

*CHAPTER 6*  
***BIOLOGICAL RESOURCES***

---

## 6.1 Vegetation

The native biodiversity of a region is greatly influenced by the region's topography, climate and geology. Topography of the Pennypack Creek Watershed changes from gently rolling hills in the Piedmont to the level Coastal Plain with a transition area along the Fall Line. The watershed receives an average of 41 inches of rainfall each year and is rich in water resources. These conditions, combined with fertile soils derived from diverse geologic formations, historically supported forest cover over the entire Pennypack Creek Watershed. These forests were mostly clear-cut for agriculture and fueled early industry in the region. Remnants of second growth, or forests that have regrown since clear cutting, still exist along stream valleys and in the region's parks and open spaces.

Forest cover and vegetation in the Piedmont region (roughly the area north of Frankford Avenue) is characteristic of the Oak–Chestnut forest community-type, typical of forest communities throughout Pennsylvania. Since widespread chestnut blight nearly eradicated the American chestnut in the 1900s, the forest is more accurately known as a Mixed Oak hardwood community. Tree species representative of this community include northern red oak hickories (*Carya* spp.), beech (*Fagus grandifolia*) and tulip tree (*Liriodendron tulipifera*). The shrub layer of these forests contain various species of viburnum (*Viburnum dentatum*, *V. recognitum* and *V. acerifolium*) and spicebush (*Lindera benzoin*). Floodplain and riparian forests in this region are typified by river birch (*Betula nigra*), sycamore (*Platanus occidentalis*) and box elder (*Acer negundo*). Dogwood species (*Cornus* spp.) and spicebush (*Lindera benzoin*) are the dominant shrubs found in the floodplains of the Piedmont.



There are numerous small wetland communities found in the watershed, including skunk cabbage and sedge-rush-grass wetlands. Vegetation found in these communities includes skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), jewelweed (*Impatiens capensis*) and species of alder (*Alnus* spp.), dogwood (*Cornus* spp.) and viburnum (*Viburnum* spp.). Forested wetlands in the watershed are usually associated with riparian or floodplain environments and are discussed above.

In the Coastal Plain, the vegetation along the creek is characterized by tidal freshwater marsh. Flora includes spatterdock (*Nuphar lutea*) and, to a lesser extent, rice cutgrass (*Leersia oryzoides*), rose mallow (*Hibiscus moscheutos*) and multiflowered mud plantain (*Heteranthera multiflora*). The Coastal Plain supports species more typical of habitats south and east of Pennsylvania. Many of these species have been extirpated (no longer present in the state) due to loss of habitat elsewhere in the state. Since little natural Coastal Plain vegetation is still present in Pennsylvania, remaining communities, such as the tidal marsh at the mouth of Pennypack Creek, are important to preserve and restore.

In 1998, Fairmount Park Commission's Environment, Stewardship and Education Division (ESED), formerly the Natural Land Restoration and Environmental Education Program, constructed a large, restored intertidal marsh wetland at the mouth of the Pennypack Creek. The Pennypack Park Master Plan recommends monitoring of this wetland to control non-native

invasive plant species and to install additional plantings to assist native vegetation establishment. There is also a small old field wetland and tidal mud flat present in the southwest corner of Pennypack Park, which represents a remnant of native tidal wetland communities that were historically present along the Delaware River. These small wetlands are important refugia for plant and animal species found nowhere else in the state except within tidal wetlands along the Delaware River.

Native vegetation in the Pennypack Creek Watershed has been severely impacted by a large population of white-tailed deer (*Odocoileus virginianus*), habitat destruction, disturbance, and competition from non-native invasive plant species. Deer browse and the presence of invasive plant species combine to cause the greatest threats to native floral biodiversity. Large populations of deer in the natural areas of the Pennypack Creek Watershed preferentially browse on native vegetation. This results in forests devoid of understory vegetation where the deer can reach and eat the herbaceous plants, shrubs, and tree saplings. Deer over-browsing saplings interrupts the process of forest succession. Thus, aging and dying trees are not being replaced. An absence of a shrub layer presents serious implications for birds and small animals that breed and forage in the forest understory.



