

Collecting and mapping data

Geographic Information System (GIS) and Global Positioning System (GPS) technologies were utilized to determine and record the location of selected features. The information collection via GPS was conducted and completed July-August 2004.

Geographical Information System (GIS)

Arc View GIS is computer software developed by ESRI (Environmental Systems Research Institute). It allows a user to develop, view, query, analyze, edit, and print maps. GIS is an extremely useful tool for identifying environmental resources, and provides an overview by locating different components, such as land-use types, natural areas, stream corridors, roadways, trails, municipal boundaries, and more.

Global Positioning System (GPS)

GPS was originally developed by the Department of Defense (DoD) to meet military requirements. It is a 24-satellite constellation that can determine a location in three dimensions – latitude, longitude, and altitude – by measuring the distance from the GPS user to four GPS satellites as they orbit overhead. This system is the most accurate way to map the location of property boundaries, trails, structures, roads, sensitive natural areas, etc.

Education

Educational Survey

In early May 2005, Wildlands Conservancy mailed a survey to 215 educational institutions. By the end of May, seven surveys were returned due to incorrect address, and 12 schools responded. The 5.8% return exceeded the goal of +/-5%. The respondents represent a cross-section of elementary, middle, and high schools as well as public and private schools in the Lehigh Valley.

The survey focused on utilizing the South Mountain Preserve as an outdoor classroom. The results, as shown below with the tabulated results and with the important information highlighted, clearly indicate an interest in fulfilling Pennsylvania Academic Standards by working with a Wildlands Conservancy naturalist/educator and using the Preserve. The top three topics of interest are, in order of preference, 1) renewable and non-renewable resources, 2) humans and the environment, and 3) earth science. The survey results also show a great interest in a child-oriented ecology walk and a nature walk with a naturalist/educator.

The responses to Question 6 (*Which of the following amenities would you need in order to bring students to the Preserve?*) points out the need for the following, in order of priority, 1) toilet facilities, 2) pavilion, trash receptacles, water fountain (3-way tie), and 3) trail maps.

South Mountain Preserve
Survey
 [5-04-05]

Wildlands Conservancy, a non-profit, member-supported organization whose mission is to preserve, protect, and enhance the land, water, ecological, and recreational resources of the Lehigh Valley and Lehigh River watershed, is conducting an environmental-resource study of our own South Mountain Preserve with funding assistance from the Pennsylvania Department of Conservation and Natural Resources (DCNR). The South Mountain Preserve, a geological wonder, encompasses 300 acres of second-growth forest located in the Borough of Emmaus, Salisbury Township, and Upper Saucon Township, and is part of the larger Robert Rodale Reserve. The Preserve is home to several rare or threatened plant species, is prime breeding habitat for amphibians, and is nesting habitat for more than 59 species of birds. In addition, the property is a significant passive and active recreational area, and contains an abundance of biking and hiking trails. The resulting stewardship plans, complete with recommendations, will pave the way for future enhancements, improvements, and environmental, educational, and recreational opportunities.

Your opinion counts! In order to increase and improve the educational opportunities on South Mountain, we need your input. Please fill out all of the following, and mail the completed survey by **Thursday, 5-12-05** to Wildlands Conservancy, 3701 Orchid Pl., Emmaus, PA 18049. Attention: Debra Lermite. ***Thanks!***

Name and Title _____ Date _____

Name and address of Institution _____

1. In the past, have you ever used the South Mountain Preserve as an outdoor classroom? Yes – **3**
 No – **9** If yes, how did you use it? Comments: Awareness of natural resources and study of nature; seeing plant and wildlife in our area; as a field trip
2. In the future, would you like to see the South Mountain Preserve available as an outdoor classroom? (See list below.) Yes – **12** No – **0**
3. Would you like to work with Wildlands Conservancy naturalist/educator of the subjects below? (Check all that apply.)

Pennsylvania Academic Standards for:

Environment and Ecology

- Watersheds and wetlands **7**
- Renewable and non-renewable resources **8**
- Environmental health **7**
- Ecosystems and their interactions **9**
- Humans and the environment **11**

(turn page over)

Geography

- Physical characteristics of places and regions **3**
- Interactions between people and places **3**

History

- Pennsylvania history 2
- Science and Technology*
- Earth sciences 6

4. What are the top three subjects you would like to be covered?

- 1) **Renewable and non-renewable resources**
- 2) **Humans and the environment**
- 3) **Earth sciences**

5. Would you participate in any of the following if they were organized and available at the South Mountain Preserve? (Check all that apply.)

Child-oriented ecology walk	9
Sensory walk for the sight-impaired and/or physically challenged	0
Nature walk with an naturalist/educator	10
Other	2

6. Which of the following amenities would you need in order to bring students to the Preserve?

Classroom building	5	Trail maps	6
Interpretative signage	1	Trash receptacles	7
Off-street parking	3	Water fountain	7
Pavilion	7	Water spigot	3
Restroom/porta potty	10	Other: transportation assistance	

Current Educational Activities

Wildlands Conservancy, Lehigh Valley Audubon Society, and many others, including untold numbers of Scout groups, have used this site for years for their programming.

The East Penn School District developed the following Emmaus High School Curriculum, according to Pennsylvania Educational Curriculum Standards, which will be linked to the Conservancy’s South Mountain Preserve:

Courses: Biology I -Ecology Unit and Environmental Science

Linked to Assessment Anchors and State Standards

S11.A.1 - Describe and interpret patterns of change in natural and man-made systems – (Referenced to Standards 3.1.10.C, 3.1.10E, 4.8.10.A)

- Signs - brief history of how the land was used; uses of land in the Lehigh Valley
- Content - changes over time, succession, impact of humans on the environment

S11.B.1 - Explain structure and function at multiple levels of organization
Referenced Standards-3.310.A, 3.310.B, 4.6.10A, 4.7.10B

- Signs - structure of the canopy, undergrowth, with names and example of the organisms that interact there because of their structure, including specific examples of organisms; use of the different habitats on South Mountain
- Content - form and function, habitat specific, appearance at different times of the year

S11.B.3.1 - Use evidence or examples to explain characteristics of and interactions within and ecosystem. Referenced Standards-4.3.10C, 4.6.10A

- Signs - example of a food chain and web; diversity within this forest and the ponds
- Content - food chain, food web, diversity, abiotic factors, limiting factors, interaction

S11.B.3.2 - Analyze patterns of change in natural or human-made systems
Referenced Standards - 3.1.10.C, 4.2.10.D, 4.3.10B, 3.1.10E, 4.3.10C

- Signs - natural events that altered the environment; how cyclic patterns occur
- Content - plant succession, importance of diversity in an ecosystem, population dynamics

S11.B.3.3 - Explain how human-made systems impact the management and distribution of natural resources. Referenced Standards- 4.2.10C, 4.4.10.C, 3.8.10C

S11.D.1.2 - Analyze how man-made systems impact management and distribution of natural resources. Referenced Standards- 4.2.10.C, 3.5.10.B, 3.6.10.A

- Signs - effect of iron mining, the use of the sand for I-78, location relative human population
- Content - impact of use of natural resources

S11.C.2.2 - Demonstrate that different ways of obtaining, transforming, and distributing energy have different consequences. Referenced Standards- 3.4.10B, 4.8.10C, 4.2.10A

- Signs- areas used for mining, the length of time, impact; effect of logging
- Content- human use of natural resources and impact on the environment

Courses: Integrated Science, Geology

Linked to Assessment Anchors and State Standards

S11.A.3.3 - Compare and analyze repeated processes or recurring elements in a pattern. Referenced Standards 3.1.10 C, 3.2.10B.

