

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

June 2006



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

Overview

The development of the *South Mountain Preserve Conservation, Greenways, and Trails Plan* involves identifying and documenting the cultural, natural, historical, recreational, ecological, and geological resources of the property. The South Mountain Study Steering Committee, local community residents and officials, and environmental and recreational organizations have and will continue to provide valuable input and guidance. The Pennsylvania Department of Conservation and Natural Resources (DCNR), Bureau of Recreation and Conservation provided funding assistance for this study.

Goal:

Balance the ecological and environmental needs of the South Mountain Preserve, while providing recreational and interpretive opportunities to benefit the community.

Objectives:

1. Conduct a resource inventory and assessment of the Preserve providing baseline documentation of the findings in a form useful as an ongoing management tool.
2. Recommend appropriate educational and recreational activities that respect the ecological assets of the Preserve.
3. Provide recommendations for the management, interpretation, recreational use, and potential expansion of the Preserve.

History of South Mountain and the South Mountain Preserve

It is estimated that the first Native Americans arrived in present-day Pennsylvania about 11,000 years ago. Our understanding of early man in North America and the culture of the local tribe, the Lenni-Lenape, is gained through the interpretation of artifacts and remains, and without the aid of a written record.

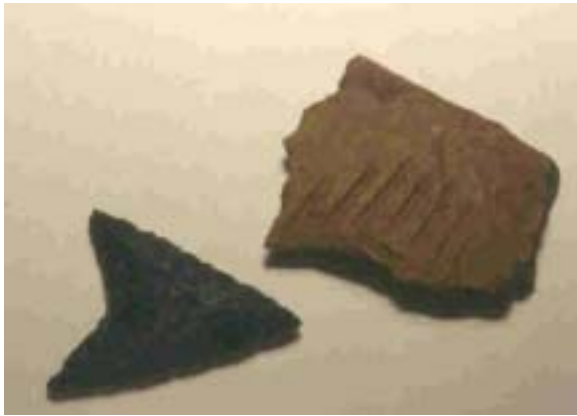
During the last portion of the Woodland Period, 1000 B.C.-1600 A.D. and before the arrival of



Europeans, the Lenni-Lenape, a branch of the Algonquians who lived along the banks of the Lehigh and Delaware rivers, lived a relatively sedentary life and villages were occupied for several years.

During this period, Indian tribes adopted the bow and arrow, and the small, chipped-stone, triangular arrow tip came into fashion. The Lenni-Lenape discovered jasper, a hard yellow, red, or brown cryptocrystalline quartz (flint-type mineral), near Vera Cruz on the slopes of South

Mountain. The Lenape used jasper for making arrowheads and other cutting implements. They used an inventive fire-and-water technique to break the jasper into manageable pieces. When an outcrop of the hard jasper was exposed, they heated it with fire, and immediately poured cold water over it, which caused it to crack into smaller transportable pieces. Quarrymen lived at these diggings for extended periods. At some excavations, more than one million cubic feet of earth had been moved from mining pits. The building of the northeast extension of the Pennsylvania Turnpike through Leiberts Gap in 1955 destroyed over half of these ancient jasper quarry pits.



Archeological evidence of jasper flakes at campfire sites throughout the area indicates that the final shaping of arrowheads and cutting implements took place away from the quarry site. South Mountain jasper arrowheads have been found in New England, New York, and south of the Potomac River. Lenni-Lenape quarrying of this valuable mineral was probably not only the first mining activity of man in Pennsylvania, but also its first mineral export.

Indian artifacts

Within a decade after Bucks County was formed in 1682 and in the area now called Lehigh County, members of the Lenni-Lenape nation, the Unami or Turtle tribe sought refuge from the Europeans among the crags and springs of South Mountain. The Lenni-Lenape used the towering rocks on the summit of the mountain for lookout purposes. During the continuous use of this section of the mountain by the Lenni-Lenape and then early European settlers, a winding trail was worn from the present Summit Lawn area to the Shelter House site established in Emmaus in 1734. In the early 18th century, Lenni-Lenape and Europeans were living side by side on South Mountain. It is said that the Europeans got kind treatment from the Lenape. William Penn stated that the common salutation of the Lenape was “Good be to you.” The Lenni-Lenape encampments on and about South Mountain enjoyed access to fish from the Delaware, Lehigh, and Perkiomen, as well as maize, potatoes, beans, pumpkins, squash, melons, fruits, nuts, berries, and roots. The European settlers bought these products from them for their own planting.

The first European settlers entered the South Mountain area in the 1720s from the Bucks, Berks, and Montgomery county regions. After initially settling in Upper Milford, Lower Milford, and Upper Saucon townships, as well as on the southern slopes of South Mountain, they crossed the mountain in 1727 and located in the broad valley known today as the Lehigh Valley. In 1735, the first public road leading into the Lehigh Valley, “The King’s High Road,” was surveyed and established. It followed the path of the Lenni-Lenape’s Perkiomen-Lehigh Path that ran north from an Indian town on the Schuylkill River to Vera Cruz, continued over South Mountain at Leiberts Gap, and ran through the Lehigh River gap at Blue Mountain. Some reports refer to The King’s High Road as a “cowpath,” while others refer to its 25-foot width. The King’s High Road itself started in Philadelphia and ended in *Maguntsche* (Macungie).