Japanese Knotweed, an aggressive invader of riparian lands

Removal of the forest understory creates opportunities for colonization by invasive non-native plants. Non-native plants threatening biodiversity in the Pennypack Creek Watershed include Japanese knotweed (*Polygonum cuspidatum*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), mile-a-minute vine (*Polygonum perfoliatum*), porcelainberry (*Ampelopsis brevipedunculata*), Japanese stiltgrass (*Microstegium vimineum*), garlic mustard (*Alliaria petiolata*) and Norway maple (*Acer platanoides*) among many others.

The Fairmount Parks ESED, Friends of Pennypack Park and the Pennypack Ecological Restoration Trust all utilize volunteers and land management techniques to control invasive plant species on their properties. These efforts are critical to preserving native plant biodiversity in the Pennypack Creek Watershed.

## 6.2 Wildlife

### Terrestrial

A long history of intensive land uses and disturbances has severely reduced the native terrestrial faunal biodiversity in the watershed since pre-colonial times. Habitat loss and fragmentation present the greatest difficulty in protecting existing populations and restoring historical wildlife species. Human population density in the watershed has created an environment that will require dedicated management to sustain healthy natural ecosystems. There are still large natural areas found in the watershed and these lands offer an opportunity to preserve and protect sustainable native wildlife populations. The large contiguous natural areas, found in Pennypack Park, Lorimer Park, and the Pennypack Preserve, provide a glimpse of the biological communities that once existed in the watershed.



Photo: F. X. Browne, Inc.

Faunal lists of birds, mammals and reptiles found in the watershed are included in Appendix B of this report. Faunal lists were compiled from information from the Fairmount Park Master Plan and Pennypack Ecological Restoration Trust. Pennypack Park and the Pennypack Preserve contain a diversity of habitats from wetlands to forests to managed meadows. Faunal observations from these locations probably capture the breadth of biodiversity in the watershed.

### DEER

Populations of white-tailed deer (*Odocoileus virginianus*) have grown dramatically in the Pennypack Creek Watershed over the last thirty years. Absences of natural predators and increases in edge habitat have allowed deer populations to grow beyond the capacity of the few remaining natural areas to sustain them. Deer browse on herbaceous ground cover, shrubs, and sapling trees, as well as acorns and other seeds. The result of browsing by a high density deer population has been the interruption of the natural life cycle of forest regeneration.

Deer preferentially feed on native vegetation and open forest habitat to invasive plants. As the forest understory disappears, small birds and animals that rely on this vegetation for cover and food can no longer live or reproduce in these forests.

Controlling the deer population in the Pennypack Creek Watershed is critical to ensuring the sustainability of the watershed's few remaining forests and intact ecosystems. Various efforts to control deer have been attempted throughout the region, ranging from managed hunts to using exclusionary fencing around large plots of land in order to promote forest regeneration.

Controlled hunts of deer in Pennypack and Lorimer Parks in 2001, 2002 and 2003 reduced deer herds in those parks and, according to Montgomery County Office of Communications, have had a beneficial impact on regeneration of vegetation in Lorimer Park. These hunts, carried out by sharpshooters in Pennypack Park and archers in Lorimer Park with special permits, were controversial and elicited protests from animal rights groups and community activists.

Other attempts to promote vegetative growth in the parks include building deer exclusion fences around restoration plantings, using tree shelters for smaller plantings, and planting trees that are taller than the deer browse line. All of these options add cost to restoration projects, reducing the amount of vegetation that can be planted. With the exception of exclusionary fencing, these other methods do little to protect the forest understory and herbaceous layer from deer browse. The Pennypack Park Master Plan indicated that controlling deer browse is critical to successful restoration of natural lands in Pennypack Park and the whole Pennypack Creek Watershed.

### Aquatic

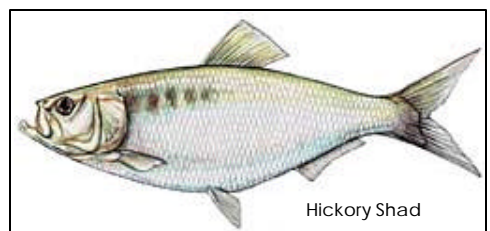
Aquatic fauna in the Pennypack Creek Watershed has been extensively studied by the Philadelphia Water Department and PA DEP as part of their habitat and water quality studies. Fish and aquatic macroinvertebrate studies indicate the aquatic communities in the Pennypack Creek are typical of disturbed habitats and are dominated by pollution tolerant, generalist feeders.