S11.D.1 - Explain and analyze the forces in the lithosphere that continually shape Earth. Referenced Standards- 3.5.10A, 4.4.10.B, 4.1.10.B

- Signs - layers of rock, major types of rocks, formation of South Mountain
- Content - types of rocks, plate tectonics, geological history of PA

S11.D.1.3 - Explain the significance and contribution of water as a resource to living things and the shaping of the land. Referenced Standards- 3.5.10.D, 4.1.10.B, 4.3.10B

- Signs - pathways of water on the mountain; changes in the land because of water; specific organisms water requirement
- Content - erosion, sedimentation, conservation, organisms' water requirements

Recreation

Recreation has a personal value and incorporates a unique combination of social, physical, biological, and managerial characteristics for each individual. Preferences range from loosely structured activities to modern and intricately designed, large-group activities, and occur individually, with pairs, or small and large groups. According to the Pennsylvania Department of Conservation and Natural Resources (DCNR), the state agency leading efforts for outdoor-recreational planning in Pennsylvania, Pennsylvanians largely recreate individually or in small groups (DCNR, 2004).

Pennsylvania's state parks are operated and managed by DCNR. Table 14 lists such state parks in eastern and southeastern Pennsylvania. Several of the top twelve parks frequented by the recreational uses survey participants are state parks.

Table 14 DCNR State Parks in Eastern and Southeastern Pennsylvania				
State Park	Total Acreage	Water Acreage	County	Recreational Activities
Jacobsburg Environmental Education Center	1,168		Northampton	multi-use trails, wildlife viewing, hunting, fishing, education
Locust Lake	1,089	52	Schuylkill	camping, water activities
Tuscarora	1,618		Schuylkill	picnics, fishing
Beltzville	2,972	949	Carbon	boating, swimming
Lehigh Gorge	4,548	20.9 miles	Luzerne, Carbon	trails, whitewater
Hickory Run	15,500		Carbon	camping, hiking
Neshaminy	330	Delaware River access	Bucks	boating
Nockamixon	5,238	1,450	Bucks	boating
Ralph Stover	45		Bucks	fishing, swimming, whitewater
Tyler	1,711		Bucks	picnicking, disc golf, ice skating
Delaware Canal	60 miles	60 miles	Bucks	hiking, biking, canoeing
Norristown	700		Montgomery	trails, baseball

Farm Park				
Evansburg	3,349		Montgomery	hiking, picnicking, golf
Fort Washington	493		Montgomery	picnicking, fishing, hiking, sledding
Nolde Forest	665		Berks	picnicking, education
French Creek	7,339	90	Berks, Chester	camping, boating, hiking
Marsh Creek	175	535	Chester	hiking, water activities
White Clay Creek	1,255		Chester	historical, trails, fishing
Ridley Creek	2,606		Delaware	picnicking, fishing, gardens
Benjamin Rush			Philadelphia	community gardens

(DCNR, 2004)

Jacobsburg Environmental Education Center, northeast of Bethlehem in Northampton County, is the closest state facility to the South Mountain Preserve. Jacobsburg is a day-use facility with hiking trails and multi-use trails for bicyclists, equestrians, and nature-watching facilities. DCNR allows hunting and fishing on the premises during appropriate seasons. Jacobsburg staff provides environmental education for 9,500 participants annually in school, adult learning, and community education programs.

DCNR recently completed a statewide recreation plan for 2004-2008. Table 15 reflects the change in outdoor participation rates in Pennsylvania in 1990-2003. This information is valuable to document the current activity trends for Pennsylvania's population.

Table 15					
Change in Outdoor Recreation Participation Rates, Pennsylvania 1990 – 2003					
(DCNR 2004)					
Activity	2003 %	Participants (Millions)	1990 %	Participants (Millions)	Change (Millions)
Bird/wildlife watching	26.7	3.1	19.4	2.2	+0.9
Golf	18.0	2.1	14.2	1.6	+0.5
Off-road motor sports	13.0	1.5	9.4	1.0	+0.5
Camping	24.2	2.8	21.3	2.4	+0.4
Boating, canoeing, water-skiing	29.0	3.4	27.1	3.0	+0.3
Football, soccer	12.9	1.5	13.0	1.4	0.0
Ice skating	10.2	1.2	10.4	1.2	0.0
Basketball	19.3	2.2	21.0	2.3	-0.1
Hunting, sport shooting	13.6	1.6	15.0	1.7	-0.1
Horseback riding	6.5	0.8	7.7	0.9	-0.1
Fishing	27.9	3.2	30.3	3.4	-0.1
Tennis	9.3	1.1	11.5	1.3	-0.2
Baseball, softball	14.7	1.7	21.8	2.4	-0.7
Sightseeing/driving for pleasure	52.9	6.1	62.4	6.9	-0.8

Swimming	48.1	5.6	59.2	6.6	-1.0
Bicycling, mountain biking	28.0	3.2	39.4	4.4	-1.1
Picnicking	41.5	4.8	62.3	6.9	-2.1

