour. This association may also occur along embankments, ditches or rights-of-way adjacent to highways, roads, or railroads.

Vegetation Description: This vegetation type is typically a near monoculture of the invasive species Japanese knotweed (*Polygonum cuspidatum*) or giant knotweed (*Polygonum sachalinense*), covering 50–100% of the area. Japanese knotweed tends to be dominant on river scour bars, while giant knotweed tends to be dominant on terrestrial embankments along transportation corridors. A hybrid of Japanese and giant knotweed may also be present. A wide variety of other species can persist beneath and around the knotweed. The species are often typical of the surrounding associations (i.e., riparian scour species, terrestrial forest species, successional old field, etc.). Some common species include staghorn sumac (*Rhus hirta*), wingstem (*Verbesina alternifolia*), white snakeroot (*Ageratina altissima* var. *altissima*), wrinkleleaf goldenrod (*Solidago rugosa*), touch-me-nots (*Impatiens* spp.), trumpetweed (*Eupatorium fistulosum*), and knotweeds (*Polygonum* spp.). Invasive species such as tree of heaven (*Ailanthus altissima*), Morrow's honeysuckle (*Lonicera morrowii*), garlic mustard (*Alliaria petiolata*), spotted knapweed (*Centaurea biebersteinii*), and Japanese stilt grass (*Microstegium vimineum*) may be common associates.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Polygonum cuspidatum</i>

Characteristic Species: *Polygonum cuspidatum*, *Polygonum sachalinense*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	NA	NA	no crosswalk	Fike 1999

Local Range: This vegetation type occurs along the shoreline of the Little Conemaugh River and potentially along highways, roads, or railroads.

Classification Comments: This type is distinguished by the extremely high cover of *Polygonum cuspidatum*, covering greater than 50% of the area in a non-forested riparian setting.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.41.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d.)
Alliance	<i>Polygonum cuspidatum</i> Temporarily Flooded Herbaceous Alliance (A.2005)
Alliance (English name)	Japanese Knotweed Temporarily Flooded Herbaceous Alliance
Association	<i>Polygonum cuspidatum</i> Temporarily Flooded Herbaceous Vegetation
Association (English name)	Japanese Knotweed Temporarily Flooded Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: Examples of this vegetation type are significant (monocultural) stands of the exotic forb *Polygonum cuspidatum*, which are found in temporarily flooded habitats such as scour bars. These disturbed habitats flood very frequently and have lots of light and rocky or sandy soil. Stands of this vegetation may be dense and shrubby, or somewhat more open. Species diversity is low, as the patches of *Polygonum* shade out other plant species. In North Carolina, this vegetation is found on scour bars and low rocky banks of the Nolichucky and French Broad rivers. In Kentucky, *Polygonum cuspidatum* is primarily along disturbed riverbanks and bars mostly in the Cumberland Plateau and Mountains where it can be in pure, dense stands.

Environmental Description: Stands of this type are found in temporarily flooded habitats such as scour bars. These disturbed areas flood very frequently and have lots of light and rocky or sandy soil. In North Carolina, it is found on scour bars and low rocky banks of the Nolichucky and French Broad rivers (B. Brown pers. comm. 2001). In Kentucky, *Polygonum cuspidatum* is primarily along disturbed riverbanks and bars mostly in the Cumberland Plateau and Mountains where it can be in pure, dense stands (M. Evans pers. comm.).

Vegetation Description: These are primarily monospecific stands of *Polygonum cuspidatum* with few other plant species. Some disturbance-oriented annual forbs may be present, along with seedlings of some woody plants (e.g., *Platanus occidentalis*, *Salix nigra*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Polygonum cuspidatum</i>

Characteristic Species: *Polygonum cuspidatum*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This vegetation is potentially found anywhere in the southeastern United States where the exotic rhizomatous forb *Polygonum cuspidatum* has formed significant (monocultural)

stands. This includes at least Alabama, Georgia, Kentucky, Maryland, North Carolina, South Carolina, Tennessee, and Virginia.

States/Provinces: AL, GA, KY, NC, PA, SC, TN, VA.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap); USFS (Cherokee?, Daniel Boone).

CONSERVATION STATUS

Rank: GNA (invasive) (31-May-2001).

Reasons: This vegetation is composed of and dominated by a species which is not native to North America.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This species has also been treated as *Reynoutria japonica*.

Similar Associations: Information not available.

Related Concepts: Information not available.

SOURCES

Description Authors: M. Pyne.

References: Brown pers. comm., Evans pers. comm., Schafale pers. comm., Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004.



Figure 28. Japanese or Giant Knotweed Herbaceous Vegetation in Allegheny Portage Railroad National Historic Site (plot ALPO.41). August 2005. NAD 1983 / UTM easting 682042, northing 4470513.

COMMON NAME (PARK-SPECIFIC): WET MEADOW

SYNONYMS

NVC English Name: Steeplebush - Blackberry species / Reed Canarygrass Shrubland

NVC Scientific Name: *Spiraea tomentosa* - *Rubus* spp. / *Phalaris arundinacea* Shrubland

NVC Identifier: CEGLO06571

LOCAL INFORMATION

Environmental Description: This variable wetland type occurs in topographically low areas, in swales, and along streams and drainages. These wetlands typically flood early in the growing season and may be saturated to near the surface for some of the growing season, but they are generally dry for much of the year. These wetlands occur over siltstone, sandstone, and shale, on a variety of silt loams and channery silt loams.

Vegetation Description: The species composition of these wetlands is variable among sites. Within each wetland, species may be locally abundant and often have patchy distribution. A mixture of predominantly graminoid species, with numerous herbaceous associates covers 70–95% of the wetland. Common dominants include rice cutgrass (*Leersia oryzoides*), broom sedge (*Carex scoparia*), shallow sedge (*Carex lurida*), reed canarygrass (*Phalaris arundinacea*), redtop (*Agrostis gigantea*), jewelweed (*Impatiens capensis*), common rush (*Juncus effusus*), sensitive fern (*Onoclea sensibilis*), arrowleaf tearthumb (*Polygonum sagittatum*), halberdleaf tearthumb (*Polygonum arifolium*), spikerush (*Eleocharis* sp.), rushes (*Juncus* spp.) and fowl mannagrass (*Glyceria striata*). Sphagnum (*Sphagnum* sp.) may be abundant in this association. Although reed canarygrass may be a common species in this association, it composes <50% relative cover in the herbaceous layer. Sites with less groundwater seepages and less frequent flooding may contain some species typical of Successional Old Field such as bentgrasses (*Agrostis* spp.), goldenrods (*Solidago* spp.), flat-top goldentop (*Euthamia graminifolia*), and sweet vernalgrass (*Anthoxanthum odoratum*). Shrubs may cover up to 25% of the area; common species include dogwood (*Cornus* sp.), bristly dewberry (*Rubus hispidus*), and the invasive species multiflora rose (*Rosa multiflora*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Impatiens capensis</i>
Herb (field)	Graminoid	<i>Leersia oryzoides</i> , <i>Phalaris arundinacea</i>
Herb (field)	Fern or fern ally	<i>Onoclea sensibilis</i>

Characteristic Species: *Leersia oryzoides*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	S5	2	Wet meadow	Fike 1999

Local Range: This wetland type is found occasionally in swales and along streams and drainages throughout the park.

Classification Comments: Wet Meadow has highly variable species composition, however, it is characterized by a diverse mix of graminoid species and hydrology flooded in the early growing season and dry or saturated the rest of the year. *Phalaris arundinacea* may be prominent, but it covers <50% relative cover in the herbaceous area. (If *Phalaris arundinacea* relative cover >50%, see Reed Canarygrass Riverine Grassland).

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.19, ALPO.31, ALPO.76, ALPO.77.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Seasonally flooded cold-deciduous shrubland (III.B.2.N.e.)
Alliance	<i>Spiraea tomentosa</i> - <i>Rubus</i> spp. Seasonally Flooded Shrubland Alliance (A.3022)
Alliance (English name)	Steeplebush - Blackberry species Seasonally Flooded Shrubland Alliance
Association	<i>Spiraea tomentosa</i> - <i>Rubus</i> spp. / <i>Phalaris arundinacea</i> Shrubland
Association (English name)	Steeplebush - Blackberry species / Reed Canarygrass Shrubland
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This wet meadow vegetation of the northeastern states occurs in a variety of settings, most frequently in low-lying areas of old fields or pastures, or beaver-impacted wetlands. The physiognomy is complex and variable, ranging from shrub thicket to herbaceous meadow with scattered shrubs. Shrub species usually include *Spiraea tomentosa*, *Spiraea alba* var. *alba*, *Rubus allegheniensis*, *Rubus hispidus*, *Lonicera morrowii*, *Salix* spp., and others. *Hypericum densiflorum* often occurs in the Central Appalachians. Associated herbaceous species are also variable in composition, depending on land-use history. Usually seen are *Phalaris arundinacea*, *Solidago rugosa*, *Solidago canadensis*, *Juncus effusus*, *Scirpus cyperinus*, *Leersia oryzoides*, *Carex scoparia*, *Carex folliculata*, *Carex lurida*, *Carex lupulina*, *Carex vulpinoidea*, *Vernonia noveboracensis*, *Eupatorium maculatum*, *Eleocharis* spp., and others.

Environmental Description: This wet meadow vegetation of the northeastern states occurs in a variety of settings, most frequently in low-lying areas of old fields or pastures, or beaver-impacted wetlands.

Vegetation Description: The physiognomy is complex and variable, ranging from shrub thicket to herbaceous meadow with scattered shrubs. Shrub species usually include *Spiraea tomentosa*, *Spiraea alba* var. *alba*, *Rubus allegheniensis*, *Rubus hispidus*, *Lonicera morrowii*, *Salix* spp., and others. *Hypericum densiflorum* often occurs in the Central Appalachians. Associated herbaceous species are also variable in composition, depending on land-use history. Usually seen are *Phalaris arundinacea*, *Solidago rugosa*, *Solidago canadensis*, *Juncus effusus*, *Scirpus cyperinus*, *Leersia oryzoides*, *Carex scoparia*, *Carex folliculata*, *Carex lurida*, *Carex lupulina*, *Carex vulpinoidea*, *Vernonia noveboracensis*, *Eupatorium maculatum*, *Eleocharis* spp., and others.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Rubus allegheniensis</i> , <i>Spiraea alba</i> var. <i>alba</i> , <i>Spiraea tomentosa</i>
Herb (field)	Forb	<i>Solidago canadensis</i> , <i>Solidago rugosa</i>
Herb (field)	Graminoid	<i>Leersia oryzoides</i> , <i>Phalaris arundinacea</i>

Characteristic Species: *Rubus allegheniensis*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Although this vegetation is widespread, its range has not been evaluated. It is known from the Central Appalachian ecoregion and the Lower New England / Northern Piedmont ecoregions, and is likely in others.

States/Provinces: NJ.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Johnstown Flood); USFWS (Great Swamp).

CONSERVATION STATUS

Rank: GNR (8-Jul-1999).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations: Information not available.

Related Concepts: Information not available.

SOURCES

Description Authors: L. A. Sneddon.

References: Decker 1955, Eastern Ecology Working Group n.d., Fike 1999, NatureServe and Russell 2003.



Figure 29. Wet Meadow in Allegheny Portage Railroad National Historic Site (plot ALPO.19). August 2005. NAD 1983 / UTM easting 707301, northing 4481367.



Figure 30. Wet Meadow in Allegheny Portage Railroad National Historic Site (plot ALPO.77). August 2005. NAD 1983 / UTM easting 713162, northing 4477345.

COMMON NAME (PARK-SPECIFIC): **SUCCESSIONAL OLD FIELD**

SYNONYMS

NVC English Name: **Orchard Grass - Timothy - Fescue species - Goldenrod species
Herbaceous Vegetation**

NVC Scientific Name: ***Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* spp.
Herbaceous Vegetation**

NVC Identifier: **CEGL006107**

LOCAL INFORMATION

Environmental Description: This association occurs in fields that are no longer plowed or planted in crops or hay grasses. These fields may be mowed infrequently. Without mowing, these sites will succeed into a forest type as woody species colonize the field. These fields are generally flat to gently sloping in a variety of topographic positions. Some of these sites may previously have been pastures. This association occurs on silt loams from the Cookport, Ernst, Gilpin, Rayne, and Wharton series, as well as the channery silt loams in the Berks and Hazelton series. The bedrock underlying these fields is generally sandstone or shale from the Allegheny or Glenshaw formations, respectively.