### FISH

Fish assessments, conducted by the Philadelphia Water Department throughout the Pennypack Creek Watershed in 2002-2003, collected a total of 16,869 individual fish of 39 different species. Of these 39 species, seven species accounted for over 80% of the total number of individuals collected. This skewed community composition is typical of impaired water bodies. Studies did, however, document a number of sport fish (small and large mouth bass (*Micropterus dolomieu* and *salmoides*), striped bass (*Morone saxatilis*), rainbow and brown trout (*Oncorhynchus mykiss* and *Salmo trutta*), and an American shad (*Alosa sapidissima*) which are often sought by recreational anglers. The small number of these sport fish collected suggests that stream habitat and/or water quality must be improved in order to enhance the fishery.

Studies showed that aquatic biodiversity decreases in an upstream direction and seems to indicate a high level of disturbance which increases as one travels up the stream. Trout stocked by PA Fish and Boat Commission in the Pennypack Creek accounted for half of the pollution intolerant species collected. Collection of stocked trout in August and September of 2002, as well as anecdotal reports from Southeastern Montgomery County Chapter of Trout Unlimited, seem to indicate that some stocked trout individuals survive the summer months.

The PA Fish and Boat Commission is currently working with Southeastern Montgomery County Chapter of Trout Unlimited, Philadelphia Water Department and Fairmount Park Commission to improve fish habitat in the Pennypack Creek. These organizations and other partners are working to remove obstructions to fish passage on the stream in order to allow migratory fish access to the Pennypack



Creek Watershed. The PA Fish and Boat Commission released Hickory Shad (*Alosa mediocris*) fry to restore breeding populations of this endangered anadromous fish to the Pennypack Creek. Over 665,000 fry were stocked in 2004 and an additional eight million fry were stocked in 2005. This effort is an extension of the Fish and Boat Commission's efforts to bring breeding populations of American Shad (*Alosa sapidissima*) back to its historic range in Pennsylvania's rivers.

A complete list of fish species collected by the Philadelphia Water Department during the 2002-2003 monitoring season is included in Appendix C of this report.

### **AQUATIC MACROINVERTEBRATES**

Aquatic macroinvertebrates, literally aquatic organisms that are large enough to see with the unaided eye and lack a backbone, are used by scientists as an indicator of water and habitat quality. Macroinvertebrate diversity and the presence of a variety of pollution sensitive species, particularly *Plecoptera*, *Ephemeroptera*, and certain *Trichoptera* taxa, indicate the biologic health of a stream system and can offer clues to both water quality and stream habitat values. Many of these organisms are insects whose larvae spend a portion of their life cycle in the water. Other important groups include taxa of aquatic insects, worms, and crustaceans.

Macroinvertebrates are generally less mobile than fish and therefore tend to be good indicators of localized water and habitat quality conditions. Macroinvertebrates are used extensively as indicators of stream quality in urban watersheds.

Macroinvertebrate surveys conducted by the Philadelphia Water Department and historical surveys conducted by the Pennsylvania Department of Health indicate that the Pennypack Creek has experienced impaired stream conditions since at least the late 1960s (dates of earliest survey records). Historic records indicate, and recent studies reaffirm, that the Pennypack Creek supports a macroinvertebrate community that is typical of impaired streams. This community consists of relatively small number of taxa of generalist feeders that are moderately pollution tolerant. Recent records reveal very few pollution sensitive taxa overall. When present, pollution sensitive *Ephemeroptera*, *Plecoptera*, and *Trichoptera* taxa occurred in very low densities.

Appendix D of this report includes the list of macroinvertebrate taxa collected by the Philadelphia Water Department in 2002-2003.

## 6.3 PNHP Species

### Pennsylvania Natural Heritage Program (formally Natural Diversity Inventory)

The Pennsylvania Natural Heritage Program (PNHP) is a cooperative project between the PADCNR Bureau of Forestry, the Western Pennsylvania Conservancy, and The Nature Conservancy. The purpose of the PNHP is to “identify and describe the Commonwealth’s rarest and most significant ecological features. These features include plant and animal species of special concern, rare and exemplary natural communities, and outstanding geologic features” (PA DCNR). Table 6.1 lists the PNHP species and communities found within the Pennypack Creek Watershed.



In Pennsylvania, protection of plant and animal life falls under the jurisdiction of three agencies. PADCNR Bureau of Forestry is responsible for protecting plant life. The PA Fish and Boat Commission has jurisdiction over fish, reptiles and amphibians and the PA Game Commission has jurisdiction over bird and mammal species.

