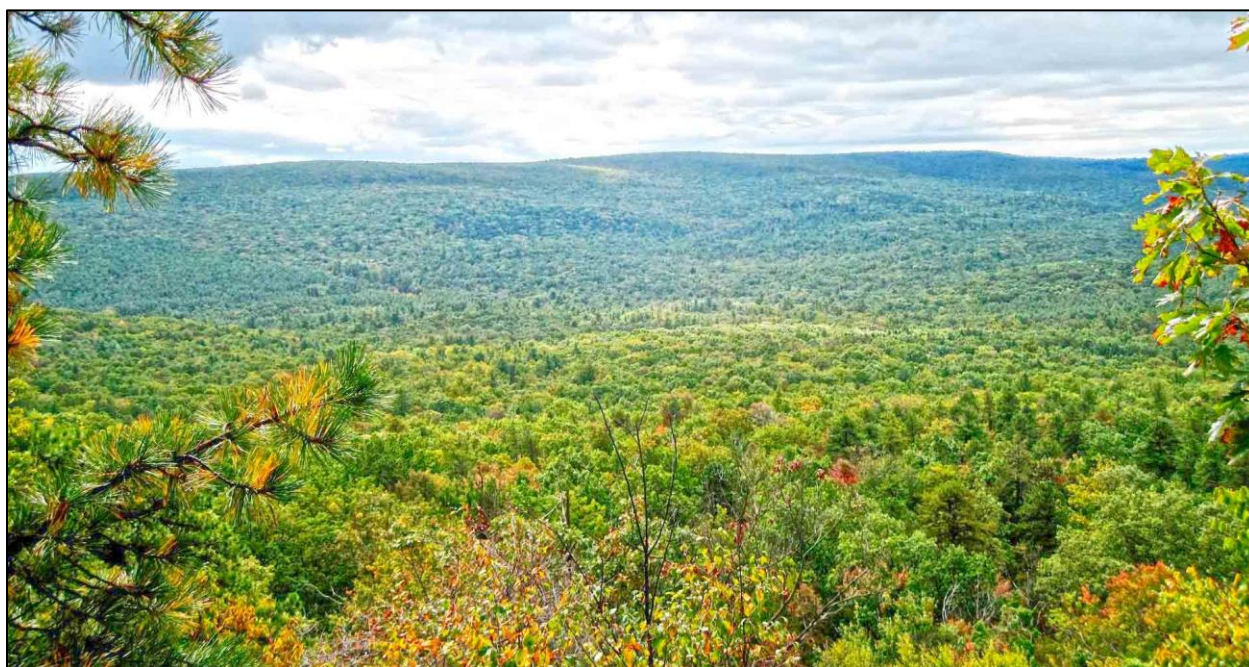


# Michaux State Forest

## Resource Management Plan



The state forest system of Pennsylvania, approximately 2.2 million acres of forest land, comprise 13 percent of the forested area in the commonwealth. The Bureau of Forestry is the steward of this land, and part of the bureau's mission is to manage state forests under sound ecosystem management, to retain their wild character and maintain biological diversity while providing pure water, opportunities for low-density recreation, habitats for forest plants and animals, sustained yields of quality timber, and environmentally sound utilization of mineral resources. In 2016, the bureau revised its State Forest Resource Management Plan (SFRMP), which is the primary instrument that the bureau uses to plan, coordinate, and communicate its management of the state forest system. The SFRMP sets forth broad policies, as well as more focused goals and objectives about state forest resources and values, to ensure that the overarching goal of state forest management – ensuring sustainability – is achieved.

State forest management is a coordinated effort involving central office program areas and field staff in 20 forest districts located throughout Pennsylvania. Each district is responsible for managing wildland fire, destructive insects, and disease on all lands throughout the district – public and private. The district staff promote wild plant conservation and private forest land conservation and stewardship. The staff also provide for the protection, administration, and management of state forest lands within the district.

This Michaux State Forest Resource Management Plan provides an overview of the district and its operations on state forest land and sets forth a framework for future management of Michaux State Forest. The planning horizon for this District SFRMP is approximately 5-10 years, after which time it will be revised to reflect changing conditions and priorities.

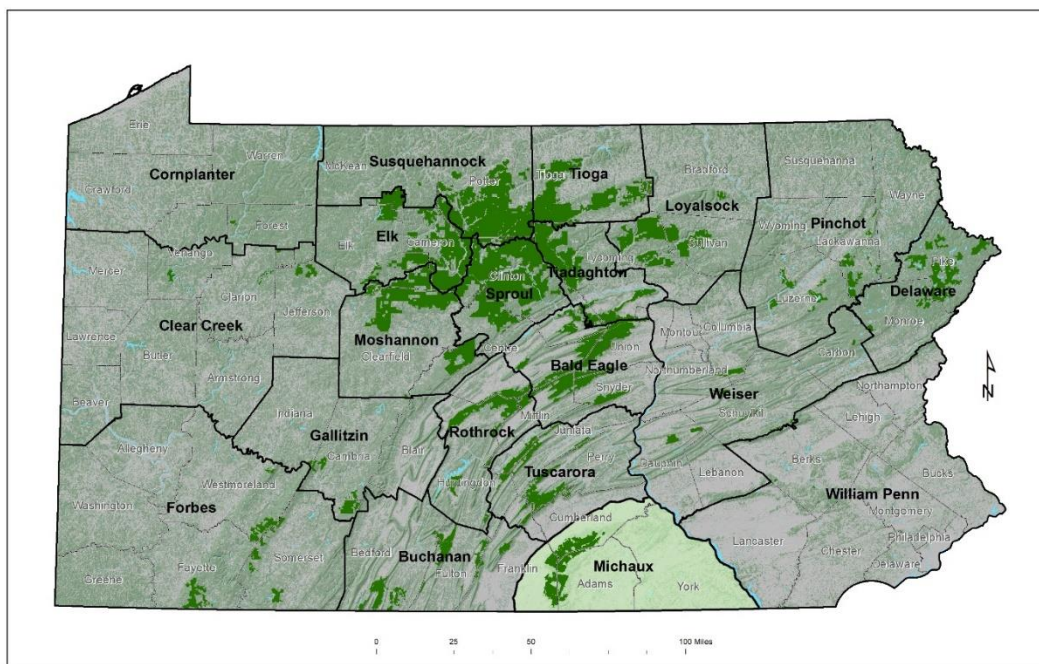
The bureau also creates District Activity Plans that describe the management activities the bureau will take within each district that may affect the public's use of state forest land. These are implementation plans that address how goals and objectives in the SFRMP and District SFRMPs are being achieved. The District Activity Plans are written at the start of each calendar year and revised mid-way through the year. They are posted on District webpages so that the public may review and comment upon them.

This Michaux SFRMP is comprised of a District Overview, a listing of District Priority Goals, and a collection of landscape management unit (LMU) plans, which are described further below.

## District Overview

### 1) Location and Description

The 87,480-acre Michaux State Forest is in south-central Pennsylvania with acreages in Adams, Cumberland, and Franklin Counties. Contained in a largely contiguous block, it represents a forested land mass roughly six miles wide and extends 36 miles northeastward from near the Pennsylvania/Maryland border. The Michaux State Forest lies midway between Gettysburg and Chambersburg, Pennsylvania and about 40 miles southwest of Harrisburg, Pennsylvania. It is approximately 1-1½ hours drive northwest of the Baltimore–Washington, DC metropolitan area and is easily accessed from Interstates 81 and 76 (Pennsylvania Turnpike), U.S. Routes 15 and 30, and Pennsylvania Routes 233 and 997.



**Figure 1-1.** Location of Michaux Forest District with state forest land (dark green).

The Michaux State Forest was named in honor of two French botanists, Andre Michaux and his son, Francois Andre Michaux. Andre and Francois Michaux traveled extensively throughout North America in the late 1700's identifying and cataloging much of the native flora. They left a legacy of \$2,000 to the Philadelphia Philosophical Society to promote forest conservation. This legacy was used by Dr. Joseph Rothrock to promote public awareness about forest conservation in Pennsylvania, an educational effort which solidified the public support necessary to develop the nation's first publicly owned forest system. Table 1-1 shows a summarized land acquisition history for the Michaux forest district.

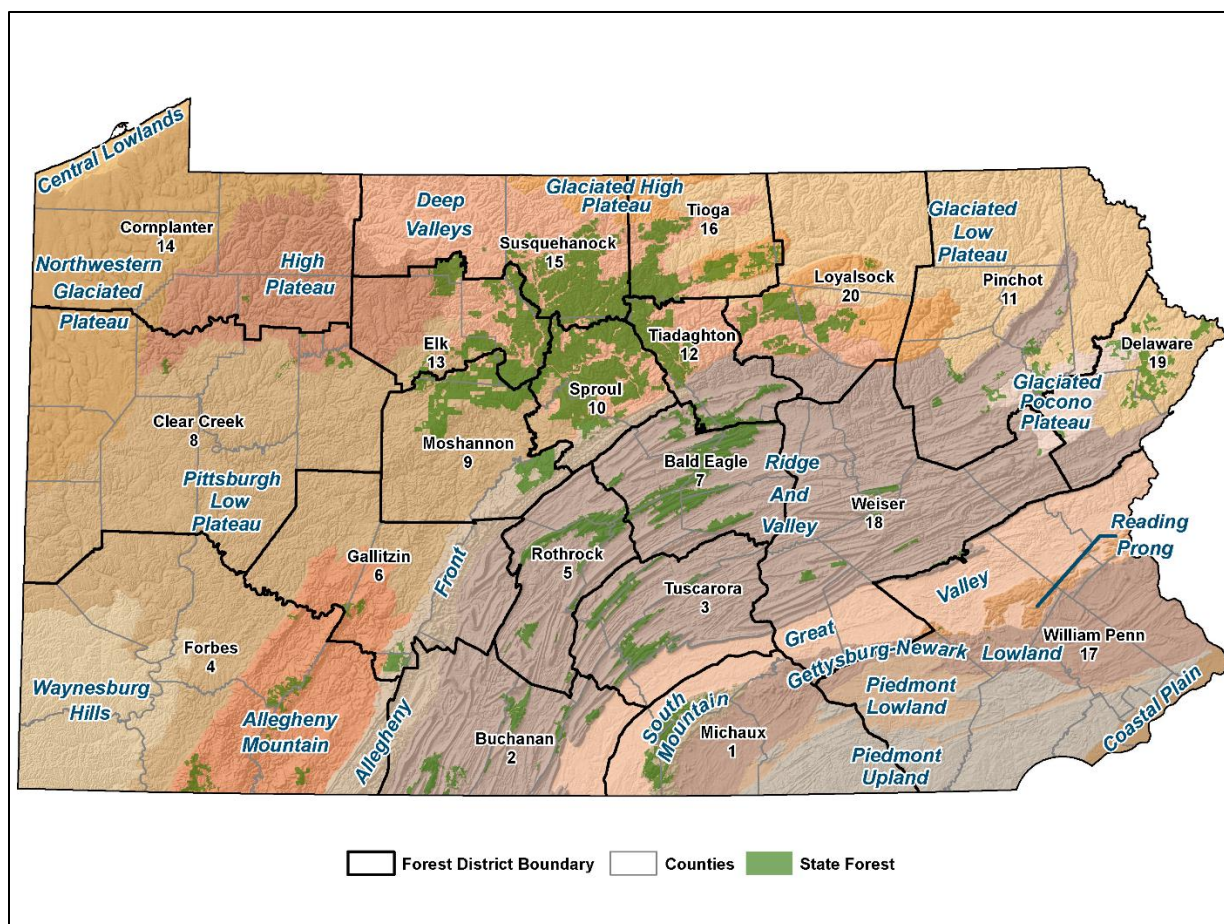
**Table 1-1.** Land acquisition history for Michaux.

Year	Acres	Seller
<b>1902</b>	558	James Dull
<b>1902</b>	17,935	Mont Alto Iron Company
<b>1902</b>	13,704	Caledonia Mining and Manufacturing Company
<b>1912</b>	16,864	South Mountain Mining and Iron Company
<b>1913-1930</b>	small, variable	variable
<b>1931</b>	4,000	Reading Company
<b>1932</b>	5,400	Deer Park Land Company
<b>1932-2007</b>	small, variable	variable
<b>2007</b>	XXX	Glatfelter Company
<b>2015</b>	1,100	Glatfelter Company
<b>2016</b>	484	Strawberry Hill Nature Preserve

## 2) The Geology and Eco-Regional Context of Michaux State Forest District

The opportunities and challenges confronted by forest managers are largely determined by regional factors shaped by geology and climate. Long term interactions between rocks and the soil types they produce, water, temperature, and weather shape the range of life forms supported by a biological system, and the way those life forms are distributed and sustained over time across the landscape. Underlying geology also determines the types of above and below ground resources available for human use within a landscape and therefore also figure prominently in determining past, current, and likely future human dependencies and land use practices that influence forests and other biological communities at landscape and regional scales. The Michaux State Forest district spans five distinct eco-regions ranging from the Great Valley along the northwestern border of the district and ranging across the South Mountain, Gettysburg Newark Lowland, Piedmont Lowland, and Piedmont upland as you move eastward across the district.





**Figure 2-1. Pennsylvania Ecological Regions.** South Mountain Ecoregion is located in the southcentral part of the state.

The Michaux State Forest lies on South Mountain, which is the northern terminus of the Blue Ridge Physiographic Province and forms a unique eco-regional context within Pennsylvania that is more like the geology and forest types ranging far to its south than it is to other forested areas just north of it across the floor of the Cumberland Valley.

While forest cover is scattered across the other five ecoregions within the district in both ridgetop and low-lying areas not suitable for other land uses, the South Mountain eco-region is predominantly forested and represents a functional bio-reserve for forested species and ecosystem functions within the eco-regions and landscapes surrounding it.

The South Mountain rises steeply from the limestone floor of Cumberland Valley to the west, and the gently rolling hills of Buchanan Valley to the east. The highest elevation in the forest (2,100 feet) occurs at Big Flat about five miles north of Caledonia State Park. The lowest elevation in the area is 675 feet near the town of Scotland.

On South Mountain, the individual northeastward trending ridges are separated by narrow, somewhat discontinuous valleys with slopes that average three to 15 percent. However, slopes of 20 to 30 percent are not uncommon along the flanks of many of the deep V-shaped stream valleys.

### *Geology overview*

The underlying rock formations of the Michaux State Forest are quite unusual and different from most other state forests due to their volcanic origin. The South Mountain geology contains some of the oldest rocks found within the state. The age of some rocks exposed on the surface in the district may be over one billion years and would be found at depths of 20,000 to 30,000 feet below the surface in Clinton County, suggesting that at one time the South Mountain probably consisted of a mountain range thousands of feet high. The core of this mountain is composed of Precambrian volcanics and rimmed by quartzite ridges of Cambrian Age. To the west of South Mountain is located the Great Valley whose floor is composed of Cambrian and Ordovician carbonates and Ordovician shales.

The oldest rocks in the Michaux State Forest belong to the Precambrian Catoclin Formation. These rocks have been described as greenstones, but more specifically, the formation is composed of ultravolcanics, which contain red to purple, finely laminated rhyolitic lava flows, and metabasalt, which contains the minerals chlorite and epidote.

The major portion of the Michaux State Forest contains rocks which belong, in ascending order, to the Weverton, Harpers, and Antietam Formations. These beds consist primarily of quartzitic sandstones and conglomerates. The Harpers Formation also contains dark banded schists and slates. The quartzites are generally white to gray in color and contain zones of gray feldspathic sandstone.

The next younger beds are dolomitic limestones and limestones belonging to the Tomstown Formation. These beds are present in the valley along and adjacent to South Mountain. Some silty dolomites are also present. Outcrops of this formation are scarce within the valley because of thick soil and gravel cover. The Triassic redbeds, also located in the Michaux, are some of the youngest rocks found in the state.

### *Human use context*

Human use of the mineral resources produced by the geology of the South Mountain have played a role in shaping the landscape ecology of the region. From Native American tribes who practiced agriculture in the Susquehanna river valley and quarried rhyolite on the Big Hill Caldera, to the fuelwood cutting of the iron industry era, humans have shaped the living landscapes on South Mountain in no small part through their use of the rocks below it. Current uses of South Mountain geology include quarries for sand, gravel, shale, and metabasalt along the forests edge which provide critical jobs and economic benefits within the local communities.

The age and complexity of South Mountain geology and the availability of rocky outcroppings that help tell the story of the rock and soil layers both in the surrounding valleys and still lying below the forest make it a critical educational resource to surrounding schools and universities. It also circumscribes, to a large extent, the types of forests and biological communities that will thrive within this particular eco-

region, the way these forests have been used in the past, and the types of issues and challenges confronting current forest management decision making.

### 3) Eco-regional Forest Types

The Michaux State Forest lies in the oak-pine and oak-hickory forest type groups, defined by the USDA Forest Service. Oak species, including chestnut, scarlet, northern-red, black, and white oak, along with yellow-poplar dominate the lower slopes. A white pine-hemlock forest type is found along some streams, while a mixed oak-pitch pine forest type is common on dry ridge top sites and southwest facing slopes. Red maple, sweet (black) birch, black gum, and hickory are common associates in all the forest types. Small patches of remnant scrub oak, pitch pine, and heath barrens communities occur on high heat index sites (S, SW aspect on or above steep inclines) and at higher elevations (1800' and greater), and around geologic outcroppings and screes along ridges.

Over the past century of fire suppression and gypsy moth defoliation, many of these endemic and once ubiquitous fire mediated community types have been significantly reduced in overall landscape level dominance and transitioned into other community types dominated by high vascular density stands of gum, red maple, and sassafras with a dense, senescent understory of laurel.

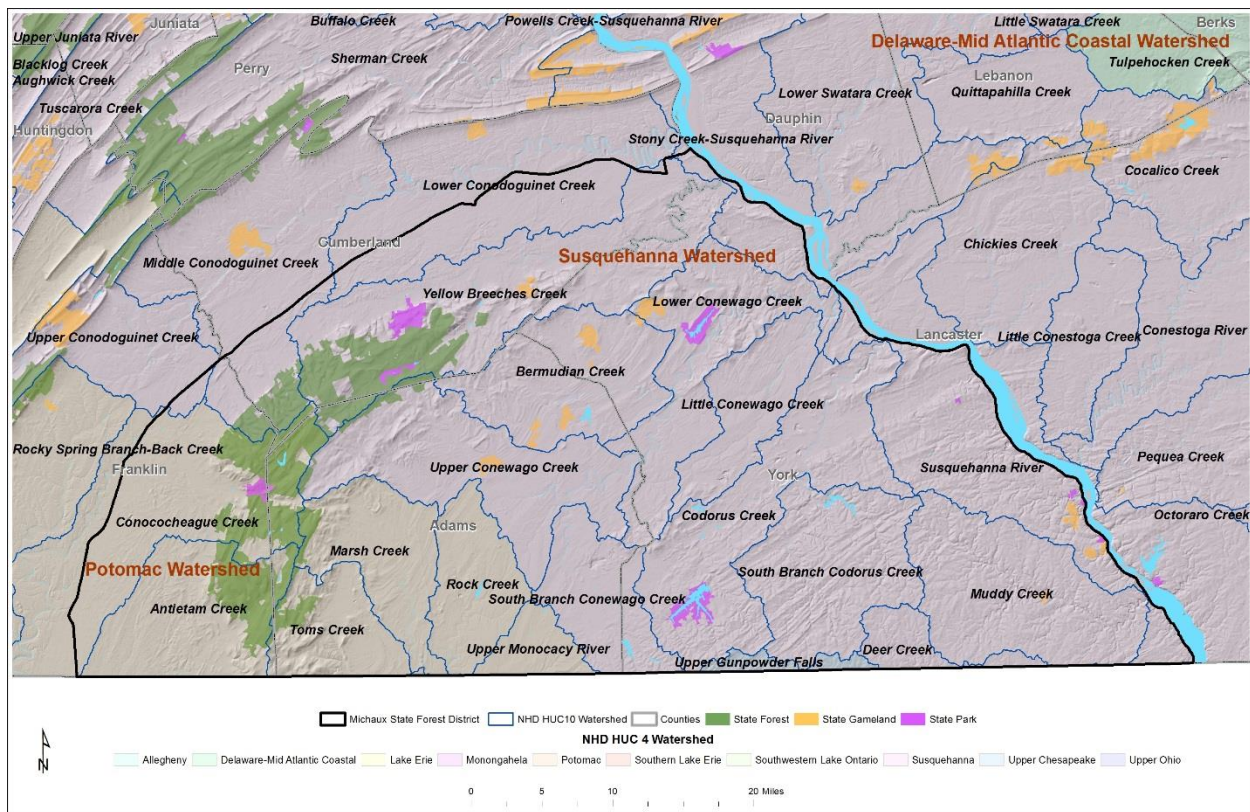
On better growing sites, the high degree of forest fragmentation and intense anthropogenic presence around the forest edge have exposed the Michaux and its surrounding private forest landscapes to a wide range of invasive exotic plant species that complicate managers' prescriptive abilities to predict long term forest trends in almost any community type given the continuous interaction with non-native flora present at both stand and landscape levels.

### 4) Watersheds

The Michaux State Forest lies within two major watersheds: the Potomac River Basin (Potomac River Sub basin) and the Susquehanna/Chesapeake Basin (Lower Susquehanna River Sub basin). Both river systems drain into the Chesapeake Bay, a vitally important ecological and economical resource in the mid-Atlantic region. Additional information on water resources of the Michaux State Forest is found in the Water section of the Michaux State Forest Supplement.

Protecting the headwaters of major river drainages was a strategic priority in the creation of the state forest system, and the Michaux continues to play critical watershed protection roles for both these major river drainages, and the surface and groundwater systems local communities depend on for potable water.





**Figure 4-1.** Map of major (Hydrologic Unit Code 4) and minor (Hydrologic Unit Code 8) watersheds within entire district. 40,412 acres of the Michaux State Forest are drained by numerous small watersheds flowing into the Susquehanna River, while 47,068 acres drain to the Potomac River.

## 5) Historical Land Use and Disturbance

### *Forest Type of the Michaux State Forest Upon European Settlement*

According to Lucy Braun's *Deciduous Forests of Eastern North America* (1950), on the northern end of the Blue Ridge the "general slopes originally supported an oak-chestnut forest, interrupted on ravine slopes by mixed forests, or in sheltered ravines, by hemlock, or hemlock-white pine communities" (p. 223). The mesophytic valleys were dominated by hemlock, white pine, tulip-tree, and white oak; whereas, white oak and red oak with pine and hemlock formed "a transition community on the lower slopes below the dry oak-chestnut upper slopes" (Braun, p. 223). However, little is known about the historic land use of the South Mountain region and forest types prior to European civilization that would have shaped or sustained these forests overtime.

Archeological evidence of rhyolite quarries and the abundance of arrowheads and artifacts found in areas of the Susquehanna river basin suggest a wide range of both extractive and cultural practices that

would have impacted forest communities at the site and landscape scale through their ecological interactions with the forest. Fire scar studies conducted to the north in the Ridge and Valley province suggest that many of the forest types within the Appalachian Mountain region prior to European settlement were at least somewhat fire mediated communities, with a periodic return interval for at least a light ground fire in most area forests averaging around 25 years prior to the 1600s, though with many ridgetop sites indicating a much higher frequency fire interval of between five-ten years.

Fire as a landscape level disturbance likely increased with the earliest advent of European settlement as early settlers emulated Native American practices to enhance game, fruit, mast, and browse production on lands too marginal to farm or graze while also using fire to clear land for agricultural purposes.

### *Post-European Settlement Biotic and Abiotic Influences*

#### *Early Harvesting*

Even prior to the intensive use of South Mountain forests to fuel the iron industry, it is quite likely many of the mountains forests would have already been harvested for high volume sawlogs to build the growing cities of America's eastern seaboard. The resulting second growth forest would have been primarily from species such as oak and chestnut that could coppice from stump and root sprouts; and it would have been these second growth coppice stands that provided such an attractive energy source for the fledging iron industry that became established at Mont Alto, Caledonia, and Pine Grove Furnace in the 1800's.

The condition of the timber on the Michaux State Forest in the early 1900s is documented in the department's semi-annual publication of that period, Pennsylvania Forestry Report. In a section of one of the early reports it states, "The original timber had all been removed between 1870 and 1885, and the young second growth was cut as soon as it became large enough to make a stick."

#### *Early Wildfires*

The oak-chestnut community, the predominant original forest type, developed into a chestnut, scarlet oak, and chestnut oak forest following the repeated cuttings. Wildfire was the first major event to affect this second growth hardwood forest. Severe wildfires repeatedly burned most of the mountainous areas from the 1890s through the 1930s, with extremely severe fires destroying vast acreages during the 1890s and in the years 1910, 1915, and 1930.

The entire Caledonia region was severely burned in the early 1900s. In 1915, the entire mountain range in the Pine Grove Furnace area burned from the Cumberland Valley to the upper end of Buchanan Valley. In addition to the forest loss, several buildings at Laurel Lake were destroyed in that fire. Characterized as a year of severe drought, much of the Michaux State Forest burned in 1930.



### *Chestnut Blight*

Introduced in 1911, the chestnut blight, which is a non-native disease of American chestnut trees, changed the forest forever. By 1920, the blight had infected every living chestnut tree, which were estimated to comprise about 40 percent of the trees in the forest at that time. The chestnut blight resulted in grossly understocked stands of predominantly scarlet oak and chestnut oak. Today, only small sprouts of American chestnut trees remain.

### *White-tailed Deer Browsing*

White-tailed deer were nearly extirpated from Pennsylvania in the early 1900s due to habitat loss and over-hunting. However, several factors allowed the deer herd to recover and quickly increase its population. The regenerating forest in the early 1900s provided ideal food and cover for the deer. Additionally, the “Buck Law,” which was passed in 1907 to protect does, enabled the deer herd to increase to a point where between 1920 and 1930 it caused considerable damage to the developing forest. Natural tree reproduction was over-browsed and plantations established during this period were almost total failures. Over-browsing by white-tailed deer has occurred to varying degrees throughout the Michaux since the 1930s. Since the early 2000’s, increased allocation of funds to ensure regeneration of commercial timber sale sites and an adaptive management program implemented by the Pennsylvania Game Commission to better balance deer abundance with available forest habitat have resulted in significant improvements to forest health and habitat quality though sustaining the appropriate balance between deer browse impacts and other plant and wildlife ecological needs continues to be a critical forest management challenge on the Michaux.

### *Insects*

During the past several decades numerous insect outbreaks have occurred the Michaux State Forest that further shaped the forest we have today. Sporadic attacks by the pit-making oak scale have resulted in scattered mortality in chestnut oak trees. The last serious scale damage occurred in the early 1950s when large numbers of chestnut oaks died. Surviving chestnut oaks often persisted but with deformed tops and reduced vigor; reducing the level of mast production and regeneration potential during a period of intense deer predation on both browse and hard mast.

Defoliating insects such as the forest tent caterpillar, leaf rollers, cankerworms, orange-striped oak worm, and gypsy moth have defoliated large areas of the forest during the past 40 years. Defoliation by the forest tent caterpillar was widespread throughout the forest in the mid-1950s and was particularly severe in the Old Forge and Pine Grove Furnace areas in 1958, 1959 and 1960. The orange-striped oak worm caused late summer defoliation periodically between 1950 and 1960.

The gypsy moth first appeared in the Michaux State Forest in the early 1970’s. The populations grew slowly until the early 1980s, when several thousand acres of state and private land were completely defoliated in the Pine Grove area. Gypsy moth populations continued to fluctuate with relatively large areas of mortality from defoliation events occurring in the late 80’s, and again between 2005-2008.

The hemlock woolly adelgid, which feeds on tree sap by attaching themselves to the base of hemlock needles, was introduced to North America in the mid-1920s from Asia and reached Pennsylvania in the

mid 1960's. Populations of the adelgid are well established in the southern portion of the Michaux State Forest and hemlock stands are in various stages of decline.

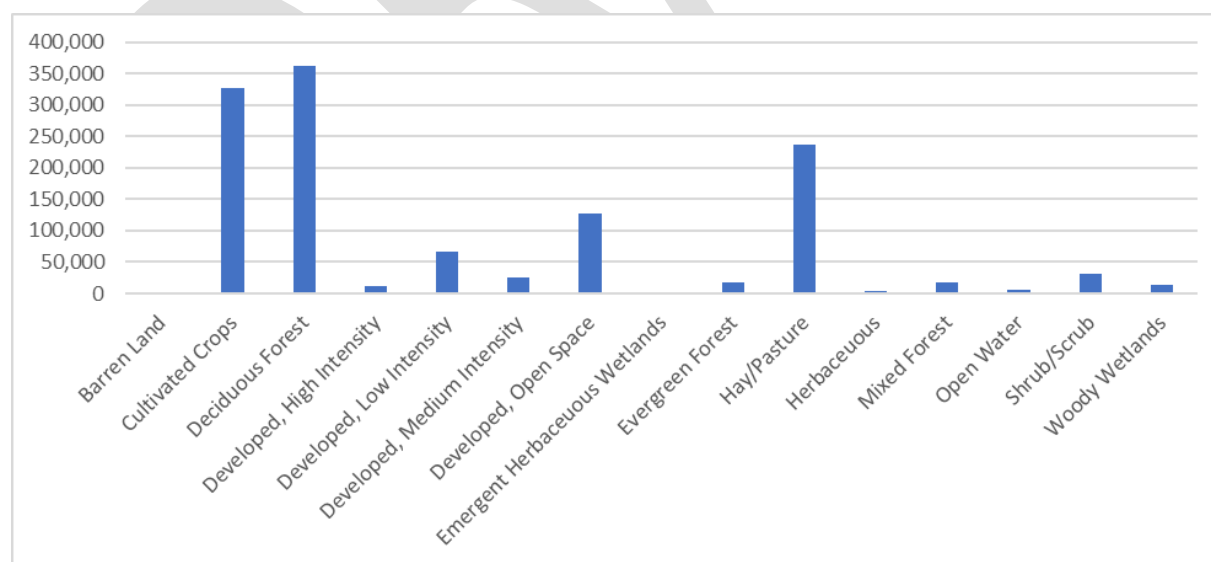
#### *Drought, Wind, and Ice*

Drought years occurred in 1930, and from 1962 to 1966, which is the driest period on record for this area. The five-year precipitation deficiency was approximately 50 inches. Droughts have continued to occur, but none as severe as the one during the mid-1960s. Scarlet oak seems to show the most serious reaction to the combination of drought and defoliation. During the late 1960s and early 1970s, scarlet oak trees declined and died over large areas of the forest.