Vegetation Description: Characteristic vegetation for this association is widely scattered trees and clumps of shrubs within a diverse mixture of goldenrods, cool-season grasses, and agricultural weeds. The herbaceous layer is typically dense (80–100% cover). Species dominance in this layer shifts through the growing season, with cool-season grasses dominant early in the summer and goldenrods dominant later in the summer. Within each field, species may be locally abundant and often have patchy distribution. The two characteristically dominant species are wrinkleleaf goldenrod (*Solidago rugosa*) and sweet vernalgrass (*Anthoxanthum odoratum*). Other abundant species include flat-top goldentop (*Euthamia graminifolia*), red fescue (*Festuca rubra*), timothy (*Phleum pratense*), early goldenrod (*Solidago juncea*), Canada goldenrod (*Solidago canadensis* var. *scabra*), creeping bentgrass (*Agrostis stolonifera*), and smooth brome (*Bromus inermis*). Common associates are wild basil (*Clinopodium vulgare*), common yarrow (*Achillea millefolium*), Queen Anne's lace (*Daucus carota*), common cinquefoil (*Potentilla simplex*), Virginia strawberry (*Fragaria virginiana*), and ox-eye daisy (*Leucanthemum vulgare*). The invasive species purple crownvetch (*Coronilla varia*) can be abundant in this association. Tall and short shrubs may be widely scattered or fairly dense (0–70% cover). Allegheny blackberry (*Rubus allegheniensis*), black raspberry (*Rubus occidentalis*), staghorn sumac (*Rhus hirta*), hawthorns (*Crataegus* spp.), black locust (*Robinia pseudoacacia*), and common elderberry (*Sambucus nigra* ssp. *canadensis*) are typical shrub species. The invasive species autumn-olive (*Elaeagnus umbellata*), Morrow's honeysuckle (*Lonicera morrowii*), multiflora rose (*Rosa multiflora*), and Japanese barberry (*Berberis thunbergii*) may also be common in this association. Scattered trees may be present but cover <25% of the field. Characteristic tree species include black locust, black cherry (*Prunus serotina*), and red maple (*Acer rubrum*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Rhus hirta</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Rubus allegheniensis</i> , <i>Rubus occidentalis</i>
Herb (field)	Forb	<i>Euthamia graminifolia</i> , <i>Solidago rugosa</i>
Herb (field)	Graminoid	<i>Anthoxanthum odoratum</i> , <i>Festuca rubra</i>

Characteristic Species: *Achillea millefolium*, *Anthoxanthum odoratum*, *Daucus carota*, *Festuca rubra*, *Fragaria virginiana*, *Leucanthemum vulgare*, *Potentilla simplex*, *Rhus hirta*, *Rubus allegheniensis*, *Solidago rugosa*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	NA	NA	no crosswalk	Fike 1999

Local Range: This common vegetation type occurs throughout the park.

Classification Comments: Old Fields are identified by a thick layer of herbaceous-graminoid vegetation dominated by a diverse mixture of goldenrods, cool-season grasses, and agricultural weeds. Trees are sparsely scattered (<25% cover), but shrubs may be sparse or dense (<75% cover).

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.4, ALPO.5, ALPO.17, ALPO.18, ALPO.21, ALPO.54, ALPO.62, ALPO.63, ALPO.74.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	<i>Dactylis glomerata</i> - <i>Rumex acetosella</i> Herbaceous Alliance (A.1190)
Alliance (English name)	Orchard Grass - Common Sheep Sorrel Herbaceous Alliance
Association	<i>Dactylis glomerata</i> - <i>Phleum pratense</i> - <i>Festuca</i> spp. - <i>Solidago</i> spp. Herbaceous Vegetation
Association (English name)	Orchard Grass - Timothy - Fescue species - Goldenrod species Herbaceous Vegetation

Ecological System(s): Information not available.

GLOBAL DESCRIPTION

Concept Summary: This broadly defined vegetation type includes pastures and post-agricultural fields and is largely composed of nonnative grasses and herbs (generally of European origin) in the early stages of succession. The fields are typically mowed at least annually. Physiognomically, these grasslands are generally comprised of mid-height (1–3 feet

tall) grasses and forbs, with occasional scattered shrubs. Species composition varies from site to site, depending on land-use history and perhaps soil type, but in general this vegetation is quite wide-ranging in northeastern and midwestern states and at higher elevations (610–1220 m [2000–4000 feet]) in the southeastern states. Dominant grasses vary from site to site but generally feature the nominal species. Other graminoid associates may include *Agrostis stolonifera*, *Agrostis hyemalis*, *Elymus repens*, *Bromus inermis*, *Bromus tectorum*, *Lolium perenne*, *Poa pratensis*, *Poa compressa*, *Schizachyrium scoparium* (not in abundance), and *Anthoxanthum odoratum*. Forbs scattered among the grasses are varied but include *Hieracium* spp., *Oxalis stricta*, *Achillea millefolium*, *Asclepias syriaca*, *Solidago rugosa*, *Solidago nemoralis*, *Solidago juncea*, *Solidago canadensis*, *Solidago canadensis* var. *scabra*, *Euthamia graminifolia*, *Cerastium arvense*, *Oenothera biennis*, *Potentilla simplex*, *Symphyotrichum lateriflorum* (= *Aster lateriflorus*), *Symphyotrichum novae-angliae* (= *Aster novae-angliae*), *Symphyotrichum lanceolatum* (= *Aster simplex*), *Daucus carota*, *Ambrosia artemisiifolia*, *Vicia cracca*, *Trifolium* spp., and many others.

Environmental Description: This association occurs on pastures and land that has been tilled.

Vegetation Description: In addition to *Dactylis glomerata* and *Rumex acetosella* these grassy fields are characterized by *Symphyotrichum* spp. (including *Symphyotrichum lateriflorum* (= *Aster lateriflorus*) and *Symphyotrichum novae-angliae* (= *Aster novae-angliae*)), *Rudbeckia hirta*, *Pteridium aquilinum*, *Chenopodium album*, *Asclepias syriaca*, *Andropogon virginicus*, *Schizachyrium scoparium*, *Phytolacca americana*, *Phleum pratense*, *Poa pratensis*, *Poa compressa*, *Elymus repens* (= *Agropyron repens*), *Bromus inermis*, *Solidago* spp. (including *Solidago rugosa*, *Solidago nemoralis*, *Solidago juncea*, *Solidago canadensis*, *Solidago canadensis* var. *scabra*), *Euthamia graminifolia*, *Oenothera biennis*, *Potentilla simplex*, *Daucus carota*, *Ambrosia artemisiifolia*, *Hieracium* spp., *Taraxacum officinale*, *Vicia cracca*, *Trifolium* spp., and many others.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Rumex acetosella</i>
Herb (field)	Graminoid	<i>Dactylis glomerata</i>

Characteristic Species: *Dactylis glomerata*, *Rumex acetosella*.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is quite wide-ranging in northeastern and midwestern states and possibly occurs at higher elevations in the southeastern states.

States/Provinces: CT, DE, KY, MA, MD, ME, NH, NJ, NY, PA, RI, TN, VA, VT, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Cape Cod, Delaware Water Gap, Fire Island, Fort Necessity, Friendship Hill, Gettysburg, Johnstown Flood, Marsh-Billings-Rockefeller, Minute Man, Morristown, Saint-Gaudens, Valley Forge, Weir Farm); USFWS (Assabet River, Great Meadows, Oxbow).

CONSERVATION STATUS

Rank: GNA (modified/managed) (8-Dec-2005).

Reasons: This vegetation type includes pasture and post-agricultural fields and is largely composed of nonnative grasses and herbs (generally of European origin).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations:

Lolium (arundinaceum, pratense) Herbaceous Vegetation (CEGL004048).

Phleum pratense - *Bromus pubescens* - *Helenium autumnale* Herbaceous Vegetation (CEGL004018).

Schizachyrium scoparium - *Solidago* spp. Herbaceous Vegetation (CEGL006333).

Related Concepts: Information not available.

SOURCES

Description Authors: Eastern Ecology Group.

References: Clark 1986, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Keever 1979, Newbold et al. 1988, Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006c, Perles et al. 2006, Sneddon et al. 1995, TDNH unpubl. data.



Figure 31. Successional Old Field in Allegheny Portage Railroad National Historic Site (plot ALPO.17). August 2005. NAD 1983 / UTM easting 707038, northing 4481316.



Figure 32. Successional Old Field in Allegheny Portage Railroad National Historic Site (plot ALPO.62). August 2005. NAD 1983 / UTM easting 707677, northing 4481573.

COMMON NAME (PARK-SPECIFIC): SPARSELY VEGETATED CLIFF

SYNONYMS

NVC English Name: Western Allegheny Plateau Sandstone Dry Cliff Sparse Vegetation
NVC Scientific Name: Western Allegheny Plateau Sandstone Dry Cliff Sparse Vegetation
NVC Identifier: CEG006435

LOCAL INFORMATION

Environmental Description: This association occurs on small rock outcrop cliffs along the Allegheny Portage Railroad trace. These small cliffs were probably created during the construction of the railroad portage. The cliffs are composed of siltstone or argillaceous sandstone from the Scherr and Rockwell formations, respectively. The slope of the cliffs is nearly vertical, although the cliff may be composed of several rock outcrops creating steep stepping stones. Minimal soil is present, accumulating only on narrow ledges and in rock crevices. Vegetation habitat is restricted to these narrow ledges and crevices in the rock face.

Vegetation Description: This vegetation type is characterized by sparse vegetation growing on narrow ledges or from bedrock crevices. The vegetation can vary greatly in composition depending on the surrounding seed sources but is generally limited to drought-tolerant species. Trees are typically absent or, when present, are usually stunted and less than 10 m in height. Tree species are often typical of the surrounding forest. The tall-shrub/sapling layer (2–5 m in height) may be moderately dense (<60% cover). The most common species in this layer is striped maple (*Acer pensylvanicum*), mountain maple (*Acer spicatum*), commonly found with sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), sweet birch (*Betula lenta*), and/or white ash (*Fraxinus americana*). The short-shrub layer (<2 m in height), when present, often contains wild hydrangea (*Hydrangea arborescens*). The herb layer can be diverse, but the total cover is usually very low (<15%). Typical species are intermediate woodfern (*Dryopteris intermedia*), white wood aster (*Eurybia divaricata*), touch-me-nots (*Impatiens capensis*, *Impatiens pallida*), spotted Joepyeweed (*Eupatorium maculatum*), and hairy Solomon's seal (*Polygonatum pubescens*).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> , <i>Acer spicatum</i>
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Hydrangea arborescens</i>
Herb (field)	Forb	<i>Eurybia divaricata</i> , <i>Impatiens capensis</i> , <i>Impatiens pallida</i>
Herb (field)	Fern or fern ally	<i>Dryopteris intermedia</i>

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>State Rank</u>	<u>Confidence</u>	<u>State Name</u>	<u>Reference</u>
PA	NA	NA	no crosswalk	Fike 1999

Local Range: This association is restricted to small cliffs along the trace.

Classification Comments: Key features of this type are sparse vegetation and vertical to near-vertical outcrops and cliffs associated with the trace. Actual species composition is variable given the limited habitat to support vegetation and unpredictable nature of plant colonization and establishment.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots: ALPO.24, ALPO.70.

Allegheny Portage Railroad National Historic Site Inventory Notes: None.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Consolidated rock sparse vegetation (VII.A.)
Physiognomic Group	Sparsely vegetated cliffs (VII.A.1.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated cliffs (VII.A.1.N.)
Formation	Cliffs with sparse vascular vegetation (VII.A.1.N.a.)
Alliance	Open Cliff Sparsely Vegetated Alliance (A.1836)
Alliance (English name)	Open Cliff Sparsely Vegetated Alliance
Association	Western Allegheny Plateau Sandstone Dry Cliff Sparse Vegetation
Association (English name)	Western Allegheny Plateau Sandstone Dry Cliff Sparse Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This dry sandstone cliff community occurs in the Western Allegheny Plateau and possibly the central Appalachian Mountains of the United States. Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on south- and west-facing slopes. Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%. Mosses and lichens are common, including crustose lichens. Woody species include *Tsuga canadensis*, *Betula alleghaniensis* (= *Betula lutea*), *Rhododendron periclymenoides* (= *Rhododendron nudiflorum*), *Kalmia latifolia*, *Toxicodendron radicans*, and rarely *Hydrangea arborescens*. The herbaceous layer contains the forbs *Agrostis perennans*, *Aquilegia canadensis*, *Mitchella repens*, *Sedum ternatum*, and *Viola blanda*. *Silene rotundifolia* often occurs at the drip line. Ferns such as *Asplenium montanum*, *Asplenium pinnatifidum*, *Asplenium rhizophyllum*, *Asplenium trichomanes*, *Cystopteris tenuis*, *Dennstaedtia punctilobula*, *Dryopteris intermedia*, *Dryopteris marginalis*, *Polypodium virginianum*, *Polypodium appalachianum*, *Woodsia obtusa*, and the rare *Asplenium bradleyi* also occur.