It has been recorded that “white traders” first entered the Lehigh Valley as early as 1701 to trade with the Lenni-Lenape, but they “... left no mark upon the country and only a meager record of their adventures. In fact their action, confined principally to more or less questionable dealings with the Indians [Lenni-Lenape], demands no chronicling.” (Everts and Richards, 1884)

In 1734, a Germanic log cabin was built next to a major Lenni-Lenape trail on the northern slope of South Mountain near the present-day Fourth Street in Emmaus. This was a temporary shelter for settlers, available while they established their own homesteads. It was referred to as *Zufluchtshaus*, German for “shelter house.” The original Lenni-Lenape trail leading to the Shelter House was transformed into a road for vehicles in 1760, connecting Emmaus with Easton by way of Bethlehem. This was the same road that was used by Moravian missionaries to travel to their various missions in Berks, Lancaster, and York counties, and even to Wachovia, their settlement in North Carolina.

The so-called Walking Purchase of 1737 was a significantly destructive event in the relationship of the Lenni-Lenape and the Europeans. It threw the ownership of the area into dispute, and it had an unfortunate effect later in Lenape-European relations in the entire area.

In 1718, the Lenni-Lenape had deeded the land extending from Philadelphia northward to South Mountain to the Europeans. Thomas Penn asserted that his father, William Penn, had also made a treaty with the Lenape in 1686 that deeded land north of South Mountain to the Europeans. Although no copy of that treaty was found, the Lenni-Lenape finally agreed to carry out the alleged 1686 treaty that would give Pennsylvania as much land as could be walked in “one-day-and-a-half.” Thomas Penn advertised for the best athletes and the fastest walkers in the province. The walk began at sunrise on September 19, 1737. By early afternoon of the first day, the main party was near Bethlehem. It was said they “crossed from Salisbury Township to the north bank of the Lehigh River at the ‘Walking Purchase Ford,’ a couple of miles west of the confluence of the Monocacy Creek and the Lehigh River; just west of that is the great bend of the Lehigh (Schmehl, 1976).”

If that narrative is correct, the participants of the walk could have passed over South Mountain where the Lenape’s Minsi Path cut through the mountain and present day Route 378 travels today. This was an early route used by settlers going over the mountain from Saucon Township to the site that became Bethlehem in 1741. They would have then crossed the Lehigh River at present-day Sterner’s Island, located mid-way between Bethlehem and Allentown. One of the walkers, Solomon Jennings, lived on the south bank of the Lehigh River at that point and was surely familiar with such a route. The walk came to its conclusion the following day, an estimated 66 miles from its start at the oak tree in Wrightstown to a spot just south of present-day Jim Thorpe. By the time all the conditions and results of the walk had been realized, the Lenni-Lenape felt that they had been cheated. The Lenni-Lenape, once the most peaceful of Pennsylvania Indian tribes, turned into the fiercest raiders of settlers during the French and Indian War from 1754-1763. The inhabitants of the area paid the price of Thomas Penn’s deceit in fear, death, and an unsettled frontier for decades to come.

The northern slope of South Mountain was prominently known during the first quarter of the 18th century for its many clear-water springs and sheltering rocks. The area on this mountainside

running westward from present day Route I-78 to South Fifth Street in Emmaus afforded an abundance of water and nooks and crannies for shelter among the rocks. These caves and outcroppings provided cover and protection for temporary or occasionally permanent abodes for the Lenni-Lenape and early European settlers. With few exceptions, the early European settlers were poor and of limited educational and cultural background, characteristics common to the first settlers in every new country. In general, they possessed unusual initiative and courage, and were deeply religious and industrious.

Many of the German immigrants who came to the South Mountain area were simple burgers and peasants. They earned their passage to Pennsylvania by selling themselves as so-called redemptioners, becoming indentured servants, and thus paying for their passage in time. Many came from Wuerttemberg and the Rhenish Palatinate between 1729 and 1750 and were of the Lutheran or Reformed faiths. When they arrived in Philadelphia, they found Penn's original counties, Philadelphia, Chester, and Bucks, already well populated, and so many pushed north and west into less-settled areas. In their native lands, they had been simple artisans and tillers of the soil, and hoped to establish themselves as the same in their new homes. Most had not owned land before, and by 1740, over 2,000 acres had been warranted to these new immigrants. In 1742, a church and graveyard were established on the northern slope of South Mountain, later to grow into the village of Emmaus.

In the late 1700s, the wooded lower slopes of South Mountain were sometimes cleared of its chestnut, oak, hickory, and birch trees to allow for animal grazing and fruit production, especially apples. The stony content of the soil and the frequent occurrence of massive rocks made cultivation difficult.

The mining of iron ore on South Mountain began in 1809, with the greatest activity taking place from the end of the Civil War to about 1885. The availability of iron ore on South Mountain, as well as trees to make charcoal to fire the furnaces, helped give rise to the iron industry, and helped launch America's "Industrial Revolution" in the Lehigh Valley. In 1880, Pennsylvania led all states in the production of iron ore, and Lehigh County led all of the counties in the state.

South Mountain was one of the major sources of limonite and *the* major source of magnetite in the Lehigh Valley. Deposits of magnetite iron ore, referred to as "Mountain Ore," was accessed through shaft mining near Emmaus and on the southern slope of the mountain. One magnetite-ore location near Vera Cruz had a 135 foot-deep mineshaft to reach the iron ore. In the quartzite northeast of Emmaus, on the northern slope of the mountain, limonite iron ore, referred to as "Valley Ore," was accessed through open-pit mining. Eventually, anthracite coal from the northern reaches of the Lehigh River watershed and iron ore from Lake Superior replaced South Mountain's raw material contribution to the iron and steel industry. A gradual decline took place in the first part of the 20th century and the last iron-ore mines on South Mountain closed in the early 1900s.



Ore mining

Sandstone quarries on the north slope of South Mountain produced the material for nearly all the buildings on the Lehigh University and Moravian College campuses, as well as many public buildings in Bethlehem and Allentown. It was well suited and extensively used for boundary and foundation walls.