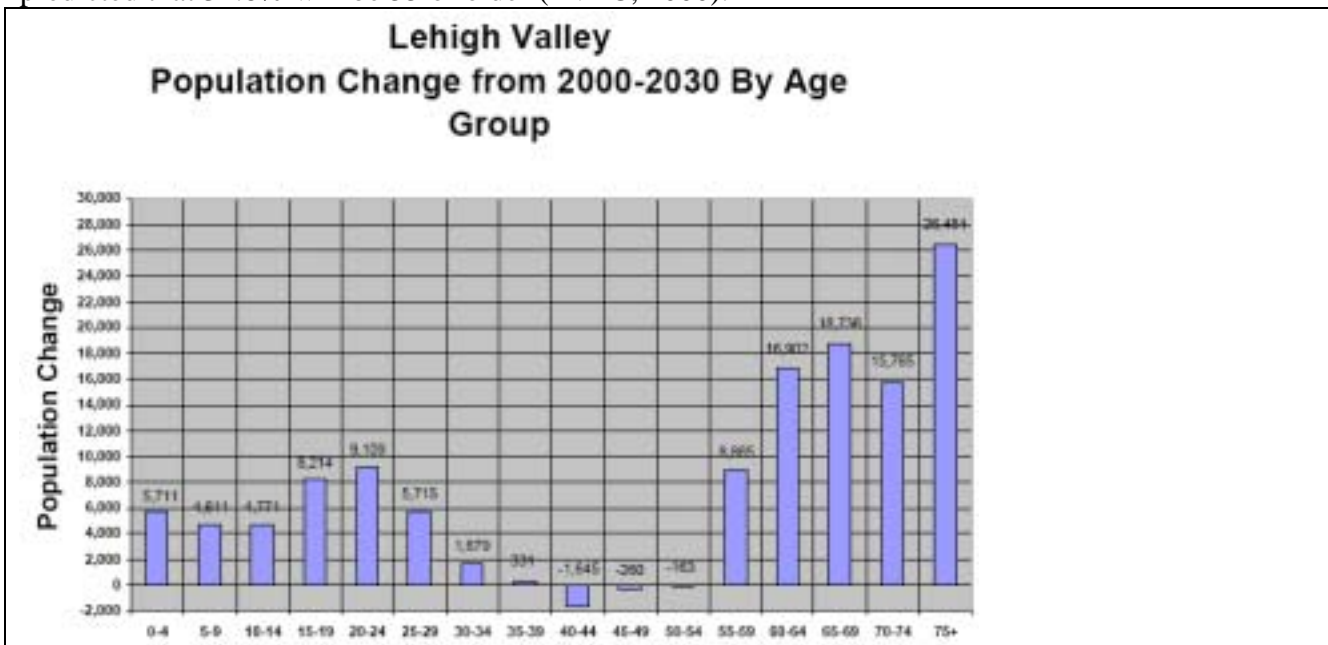
Table 15 indicates that both bicycling and horseback riding have declined in the number of participants since 1990. Bird/wildlife watching has experienced the greatest increase in number of participants since 1990 with nearly one million more participants. Bicycle riding remains a popular activity for children and young adults until age 17, but from age 18 and above, the popularity of bicycling declines. All ages enjoy walking and swimming. The trends indicate a greater interest in lower-impact activities such as walking and wildlife observation rather than more intense or higher-impact activities such as competitive sports or motor sports.

The DCNR Recreation Plan for 2004-2008 also documented that almost half of Pennsylvanians felt that their outdoor recreation activities would increase over the next five years. A quarter felt that their indoor recreation activities would increase during the same period. Younger, better educated, and higher-income people were more likely to anticipate a recreation increase. Facilities managed by local government accounted for the largest portion (43%) of recreation activity. State-run facilities accounted for 20% of recreation activity, federal 10%, and private 28%. People with higher incomes and more education were more likely to use private facilities (DCNR, 2004).

Table 16					
Participation Rates for Ten Most Popular Activities by Age Group, Pennsylvania 2002-2003					
5-12		13-17		18-24	
Swimming	82.5	Swimming	72.5	Walking	62.6
Walking	71.8	Walking	64.2	Swimming	59.3
Sledding	70.0	Jogging	60.7	Jogging	56.6
Bicycling	67.3	Basketball	56.9	Sightseeing	50.1
Picnicking	58.5	Sledding	55.5	Visit Wild Areas	45.4
View Nature	57.9	Bicycling	42.3	View Nature	41.4
Nature Walks	55.0	Fishing	42.3	View Nature	37.0
Fishing	50.6	Sightseeing	39.7	Basketball	36.7
Visit Wild Areas	48.7	Football	38.5	Hiking	34.1
Sightseeing	47.7	Skiing	38.4	Sledding	32.2
				Picnicking	
25-34		35-44		45-54	
Walking	73.1	Walking	74.7	Walking	71.7
Swimming	60.0	Sightseeing	60.8	Sightseeing	56.8
Sightseeing	57.7	Swimming	58.8	View Nature	54.4
View Nature	52.5	View Nature	57.6	Visit Wild Areas	48.8
Visit Wild Areas	49.3	Visit Wild Areas	54.9	Areas	47.0
Areas	42.4	Areas	53.3	Picnicking	46.5
Picnicking	36.9	Picnicking	41.0	Swimming	38.2
Jogging	35.3	Nature Walks	38.2	Nature Walks	33.3

Hiking	35.1	Hiking	34.3	Hiking	26.9
Nature Walks	31.9	Fishing	33.1	Fishing	25.2
Camping		Sledding		Watch Wildlife	
55-64		65-74		75 and over	
Walking	63.4	Walking	58.6	Walking	45.3
Sightseeing	54.6	Sightseeing	50.4	Sightseeing	32.6
View Nature	51.4	View Nature	44.5	View Nature	28.1
Visit Wild	41.7	Picnicking	34.7	Picnicking	21.6
Areas	38.8	Visit Wild	30.1	Swimming	13.6
Picnicking	32.7	Areas	26.6	Visit Wild	12.8
Swimming	26.1	Swimming	24.0	Areas	12.0
Hiking	25.9	Nature Walks	22.4	Nature Walks	8.4
Nature Walks	23.3	Bird	19.2	Golf	8.4
Fishing	22.6	Watching	16.7	Fishing	7.5
Bird Watching		Fishing		Jogging	
		Boating			

In the year 2000, 24.8% of the Lehigh Valley population was 55 or older; in the year 2030 it is predicted that 32.8% will be 55 or older (LVPC, 2000).



Lehigh Valley Population Changes

Northampton, Lehigh, and Berks counties comprise Region 2. Table 17 lists participation rates for the ten most popular activities in this region. Viewing nature and wildlife account for four of the top ten outdoor activities. Notably missing from this list is bicycling which had been an American favorite pastime for many generations.

Wildlife watching as a recreational activity is growing. Survey results estimate that more than 40% of the adult U.S. population participates in wildlife watching activities and the money spent on

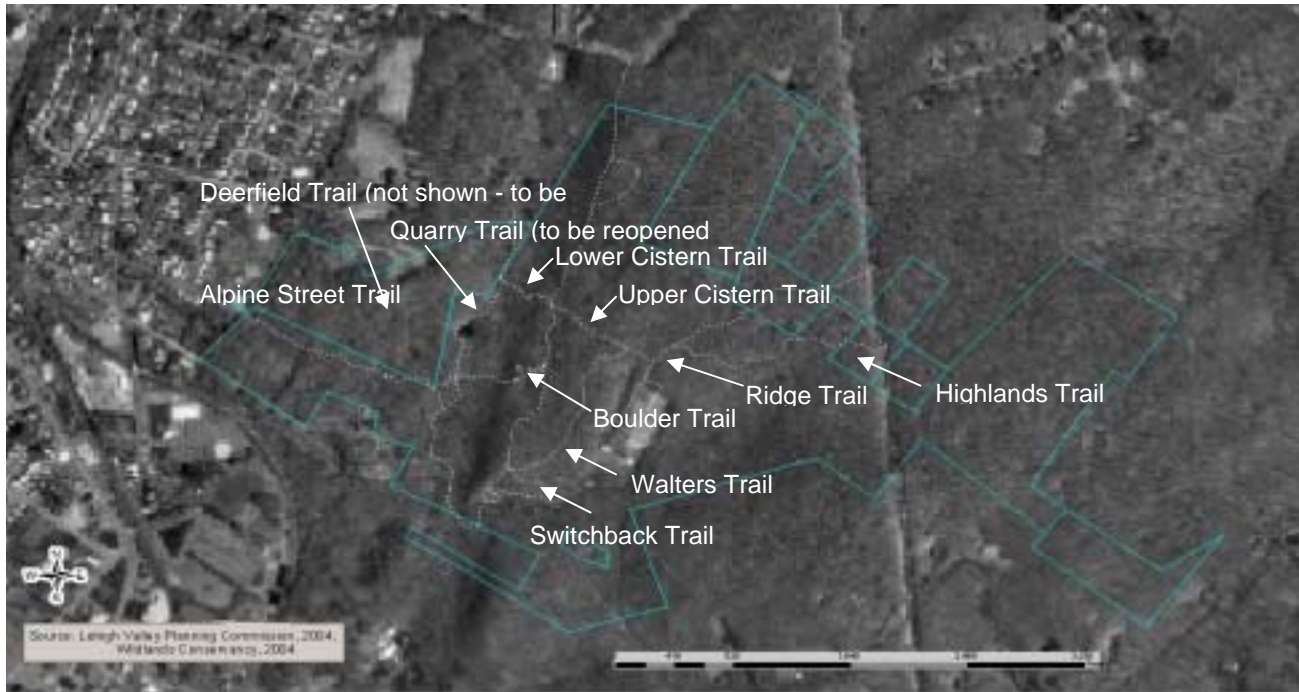
travel, lodging, food and equipment associated with this activity contributes nearly \$20 billion to the national economy (New Jersey Department of Environmental Protection, n.d.).