Environmental Description: This dry sandstone cliff community occurs in the Western Allegheny Plateau and possibly the central Appalachian Mountains of the United States. Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on south- and west-facing slopes.

Vegetation Description: Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%. Mosses and lichens are common, including crustose lichens. Woody species include *Tsuga canadensis*, *Betula alleghaniensis* (= *Betula lutea*), *Rhododendron periclymenoides* (= *Rhododendron nudiflorum*), *Kalmia latifolia*, *Toxicodendron radicans*, and rarely *Hydrangea arborescens*. The herbaceous layer contains the forbs *Agrostis perennans*, *Aquilegia canadensis*, *Mitchella repens*, *Sedum ternatum*, and *Viola blanda*. *Silene rotundifolia* often occurs at the drip line. Ferns such as *Asplenium montanum*, *Asplenium pinnatifidum*, *Asplenium rhizophyllum*, *Asplenium trichomanes*, *Cystopteris tenuis*, *Dennstaedtia punctilobula*,

Dryopteris intermedia, *Dryopteris marginalis*, *Polypodium virginianum*, *Polypodium appalachianum*, *Woodsia obtusa*, and the rare *Asplenium bradleyi* also occur.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Semi-shrub	<i>Mitchella repens</i>
Herb (field)	Forb	<i>Aquilegia canadensis</i>
Herb (field)	Graminoid	<i>Agrostis perennans</i>
Herb (field)	Fern or fern ally	<i>Dennstaedtia punctilobula</i>

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.

States/Provinces: OH, PA, WV.

Federal Lands: NPS (Allegheny Portage Railroad).

CONSERVATION STATUS

Rank: GNR (24-Jan-2003).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: These cliffs are known locally as "rock houses." In Ohio, Anderson (1996) provides several references to lichen composition on sandstone cliffs.

Similar Associations:

Kittatinny Ridge Sandstone Cliff Sparse Vegetation (CEGL006443).

Sandstone Dry Cliff Sparse Vegetation (CEGL002045).

Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287).

Related Concepts:

Cliff Communities (Anderson 1996) B.

SOURCES

Description Authors: L. A. Sneddon.

References: Anderson 1996, Eastern Ecology Working Group n.d., Perles et al. 2006, Sneddon and Menard 2002.



Figure 33. Sparsely Vegetated Cliff in Allegheny Portage Railroad National Historic Site (plot ALPO.24). August 2005. NAD 1983 / UTM easting 710458, northing 4478596.

Vegetation Map Production

In order to produce an association-level vegetation map, the vegetation cover type map was edited and refined onscreen in ArcView 3.2. Each vegetated polygon was assigned a vegetation association. Assignments were informed by the plot data, field observations, aerial photography signatures, and topographic maps. Polygon boundaries were also revised based on these four information sources. Several polygons were labeled as mosaics where two associations were present in a polygon and clear boundaries between the two associations could not be delineated. Polygons that were attributed with modified Anderson level II categories retained their attributes. An aerial photograph interpretation key for the vegetation associations and Anderson level II categories (modified) is located in Appendix A.

The thematic accuracy of this vegetation association map was then assessed. Based on the accuracy assessment sampling data, the association map was revised again to correct errors and create more accurate vegetation association polygon boundaries. In this final revision, accuracy assessment data, plot data, field observations, aerial photography signatures, and topographic maps were used to revise polygon boundaries and attributes.

The resulting final vegetation association map is shown in Figure 34 and a summary of the vegetation association distribution and abundance is provided in Table 6. The number of total mapped hectares listed in Table 6 is larger than the number of hectares in the park because the mapped polygons extend beyond the park boundary.

Accuracy Assessment

Positional Accuracy

The final horizontal positional accuracy for both mosaics is 1.18 meters and meets Class 1 National Map Accuracy Standards (FGDC 1998b). A copy of the spreadsheet that contains the x and y coordinates for each ground control point and the accuracy calculation formula is included in the air photo archive.

Thematic Accuracy

Based on the contingency matrix (Table 7), the Kappa index for the vegetation association map was $68.7\% \pm 6.9\%$, with the overall percent accuracy calculated as 72.4%. This does not exceed the USGS/NPS vegetation mapping protocol requirement of 80%. The errors of commission for seven of the 16 vegetation associations exceeded the USGS/NPS Vegetation Mapping Protocol requirement of 80% (Table 7). All of the associations except Northern Red Oak - Northern Hardwood Forest reported errors of commission above 50%. The errors of omission for eight of the 16 vegetation associations exceeded the USGS/NPS vegetation mapping protocol requirement of 80% (Table 7). Only two associations, Northern Red Oak - Northern Hardwood Forest and Tuliptree - Beech - Maple Forest, reported errors of omission below 50%.

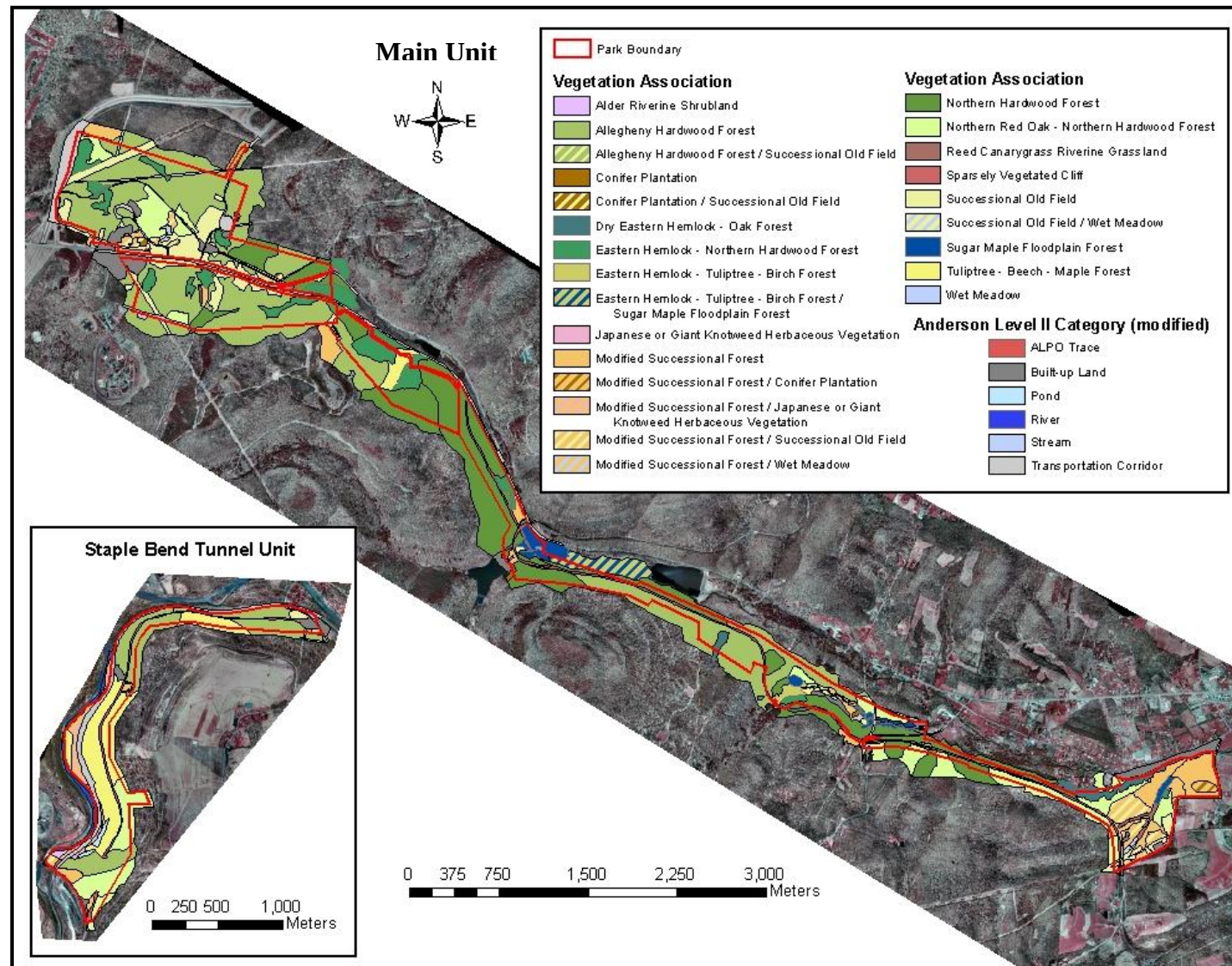


Figure 34. Vegetation associations and Anderson level II categories (modified) for Allegheny Portage Railroad National Historic Site (ALPO).

Table 6. Number of polygons, total mapped hectares, and mapped hectares within the park boundary for vegetation associations and Anderson level II categories (modified) at Allegheny Portage Railroad National Historic Site (ALPO).

Vegetation Association	Number of Polygons	Total Mapped Hectares	Mapped Hectares Within Park Boundary
Alder Riverine Shrubland	1	0.44	0.44
Allegheny Hardwood Forest	31	239.92	167.72
Allegheny Hardwood Forest / Successional Old Field mosaic	1	0.38	0.26
Conifer Plantation	5	1.61	1.15
Conifer Plantation / Successional Old Field mosaic	3	1.23	1.23
Dry Eastern Hemlock - Oak Forest	4	8.03	5.39
Eastern Hemlock - Northern Hardwood Forest	17	39.11	31.23
Eastern Hemlock - Tuliptree - Birch Forest	1	2.36	2.34
Eastern Hemlock - Tuliptree - Birch Forest / Sugar Maple Floodplain Forest mosaic	1	10.27	1.48
Japanese or Giant Knotweed Herbaceous Vegetation	3	1.88	1.59
Modified Successional Forest	22	36.52	27.40
Modified Successional Forest / Conifer Plantation mosaic	2	2.08	2.01
Modified Successional Forest / Japanese or Giant Knotweed Herbaceous Vegetation mosaic	2	5.10	4.14
Modified Successional Forest / Successional Old Field mosaic	12	14.61	14.53
Modified Successional Forest / Wet Meadow mosaic	2	0.65	0.65
Northern Hardwood Forest	22	140.98	86.83
Northern Red Oak - Northern Hardwood Forest	22	65.70	46.38
Reed Canarygrass Riverine Grassland	1	1.58	1.58
Sparsely Vegetated Cliff	9	1.12	0.98
Successional Old Field	35	41.97	35.11
Successional Old Field / Wet Meadow mosaic	2	0.47	0.44
Sugar Maple Floodplain Forest	9	11.21	8.62
Tuliptree - Beech - Maple Forest	7	34.67	28.84
Wet Meadow	2	0.98	0.98
Anderson Level II Category (modified)			
ALPO Trace	9	16.64	15.46
Built-up Land	24	25.78	12.25
Pond	7	1.37	1.45
River	1	3.32	0.59
Stream	5	2.25	1.68
Transportation Corridor	13	38.19	15.59
Total	275	750.40	518.30

Table 7. Contingency matrix and calculated errors for the thematic accuracy assessment of the vegetation association map of Allegheny Portage Railroad National Historic Site.