Over the years, there were attempts to find and mine many other minerals on South Mountain. Gold, graphite, corundum, garnet, and zircon are among the many that were sought, but none was found in enough abundance to become commercially successful.

The 21st Century

Since the early 20th century, the history of South Mountain has been a quieter one. After more than a century of industry and timbering, the natural vegetation regenerated into a mature deciduous forest. Remnants of past industrial activities are still visible but no longer dominate the landscape.

Until the 1960s, there was only scattered and low-density development on South Mountain. In the 1970s, the effort to control unwanted development on the mountain resulted in the formation of the Lehigh Valley Conservancy, later to become Wildlands Conservancy. Robert Rodale, president of then Rodale Press Inc., bought the 96-acre Walters Tract on South Mountain in 1976 and donated it to the Conservancy in 1978. The tract was part of a farm originally purchased in 1770 by Henry Kemmerer, the son of Frederick Kemmerer, a German immigrant who came from Wurtemberg, Germany in 1742. Farming had taken place in the upper fields for over 230 years, and the remnants of iron mining in the form of ore pits still exist.

The Walters Tract acreage was the first in the establishment of Wildlands Conservancy's 300-acre South Mountain Preserve. The South Mountain Preserve, along with the city of Allentown's adjacent parkland, form the 700-acre Robert Rodale Reserve. In 1999, the northwest-facing forested section of South Mountain's Robert Rodale Reserve was designated "the top priority natural area in Lehigh County" by the Pennsylvania Science Office of The Nature Conservancy. Other significant preserved areas of South Mountain include Walking Purchase Park, which is located at the base of the northern slope of South Mountain in Salisbury Township along the Lehigh River. Adjacent and up the north slope of the mountain is the "Lehigh Uplands." Together, Walking Purchase Park and the Lehigh Uplands comprise over 331 acres of publicly owned park.

Barbara, Dr. Preston, 1959; Bortz, Dean, 2000; Dennis and Iobst, 2004; Everts and Richards, 1884; Halma, Robert and Oplinger, Carl S., 2001; Hauser, James, 1901; Heckewelder, John, 1971; Kulp, Randolph, 1956; Loehr, Charles R., 1977; Meyers, Albert Cook, 1970; Roberts, Charles R., 1914; Rupp, Daniel, 1845; Schlenker, Pamela, 1978; Wallace, Paul A.W., 1987; Wildlands Conservancy, 2004; and Yeates, Dr. W. Ross, 1963.

or parts of 22 counties. This section occurs as a northeast southwest, band that curves from Bedford and Fulton counties in the southwest to Lackawanna, Carbon, Monroe, and Pike counties in the northeast. The section includes all of Huntingdon, Mifflin, Juniata, Perry, Snyder, Union, Northumberland, Montour, and Schuylkill counties (<http://www.dcnr.state.pa.us/forestry/sfrmp/docs/PA%20Ecoregions%20section%20descriptions%20&%20links.pdf>). The Blue Mountain on the northern border of the Lehigh Valley lies within the Appalachian Mountain Section.

The Great Valley Section of the Ridge and Valley Province is a chain of lowlands extending south and west from the Hudson Valley. Its main segments are the Lehigh, Lebanon, Cumberland, and Shenandoah valleys, the Valley of Virginia, and the Valley of East Tennessee. Along a major north-south travel and settlement corridor, the Great Valley has some of the most fertile soils in eastern United States (<http://www.answers.com/topic/appalachian-mountains>).

In southeastern Pennsylvania, the Great Valley Section of the Ridge and Valley Province consists of a very broad lowland that lies south of Blue Mountain. The two-county region called the Lehigh Valley lies between the Blue Mountain and the New England Province (referred to locally as South Mountain, the Reading Prong, or Lehigh Mountain). The lowland has gently undulating hills eroded into shales and siltstones on the north side of the valley, and a lower-elevation, flatter landscape developed on limestones and dolomites on the south side.

The New England Province starts in Connecticut, continues across the lower Hudson Valley and New Jersey into Pennsylvania, ending abruptly in Berks County. The 45-mile stretch between Easton and Reading is a low ridge of wooded hills, which project upward, in significant contrast to the surrounding lowlands. Much of the present water supply for a number of communities in eastern Pennsylvania (including the city of Allentown) flows from these hills. In 1977, the Joint Planning Commission for Lehigh and Northampton Counties (now the Lehigh Valley Planning Commission) studied 13,000 acres of South Mountain stretching from Liebert's Creek to Saucon Creek and recommended the preservation of additional open space and recreation areas.

Widely recognized landmark in eastern Pennsylvania, South Mountain forms a topographical and cultural barrier between southeastern Pennsylvania and the Lehigh Valley. South Mountain derives its name from the Lehigh Valley-centric notion that it is the "hill to the south." It is sometimes referred to as Lehigh Mountain, and rises from an elevation of approximately 400 feet above sea level to over 1,000 feet at its summit (Pazzaglia, 2002).