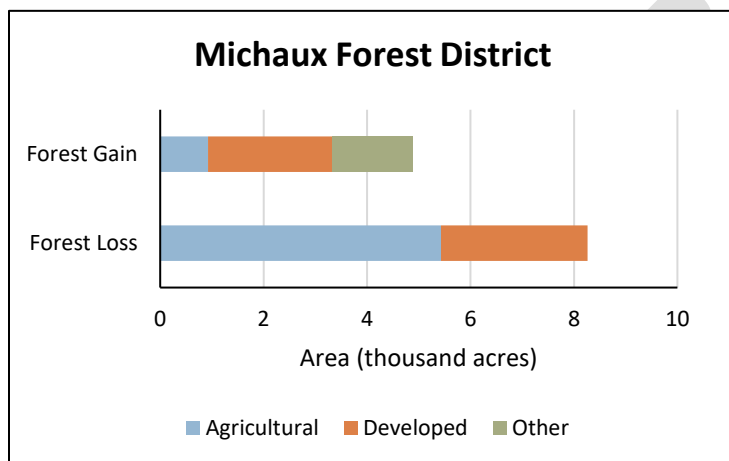
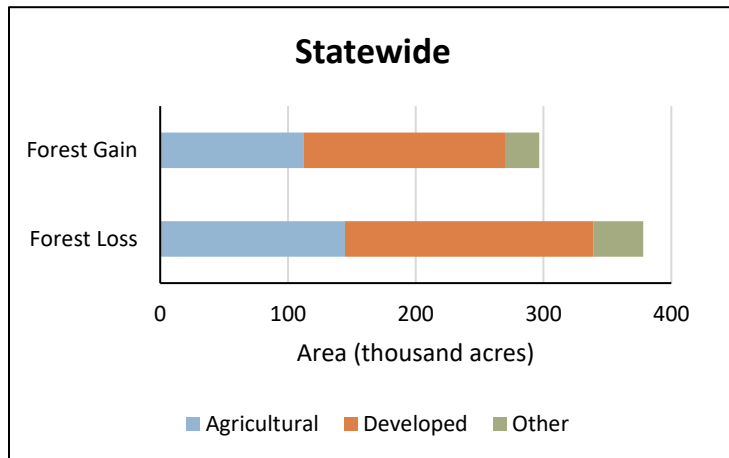
A severe wind and ice storm in March 1993 damaged or uprooted trees on about 8,000 acres of the Michaux State Forest. Some of the district's highest quality saw-timber stands were destroyed wholly, or in part. This material was salvaged over a three-year period and the resulting homogeneity of stands in a stem-exclusion stage poletimber forest of largely red maple and birch stands in this storm damage area represents a critical ecological bottleneck for many wildlife species.

## 6) Forest Cover Change and Forest Ownership

A critical understanding in forest management is that forests grow and change over time as interconnected, living systems. Through interactions with other vegetation cover types and land use practices, they provide the assorted benefits we value them for.



**Figure 5-1.** Acres of land cover types from National Land Cover Database for entire district.



**Figure 5-2.** Gross forest loss and forest gain 2011-2016 (based on US Forest Service FIA plot data: <https://www.fia.fs.fed.us/>) by land-use categories for (a) the entire state; and (b) within Michaux Forest District. The colors in *forest gain* represent the type of land cover FROM WHICH the forestland came (e.g. agricultural could be an old farm field that gained enough tree cover in that period to now be classified as forest). Similarly, colors in *forest loss* represent the categories TO WHICH forestland was converted (e.g. agricultural could be a forest that was cut and converted to pasture).

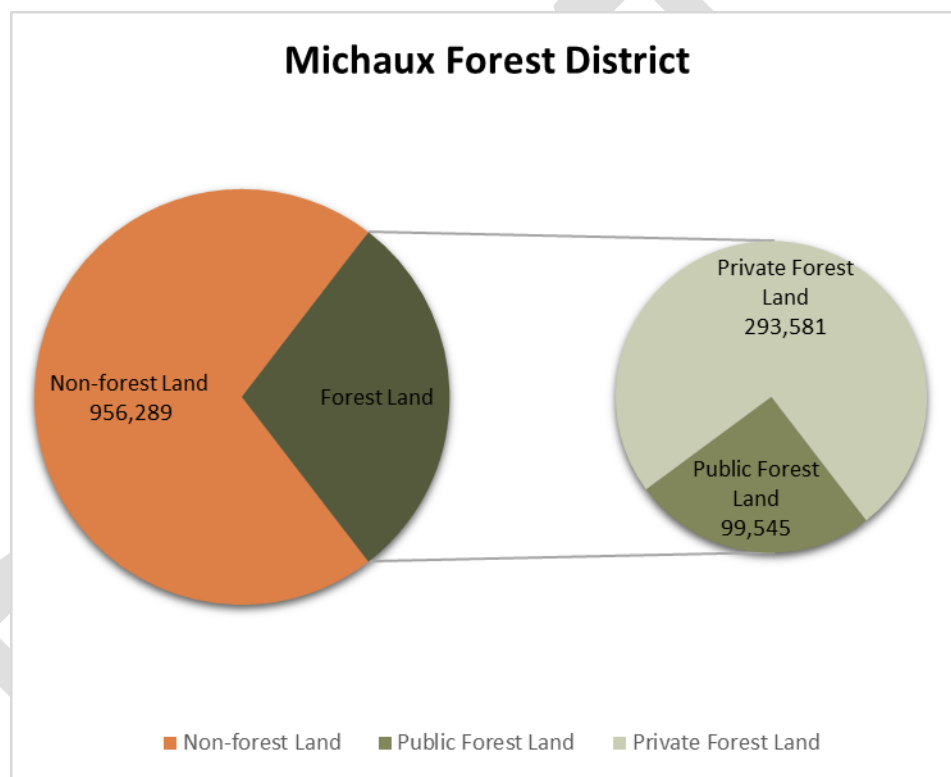
In the Michaux District, deciduous forests are still a dominating land cover, followed closely by agricultural cropland and hay/pastureland (Figure 5-1); however, many of the benefits of sustaining thriving and diverse forests accrue to the public in ways not directly supported by the marketplace. These come in the form of healthier streams, more wildlife diversity, and a more pleasing landscape aesthetic to live in and recreate on.

Therefore, market pressures, particularly in areas such as the Michaux District, with high levels of recreation and economic use pressures, tend to reward decisions that generally either erode forest productivity and diversity through unsustainable timber harvesting practices, or that result in converting

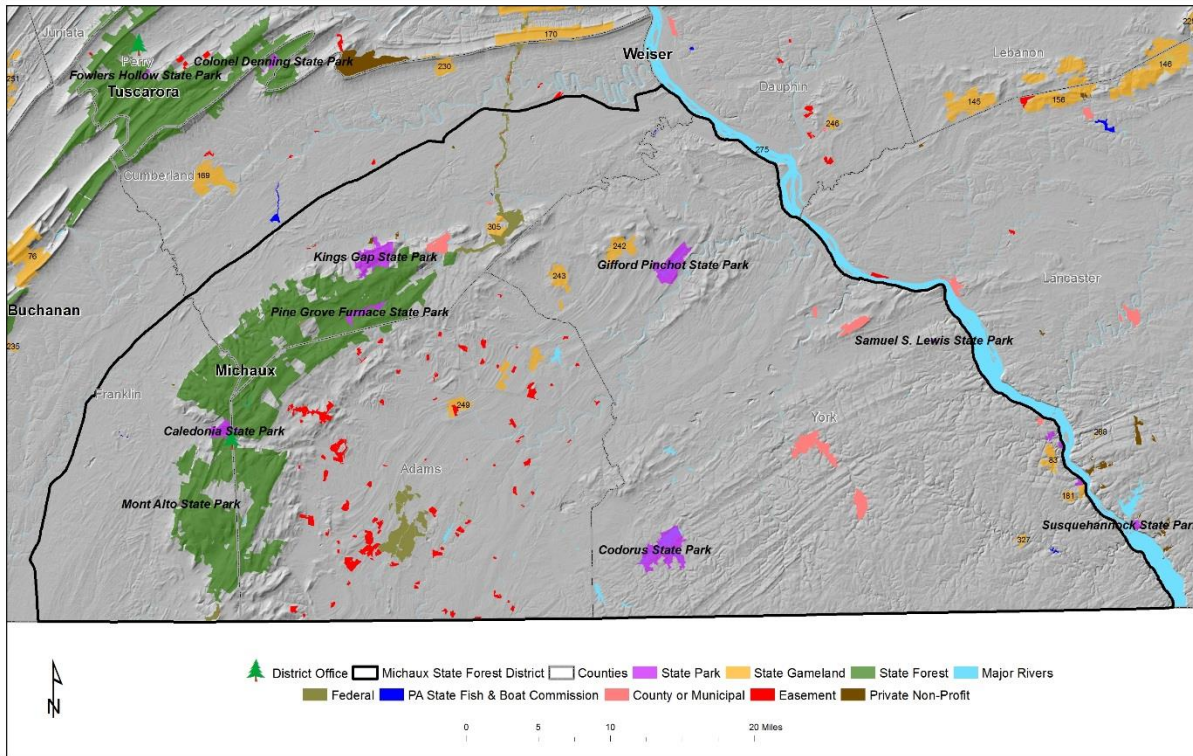


forested land cover to other uses such as agriculture or residential use. Figure 5-2 compares the rate of forest cover loss within the Michaux State Forest District to statewide averages.

Of the forest cover within the Michaux Forest District, roughly a third of the acres are contained within public lands comprised primarily of the state forest and state park lands, state game lands, and county and municipal parks (Figure 5-3). While the Michaux is by far the largest block of protected lands within the district, active local conservancies, particularly in Adams and Cumberland counties, have also protected significant acreages through conservation easements. This map demonstrates the importance of working with other partners invested in land protection, such as state and municipal parks and local conservancies, in demonstration and education around sustainable forest management practices and values (Figure 5-4).



**Figure 5-3.** Percentage of total acreage within Michaux Forest District that is forested vs. non-forested and the ownership breakdown of the forestland (public vs. private), (based on US Forest Service FIA plot data: <https://www.fia.fs.fed.us/>).



**Figure 5-4.** Public/protected lands within entire district.

## 7) Economy and Timber Products Industry

### *Local economy*

The economy of the area surrounding the Michaux State Forest is principally agricultural. Adams County leads the state in fruit production with apples and peaches the primary crops. Franklin County is second in apple production. Dairy, corn, forage crops, soybeans, small grains, and poultry are the other main agricultural products.

There are several small to medium size manufacturing plants located in the communities near the Michaux State Forest. Interstate 81 has attracted businesses along that important transportation corridor which has greatly supported the local economy.

### *Local forest products industry*

The local forest products industry consists of numerous small to medium size sawmills, firewood processors, and The Glatfelter Pulp Wood Company in Spring Grove. Gish Logging Inc. of Fort Loudon advertises as North America's largest producer of kiln-dried packaged firewood and bulk air-dried cut and split firewood, selling their product internationally. While high-grade timber is in demand, low-grade products such as railroad ties, pallet material, and structural timber form the backbone of the local forest products industry. Over the past management period, hardwood stumpage prices have risen slightly; concurrently, the demand for timber harvested from the Michaux State Forest has remained steady. Historically, the Michaux State Forest has been a consistent and steady supplier of hardwood

stumpage, which has undoubtedly had a somewhat stabilizing effect on the local forest products industry.

The Michaux State Forest will continue to provide a limited amount of high-quality hardwood timber over the next management period. However, lower-grade stumpage and pulpwood will increasingly comprise the bulk of the commercial products harvested. This is due to the increasingly higher proportions of lower-quality sites available for harvest. The pulpwood and firewood market has remained steady in recent years. However, market conditions can fluctuate considerably in a matter of months. A healthy pulpwood market is critical to managing many stands on the Michaux State Forest. In addition to Glatfelter, a pulpwood company in western Maryland has purchased numerous sales in recent years. The use of wood for fuel is common in the area, and probably will continue through the present management period. Thousands of cords are utilized annually. The district continues to be a leader in fuel wood sales within the bureau.

There is considerable advanced white pine reproduction in some of the stands recently harvested on the Michaux State Forest, suggesting that white pine has the potential to be a major component of the future forest.

The logging industry has an important, but difficult to measure, impact on the local economy. The number of local mills and logging companies has declined over the last management period. Experienced loggers can be a limiting factor in the local forest products industry, so training programs to develop newcomers would be an important component for this industry. A large initial capital investment can also be a real challenge for entrepreneurs in this field.

Timber produced on the Michaux is, and will continue to be, an important part of the local wood products industry. The average annual output of Michaux forest products over a five-year period from 2012 to 2016 includes 1271 thousand board feet, 3897 hundred cubic feet, and 1296 cords of firewood sold to the general public, with a total annual value of \$503,291.

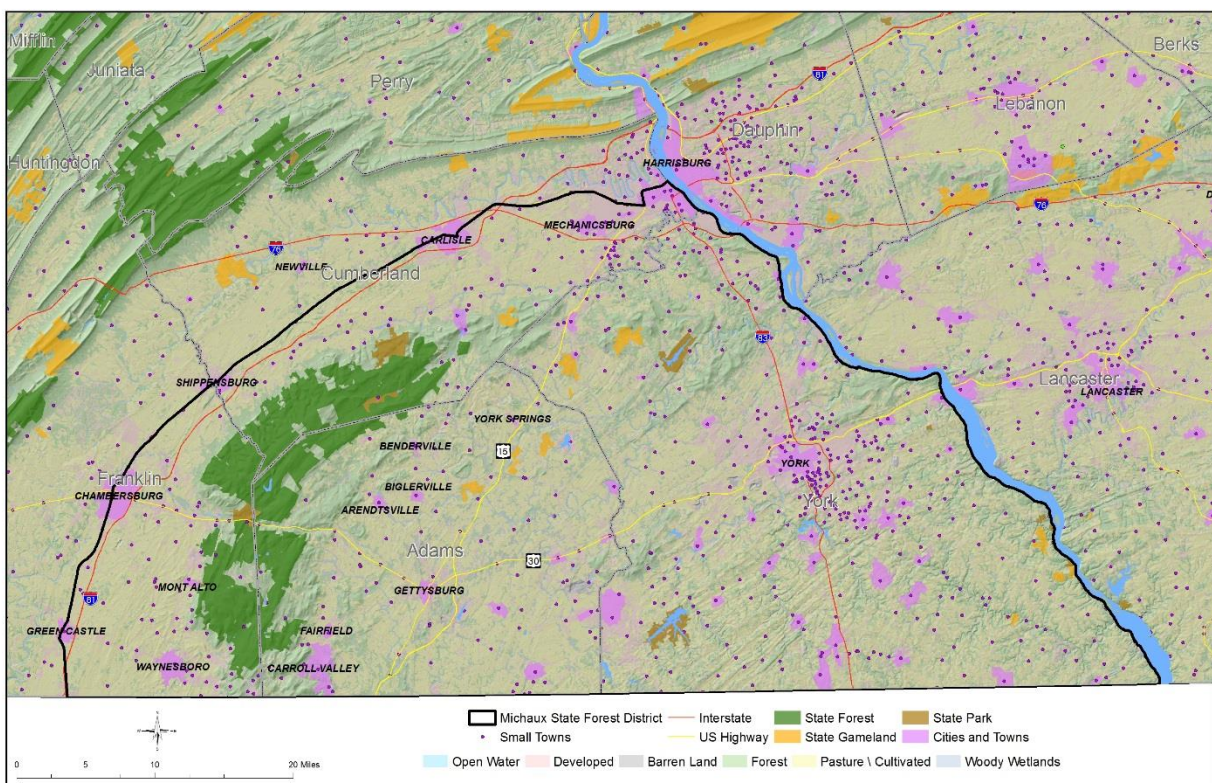
In 2012 the Bureau of Forestry surveyed local timber products primary producers to gauge the size and strength of the timber industry in Pennsylvania. Of the 312 known mills in the state, 25 were found in the Michaux Forest District's four counties. Eighteen of the 25 mills responded to the survey. Of the 243 mills that reported county data in 2012, they harvested 5.4 million cubic feet of timber from Cumberland, York, Franklin, and Adams counties across state forest and private lands. Within the 14 counties of the south-central region, more softwood sawtimber was harvested than the rest of the state combined. The 2016 timber products output survey results should be published in 2018. One local lumber mill has closed its doors since the 2013 TPO report was published.

## 8) Demographic Context

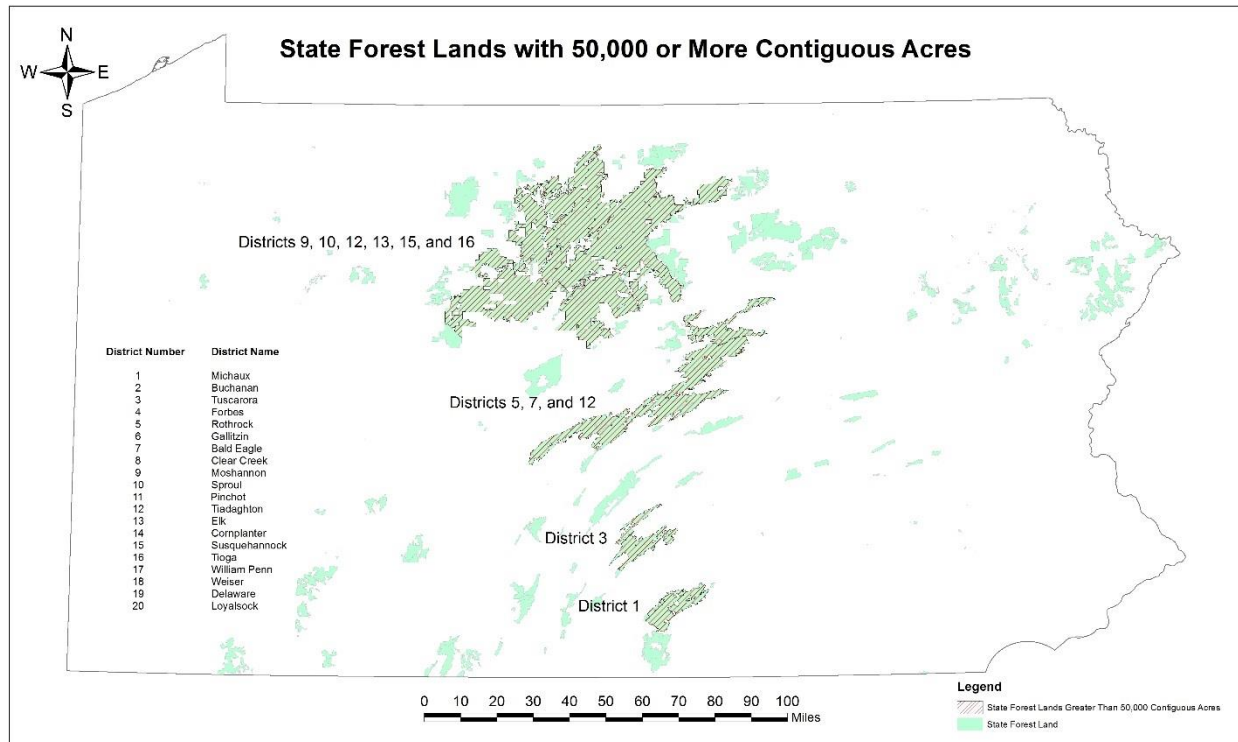
The demographic context of the Michaux, coupled with the large contiguous nature of its land mass creates some of the most profound challenges and opportunities for local forest managers. With a population density of just under 1 million people in the four county area of the district, the Michaux is also less than a two hour drive from the Baltimore/Washington DC metropolitan areas and also sees significant use from smaller population such as Hagerstown and Fredericksburg which are just across the Maryland/Pennsylvania border. As a relatively large block of forest land, the Michaux provides



sufficient scale and opportunity for extended visits by mountain bikers, equestrians, ATV enthusiasts, hikers, and history seekers that are not as well supported on smaller and discontinuous state forest or park lands. This unique demographic context also means that the forests and streams of the Michaux also function as a critical bioreserve for unique forest communities and wildlife populations highly threatened by the presence of anthropogenic stressors and isolated from larger populations and habitat patches that would better enable their resilience and survival over time. Finally, and perhaps most importantly, the demographic context of the Michaux both historically and today, make it an advance learning model for developing understandings of how to manage and direct human activities and aspirations in ways that sustain and enhance the carrying capacities, resilience, and diversity of the forest systems they recreate on or live within.



**Figure 7-1.** Map of public lands, population centers, and land use types (aggregated from National Land Cover Database).



**Figure 7-2.** State Forest Lands with 50,000 or more contiguous acres. The Michaux State Forest contains one of the four contiguous blocks of State Forest Land within the Commonwealth which encompasses 50,000 acres or more.

**Table 7-1.** Population within 10 mile to 60 mile radius of 50,000 or more contiguous acres of State Forest Land.

District	10 Mile Radius	20 Mile Radius	30 Mile Radius	40 Mile Radius	50 Mile Radius	60 Mile Radius
<b>1</b>	204,888	554,785	1,276,418	1,950,624	2,816,012	5,100,068
<b>3</b>	74,817	338,966	793,353	1,504,309	2,269,003	3,169,126
<b>5, 7, and 12</b>	439,230	699,706	932,695	1,325,294	2,316,917	3,027,742
<b>9, 10, 12, 13, 15, and 16</b>	189,803	483,434	764,786	1,210,912	1,607,490	2,202,178

## 9) Conservation Landscapes and Cultural Resources

The Michaux lies within the South Mountain Conservation landscape and participates with the South Mountain Partnership in its mission to highlight the natural, aesthetic, historic, cultural, community, agricultural, and recreational resources in southcentral Pennsylvania. The South Mountain Partnership sustains a network of regional stakeholders that work to ensure the cultural and natural resources of the South Mountain region are sustained and promoted within the region.

The South Mountain partnership has been particularly helpful in convening cultural and historic resource expertise to help develop a historical framework for identifying and prioritizing historic and cultural resources on the Michaux and providing the expertise and stakeholder engagement resources to begin protecting, managing, and interpreting these sites to the public. An early example of the collaborative work the South mountain partnership has done to leverage the cultural and historic resources on the Michaux is the interpretive trail development at the POW camp sustained by local volunteers and hosted on the Cumberland County Historical Society's Website. (<https://www.historicalsociety.com/>).

The Recently completed Conservation Landscape Assessment by the South Mountain Partnership represents Phase 1 sets the historic, landscape level context which will direct additional district and stakeholder efforts towards identifying and prioritizing, and then protecting, managing, and interpreting the critical historic and cultural resources within the state forest. [http://southmountainpartnership.org/wp-content/uploads/2016/03/MichauxCLA\\_DRAFT\\_2016.pdf](http://southmountainpartnership.org/wp-content/uploads/2016/03/MichauxCLA_DRAFT_2016.pdf).

**Table 9-1.** Inventoried cultural/ historic features on Michaux state forest lands.

Feature	Count of Feature
CCC Camp	100
Charcoal Hearth	3743
Homestead	76
Logging Camp	14
Logging RR Grade	39
Mill Site	27
Old Building Foundation	78
Spring Water Collection Site	80
American Chestnut > 10 dbh	18
Archeological Site	6
Cave	1
Cemetery	27
Furnace	3
Grave Site	12
Mine	15
Monument	20
Quarry	175
Rubble Land	440
Spring	242
Tunnel	4

Additional historic and cultural resources within the state forest and across the district are catalogued at the PNHP cultural and historic resources site maintained by the Pennsylvania Historic and Museum Commission which is a critical partner of the South Mountain Partnership.



Ongoing efforts of the South Mountain partnership critical to the future success of management efforts on the Michaux also include developing a science and research forum among local university programs and researchers with ongoing interests in historic, archaeological, and cultural resources on the Michaux. The same project is working to develop greater organization and collaboration between Michaux and other public land managers and decision makers and the region, and the educational and learning assets represented by the universities within the district. Table 9-1 presents a list of inventoried cultural/ historic resources on Michaux state forest lands.

## 10) District Organization and Operations

The Michaux State Forest is one of the 20 state forests administered by the Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry. It comprises about 4% of the 2.1 million-acre state forest system. Within the bureau, the administrative responsibility of the Michaux State Forest is delegated to the district forester, who oversees the operations and activities of local district management staff from the District Headquarters located at 10099 Lincoln Way East, Fayetteville, Pennsylvania 17222.

District management staff administer all Bureau of Forestry program area operations within the district, and develop localized goals, objectives, and project priorities within the Michaux state forest in accordance with the state-wide goals and guidelines outlined in the State Forest Resource Management Plan.

District Operations are divided into four functional areas:

*Customer and administrative support services* are provided by two full-time and one part-time staff. One full-time administrative assistant works closely with district managers and supervisors to develop and monitor annual district budget and spending plan, oversees district purchasing and book keeping, provides personnel administrative support services, and assists with customer service needs. A full-time Clerk Typist 2 does personnel time-keeping administration, automotive record keeping, stakeholder communications, and provides administrative and clerical support for the District's leased campsite and planned recreational events along with front desk receptionist and customer service duties. A seasonal Clerk Typist 1 assists with receptionist and customer service, campsite registration, firewood permit sales, and clerical tasks during the district's busy recreation season from March to November. All front desk administrative support staff function as radio dispatch during routine workhours as well as during emergency operations such as fire or search and rescue.

*District infrastructure and recreation management* are the responsibility of the Assistant District Forester of Operations who supervises one full time Maintenance Foreman, four full-time Rangers, a full-time Recreation forester, and a seasonal forest recreation technician. The Maintenance Foreman has direct supervision of four full time Equipment Operators and five seasonal laborers. District operations staff maintain over 118 miles of public access roads, district equipment and vehicle fleet, buildings, and recreational infrastructure such as picnic and parking areas, target range, fishing piers, and other user amenities on the forest. The Recreation Forester with assistance from the seasonal forest technician manage large event and leased campsite administration needs, coordinate volunteer

and trail stewardship engagement efforts, serve as liaisons with recreational stakeholder groups, and monitor and inventory formal and informal trail conditions and issues and assist district managers and stakeholder groups in short and long term planning and prioritization of trail system and recreational program development needs. The district ranger force provides critical support across all district functions by enforcing state forest rules and regulations and other law enforcement needs on the state forest, providing public contact and visitor services both during patrol and through planned engagement activities, and by monitoring forest and forest infrastructure conditions, user issues and concerns, and resource protection needs to support informed management decision making.

*Forest management* within the district is overseen by the Assistant District Forester of Forest Management who supervises three full time state forest management foresters, two full time private lands service foresters, and one seasonal forest tech.

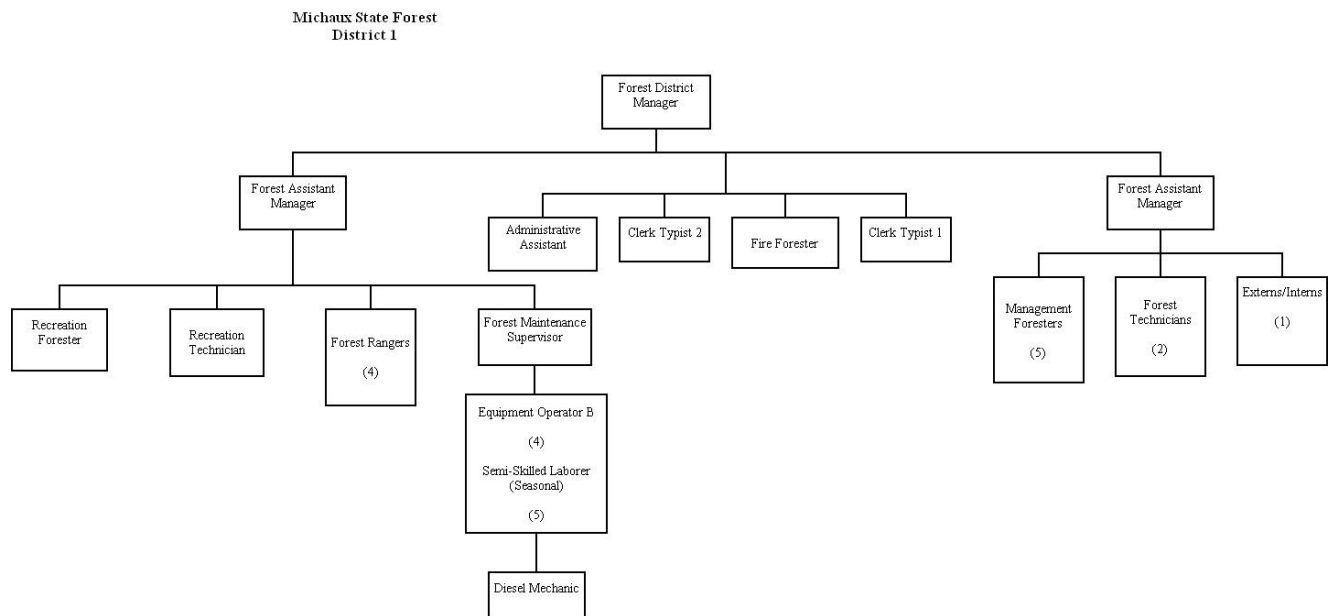
The three state forest management foresters share duties in planning and implementing commercial and non-commercial forest habitat management activities while also providing specialized foci around GIS and computer support for district operations, coordinating and overseeing Right of Way and Road Use agreements, and managing wildlife habitat and monitoring programs. Forestry operations are planned for and prioritized continuously on a multi-year basis based on a range of monitoring and information gathering practices contained formally within a fifteen-year exam process for each landscape management unit within the district. Annual priorities are set, budgeted for, and executed within the District's annual activity plan. On the Michaux state forest, forest management activities range from commercial timber sales and non-commercial management activities to enhance landscape level diversity, resilience, and carrying capacity for native forest plants, community types, and both game and non-game wildlife species. On other forest lands within the district, forest sustainability goals are approached through the education, outreach, and technical services provided by the district's two full time service foresters in their work with local private forest landowners, schools, conservation district staff, conservancies, local governments, and local forest industry stakeholders.

Finally, the Bureau of Forestry's *fire suppression and prescribed fire programs* are overseen by the District's fire forester who, along with the Assistant District foresters and front office administrative staff, reports directly to the District Forester. The District Fire Forester works with the Bureau's Division of Forest Fire Protection to provide training and funding support for wildland fire fighting to local volunteer fire companies. This position also assists the District forester in administering and developing the District's Forest Fire Warden program and the training, development, and succession planning to ensure critical fire management capacity, qualifications, and preparedness levels are sustained within the district staff. The District fire forester oversees the district's prescribed burn program and helps prioritize and implement annual prescribed burn projects within the district and with other forestry districts and agency partners. The District fire forester also conducts habitat management projects, including commercial timber sales, where such efforts are also conducive to mitigating areas of high wildfire risk; or re-establishing high-priority fire dependent communities at a landscape level.