Accuracy Assessment Observation	Mapped Association																Total	Error of Commission (Percent Correct)
	Alder Riverine Shrubland	Allegheny Hardwood Forest	Conifer Plantation	Dry Eastern Hemlock - Oak Forest	Eastern Hemlock - Northern Hardwood Forest	Eastern Hemlock - Tuliptree - Birch Forest	Japanese or Giant Knotweed Herbaceous Vegetation	Modified Successional Forest	Northern Hardwood Forest	Northern Red Oak - Northern Hardwood Forest	Reed Canary-grass Riverine Grassland	Sparsely Vegetated Cliff	Successional Old Field	Sugar Maple Floodplain Forest	Tuliptree - Beech - Maple Forest	Wet Meadow		
Alder Riverine Shrubland	1																1	100.00%
Allegheny Hardwood Forest		13						3	1	5					1		23	56.52%
Conifer Plantation			4					1									5	80.00%
Dry Eastern Hemlock - Oak Forest				2													2	100.00%
Eastern Hemlock - Northern Hardwood Forest		1		1	5												7	71.43%
Eastern Hemlock - Tuliptree - Birch Forest						2											2	100.00%
Japanese or Giant Knotweed Herbaceous Vegetation							3					1					4	75.00%
Modified Successional Forest		2						13	1					1	2		19	68.42%
Northern Hardwood Forest		4							16						1		21	76.19%
Northern Red Oak - Northern Hardwood Forest		2						2	2	3				1			10	30.00%
Reed Canarygrass Riverine Grassland											1						1	100.00%
Sparsely Vegetated Cliff												5					5	100.00%
Successional Old Field													22			1	23	95.65%
Sugar Maple Floodplain Forest										2				3			5	60.00%
Tuliptree - Beech - Maple Forest							1								1		2	50.00%
Wet Meadow													1			3	4	75.00%
Total	1	22	4	3	5	2	4	19	20	10	1	6	23	5	5	4	134	
Error of Omission (Percent Correct)	100.00%	59.09%	100.00%	66.67%	100.00%	100.00%	75.00%	68.42%	80.00%	30.00%	100.00%	83.33%	95.65%	60.00%	20.00%	75.00%		
Total Points Correct																	97	
Overall Accuracy																	72.4%	
Kappa Index																	68.7%	
90% Confidence Interval for Kappa Index																	6.9%	

The low errors of commission and omission calculated for Northern Red Oak - Northern Hardwood Forest indicate that the distribution of the northern red oak and other oaks (*Quercus* spp.) is patchy and inconsistently predicted by the aerial photography interpretation. The low error of omission reported for Tuliptree - Beech - Maple Forest was caused by errors in aerial photography interpretation.

Project Deliverables

Final products of the vegetation mapping project are shown in Table 8. All products have been delivered to the National Park Service by the Western Pennsylvania Conservancy.

Table 8. Summary of products resulting from the Allegheny Portage Railroad National Historic Site vegetation classification and mapping project.

Product	FGCD-complaint spatial metadata
Aerial photos, including flight line map and photoindex	Yes
Photomosaic as paper copy and in digital format	Yes
Annotated field forms with vegetation plot sampling data	Not applicable
Vegetation plot sampling data in the PLOTS 2.0 database	Not applicable
Differentially corrected GPS locations of vegetation plots	Yes
Annotated field forms with thematic accuracy assessment data	Not applicable
Thematic accuracy assessment data in the PLOTS 2.0 database	Not applicable
Differentially corrected GPS locations of thematic accuracy assessment sampling points	Yes
Digital photos representative of all vegetation types	Not applicable
Final map of vegetation associations as paper copy and in digital format	Yes
Final report as paper copy and in digital format	Not applicable

Discussion

Vegetation Classification and Characterization

This study at Allegheny Portage Railroad National Historic Site identified 16 vegetation associations: Alder Riverine Shrubland, Allegheny Hardwood Forest, Conifer Plantation, Dry Eastern Hemlock - Oak Forest, Eastern Hemlock - Northern Hardwood Forest, Eastern Hemlock - Tuliptree - Birch Forest, Japanese or Giant Knotweed Herbaceous Vegetation, Modified Successional Forest, Northern Hardwood Forest, Northern Red Oak - Northern Hardwood Forest, Reed Canarygrass Riverine Grassland, Sparsely Vegetated Cliff, Successional Old Field, Sugar Maple Floodplain Forest, Tuliptree - Beech - Maple Forest, and Wet Meadow. These vegetation associations are strongly influenced by the varied environmental setting and previous land use within the park.

The most abundant association in Allegheny Portage Railroad National Historic Site is Allegheny Hardwood Forest, covering over half (52%) of the park area. This association is the most common forest type in the Summit Level section of the park's Main Unit on top of the Allegheny Plateau. This forest type is very common in northern and western Pennsylvania on higher elevations of the Allegheny Plateau. Northern Hardwood Forest is the second most common vegetation association within the park (17% of the park area). It is very similar to Allegheny Hardwood Forest; however, sugar maple is typically dominant in Northern Hardwood Forest, whereas, black cherry is a typical dominant in Allegheny Hardwood Forest. Northern Hardwood Forest occurs in patches interspersed within the Allegheny Hardwood Forest, and is most common on the slopes north of the Hollidaysburg Reservoir. The higher quality examples of these two forest types occur in the Main Unit to the north and west of the Hollidaysburg Reservoir.

Several other forest associations occur scattered throughout the park within these two common forest types. Three of these associations are mixed hemlock types, dominated by eastern hemlock (*Tsuga canadensis*) and other hardwoods. These hemlock types are differentiated from each other by their environmental setting and the species of co-dominant hardwood. Dry Eastern Hemlock - Oak Forest occurs on dry upper slopes and is co-dominated by oaks, including chestnut oak (*Quercus prinus*). Eastern Hemlock - Tuliptree - Birch Forest, co-dominated by tuliptree and birches (*Betula* spp.), is restricted to ravines and streamsides. Eastern Hemlock - Northern Hardwood Forest is more common (6% of the park area) than the other two hemlock types. It occurs in areas where hemlock mixes with the two most common hardwood forest types, and is dominated by maples (*Acer* spp.), birches, and black cherry. The patches of hemlocks that are currently widely scattered throughout the Allegheny Hardwood Forest may indicate that this species may have been more abundant within the region's forests prior to logging; however, no direct evidence was found during this project.

Northern Red Oak - Northern Hardwood Forest also occurs in patches throughout the park. This association was often misclassified during the classification analyses, and reported very low errors of commission and omission during accuracy assessment. This was caused by the patchy and inconsistent distribution of northern red oak and other oaks within the Allegheny Hardwood Forest and Northern Hardwood Forest. The other association that reported a low error of

omission was Tuliptree - Beech - Maple Forest. This association is most abundant in the Staple Bend Unit where tuliptree has colonized the mesic slopes after they were cleared. The errors most likely were caused by problems with aerial photography interpretation in locations where the architecture of the tree canopy was difficult to distinguish from other hardwood species. Other possible contributing factors to the mapping errors in these two types are previous logging and other disturbances that have caused great variation in the composition of the hardwood forests. Due to the previous disturbances' effects on the forest's composition and structure, determining the correct vegetation association at many of the accuracy assessment points was challenging.

The forest types in the Staple Bend Unit are generally of lower quality, compared with the forests at higher elevations in the Main Unit. The areas of Allegheny Hardwood Forest in the Staple Bend Unit share some characteristics with Modified Successional Forest, as they tend to contain younger trees and many invasive species. In addition, much of the Staple Bend Unit contains dense infestations of Japanese knotweed (*Polygonum cuspidatum*), giant knotweed (*Polygonum sachalinense*), or the hybrid of those two species (*Polygonum x bohémica*). All of the mapped occurrences of Japanese or Giant Knotweed Herbaceous Vegetation are located within the Staple Bend Unit.

Four associations are associated with riparian habitats along rivers, streams, and drainages. Alder Riverine Shrubland occurs in one small patch along the Little Conemaugh River in the Staple Bend Unit. The Main Unit contains a single occurrence of Reed Canarygrass Riverine Grassland along small drainages in the southeast corner of the unit. Wet Meadow occurs in a few locations within the Main Unit where herbaceous and graminoid vegetation surrounds small drainages. Sugar Maple Floodplain Forest covers more area than the previous three associations, but it is limited in extent to areas surrounding Blair Gap Run.

The previous four vegetation associations can be crosswalked to the Cowardin wetland classification that was used for National Wetland Inventory mapping (Cowardin et al. 1979). Wet Meadow and Reed Canarygrass Riverine Grassland are best classified as Palustrine, Emergent, Persistent (PEM1). Sugar Maple Floodplain Forest corresponds to Palustrine, Forested, Broad - leaved Deciduous (PFO1). Alder Riverine Shrubland can be classified as Palustrine, Scrub-Shrub, Broad - leaved Deciduous (PSS1).

Nine Sparsely Vegetated Cliff areas are shown in the vegetation association map; however, there may be additional cliffs in the park that were not captured by the map. Most of these vertical rock features were created during the construction of the portage railroad, although some small natural cliffs may occur away from the trace.

Due to previous disturbances and land use history, Modified Successional Forest, Conifer Plantations, and Successional Old Field are fairly common associations in the park, especially in the southeastern corner of the Main Unit. These vegetation types are a direct result of land clearing, agriculture, silviculture, or a combination thereof. They typically contain invasive species and may occur as mosaics with other disturbed or successional associations.

Vegetation Map Production

The final vegetation map for Allegheny Portage Railroad National Historic Site depicts 16 vegetation associations and six modified Anderson level II categories. The final vegetation map is based on aerial photography that was flown in April 2003. Since that time, the vegetation in the park continues to change. Continued natural succession in the Successional Old Field and Modified Successional Forest associations will influence the vegetation. Management of invasive species and woody plants will also alter the vegetation. Despite these continual changes, the vegetation map produced by this project provides crucial baseline data for park resource managers.

The majority of the park (approximately 65% of the area) contains deciduous hardwood forest, the most difficult vegetation cover type to differentiate into associations through aerial photography interpretation. Also, the varied land use and disturbance history has significantly altered the vegetation composition and structure in some parts of the park, creating further challenges for the classification and mapping of the vegetation. Considering these two influences, a Kappa index below 80%, such as was reported for this park's vegetation map, is expected. Because the map errors that were identified during accuracy assessment have been corrected in the final vegetation association map, this final map is more accurate than reported in the accuracy assessment results section. Re-assessing the thematic accuracy of the final vegetation association map would require another round of intensive field sampling. The costs of a second round of sampling do not seem justified simply to quantify the level of increased accuracy in the final map.

Recommendations for Future Projects

Nonnative invasive species are a major threat to the native vegetation at Allegheny Portage Railroad National Historic Site, particularly in disturbed areas and along the historic trace. Ninety nonnative species were found in the park during plot and accuracy assessment sampling (summarized in Zimmerman 2006). The most widespread nonnative invasive plant species was multiflora rose (*Rosa multiflora*), which was present at just over 32% of the survey points and in 12 of the 16 vegetation associations. Japanese stiltgrass (*Microstegium vimineum*) and Japanese knotweed may be the most severe threats to native species and intact forest communities in the park, as they appear to be able to tolerate understory conditions and thrive in light gaps (Zimmerman 2006). The historic trace, which can approach 15 m in width, may facilitate the movement of invasive species into the park's relatively high quality hardwood and mixed hemlock-hardwood forests. Therefore, future management should include significant invasive species control activities along the length of the trace, focusing on species identified by Zimmerman (2006).

Restoration or management plans should be developed for the areas mapped as Modified Successional Forest, Conifer Plantation, and Successional Old Field. These vegetation types tend to contain significant cover of nonnative invasive species. A management plan for Successional Old Field areas should specify a management schedule that identifies appropriate activities and times for mowing and use of herbicide. Restoration plans for Modified Successional Forest and Successional Old Field areas should focus on controlling nonnative invasive plant species as the primary goal. While eradication of all nonnative plants is not

feasible in former agricultural areas, management should target the most problematic nonnative invasive species for removal and facilitate the transition to closed canopy forests, dominated by native tree and shrub species. The Conifer Plantation sites should be examined to determine desired conditions and the appropriate management strategies to achieve these conditions.

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Appendix A. Aerial photograph interpretation keys to vegetation cover types, vegetation associations, and Anderson level II categories (modified) at Allegheny Portage Railroad National Historic Site.

**AERIAL PHOTOGRAPH INTERPRETATION KEY TO VEGETATION COVER
TYPES AND ANDERSON LEVEL II CATEGORIES (MODIFIED) AT
ALLEGHENY PORTAGE RAILROAD NATIONAL HISTORIC SITE
for April 2003 Color Infrared Aerial Photography**

1. Individual tree crowns visible as gray, black, or pink signatures of varying architecture. Trees cover greater than 25% of area. (If buildings, structures, parking lots, and roads are present see couplet 10 below).
2. Signatures of at least 25% of the trees are pink and conical, indicating evergreen trees.
3. Signatures of at least 25% of the trees are pink and conical, creating a near continuous pink canopy or an open canopy of conical crowns.
4. Tree crowns cover 25–60% of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present.