Table 6.1 PNHP Species in the Pennypack Creek Watershed						
Species Name	Common Name	State Rank	Status	Proposed Status		
Plants						
<i>Alasmidonta varicosa</i>	brook floater	S2		PE	Source: PA DCNR	
<i>Amelanchier canadensis</i>	serviceberry	S?	N			
<i>Andropogon gyrans</i>	elliott's beardgrass	S3	N	PR		
<i>Baccharis halimifolia</i>	eastern baccharis	S3	PR	PR		
<i>Bartonia paniculata</i>	screw-stem	S3	N	TU		
<i>Cuscuta pentagonia</i>	dodder	S2	N	TU		
<i>Eupatorium rotundifolium</i>	eupatorium	S3	TU			
<i>Glyceria obtusa</i>	blunt manna-grass	S1	PE	PE		
<i>Juncus filliformis</i>	thread rush	S3	PR	PR		
<i>Magnolia virginiana</i>	sweet bay magnolia	S2	PT	PT		
<i>Panicum lucidum</i>	shining panic-grass	S1	TU	PE		
<i>Polygala cruciata</i>	cross-leaved milkwort	S1	PE	PE		
<i>Woodwardia areolata</i>	netted chainfern	S2	N	PT		
Fish						
<i>Gasterosteus aculeatus</i>	threespine stickleback	SA?	PE	PE		

Table 6.2 serves as the key to the state status ranking system. This ranking system describes the status of threatened and endangered species found in the Pennypack Creek Watershed. There are two Pennsylvania Endangered plants and one Pennsylvania Endangered fish historically found in the Pennypack Creek Watershed. It is important to note that of the fourteen species on the PNHP list, only Dodder (*Cuscuta pentagonia*) and Eupatorium (*Eupatorium rotundifolium*) were identified in recent species lists from the ESED Pennypack Park Master Plan and Philadelphia Water Department fish surveys of the creek. Species lists from the Pennypack Preserve indicate occurrences of sweet bay magnolia (*Magnolia virginiana*) and serviceberry (*Amelanchier canadensis*). This does not mean that these species are not present in other natural areas of the watershed or that other fish species do not inhabit the Pennypack Creek.

The ESED Pennypack Park Master Plan mentions the potential to restore populations of the Threespine Stickleback (*Gasterosteus aculeatus*), a Pennsylvania endangered fish, to tidal ponds in the lower portion of the watershed.

Table 6.2 Key to Global and State Ranking System				
State Element Ranking	Implication	State Status	Implication	
S1	Critically Imperiled in the State (<5 Occurrences)	PE	PA Endangered	Source :PA DCNR
S2	Imperiled In The State (6-20 Occurrences)	PR	PA Rare	
S3	Rare Or Uncommon in the State (21-100 Occurrences)	PT	PA Threatened	
S4	Apparently Secure in the State	PX	PA Extirpated	
S5	Demonstrably Secure in the State	CA	Candidate at Risk	
A	Accidental in the State	N	No Current Legal Status	
B	Breeding Population in the State	TU	Tentatively Undetermined	
N	Non-Breeding Population			
X	Believed to be Extirpated from State			
?	Uncertain Status			

## 6.4 Important Habitats

Pennypack Park, Lorimer Park, and the Pennypack Preserve contain the largest contiguous tracts of land and diversity of habitats in the watershed. These parks and natural lands contain important tracts of forests, wetlands and meadows that provide habitat for various animal and plant species.

There are other smaller natural areas in the watershed that potentially harbor important populations of native plants and animal species. Linking these natural areas with major green corridors will increase the value of these smaller natural areas in terms of their ability to sustain diverse plant and wildlife populations.

### Forests

Pennypack and Lorimer Parks and the Pennypack Preserve all contain significant acres of second growth forest. Since the watershed was largely clearcut for agriculture since early European settlement, existing forests are considered “second growth” because they have regrown since clearcutting. However, there are several small areas of old forest, primarily found on the steep slopes and riparian zones along the Pennypack Creek.

Remaining forest communities are experiencing significant threats from deer browsing and the presence of non-native invasive plant species that have severely restricted the understory habitats in the watershed’s forests. These understory habitats are critical for small birds and animals that nest, forage, and hunt in this level of the forest vegetation. Pressure on the understory level of these forests is also interrupting the replacement and recruitment of canopy trees in the forests. Since sapling trees are being eaten or displaced from their natural habitat by invasive species, the trees in the existing forests are aging, dying and not being replaced.