District budget and personnel allocations are set to provide some degree of consistency across all state forests for resource management needs within the local management context. Key variables informing current allocation formulas include quantitative metrics such as miles of state forest roads, numbers of maintenance or fire divisions, and acres of annual timber management goals. Many factors driving local management unit costs, such as: road and trail use volume depreciation costs, transactional

administrative costs of public engagement, visitor services, and recreational program administration costs, and landscape management needs not directly associated with management of commercial timber acreage are not quantitatively integrated into current organizational funding formulas within the Bureau.

Following is an organizational chart displaying the personnel of the Michaux Forest District.

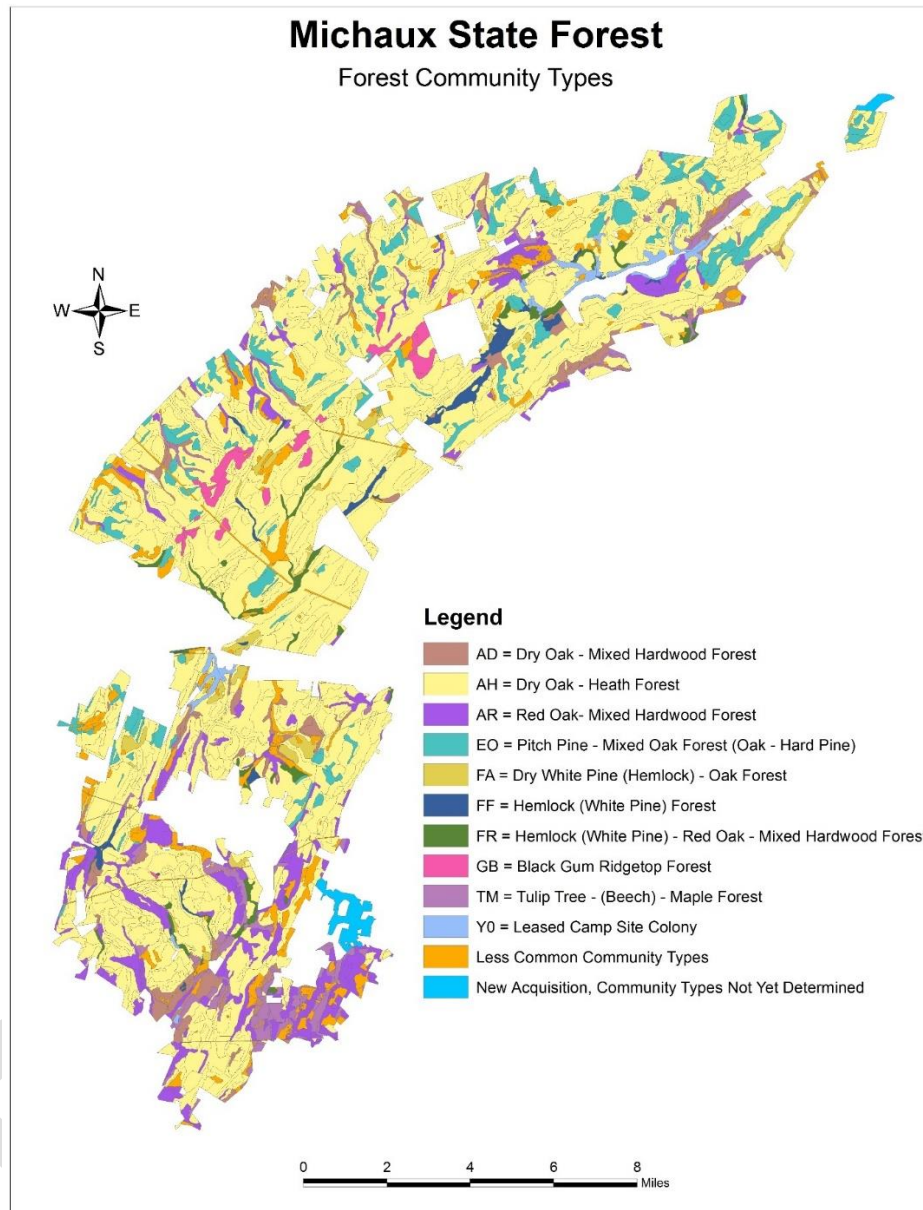


**Figure 9-1.** Michaux State Forest organizational chart.

## 11) Habitat and Species Priorities for Michaux State Forest Management

The Michaux as a forest system is dominated by senescent dry oak heath stands along the spine of South Mountain and Piney Mountain Ridges. Dry oak heath is largely an artifact forest type resulting from past extractive forest practices followed by a series of biotic and abiotic stressors and coupled with over a century of fire suppression in what would have been highly fire dependent forest plant communities, historically.





**Figure 10-1. Michaux community types.** The Dry Oak – Heath Forest type is the most common vegetative community type on Michaux State Forest.

Management practices over the past century within the Bureau of Forestry have largely been targeted at addressing acute mortality inducing factors; primarily on the forests more economically valuable growing sites; leaving the large proportion of lower quality growing sites largely unmanaged and allowed to transition gradually into what are now in many places largely black gum, red maple, and sassafras dominated overstories above dense, brittle, and extremely flammable understories of century old mountain laurel.

Many of the current forest acres of dry oak heath on the Michaux are losing some of the highest value ecological species -- primarily chestnut oak, scrub oak, and pitch-pine -- and with them a huge diversity

of insects, rodents, birds, and mammals that have evolved to feed, nest, and shelter in the types of vegetative patterns and cycles these historic forest communities cast across the mountain for millennia.

For years, already, many of the low heath components in these stands, e.g., huckleberry and blue berry, in the absence of fire, have been overtopped and reduced in vigor and fruit production by mountain laurel. In streamside forests and floodplain areas, highly fire sensitive rhododendrons, in the absence of frequent creeping groundfires that would have sustained a high degree of patchiness and floral diversity along the Michaux's headwater tributary areas, have grown into beautiful, but dense and homogeneous monocultures that limit the types of floral diversity and vertically diverse woody structures in both the stream itself, and within the adjacent floodplain forest.

Creating greater community type, age class, and patch size diversity at the stand, multi-stand, landscape, and forest level is needed to optimize the ecological diversity and biological productivity of the Michaux's forest, stream, and wildlife communities.

Active and proactive management in many areas of the forest that have been overlooked over the past many decades of prioritizing salvage operations of more economically valuable growing sites can play a critical role in improving habitat conditions for a range of endangered and listed wildlife species while enhancing landscape level carrying capacities for popular game species and improving the aesthetic and recreational experience for forest visitors and trail users.

### *Ecoregional priorities*

To organize and prioritize our work at the system, landscape, and stand level of management, and to make the most effective use possible of the range of management tools and alternatives available to us within the state forest context, the Michaux Forest District staff has identified six ecoregional priorities for targeted investment in active and adaptive habitat management:

1. Plant sanctuaries and special plant management areas for listed and ecologically important native wild plants.
2. Vernal pond systems.
3. Stream systems.
4. Dwarf scrub oak pitch pine barrens and associated transitional fire mediated community types (Fire dependent tolerant mixed oak and hard pine, oak/pine savannah, and glade/meadow ecotypes).
5. Ruffed grouse.

While stabilization and recovery of Ruffed grouse is the only wildlife species specifically identified within our Eco-regional goals for district forest management activities; it is one of several focal wildlife species that is being monitored to both inform how and where we prioritize our management work in the short term, and how we hope to adapt and learn from it to better serve the sustainability and resilience of the forest over time. The following is the fuller list of focal wildlife species that inform our concern for and approach to managing these critically important eco-regional habitats.

### *Avian Species:*

The South Mountain, and therefore the Michaux, is designated as an Important Bird Area given both its critical bioserve function within the local region for resident forest dependent birds; and for its importance as a migration route for migratory bird species.

Beyond broad landscape level goals for diverse, resilient, and interconnected habitat types and age classes, Michaux managers consistently seek to consider the impacts of recreational and forest management decisions on both avian species and the public who enjoys using the state forest for recreational birding, research and education, and hunting.

From seasonal road closures to minimize human disturbance during nesting seasons in critical habitat areas to seasonal and daily operational hours at the target range that minimize conflicts between ranger users and birders, there are many factors that need to be considered to ensure the Michaux provides optimal habitat both for the avian communities that depend on it, and for the many recreational pursuits that are enhanced by the presence of vibrant bird life on the forest. The following focal avian species also represent critical ongoing habitat and monitoring projects on an annual and periodic basis.

#### Ruffed Grouse:

Ruffed grouse need early successional habitat, but they are also a uniquely valuable indicator of what ecologists call “habitat heterogeneity” at a landscape scale or even sub-landscape scale (1,000 acres or less). In other words, they do best where there are a range of habitat types and features in proximity within an area.

Many people think of the ruffed grouse as a strong flyer due to how frequently encounters with it result in its explosive escape flight, or “flush.” However, when undisturbed or threatened, it behaves very similarly to a chicken, and spends most of its time walking. Therefore, it is highly dependent, particularly during nesting and brood rearing stages of its life cycle, on being able to find food, water, and escape cover and shelter from the elements within relatively small home ranges.

As an example of the importance of microsite habitat components to grouse population dynamics, biologists have learned that nesting within 300’ of a perennial water source is one of the most critical factors (along with the hen’s energy reserves going into nesting season) to hatching rates and early brood survival since a grouse hen will typically walk rather than fly from the nest to a known watering site. Therefore, the closer to a perennial water source a grouse hen can find suitable food resources and dense sapling and dead wood cover for nest protection, the less exposure both she and her offspring face during the critical reproductive phase of the grouse life cycle.

And currently, the remaining grouse on the Michaux need all the help they can get in optimizing their reproduction rates, as Pennsylvania Game commission data indicates the Pennsylvania state bird is in significant and rapid decline across the southern half of Pennsylvania. The most likely cause for the precipitous decline since the early 2000’s is the emergence of West Nile Virus, also known as Bird Flu. At present, grouse are so sparse on the Michaux that the number of annual flushes or sightings encountered by Michaux staff rarely exceed a dozen.

Based on growing concern on the part of staff members, in 2012, foresters began adapting the decades long relationships developed with the Pennsylvania Game Commission and local forest stakeholders to assist in the recovery of Wild Turkey populations to learn if a focused and sustained effort on behalf of South Mountain grouse populations would enable us to stabilize and eventually see some level of recovery in the number of birds sustained on the mountain.

Because many models suggest grouse recovery at this point may be improbable, other species we will be monitoring as co-indicators of the kinds of habitat grouse need include wood thrush, American woodcock, and rufous sided towhee, though our highest priority habitat improvement projects each year will be conducted in areas where we encounter grouse in the late winter/early spring period the year before to ensure we are putting the best habitat in areas where we have recently encountered mature birds going into the nesting season.

Much of the habitat work we have been and will continue doing to benefit ruffed grouse is extremely synergistic across our other four eco-regional habitat priorities; from enhancing dead wood nesting habitat, vertical canopy structure, floral diversity, and soft and hard mast production in streamside and flood plain forests and in and around our herbaceous openings, to sustaining vigorous and productive early successional huckleberry and scrub oak production in our barrens sites, to increasing the areas of dense young pitch pine forests on our site three; the ruffed grouse has become the symbol of the future forest conditions we hope to achieve on the Michaux over the next several decades to a century.

### American Woodcock

American woodcock, like grouse, require a mix of habitat age classes and types in close proximity to each other on the landscape; and like grouse, are highly dependent on relatively large, dense patches of sapling age forests for optimal reproduction and survival. Unlike grouse, which following an initial juvenile dispersal flight, usually occupy a relatively small home range as a resident bird species; American woodcock are seasonally migratory and though they will occupy a relatively small area during courtship, nesting, and brood rearing phases of their life cycles; are also dependent on the availability and opportunistic use of high quality habitat as they migrate through the Michaux during spring and fall migrations.

Management efforts for the woodcock involve spring monitoring counts of courtship flights at established monitoring points throughout the forest; controlling invasive species in areas of high quality wetland scrub/shrub habitat, and edge and block cuttings of aspen adjacent to old field edges. A recent study done at Shippensburg also found American woodcock are ubiquitous around the herbaceous openings originally established to enhance American turkey recruitment rates and now also being manipulated to enhance ruffed grouse and pollinator populations.

### Wild Turkey

In the 1980's when South Mountain turkey populations lagged statewide averages, the Pennsylvania Game Commission and the National Wild Turkey Federation established the Wild Turkey Task Force to invest in localized research and focused habitat improvement projects to better understand the reproductive ecology of the local wild turkey flock.

As part of that effort, the Michaux state forest and local NWTF chapters established over forty permanent herbaceous openings to provide optimal brood rearing and soft mast production areas. Originally planted with cool season grasses and legumes and exotic shrub species such as Autumn olive, these openings have been largely rejuvenated over the past decade into forest meadow habitats featuring warm season grasses such as big and little bluestem, Indian grass, switchgrass, and wild rye



and native legumes and wildflowers such as partridge pea, Echinacea, bergamot, and aster. Native shrubs and trees that produce a variety of soft and hard mast ranging from viburnums and dogwoods, to chinquapin and Allegheny plum have also been incorporated into these permanent openings and are currently being sustained in large part through infrequent mowing and periodic prescribed fires.

Today, though the wild turkey population on the Michaux is robust and we are adapting our management practices around these openings to target some of the more specific needs of ruffed grouse and wood cock for large woody nesting material and canopy structure and stem density along the edges of the openings; Michaux staff still maintain annual monitoring efforts to provide data to the Pennsylvania Game commission in order to set fall harvest seasons commensurate with short term population fluxes.

Continued partnerships between the Michaux management staff, the Pennsylvania Game commission, the National Wild Turkey federation, and local Audubon chapters are continuously being leveraged to demonstrate the benefits of active and adaptive forest habitat management for wild turkey and other game and non-game avian species to concurrently benefit forest level ecosystem functions and recreational and cultural uses of this state forest.

Major habitat restoration efforts in the highly invaded Camp Michaux and Big Pine Flats landscapes are emergent outgrowths of these past trajectories in managing the Michaux both for the wide range of bird species that depend on it, and the stakeholders interested in safekeeping their futures on the forest.

### *Brook Trout*

Brook trout are the official state fish and are important on the Michaux as both a popular game fish, and an overall indicator of stream, watershed, and forest system functioning. Like many of its resident wildlife species, the native brook trout populations on the Michaux represent a critical component in the overall genetic diversity of the species across the state and are, therefore, a critical conservation priority for Michaux managers. Adult brook trout, with a tolerance range of 4.0-9.5 pH, are generally more tolerant of low pH (acidity) than other trout species. However, they respond favorably to improved cation exchange capacity, particularly in terms of juvenile survival and recruitment rates, and when faced with other stressors such as high water temperatures, and environmental toxins. As high trophic level predators in forest streams, brook trout growth rates are also excellent indicators of abundance and diversity of an even more sensitive suite of indicators of stream and forest health that can be even more efficiently monitored than brook trout themselves; the diversity and abundance of stream macro-invertebrate populations.

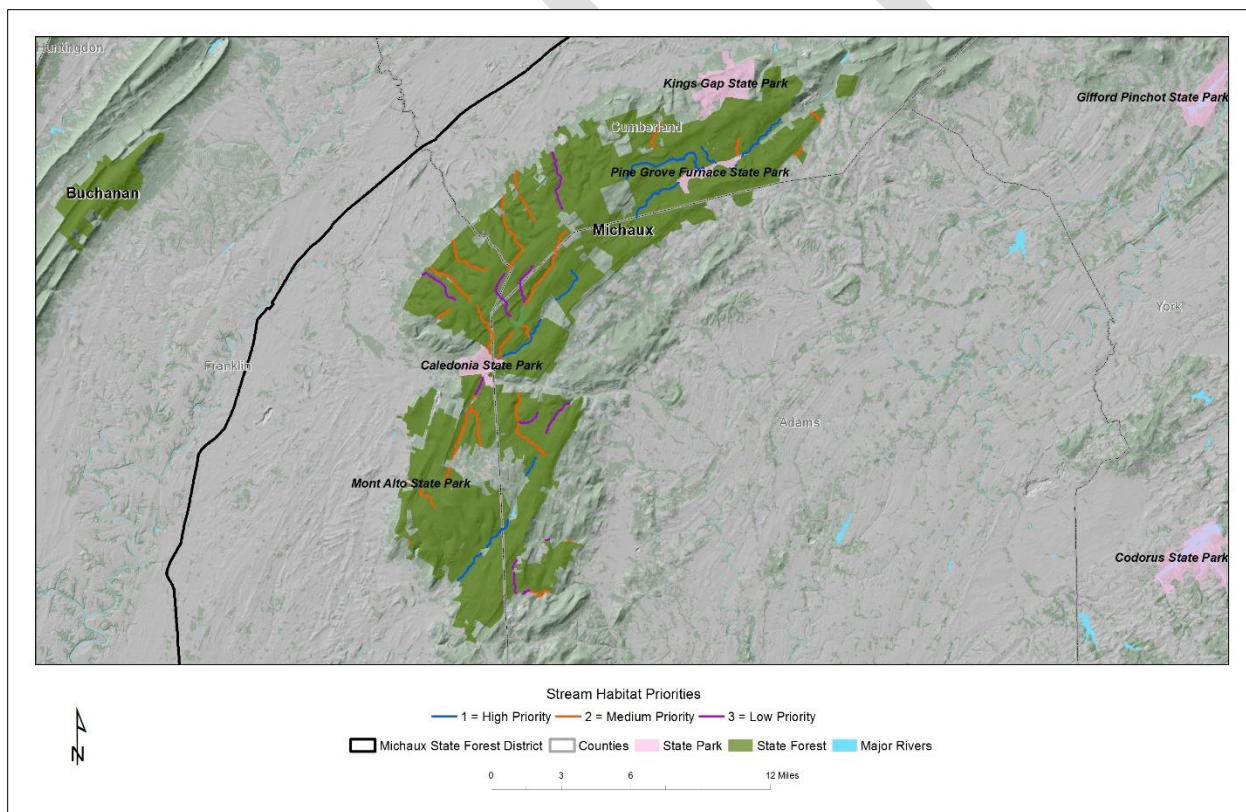
Given the critical importance of stream health and water quality to the overall state forest ecosystem management goals and the critical role the Michaux plays as both a potable supply, a recreational fishery, and a bio-reserve for a host of terrestrial and aquatic species depending on ecological interactions between stream and forest systems at a microsite, tributary, watershed, and eco-regional level, the Michaux management staff has invested considerable time in recent years in a range of projects to address short and long-term goals designed to enhance the reproductive efficiency, age class structure, and resilience of native brook trout populations.

Critical short term goals include ensuring we minimize impediments to brook trout and macro-invertebrate from our roads and culverts, address segmenting features such as impoundments and habitat trap stream segments, and enhance in stream structure and overhead cover through placement

of large woody materials in high priority stream segments showing critical shortages of such habitat features.

Longer term objectives to develop better brook trout habitat on the Michaux are to enhance floral diversity, dead wood habitat, and vertical canopy structure in forest stands within 300' of forest streams (This critical nesting zone for grouse, wood thrush, and American woodcock among other birds, is also a critical habitat zone for many macro-invertebrate and pollinator species who need proximity to a perennial water source to complete part of their life cycle) and to retain large woody material and floodplain adapted species such as red maple, black gum, black birch, and aspen in palustrine (flood plain) delineated forest areas.

A key component in achieving these objectives will be to determine where long-term, chronic environmental conditions such as acidified precipitation and low-cation exchange soils at a watershed or tributary system level are “low holes in the bucket” that need to be addressed to achieve overall ecosystem functionality and health for both the brook trout, and the many other species that benefit from optimal ecological conditions for brook trout on the Michaux.



**Figure 10-3.** Streams within the district prioritized for aquatic habitat improvement projects based on PFBC Stream Habitat Improvement Prioritization Tool.

### *Timber Rattlesnakes*

The Timber rattlesnake is currently a delisted species statewide, but is still locally protected on the Michaux due to the genetic isolation of the South Mountain population and the level of anthropogenic stressors exerted on it. Due to its importance as a conservation priority in this forest system, a number of special management practices are being implemented by Michaux staff to enhance habitat components across the Michaux. Priorities range from outreach and education to loggers, recreational groups, and surrounding landowners about the protected status and important ecological role timber rattlesnakes play in our forest, to reserving islands of larger diameter down woody debris in district timber sales to enhance foraging habitat and microsite diversity within harvested stands. When constructing new haul roads, Michaux foresters instruct contractors to move any large rocks encountered during road building to the north or east side of the haul road, optimizing solar exposure and basking habitat in areas likely to remain sun-rich for a decade or more. Habitat work near gestation sites is prioritized annually based on guidance from Ecological Services Section biologists and the Pennsylvania Fish and Boat Commission. Work within these sites consists of opening the canopy by cutting down and sometimes treating shade tolerant species with herbicide to increase light on the forest floor for thermal warming. An annual assessment of known gestation sites is needed to more closely monitor the South Mountain rattlesnake's reproductive capacity and to develop and adaptive management plan around weighing trade-offs between potential risks and rewards from management activities such as prescribed fire, trail building, and event planning.

### *Vernal Pond Obligates*

The Michaux has the highest density of high quality vernal pool complexes in any state forest system. While there are many different vernal pools obligates, often with somewhat competing lifecycle needs that complicates active management decision making. Where population monitoring data exists to support adaptive management decision making and monitoring, Michaux managers, local research partners, and the Pennsylvania Fish and Boat Commission are trying to learn more about how to build population resilience and reproduction rates among pond obligates by improving forest habitat features within and around pond complexes, often by creating small canopy gaps and increasing the amount of downed, large woody material in and around pond edges. Vernal pond systems are also high priority resource protection areas for Michaux rangers and state forest officers during the spring.

### *Whitetail Deer*

The Whitetail deer is the most popular game species in Pennsylvania and is a critical economic and recreational resource on the Michaux. It is also one of the most significant ecological factors influencing forest plant community dynamics at the stand and landscape level; often dictating what types of plants are able to grow and reproduce in forest understories and which ones don't. Michaux managers are seeking creative ways to embrace the challenge of sustaining a high quality deer herd and high quality hunting experience on the Michaux; while also ensuring that deer browse impacts on desirable plant assemblages in the understory don't erode habitat quality for other game and non-game species over the long term.

Along with the range of habitat management issues already covered -- most of which also enhance habitat quality and carrying capacity for whitetail deer -- the Michaux also participates in the

Pennsylvania Game Commissions Deer Management Assistance Program (DMAP) which provides additional antlerless allocation permits to participating hunters.

Since 2010, DMAP data collection and monitoring, and enrollment and allocation decision making have been based on five, permanent deer management areas within the Michaux, two of which have been enrolled in the program since 2011. Hunter demand for the additional antlerless harvest opportunities remains strong though it is currently difficult to tell if enrollment in the program creates a differential impact on habitat conditions compared to units not enrolled in the program. In 2017, in part because of the inclusion of the Michaux into the Game Commissions Disease Management Area for Chronic Wasting Disease, the southern management unit within the Michaux was also enrolled in the program and, as with the other two units, all allocated tags were purchased.

## 12) Commercial timber management

Providing a sustainable flow of forest products to local and state economies is both a part of the Bureau of Forestry's strategic plan as well as one of the most cost-effective approaches to habitat management available to state forest managers. Timber harvesting priorities and activities on the Michaux, as in all state forests, are guided by a harvest allocation model that sets timber harvest schedules on an annual, periodic, and 150-year planning horizon. The goals of the model are to promote and maintain desired landscape conditions, create a diversity of successional stages and native forest communities, balance the age class distribution, and provide a sustained yield of quality timber. The model uses the bureau's forest inventory data, economic information, bureau policies, and desired ending target forest conditions to develop timber harvest schedules that best meet the bureau's silvicultural and timber management goals. A detailed discussion of the harvest allocation model can be found in the 2016 SFRMP, beginning on page 93.

The current district annual harvest allocation goal calls for 439 acres of regeneration acres, 124 acres of shelterwood harvest, 104 acres of buffer treatment, and 43 acres of improvement harvest. The bureau is presently in the second harvest allocation period of the model. The Michaux State Forest's timber harvest goals for the second period are shown in the table below.

Disturbance events often take precedence when deciding on acreage to be treated. Large scale events such as gypsy moth outbreaks, the ice and wind storm blowdown in 1993, tornadoes, and other insect and disease outbreaks can disrupt any harvest model, both spatially on the landscape and size of the event.

**Table 11-1. Harvest Allocation targets for Michaux state forest.** Target shelterwood (Shelt), overstory removal (OR), intermediate (Int), and buffer treatment acreages for the second decade of the timber harvest schedule, aggregated by forest type, site class, stocking level, and treatment. Additional shelterwood treatments for 3 or more stage shelterwoods are not represented in these targets.

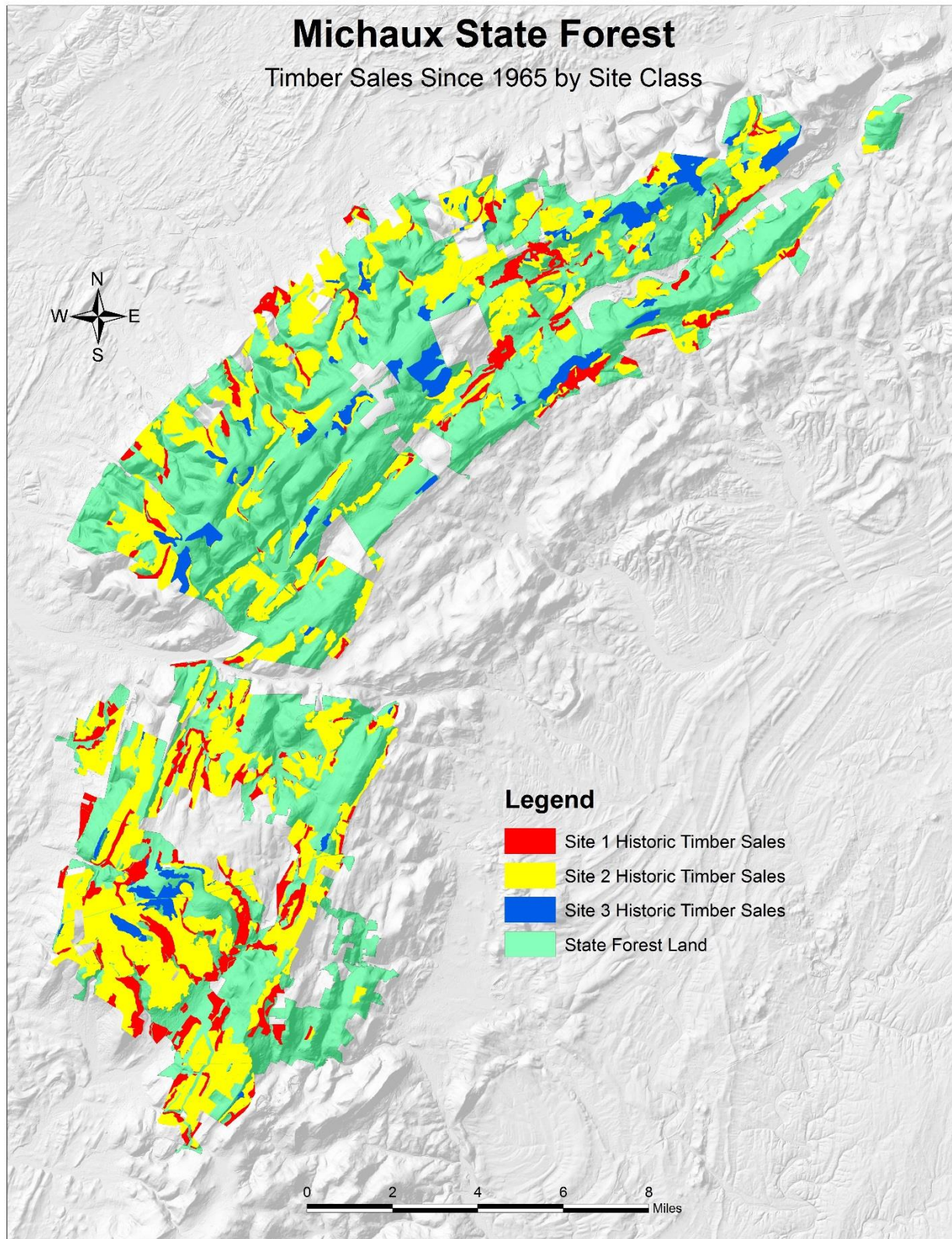


Aggregated Forest Community Type	Site 1 Fully-stocked		Site 1 Under-stocked		Site 2 Fully-stocked		Site 2 Under-stocked		Site 3 Fully-stocked		Site 3 Under-stocked		Totals			
	Shelt	OR	Shelt	OR	Shelt	OR	Shelt	OR	Shelt	OR	Shelt	OR	Shelt	OR	Int	Buffer
Northern Hardwoods	0	0	0	0	0	0	0	0	0	0	0	0	0	0	430	2,250
Allegheny Hardwoods	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Red Oak	106	306	11	3	46	129	2	0	1	4	0	0	166	443		
Other Oaks	0	249	16	0	999	2,170	0	0	0	1,378	0	0	1,015	3,797		
Red Maple	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Other Hardwoods	0	31	0	0	0	0	0	0	54	123	0	0	54	153		
Conifers	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
<b>Totals</b>	<b>106</b>	<b>586</b>	<b>27</b>	<b>3</b>	<b>1,045</b>	<b>2,299</b>	<b>2</b>	<b>0</b>	<b>56</b>	<b>1,504</b>	<b>0</b>	<b>0</b>	<b>1,235</b>	<b>4,392</b>	<b>430</b>	<b>2,250</b>

The challenge for the district now is to implement the harvest allocation model for ecosystem management within this particular eco-region and forest type in a way that sustains ecosystem functions and habitat resilience and connectivity at both the landscape management unit and forest system (district) scale.