Table 17 Participation rates for the ten most popular activities for DCNR Planning Region 2	
Walking	65.2
Sightseeing	54.7
Swimming	52.7
View Nature	52.7
Visit Wild Areas	46.0
Picnicking	40.0
Nature Walks	36.4
Hiking	31.8
Fishing	30.2
Jogging	27.2

The South Mountain Preserve is open to the public and used for a variety of recreational activities due to its natural attractiveness and proximity to highly populated residential areas. The most popular recreational activities occurring currently at Preserve include walking/hiking, mountain biking, boulder climbing, and nature observing, including bird watching. These activities are in keeping with the findings of DCNR’s study. Geo-caching, a form of scavenger-hunting, began on the Preserve in 2004.

Existing trails

There are several miles of trails, many of which are old logging and mining roads. As of June 2006, 80% of the Preserve’s trails have been mapped using GPS technology. Other trails developed because of continual use over the years by hikers and mountain bikers. Based on observations of researchers, mountain biking has become the most frequent and extensive use of the trails, especially the last five years. Adults participate almost as often as youths; the youth tend to be in groups of three to five, and adults mostly travel alone or with one companion (Cary, 1998). Ongoing attempts are made to reroute existing trails that leave the Preserve or are inappropriately encroaching on adjacent landowners’ properties to remain entirely and comfortably on Preserve.



At one time, a trail ran north off the main trail from Alpine Street and proceeded through the young successional forest to connect to the Quarry Trail. Over time, this trail has overgrown and is rarely used. It is proposed to call it the Deerfield Trail and reopen it seasonally to allow a lower 1 ½ mile loop connecting to the Alpine Street trailhead and Quarry Trail.

There are areas in the Preserve where new trails have been proposed as seen on Map 4. The Borough of Emmaus has proposed a new trail starting on the south side of the Perkiomen Rail Line by the recycling center leading to the Preserve property along Weiders Lane. The Conservancy is working with Emmaus to help secure the necessary land and construct the trail. Additionally, the Conservancy is considering establishing a new trailhead, trail system and parking area in the old meadow portion of the Preserve between the Alpine St. trailhead and Weiders Lane. Discussion with an adjacent landowner on the northwest side of the Preserve about land preservation and the possible, evidential creation of a trailhead is ongoing. (See Map 4.)

The potential for improving and enhancing existing trails and constructing new trails at the Preserve is evident. Factors for the assessment of potential trails included existence of current trails, sensitive areas, viewsheds, and opportunities for connections and interpretation. Trails can be effective wildlife management tools, and can help avoid the creation and use of renegade trails. Guidelines for trails consider habitat impacts and conservation, wildlife impacts and comfort for all trail users.

The adoption of several principles of habitat conservation help protect undisturbed woodlands and wet areas during trail planning. Conservation includes preserving large areas of undisturbed, contiguous habitat, avoiding small patches of high-quality environment, keeping trail density low near undisturbed areas, and creating a balance of trails across available land. Areas disturbed by invasive plant species, and sites where prior construction has taken place, such as roads, are more favorable trail sites. Trails used to interrupt the growth of invasive species are tools for habitat restoration as well as a mechanism to halt encroachment by invasive species.

Riparian areas along waterways are sensitive zones that provide habitat for high numbers and variety of species, and therefore entrances into riparian areas need to be strategically located, ensuring that both visitors and wildlife have access. Wet areas should remain connected to other natural areas, and sufficient cover provided for wildlife to travel to the wet area (Colorado State Parks, 1998). Planning includes numbers and locations of stream crossings, minimizing numbers of crossings, avoiding stream confluences, and establishing stream buffers.

The edges of ecological areas are subject to influence from surrounding factors. Ecological edges attract generalist species, including invasive plants (e.g., autumn olive and barberry) and animals (e.g., blue jays and raccoons), at the expense of specialist species that require specialized conditions for survival. Degraded areas, which have potential to be restored, are more appropriate for trail construction (Colorado State Parks, 1998).

Possible trail users include walkers, hikers, bicyclists, and nature observers, such as bird watchers. Several trail-design principles adopted from the environmental impact assessment conducted by the National Park Service evaluation of trails at the Delaware Water Gap National Recreation Area include loops with spurs to sensitive areas, maintaining easy grades, avoid traversing steep slopes, using long switches to minimize hikers cutting across switchbacks, adding steps or support where necessary along trails, following contours, using swales and water bars, interconnecting trails and stacking loops, and using grade reversals (National Park Service, 1999).

The design of trails takes into account the variety of hiker needs, including disabilities, and the potential environmental impact. Hiking trails typically have a three- to four-foot tread of compacted soil and a minimum eight-foot-high vertical clearance. Each trail has a zone of influence that varies in size. A zone of influence refers to the zone of environmental impact caused by the trail, and it may extend for hundreds or thousands of feet on either side of a trail. Trails can create environmental edges that affect surrounding landscapes.

Accessible Trails

The Americans with Disabilities Act (ADA) requires that trails are accessible, but without clearly specifying how. The final report of the Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas includes ADA Accessibility Guidelines (ADAAG) for trails, outdoor recreational access routes, beach access routes, and picnic and camping facilities, and it will be proposed by the end of 2006.

According to the ADA, a trail is "a route that is designed, designated, or constructed for recreational pedestrian use or provided as a pedestrian alternative to vehicular routes within a transportation system." The accessibility guidelines apply to those trails which are designed and constructed for pedestrian use. These guidelines are not applicable to trails primarily designed and constructed for recreational use by equestrians, mountain bicyclists, snowmobile users, or off-highway vehicle users, even if pedestrians may occasionally use the same trails. Accessibility guidelines apply to trails used as non-motorized transportation facilities for bicyclists and skaters as well as pedestrians.