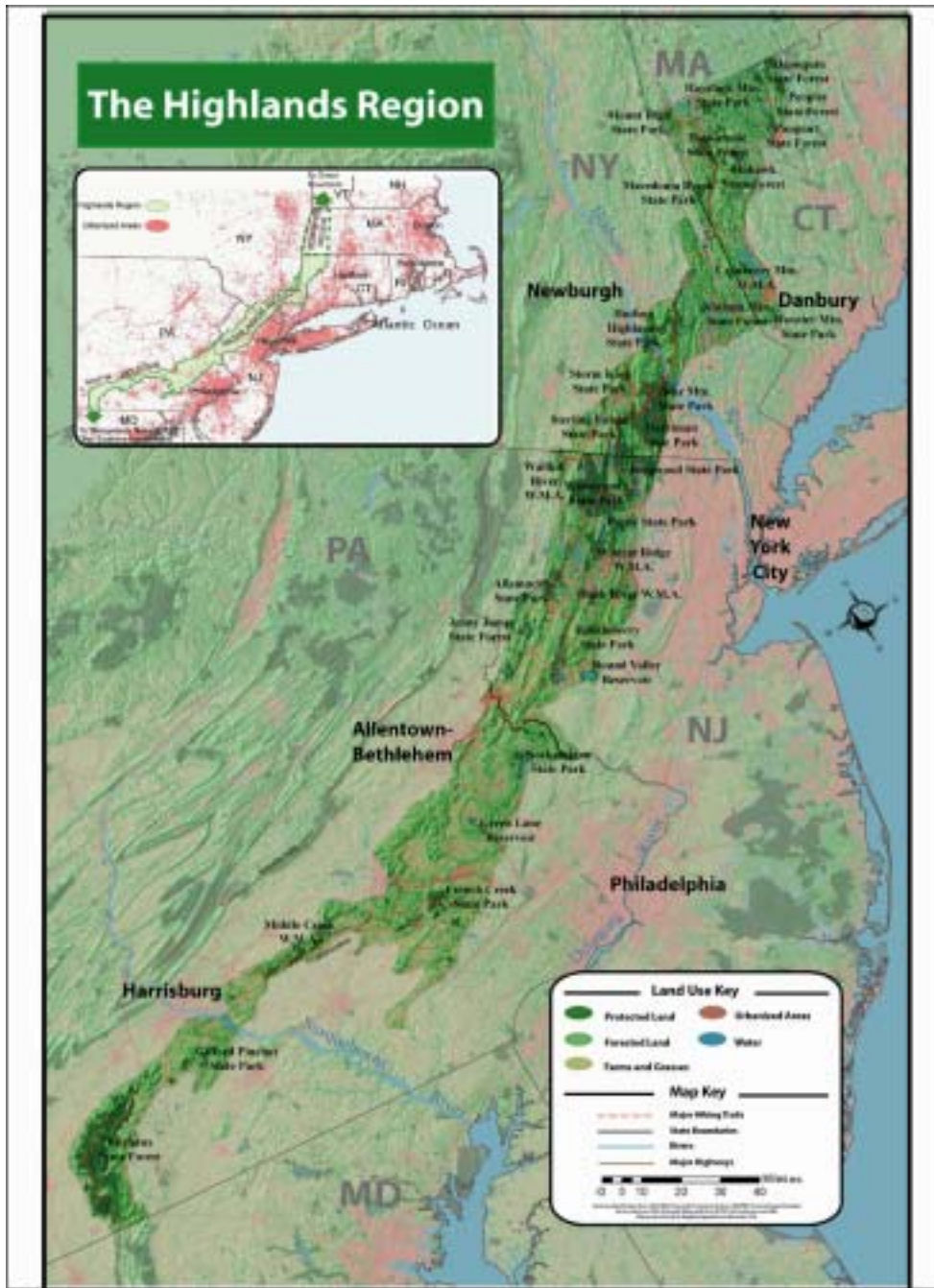
South Mountain is also considered a part of the Highlands region, which is, in turn, part of the great green sweep of the Appalachians that shadows the East Coast from Georgia to Maine. The 305-acre South Mountain Preserve spans three municipalities – Emmaus Borough, Salisbury Township, and Upper Saucon Township.



<http://www.worldatlas.com/webimage/countrys/nalnd.htm>

The Highlands Region

The Highlands region stretches from eastern Pennsylvania (starting in Reading) through New Jersey and New York to northwestern Connecticut, forming a vital linkage between the Berkshires to the north and the Blue Ridge Mountains to the south.



Located within an hour of nearly 25 million Americans, the Highlands form a "greenbelt" of forests and farmland adjacent to the sprawling Philadelphia-New York-Hartford urban corridor.



<http://www.highlandscoalition.org/thehighlands.htm>

Robert Rodale Reserve

The approximately 650-acre Robert Rodale Reserve, located in Lehigh County, was established cooperatively by Wildlands Conservancy, the City of Allentown, the County of Lehigh, the Township of Salisbury, and the Borough of Emmaus, to protect the beautiful viewshed of the Lehigh Valley, to assure the protection of wildlife habitat, and to provide recreational uses for the surrounding communities. The Reserve is chiefly comprised of the City of Allentown’s South Mountain Park (350 acres) and Wildlands Conservancy’s South Mountain Preserve (300 acres). Together, these lands form a significant part of the green backdrop for the communities just to the north, and are a most pleasing and important aspect of the Lehigh Valley. Both contain maturing, second-growth forest, are home to rare or threatened plant species, are prime breeding habitat for amphibians, and provide nesting habitat for more than 59 species of birds.

The preservation of this land was the vision of Bob Rodale of Rodale, Inc., as well as many others. Over the years, Bob and Ardeth Rodale, Rodale, Inc., the City of Allentown, the County of Lehigh, the Township of Salisbury, and others made gifts of land and funds to the Conservancy to expand the reserve.

The Robert Rodale Reserve was designated a top-priority natural area in Lehigh County, referred to as the Natural Areas Inventory (NAI) Robert Rodale Reserve site. For over a decade, efforts have been underway by the Pennsylvania Natural Diversity Inventory (PNDI) partnership, individual county planning offices, The Nature Conservancy (TNC) in eastern Pennsylvania, and

the Western Pennsylvania Conservancy in the western portion of the Commonwealth to inventory ecological areas such as the Robert Rodale Reserve site in each county. These inventories identify, map and discuss important ecological places within a county, prioritize them based on their attributes, and provide recommendations regarding their management and protection. These areas possess animal or plant species and habitats of concern. County inventories inform county residents about their living heritage and provide a tool to use in planning the future of their communities.