Evergreen Woodland

4. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.

Evergreen Forest

3. Signatures of 25–75% of the trees are pink and conical. The canopy contains interspersed light to dark gray deciduous tree crowns and pink, conical evergreen tree crowns.
5. Tree crowns cover 25–60% of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present.

Mixed Evergreen - Deciduous Woodland

5. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.
6. Forest occurs in a swale, depression, or low topographic position. Polygon typically surrounds or includes curvilinear drainage features.

Temporarily Flooded Mixed Evergreen - Deciduous Forest

6. Forest occurs in a terrestrial setting with no evidence curvilinear drainage features or other hydrologic indicators.

Mixed Evergreen - Deciduous Forest

2. Signatures of trees are light to dark gray or black, indicating cold-deciduous trees. Less than 25% of the trees are pink and conical.
7. Tree crowns cover 60% or less of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present.

Deciduous Woodland

7. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.
8. Forest occurs immediately adjacent to the dark blue gray signature of a creek or drainageway. Shading of forest floor tends to be more dark gray than white.

Temporarily Flooded Deciduous Forest

8. Forest does not occur immediately adjacent to the dark blue gray signature of a creek or drainageway. Shading of forest floor tends to be more light gray or white than dark gray.

Deciduous Forest

1. Individual tree crowns cover less than 25% of the area.
9. Signature is primarily white, gray, or pink ranging from uniform to mottled. Buildings, structures, parking lots, and roads are absent. Signature is not uniform dark blue gray with occasional white speckles, indicating open water.
10. Signature is light to dark gray and has an extremely steep slope when viewed through a stereoscope. Vegetation is minimal. Feature appears adjacent to roads, the Allegheny Portage Railroad trace, railroads, or rivers.

Cliff

10. Signature is primarily of a matrix of white, gray or pink vegetation. Feature does not have an extremely steep slope when viewed through a stereoscope.
11. Shrubs cover greater than 25% of the area, appearing as round gray circles, or short, thin, pink cones. Shrubs are scattered or in clumps within a matrix of white, light gray, or pink herbaceous vegetation. Areas of dense deciduous shrub cover will have a bumpy gray signature.
12. Shrubs occur in a matrix that is in parts bright dappled white, indicating hummocks herbaceous vegetation in saturated soil. Dark gray curvilinear drainage features are present.

Temporarily Flooded Deciduous Shrubland

12. Shrubs occur in a matrix that is mottled white, light pink, or bright pink. Dark gray curvilinear drainage features are absent.

Deciduous Shrubland

11. Shrubs cover 25% or less of the area. Signature is almost entirely white, light gray, and/or light to bright pink herbaceous vegetation, ranging from uniform to mottled.

13. Signature is bright white and dappled, indicating saturated soil and hummocky herbaceous vegetation. Dark gray linear drainage features are present.

Saturated Herbaceous Vegetation

13. Signature tends to be light pink, white, and/or light gray. Parallel mow lines are often prominent. Polygons often have linear edges and regular shapes.

Grassland

9. Either buildings, structures, parking lots, and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature; or signature is uniform dark blue gray with occasional white speckles, indicating open water.

14. Buildings, structures, parking lots and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature.

15. Buildings, and structures, often surrounded by frequently mowed turf grass that has a light, bright pink signature.

Built-up Land

15. Linear transportation features that have a linear signature often with visible lane lines and automobiles.

16. Larger roads and highways have a linear uniform light gray to blue-gray signature often with visible lane lines and automobiles.

Transportation Corridor

16. Thin linear feature of light gray, pink or white that occurs on the path of the Allegheny Portage Railroad.

ALPO Trace

14. Signature is dark blue gray with occasional white speckles, indicating open water.

17. Feature is curvilinear and dark blue gray with occasional white speckles.

18. Curvilinear feature has measurable width and borders the Staple Bend Tunnel Unit.

River

18. Curvilinear feature has negligible width and occurs within forest or other vegetation.

Stream

17. Feature is small, rounded or curvilinear dark blue gray to black features isolated within other vegetation types.

Pond

**AERIAL PHOTOGRAPH INTERPRETATION KEY TO VEGETATION
ASSOCIATIONS AND ANDERSON LEVEL II CATEGORIES (MODIFIED) AT
ALLEGHENY PORTAGE RAILROAD NATIONAL HISTORIC SITE
for April 2003 Color Infrared Aerial Photography**

1. Individual tree crowns visible as gray, black, or pink signatures of varying architecture. Trees cover greater than 25% of area. (If buildings, structures, parking lots, and roads are present see couplet 11 below).

2. Signatures of at least 25% of the trees are pink and conical, indicating evergreen trees.

3. Crowns are bright pink and sharply or obscurely starred-shaped, indicating pines (*Pinus* sp.) or spruce (*Picea* sp.). Evergreen trees are typically of uniform height and diameter, although smaller gray deciduous trees may be interspersed.

Conifer Plantation

3. The conical crowns are dark pink and rough-textured, indicating eastern hemlock (*Tsuga canadensis*).

4. Forest occurs on dry sites. The deciduous crowns tend to be darker gray with the craggy, irregular architecture of oaks (*Quercus* spp.).

Dry Eastern Hemlock - Oak Forest

4. Forest occurs on dry-mesic to mesic sites. The deciduous crowns tend to be lighter gray to white, with more regular architecture. These crowns often appear rounded or ovular, as is typical of tuliptree (*Liriodendron tulipifera*), maples (*Acer* spp.), and other hardwoods.

5. Tuliptree (*Liriodendron tulipifera*) is a prominent deciduous tree, with a white signature and vase-shaped or inverted-triangular-shaped architecture. The association tends to occur in the bottom of ravines and along streams

Eastern Hemlock - Tuliptree - Birch Forest

5. Tuliptree (*Liriodendron tulipifera*), with its vase-shaped or inverted-triangular-shaped architecture, is not a prominent tree. Deciduous tree crowns often appear spherical, rounded or ovular, as is typical of maples (*Acer* spp.) and birches (*Betula* spp.).

Eastern Hemlock - Northern Hardwood Forest

2. Signatures of trees are light to dark gray or black, indicating cold-deciduous trees. Less than 25% of the trees are pink and conical.

6. Canopy trees are varied, light to dark gray or black deciduous trees, often draped in dark gray or black vines. Canopy trees can typically young in stature often with prominent open canopy gaps. Groundstory is dappled bright pink, dark gray, or white. Vegetation has a messy, junky appearance.

Modified Successional Forest

6. Vegetation does not have messy, junky appearance. Canopy trees are more uniform. Groundstory is typically light gray or white.
7. More than 25% of the tree crowns are either: a) tuliptree (*Liriodendron tulipifera*), with its white signature and vase-shaped or inverted-triangular-shaped architecture, or b) oaks (*Quercus* spp.) with a dark gray signature and open asymmetrical canopies and coarse craggy branches.

8. Tuliptree (*Liriodendron tulipifera*), with its white signature and vase-shaped or inverted-triangular-shaped architecture, covers >25% of the area.

Tuliptree - Beech - Maple Forest

8. Oaks (*Quercus rubra*, *Quercus* spp.) with a dark gray signature and open asymmetrical canopies and coarse craggy branches cover >25% of the area.

Northern Red Oak - Northern Hardwood Forest

7. Deciduous tree crowns often appear spherical, rounded or ovular, as is typical of maples (*Acer* spp.) and birches (*Betula* spp.). Tuliptree (*Liriodendron tulipifera*) and oaks (*Quercus* spp.) are not prominent in the canopy.

9. The majority of crowns appear as floating spheres with regular, whitish, fine branching, typical of sugar maple (*Acer saccharum*).

10. Forest occurs in a flat area surrounding a stream (dark gray curvilinear feature).

Sugar Maple Floodplain Forest

10. Forest occurs on gentle to steep slopes, not on the flat area surrounding a stream. This is a very common association in the park.

Northern Hardwood Forest

9. Canopy contains a mixture of deciduous species including: red maple (*Acer rubrum*, signature is whitish gray, open, inverse conical architecture), black cherry (*Prunus serotina*, signature is gray, long ovular, with a slightly messy appearance), or birches (*Betula* spp., gray, compact fan-shaped, with somewhat irregular architecture). This is a very common association in the park, especially in the western portion of the main unit.

Allegheny Hardwood Forest

1. Individual tree crowns cover less than 25% of the area.

11. Signature is light to dark gray and has an extremely steep slope when viewed through a stereoscope. Vegetation is minimal. Feature appears adjacent to roads, the Allegheny Portage Railroad trace, railroads, or rivers.

Sparsely Vegetated Cliff

11. Signature does not have an extremely steep slope when viewed through a stereoscope.

12. Signature is predominantly white, light gray or pink herbaceous vegetation, ranging from uniform to mottled. Shrubs, appearing as round gray circles, may be present or absent, scattered or in clumps within the white to light gray matrix of herbaceous vegetation. Buildings, structures, parking lots, roads, and open water are absent.

13. Individual shrubs, appearing as round gray circles, are widely scattered or absent. Signature is white, light gray, or light to bright pink, indicating herbaceous vegetation.

14. Signature is bright white, with gray or pink dapples or mottles, indicating temporarily-flooded to saturated herbaceous vegetation. Polygon is adjacent to or contains dark gray curvilinear features of creeks or drainages.

15. Signature is bright white and dappled with gray to black speckled or textured areas that indicate saturated soil and hummocky vegetation. Dark gray linear drainage features are prominent or common.

Wet Meadow

15. Signature is bright white, mottled with pink. Polygon occurs adjacent to large dark gray curvilinear feature of creek.

Reed Canarygrass Riverine Grassland

14. Signature is either: a) light gray and uniformly fine-textured bumpy, or b) mottled bright to light pink and/or white.

16. Signature is light gray and uniformly fine-textured bumpy, indicating a monoculture of knotweed (*Polygonum cuspidatum*, *P. sachalinense*). Vegetation occurs along rivers and roadsides.

Japanese or Giant Knotweed Herbaceous Vegetation

16. Signature tends to be bright to light pink and/or white, with no indication of drainage features or saturated soils.

Successional Old Field

13. Shrubs, appearing as round gray circles, cover greater than 25% of the area, scattered or in clumps within the white to light gray matrix of herbaceous vegetation. Areas of dense shrub cover will have a bumpy gray signature.

17. Dense shrub cover appears as a bumpy gray signature adjacent to a dark curvilinear drainage feature.

Alder Riverine Shrubland

17. Shrubs, appearing as round gray circles or pink cones, are present, scattered or in clumps within the pink or white matrix of herbaceous vegetation. Scattered tree crowns may also be visible. Dark curvilinear drainage features are absent.

Successional Old Field

12. Either, buildings, structures, parking lots and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature. Or, signature is uniform dark blue gray with occasional white speckles, indicating open water.

18. Buildings, structures, parking lots and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature.

19. Buildings, and structures, often surrounded by frequently mowed turf grass that has a light, bright pink signature.

Built-up Land

19. Linear transportation features that have a linear signature often with visible lane lines and automobiles.

20. Larger roads and highways have a linear uniform light gray to blue-gray signature often with visible lane lines and automobiles.

Transportation corridor

20. Thin linear feature of light gray, pink or white that occurs on the path of the Allegheny Portage Railroad.

ALPO trace

18. Signature is dark blue gray with occasional white speckles, indicating open water.

21. Feature is large, curvilinear, and dark blue gray with occasional white speckles and borders the Staple Bend Tunnel Unit.

22. Curvilinear feature has measurable width and borders the Staple Bend Tunnel Unit.

River

22. Curvilinear feature has negliable width and occurs within forest or other vegetation.

Stream

21. Feature is small, rounded or curvilinear dark blue gray to black features isolated within other vegetation types.

Pond

Appendix B. Vegetation plot sampling form.