The proposed guidelines apply only to areas of newly designed or newly constructed and altered portions of existing trails. "Program accessibility" generally means that the major elements in a recreation program need to be accessible.

Paving is not required, as long as the surface is "firm and stable." While handrails and edge protection are not required, they may be provided and should meet appropriate standards. Under the proposed guidelines, an accessible trail would meet these minimum technical provisions:

- Clear tread width: 36" minimum
- Tread Obstacles: 2" high maximum (up to 3" high where running and cross slopes are 5% or less)
- Cross Slope: 5% max.
- Running slope (trail grade) meets one or more of the following:
 - 5% or less for any distance
 - up to 8.33% for 200' maximum – resting intervals no more than 200' apart
 - up to 10% for 30' maximum – resting intervals 30'
 - up to 12.5% for 10' maximum – resting intervals 10'
- No more than 30% of the total trail length may exceed a running slope of 8.33%
- Passing Space: provided at least every 1000' where trail width is less than 60"
- Signs: shall be provided indicating the length of the accessible trail segment

Source: <http://www.americantrails.org/resources/accessible/ada.html>

Environmentally Sensitive Areas

In order to evaluate existing and proposed recommend recreational activities, including trails, for visitors at the Preserve, several environmental factors were evaluated in terms of suitability for recreational activities. Trail development involves construction of a route through natural systems that affect soils, vegetation, topography, wildlife, and flow of surface water. The long-term use of trails by hikers, bikers, and/or walkers continues to create impacts in the surrounding environment for the lifetime of the trail. In the case of the Preserve, the steep slopes, woods, springs, small streams, seeps, quarries, and vernal pools on the property are significant environmental factors for consideration and analyses. Additional features that require consideration are accessibility to the property, parking, existing structures, interpretive opportunities, and aesthetic appeal for visitors.

The location of environmentally sensitive areas was determined by analyzing and mapping available data on land cover, hydrology, and slope (Map 10). Buffers of 500 feet were designated around wet areas such as vernal pools, springs, seeps, streams, and quarries. The areas of steepest slope, 25-60 % slope, were isolated and overlaid with the wet-buffer layer. Areas of steep slope and areas falling within the 100-foot wet-buffer were classified as highly sensitive. It is known that wildlife, especially amphibians and reptiles rely on these wet-buffer areas for survival. Mammals and birds require sources of water and the food sources associated with water. Wetlands require extra protection and areas of steep slope are extremely susceptible to erosion.

As shown above in the section on species of special concern, animal species need plant communities for food, shelter, and nesting habitat. Damage, reduction, and/or elimination of plant communities will have a detrimental affect on dependent animal species.

From an erodibility standpoint, the definition of steep can vary depending on surface soil type and underlying geology. In general, extra caution is warranted on a slope exceeding ten percent (one foot of vertical drop per ten feet of horizontal distance) (Pennsylvania Association of Conservation Districts 1998).

Future recreational uses for this property will require careful planning and rigorous maintenance to protect the soil, vegetative, wildlife, and water resources.

The collective analysis of the botanical, herpetological, bird, and mammal surveys, along with the mapping of the soils, geology, topography, and hydrology, results in a comprehensive map indicating environmentally sensitive areas (Map 10). The areas to note include not only the environmentally sensitive areas, but also the remaining voids or less environmentally sensitive areas. These less environmentally sensitive areas are generally less steep and vegetated with meadows, young miscellaneous forest/woodland, and/or successional field.

The permanent fishless pond, four seasonal forest pools, seepages, and small stream courses, all on the western slopes, provide the necessary habitat for amphibians and reptiles. South Mountain Preserve has one of the most robust populations of Jefferson and spotted salamanders in Pennsylvania, and potentially throughout the entire northeastern U.S. Problems such as sedimentation from trail overuse, collection of specimens for pets, and people introducing fish into the permanent ponds are some, but not all, of the major - and very real problems facing the continued biological integrity of the seasonal forested pools on South Mountain Preserve. The best chance of ensuring the stability of these species at the site is to seasonally restrict access.

Environmentally sensitive areas of special note include:

- The various wet areas (permanent fishless pond, four seasonal forest pools, seepages, and small stream courses) on the western side of the site.
- Seasonal Forest Pool #5 is on the northern border of the site.

Environmental impact of educational and recreational activities – Every educational and recreational user group can cause some deleterious impact to the environment by their use. With environmentally minded regard, design, and execution of educational and recreational programs and activities, environmental impact can be kept to a minimum.

Walking and hiking

As indicated in the Pennsylvania Department of Conservation and Natural Resources' (DCNR) Recreation Plan for 2004-2008, walking and hiking are popular activities in Pennsylvania, in Region 2. Impacts from these activities could include soil erosion, littering, vegetation trampling, and wildlife disturbance. However, these activities are generally considered low-impact and are considered wildlife-oriented. Concerted efforts to minimize the width of the trails, locate trails in less sensitive areas, and keep walkers and hikers on the trail aid in the protection of wildlife and their habitat.

Environmental education and interpretation

Environmental education and interpretation include a variety of activities and facilities that seek to increase the public's knowledge and understanding of wildlife and the environment, and to promote conservation. Examples of environmental-education activities include staff or teacher-led events, student and teacher workshops, and nature studies. Interpretive programs and facilities include special events, visitor center displays, interpretive trails, visitor contact stations, and signs.

The use of the Preserve for on-site, hands-on, action-oriented activities by individuals as well as small and large groups to accomplish environmental education objectives may impose low-level

impacts on the sites used for the activities. Impacts may include trampling of vegetation and temporary disturbance to wildlife species in the immediate use area. Such impacts would not be permanent or long lasting. Most interpretive activities are self-guiding and pose minimal threat to wildlife and habitat.

Environmental education and interpretation can have positive outcomes, such as instilling a land-preservation ethic in visitors, developing support for the Preserve, and lessening vandalism, poaching, and littering.

Bicycling

Environmental impacts may occur with bicycling, such as littering and vegetation and wildlife disturbance, and these can be minimized with single-tread trails and provided users stay on the designated trails. Bicycling on trails is considered a low-impact, wildlife-oriented use. Working with mountain biking organizations to minimize the width of the trails, locate trails in less sensitive areas, and keep bikers on the trail aid in the protection of wildlife and their habitat.

Management Models

The South Mountain Preserve offers a unique, local experience to visitors and provides a natural area where wildlife thrives. Regionally, no similar wildlife areas and facilities exist. The Preserve is most suitable to wildlife observation, environmental education, and environmentally respectful recreational activities rather than vigorous recreational alternatives. Fortunately, there is a wide range of modern and highly controlled recreational opportunities located throughout the region.

Two alternative management strategies for the Preserve include the wildlife-refuge model utilized by the U.S. Department of Fish and Wildlife, and the state-park model utilized by the Pennsylvania Department of Conservation and Natural Resources (DCNR). The difference between these management models can be found in the mission of each agency.