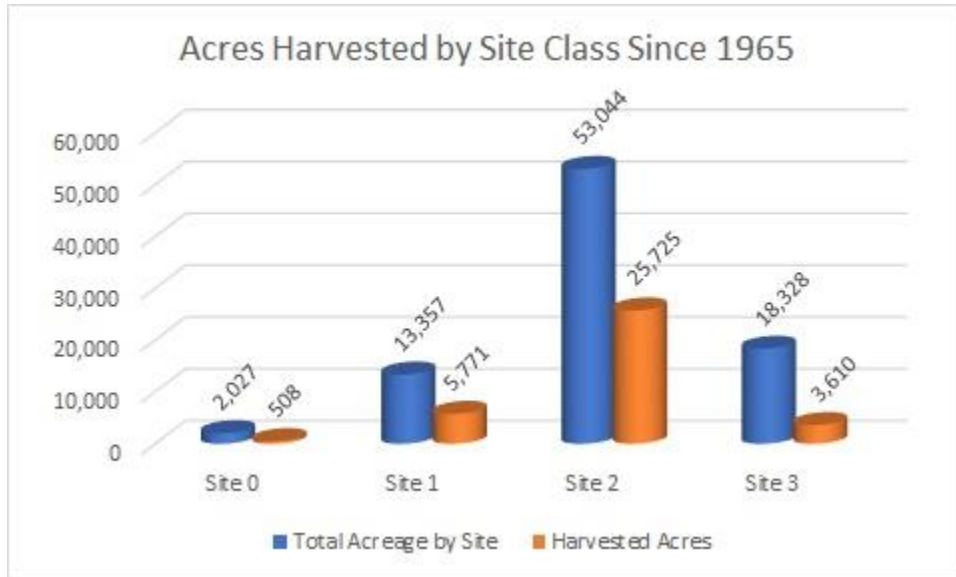
A number of considerations based on the priorities established by the existing harvest allocation model inform current district commercial timber management priorities and planning:

- 1) The model currently provides only timber type and site class features to consider when targeting stands for harvest. Additional factors that need to be considered, such as spatial arrangement, connectivity, and interspersions on a landscape scale, are not prescriptive within the state model. Future sales will need to focus on site 3 stands due to treating site 1 and site 2 stands more heavily over the past 50 years. These site 3 stands can often be successfully regenerated as compared to sites 1 and 2. But the lower value received through timber sales make them only marginally economically feasible, especially if road costs are high to access the site.

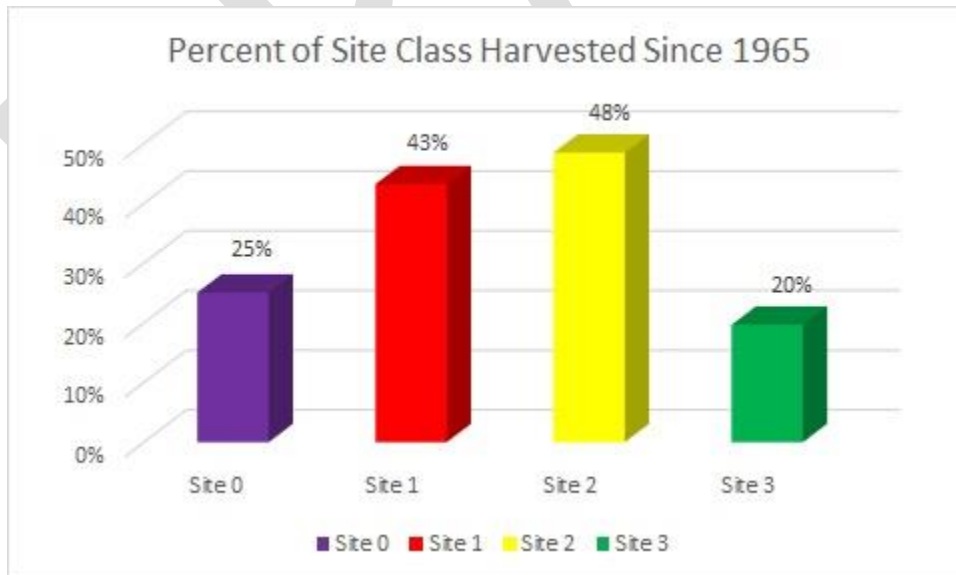


**Figure 11-1.** Map depicting commercial timber sale activities since 1965 across the spatial distribution of site classes across the Michaux.

Figure 11-2 and Figure 11-3 below illustrate that site 3 stands have been harvested at a slower rate in the past 50 years. Concentration of sales in the future must rely more heavily in site 3 areas.



**Figure 11-2.** Acres harvested by site class since 1965.



**Figure 11-3.** Percent of site class harvested since 1965.

- 2) The model is only prescriptive for the commercially viable (i.e. Multiple Resource Management Zone) acres of the forest. On the Michaux, the proportion of Multiple Resource Zone acres vs. other management zones not considered by the model is lower than the average across the entire state forest system (66% MRZ on the Michaux vs. 50% statewide.) This is due in part because of the accessibility of most of the Michaux land base for commercial timber harvesting, and the historically robust local markets for low quality timber products such as pulp and firewood. Therefore, a greater percent of the Michaux land mass is scheduled by the current harvest allocation model than for many districts. However, many of the forest types within the Michaux multiple resource zone acres may not optimize landscape level habitat values or ecosystem functions under management practices assumed within the current model prescriptions. Given how little is known about how to manage many of these habitat types at a landscape or system level in terms of optimal patch size, interconnectivity of successional stages or community types, and intermediate management investments (i.e. prescribed fire or mowing) needed to sustain the diversity, resilience, ecological functions, or timber products and yields these sites are capable of, current and near future land management priorities and decisions on the Michaux will be informed by rather than constrained by harvest model prescriptions.

As we enter a new era of planned and prescribed fire as an active management tool within the district and grapple with how to optimize the ecological, recreational, and forest products values of these areas of the multiple resource zone acres, we will need to develop more transparent and prescriptive management modeling tools to help both inform and communicate our decision-making approach and priorities within the ten year periodic planning horizon used by the model. For the current planning cycle, we have simply identified areas where current model prescriptions and management zone guidelines may not be as relevant as other components of local district decision making. These areas include our site 3's multiple resource zone acres and our high elevation Early Successional Habitat Supra areas above 1800' elevation.

- 3) Current model assumptions regarding non-modeled acres, and modeled roadside aesthetic, and streamside buffer acres are:
- a. existing harvest guidelines and/or forest successional trends for buffer and non-modeled acres will serve both site specific social and ecological functions as well as contribute at a system level by ensuring adequate connectivity of late successional, high-canopied (i.e. Old Growth) forest habitat types for species dependent on those habitat types.

On the Michaux, such assumptions are not well founded in many cases, as many of our non-modeled limited resource zone acres represent some of the forest's most xeric sites and fire dependent plant and animal communities, and many of our main ridgetop road corridors would be more aesthetically pleasing and ecologically valuable if maintained in fire maintained low-heath/scrub oak and warm season grass understories with a sparse canopy of open grown chestnut or burr oak, and shortleaf and pitch pine. Conversely, large patch sizes and interconnectivity of late successional, high canopied "Old Growth" habitats are critically under-represented at this point on Michaux landscapes.



Therefore, current district management priorities include an effort to proactively identify high priority areas within the forest where stand and landscape level management decisions should sustain or augment late-seral stage forest habitat conditions and functions in order to meet the “extended rotation” acres prescribed by the existing harvest model within the MRZ. Within the Michaux context, priorities for extended rotation or “accelerated Old Growth conditions acres” include the Wert Wild Area, floodplain and streamside forest supra areas, the Critical Drainages Antietam and Conococheague/ Mountain Creek LMU’s, and the large viewshed and public water protection zones. Current management activities prioritized for these extended rotation prioritized areas range from Large Woody Material habitat treatment in streams and crop tree thinning/release treatments in pole timber age stands around our wildlife openings are being used to accelerate late seral forest habitat features such as dead woody structure on the forest floor and diverse vertical structure within closed canopy stands.

## 13) Fire Management

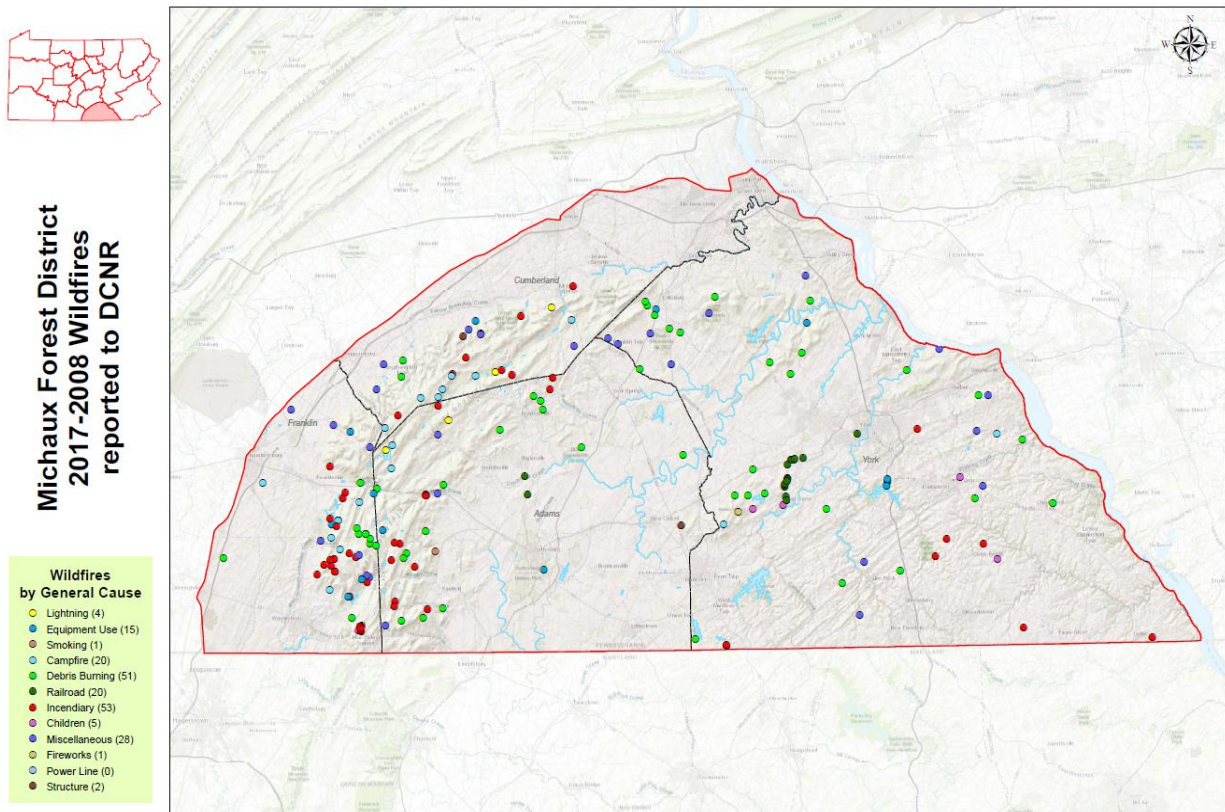
### *Wildfire Suppression*

Wildland forest fires pose tremendous risks to both human and natural resource values. Sustaining a high degree of preparedness and professional capacity in responding to the threats posed by wildlands fire is a critical part of the Bureau of forestry’s, and therefore the Michaux State Forest District’s, Operational Mission. Reducing the risk of catastrophic wildfires on the state forest is also a continuous and critically important part of its land management and organizational priority setting and planning process.

The Michaux State Forest District supports over 110 local volunteer fire companies in suppressing, documenting, and investigating wildland fires throughout Franklin, Cumberland, Adams, and York Counties. It is supported in this work by 68 Fire wardens and 5 Fire warden crews. All district staff are trained in basic wildland firefighting and incident command structure used by emergency management agencies. Numerous district staff also participate in the state’s Type 3 management team and volunteer for out of district and out of state fire suppression detail when the need arises.

The following is a brief inventory of the wildfire suppression equipment and personnel qualifications currently maintained at the District:

- Resources:
  - Engines: UTV (x2), Type 7 ((x2, (A-26, A-36))) Type 6 ((x2 (A-10, A-30))). Type 6 in repair ((x1(A-20))). Type 5 being built ((x1 (E5-01-1))), Tender 1,000 gallon (x1)
- Human Power:
  - ICT5 (x3), Faller II (x1) Faller 3 (x2), FFT1 (x4), FFT2 (x 20) (Figures include personnel who hold multiple qualifications, IE, ICT5’s included in FFT1 #’s and FFT2 #’s)
- Equipment:
  - Leaf blowers (x5), Gas powered Brush Cutters (x2), Rakes 26, Pulaskis 21, Rogue Hoes 15, Shovels 7



**Figure 12-1.** Wildfires by cause in District since 2008.

**Table 12-1.** Significant wildfires on Michaux State Forest since 2008

Year	Location	Size (acres)
2009	Baily Springs Spring	35
2011	Swift Run Rd. Spring	10.50
2014	Woodrow Road. Spring	35
2015	Strawberry (private inholding) Spring	10.25
2016	Rattlesnake Ridge	8.5
2016	Brown Rocks	5
2017	Pulpit Rock	7
2017	Tumbling Run (Private inholding)	25

### *Prescribed Fire*

The use of prescribed fire on the Michaux State Forest has been occurring since prior to 2008. Advanced practices under the 2009 Prescribed Burning Practices Act opened the door for increased use of prescribed fire across the state forest. In 2013, district staff conducted their first prescribed burn under

this act, and the use of prescribed burning has been continually increasing annually across the Michaux as a landscape and ecosystem management tool. Current uses of prescribed burning include, but are not limited to, managing native wildflowers, grasses and legumes on Special Wildlife Management Areas (SWMA, AKA Wildlife openings), competing vegetation management in conjunction with timber sale practices, invasive species control (experimental burns to monitor effects of prescribed burning and invasive species), and burning in fire dependent ecosystems (Scrub oak/pitch pine/savannas).

Current concentrations of prescribed fire use are focusing towards restoration of remnant scrub oak/pitch pine communities which through lack of active fire management, have succeeded into ridge top black gum, and mountain-laurel communities.

## 14) Major Forest Health Issues

While proactively pursuing its priority forest habitat management goals and objectives, Michaux managers are constantly also reacting to persistent forest health threats and complicating factors that threaten the types of future forest habitat conditions we hope to achieve. Accepting the presence of such challenges and realistically and proactively incorporating both known and experimental methods of minimizing the negative impacts they can have on forest communities over time is critical both to sustaining public trust and to minimizing management costs. The following are some of the most critical challenges encountered in land management activities on the Michaux and some of the strategies employed to address them.

### *Invasive Plants*

Invasive plant is a name for a species that has become a weed pest, a plant that grows aggressively, spreads, and displaces native plants. Invasive plants tend to be non-native species that have been introduced into areas by accident or on purpose for cultivation or landscaping. In their natural range, these plants are limited by factors that keep them in balance including pests, herbivores, or diseases. However, when introduced into an area where these limitations are absent, many of these species become invasive. Invasive plants can be trees, shrubs, vines, grasses or flowers. They reproduce by roots, shoots, seeds, or all three. Invasive plants tend to appear on disturbed ground, and the most aggressive can invade existing ecosystems. Invasive plants are generally undesirable because they are difficult to control and can dominate whole areas. Ecological impacts of invasive plants include: cause changes to the availability of nutrients, light and water for native plants; disruption of native plant-pollinator relationships; serve as host reservoirs for plant pathogens; replace nutritious native plant foods with lower quality sources; kill trees and shrubs through girdling; cause changes in the rate of soil erosion; and cause changes to natural ecological processes, such as plant community succession. Invasive plants reduce habitat for native wildlife. Invasive plants often emerge earlier in the spring and push natives out through fast reproduction. This limits habitat available for native wildlife. Invasive plant infestations can be extremely expensive to control, as well as environmentally destructive.

Invasive plant infestations are a major concern on the Michaux State Forest. Prominent invasive plants found on the Michaux include mile-a-minute (*Persicaria perfoliate*), tree-of-heaven (*Ailanthus altissima*), Japanese Angelica tree (*Aralia elata*), Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), Japanese privet (*Ligustrum japonicum*), Japanese stiltgrass (*Microstegium vimineum*), cork tree (*Phellodendron amurense*), multiflora rose (*Rosa multiflora*), Japanese knotweed (*Fallopia japonica*), oriental bittersweet (*Celastrus orbiculatus*), Japanese spiraea (*Spiraea japonica*), poison

hemlock (*Conium maculatum*), bee-bee tree (*Tetradium daniellii*), periwinkle (*Vinca minor*), wineberry (*Rubus phoenicolasius*), and various bush honeysuckles (*Lonicera* spp.). Illegal dumping of yard clippings is a major problem on the Michaux State forest. Often these yard clippings contain seed or whole plants with roots of non-native plants that can quickly become established.

Michaux State Forest has been implementing aggressive herbicide treatments for such infestations. Herbicide treatments are done either by foliar, basal bark, cut-stump or hack-and-squirt treatment. District staff began herbicide treatment in 2015 to a 400-acre infestation of Japanese barberry around Pine Grove Furnace State Park. Once treatment is complete the area will be monitored and planted with native tree species. District staff will continue to conduct yearly treatments of invasive plants.

Herbicide contracts are also used to treat infestations. A 95-acre infestation of cork tree and bee-bee tree near Mont Alto Campus was treated in 2016 using a contractor. A core area for a plethora of invasive species located in the northern part of Michaux is Camp Michaux. Camp Michaux is an historically important site where 25 acres of invasive plants have been treated. Currently a management plan is being developed to treat an additional 202 acres in this area. This treatment will not only help restore the cultural aspect of Camp Michaux, but it will also reduce a core area of invasive plants.

Biological control is being used on the Michaux to control mile-a-minute infestations. Mile-a-minute weevils have been released in various locations throughout the Michaux. These weevils are a natural control of mile-a-minute. The weevils have undergone extensive testing in labs to ensure that they will have no impact on native vegetation. Adult weevils feed on the leaves and lay eggs on the plant. The larval that emerge bore into the plant stem at the nodes and feed. The weevils do not eradicate the infestation but they can control the spread of the infestation.

There are more than 30 other known non-native plants found on Michaux State Forest. These additional species have the potential to become invasive if not controlled. Michaux State Forest implements the Early Detection Rapid Response (EDRR) plan of action. Once an invasive plant has been detected the location is mapped through the invasive map app. The plant is then treated by prioritization. The location is then monitored to insure the plant has been eradicated and did not reproduce. The EDRR approach can be effective to combat new invasive plants and control the spread of invasive plants already established on the state forest. Michaux State Forest staff has implemented a list of species for their EDRR plan.

EDRR species developed by Michaux State Forest:

- Japanese angelica (*Aralia elata*) – North of Mont Alto (Route 233) and Cold Springs Road
- Kudzu (*Pueraria lobata*)- All state forest land
- Poison hemlock (*Conium maculatum*) - All state forest land
- Japanese Knotweed (*Fallopia japonica*) - All state forest land
- Phragmites (*Phragmites australis*) - All state forest land
- Pale swallow-wort (*Vincetoxicum rossicum*) (Note: this species was just found along Route 233 this year. District staff hand pulled the existing population, some individuals of which had already set seed and the site will be monitored this fall and next spring to treat any residual individuals with herbicide.)



Invasive plants not yet found on Michaux State Forest:

- Wavyleaf basketgrass (*Oplismenus hirtellus*)
- Black swallow-wort (*Vincetoxicum nigrum*)

Invasive plants are also a major problem on private forests, and can serve as an infestation source for the Michaux. These plants are especially problematic because many private woodland owners are not able to identify these woody and herbaceous invaders. Invasives are green so they are often viewed as good. When left untreated, they can go to seed and spread quickly. Wavyleaf basketgrass, the newest exotic invasive to join the plant invaders of Pennsylvania, was recently found in York County. Other common species found on private lands are mile-a-minute vine, Japanese stiltgrass, garlic mustard, multiflora rose, shrub honeysuckle, autumn olive, Japanese honeysuckle, privet, Oriental bittersweet, Japanese barberry, tree of heaven, Japanese angelica and Norway maple. Service foresters are available to help private woodland owners identify and control nonnative invasive plants on their property. Public education and cooperation can help prevent the spread of invasive plants.

### *Invasive Insects*

Emerald Ash Borer (EAB), *Agrilus planipennis*, is native to eastern Asia and was first detected in the United States in 2002. EAB will most likely kill nearly all ash trees in the district and state. Pennsylvania drafted a 10-year ash management plan in 2014. EAB was confirmed in the Michaux State Forest in 2015. Ash is not a major component on the Michaux, but is found more readily on private lands in the district. Michaux foresters selected 43 ash trees in three separate locations to inject with insecticides to maintain the health of the trees for biodiversity and a future seed source. Trees were treated in 2015 and 2017. Future treatments will depend on evaluations of the insecticide effectiveness.

Hemlock wooly adelgid (HWA), *Adelges tsugae*, is an invasive insect that is killing thousands of hemlock trees in the eastern United State, including Pennsylvania. The small aphid-like insect sucks sap from young twigs resulting in loss of needles, eventually killing the tree. Hemlocks have been infested on the Michaux for possibly two decades or more, and thousands of trees have died. However, pockets of hemlocks still survive, especially seedlings and saplings along with some larger unhealthy-looking trees. Michaux foresters have treated hundreds of hemlocks with insecticides in select locations in 2005, 2006, 2007, 2014, and 2015. Insect predators of the adelgid have been released to aid in long-term control of this pest.

Gypsy Moth (GM), *Lymantria dispar*, is one of North America's and Pennsylvania's most devastating forest pests. It was introduced accidentally near Boston, Massachusetts in the 1800's. Since then, periodic outbreaks have defoliated and caused tree mortality in Pennsylvania's woodlands. Our ecologically and economically valuable oak species are susceptible and therefore a major concern along with hundreds of other species that are hosts. Oaks provide both hard mast and nutritious foliage and buds for many wildlife species to feed on. Every year the Bureau of Forestry conducts an aerial survey of both state and private forests in the district to detect GM outbreaks and other pest issues. Ground surveys are performed on any potential problems for confirmation and identification. If GM is detected,

it may be part of a spray program the following year. We have had small spray programs in the district in 2016 and 2017 at Kings Gap State Park. The last major outbreak and spray program on the Michaux State Forest and private lands in the district occurred in 2008 and 2009. The spray is most often *Bacillus thuringiensis* (Bt), a biological control that is sprayed on the foliage and ingested by the small caterpillars. Other biological controls including a virus and a fungus have caused considerable mortality of the GM population in North America. Typically, defoliation must occur successive years to cause mortality but combined with other stressors such as severe drought, mortality may be more imminent. GM defoliation also makes trees more susceptible to secondary invaders that may cause mortality such as the two-lined chestnut borer.

Spotted lanternfly (SL), *Lycorma delicatula*, an invasive planthopper, was discovered in Berks County, Pennsylvania on September 22, 2014. Current research indicates that this insect is a sap sucking insect that greatly weakens the host to other stressors but does not kill the host outright, but the resulting excrement covers the lower limbs and ground with honeydew. This honeydew and fungal growth, known as sooty mold, reduces salability of fruits. The Asian native affects at least 25 plant species that occur in Pennsylvania, including grapes, pines, fruit trees, and hardwood species. In the U.S., the SL has the potential to greatly impact the viticulture (grape), fruit orchards, plant nursery and timber industries. One highly preferred host species is tree of heaven, *Ailanthus altissima*. These nonnative invasive trees can be used as detection sites or trap trees for controlling small populations. The current strategy for SL management is to slow the spread. Because the SL is a poor disperser, the main method of movement over long distance is from human transportation. The Pennsylvania Department of Agriculture has placed a quarantine on 13 southeastern counties. This quarantine requires the inspection of everything exiting the quarantine area. Any detection of SL in the Michaux State Forest or surrounding counties will greatly complicate the wood product production and transportation process for our local producers. A SL management plan should be developed proactively to increase the resilience of the Michaux State Forest against this novel pest.

Southern pine beetle (SPB), *Dendroctonus frontalis*, is a destructive insect pest of North and Central American pines. In May of 2017 the Bureau of Forestry Forest Health Section beetle trapping program discovered a population of SPB in Codorus State Park in York County. This beetle has the potential to greatly affect the management of pine stands on the Michaux. It is found from Pennsylvania to New Mexico and south to Nicaragua. It is a native pest that prefers to infest loblolly, shortleaf, pitch, and Virginia pines but can infest all pine species including spruces and hemlock. Signs and symptoms of this beetle include frass, pitch tubes, S-shaped galleries, and reddening of the canopy. These bark beetles typically affect stressed trees but populations can explode into outbreaks and killing healthy, vigorously growing trees. These outbreaks progress like a wildfire along what is known as a killing front. SPB populations increase in the spring and continue to grow up to 120 feet per day until the winter temperatures slow the killing front's expansion. Trapping sampling is effective for finding smaller SPB populations. Aerial surveying is very useful for discovering where infestations are expanding into outbreaks. Suppression of outbreak level populations is possible through cut and remove, cut and spray, cut and leave and cut and burn actions. The recommended action is to stop the spread by cut and remove treatments. By cutting and removing all susceptible trees within the infestation area and creating a buffer by cutting all susceptible trees out in front of the killing front, it cuts off the supply of new living trees for the beetle population expansion. Prevention is possible to keep SPB populations below the threshold of outbreak by thinning pine stands to less than 80 square feet of basal area per

acre. Early detection and rapid response actions should be used for infestations that are rapidly growing to outbreaks.

### *Disease*

White pine decline - Chlorosis, premature needle drop, branch flagging, branch or trunk cankers, and tree death are the symptoms of several fungal pathogen causal agents of white pine decline.

*Canavirgella* needle cast, *Lecanosticta acicula* (the asexual state of *Mycosphaerella* leaf spot or brown spot) *Diplodia* tip blight, and other needle disease fungi have been identified on eastern white pine in the Michaux State Forest and surrounding state parks. These fungal pathogens are just a few of the pathogens that have been causing decline in eastern white pine in the northeastern United States. Most of the tree death that has been reported on the Michaux has been in understory sapling white pine populations.

The amount of precipitation has been linked to severity of outbreaks of these diseases. An increase in precipitation during the months of May, June and July, the months when white pine needles are elongating, is positively correlated with damage from needle blight pathogens. However, as is the case with many conifer needle pathogens, that effect has a one year delay. There are no known management or practical treatment options for use in a forested setting. Maintaining vigorously growing trees may reduce the impact of these foliar pathogens.

Thousand Cankers Disease (TCD) is the dieback and mortality of eastern black walnut (*Juglans nigra*) from an interaction of a fungus and tiny reddish-brown bark beetle native to Arizona, California, and New Mexico. The walnut twig beetle *Pityophthorus juglandis* creates galleries beneath the bark of affected branches and the main stem, resulting in fungal infection and canker formation from the pathogen *Geosmithia morbida*. The large number of cankers found on infected stems suggests the disease's name, thousand cankers disease. TCD was found in southeastern Pennsylvania in 2011. The Michaux State Forest has a small population of black walnut. The proximity of the currently affected trees to the Michaux State Forest means that this pathogen complex may eventually spread to the large populations of walnut in the farmed valleys of York, Cumberland, Adams and Franklin counties. Currently, a quarantine prohibits the movement of these products outside of the currently affected counties: Bucks County quarantined in 2011, Lancaster, Chester, Delaware, Montgomery and Philadelphia counties, which were quarantined in August 2014. Visually inspecting walnut trees for dieback is currently the best survey tool for detecting TCD in the eastern United States. Culturing on agar can be used to identify the fungus and pheromone traps can be used to detect the presence of beetles.

## 15) Major Recreational Uses and Management Issues

The history of the Michaux as a state forest is as inextricably linked to the eco-regional value it holds as a recreational destination for outdoor, forest based activities as it is to the ecosystem functions the mountain and its forests provide. Even at the time of the earliest land acquisitions; resort communities

around Mount Alto, Caledonia, and Pine Grove Furnace drew people from both adjoining Pennsylvania population centers as well as from the Baltimore and DC metropolitan areas.

Today, the Michaux supports more; and more intense recreational use than any other state forest system. It is in high demand as an event venue given the range and scale of opportunities supported by its contiguous land mass and proximity to large populations and the growing market demand for planned events within many outdoor user groups. Local communities also look to the Michaux and the surrounding state parks as a recreational asset to attract tourism dollars into the local area further increasing the exposure and appeal created for the forests recreational opportunities. The free access (with registration) to camping at the forest's primitive campsites provides not just cost effective opportunities for a forest getaway weekend, but is increasingly used as a low-cost lodging alternative for motorists traveling through the area. Finally, nearly one million people reside in the four counties within the district itself; and the mountain serves as an easily accessed backyard playground for many local hikers, trail runners, birders, hunters, anglers, bikers, equestrians, and motorized sports enthusiasts who know its roads, trails, and terrain and feel a high degree of ownership of and engagement with the mountain and its forests.

Along with the spontaneous and planned event uses sustained by the forest and administered by the district staff, the forest also contains 454 leased campsites, clustered loosely in two distinct campsite "communities" around Pine Grove Furnace State Park and the Caledonia Golf Course.

While a complete inventory of the recreational opportunities available on the Michaux is available on its website and public use maps, the intent of this section is to highlight key issues and management challenges, and opportunities associated with current recreational uses of the state forest facing both users, and Michaux forest managers moving into the future.

### *Shared Use Trail System*

Based on current state forest rules and regulations, walking, horseback riding, and mountain biking are allowed anywhere on the state forest unless posted closed to such activities. On a forest like the Michaux, which has been crisscrossed with largely unplanned yet nearly continuously used road and trail traces for over two centuries, this creates an extremely interesting forest and trail setting to recreate in for hikers, trail runners, horseback riders, and mountain bikers who live locally and have time to scout out and enhance its tangled treasure of trails; or even take the liberty to create some new ones! For visitors to the forest looking for a thoughtfully laid out and mapped horseback riding or mountain biking experience, particularly for beginning or novice riders, it can be a frustrating disappointment. For Michaux forest managers trying to serve the interests of both types of trail users while also trying to improve habitat and harvest timber and maintain roads and buildings – all of which have annualized and periodic funding and personnel allocations to support and timeline obligations to fulfill – the challenge of the Michaux's formal and informal shared use trail network feels insurmountable.

In 2016, funding from the Recreation Section produced a Trail Assessment for existing trails north of route 30. This report focuses District efforts around engaging shared use trail stakeholder groups in developing and sustaining a manageable shared use trail system that meets existing user expectations and utilizes the most valuable and sustainable components of existing trail segments already in use and compatible with the overall ecology of the forest. In the assessment, several priority trail restoration areas were identified as pilot projects to build the district and local stakeholder capacity around



designing, building, and maintaining high quality, satisfying, sustainable, and largely static shared use trails on the Michaux.

Those priority trail areas are in the area north of Pine Grove Furnace State park near Pole Steeple and Hammonds' Rocks outcroppings and near Long Pine Run Reservoir.