The 1997 *Lehigh - Northampton Counties Natural Areas Inventory (NAI)* states: “*Robert Rodale Reserve - The City of Allentown and Wildlands Conservancy both own this reserve. It is a good quality northern Appalachian circumneutral seeps natural community containing two plant species of special concern. There are multiple vernal pools within the site, which are important for the breeding of amphibians. Forest fragmentation is the greatest threat to this natural area.*” (See Map 2.)

Table 1 below outlines the former owners, acreage, and dates of donation or acquisition that currently comprise the approximately 305-acre South Mountain Preserve.

Table 1					
South Mountain Preserve - Land Acquisition					
Former Owner	Acreage	Date	Former Owner	Acreage	
<i>Walters</i>	173.5390	1976	<i>Walters Tract - consisting of:</i>		
Homm	11.2600	1984	Goldfarb	4.4000	
Bogart	4.3000	1985	Lehrick	33.0000	
Stevens	9.0000	1986	Lehrick	18.0500	
Emmaus VWF	9.4771	1986	Lehrick	21.3000	
Trapp	10.9000	1987	Rodale	96.7890	
Paules	19.1000	1987	Total acreage	173.5390	
Benfield	4.3000	1987			
Rodale	24.8650	1990			
Rodale	21.9940	1990			
Lichtenwalner	3.9690	1991			
Hausman	5.5000	1991			
Reszek	4.3000	1991			
So-Pro, Inc.	8.5300	1992			
Mareks	2.5000				
Total acreage	313.5341				

As a part of this *South Mountain Preserve Conservation, Greenways, and Trails Plan*, and in response to the pressing boundary issue, Harte Engineering, Inc., of Bethlehem, PA, was engaged to conduct a boundary survey in 2005. As is often the case, there were some discrepancies in the acreage of the individual tax parcels represented above, and surveys are the most accurate way of determining location and size. Officially, the South Mountain Preserve contains 305.69 acres.

Greenways and Trails

Greenways are publicly and/or privately owned corridors of protected open space managed for conservation and recreation purposes. They often follow natural land or water features, and link nature reserves, parks, cultural features, and historic sites with each other and with populated areas. Some greenways include recreational trails, while others are solely for the protection of conservation resources. Trails are pathways used for walking, bicycling, horseback riding, or other forms of recreation or transportation.

Environmentally, greenways and trails support the health of the environment by:

- enhancing the quality of life in a community or region;
- accentuating the scenic beauty of the area;
- protecting water resources by buffering non-point source pollution;
- providing opportunities to protect and manage wildlife, forests and ecological systems;
- providing recreational opportunities for families and individuals of all ages and abilities;
- providing alternatives to automotive transportation, thus reducing traffic congestion;
- adding positively to our economic climate; and
- being beneficial for health and wellness for individuals of all ages.



In 1998, Pennsylvania Governor Tom Ridge's Executive Order 1998-3 called for an action plan for advancing the Pennsylvania's Greenways Partnership Program into the 21st century. This greenway vision is to develop an outstanding network of greenways across the commonwealth. The existing, proposed, and future greenway systems in the watershed will connect with this vision. A February 2003 update identified greenways or linear trails that covered 50 miles in length and included two (2) or more counties.

These spines provide statewide linkages to which municipalities can implement local system connections.