Wildlife-refuge model

The U.S. Fish and Wildlife Service is the principal agency through which the federal government carries out its responsibilities to conserve, protect, and enhance fish and wildlife, and their habitats. It manages a diverse system of 500+ refuges encompassing over 92 million acres of lands and waters spanning the continental U. S., as well as Alaska and Hawaii. Wildlife-dependent recreation is a priority public use of the country's refuge system and is supported where it is compatible with management of the refuge. A wide array of facilities on many refuges enhances visitor's wildlife-dependent recreational experience. Examples include hunting, photography, observation blinds, fishing piers, boat launches, nature and interpretive trails, observation towers, and boardwalks. It is generally agreed that the U.S. Fish and Wildlife Service's wildlife refuge system represents the most comprehensive wildlife-management program in the world.

State-park model

The Pennsylvania Department of Conservation and Natural Resources (DCNR) model for recreational management is the state park. State parks operated by DCNR offer a variety of recreational facilities. Jacobsburg State Park is the closest state facility to the South Mountain Preserve. Located northeast of Bethlehem in Northampton County, Jacobsburg State Park draws more than 200,000 visitors annually, mainly from the Lehigh Valley. Jacobsburg is a day-use

facility with facilities for hikers, equestrians, mountain bikers, and outdoor enthusiasts. Hunting and fishing are allowed on the premises only during appropriate seasons. Of the 1,168 acres, 80 acres are off-limits to hunters. The facility also provides environmental education to 9,500 participants annually through school, adult learning, and community-education programs.

The vision for the South Mountain Preserve is more closely aligned with the state-park model, but is in keeping with the wildlife refuge model due to its wildlife. The Preserve is well-known for its geological formations, herpetological habitat and populations, and birdlife. Portions of the Preserve have been used by mountain bikers, hikers, rock climbers, and others for decades. Additionally, the Preserve serves as an outdoor classroom. The whole of South Mountain constitutes the green backdrop for the entire Lehigh Valley and has great aesthetic value appreciated by residents and visitors alike. The multi-faceted South Mountain Preserve is a significant community asset worthy of careful protection and management.

Land Preservation

It is obvious that the protection of South Mountain, whether through the expansion of the South Mountain Preserve, conservation easements, and/or fee acquisition, is of vital importance. Maps 11 and 12 shows the regional and local potential conservation areas. Along with the protection of the natural resources and environmentally-sensitive areas is the need to provide connectivity with other park lands and preserved properties.

Wildlands Conservancy – Legacy Land Funds

On January 18, 2005, the board of directors of Wildlands Conservancy adopted a resolution to increase the organization's efforts in land preservation by establishing *Legacy Land Funds* (LLF). These funds will hold dollars raised for the purpose of preserving important natural and recreational areas, as well as working farms in the Conservancy's region of focus.

A group of sub-funds was created under the LLF umbrella which will allow donors to focus their contributions on specific areas of interest related to land protection. These sub-funds are: the Wildlands Preservation Fund (WPF), the South Mountain Preservation Fund (SMPF), and the Open Lands Fund (OLF).

The purpose of the SMPF is exclusively to support the purchase, and the activities surrounding the purchase, of land or easements on land on South Mountain (also known as the New England Physiographic Providence).

Land Preservation Methods

There are two major ways of preserving land: conservation agreements (sometimes called "conservation easements") and fee acquisition. Conservation agreements are preservation tools that help protect environmental areas, farmlands, woodlands, meadows, riparian corridors, greenways, and scenic vistas into perpetuity. Additionally, these protected areas can aid in maintaining water quality, be it groundwater, wetlands, or streams. A conservation agreement is a legal agreement between a landowner and a land trust (a private, non-profit conservation organization) or government entity that permanently limits a property's uses in order to protect its conservation values. Conservation agreements are either donated or sold to a non-profit organization or other entity able to hold the agreement in perpetuity.

When a landowner sells or donates a conservation agreement, the owner permanently forfeits some of those rights, but retains others associated with their land. As examples, both a conservation agreement designed to protect wildlife habitat and an agreement on a farm designed to perpetuate continued farming would prohibit commercial and/or residential development. All future owners of the land are also bound by the agreement terms. It is said, “the agreement runs with the title,” meaning a change in ownership does not affect the agreement.

Most nonprofit conservation organizations, such as Wildlands Conservancy, as well as private and governmental entities, often actively seek to acquire, through donation, bargain sale, or fee acquisition (outright purchase), land that contains endangered species of flora and fauna, prime agricultural soils, scenic vistas, or to provide recreational activities such as hiking, biking, fishing, hunting, and more. Additionally, they strive to protect land along rivers, streams, and other bodies of water.

Recommendations

The analysis of the inventories and research lead to the following specific, immediate implementation and ongoing/future implementation recommendations.

Top Recommendations for the South Mountain Preserve:

1. Preserve high-quality habitat types and/or large parcels of property in close proximity to the Preserve and on South Mountain to protect natural resources and to add to the connectivity of the Preserve with other park lands and preserved properties as indicated on Map 12.
2. Post and information about the South Mountain Preserve on the Conservancy's website, including contact numbers in case of emergencies, safety concerns, and/or maintenance issues, and update a minimum of twice a year.
3. Develop an educational program with East Penn School District in accordance with Pennsylvania curriculum standards that will focus on geology, wildlife, hydrology, and history and will establish the Preserve as an educational resource for the Lehigh Valley community.
4. Address the following maintenance issues as outlined in Chart 3:
 - a. Repair four existing kiosks.
 - b. Install waterbars on the four steeply sloped trails where erosion is an issue.
 - c. Extend the existing boardwalk on the Alpine Street Trail by eight linear feet, and install 160 linear feet of boardwalk over wet areas on the lower portion of the Switchback Trail.
 - d. Clear six acres of the lower field to provide a greater variety of breeding-bird habitat.
 - e. Install stepping-stones over three small streams known to be causing erosion due to mountain bikes.
 - f. Repair fencing at the top of the Lower Cistern Trail.
 - g. Secure the cisterns.
 - h. Update trail markings on all of the trails.
5. Design a signage vocabulary which includes directional, interpretation, and educational signage, as well as kiosks.
 - a. Install a minimum of 25 directional signs, including signs at key locations, trail junctions, and trailheads.
 - b. Install a South Mountain Preserve site sign at the junction of trails on the Alpine Street trail.
 - c. Install a minimum of 16 educational/interpretive signs at key locations as outlined by East Penn School District for students and the general public as well.
6. Seasonally close (Feb.-June) and reopen (June-January) the Deerfield Trail and the Quarry Trail to protect sensitive habitat and species during peak breeding periods and to allow a lower 1½-mile loop connecting to the Alpine Street Trail and trailhead during off-peak periods.
7. Work with the local mountain-biking associations, utilizing International Mountain Biking Association's (IMBA) guidelines and procedures, to design and install the proposed single-track trails shown on Map 4.
8. Establish a new trailhead, trail system, and parking area, all constructed using ADA guidelines, in the old meadow portion of the Preserve between the Alpine Street trail and Weiders Lane.
9. Work with recreational groups and volunteers once each summer to post boundary signs where previously posted signs have been removed or damaged.

10. Monitor human activities once a month to identify unexpected impacts or conditions. Document findings with data and photos. Respond quickly and appropriately (e.g., moving trails, limiting access, reducing activities) with measures that are necessary for long-term protection.
11. Develop a prevention-and-control management plan for the exotic invasive plant species found on the property.