The remaining forests in the watershed will require extensive management in order to ensure their long term viability and survival. Important management considerations include managing the deer population throughout the watershed, excluding deer and invasive plant species from restoration sites and existing critical natural areas and creating sustainable habitat structure in the watershed’s forests so that they can host the diversity of wildlife historically found in the region’s forests. Some of these management options are controversial and all will require great cooperation and effort from all of the watershed stakeholders in order to be successful.

### Wetlands

There are many small wetlands still found in the Pennypack Creek Watershed. Most of these wetlands are associated with the stream system and its floodplains. These small wetlands are a result of a high water table or water from the creek overtopping its banks and pooling in depressions. These riparian wetlands are threatened by the severe hydrologic fluctuations caused by the urban and suburban development of the watershed and its attendant increases in stormwater flows. In many places, streambed erosion and downcutting has resulted in a stream that is disconnected from its floodplain, and as a result, many riparian wetlands no longer receive the flow required to sustain wetland hydrology. Wetlands in the watershed are also under pressure from non-native invasive species, especially in riparian zones, where disturbance from high velocity stormflows opens habitat to colonization from invasive species.

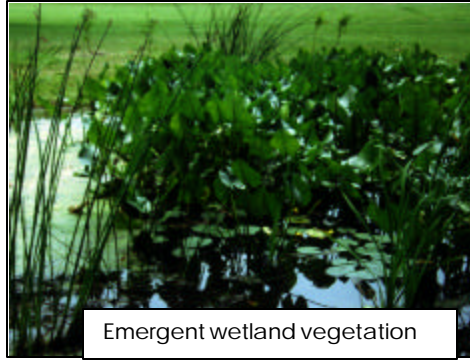


Photo: F. X. Browne, Inc.

Pennypack Park contains some regionally significant wetlands because of its location and tidal characteristics. The park contains the portion of the watershed that is located in the Atlantic Coastal Plain Ecoregion and also the tidal portion of the Pennypack Creek. These two factors make the lower Pennypack Creek Watershed home to biological communities that have been disappearing from Pennsylvania since the time of the earliest settlements.

Historically, wetlands in the Coastal Plain have been filled and paved over to facilitate development of the city of Philadelphia and the Delaware riverfront. As previously discussed, the Coastal Plain regions of the Pennypack Creek Watershed support biological communities that are typically found to the south and east of Pennsylvania. Species found in these communities are at the edges of their geographical distribution and typically found nowhere else in the state. The tidal freshwater marshes and Coastal Plain wetlands in Pennypack Park are important reserves of these disappearing habitats.

Currently there are two large restored tidal wetlands at the mouth of the Pennypack Creek located within the park and one small wetland along the Delaware River downstream of the mouth of the Pennypack, also located in the park. These restorations have improved rare coastal habitats in Pennsylvania and provide an opportunity to reintroduce native flora and fauna that have been extirpated from the watershed.

The Philadelphia Water Department is performing a comprehensive wetland assessment of the Philadelphia watersheds including the Pennypack Creek. The purpose of this assessment is to identify the size, quality and location of wetlands in the city's watersheds, including portions of those watersheds outside of the city. The assessment will ultimately identify potential wetland restoration sites that can be utilized to provide water quality improvements for stormwater or combined sewer overflow effluents.

Field studies on the Pennypack Creek Watershed were completed in late 2004. Wetlands were identified using U.S. Army Corps of Engineers *Wetland Delineation Manual*. Wetlands were identified as jurisdictional wetlands but boundaries were not delineated. Currently the project consultants are compiling field data and identifying and prioritizing potential wetland restoration projects.

Results of the wetlands assessment for the Pennypack Creek Watershed are expected in 2005. Results of this report will be included in this plan if they are available before the Draft of this plan is completed.

## Meadows

Meadow, grassland and successional habitats are fairly uncommon in the Pennypack Creek Watershed. Upland meadows are particularly susceptible to invasive species that can tolerate a wide range of habitat conditions and sunlight. In Pennypack Park, meadows are often preferred spots for illegal dumping and vandalism. Meadows left in their natural state succeed to woodlands over time unless they are managed to remain meadows through burning or periodic mowing.