Existing designated Shared Use Trail systems on the Michaux that are supported by some level of mapping and on-site marking include the Flat Rock Trail system north of Caledonia State Park, and the Middle Ridge Trail Loop System on the Glatfelter tract.

Implementation of the Michaux Trail Assessment Report and Stakeholder Engagement strategy is one of the highest priorities in coming years for the districts forestry operations staff. Integrating sustainable shared use trail planning and management into our forest management workload and building the knowledge and capacity among district staff and volunteer groups to sustain this component of the districts' obligations represents a significant cultural and institutional shift at both the district and the Bureau level. But it is work that is essential if we are to sustainably address current, and future public demands for the recreational opportunities of this forest.

### *Equestrian Use*

Concurrently with designing an improved shared use trail system, Michaux managers would like to improve the equestrian facilities at the existing parking areas designed to support overnight horse camping on the forest; primarily Big Pine Flats and Piney Mountain Parking areas. Currently, a lack of designated camping/trailer spots, lack of manure disposal facility, and traffic control and signage measures directing trailer and traffic flows in and out of these facilities contributes to user conflicts, maintenance costs, and confusion among recreational visitors not intimately familiar with how things are done on the Michaux. The recent addition of the parking lot off Mt. Hope Road on the Glatfelter tract provided a much-needed additional day use parking lot that can accommodate horse trailers in the southern part of the forest. Tea berry and Peggy Hill Parking lots provide additional day use opportunities for Michaux equestrians.

### *Planned Group Use and Events*

One of the key policies in place to sustain "low density, dispersed recreation" within the state forest system is the requirement that any planned event by parties of ten or more individuals need to secure an Letter of Authorization (LOA) from local district managers prior to engaging in the event. Securing a LOA requires that the event organizer fill out a risk assessment form to identify potential types of risk to participants or other forest users resulting from the event and to sign an indemnification form freeing the Commonwealth from liability. For events considered "high risk," event organizers will also be asked to provide proof of liability insurance depending on the rate of risk associated with the activity.

For larger events, or events that charge a participation fee, a Special Activities Agreement (SAA) or Commercial Activities Agreement (CAA) is required which is a contractual document reviewed and approved by the Attorney General's office.

Historically, the Michaux state forest has administered more planned event agreements than the rest of the state forest system combined. After flatlining any additional large (greater than 100 individuals)

events in 2011, and coupled with widespread and growing demand for the use of the state forest system as event venues across the state; today the Michaux only administers between 30-40% of the event agreements administered by the State forest system.

There are significant benefits to supporting group activities on the Michaux: Such activities introduce a wide range of individuals to the forest and surrounding communities who may not otherwise visit. Many of the Michaux's events support worthy causes and raise funds for issues and organizations within our local community. There is an undoubtedly positive economic benefit and multiplier effect within the surrounding community from this recreational opportunity.

While we continue to sustain a dialogue on these issues with current and aspiring Michaux event organizers, local and state policy makers, and within the district, some key changes we will be making to our local administration of group activity and event requests in coming years include:

- Only permit planned activities on a subset of already designated trails to reduce the amount of administrative time reviewing requests for group and activity use of the informal areas of the Michaux shared use trail system.
- Require all requests for large group events to be submitted between January and February of every year so that we can prioritize event and group activities based on other factors influencing our annual workload.
- In future years, we see the need for a more transparent and measurable process by which to evaluate the optimal mix of event opportunities sustained in a given period on the Michaux based on system constraints and the wide range of desirable values that can be pursued through continued support of this burgeoning interest in state forest recreation.

### *Leased Campsite Program*

Leased Campsites on the Michaux go back to the very inception of the state forest system. Early acquisitions around the Caledonia resort community and Pine Grove Furnace were already popular areas for hunting cabins and recreational part time residences for urban dwellers in Carlisle and Harrisburg.

Many of today's campsite lessees on the Michaux trace their association with their campsite and with the forest back across multiple generations. Many also trace a parallel lineage with their commitment to and interest in forestry and conservation and engaged volunteer and stakeholder support for forest stewardship.

Current campsite leases stipulate that lessees own the cabin structures, but lease the land they are on from the Commonwealth for \$200 annually. Limits to square footage of livable space (1,000 square feet), second stories, pressurized internal water and septic systems, and constraints to decisions about landscaping and additional structures on the lease are designed to ensure forest leased campsites provide for a comfortable but rustic dwelling that supports part time recreational use of the forest. Current lease language also requires that lessees maintain an alternative fulltime Pennsylvania residence and disallows mailboxes and trash disposal at cabin sites.

District administration of leased campsites on the Michaux includes conducting annual three year inspections, responding to requests for lease transfers, addition and improvement approvals, and

addressing non-compliance issues. The administrative workload from the leased campsite program represents the annual equivalent of 1.5 full time staff in an average year.

Moving forward, Michaux managers are seeking ways to ensure our administrative efforts in support of the leased campsite program are efficiently invested to broadly serve the interests of campsite lessees willing and able to comply with the contractual constraints on residence, amenity improvements, and landscaping decisions on their lease.

In a district supporting an estimated 330,000 visitors a year on a trail system in desperate need of redesign and volunteer groups clamoring to help us in the broader public work needed to support the recreational values of the forest for the next generations, it is critical that our work in sustaining what should be one of the most static administrative obligations on district staff become far more efficient over time while still sustaining participant satisfaction and sense of parity within the program.

### *Appalachian Trail*

The Appalachian Trail bisects Michaux State forest from South to North and serves as the backbone for most of the designated hiking only trails within the Michaux. Stretching from Georgia to Maine, the halfway point for this iconic trail system is located at Pine Grove Furnace State Park which also serves as the location of the Appalachian Trail Museum. These factors, coupled with the general demographic context of the forest make visitation rates on Michaux's AT segments some of the highest in the nation as they support both heavy local day and weekend users.

The Michaux forest staff work closely with Appalachian Trail Conservancy staff, Potomac and Appalachian Trail Club members, and the National Park Service in addressing joint management issues of the AT corridor, its users, and the landscapes they sojourn across on the Michaux. In recent years, there has been a joint effort between ATC, Pennsylvania heritage partners, and Michaux management staff to invest in a critical barrens restoration project in the vicinity of Dead Woman's Hollow along Ridge Road. That effort has also expanded into a joint effort to restore the heavily invaded landscape of Bunker hill to more desirable savannah like conditions that will be implemented summer of 2018.

Improving ecological habitat conditions along this critical recreational asset in ways that enhance the AT user experience while also reducing trail hazards, user conflicts, and maintenance costs will continue to be key areas of collaboration and partnership between the Michaux and the Appalachian Trail community.

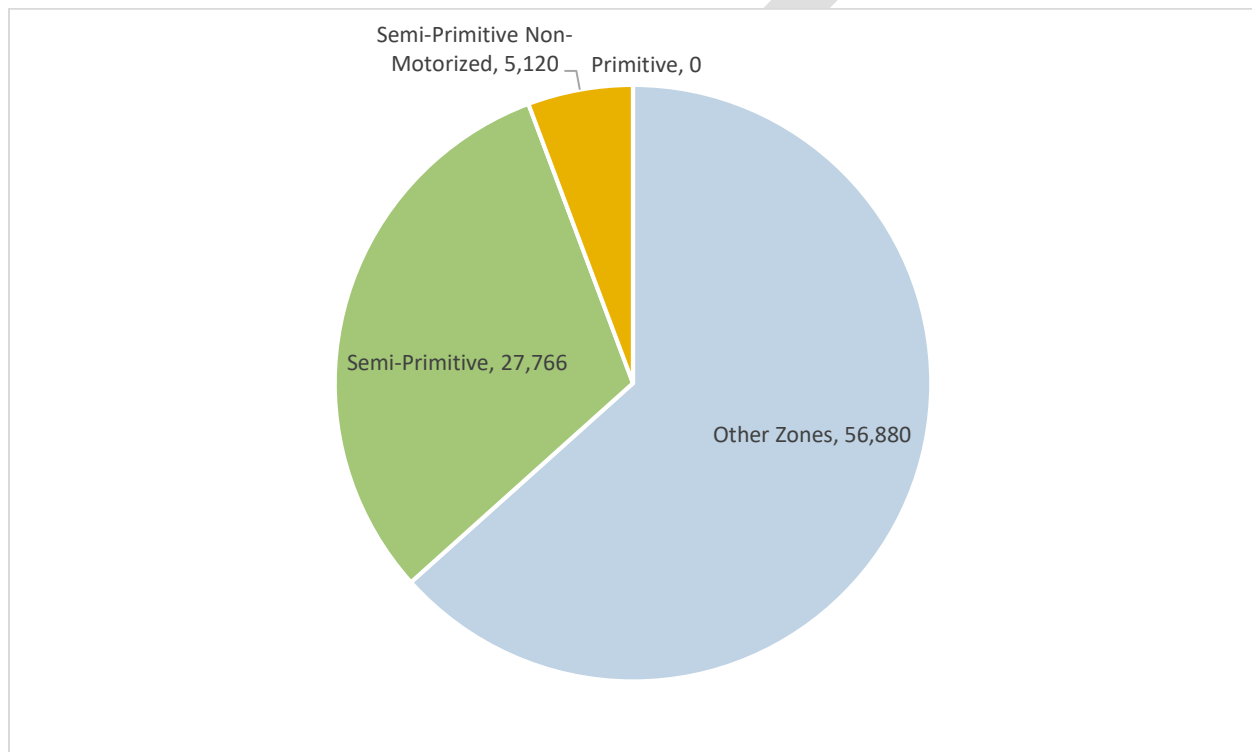
### *Recreation Opportunity Spectrum*

The Recreational Opportunity Spectrum Model is used as a planning tool to ensure addition of anthropogenic features such as roads, trails, or parking areas are designed to minimize erosion of opportunities for forest users to experience "primitive" or "wilderness" conditions in certain areas of the forest (Figures 14-1, and 14-2).

ROS model results for the Michaux are somewhat unreliable at predicting user experience because such a large portion of it Michaux trails are undocumented and therefore unmodeled.

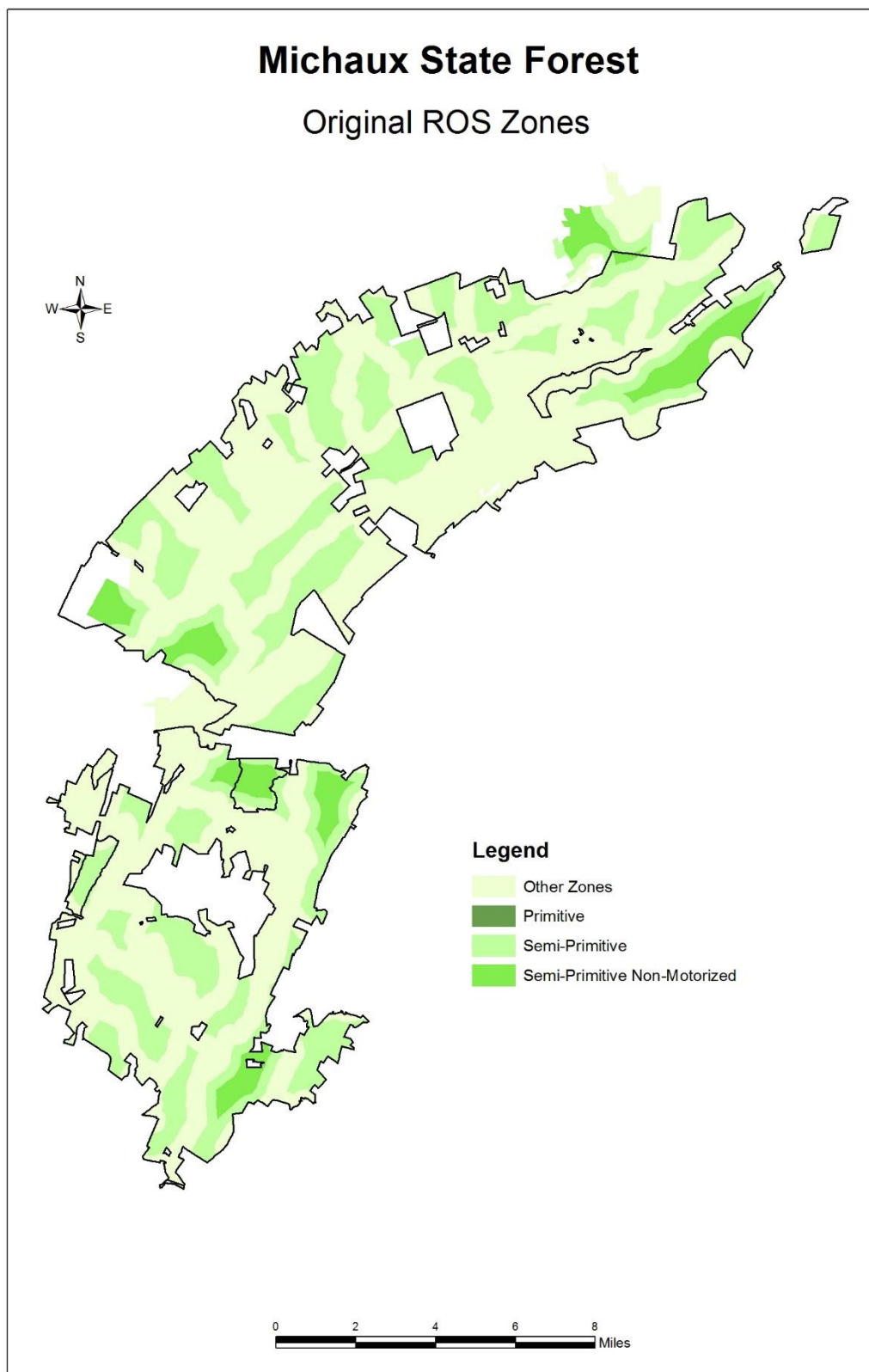
Therefore, it is much more likely for forest users to encounter a higher density of trails and higher rates of human presence in areas of the Michaux the ROS model would suggest are Semi-Primitive or Primitive.

Designing and developing a sustainable, static shared use trail system and engaging Michaux forest users around trail stewardship concepts will allow us to more closely align ourselves with existing planning tools and recreational management aspirations articulated within the SFRMP.



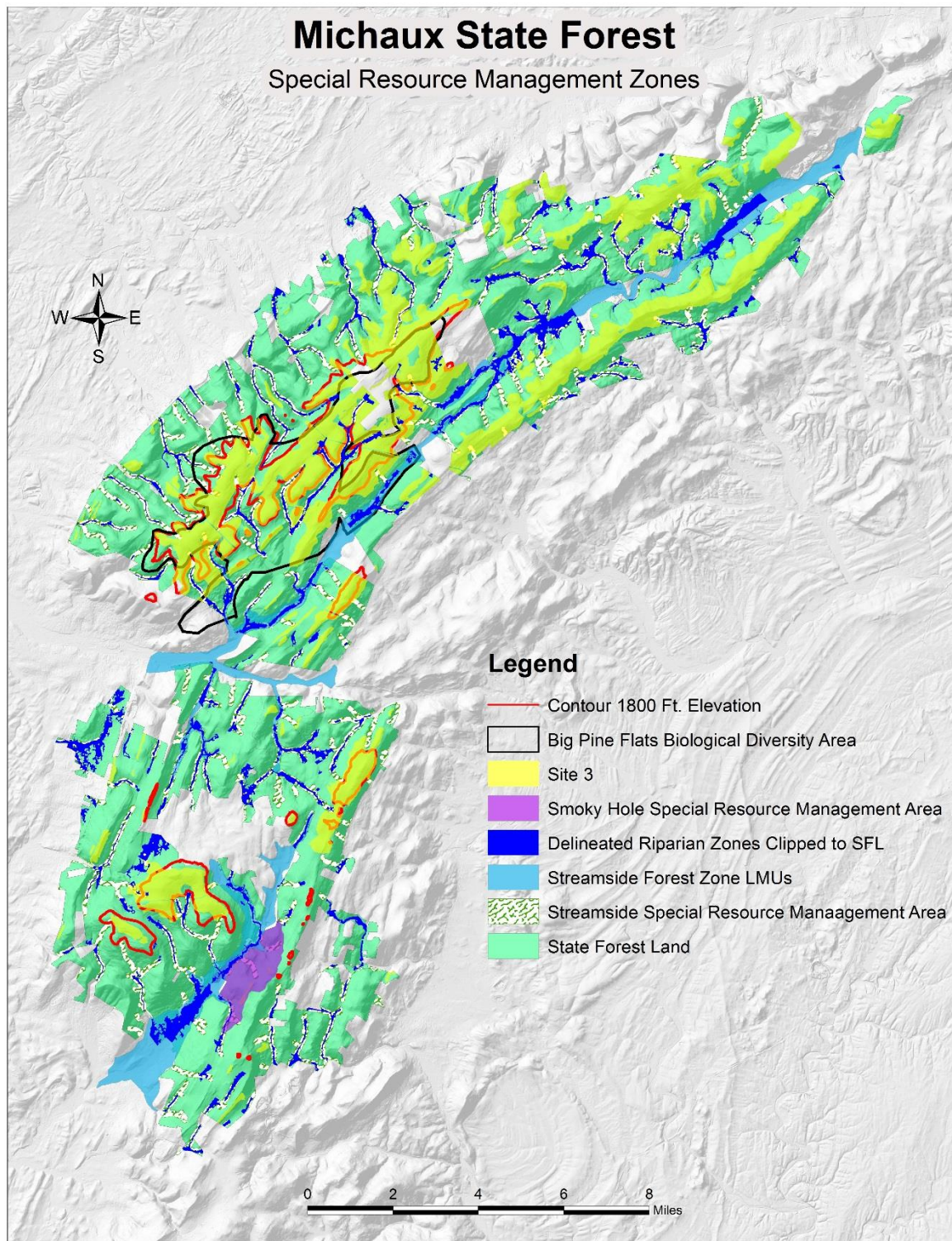
**Figure 14-1.** Acres of state forest land in this district by Recreation Opportunity Spectrum (ROS) classifications (2012). ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones.





**Figure 14-2.** Map of summer Recreational Opportunity Zones.

## 16) Special State Forest Designations



**Figure 15-1.** Map of Special Resource Management Zones.

## *Supra Areas*

- 1) Big Pine Flats Biological Diversity Area – 9717 acres state forest land
  - a. Designated as a natural heritage area of importance
  - b. Recognized for its ridgetop barrens ecosystem, vernal pools, seepage wetland complexes, and talus sloped
  - c. Crucial habitat for numerous species of special concern
- 2) 1800' core Barrens/ ESH management areas
  - a. Based on analysis of vegetative features identified within the Big Pine Flats Biological Diversity area, district managers are proposing that other areas at or above 1800' elevation along the South Mountain ridge be prioritized for continuous management of Pitch pine scrub oak, low heath, savannah, and other disturbance mediated community types to improve dispersion and connectivity of these once ubiquitous forest types across the state forests landscapes.
- 3) Site 3 Fire mediated oak and hard pine priority sites
  - a. Management of the lower quality growing sites across the Michaux has lagged behind investments made in salvaging and regenerating higher quality sites. Economic and ecological considerations unique to these areas will require a special focus on the part of Michaux and statewide decision makers over coming decades to ensure the social and ecological values of these sites are optimized at the forest system level. Identified objectives for these sites include an intentional effort to enhance the pitch pine component through increased use of prescribed fire and other pine regeneration practices, and to sustain patch size diversity and inclusion of transitional community types and habitat features such as standing and downed large woody material, and shrub/heat/grass patch interspersions; particularly on high heat index sites within the site three Supra area complexes.
- 4) Smoky Hole Special Resource Management Area – 1191 acres
  - a. One of the least disturbed areas on Michaux with most of it untouched since charcoaling occurred in 19<sup>th</sup> century
  - b. Pockets of large oak, birch, hemlock, maple, and gum up to 150 years in age occur on some protected sites which represent the best example of “old growth” on the Michaux
  - c. No ATV trails
- 5) Critical Drainages Landscapes
  - a. Sustaining and enhancing the critical ecological interactions between forest and aquatic environments has been a part of the Bureau of Forestry’s mission since its inception, and the Michaux has been the vanguard of the state’s experiment in

managing these two ecosystems to benefit current and future generations since its earliest acquisitions. Two of the eleven Land Management Units, Antietam Creek Landscape and Conococheague/Mountain Creek Landscape represent critical drainages within the Michaux that serve as monitoring points for the ecosystem level effects of the Michaux's landscape management practices.

- b. Adapting forest management practices in order to address eco-regionally important priorities will include modifying silvicultural practices within the streamside forest zone identified as critical nesting habitat for grouse and other avian species, and enhancing dead wood habitat and flood plain hydrological connectivity, and palustrine adapted floral diversity within delineated floodplain forest zones.

### *High Conservation Value Forests*

HCVF Category	Acres
1.1, areas legally protected or managed primarily for concentrations of biodiversity values that are significant at the ecoregion or larger scale	691
1.2, areas with significant concentrations of rare, threatened or endangered species or rare ecological communities, endemic	4,750
3.3, rare, threatened, or endangered ecosystem	3
4.1, areas providing a source of community drinking water	902
6.2, areas with cultural features created intentionally by humans	159

**Table 15-1.** Acres of High Conservation Value Forest by category.

To comply with Principle 9 of the FSC U.S. Forest Management Standards, the bureau evaluated and assessed areas for inclusion as HCVFs. While the BOF believes that all state forest lands are of highest conservation value, areas not designated as such are still of equal importance and are protected through law and best management practices. The areas which have been identified as HCVFs are mapped and managed in a manner that will maintain and/or enhance the values for which they have been designated. More information about HCVFs can be found in the SFRMP, p. 64.



## Wild and Natural Areas

Michaux	Name	Acreage
<b>Natural Areas</b>	Beartown Woods Natural Area	25.4
	Carbaugh Run Natural Area	828.0
	Meeting Of The Pines Natural Area	603.3
	Mt Cydonia Ponds Natural Area	180.6
	<b>Natural Area Total</b>	<b>1,637.4</b>
<b>Wild Areas</b>		0.0
	<b>Wild Area Total</b>	<b>0.0</b>
<b>Total</b>		<b>1,637.4</b>

**Table 15-2.** Total acreage of Wild and Natural Areas on state forest land within Michaux State Forest.

## 17) Interpretive Plans

The District has a number of initiatives to develop interpretation, demonstration, and educational values of the forest.

- (1) Hammonds Rocks Vista and Interpretive site
  - (a) Following the graffiti clean-up in 2016 at Hammonds Rocks vista, an interpretive display was developed and is in the process of being constructed to help visitors engage with the key geological, ecological, and cultural values of this vista area
  - (b) Future plans include developing additional trail connectivity and limited trail head parking in the vicinity to enhance non-motorized access to the site for Michaux trail enthusiasts
- (2) Camp Michaux Learning Landscapes Initiative
  - (a) Michaux staff are partnering with the Appalachian Trail Conservancy, Potomac/Appalachian Trail Club, Friends of Pine Grove Furnace State Park, National Wild Turkey Federation, Camp Michaux/Pow Interpretive Trail volunteers, and researchers and educators from Dickinson College and Shippensburg University to develop the recreational, ecological, cultural, and educational resources within the historic agricultural and industrial lands complex within the Bunker Hill area of the Camp Michaux landscape.
  - (b) Expanding the interpretive opportunities will include opportunities to learn about the geologic, archaeological, and historic information currently known about this site, ongoing research questions and learning opportunities this landscapes demonstrates regarding how human use impacts landscape ecology and natural resources, and demonstration of sustainable and restorative forest and other native habitats management on different levels of scale.
- (3) Froulicher/Glatfelter Watershed Demonstration Forest
  - (a) With the recent acquisition of Tree Farm #1 and the imminent acquisition of significant portions of the Strawberry Hill Nature Preserve, the Michaux is also partnering with the Strawberry Hill

Nature Preserve and Education center and other local partners to leverage the existing educational values of that organization around watershed protection and health along with the legacy of the Glatfelter tract as the initial site of the Tree Farm program which seeks to demonstrate the societal value of sustainable forestry in providing Wood, Water, Wildlife, and Recreation to present and future generations.

(4) Bicentennial Tree Trail

- (a) The longest standing interpretive site on the Michaux is the Bicentennial Tree Trail within the Beartown Woods Natural area. This trail provides interpretive panels introducing trail users to the assemblage of Northern Hardwood tree species, unique within the South Mountain region.
- (b) Trail improvements and improved interpretive signage are needed to sustain the user experience and educational value of this existing interpretive site.

## Summary of District Priority Goals

The following is the list of District Priority Goals touched on in this plan:

- 1) Continue to diversify the age class structure, diversity, and resilience of the forest community through implementation of annual commercial timber harvesting and through non-commercial practices such as microsite management, prescribed burning, and restoration of invaded stands and landscapes.
- 2) Sustain and restore eco-regionally significant forest types and custodial wildlife species by focused adaptive management practices on the following four subsystems and/or indicator species
  - a. Restoration of fire mediated communities such as Pitch Pine Scrub Oak and low-heath barrens and transitional ecologies at either end of the forest cover continuum with glade, meadow, and savannahs or Pitch, Shortleaf and fire dependent oak stands.
  - b. Improve stream system functioning by ensuring habitat connectivity, large woody material structural diversity within and along streams, and restoring canopy structure and floral diversity components in streamside and floodplain forest areas.
  - c. Manage listed and ecologically significant wild plant populations in designated plant sanctuaries and propagation areas. Where feasible and desirable, implement assisted colonization efforts to enhance population resilience and interconnectivity at the system level
  - d. Monitor and improve habitat conditions around vernal ponds and pond complexes to enhance population resilience within and across pond obligate plant and animal species
  - e. Stabilize grouse population decline and provide opportunity for population recovery through targeted habitat projects along herbaceous edges and within streamside and floodplain forest areas to ensure availability of optimal nesting habitat where adult birds are encountered.
- 3) Provide a welcoming attitude to forest recreational users and work to provide sustainable and high quality trail and forest use experiences within the Michaux

- a. Engage existing trail users and district staff in developing the individual and collective stewardship capacity to design, build, and sustain a world class shared use trail system that optimizes the cultural, ecological, and recreational values within the Michaux
  - b. Create parity across amenity values enjoyed by leased campsite program participants while improving administrative efficiency and transparency around administrative costs and constraints.
  - c. Ensure staff time invested in administrative and transactional costs associated with organized group activities and event programming are optimally allocated in the service of public recreational use needs
  - d. Reduce annual Road maintenance costs through redesign and optimization of the Michaux public and administrative road systems.
  - e. Develop interpretive and demonstration landscapes and trail systems at Camp Michaux and Strawberry Hill.
  - f. Improve Equestrian Camping facilities at Big Pine Flats and Piney Mountain Parking areas
  - g. Continue to improve signage, trail conditions, and rider engagement opportunities within the ATV trail system.
- 4) Continue to develop the Districts Capacity and Preparedness in Fire Suppression and Management
- a. Ensure consistent development of district staff qualification levels to prevent critical qualifications capacity gaps in higher level qualifications (RXB's, Firing Boss, ICT5's, Engine boss, etc.)
  - b. Continue to support local volunteer fire companies with high quality training in wildland fire fighting
  - c. Work to recruit committed individuals with strong leadership skills and a keen interest in professional wildlands fire management to the Fire Warden's program
  - d. Use prescribed fire to mitigate high-hazard fuel areas in the Michaux's dry oak heath ridgetop forests to meet ecological and recreational goals while providing for public safety and reducing the risk of high suppression costs
  - e. Use prescribed fire and fire tolerant plant communities to reduce the cost of micro-site management of invasive species and to provide a cost effective alternative to highly invaded and high use recreational areas.
- 5) Provide high quality outreach and education opportunities that engage the surrounding communities and stakeholders in the value of sustainable forestry within the district.

## Landscape Management Unit Plans

With the 2016 revision of the SFRMP, the bureau introduced the LMU concept to facilitate consistent, structured, and integrated resource management and planning across large landscape units on state forest and adjoining lands. LMUs were delineated for all state forest land in 2016-2017. The LMU, which complements other ecological delineations, now serves as the primary unit for landscape-level planning and management on state forest lands. LMUs help the bureau facilitate planning on a landscape scale that has ecological context, incorporate multiple forest uses and values, and promote ecological analysis. The units also serve as a tool to facilitate cooperative management with adjoining forest districts, landowners, and agencies. An explanation of how LMUs were delineated is found in the 2016 SFRMP on page 62.

The bureau has developed LMU Plans for every LMU containing state forest land. The LMU Plans for LMUs within Michaux State Forest District are found below. Each LMU Plan contains three elements:

- Abstract – a 1-2 page narrative describing the LMU and its important features;
- LMU Priority Goals – a list of points of emphasis for state forest land management within the LMU, similar to the District Priority Goals, but at the LMU level; and
- Profile – tables, charts, and accompanying text that more fully describe the LMU's characteristics.

# Antietam Creek

## Landscape Management Unit

### Abstract

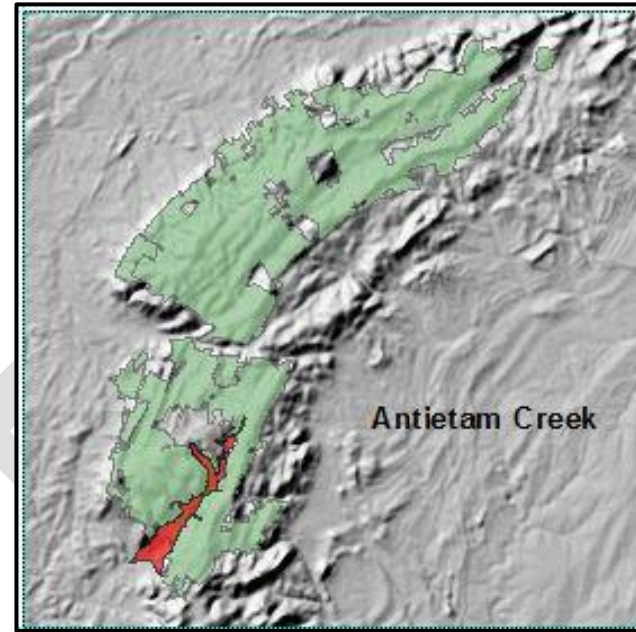
The Antietam Creek landscape is a long narrow landscape in the South Mountain ecoregion, extending from the village of South Mountain south along the East Branch of Antietam Creek and its tributaries to the village of Glen Forney. The area is distinguished by a rich industrial land use history, recreational opportunities, and riparian forest areas along Antietam creek.