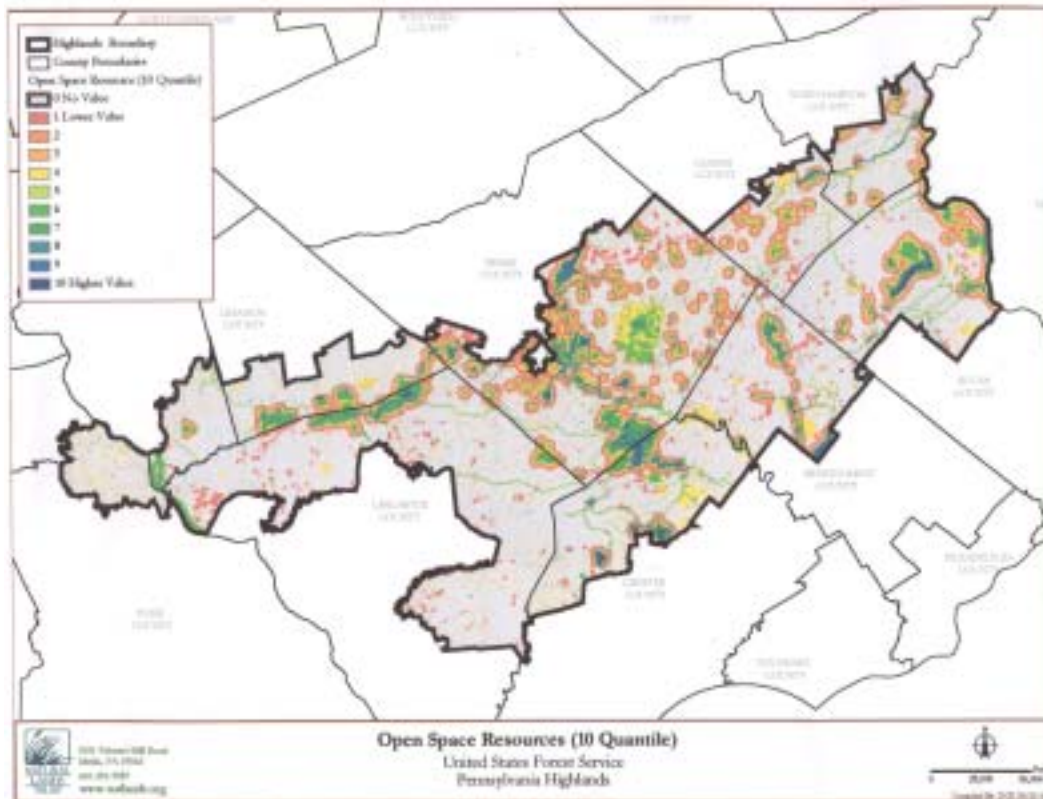
The Highlands Coalition

The Highlands Coalition's mission is the protection of an area of high ground stretching across four states: From the Massachusetts/Connecticut border in western Connecticut, south and west across the Hudson River in New York State in the area of West Point, across all of northern New Jersey, and in Pennsylvania from the Delaware River at Easton southwest to the Maryland border in Adams and York counties. This high ground encompasses the geologic New England physiographic province in addition to the hills that run from Reading southwest to the area of Hanover. It is predominately forested and provides habitat and migration corridors for animals and birds. In addition, it contains hundreds of historic sites as well as being the source of drinking water for millions of people, especially in the cities of northern New Jersey. It is within driving distance of less than an hour for people in the New York to Philadelphia corridor and is heavily used by people for recreation and scenic enjoyment.

The groups and organizations forming the membership of the Highlands Coalition began to come together over a decade ago in New Jersey, and then expanded to the other three states. They recently created a 501(c)(3) non-profit organization which has an executive director and other staff. Each state has its own organizational committee. The organization receives support from private foundations via grants, and receives substantial support of both staff and money from regional, statewide, and multi-state organizations.

The Highlands region has been recognized as "a landscape of national significance," by the U. S. Forest Service and as a "Special Resource Area" by the state of New Jersey. The Highlands Coalition, established in 1988, seeks to protect and enhance the sustainability of natural and human communities in the Highlands region of Pennsylvania, New Jersey, New York, and Connecticut. The coalition is comprised of more than 110 local, state, regional, and national conservation organizations and is working to protect and connect the "Critical Treasures of the Highlands," and to ensure smart and sustainable growth in the region. At the federal level, the coalition is working to secure federal funding for land protection in the Highlands through existing programs, such as Forest Legacy, and through passage of the Highlands Stewardship Act. At the state level, work is being done to increase state funding for land protection in the Highlands and to foster more regional approaches to planning for, and managing growth in, the region. At the local level, work is conducted with citizens groups to fend off unwise and unwanted developments that threaten the Highlands' resources.

As shown on Map 1, the Highlands Region extends across the southern portion of the Lehigh Valley and includes the South Mountain Preserve. Extensive efforts are being made to protect natural resources in this Region.



Berks-Lehigh Valley Greenway Task Force

The Berks-Lehigh Valley Greenway Task Force was created – and is chaired by – the Pennsylvania Department of Conservation and Natural Resources’ Bureau of Recreation and Conservation (DCNR). Its membership includes any conservation organization, municipal entity, institution, or individual interested in greenway and trail development in the Berks County/Lehigh Valley region.

The mission of the task force is to coordinate and facilitate federal, state, county, and municipal planning and implementation of greenways in Berks, Lehigh, and Northampton counties. It seeks to identify existing and potential projects in the region and to provide guidance in planning and implementation, as needed. It provides information on the availability of funding, technical assistance, and other resources. It reviews projects and concepts that are potential models for advancing greenways and conservation goals in the area. It explores the availability of DCNR’s technical and staff resources for current and future planning activities (Wildlands Conservancy, 2004).

The Preserve is clearly located within various greenways – regionally and locally – as shown on Map 3. Besides the Highland Region, the Preserve is part of the South Mountain range which provides recreational opportunities for families and individuals of all ages and abilities while accentuating the scenic beauty of the area. Additionally, the band of woodlands that exists on the South Mountain range acts as a wildlife corridor, protects water resources, and is beneficial for health and wellness for individuals of all ages.

Existing Trails

There are several miles of trails, many of which are old logging and mining roads (Map 4). These loop through the Preserve, connect to trails that exist on the rest of the Robert Rodale Reserve, and connect to trails on adjacent, private property. Efforts have been made to terminate the trails at the borders of privately-owned property. 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).

Two Pennsylvania Power and Light (PPL) rows transverse the Preserve, running basically north-south and east-west. These act as additional trails for bikers, hikers, and motorized vehicles. (See more about trails under ‘Recreation.’)

Geology

South Mountain has a fascinating and diverse geological history derived from tectonics, glacial, and weathering processes. The landscape on South Mountain reveals the geological evolution of eastern North America.

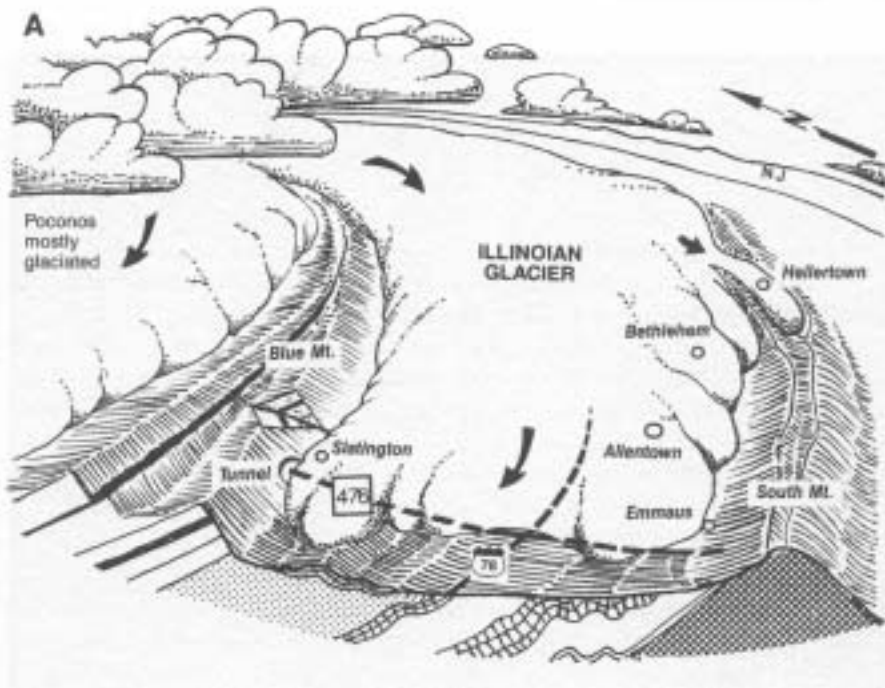
Approximately 450 and 250 million years ago, in a time known as the Paleozoic Era, the Atlantic Ocean did not exist, and instead, there was a more narrow sea called Iapetus. The Iapetus Sea was bordered on one side with North America and Africa on the other. During most of the Paleozoic Era, North America, Africa, and Eurasia slowly, but steadily, moved toward one