Form 3: Quantitative Community Characterization Draft: Summer 2003
NPS 6 Parks Vegetation Mapping Project

A. General Information

Plot Number: _____ Park Name: _____
Survey date: _____ Surveyors: _____
Easting: _____ E Northing: _____ N EPE/APE: _____ DOP: _____ Map datum: _____ Zone: _____

B. Environmental Description

Representative sketch of stand and landscape position Picture No.: _____		Slope: _____ Aspect: _____ Elevation: _____ Stoniness: __ Stone free <0.1% __ Moderately stony 0.1–1% __ Stony 3–15% __ Very stony 15–50% __ Exceedingly stony 50–90% __ Stone piles >90%																																																	
Topographic position: __ Interfluvium (ridgetop) __ Low slope __ High slope __ Toe slope __ High level __ Low level __ Midslope __ Channel wall __ Backslope __ Channel bed __ Step in slope __ Basin Floor __ Other: _____		Hydrologic regime: __ Permanently flooded __ Semi-permanently flooded __ Seasonally flooded __ Intermittently flooded __ Temporarily flooded __ Artificially flooded __ Saturated (wet, but never flooded)																																																	
Soil drainage: __ Rapidly drained __ Well drained __ Moderately well drained __ Somewhat poorly drained __ Poorly Drained __ Very poorly drained		Average soil texture: __ sand __ clay loam __ sandy loam __ clay __ loam __ peat __ silt loam __ muck __ other: _____																																																	
Soil profile description: note depth, texture, and color of each horizon. Note significant changes such as depth to mottling, depth to water table, root penetration depth		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Horizon</th> <th style="width: 15%;">Depth</th> <th style="width: 20%;">Texture</th> <th style="width: 10%;">Color</th> <th style="width: 10%;">pH</th> <th style="width: 30%;">Comments</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>		Horizon	Depth	Texture	Color	pH	Comments																																										
Horizon	Depth	Texture	Color	pH	Comments																																														
Unvegetated surface: _____ % Bedrock _____ % Litter, duff _____ % Large rocks (> 10 cm) _____ % Wood (> 1 cm) _____ % Small rocks (0.2–10 cm) _____ % Water _____ % Sand (0.1–2 mm) _____ % Bare soil _____ % Other: _____		Plot representativeness: Note homogeneity of vegetation in plot versus rest of community Environmental Comments: Note surrounding vegetation, landscape context, herbivory, stand health, recent/historic anthropogenic evidence, etc.																																																	

[illegible]

Appendix C. Plants observed in Allegheny Portage Railroad National Historic Site during vegetation plot and thematic accuracy assessment sampling.

Plants Observed in Allegheny Portage Railroad National Historic Site During Vegetation Plot and Thematic Accuracy Assessment Sampling

Nomenclature follows the *PLANTS Database, Version 3.5* developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA, NRCS 2006). For this report, some common names listed in the PLANTS database were changed to reflect the common names typically used by ecologists and resource managers in this region.

Family	Scientific Name	Common Name
Aceraceae	<i>Acer negundo</i>	boxelder
	<i>Acer pensylvanicum</i>	striped maple
	<i>Acer rubrum</i>	red maple
	<i>Acer saccharinum</i>	silver maple
	<i>Acer saccharum</i>	sugar maple
	<i>Acer spicatum</i>	mountain maple
Anacardiaceae	<i>Rhus hirta</i>	staghorn sumac
	<i>Toxicodendron radicans</i>	eastern poison ivy
Apiaceae	<i>Daucus carota</i>	Queen Anne's lace
	<i>Osmorhiza claytonii</i>	Clayton's sweetroot
	<i>Sanicula canadensis</i>	Canadian blacksnakeroot
	<i>Taenidia integerrima</i>	yellow pimpernel
Apocynaceae	<i>Apocynum cannabinum</i>	Indianhemp
Aquifoliaceae	<i>Ilex montana</i>	mountain holly
Araceae	<i>Arisaema triphyllum</i>	Jack in the pulpit
Araliaceae	<i>Aralia nudicaulis</i>	wild sarsaparilla
	<i>Aralia spinosa</i>	devil's walkingstick
	<i>Panax quinquefolius</i>	American ginseng
	<i>Asarum canadense</i>	Canadian wild ginger
Asclepiadaceae	<i>Asclepias syriaca</i>	common milkweed
Aspleniaceae	<i>Asplenium platyneuron</i>	ebony spleenwort
Asteraceae	<i>Achillea millefolium</i>	common yarrow
	<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot
	<i>Ambrosia artemisiifolia</i>	annual ragweed
	<i>Anaphalis margaritacea</i>	western pearly everlasting
	<i>Antennaria parlinii</i>	Parlin's pussytoes
	<i>Bidens</i> sp.	beggarticks
	<i>Centaurea biebersteinii</i>	spotted knapweed
	<i>Cirsium arvense</i>	Canada thistle
	<i>Cirsium vulgare</i>	bull thistle
	<i>Doellingeria umbellata</i> var. <i>umbellata</i>	parasol whitetop
	<i>Erechtites hieraciifolia</i>	American burnweed
	<i>Erigeron strigosus</i>	prairie fleabane
	<i>Eupatorium fistulosum</i>	trumpetweed
	<i>Eupatorium maculatum</i>	spotted joeypyeweed
	<i>Eupatorium perfoliatum</i>	common boneset

Family	Scientific Name	Common Name
Asteraceae (cont.)	<i>Eupatorium purpureum</i>	sweetscented joepyeweed
	<i>Eurybia divaricata</i>	white wood aster
	<i>Euthamia graminifolia</i>	flat-top goldentop
	<i>Hieracium aurantiacum</i>	orange hawkweed
	<i>Hieracium caespitosum</i>	meadow hawkweed
	<i>Leucanthemum vulgare</i>	ox-eye daisy
	<i>Oclemena acuminata</i>	whorled wood aster
	<i>Packera aurea</i>	golden ragwort
	<i>Packera obovata</i>	roundleaf ragwort
	<i>Prenanthes</i> sp.	rattlesnakeroot
	<i>Rudbeckia laciniata</i>	cutleaf coneflower
	<i>Solidago caesia</i>	wreath goldenrod
	<i>Solidago canadensis</i>	Canada goldenrod
	<i>Solidago canadensis</i> var. <i>scabra</i>	Canada goldenrod
	<i>Solidago gigantea</i>	giant goldenrod
	<i>Solidago juncea</i>	early goldenrod
	<i>Solidago patula</i>	roundleaf goldenrod
	<i>Solidago rugosa</i>	wrinkleleaf goldenrod
	<i>Symphyotrichum lateriflorum</i> var. <i>lateriflorum</i>	calico aster
	<i>Symphyotrichum patens</i> var. <i>patens</i>	late purple aster
	<i>Symphyotrichum prenanthoides</i>	crookedstem aster
	<i>Taraxacum officinale</i>	common dandelion
	<i>Tussilago farfara</i>	coltsfoot
	<i>Verbesina alternifolia</i>	wingstem
	<i>Vernonia noveboracensis</i>	New York ironweed
Balsaminaceae	<i>Impatiens capensis</i>	jewelweed
	<i>Impatiens pallida</i>	pale touch-me-not
Berberidaceae	<i>Berberis thunbergii</i>	Japanese barberry
	<i>Caulophyllum thalictroides</i>	blue cohosh
	<i>Podophyllum peltatum</i>	mayapple
Betulaceae	<i>Alnus glutinosa</i>	European alder
	<i>Alnus serrulata</i>	smooth alder
	<i>Betula alleghaniensis</i>	yellow birch
	<i>Betula lenta</i>	sweet birch
	<i>Carpinus caroliniana</i>	American hornbeam
	<i>Ostrya virginiana</i>	eastern hop-hornbeam
Boraginaceae	<i>Hackelia virginiana</i>	beggarslice
Brassicaceae	<i>Alliaria petiolata</i>	garlic mustard
	<i>Arabis</i> sp.	rockcress
	<i>Cardamine diphylla</i>	crinkleroot
Brassicaceae (cont.)	<i>Hesperis matronalis</i>	dames rocket
Campanulaceae	<i>Lobelia inflata</i>	Indian-tobacco
Caprifoliaceae	<i>Lonicera maackii</i>	Amur honeysuckle
	<i>Lonicera morrowii</i>	Morrow's honeysuckle
	<i>Sambucus nigra</i> ssp. <i>canadensis</i>	common elderberry

Family	Scientific Name	Common Name
Caprifoliaceae (cont.)	<i>Sambucus racemosa</i> var. <i>racemosa</i>	red elderberry
	<i>Viburnum acerifolium</i>	mapleleaf viburnum
	<i>Viburnum dentatum</i> var. <i>lucidum</i>	southern arrowwood
	<i>Viburnum prunifolium</i>	blackhaw
Caryophyllaceae	<i>Dianthus armeria</i>	Deptford pink
	<i>Saponaria officinalis</i>	bouncingbet
	<i>Silene vulgaris</i>	maidenstears
	<i>Stellaria media</i>	common chickweed
	<i>Stellaria pubera</i>	star chickweed
Clusiaceae	<i>Hypericum perforatum</i>	common St. Johnswort
	<i>Hypericum punctatum</i>	spotted St. Johnswort
	<i>Triadenum virginicum</i>	Virginia marsh St. Johnswort
Convolvulaceae	<i>Calystegia sepium</i>	hedge false bindweed
Cornaceae	<i>Cornus alternifolia</i>	alternateleaf dogwood
	<i>Cornus amomum</i>	silky dogwood
	<i>Cornus racemosa</i>	gray dogwood
	<i>Cornus sericea</i>	redosier dogwood
	<i>Cuscuta</i> sp.	dodder
Cyperaceae	<i>Carex aestivalis</i>	summer sedge
	<i>Carex albursina</i>	white bear sedge
	<i>Carex appalachica</i>	Appalachian sedge
	<i>Carex blanda</i>	eastern woodland sedge
	<i>Carex communis</i>	fibrousroot sedge
	<i>Carex crinita</i>	fringed sedge
	<i>Carex debilis</i>	white edge sedge
	<i>Carex digitalis</i>	slender woodland sedge
	<i>Carex gracillima</i>	graceful sedge
	<i>Carex gynandra</i>	nodding sedge
	<i>Carex laxiculmis</i>	spreading sedge
	<i>Carex laxiflora</i>	broad looseflower sedge
	<i>Carex lupulina</i>	hop sedge
	<i>Carex lurida</i>	shallow sedge
	<i>Carex pensylvanica</i>	Pennsylvania sedge
	<i>Carex plantaginea</i>	plantainleaf sedge
	<i>Carex projecta</i>	necklace sedge
	<i>Carex radiata</i>	eastern star sedge
	<i>Carex retroflexa</i>	reflexed sedge
	<i>Carex scoparia</i>	broom sedge
	<i>Carex swanii</i>	Swan's sedge
	<i>Carex vulpinoidea</i>	fox sedge
	<i>Eleocharis tenuis</i>	slender spikerush
	<i>Scirpus atrovirens</i>	green bulrush
	<i>Scirpus georgianus</i>	Georgia bulrush
Dennstaedtiaceae	<i>Dennstaedtia punctilobula</i>	eastern hayscented fern
	<i>Pteridium aquilinum</i>	western brackenfern

Family	Scientific Name	Common Name
Dioscoreaceae	<i>Dioscorea quaternata</i>	fourleaf yam
Dipsacaceae	<i>Dipsacus fullonum</i>	Fuller's teasel
Dryopteridaceae	<i>Athyrium filix-femina</i>	common ladyfern
	<i>Dryopteris intermedia</i>	intermediate woodfern
	<i>Dryopteris marginalis</i>	marginal woodfern
	<i>Onoclea sensibilis</i>	sensitive fern
	<i>Polystichum acrostichoides</i>	Christmas fern
Elaeagnaceae	<i>Elaeagnus umbellata</i>	autumn olive
Ericaceae	<i>Gaultheria procumbens</i>	eastern teaberry
	<i>Gaylussacia baccata</i>	black huckleberry
	<i>Kalmia latifolia</i>	mountain laurel
	<i>Rhododendron maximum</i>	great rhododendron
	<i>Vaccinium angustifolium</i>	lowbush blueberry
Fabaceae	<i>Vaccinium pallidum</i>	Blue Ridge blueberry
	<i>Amphicarpaea bracteata</i>	American hogpeanut
	<i>Coronilla varia</i>	purple crownvetch
	<i>Lotus corniculatus</i>	birdfoot deervetch
	<i>Robinia pseudoacacia</i>	black locust
Fagaceae	<i>Castanea dentata</i>	American chestnut
	<i>Fagus grandifolia</i>	American beech
	<i>Quercus alba</i>	white oak
	<i>Quercus coccinea</i>	scarlet oak
	<i>Quercus prinus</i>	chestnut oak
	<i>Quercus rubra</i>	northern red oak
Hamamelidaceae	<i>Quercus velutina</i>	black oak
	<i>Hamamelis virginiana</i>	American witch-hazel
Hydrangeaceae	<i>Hydrangea arborescens</i>	wild hydrangea
Hydrophyllaceae	<i>Hydrophyllum virginianum</i>	Shawnee salad
Juglandaceae	<i>Carya cordiformis</i>	bitternut hickory
	<i>Carya glabra</i>	pignut hickory
	<i>Carya ovata</i>	shagbark hickory
Juglandaceae	<i>Juglans nigra</i>	black walnut
Juncaceae	<i>Juncus acuminatus</i>	tapertip rush
	<i>Juncus effusus</i>	common rush
	<i>Juncus tenuis</i>	poverty rush
Lamiaceae	<i>Clinopodium vulgare</i>	wild basil
	<i>Glechoma hederacea</i>	ground ivy
	<i>Lycopus virginicus</i>	Virginia water horehound
	<i>Monarda</i> sp.	beebalm
	<i>Prunella vulgaris</i>	common selfheal
Lauraceae	<i>Pycnanthemum</i> sp.	mountainmint
	<i>Lindera benzoin</i>	northern spicebush
	<i>Sassafras albidum</i>	sassafras
Liliaceae	<i>Allium</i> sp.	onion
	<i>Disporum lanuginosum</i>	yellow fairybells