Site Improvement and Maintenance Recommendations:

Short-term

- Post and information about the South Mountain Preserve on the Conservancy's website, including contact numbers in case of emergencies, safety concerns, and/or maintenance issues, and update a minimum of twice a year.
- Work with recreational groups and volunteers, at least once during each summer, to post boundary signs where previously posted signs have been removed or damaged.
- Address all maintenance issues outlined in Chart 3, including:
 - Repair four existing kiosks.
 - Install waterbars on the four steeply sloped trails where erosion is an issue.
 - Extend the existing boardwalk on the Alpine Street Trail by eight linear feet, and install 160 linear feet of boardwalk over wet areas on the lower portion of the Switchback Trail.
 - Clear six acres of the lower field to provide a greater variety of breeding-bird habitat.
 - Install stepping-stones over three small streams known to be causing erosion due to mountain bikes.
 - Repair fencing at the top of the Lower Cistern Trail.
 - Secure the cisterns.
 - Update trail markings on all of the trails.
- Close three known renegade trails by adding trail connections to existing trails, and monitor site once a month for new renegade trails.
- Clean up debris on site, especially in the PPL rights-of-way and popular gathering spots. Monitor once a month to quickly address future dumping.
- Design a signage vocabulary which includes directional, interpretation, and educational signage, as well as kiosks.
 - Install a minimum of 25 directional signs.
 - Install a South Mountain Preserve site sign at the junction of trails on the Alpine Street trail.
 - Install a minimum of 12 educational/interpretive signs at key locations to educate the public about the various natural and cultural features of the Preserve
- Develop two-color, tri-fold educational and informative trail maps, and print a minimum of 500.

Long-term

- Provide a full-time, on-site South Mountain Preserve manager with appropriate supporting staff.

Plant Communities Recommendations:

Short-term

- Monitor human activities once a month and assess the impact on plant communities and special habitat areas over time. Document findings with data and photos. Respond quickly and appropriately (e.g., moving trails, limiting access, reducing activities) with measures that are necessary for long-term protection.

Long-term

- Update the 1998 forest-stewardship plan to outline phased strategies to protect, restore, and maintain natural, healthy, and functioning plant communities.
- Assign responsibility to Conservancy staff for plant communities, plant species, as well as special-habitat stewardship, function, and protection.
- Utilize Conservancy staff as well as partners and/or outside experts (e.g., Pennsylvania Bureau of Forestry and Pennsylvania Game Commission) to implement this protection and monitoring program.
- Coordinate monitoring efforts with other entities so South Mountain Preserve data are comparable and consistent among agencies and conservation organizations to enable better indications of forest function and health across the entire commonwealth.
- Protect any trees planted in canopy gaps with wire cages, or choose to plant larger trees whose crowns are above the browsing height of deer. Protect the stems from antler rubbing with the use of tree-wrapping tape.

Invasive Plants Recommendations:

Short-term

- Take caution to use uncontaminated construction materials. All areas that receive imported material must be monitored to quickly identify and address the new establishment of any invasive species.

Long-term

- Develop a prevention and control management plan for the exotic invasive plant species found on the property.
- Consult with a Penn State Cooperative Extension for more information on appropriate herbicides and application measures for specific species.
- Utilize Conservancy staff as well as volunteers, partners and/or outside experts (e.g., Pennsylvania Bureau of Forestry and Pennsylvania Game Commission) to implement this monitoring and eradication/control program.
- Where appropriate, minimize human disturbance during new trail construction to curtail the spread of invasive plant species.

Wildlife Recommendations:

Short-term

- Seasonally reopen the Deerfield Trail and the Quarry Trail to allow a lower 1½-mile loop connecting to the Alpine Street Trail and trailhead.
- Limit pesticide and herbicide applications, except when deemed necessary (i.e., autumn olive control) to provide resource protection.

Long-term

- Once a year, in the fall, cut the two upper fields to keep them from reverting to forest.
- Develop a deer-management plan, working with the Pennsylvania Game Commission and/or other wildlife-management organizations to determine the best deer-herd management techniques for the area.
- Utilize Conservancy staff as well as volunteers, partners and/or outside experts (e.g., Pennsylvania Bureau of Forestry, Pennsylvania Game Commission) to implement this monitoring and management program.

- Work with neighbors, municipalities, and other conservation organizations to promote wildlife corridors along South Mountain.
- Use volunteers to observe and document migratory birds annually as baseline information
- Maintain plant communities as habitats and for food sources for birds (migrating and resident), amphibians, reptiles, mammals, fish, macro-invertebrates, insects, and other wildlife, especially rare, threatened, endangered, and special concern species.
- Utilize native shrubs and grasses that provide food for migrating birds and other wildlife around existing and new facilities, openings, and access routes.
- Fill in the large trail puddles near Seasonal Forest Pool #1.
- Provide a vernal-pool buffer of 200 meters from the edges of the Permanent Fishless Pond and Seasonal Forest Pool #2/#5.
- Conduct a long-term study using standardized sampling on a fixed time scale to monitor the health and populations of the amphibians and reptiles.
- Regularly monitor and assess the impact of human activities on birds, mammals (excluding deer), amphibians and reptiles, and especially on the vernal-pond-breeding species over time. Document findings with data. Respond quickly and appropriately (e.g., moving trails, limiting access, reducing activities) with measures that are necessary for long-term protection.

Education Recommendations:

Short-term

- Develop an educational program with East Penn School District in accordance with Pennsylvania curriculum standards that will focus on geology, wildlife, hydrology, and history and will establish the Preserve as an educational resource for the Lehigh Valley community. Install a minimum of 16 signs as outlined by East Penn School District.
- Install a minimum of 12 educational/interpretive signs at key locations to educate the public about the various natural and cultural features of the Preserve, including but not limited to the riparian zone of the stream that crosses the Alpine St. trail, the permanent fishless pond (old quarry) for the history of the mining and for the wildlife, the switchback trail, the boulder area, the stone gates, the old carriage road, the two forest plant communities, the circumneutral skunk cabbage seep plant community, and the history of the Indians.
- Collaborate with local universities, educational institutes, and local conservation groups to provide educational opportunities. Include recreational activities in the educational programming, such as guided hikes, bird watching, night observation, and forest management.
- Utilize volunteers and Conservancy staff to monitor recommended educational and recreational activities on an on-going basis to identify unexpected impacts or conditions.

Long-term

- Provide ongoing public awareness through media outlets and brochures, including information about the South Mountain Preserve on the Conservancy's website.
- Limit public use in the following areas to scheduled, guided educational tours and other appropriate activities to prevent undue disturbance of these critical resources:
 - The various wet areas (permanent fishless ponds, four seasonal forest pools, seepages, and small stream courses) on the western side of the site.
 - Seasonal Forest Pool #5 on the northern border of the site.