Photo: Joanne Dahme

Meadows provide habitat for a number of species that have been in decline in Pennsylvania since agricultural fields and hedgerows have been converted to urban and suburban land uses. Many species of invertebrates, grassland nesting birds and plant species are found only in large tracts of native grasslands.

There are a number of meadows found in Pennypack and Lorimer Parks but the highest quality native grassland meadows can be found on the Pennypack Preserve. The Pennypack Ecological Restoration Trust has been restoring native warm season grass meadows on their property for over five years and has created over 100 acres of native warm season grass meadows that are managed to provide habitat for grassland species, especially nesting birds.

The ESED Pennypack Park Master Plan also identifies the need to restore and manage grasslands in the park to improve habitat diversity.

In addition, there are many opportunities in the watershed, outside of the parks, to support the creation of grassland habitats and to encourage their use by grassland nesting birds. Large open areas, such as corporate office park fields, can be managed as meadows by reducing mowing to one time per year. Mowing can be scheduled for late summer to avoid grassland nesting bird breeding season. These management measures would save property owners mowing and management costs while improving habitat. Tall grass meadows also reduce stormwater run-off from a site and the taller vegetation can improve stormwater quality.

## 6.5 NATURAL AREAS INVENTORY

County Natural Areas Inventories are surveys of rare, threatened and endangered species and locations of high quality natural areas found within Pennsylvania's counties. Natural Areas Inventories identify important resources and offer management recommendations to protect these sites and biological communities. The inventories can serve as guides to identify sites that are important to preserve and protect in their natural state. Bucks and Montgomery Counties have conducted Natural Areas Inventories in 1999 and 1997 respectively. Philadelphia does not have a Natural Areas Inventory, however the ESED Parks Master Plans (1999) have identified important natural areas, as well as rare, threatened, and endangered species found within the Fairmount Park System and can serve as an inventory of natural areas for Philadelphia.

Rare species found in the park and identified in the Pennypack Creek Park Master Plan include Dodder (*Cuscuta campestris*) and Eupatorium (*Eupatorium rotundifolium*). The tidal wetlands at the mouth of the Pennypack Creek and the old field meadow on the west bank of the creek between Verree and Krewstown roads are examples of important habitats in the park. The ESED Pennypack Park Master Plan provides detailed species and habitat descriptions in their report.

The Natural Areas Inventory of Montgomery County indicates that there are three sites of statewide significance and two locally significant natural area sites found within the Pennypack Creek Watershed in the county. There are no Natural Area Inventory sites in the Pennypack Creek Watershed located in Bucks County. The Montgomery County sites are listed below in order of their significance:

### Sites of statewide significance

#### **HIGH PRIORITY PROTECTION FOR MONTGOMERY COUNTY**

##### Frazier's Bog, Upper Moreland Township

A small remnant of this wetland community persists. The site is significant due to the presence of three plants of special concern including a PA threatened shrub. Much of the bog was lost to the development of an adjacent golf course. The remaining habitat would benefit from preservation and invasive species control.

#### **GENERAL PRIORITY PROTECTION FOR MONTGOMERY COUNTY**

##### Willow Grove Station, Horsham Township

This site consists of a grass species of special concern on the grounds of the Willow Grove Naval Air Station. The Natural Area Inventory recommends management of the habitat to preserve this species of grass.

##### Willow Grove Roadside

This site contains a small population of a rare plant near the Willow Grove Turnpike exchange. The Natural Area Inventory did not recommend protection of this site.

Sites of local significance:

**HIGH PRIORITY FOR LOCAL PROTECTION FOLLOWING PRESERVATION OF SITES OF STATEWIDE SIGNIFICANCE**

Bethayres Swamp, Lower Moreland Township

This wetland consists of a grass, rush and sedge marsh, shrub swamp community and a small area of forested lowlands. The Natural Area Inventory identifies this site as good bird habitat in the developed region of Montgomery County.

**LOW PRIORITY FOR LOCAL PROTECTION FOLLOWING PRESERVATION OF SITES OF STATEWIDE SIGNIFICANCE**

Big Oak Woods, Abington Township

This location is currently protected within Lorimer Park but would benefit from management to prevent the encroachment of invasive plant species. The site exhibits good oak forest community structure including understory shrub vegetation.

Native biological communities are under great pressure in the Pennypack Creek Watershed. Preservation and management of prioritized natural areas and habitats are obvious starting points to maintain watershed biodiversity.