Family	Scientific Name	Common Name
	<i>Lilium</i> sp.	lily
Liliaceae (cont.)	<i>Maianthemum canadense</i>	Canada mayflower
	<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	feathery false lily of the valley
	<i>Medeola virginiana</i>	Indian cucumber
	<i>Polygonatum pubescens</i>	hairy Solomon's seal
	<i>Streptopus lanceolatus</i> var. <i>roseus</i>	twistedstalk
	<i>Trillium erectum</i>	red trillium
	<i>Trillium undulatum</i>	painted trillium
	<i>Uvularia sessilifolia</i>	sessileleaf bellwort
Lycopodiaceae	<i>Huperzia lucidula</i>	shining clubmoss
	<i>Lycopodium digitatum</i>	fan clubmoss
	<i>Lycopodium obscurum</i>	rare clubmoss
Magnoliaceae	<i>Liriodendron tulipifera</i>	tuliptree
	<i>Magnolia acuminata</i>	cucumber-tree
Monotropaceae	<i>Monotropa uniflora</i>	Indianpipe
Nyssaceae	<i>Nyssa sylvatica</i>	blackgum
Oleaceae	<i>Forsythia</i> sp.	forsythia
	<i>Fraxinus americana</i>	white ash
	<i>Fraxinus pennsylvanica</i>	green ash
	<i>Ligustrum obtusifolium</i>	border privet
	<i>Syringa vulgaris</i>	common lilac
Onagraceae	<i>Circaea alpina</i>	small enchanter's nightshade
	<i>Circaea lutetiana</i>	broadleaf enchanter's nightshade
	<i>Oenothera biennis</i>	common evening-primrose
	<i>Oenothera fruticosa</i>	narrowleaf evening-primrose
Ophioglossaceae	<i>Botrychium virginianum</i>	rattlesnake fern
Orobanchaceae	<i>Epifagus virginiana</i>	beechdrops
Osmundaceae	<i>Osmunda cinnamomea</i>	cinnamon fern
	<i>Osmunda claytoniana</i>	interrupted fern
Oxalidaceae	<i>Oxalis montana</i>	mountain woodsorrel
	<i>Oxalis stricta</i>	common yellow oxalis
Phytolaccaceae	<i>Phytolacca americana</i>	American pokeweed
Pinaceae	<i>Picea pungens</i>	blue spruce
	<i>Pinus resinosa</i>	red pine
	<i>Pinus strobus</i>	eastern white pine
	<i>Pinus sylvestris</i>	Scotch pine
	<i>Tsuga canadensis</i>	eastern hemlock
Plantaginaceae	<i>Plantago lanceolata</i>	narrowleaf plantain
Poaceae	<i>Agrostis capillaris</i>	colonial bentgrass
	<i>Agrostis gigantea</i>	redtop
	<i>Agrostis perennans</i>	upland bentgrass
	<i>Agrostis stolonifera</i>	creeping bentgrass
	<i>Andropogon virginicus</i>	broomsedge bluestem
	<i>Anthoxanthum odoratum</i>	sweet vernalgrass
	<i>Brachyelytrum erectum</i>	bearded shorthusk

	<i>Bromus inermis</i>	smooth brome
	<i>Cinna</i> sp.	woodreed
Family	Scientific Name	Common Name
Poaceae (cont.)	<i>Dactylis glomerata</i>	orchard grass
	<i>Danthonia compressa</i>	flattened oatgrass
	<i>Danthonia spicata</i>	poverty oatgrass
	<i>Dichanthelium acuminatum</i> var. <i>acuminatum</i>	tapered rosette grass
	<i>Dichanthelium boscii</i>	Bosc's panicgrass
	<i>Dichanthelium clandestinum</i>	deertongue
	<i>Elymus hystrix</i>	eastern bottlebrush grass
	<i>Elymus riparius</i>	riverbank wildrye
	<i>Festuca rubra</i>	red fescue
	<i>Glyceria canadensis</i>	rattlesnake mannagrass
	<i>Glyceria striata</i>	fowl mannagrass
	<i>Holcus lanatus</i>	common velvetgrass
	<i>Leersia oryzoides</i>	rice cutgrass
	<i>Leersia virginica</i>	whitegrass
	<i>Lolium arundinaceum</i>	tall fescue
	<i>Lolium pratense</i>	meadow ryegrass
	<i>Microstegium vimineum</i>	Japanese stilt grass
	<i>Phalaris arundinacea</i>	reed canarygrass
	<i>Phleum pratense</i>	timothy
	<i>Poa alsodes</i>	grove bluegrass
	<i>Poa compressa</i>	Canada bluegrass
	<i>Poa pratensis</i>	Kentucky bluegrass
Polygonaceae	<i>Polygonum arifolium</i>	halberdleaf tearthumb
	<i>Polygonum caespitosum</i>	oriental ladysthumb
	<i>Polygonum cuspidatum</i>	Japanese knotweed
	<i>Polygonum pensylvanicum</i>	Pennsylvania smartweed
	<i>Polygonum sachalinense</i>	giant knotweed
	<i>Polygonum sagittatum</i>	arrowleaf tearthumb
	<i>Polygonum scandens</i>	climbing false buckwheat
	<i>Polygonum virginianum</i>	jumpseed
	<i>Rumex acetosella</i>	common sheep sorrel
	<i>Rumex obtusifolius</i>	bitter dock
Primulaceae	<i>Lysimachia quadrifolia</i>	whorled yellow loosestrife
	<i>Trientalis borealis</i>	starflower
Pteridaceae	<i>Adiantum pedatum</i>	northern maidenhair
Ranunculaceae	<i>Actaea pachypoda</i>	white baneberry
	<i>Cimicifuga racemosa</i>	black bugbane
	<i>Hepatica nobilis</i> var. <i>acuta</i>	sharplobe hepatica
	<i>Ranunculus hispidus</i>	bristly buttercup
Rhamnaceae	<i>Rhamnus cathartica</i>	common buckthorn
Rosaceae	<i>Amelanchier arborea</i>	common serviceberry
	<i>Amelanchier laevis</i>	Allegheny serviceberry
	<i>Crataegus</i> sp.	hawthorn

	<i>Fragaria virginiana</i>	Virginia strawberry
	<i>Geum canadense</i>	white avens
	<i>Geum virginianum</i>	cream avens
Family	Scientific Name	Common Name
Rosaceae (cont.)	<i>Malus pumila</i>	paradise apple
	<i>Physocarpus opulifolius</i>	eastern ninebark
	<i>Potentilla simplex</i>	common cinquefoil
	<i>Prunus avium</i>	sweet cherry
	<i>Prunus pensylvanica</i>	pin cherry
	<i>Prunus serotina</i>	black cherry
	<i>Prunus virginiana</i>	choke cherry
	<i>Pyrus</i> sp.	pear
	<i>Rosa multiflora</i>	multiflora rose
	<i>Rubus allegheniensis</i>	Allegheny blackberry
	<i>Rubus flagellaris</i>	northern dewberry
	<i>Rubus hispidus</i>	bristly dewberry
	<i>Rubus idaeus</i>	American red raspberry
	<i>Rubus occidentalis</i>	black raspberry
	<i>Rubus odoratus</i>	purpleflowering raspberry
	<i>Spiraea tomentosa</i>	steeplebush
Rubiaceae	<i>Galium asprellum</i>	rough bedstraw
	<i>Galium circaezans</i>	licorice bedstraw
	<i>Mitchella repens</i>	partridgeberry
Salicaceae	<i>Populus grandidentata</i>	bigtooth aspen
	<i>Populus tremuloides</i>	quaking aspen
Saxifragaceae	<i>Heuchera</i> sp.	alumroot
	<i>Mitella diphylla</i>	twoleaf miterwort
	<i>Tiarella cordifolia</i>	heartleaf foamflower
Scrophulariaceae	<i>Linaria vulgaris</i>	butter and eggs
	<i>Mimulus ringens</i>	Allegheny monkeyflower
	<i>Verbascum thapsus</i>	common mullein
	<i>Veronica officinalis</i>	common gypsyweed
Simaroubaceae	<i>Ailanthus altissima</i>	tree of heaven
Smilacaceae	<i>Smilax glauca</i>	cat greenbrier
	<i>Smilax rotundifolia</i>	roundleaf greenbrier
	<i>Smilax tamnoides</i>	bristly greenbrier
Solanaceae	<i>Solanum dulcamara</i>	climbing nightshade
Sphagnaceae	<i>Sphagnum</i> sp.	sphagnum
Thelypteridaceae	<i>Thelypteris noveboracensis</i>	New York fern
Tiliaceae	<i>Tilia americana</i>	American basswood
Ulmaceae	<i>Ulmus americana</i>	American elm
	<i>Ulmus rubra</i>	slippery elm
Urticaceae	<i>Boehmeria cylindrica</i>	smallspike false nettle
	<i>Laportea canadensis</i>	Canadian woodnettle
	<i>Pilea pumila</i>	Canadian clearweed
Verbenaceae	<i>Verbena hastata</i>	swamp verbena

Violaceae	<i>Viola blanda</i>	sweet white violet
	<i>Viola canadensis</i>	Canadian white violet
	<i>Viola cucullata</i>	marsh blue violet
	<i>Viola hastata</i>	halberdleaf yellow violet
Family	Scientific Name	Common Name
Violaceae (cont.)	<i>Viola palmata</i>	early blue violet
	<i>Viola pubescens</i>	downy yellow violet
	<i>Viola pubescens</i> var. <i>pubescens</i>	downy yellow violet
	<i>Viola rotundifolia</i>	roundleaf yellow violet
	<i>Viola sororia</i>	common blue violet
	<i>Viola striata</i>	striped cream violet
Vitaceae	<i>Parthenocissus quinquefolia</i>	Virginia creeper
	<i>Vitis aestivalis</i>	summer grape

Appendix D. Dichotomous field key to the vegetation associations of Allegheny Portage Railroad National Historic Site.

**KEY TO VEGETATION TYPES AT
ALLEGHENY PORTAGE RAILROAD NATIONAL HISTORIC SITE**

1. Scattered or sparse vegetation on near vertical rock outcrops or cliffs along the Allegheny Portage Railroad trace, the Little Conemaugh River, or other transportation corridors.

Sparsely Vegetated Cliff

1. Vegetation does not occur on near vertical rock outcrops or cliffs.
2. Trees cover less than 25% of the area. Vegetation is dominated by shrub, herbaceous, or graminoid species.
3. Vegetation is associated with the Little Conemaugh River, a stream or drainage. Soil is saturated or under standing water for at least part of the growing season. Hydrophilic species such as sedges (*Carex* spp.), reed canarygrass (*Phalaris arundinacea*), cutgrass (*Leersia* sp.), knotweeds (*Polygonum* spp.) or alders (*Alnus* spp.) are dominant.
4. Vegetation occurs adjacent to the Little Conemaugh River, and is strongly dominated by Japanese knotweed (*Polygonum cuspidatum*), giant knotweed (*Polygonum sachalinense*), or alders (*Alnus* spp.).