another, closing the Iapetus Sea. As these three continents drew closer, the crust was repeatedly crumpled and uplifted to form mountain ranges. The Iapetus Sea finally closed completely about 250 million years ago, resulting in a head-on collision between eastern North America and northwestern Africa. This caused a major shortening of the crust and rocks moved horizontally, stacking up on top of one another. The result was a youthful Appalachian Mountain chain, of which the Blue Mountain, Lehigh Valley, and South Mountain are a part.

The South Mountain range (a/k/a the New England Province, the Reading Prong, and Lehigh Mountain) is composed of crystalline rocks, such as granite, gneiss, and quartzite, which are approximately one billion years old. The rocks are derived from far to the southeast, perhaps as far away as Philadelphia. They were pushed to the northwest into their present location because of a low-angle fault called a “thrust fault.” They sit on top of limestone and shale that is much younger at only about 450 million years old. The crystalline rocks are hard, more difficult to erode, thus leaving them topographically elevated. In contrast, the thick vegetation and wet climate of Pennsylvania work to efficiently dissolve the limestone that underlies the crystalline rocks, and therefore these rocks are at lower elevations.

The northwestern flank of South Mountain is where an ancient glaciation terminated. Evidence of that glaciation is present along South Mountain as a delta that flowed into a proglacial lake. One of the best pieces of evidence for glaciations in Pennsylvania lies on South Mountain in the form of a river delta that built out into a former glacial lake.

In the last approximately 2.5 million years of the Earth’s history, the climate has been relatively cold. At least seven or eight times within that period, “ice ages” have occurred when enormous ice sheets grew in eastern Canada and flowed south into Pennsylvania. About 150,000 years ago the Illinoian ice age arrived and receded in the Lehigh Valley.



Glaciation in the Lehigh Valley (Halma, Robert and Oplinger, Carl S., 2001)

As the glacial ice flowed southwest into the Lehigh Valley toward what is now Allentown, it completely covered the Lehigh River. More importantly, it banked up against the northwest flank of South Mountain, and completely blocked the path of any river or stream trying to flow north into the Lehigh River. The Little Lehigh Creek is one such north-flowing tributary that had its path completely blocked by the wall of ice in the Lehigh Valley. A lake formed in the valley of the dammed Little Lehigh Creek. The lake level rose steadily and fixed at about 460 feet above sea level because a small, marginal ice channel formed and provided an outlet through which the lake could drain. The beginning of that channel was located where the present town of Topton is today, and ran south, ending at the base of the South Mountain northeast of Emmaus. The channel delivered a point source of sand and gravel to the glacial edge of the lake, resulting in a delta. The top of the delta was at about 460 feet, consistent with the spillway elevation at Topton. The lake drained as the ice retreated, and the delta remained along the mountainside as a pile of sand and gravel. Later removed and utilized for the building of roadways, only a fraction of the original sand and gravel piles remain (Pazzaglia, 2002; Iobst, 2004; Loehr, Charles R., 1977; Miller, Benjamin L., 1941; and Schlenker, Pamela, 1978-79).

Geologically, the receding glacier left some of the oldest boulders in Pennsylvania. These 1 billion year old boulders on the South Mountain Preserve are considered a National Landmark as a natural area and referenced in many books. Currently, the boulders are often used for boulder climbers, especially those new to the sport.

Soils

Soils data obtained from the Lehigh Valley Planning Commission lists 15 different soil types of varying slopes and qualities underlying the South Mountain Preserve (Map 5).

Clarksburg

Clarksburg Silt Loam, 0 to 3 percent slopes

Clarksburg Silt Loam, 3 to 8 percent slopes

Gladstone (formerly called Chester)

Gladstone Gravely Silt Loam, 0 to 8 percent slopes, very bouldery

Gladstone Gravely Silt Loam, 8 to 15 percent slopes, very bouldery

Gladstone Gravely Silt Loam, 8 to 25 percent slopes, very bouldery

Gladstone Gravely Silt Loam, 25 to 55 percent slopes, very bouldery

Hazelton

Hazelton Very Channery Loam, 8 to 25 percent slopes, extremely stony

Hazelton Very Channery Loam, 25 to 60 percent slopes, extremely stony

Laidig

Laidig Very Gravelly Loam, 8 to 25 percent slopes, extremely stony

Murrill

Murrill Gravelly Loam, 8 to 15 percent slopes

Thorndale-Penlaw

Thorndale-Penlaw Silt Loams, 0 to 3 percent slopes

Urban Land - Duffield Complex

Urban Land - Duffield Complex, 0 to 8 percent slopes

Washington

Washington Silt Loam, 3 to 8 percent slopes

Udorthents

(no description available)

Quarries

(no description available)

The following descriptions are taken from the *Soil Surveys of Lehigh and Northampton Counties*:

Clarksburg Series – The Clarksburg series consists of deep, moderately well drained, nearly level to gently sloping soils that formed in material weathered from limestone, “cement rock,” and small amounts of shale. These soils are in drainage ways and on lower toe slopes, and have a predominately southern exposure.