Total landscape acreage is 2,845 acres with 1,406 acres found in state forest. Elevations in this LMU range from 1716 at the highest point to 769 above sea level. A variety of forest types are found here (Figure 2), and much of the land value is closely associated with riparian and aquatic ecosystems, including streams and vernal ponds found in the south. This LMU encompasses several areas of cultural importance and habitat for several sensitive plant and animal species including the Glen Forney Vernal Natural Heritage area which has more than 30 vernal pools many other important plant and animal wetland species. It also catches portions of the Kepner Knob Heritage Area which provides habitat for timber rattlesnakes and other wildlife species.

Numerous trails provide recreational opportunities (Table 3). Peggy's Hill and Swift Run recreation parking areas provide access for horses, snowmobiles, and other forms of recreation. Other notable features are the heavily-used Old Forge Picnic Area, Old Forge Ranger Station, Camp Penn (United Methodist Church Camp), and leased state forest campsites south of Old Forge.

The southern portion of the LMU was heavily industrialized throughout the 1800s. Iron pits were quarried, streams were diverted and dammed, and mill races were built. Multiple mill dams used waterwheels to power the local iron industry. Farms, a sawmill, a school, and a cemetery were established to support the mill works all within this landscape unit. In the 1930s, two Civilian Conservation Corps camps were built in the LMU. One camp has become Camp Penn the Methodist Church Camp and the other has returned to forest again. Remnants of the iron industry including the two former mill dams can be found at various sites between the ranger station and Wirt Road and must be preserved.

Much of the northern portion of the landscape is comprised of the Waynesboro municipal watershed that utilizes water from the East Branch of Antietam Creek Watershed. The Waynesboro reservoir lies near the middle of the landscape along Old Forge Road north of Hayes Run. A section of land owned by the Waynesboro Water Authority above the reservoir is found in the landscape near Old Forge, with a waterline running south from the water treatment plant. The East Branch Antietam is stocked with trout from the water treatment plant to the bridge on Wirt Road. Native trout can be found to the north of the treatment plant. Twenty four miles of high quality designated stream are found in this landscape (Table 4).





A special site in this landscape is found in stands in compartment 52 (east of Old Forge Road, north of Rattlesnake Run Road, and south of Peggy's Hill). This area is typed as Special Resource Management Zone (typed "S" and locally called the Smokey Hole or Wert Wild Area). While not large enough for formal designation as a Wild Areas, this area has been designated as a Special Resource area as it was spared the devastating windstorm of 1993 and represents one of the district's larger contiguous blocks of late stage second growth forest. This area has been specially designated as a core area of extended rotation and "accelerated Old Growth" management which will focus as much as possible on gap phase replacement strategies and sustaining high connectivity and coverage of high canopied forest habitat critical to species such as cerulean warblers, scarlet tanagers, and other declining late-seral dependent avian species.

Like many areas of the Michaux State Forest, invasive species threaten this landscape. The hemlock woolly adelgid has severely impacted the eastern hemlocks throughout the landscape. Hemlock occupies many stands in the overstory, mid-story, and understory along the streams. Many hemlocks have died with nearly all showing sparse crowns. Japanese stiltgrass is found in a large percentage of stands. Several invasive shrubs can be found in the stream corridor, Japanese barberry, privet, and multiflora rose. A patch of the invasive kudzu vine has been recorded for 30 or more years along the SCS Camp Road, with recent efforts to eradicate the vine from the area.

There is somewhat limited opportunity for timber sales, especially regeneration harvests in the landscape. But timber quality is excellent with a large percentage of the state forest acreage is classified as site 1 stands. Like in many other areas of the Michaux Forest most of these site 1 stands have either already been harvested in the last 50 years or are within the buffer for aquatic features.

The water resources and recreation infrastructure should be the top management objectives for this landscape. This landscape management unit provides ample opportunities for active management to promote species of concern and cultural resources.

## Priority Goals

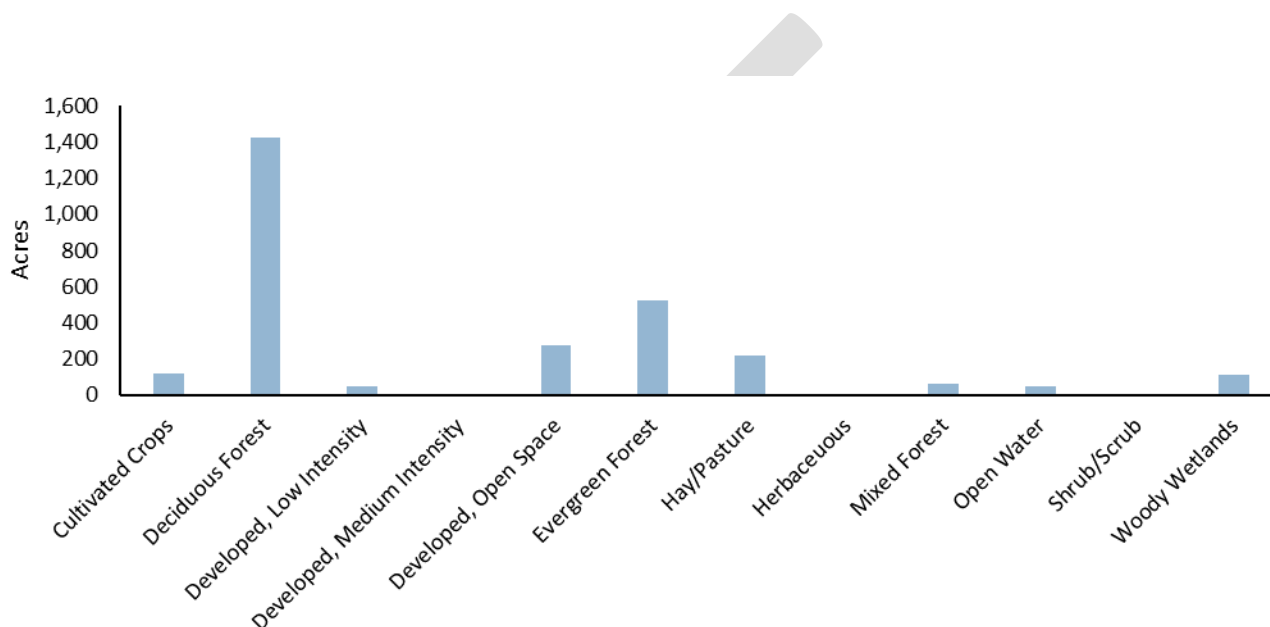
1. Maintain or improve aquatic habitat and water quality by improving road design and culvert structures to provide aquatic organism passage.
2. Increase extended rotation forest acreage to provide improved riparian habitat. In riparian areas, Special management regimes should be implemented, i.e., longer rotation harvests, that allow the tree diameters to increase, providing potential large woody debris to fall into the waterways. Many streams are lacking in large woody debris for stream bed complexity and emergent substrate. Emergent logs provide refuge, foraging, pupation, emergence sites for aquatic invertebrates. Reptiles and amphibians also require basking sites provided by emergent large woody debris.
3. Develop recreational and interpretive opportunities associated with historic industrial land uses during the PA iron boom. Preserving and Increasing historic site interpretation to bring the past to life for generations to come would benefit this landscape greatly. By informing the public of past land use, this area has the potential to become a recreational destination.
4. Focus on controlling kudzu and other high priority Invasive species (district could call out those high priority species for this LMU)

## Profile

**Table 1.** LMU acreage: total and state forest land only.

	Acres
State Forest Land	1,406
LMU Total	2,845

**Ecoregion:** South Mountain



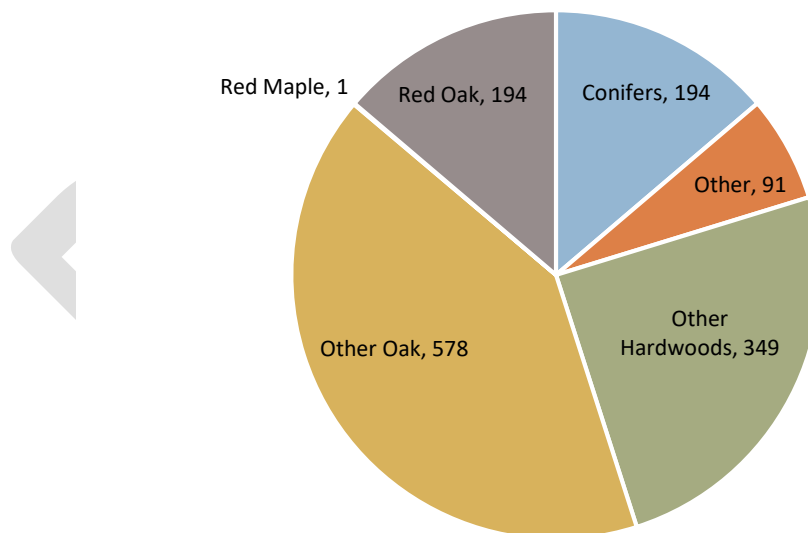
**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU. Much of this LMU is in deciduous forest with a smaller portion in evergreen forest. There is a sizable portion in developed, open space much of which is found off of state forest.

**Table 2.** Miles of roads by category on state forest land in this LMU. Road categories are described on p. 199 of the 2016 SFRMP. Twelve miles of State forest roads are contained within this landscape the longest section being Old Forge Road with shorter sections of the Waynesboro Reservoir access road, Swift Run Road, Rattlesnake Run Road, Staley Road, Wirt Road, Three Springs Road, and SCS Camp Road. Cold Springs Road, Fish and Game Road, and Mentzer Gap Road are located on private lands.

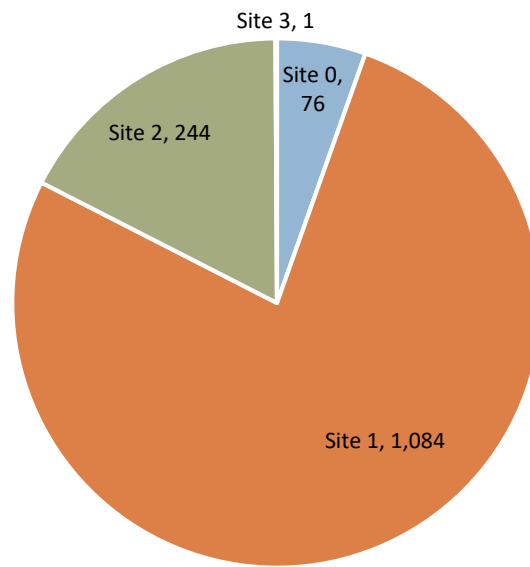
Road Category	Total Miles
Z1 - Public Use Road	8
Z3 - Administrative Road	4
<b>Total</b>	<b>12</b>

**Table 3.** Miles of trails on state forest land in this LMU open to various types of recreational use. The Appalachian National Scenic Trail crosses the landscape just north of Swift Run Road. Portions of the Equestrian Trail, Chickadee Trail, and Shortcut Trail are in the landscape. Snowmobile roads and trails provide several miles of riding opportunity.

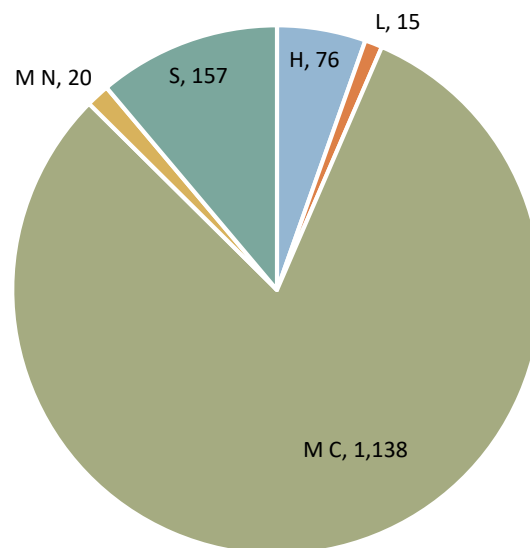
Trail Category	Total Miles
Hiking	8
Biking	7
Equestrian	7
X-Skiing	7
ATV I	0
ATV II	0
Snowmobile/ Joint Use Road	1



**Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. The predominant stand types are dry oak, tuliptree-maple, red oak , and hemlock-oak.

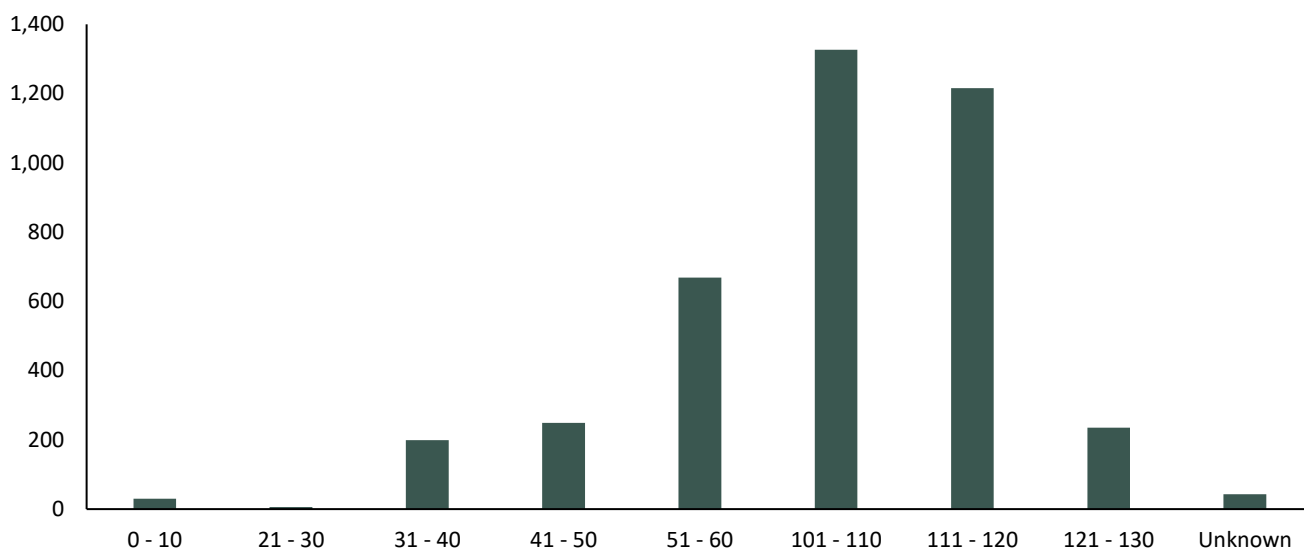


**Figure 3. Acreage of state forest land in this LMU by site class.** Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP. Most the state forest land in this landscape unit is considered Site 1 and the rest is site 2. There are some constraints for timber management due to proximity to aquatic resources and wet soil conditions in many stands within this landscape, but there are significant acreages in in site 1 stands.



M&N = multiple resource zone, non-commercial  
M&C = multiple resource zone, commercial  
L = limited resource zone  
N = natural area  
W = wild area  
S = special resource management zone  
H = anthropogenic management zone  
U = lands where zoning is unknown

**Figure 4.** Acreage by management zoning on state forest land in this LMU. Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP. A sizable portion of the landscape is typed as buffer due to the streams, and an additional 450 acres has been designated as special management areas around the vernal pond complexes.



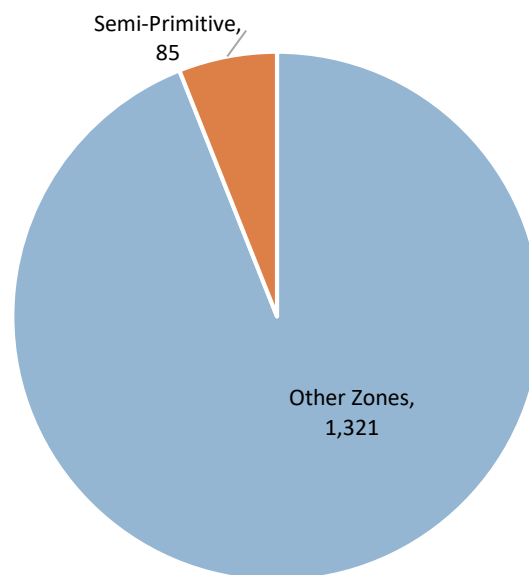
**Figure 5.** Acres of forest age classes on state forest land in this LMU. This LMU is typical of most of the surrounding state forest. the current age classes of the stands provides opportunities for long rotation stands along the waterways.

**Table 4.** Miles of stream by classification within entire LMU. Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. Much of the northern portion of the landscape is comprised of the Waynesboro municipal watershed that utilizes water from the East Branch of Antietam Creek Watershed. The Waynesboro reservoir lies near the middle of the landscape along Old Forge Road north of Hayes Run. The East Branch Antietam is stocked with trout from the water treatment plant to the bridge on Wirt Road. Native trout can be found to the north of the treatment plant. twenty four miles of high quality stream are found in this landscape.

Class	Total (miles)
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Undesignated	0
High Quality Waters	24
Human-made Impoundment/ Pond	1
Natural Lake/ Pond	2
<b>Total</b>	<b>27</b>



**Figure 6.** Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications. ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. The score falls within the 15<sup>th</sup> percentile of all state forest LMUs, making it a somewhat fragmented area relative to other portions of state forest land.

LMU Name	Core Forest Index
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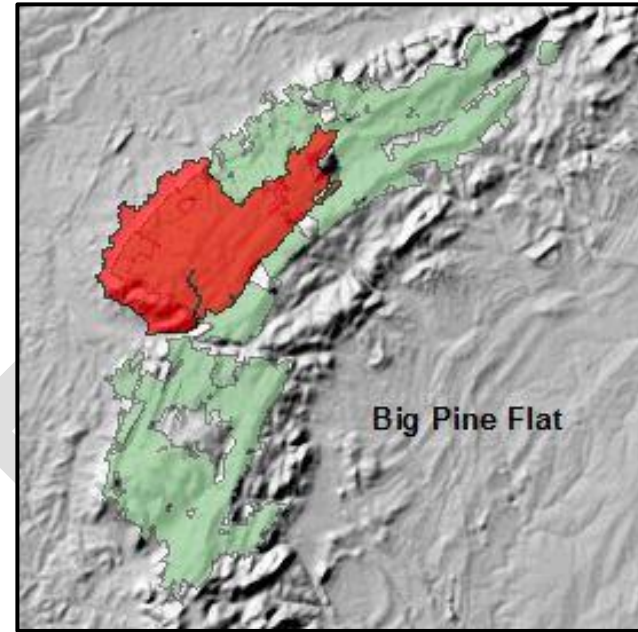
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# Big Pine Flat

## Landscape Management Unit

### Overview

The Big Pine Flat LMU is a unique landscape in the mid-western portion of Michaux State Forest categorized at once by motorized recreation opportunities and wild character values. This landscape is comprised of 28,476 acres with 20,583 acres (72%) located within the state forest boundary. This LMU is in the South Mountain Ecoregion and is primarily deciduous forest with very spotty open land at the toe of the mountain where farmlands meet the forest. The boundaries of this LMU follow the Rt.233 corridor north east to Dead Woman's Hollow, turns north through the Tumbling Run Preserve (Private inholding), then follows just north of Ridge Road, South to Baltimore Rd., where it then cuts West to the valley. The Boundary then follows the toe of the mountain south along the toe/mountain edge to Rt. 30 where it turns East and follows back to Rt. 233 in Caledonia SP.



The forest area is primary multiple resource commercial (70%) and is mainly oak-heath typing with chestnut oak, scarlet oak, and ericaceous shrubs in the understory. A significant amount of this landscape is classified as High Conservation Value Forest (HCVF), which is also included in the Big Pine Flats Biodiversity Management plan drafted in 2007 by the Pennsylvania Natural Heritage Partners; and recommendations from that plan for management of Pitch pine scrub oak barrens, vernal ponds, rocky outcropping, and acidic spring seep/bog habitat types and species of concern are being both implemented on this landscape as well as informing district habitat management priorities across the forest. Two State Forest Wild Plant Sanctuaries are located within this LMU.

This landscape also contains some of the most intense recreational use within the Michaux. It contains the Big Pine Flat's Parking area which serves as a trail head for the ATV, Snowmobile, and shared used trail system; as well as a staging area for most of the district's large organized events. It also contains Long Pine Run Reservoir, the most intensely used recreational water body on the forest. The Michaux target range and the most well developed designated shared-use and hiking trail system are in this landscape. The Flat Rock Trail system is contained within this LMU, making the LMU a priority focus for both Michaux managers and the visiting public. Furthermore, the Appalachian Trail is centrally located in this LMU extending the entire length from Rt. 30 in the South to Northern most extent of the LMU.

### Priority Goals

1. Implementation of Big Pine Flat and HCVF management plan for unique habitats and species of concern.
2. Protection of unique wetland complexes located throughout this landscape.

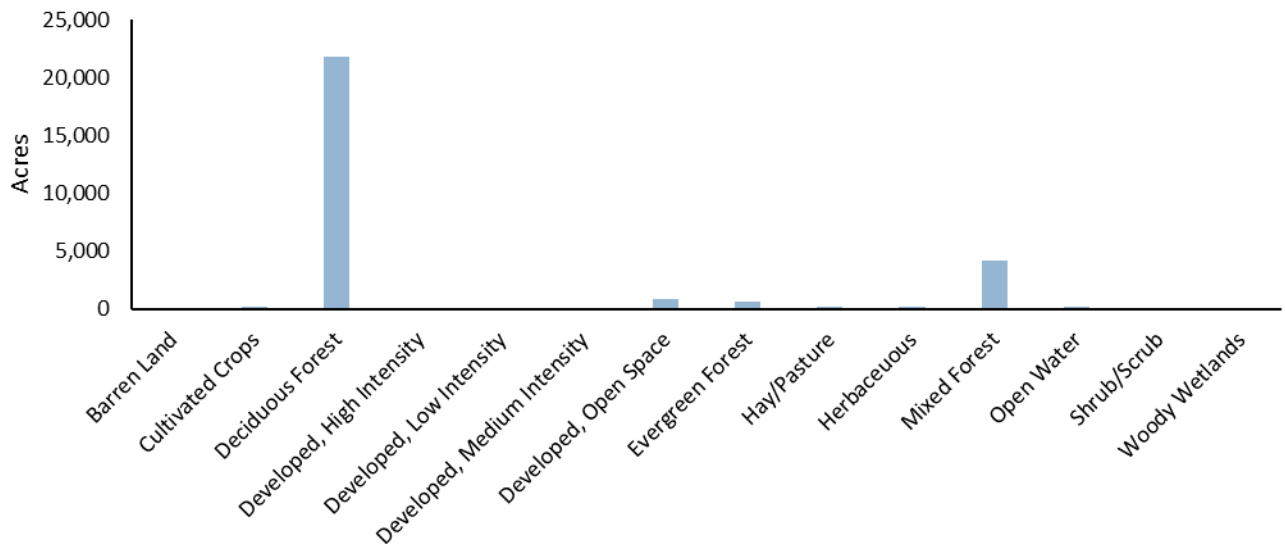
3. Actively manage state-listed plant species found within this LMU by creating/maintaining early successional habitat, controlling invasive species, and protecting acidic forest seeps.
4. Improve/redesign recreational infrastructure at high use recreational hubs (Big Flat Horse camping area, Long Pine Reservoir parking lot, shared used trail system).

## Profile

**Table 1.** LMU Area acreage: total and state forest land only.

	Acres
State Forest Land	20,583
LMU Total	28,476

**Ecoregion:** Deep Valleys South Mountain



**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU. Over 90 % of this LMU is comprised of deciduous and mixed forest. However, across this landscape remnant patches of scrub oak, pitch pine barren and pitch pine savannahs are evident but have succeeded into noncommercial ridge top black gum, chestnut oak, mountain-laurel stands due to the lack of a historic fire cycle. An implication for management would be to covert a large portion of the deciduous, ridge top black gum (approx. 1800' contour as a guide) to shrub/scrub.

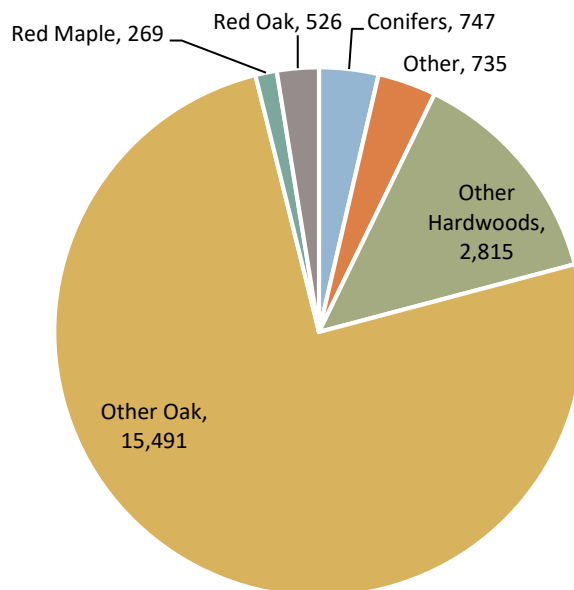
**Table 2.** Miles of roads by category on state forest land in this LMU. Road categories are described on p. 199 of the 2016 SFRMP. Major Z1 public use roads include, Ridge Rd., Stillhouse Hollow Rd., Milesburn Rd., Birch Run Rd., Middle Ridge Rd. Means Hollow Rd., Thompson Hollow Rd., Three Turn Rd., Big Pond Rd., Hogshead Rd., and Woodrow Rd.

Road Category	Total Miles
Z1 - Public Use Road	39
Z3 - Administrative Road	68
<b>Total</b>	<b>107</b>

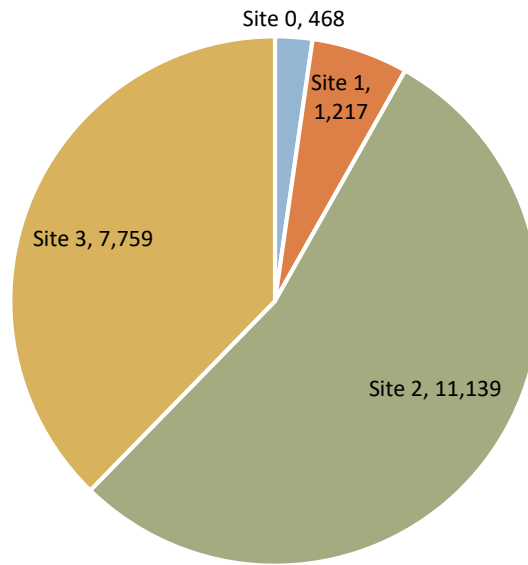
**Table 3.** Miles of trails on state forest land in this LMU open to various types of recreational use. This landscape contains some of the most intense recreational use within the Michaux. It contains the Big Pine Flat's Parking area which serves as a trail head for the ATV, Snowmobile, and shared used trail system as well as a staging area for most of the district's large organized events. The most well developed designated shared-use and hiking trail system is in this landscape, and the Flat Rock Trail system is contained within this LMU.

Trail Category	Total Miles
Hiking	69
Biking	51
Equestrian	51
X-Skiing	51
ATV I	7
ATV II	0
Snowmobile/ Joint Use Road	10

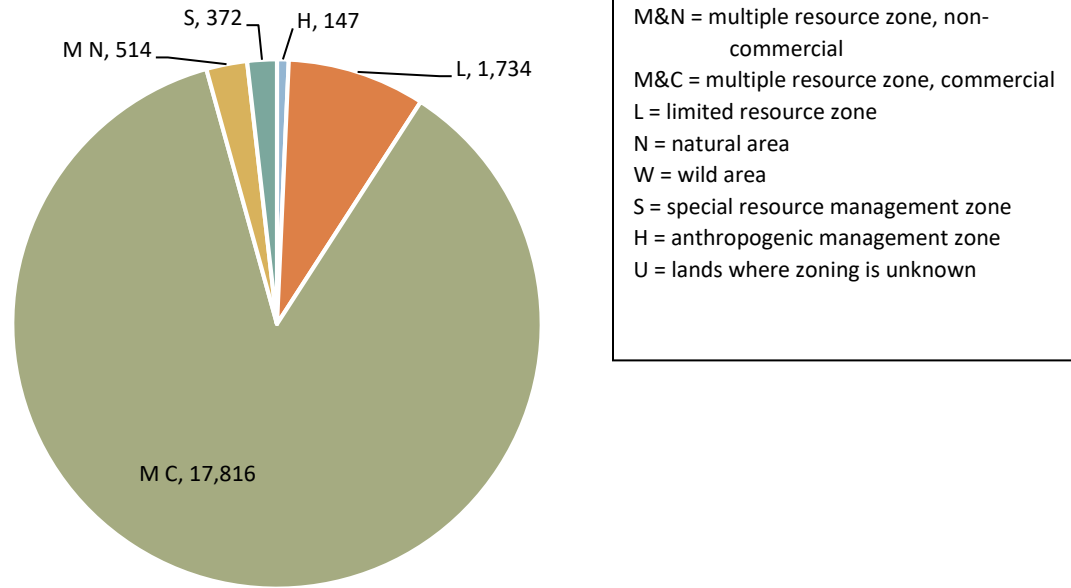




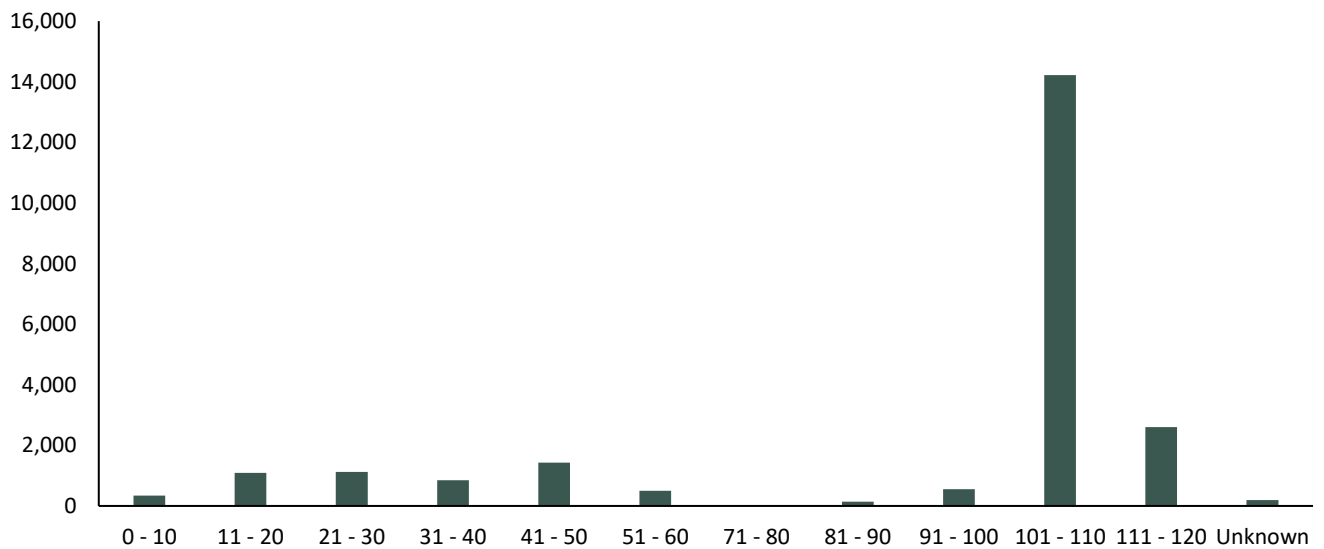
**Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. The forest is mainly oak-heath typing with chestnut oak and scarlet oak and ericaceous shrubs in the understory. Active management in the oak-heath typing will include use of prescribed fire, timber harvesting to regenerate these sites, and herbicide to control invasive species. Special management tools and practices will be conducted to maintain, regenerated, and preserve any “rare” or special forest typing areas.