Recreation Recommendations:

Short-term

- Complete the mapping of the trails using GPS.
- Reroute any existing or new renegade trails that leave the Preserve or are inappropriately encroaching on adjacent landowners' properties to remain entirely and comfortably on Preserve property.
- Collaborate with the Borough of Emmaus to help secure the necessary land and construct the proposed trail which starts on the south side of the Perkiomen Rail Line by the recycling center leading to the Preserve property along Weiders Lane trail.
- Establish a new trailhead, trail system, and parking area, all constructed using ADA guidelines, in the old meadow portion of the Preserve between the Alpine Street trail and Weiders Lane.
- Work with the local mountain-biking associations, utilizing International Mountain Biking Association's (IMBA) guidelines and procedures to design and install the proposed single-track trails shown on Map 4.
- Continue to pursue the creation of additional trailheads on the western side of the Preserve in addition to the Alpine Street trailhead.

Long-term

- Monitor recreational activities on an on-going basis to identify unexpected impacts or conditions.
- Work with to determine the best trail solutions for protecting the environment and providing biking opportunities.
- Work with federal, state, and local organizations to provide specific funding for recreational opportunities and appropriate facilities.
- Work with partners, such as the Lehigh Valley Convention & Visitors Bureau, to develop recreation programming that will attract visitors to the Lehigh Valley.

Expansion and Land Preservation Recommendations:

Short-term and Long-term

- Preserve high-quality habitat types and/or large parcels of property in close proximity to the Preserve and on South Mountain to protect natural resources and to add to the connectivity of the Preserve with other park lands and preserved properties as indicated on Map 12.

***SOUTH MOUNTAIN PRESERVE
CONSERVATION, GREENWAYS, AND TRAILS PLAN***

Recommendations	Estimated Costs
1. Preserve high-quality habitat types and/or large parcels of property in close proximity to the Preserve and on South Mountain to protect natural resources and to add to the connectivity of the Preserve with other park lands and preserved properties as indicated on Map 12.	
2. Post and information about the South Mountain Preserve on the Conservancy's website, including contact numbers in case of emergencies, safety concerns, and/or maintenance issues, and update a minimum of twice a year.	\$ 1,560.00
3. Develop an educational program with East Penn School District in accordance with Pennsylvania curriculum standards that will focus on geology, wildlife, hydrology, and history and will establish the Preserve as an educational resource for the Lehigh Valley community.	\$ 2,600.00
4. Address the following maintenance issues as outlined in Chart 3.	
a. Repair four existing kiosks.	\$ 600.00
b. Install waterbars on the four steeply sloped trails where erosion is an issue.	\$ 1,040.00
c. Extend the existing boardwalk on the Alpine Street Trail by eight linear feet, and install 160 linear feet of boardwalk over wet areas on the lower portion of the Switchback Trail.	\$ 8,000.00
d. Clear six acres of the lower field to provide a greater variety of breeding-bird habitat.	\$ 3,100.00
e. Install stepping-stones over three small streams known to be causing erosion due to mountain bikes.	\$ 520.00
f. Repair fencing at the top of the Lower Cistern Trail.	\$ 520.00
g. Secure the cisterns.	\$ 1,020.00
h. Update trail markings on all of the trails.	\$ 520.00
5. Design a signage vocabulary which includes directional and interpretation/educational signage, as well as kiosks.	\$ 5,300.00
a. Install a minimum of 25 directional signs, including signs at key locations, trail junctions, and trailheads.	\$ 1,875.00
b. Install a South Mountain Preserve site sign at the junction of trails on the Alpine Street trail.	\$ 8,000.00
c. Install a minimum of 16 educational/interpretive signs at key locations as outlined by East Penn School District for students and the general public as well.	\$ 2,400.00
6. Seasonally close (Feb.-June) and reopen (June-January) the Deerfield Trail and the Quarry Trail to protect sensitive habitat and species during peak breeding periods and to allow a lower 1½-mile loop connecting to the Alpine Street Trail and trailhead during off-peak periods.	\$ 520.00
7. Work with recreational groups and volunteers once each summer to post boundary signs where previously posted signs have been removed or damaged.	\$ 520.00
8. Establish a new trailhead, trail system, and parking area, all constructed using ADA guidelines, in the old meadow portion of the Preserve between the Alpine Street trail and Weiders Lane.	\$ 5,600.00
9. Work with the local mountain-biking associations, utilizing International Mountain Biking Association's (IMBA) guidelines and procedures, to design and install the proposed single-track trails shown on Map 4.	\$ 2,600.00
10. Monitor human activities once a month to identify unexpected impacts or conditions. Document findings with data and photos. Respond quickly and appropriately (e.g., moving trails, limiting access, reducing activities) with measures that are necessary for long-term protection.	\$ 4,680.00
11. Develop a prevention-and-control management plan for the exotic invasive plant species found on the property.	\$ 5,000.00

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LIST OF POTENTIAL PARTNERS

Allentown (City of), Parks Department
Allentown (City of), Recreation Department
Allentown Hiking Club
Borough of Emmaus
Cedar Crest College
Clean Water Action
Coalition for Alternative Transportation
Delaware & Lehigh National Heritage Corridor and Heritage State Park
DeSales University
Discovery Center (The)
Ducks Unlimited
Great Valley Girl Scout Council
Hawk Mountain Sanctuary Association
Highlands Coalition
International Mountain Biking Association
Jacobsburg State Park (DCNR)
JCC
Kutztown University
Lehigh Carbon Community College
Lehigh Career and Technical Institute
Lehigh (County of)
Lehigh County Conservation District
Lehigh County Historical Society
Lehigh County Juvenile Probation Department
Lehigh University / Earth Observatory
Lehigh Valley Convention & Visitors Bureau
Lehigh Valley Planning Commission
Lower Saucon Township
Moravian College
Muhlenberg College
National Audubon Society – Lehigh Valley Chapter
Nestor’s Sporting Goods, Inc.
Penn State Cooperative Extension Office – Lehigh County
Penn State University / Lehigh Valley
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Environmental Protection
Pennsylvania Fish & Boat Commission
Pennsylvania Game Commission
Sierra Club
South Mountain Cycling Center
Upper Saucon Township
Valley Mountain Bikers
Valley Youth House
Wildlife Information Center

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- Amy R. Croushore - Wildlands Conservancy staff naturalist
- Karen Dannenhower - Lehigh Carbon Community College intern
- Heather Dorn - Wildlands Conservancy volunteer
- Janet Fabian - Wildlands Conservancy volunteer
- Matt Fay – Scoutmaster, Boy Scouts Troop #5
- Richard Grghring – Deer Management Group
- James Hart - Mammalogist, Pennsylvania Natural Heritage Program
- John Levin - Lehigh Valley Audubon Society
- Bernie Morris - Lehigh Valley Audubon Society
- George Palmer - Wildlands Conservancy volunteer
- Brandon M. Ruhe & Associates LLC - herpetological survey
- Justin T. Ruhe - Wildlands Conservancy volunteer
- Gene Scharle - Allentown Hiking Club
- Jim Schneck - Emmaus resident, trail mapper
- Claudia Steckel - Botanical Inventory, Inc.
- David Steckel - Natural Lands Trust volunteer
- Theodore Thwing - Lehigh University intern
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