Chester gravelly silt loam – Chester loams is well-drained silt and silty clay loams that is 4 to 10 feet thick and underlain by glaciated granite, granitic gneiss, and schist. Variable amounts, as much as 35 percent, of pebbles 1 to 3 inches in diameter are on the surface and throughout the profile. The very stony areas have many cobbles and boulders that range from 3 inches to 4 feet in diameter. The depth to seasonally high water table is usually greater than 3 feet, and the depth to bedrock is 4-20 feet.

Brandywine silt loam – Brandywine loam is well-drained to gravelly sandy and is 1 to 3 feet thick. It generally resides on uplands which are underlain by granite and gneiss. Some areas contain up to 30 percent cobbles and some boulders. The depth to seasonally high water table is greater than 3 feet, and the depth to bedrock is to 1-3 feet.

Fleetwood gravelly loam – Fleetwood loam is well-drained gravelly and very stony that is 3 to 5 feet thick and underlain by sandstone and quartzite. The very stony soils have large boulders on the surface and throughout the profile. Generally, the depth to seasonally high water table is greater than 5 feet, and the depth to bedrock is 3-5 feet.

Topography

The topography of the Preserve reflects the underlying geology and consists largely of moderate to steep slopes, with an area of gentle-to-moderate slope along the western edge. The ridge of the South Mountain Range runs basically northeast-southwest through the Preserve (Map 6).

Slope

The slope of the land influences the amount of precipitation that pools on the land surface, infiltrates into the ground water, or runs off the land surface as overland flow to surface water. When all other factors are the same, precipitation infiltrates into the subsurface in areas characterized by low slope, and runs off land surface in areas characterized by high slope. Map 6 clearly illustrates that the majority of the land is moderately steep to very steep and with over half of it very steep. The runoff from a storm event quickly drains into the small streams and tributaries that eventually empty into Trout Creek. Springs add to the run-off as well, and the permanent stream courses have water in them year-round.

Hydrology

The Preserve lies within the Little Lehigh Creek and Saucon Creek watersheds, which are, in turn, in the Lehigh River and Delaware River watersheds. Due to the ridge line that is the dividing line between the two smaller watersheds and runs northeast-southwest through the Preserve, the Little Lehigh watershed lies to the northwest and the Saucon Creek to the southeast.

The term “wetland” describes, in a collective way, what are more commonly known as marshes, bogs, swamps, and wet meadows. Wetlands are vegetated by grasses, sedges, rushes, and other herbaceous plants which emerge from the water or wet soil surface. Wet meadows are areas adjacent to springs and streams where the ground is moist throughout the year. The vegetative characteristics of wet meadows are skunk cabbage and grasses. Wet environments, together with large amounts of nutrients, often result in an abundance of vegetation. Due to their great productivity, wetlands are rich with diverse species, a phenomenon known as biodiversity.

Wetlands also function to improve and purify water quality, add to a healthy environment, and aid humans in a variety of ways. Often called ‘nature’s sponge,’ wetlands help control flooding.

The wetland types on the Preserve are seasonal forest pools as well as numerous permanent and intermittent stream courses. The seasonal forest pools include naturally-occurring and man-made pools, with the man-made pools being remnants of mining. The majority of the manmade pools are located along Quarry Trail.

Table 2 Wetland Types on South Mountain Preserve	
Wetland Type	Location
Permanent fishless pond (result of past quarrying operations)	GPS coordinates N40o 32.859' W075o 28.671', elev. ca. 185 m, (Accuracy ca. 7.5 m)
Seepages	in several spots throughout the site, but the greatest concentrations are close to the stream courses on the western slopes and along the power-line cut.
Seasonal Forest Pool #1, a shallow, spring-fed pool	in a small but steep ravine (most likely the result of past quarrying operations) - GPS coordinates N40 32.663 W075 28.715, elev. ca. 151 m, (Accuracy ca. 7.5 m)
Seasonal Forest Pool #2 is the most ephemeral of the seasonal forest pools found on site. In wet years, it will hold water over two meters in depth; in drier years, it will have a short or no hydro-period.	GPS coordinates N40o 32.887' W075o 28.596', elev. ca. 186 m, (Accuracy ca. 6 m)
Seasonal Forest Pool #3 is the second smallest pool on site	GPS coordinates N40o 32.909 W075o 28.611, elev. ca. 190 m, (Accuracy ca. 6 m)
Seasonal Forest Pool #4	GPS coordinates N40o 33.005 W075o 28.572, elev. ca. 177 m, (Accuracy ca. 6 m)
Seasonal Forest Pool #5	northern border of the property - GPS coordinates N40o 33.046 W075o 28.568, elev. ca. 174 m, (Accuracy ca. 6 m)
Stream courses (both permanent and intermittent)	on the western side and power-line cut

(Brandon M. Ruhe & Associates LLC)

Municipal Zoning

The Preserve spans three municipalities, Emmaus Borough, Salisbury Township, and Upper Saucon Township, each having a unique set of zoning definitions. In Emmaus Borough, the Preserve is zoned Conservation – Residential; in Salisbury Township it is also largely zoned Conservation – Residential, with a small area on the southern portion zoned Rural Residential; and in Upper Saucon Township it is zoned South Mountain Conservation (Map 7.) Although bearing different names, all of the zoning includes the protection of conservation values.