5. Vegetation is strongly dominated by Japanese knotweed (*Polygonum cuspidatum*) or giant knotweed (*Polygonum sachalinense*).

Japanese or Giant Knotweed Herbaceous Vegetation

5. Vegetation is strongly dominated by alders (*Alnus* spp.).

Alder Riverine Shrubland

4. Vegetation occurs along smaller streams or drainages, and dominated by reed canarygrass (*Phalaris arundinacea*), rice cutgrass (*Leersia oryzoides*), sedges (*Carex* spp.), and knotweeds (*Polygonum* spp., excluding *P. cuspidatum* and/or *P. sachalinense*).
6. Reed canarygrass (*Phalaris arundinacea*) that covers less than 50% of the area. Vegetation is dominated by a diverse mix of hydrophilic graminoids, predominantly rice cutgrass (*Leersia oryzoides*), sedges (*Carex* spp.), rushes (*Juncus* spp.), and knotweeds (*Polygonum* spp.).

Wet Meadow

6. Vegetation is dominated by reed canarygrass (*Phalaris arundinacea*) that covers at least 50% of the area. The dense graminoid vegetation usually contains significantly less botanical diversity than the Wet Meadow type above.

Reed Canarygrass Riverine Grassland

3. Vegetation is primarily terrestrial with hydrophilic species absent or as occasional associates. Typical dominants include: goldenrods (*Solidago* spp.), sweet vernalgrass (*Anthoxanthum odoratum*), fescue (*Festuca* spp.), timothy (*Phleum pratense*), bentgrass (*Agrostis* spp.), blackberries and raspberries (*Rubus* spp.), staghorn sumac (*Rhus hirta*), hawthorns (*Crataegus* sp.), black locust (*Robinia pseudoacacia*), autumn olive (*Elaeagnus umbellata*), Morrow's honeysuckle (*Lonicera morrowii*), and multiflora rose (*Rosa multiflora*). Shrub cover varies from absent to fairly dense (0–70% cover). Dense patches of eastern hayscented fern (*Dennstaedtia punctilobula*) and other ferns growing in rights-of-way are also included here. (For dense stands of Japanese knotweed (*Polygonum cuspidatum*) or giant knotweed (*Polygonum sachalinense*) along transportation corridors in terrestrial settings, see couplet 5 above.)

Successional Old Field

2. Trees cover greater than 25% of the area, creating an open to closed canopy.
7. Coniferous trees compose 25% or greater of the relative cover of the canopy and subcanopy combined.
8. Coniferous trees are pines (*Pinus* sp.) or spruce (*Picea* sp.). Trees were likely planted. Adventitious hardwoods may be present.

Conifer Plantation

8. Coniferous trees are hemlock (*Tsuga canadensis*). Hardwood associates vary widely.
9. Prominent hardwood associates include oaks (*Quercus* sp.) or tuliptree (*Liriodendron tulipifera*). Vegetation occurs on dry upper slopes or along ravine and stream bottoms.
10. Canopy is composed of eastern hemlock (*Tsuga canadensis*) and oaks (*Quercus* spp.), predominantly northern red oak (*Quercus rubra*) or chestnut oak (*Quercus prinus*). Vegetation occurs on dry upper slopes.

Dry Eastern Hemlock - Oak Forest

10. Canopy is composed of eastern hemlock (*Tsuga canadensis*), and tuliptree (*Liriodendron tulipifera*), with maples (*Acer* spp.) and birches (*Betula* spp.) as associates. This association is restricted to the bottoms of ravines and along streams.

Eastern Hemlock - Tuliptree - Birch Forest

9. Prominent hardwood associates include maples (*Acer* spp.), black cherry (*Prunus serotina*), American beech (*Fagus grandifolia*), and birches (*Betula* spp.). Vegetation occurs on mid- to lower slopes, in ravines, and around drainages.

Eastern Hemlock - Northern Hardwood Forest

7. Coniferous trees compose less than 25% of the relative cover of the canopy and subcanopy combined.
11. Canopy is dominated by weedy, early successional species such as black locust (*Robinia pseudoacacia*), white ash (*Fraxinus americana*), black walnut (*Juglans nigra*), sassafras (*Sassafras albidum*), black cherry (*Prunus serotina*), eastern white pine (*Pinus strobus*), apple (*Malus* sp.), hawthorns (*Crataegus* sp.) and tree of heaven (*Ailanthus altissima*). Invasive species may also be prevalent in the shrub and herbaceous layers.

Modified Successional Forest

11. Canopy is dominated by oaks (*Quercus* spp.), maples (*Acer* spp.), birches (*Betula* spp.), black cherry (*Prunus serotina*), or American beech (*Fagus grandifolia*). Weedy, early successional species such as black locust (*Robinia pseudoacacia*), white ash (*Fraxinus americana*), black walnut (*Juglans nigra*), apple (*Malus* sp.), hawthorns (*Crataegus* sp.) and tree of heaven (*Ailanthus altissima*) are absent or rare associates.
12. Oaks (*Quercus* spp.) and/or tuliptree (*Liriodendron tulipifera*) compose 25% or greater relative cover in all of the canopy layers combined.
13. Northern red oak (*Quercus rubra*) or other oak (*Quercus* spp.) species compose 25% relative cover or greater in all of the canopy layers combined. Typical canopy associates include black cherry (*Prunus serotina*), red maple (*Acer rubrum*), and sugar maple (*Acer saccharum*).

Northern Red Oak - Northern Hardwood Forest

13. Tuliptree (*Liriodendron tulipifera*) compose 25% relative cover or greater in all of the canopy layers combined. Typical canopy associates include maples (*Acer* spp.) and American beech (*Fagus grandifolia*).

Tuliptree - Beech - Maple Forest

12. Oaks (*Quercus* spp.) and/or tuliptree (*Liriodendron tulipifera*) compose less than 25% relative cover in all of the canopy layers combined. Typical canopy dominants include black cherry (*Prunus serotina*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), birches (*Betula* spp.), or American beech (*Fagus grandifolia*).
14. Canopy is clearly dominated sugar maple (*Acer saccharum*) and occurs in the floodplain of a small stream.

Sugar Maple Floodplain Forest

14. Canopy is dominated by one or more of the following species: black cherry (*Prunus serotina*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), birches (*Betula* spp.), or American beech (*Fagus grandifolia*). Vegetation is not restricted to the floodplains of small streams.
15. Red maple (*Acer rubrum*) and/or black cherry (*Prunus serotina*) are usually the canopy dominants, occasionally with one or both of these species having high relative cover (>50%). Numerous associate species can be present, including American beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), cucumber-tree (*Magnolia acuminata*), sweet birch (*Betula lenta*), sugar maple (*Acer saccharum*), and hickories (*Carya glabra*, *Carya ovata*).

Allegheny Hardwood Forest

15. Sugar maple (*Acer saccharum*) is usually dominant (typically 50–75% relative cover), covering at least 25% relative cover of the canopy and subcanopy combined. Common canopy associates include: red maple (*Acer rubrum*), black cherry (*Prunus serotina*), American beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), American basswood (*Tilia americana*), sweet birch (*Betula lenta*), and yellow birch (*Betula alleghaniensis*).

Northern Hardwood Forest

Appendix E. Accuracy assessment data form.

Accuracy Assessment Form for USGS-NPS Vegetation Mapping Program

Plot Number: _____ Park: _____ Date: _____ Observers: _____
Easting: _____ E Northing: _____ N EPE/APE: _____ DOP: _____ Map datum: _____ Zone: _____
Topographic Description: _____ Elevation: _____ Aspect: _____ Canopy Closure: _____
Vegetation Association at Point: _____
Veg Assoc 1 w/in 50 m of point: _____
Veg Assoc 2 w/in 50 m of point: _____
Major Species by Strata: _____

Rationale for Classification: _____

Comments: _____

Accuracy Assessment Form for USGS-NPS Vegetation Mapping Program

Plot Number: _____ Park: _____ Date: _____ Observers: _____
Easting: _____ E Northing: _____ N EPE/APE: _____ DOP: _____ Map datum: _____ Zone: _____
Topographic Description: _____ Elevation: _____ Aspect: _____ Canopy Closure: _____
Vegetation Association at Point: _____
Veg Assoc 1 w/in 50 m of point: _____
Veg Assoc 2 w/in 50 m of point: _____
Major Species by Strata: _____

Rationale for Classification: _____

Comments: _____

Appendix F. Index of representative photographs of vegetation classification sampling plots in Allegheny Portage Railroad National Historic Site.

Index of Photographs
By Vegetation Association

	Page
Dry Eastern Hemlock - Oak Forest	
Figure 8. ALPO.26	30
Figure 9. ALPO.35	30
Eastern Hemlock - Northern Hardwood Forest	
Figure 10. ALPO.20	34
Figure 11. ALPO.47	35
Eastern Hemlock - Tuliptree - Birch Forest	
Figure 12. ALPO.28	40
Northern Red Oak - Mixed Hardwood Forest	
Figure 13. ALPO.10	45
Figure 14. ALPO.75	46
Allegheny Hardwood Forest	
Figure 15. ALPO.25	51
Figure 16. ALPO.53	52
Northern Hardwood Forest	
Figure 17. ALPO.22	57
Figure 18. ALPO.48	57
Tuliptree - Beech - Maple Forest	
Figure 19. ALPO.38	61
Figure 20. ALPO.49	62
Modified Successional Forest	
Figure 21. ALPO.1	66
Figure 22. ALPO.29	67
Conifer Plantation	
Figure 23. ALPO.65	71
Sugar Maple Floodplain Forest	
Figure 24. ALPO.23	75
Figure 25. ALPO.66	75
Alder Riverine Shrubland	
Figure 26. ALPO.39	78
Reed Canarygrass Riverine Grassland	
Figure 27. ALPO.32	82

Index of Photographs
By Vegetation Association (continued)

	Page
Japanese or Giant Knotweed Herbaceous Vegetation	
Figure 28. ALPO.41	86
Wet Meadow	
Figure 29. ALPO.19	90
Figure 30. ALPO.77	90
Successional Old Field	
Figure 31. ALPO.17	94
Figure 32. ALPO.62	95
Sparsely Vegetated Cliff	
Figure 33. ALPO.24	99

Index of Photographs
By Plot Number

	Page
ALPO.1. Modified Successional Forest (Figure 21)	66
ALPO.10. Northern Red Oak - Mixed Hardwood Forest (Figure 13)	45
ALPO.17. Successional Old Field (Figure 31)	94
ALPO.19. Wet Meadow (Figure 29)	90
ALPO.20. Eastern Hemlock - Northern Hardwood Forest (Figure 10)	34
ALPO.22. Northern Hardwood Forest (Figure 17)	57
ALPO.23. Sugar Maple Floodplain Forest (Figure 24)	75
ALPO.24. Sparsely Vegetated Cliff (Figure 33)	99
ALPO.25. Allegheny Hardwood Forest (Figure 15)	51
ALPO.26. Dry Eastern Hemlock - Oak Forest (Figure 8)	30
ALPO.28. Eastern Hemlock - Tuliptree - Birch Forest (Figure 12)	40
ALPO.29. Modified Successional Forest (Figure 22)	67
ALPO.32. Reed Canarygrass Riverine Grassland (Figure 27)	82
ALPO.35. Dry Eastern Hemlock - Oak Forest (Figure 9)	30
ALPO.38. Tuliptree - Beech - Maple Forest (Figure 19)	61
ALPO.39. Alder Riverine Shrubland (Figure 26)	78
ALPO.41. Japanese or Giant Knotweed Herbaceous Vegetation (Figure 28)	86
ALPO.47. Eastern Hemlock - Northern Hardwood Forest (Figure 11)	35
ALPO.48. Northern Hardwood Forest (Figure 18)	57
ALPO.49. Tuliptree - Beech - Maple Forest (Figure 20)	62
ALPO.53. Allegheny Hardwood Forest (Figure 16)	52
ALPO.62. Successional Old Field (Figure 32)	95
ALPO.65. Conifer Plantation (Figure 23)	71
ALPO.66. Sugar Maple Floodplain Forest (Figure 25)	75
ALPO.75. Northern Red Oak - Mixed Hardwood Forest (Figure 14)	46
ALPO.77. Wet Meadow (Figure 30)	90

Appendix G. Bibliography for global vegetation descriptions from the National Vegetation Classification System.

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