**Figure 3.** Acreage of state forest land in this LMU by site class. Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP. This LMU is mainly site 2, however a large portion of it is in the site 3, ridge top class. These site 3 areas are ridgetop, poor growing sites that many historic fire dependent ecosystems are located in, and special management tool such as mowing and prescribed fire should be used to capitalize on resource sustainability and resiliency. The site 2 areas will be maintained primarily through timbersale practices to maintain distribution of age classes.



**Figure 4. Acreage by management zoning on state forest land in this LMU.** Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP. The forest zoning is primary multiple resource commercial. This LMU is largely made of Multiple Use Commercial. Primary means of active management for this zone is by commercial timbersale. Other intermediate management tools may include prescribed fire, fencing, herbicide, and mowing in order to actively manage desirable and undesirable regeneration.

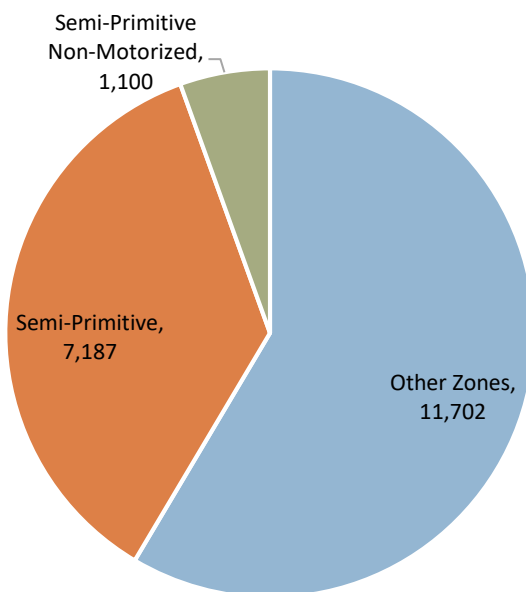


**Figure 5. Acres of forest age classes on state forest land in this LMU.**

The majority of this LMU is in the upper age classes (100+ years) and does not balance well to evenly distributing. Although the lower age classes are more evenly distributed, approximately 70% of the LMU is in the upper age class. Timber harvesting in lower quality sites (site 3) and prescribed burning to promote younger forest will help balance this top heavy LMU.

**Table 4. Miles of stream by classification within entire LMU.** Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. Big Pine Flats contains Long Pine Run Reservoir, the most intensely used recreational water body on the forest.

Class	Total (miles)
Undesignated	3
High Quality Waters	62
Human-made Impoundment/ Pond	2
Natural Lake/ Pond	1
<b>Total</b>	<b>67</b>



**Figure 6.** Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications. ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones. The recreational opportunity in this LMU is very high with nearly 90% of the LMU having a least “semi-primitive” or Semi-/developed zones. Examples of these recreational areas are the Big Flat ATV Trail head and Horseback camping area, Long Pine Reservoir, The Appalachian Trail, Rocky Knob Trail, and the Michaux State Forest Shooting Range.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. This score is the 3<sup>rd</sup> highest within the district. The score falls within the 28<sup>th</sup> percentile of all state forest LMUs, making it a somewhat fragmented area relative to other portions of state forest land.

LMU Name	Core Forest Index
Big Pine Flat	93

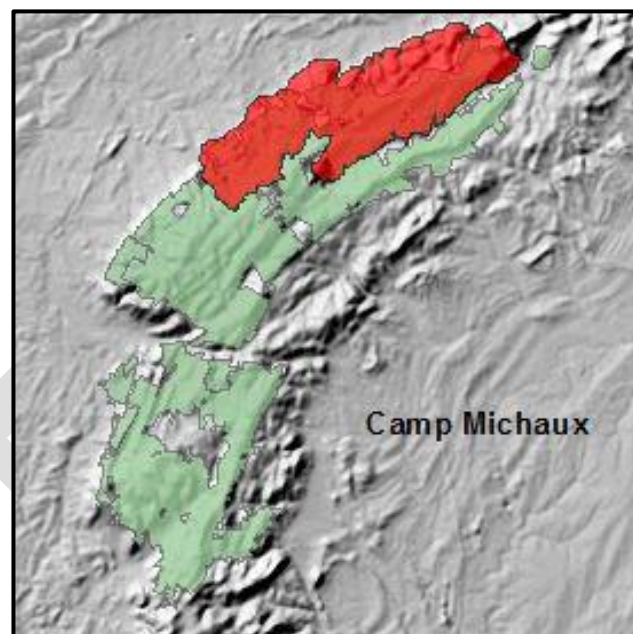


# Camp Michaux

## Landscape Management Unit

### Abstract

The Camp Michaux LMU covers 30,619 acres along the northwestern arc of the South Mountain eco-region. It contains 19,740 acres of state forestland stretching from approximately where Shippensburg Road transects the forest from west to east in the south to the village of Mount Holly Springs in the North. Kings Gap Environmental Learning Center, one of the three State Parks within the Michaux, is in the northwest corner of this landscape, and route 233, Pine Grove Furnace State Park, and Pine Grove Road roughly parallel it's eastern edge.



The tributaries on this landscape form the headwaters of the important Yellow Breeches watershed. Some of the tributaries on this landscape feed directly into the Yellow Breeches off the western edge of the forest (Hairy Springs, Watery Hollow, Cold Spring, and Spruce Run, while others (Tom's Run, Iron Run, Sage Run) feed off the eastern slope of the landscape into Mountain Creek which later feeds into the Yellow Breeches north of Mount Holly Springs. This LMU has the Mountain Creek Seeps Natural Heritage Core Habitat area which has extensive seeps along the lower part of the main branch of Sage Run and Mt. Creek and supports 8 plant species of concern Maintaining and enhancing connectivity and quality of stream, streamside forest, and floodplain/palustrine habitat within this landscape is critical given the bio-reserve function these stream segments serve for the range of ecosystem functions supported within these unique habitat areas. They are particularly critical watersheds for adaptive management conservation measures for brooktrout populations; as well as to ensure high water quality and macro-invertebrate diversity to feed into the important stocked trout fishery provided by the Yellow Breeches on the valley floor.

Terrestrial habitat type across this landscape is dominated by dry oak heath forests with a significant Pitch pine component and some scrub oak/dwarf gum and sassafras barrens in areas along the ridge tops. Lower elevations on the western slope transition to more mixed oak/pine forest types. In and around the Pine Grove Furnace State Park area, there is the highest concentration of CCC era pine, Norway spruce, and larch plantations on the Michaux state forest. Along with the Big Pine Flats LMU directly to the south, significant acres of this landscape are captured in the Big Pine Flats Biodiversity Management Plan and some of our larger early projects in pitch pine scrub oak barrens habitat restoration are taking place on this landscape just south of the Tumbling Run Inholding. .

Critical habitat priorities include stream and brook trout habitat enhancement, three Wild Plant Sanctuaries, and reintroducing fire as a management tool to ensure regeneration and expansion of fire dependent species and community types such as pitch and short leaf pine, heath balds, scrub oak barrens, and grass savannah patches. The district is attempting to tie many of these habitat objectives together in a landscape level treatment to enhance colonization/expansion of pitch pine/scrub oak

patches together with daylighting and enhancing rocky outcropping habitat for reptile diversity at the Spruce Run Vista and Hammonds Rocks area.

Like all other Michaux landscapes, invasive plant species are a challenge to meeting state forest goals within this management context. Areas around Pine Grove Furnace State Park and the old CCC and POW camp at Camp Michaux represent both some of the earliest acquisitions that led to the establishment of the conservation movement and PA's public lands system, but they also reflect the ongoing legacy of past conservation attempts to use introduced and non-native species to achieve conservation goals. Today, those early attempts at conservation have left a legacy of large acreages in a tangle of multiflora rose, honeysuckle, barberry, oriental bittersweet, privet, and a host of other invasive plant species. Interspersed within this part of the landscape is the northern cluster of Michaux's leased campsites and the Pine Grove Furnace State Park complex.

This area has a growing network of informal trails including the area between Woodrow and Michaux Roads which is locally coined the "Black Hole" given the tangled system of spontaneous, unmarked single track trails in the area. There is also a growth in trail construction activity between Pine Grove Furnace State Park and the Hammonds Rock/Spruce Run Vista areas which the district is also hoping to begin addressing through both the Spruce Run Vista/Hammonds Rocks Landscape management project as part of implementing the recommendations from the Michaux Trails Assessment.

Because of high visitation rate and landscape use by forest visitors, particularly around Pine Grove Furnace State park and Camp Michaux, district managers have some real opportunities to further the century old narrative of the Bureau of Forestry by adapting newly available methods such as prescribed fire and assisted colonization of fire dependent native species such as burr and scrub oak, chinquapin, shortleaf and pitch pine, and fire adapted warm season grasses and forbs to try to reclaim some of these areas while optimizing and demonstrating the recreational, historic, and ecological values of this historic site to future generations. . Some of these opportunities have been captured in a short concept paper entitled the Michaux Learning Landscapes Initiative around which the district is working with local stakeholder groups and the initial stage of an extensive habitat restoration project in the vicinity of Bunker hill is scheduled to begin this summer in partnership with the Natural Wild Turkey Federation and the Appalachian Trail Conservancy.

## Priority Goals

1. Increase resilience and abundance of rare plant communities in designated plant sanctuaries and as appropriate, work at expanding populations into new habitat areas over time.
2. Increase stream and floodplain connectivity and habitat by removing segmenting features and enhancing in and around stream downed woody debris structure and floristic diversity.
3. Utilize prescribed fire in fire-dependent communities to promote desirable regeneration and establish Early Successional Habitat patches for disturbance dependent species
4. Maintain and interpret scenic and habitat values at Spruce Run and Hammond's Rock's Vista areas.
5. Establish an interpretive demonstration forest walking trail and woodlot along Tom's Run to communicate historic, social, and ecological values of sustainable forest management at stand and landscape scale on public and private lands.

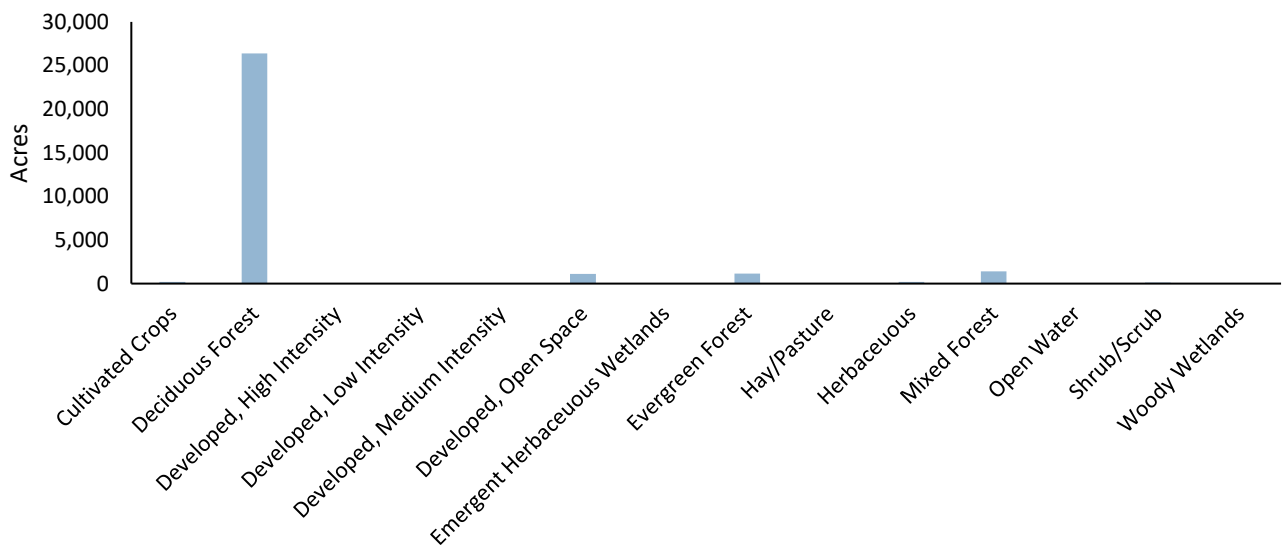
6. Restore invaded landscapes of Camp Michaux and along the Appalachian trail corridor by developing multi-stand level management planning to achieve recreational, historic preservation, and ecological restoration goals
7. Develop high value nested loop shared-use trail system and parking access in “Black Hole” area between Woodrow Road and 233.

## Profile

**Table 1.** LMU Area acreage: total and state forest land only.

	Acres
State Forest Land	19,470
LMU Total	30,619

**Ecoregion:** South Mountain



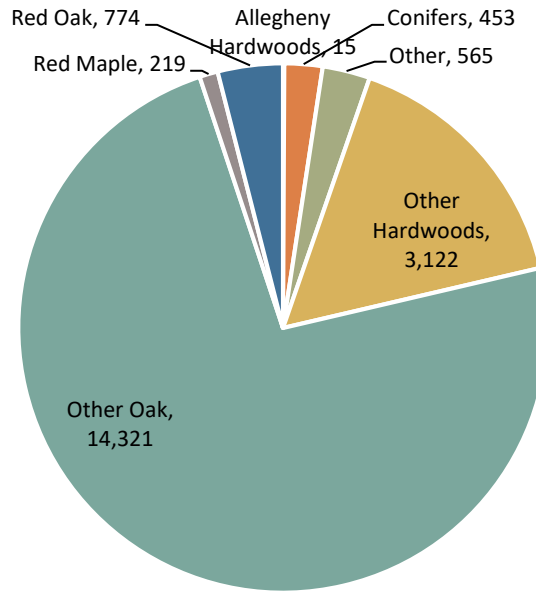
**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU.

**Table 2.** Miles of roads by category on state forest land in this LMU. Road categories are described on p. 199 of the 2016 SFRMP.

Road Category	Total Miles
Z1 - Public Use Road	42
Z2 - Drivable Trail	0
Z3 - Administrative Road	75
<b>Total</b>	<b>118</b>

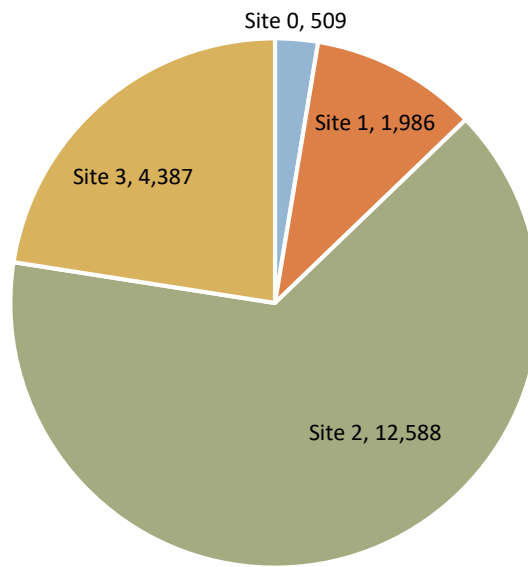
**Table 3.** Miles of trails on state forest land in this LMU open to various types of recreational use. This area has a growing network of informal trails including the area between Woodrow and Michaux Roads which is locally coined the “Black Hole” given the tangled system of spontaneous, unmarked single track trails in the area.

Trail Category	Total Miles
Hiking	24
Biking	17
Equestrian	17
X-Skiing	17
ATV I	0
ATV II	0
Snowmobile/ Joint Use Road	1

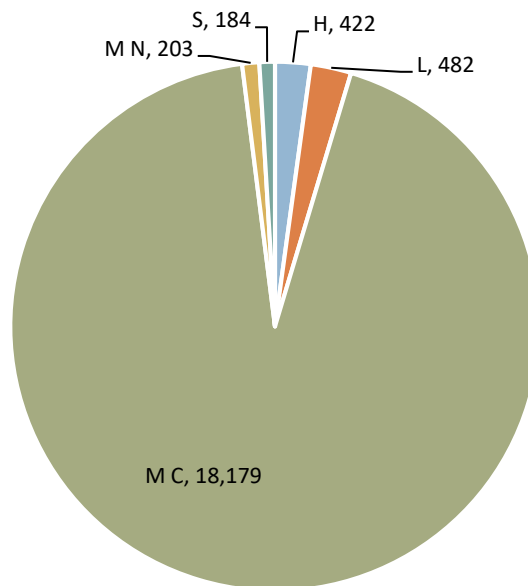


**Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. **Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. Terrestrial habitat type across this landscape is dominated by dry oak heath forests with a significant pitch pine component and some scrub oak/dwarf gum and sassafras barrens in areas along the ridge tops. Lower elevations on the western slope transition to more mixed oak/pine forest types. In and around the Pine Grove Furnace State Park area, there is the highest concentration of CCC era pine, Norway spruce, and larch plantations on the Michaux state forest. Along with the Big Pine Flats LMU directly to the south, significant acres of this landscape are captured in the Big Pine Flats Biodiversity Management Plan and some of our larger early projects in pitch pine scrub oak barrens habitat restoration are taking place on this landscape just south of the Tumbling Run inholding.



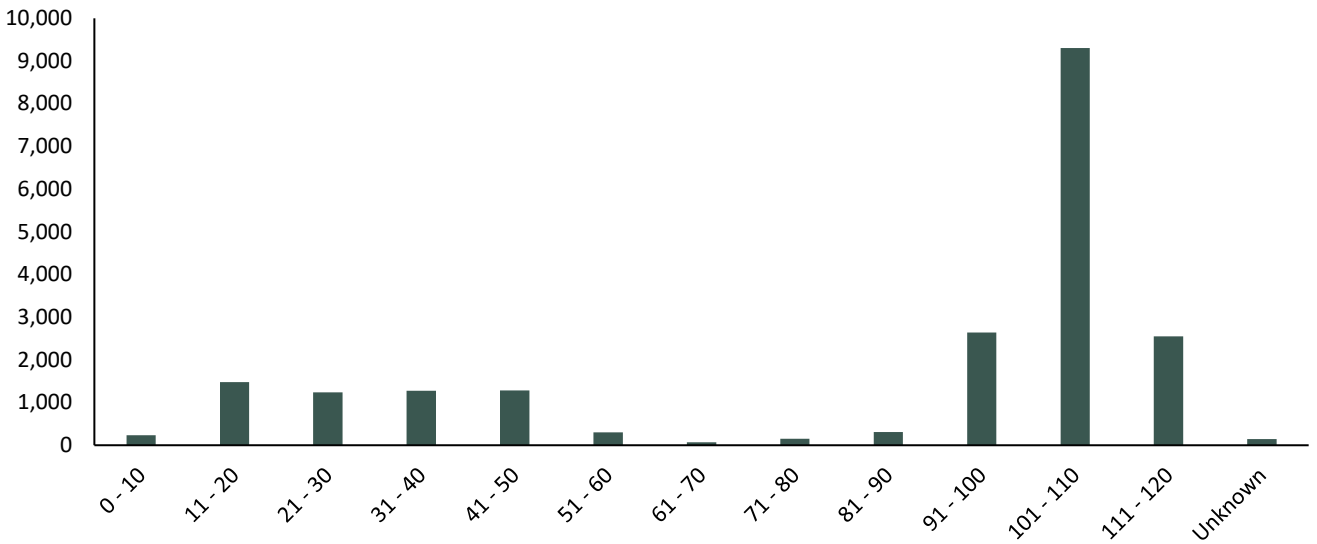


**Figure 3.** Acreage of state forest land in this LMU by site class. Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP.



M&N = multiple resource zone, non-commercial  
M&C = multiple resource zone, commercial  
L = limited resource zone  
N = natural area  
W = wild area  
S = special resource management zone  
H = anthropogenic management zone  
U = lands where zoning is unknown

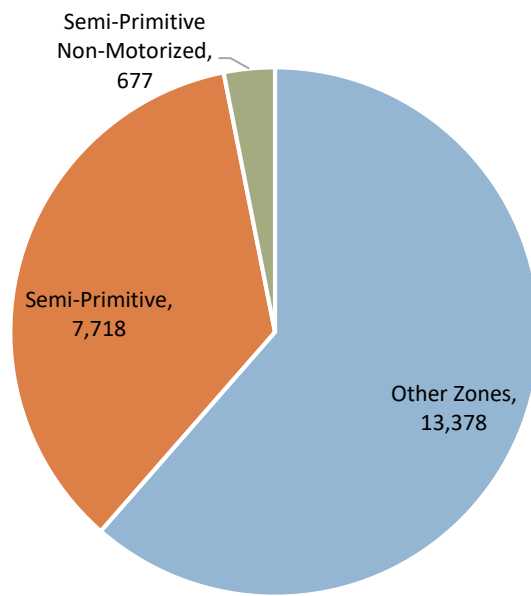
**Figure 4.** Acreage by management zoning on state forest land in this LMU. Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP.



**Figure 5.** Acres of forest age classes on state forest land in this LMU.

**Table 4.** Miles of stream by classification within entire LMU. Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. The tributaries on this landscape form the headwaters of the important Yellow Breeches watershed. Some of the tributaries on this landscape feed directly into the Yellow Breeches off the western edge of the forest (Hairy Springs, Watery Hollow, Cold Spring, and Spruce Run, while others (Tom’s Run, Iron Run, Sage Run) feed off the eastern slope of the landscape into Mountain Creek which later feeds into the Yellow Breeches north of Mount Holly Springs.

Class	Total (miles)
Undesignated	1
High Quality Waters	59
Natural Lake/ Pond	1
<b>Total</b>	<b>61</b>



**Figure 6.** Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications. ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. This score is the highest within the district. The score falls within the 25<sup>th</sup> percentile of all state forest LMUs, making it a somewhat fragmented area on state forest land.

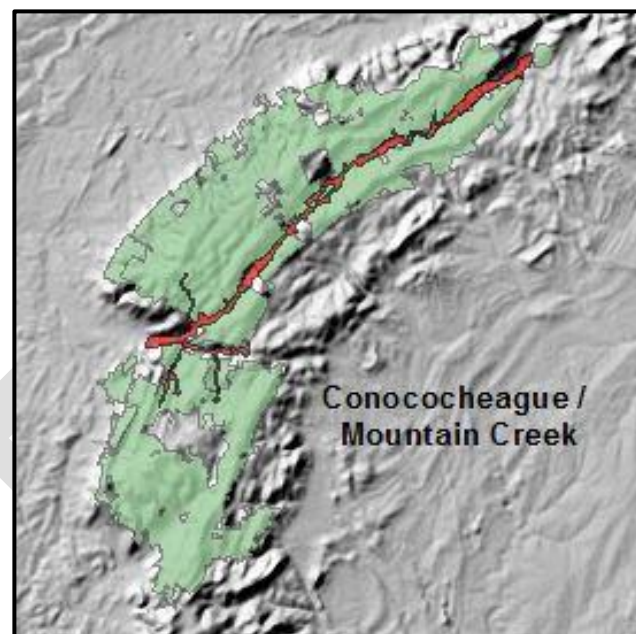
LMU Name	Core Forest Index
Camp Michaux	93

# Conococheague / Mountain Creek

## Landscape Management Unit

### Abstract

Conococheague/ Mountain Creek Landscape is a long serpentine landscape of central South Mountain which encompasses the headwaters of the Conococheague Creek and the confluences of many tributaries and along the length of Mountain Creek past the northern end of Pine Grove Furnace State Park. It is bordered by mostly state forest lands in the north with Caledonia State Park and private lands in the south. The landscape runs in a northeast to southwest direction, parallel to Route 233 and then along Carbaugh Run and its tributaries, parallel to Route 30 to the east. The headwaters begin at an elevation of 1885' in the northeast and leave the landscape at about 637'.



This landscape lies in multiple watersheds. The riparian forests on both banks from the headwaters of the Mountain Creek to where Mountain Creek leaves South Mountain defines the upper reach of the landscape. The headwaters of the Conococheague Creek to the confluence with the exceptional value Carbaugh Run and some of its tributaries constitute the bulk of the southern portion of the landscape. Mountain Creek has been limed in the recent past to reduce acid rain effects on aquatic organisms.

While not a major timber contributor to the charcoal era, this landscape contains the remains of two iron furnaces: Pine Grove Iron Works and Caledonia Furnace. These have both become very popular State Parks. Widespread exploitive harvesting and burning of the forest surrounding the charcoal fired iron furnaces in the mid to late 1800s shaped the current forests of the entire South Mountain ecoregion. This landscape unit did not escape the axe. More recently harvesting has been limited in the riparian areas resulting in a second growth forest that is generally about 100 years old.

The landscape is largely comprised of a mixed oak/conifer riparian forest on mostly lower slopes, with a greater overstory conifer component to the south and southwest near Route 30 and Caledonia State Park. Mixed oak stands of chestnut oak, scarlet oak, and white oak can be found in the drier portions of the landscape. Red oak, white oak, red maple, and tulip poplar are found on the better sites with eastern hemlock and white pine as the major conifer species in the overstory/midstory in the riparian areas. Rhododendron thickets are found along many of the streams. Timber quality is good but not easily accessible. Roughly two thirds of the forest of this landscape are typed as site two while just under a quarter are site one. This LMU contains two Wild Plant Sanctuaries to protect several sensitive plant populations.

This landscape has several invasive species present which could pose a problem in the future. There is Japanese stiltgrass evident along the state forest roads, trails, and some haul roads. Japanese knotweed has been found as well as mile-a-minute. Japanese barberry is especially prevalent in the Pine Grove

Furnace State Park area. Japanese knotweed eradication has been targeted as a high priority for this landscape.

Another notable feature in the landscape is a spring that constantly produces bubbles in a rock lined shallow pool. Plant species common to the seepage areas include cinnamon, royal, and New York ferns; fly poison, Indian cucumber, bellwort, sedges, and sphagnum mosses.

The long skinny shape means that it lies in three counties: Franklin, Cumberland, and Adams Counties. About half of the 5,088 acre landscape is Michaux State Forest and the remaining acreage lies in Pine Grove Furnace, Caledonia State Park National Park Service land and private lands. The Borough of Shippensburg is about 10 miles west of the landscape, while Mt. Holly Springs is about 6 miles to the north. Chambersburg Borough's water treatment plant is in Caledonia State Park along Route 233. Guilford Township has numerous deep water wells along Hosack Run off Quarry Gap Road. State Route 233 is the backbone of travel through the South Mountain region. This very scenic state route carries most traffic into and out of the heart of the Michaux State forest. It also passes through both State Parks found in the unit.

Pine Grove Furnace State Park's 696 acres lie in the northern half of the landscape. This very popular park contains two lakes, a hostel, a general store, picnic areas, campsites, leased and rental cabins, and hiking/biking trails. Millions of visitors stop by the park every year. This Park is very near to the halfway point on the U.S. National Park Service's National Scenic Appalachian Trail. 3000 registered through hikers hiked the entire trail through this park in 2016 alone.

Caledonia State Park contains numerous hiking trails, including one mile of the Appalachian Trail and blue side trail. Also, Hosack Run Campground, part of Chinquapin Hill campground, the office complex, picnic areas, and the swimming pool are in the landscape.

Besides visiting the two high traffic State Parks, fishing is the main recreational use of this landscape. The many miles of stocked trout waters bring droves of anglers to this landscape every year. Two miles of Carbaugh Run found within this landscape are classified as exceptional value. Thirty-three miles of stream are considered high value streams.

The Borough of Chambersburg's 20,000 residents are key stakeholders for water quality in this landscape. Since 1912 the residents have used water flowing in an all gravity system from or through this landscape. The water treatment plant is located within this landscape, it currently provides 1.5 billion gallons a year. Guilford Township and all of the local private land residents also rely on clean drinking water from the aquifers below this landscape.

The Irvin Estates, a major private tract that divides the state forest land in the northern part of the landscape, is an older housing development with both seasonal and permanent residents adjacent to Route 233.

Most of the private land in the southern reaches of the landscape is occupied by homes, housing developments, and commercial businesses along Route 30.



## Priority Goals

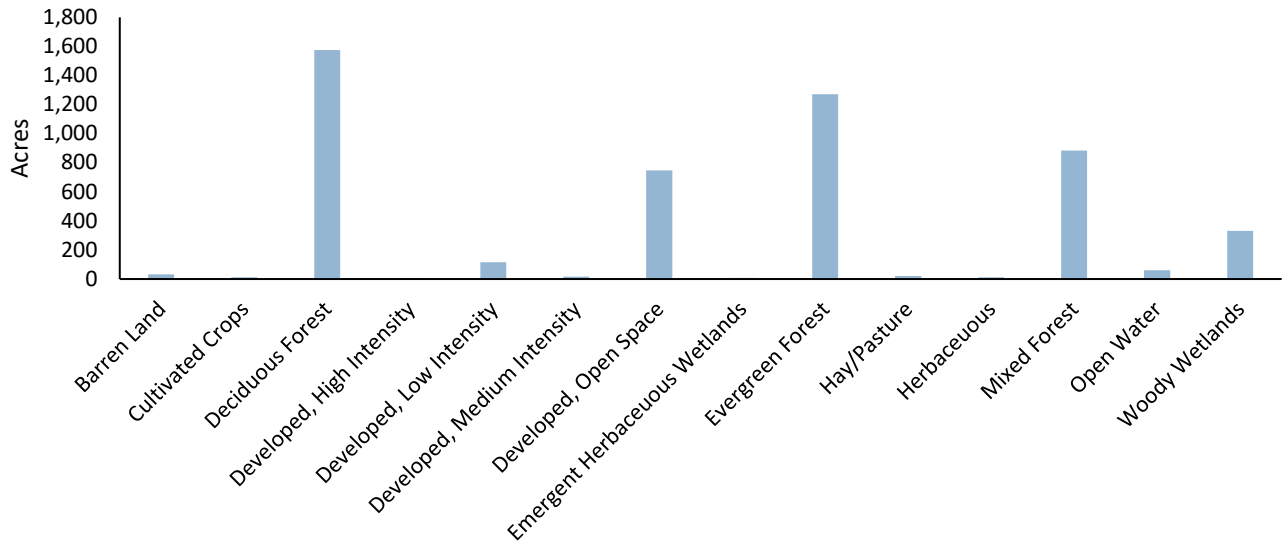
1. Maintain or Improve aquatic habitat and water quality. This LMU is delineated by waterways and their immediate riparian areas. Assess and prioritize barriers to aquatic organism passage for replacement. Improvements in road design and culvert structures to provide aquatic organisms free passage can be implemented in the LMU. Healthy aquatic systems require aquatic organism free passage up and downstream in the first and second order streams for adequate foraging and reproduction.
2. Work with partner organizations such as Trout Unlimited or local colleges to assess the Mountain Creek liming project.
3. Utilize Early Detection Rapid Response methods to control Invasive species as prioritized by threat level.
4. Work with Eco and Planning for inventory and actively manage state-listed plant species found within this LMU by creating/maintaining early successional habitat, controlling invasive species, and protecting acidic forest seeps.
5. Inventory, map, interpret, and protect cultural resources.
6. Improve Infrastructure to reduce impedance of water quality is the top management concern for forest managers.
7. Evaluate the need for large woody debris in waterways for aquatic organisms and provide more through large woody material projects.
8. Monitor and reduce detrimental effects of recreation. Low impact recreation in these sensitive forests should be encouraged. District operation should aim to reduce illegal; poorly planned trail building, and offroad vehicle activities.

## Profile

**Table 1.** LMU Area acreage: total and state forest land only.

	Acres
State Forest Land	2,670
LMU Total	5,088

**Ecoregion:** South Mountain



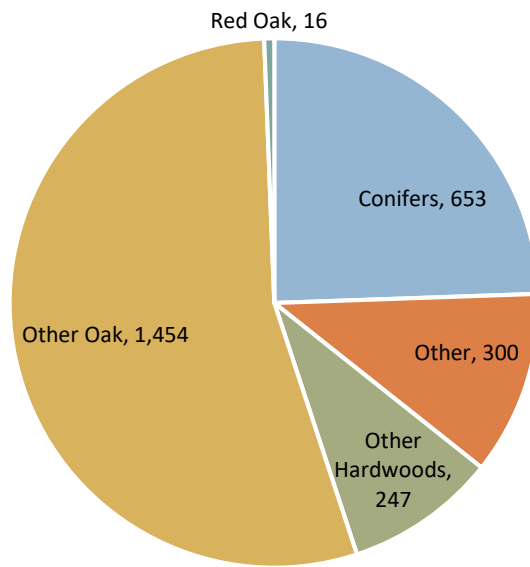
**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU. Most of the private land in the southern reaches of the landscape is occupied by homes, housing developments, and commercial businesses along Route 30.

**Table 2.** Miles of roads by category on state forest land in this LMU. Road categories are described on p. 199 of the 2016 SFRMP. State Route 233 a Z1 designated road is the backbone of travel through the South Mountain region.

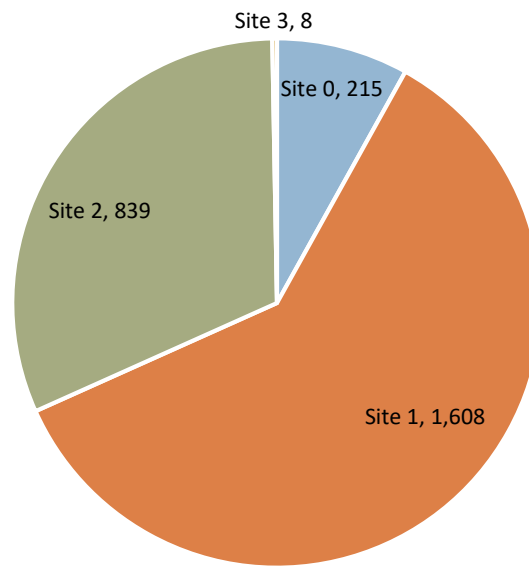
Road Category	Total Miles
Z1 - Public Use Road	14
Z3 - Administrative Road	8
<b>Total</b>	<b>23</b>

**Table 3.** Miles of trails on state forest land in this LMU open to various types of recreational use.

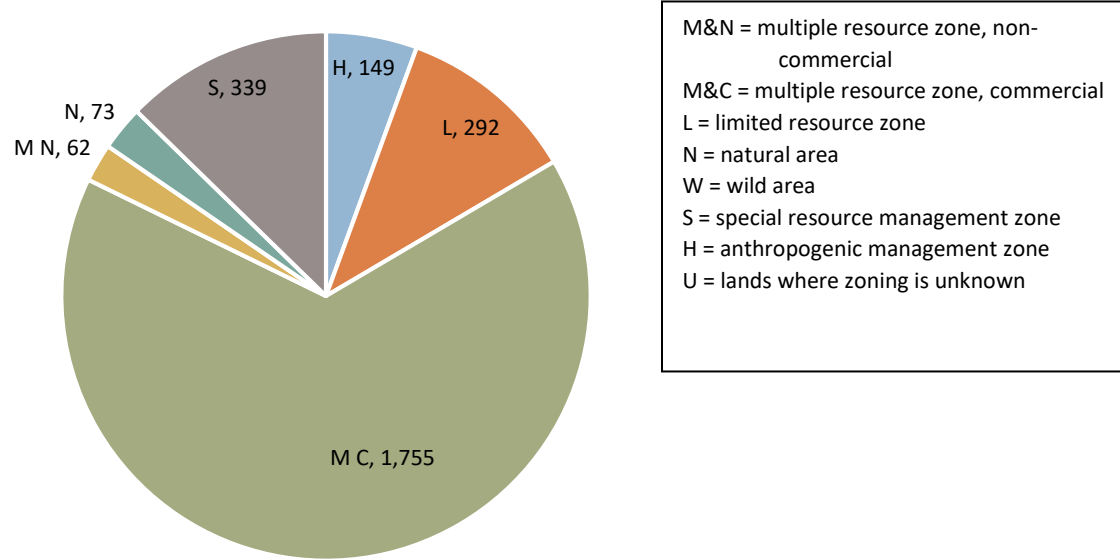
Trail Category	Total Miles
Hiking	9
Biking	9
Equestrian	8
X-Skiing	8
ATV I	2
ATV II	0
Snowmobile/ Joint Use Road	1



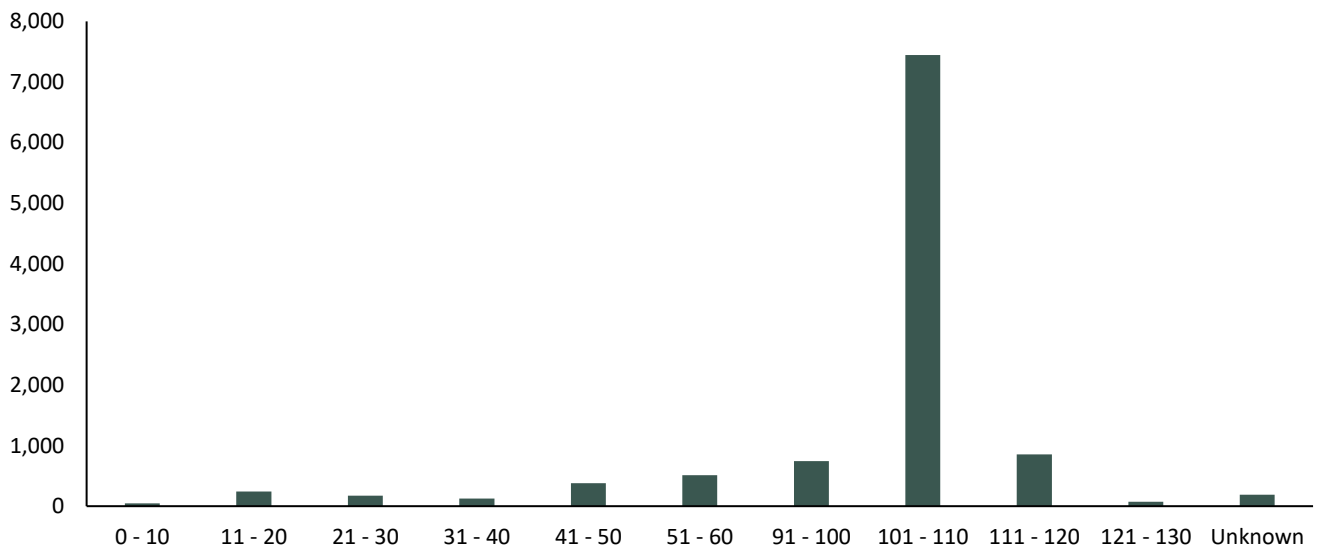
**Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. The landscape is largely comprised of a mixed oak/conifer riparian forest on mostly lower slopes, with a greater overstory conifer component to the south and southwest near Route 30 and Caledonia State Park. Mixed oak stands of chestnut oak, scarlet oak, and white oak can be found in the drier portions of the landscape. Red oak, white oak, red maple, and tulip poplar are found on the better sites with eastern hemlock and white pine as the major conifer species in the overstory/ midstory in the riparian areas.



**Figure 3.** Acreage of state forest land in this LMU by site class. Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP. Timber quality is good but not easily accessible. Roughly two thirds of the forest of this landscape are typed as site two while just under a quarter are site one.



**Figure 4.** Acreage by management zoning on state forest land in this LMU. Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP. Timber quality is good but not easily accessible. Maintaining the water resource is the primary management objective of this landscape.

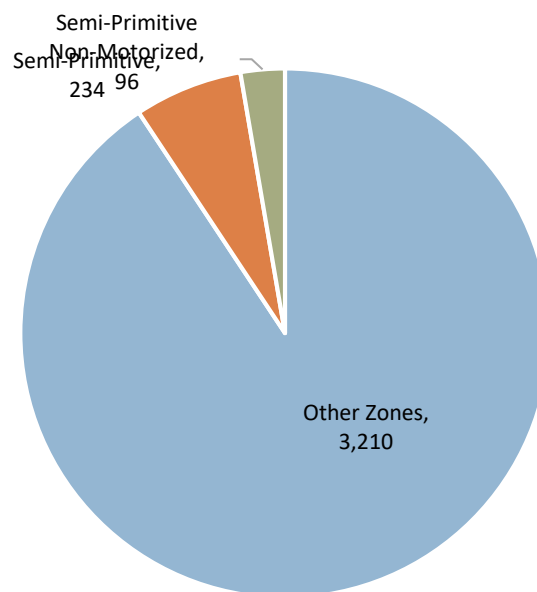


**Figure 5.** Acres of forest age classes on state forest land in this LMU. Wide spread exploitive harvesting burning of the forest surrounding the charcoal fired iron furnaces in the mid to late 1800s shaped the current forests of the entire South Mountain ecoregion. More recently harvesting has been limited in the riparian areas resulting in a second growth forest that is generally about 100 years old.



**Table 4. Miles of stream by classification within entire LMU.** Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. Two miles of Carbaugh Run found within this landscape are classified as exceptional value. fifty two miles of stream are considered high quality streams.

Class	Total (miles)
Undesignated	2
High Quality Waters	52
Exceptional Value Waters	2
Wilderness Trout Streams	1
<b>Total</b>	<b>57</b>



**Figure 6. Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications.** ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. This score falls within the 9th percentile of all state forest LMUs, making it a somewhat fragmented area relative to other portions of state forest land. In the core forest analysis, streams that caused a gap in the forest canopy were counted as fragmenting features.

LMU Name	Core Forest Index
Conococheague/ Mountain Creek	84

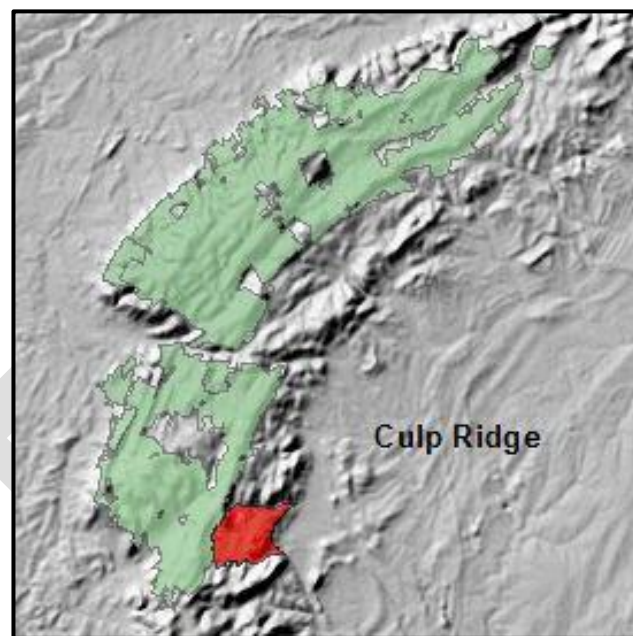
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# Culp Ridge

## Landscape Management Unit

### Abstract

The Culp Ridge LMU is a unique landscape in the southwestern portion of Michaux State Forest. The LMU encompasses 4,032 acres in Hamiltonban Township, Adams County. To date (2017), the Michaux State Forest comprises 2,241(56%) acres of the LMU. Private lands, including two inholdings within Michaux, comprise the rest of the LMU. Culp Ridge LMU lies within the South Mountain ecoregion, which is characterized by ridges dissected by deep valleys. The ridges run north to south parallel with the South Mountain. The LMU's elevation ranges from 700 feet to 1,600 feet. There are eight miles of three major streams that transect within the LMU: Middle Creek, Copper Run and Tom's Creek. Tom's Creek is classified as an exceptional value stream. Tom Creek supports a healthy population of wild brook trout. These waters are all tributaries of the Potomac River Watershed Basin.



Much of the forested land in Culp Ridge LMU was clearcut in the early 1900s for agriculture purposes. Barn foundations and rock fence rows can be viewed throughout the LMU. In 1947 Glatfelter Pulpwood Company purchased a 2,500-acre parcel in Adams County. 2,241(90%) acres of the purchased parcel are within in Culp Ridge LMU. The property was designated as Pennsylvania's first certified tree farm. The property was managed as a hunting preserve and for pulpwood production. Conifer and larch plantations were created as well as herbaceous openings. The landscape was heavily managed through timber harvesting without sufficient desirable regeneration present and an over abundant deer population. This management has led to an infestation of invasive species throughout the LMU. *Ailanthus*, mile-a-minute, Japanese barberry, Japanese honeysuckle, Japanese angelica tree, and Japanese siltgrass are very common. The Conservation Fund, Adams county and the state purchased the property from Glatfelter in 2007.

The LMU consists of 1,040(26%) acres of mature red oak stands and 818(20%) acres of tulip poplar stands. The LMU contains its own unique forest classification not found in other LMUs in Michaux State Forest. Stands of mixed hardwoods within the LMU can be identified as cove forest communities. A cove forest is a type of deciduous forest community associated with Appalachian Mountain coves. Cove Forest are found in protected positions in the landscape at middle to low elevations. Cove forest are known to have a large diversity of tree and shrub species. Tree species associated with cove forest communities include American basswood, tulip poplar, sugar maple, red maple, yellow birch, white ash, bitternut hickory, eastern hemlock and mixed oak. Timber potential is high in the LMU with many good growing sites. Two state timber sales have been done within the LMU. Invasive species will continue to cause problems in the LMU for years into the future if not controlled. Control will not be possible without a huge undertaking of time, money and manpower. Mile-a-minute weevils have been released at various sites within the LMU.

Three herbaceous openings are being managed for woodcock habitat. Plant and animal species of concern occur on this LMU. Also, the South Mountain has been designated by the PA Fish & Boat Commission as a special protection area for the timber rattlesnake. Timber rattlesnake collection is not permitted in any part of the Michaux State Forest; even with a collection permit.

Culp Ridge LMU is a popular destination for recreationists. A ten-mile network of shared use trail has been created using the existing road network from past timber harvesting within the LMU. The shared use trail is open to horseback riding, mountain biking and hiking. Old barn foundations, rock fence rows and a cemetery can be viewed along the shared use trail adding an historical element to one's experience. There are no plans for creating snowmobile or ATV trails in the LMU. Hunting, fishing, and birding are also popular activities within the LMU.

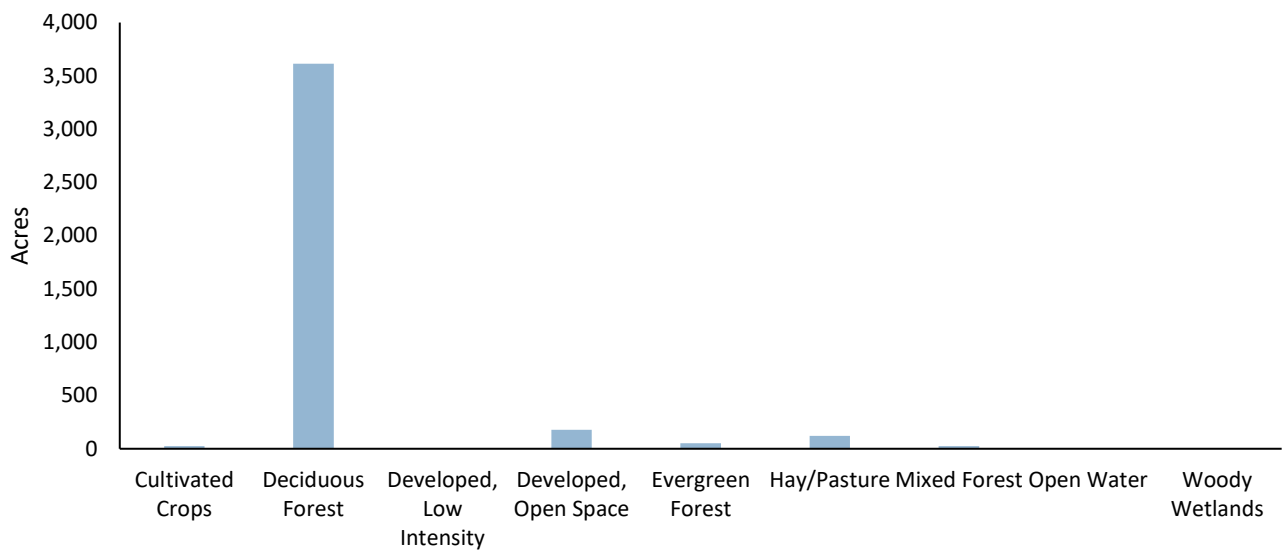
## Priority Goals

1. Improve and maintain habitat for State Wildlife Action Plan species such as woodcock.
2. Maintain or Improve aquatic habitat and water quality. This LMU includes an EV waterway and riparian forest. Improvements in road design and culvert structures to provide aquatic organisms free passage can be implemented in the LMU. Healthy aquatic systems require the ability to travel up and downstream in the first and second order streams for adequate foraging and reproduction.
3. Work with Eco and Planning for the inventory and management of sensitive natural resources on this tract including wetlands.
4. Inventory, map, interpret, and protect cultural resources.
5. Maintain the trail system throughout the LMU through mowing and signage upkeep.
6. Promote and restore cove forest community.
7. Combat the infestation of invasive species within the LMU. Implement a plan to survey LMU to locate, map, and treat invasive species. After treatment monitor and use EDRR techniques to control invasive species.

**Table 1.** LMU Area acreage: total and state forest land only.

	Acres
State Forest Land	2,241
LMU Total	4,032

**Ecoregion:** South Mountain



**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU.

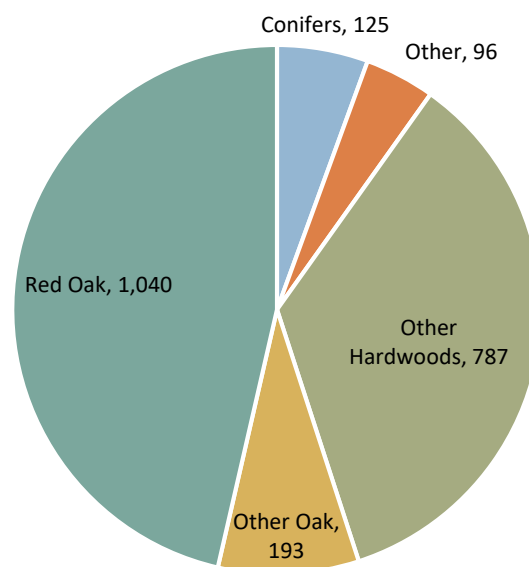
Deciduous forest dominant the landscape within Culp Ridge LMU. Large mature red oak and tulip poplar stands dominant the forested portion of the LMU. The remaining forested portion of the LMU consist of dry oak- heath forest mixed with conifer and larch plantations. The eastern portion of the LMU consist of housing developments and agricultural land including hay fields, pasture, and orchards interspersed with small woodlots.

**Table 2.** Miles of roads by category on state forest land in this LMU. Road categories are described on p. 199 of the 2016 SFRMP. The main access to the recreational opportunities and timber resources in this landscape are from paved roads owned by Hamiltonban township. Mount Hope Road runs north to south through the LMU, Gum Spring Road and Lower Gum Spring Road run along the southeastern boundary of the LMU, and Iron Spring Road runs along the southwestern boundary of the LMU. Along these roads are two parking areas and numerous pull offs that allow easy public access to the administrative roads and trails within the LMU. Ten miles of administrative roads within the LMU have been utilized to construct a shared use trail. These roads will also be utilized for timber harvesting within the LMU.

Road Category	Total Miles
Z1 - Public Use Road	2
Z3 - Administrative Road	11
<b>Total</b>	<b>13</b>

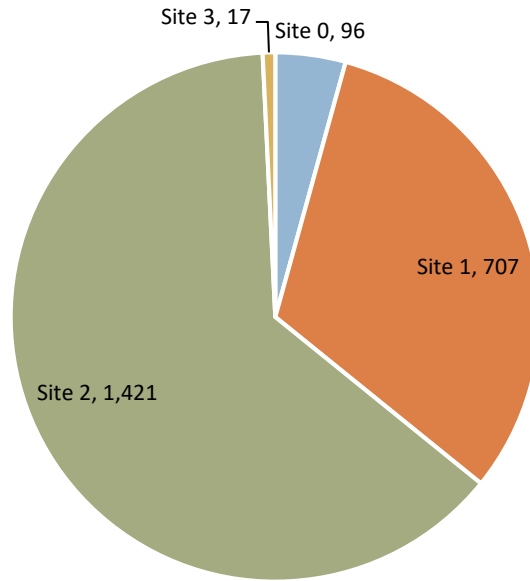
**Table 3.** Ten miles of trails on state forest land in this LMU are open to various types of recreational use. Culp Ridge LMU is a popular destination for recreationists. A ten-mile network of shared use trail has been created using the existing road network from past timber harvesting within the LMU. The shared use trail is open to horseback riding, mountain biking and hiking. There are no plans for creating snowmobile or ATV trails in the LMU.

Trail Category	Total Miles
Hiking	10
Biking	10
Equestrian	10
X-Skiing	10
ATV I	0
ATV II	0
Snowmobile/ Joint Use Road	0

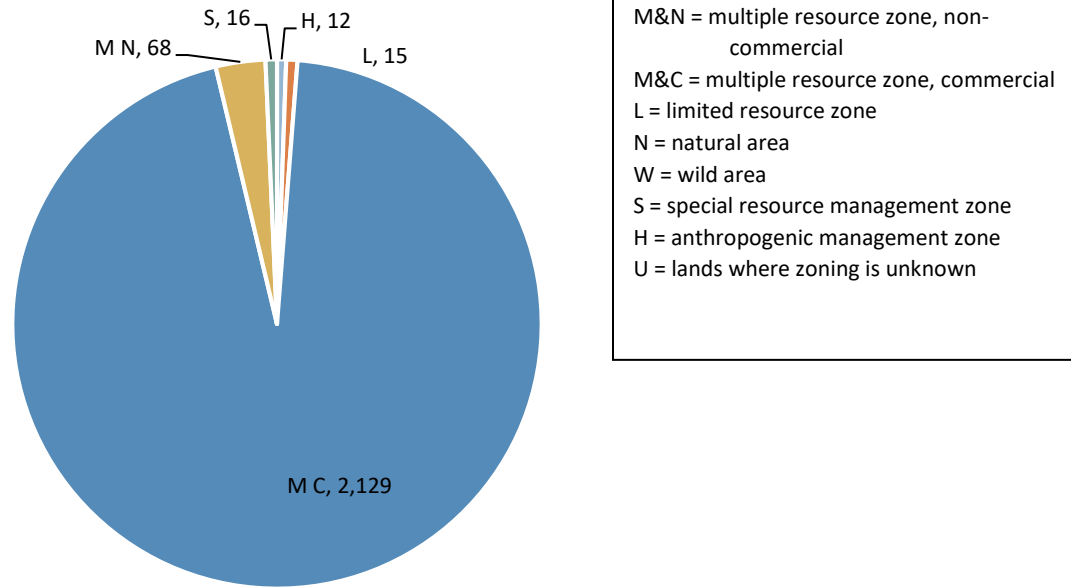


**Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. The LMU consists of 1,040(26%) acres of mature red oak stands and 818(20%) acres of tulip poplar stands. The LMU contains its own unique forest classification not found in other LMUs in Michaux State Forest. Stands of mixed hardwoods within the LMU can be identified as cove forest communities. A cove forest is a type of deciduous forest community associated with Appalachian Mountain coves.

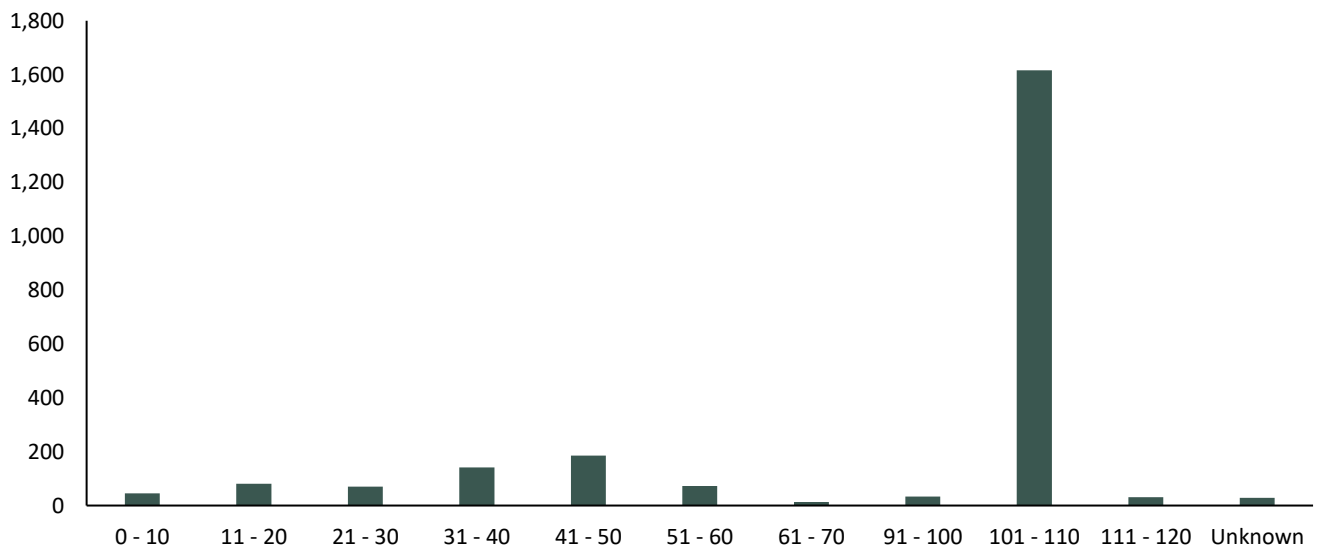




**Figure 3.** Acreage of state forest land in this LMU by site class. Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP. The site class distribution is 737(33%) acres of site 1, 1,465(65) acres of site 2, 17(.01%) acres of site 3, and 96(.04%) acres of site 0.



**Figure 4.** Acreage by management zoning on state forest land in this LMU. Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP.

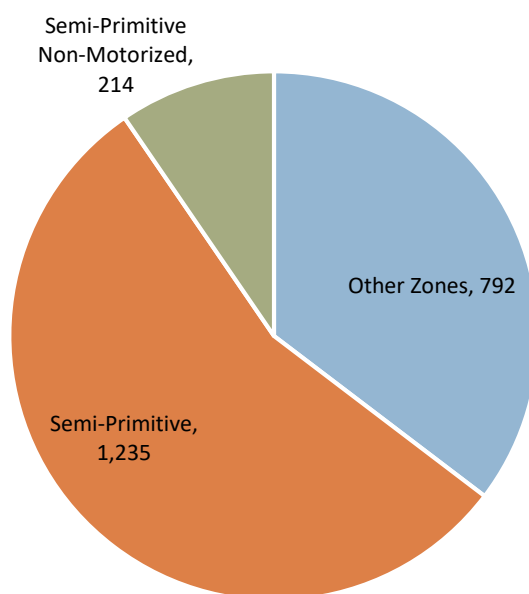


**Figure 5.** Acres of forest age classes on state forest land in this LMU. Much of the forested land in Culp Ridge LMU was clearcut in the early 1900s for agriculture purposes. Later, the property was managed as a hunting preserve and for pulpwood production. Conifer and larch plantations were created as well as herbaceous openings. The landscape was heavily managed through timber harvesting without sufficient

desirable regeneration present and an over abundant deer population. Two state timber sales have been done within the LMU.

**Table 4.** Miles of stream by classification within entire LMU. Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. There are eight miles of three major streams that transect within the LMU: Middle Creek, Copper Run and Tom’s Creek. Tom’s Creek is classified as an exceptional value stream. Tom’s Creek supports a healthy population of wild brook trout. These waters are all tributaries of the Potomac River Watershed Basin.

Class	Total (miles)
High Quality Waters	15
Exceptional Value Waters	4
<b>Total</b>	<b>20</b>



**Figure 6.** Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications. ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones. Culp Ridge LMU is a popular destination for recreationists. A ten-mile network of shared use trail has been created using the existing road network from past timber harvesting within the LMU. The shared use trail is open to horseback riding, mountain biking and hiking. Hunting, fishing, and birding are also popular activities within the LMU.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. This score is in the 20<sup>th</sup> percentile of all state forest LMUs, making it a somewhat fragmented area on par with other portions of state forest land. Much of the state forest land in the LMU is remote and has a closed canopy but that can be deceiving. Miles of administrative roads, trails fragment the landscape within the LMU. Three herbaceous openings are located within the LMU as well as the cleared site of the original tree farm hunting lodge. A section of pipeline owned by Columbia Gas transects through the LMU.

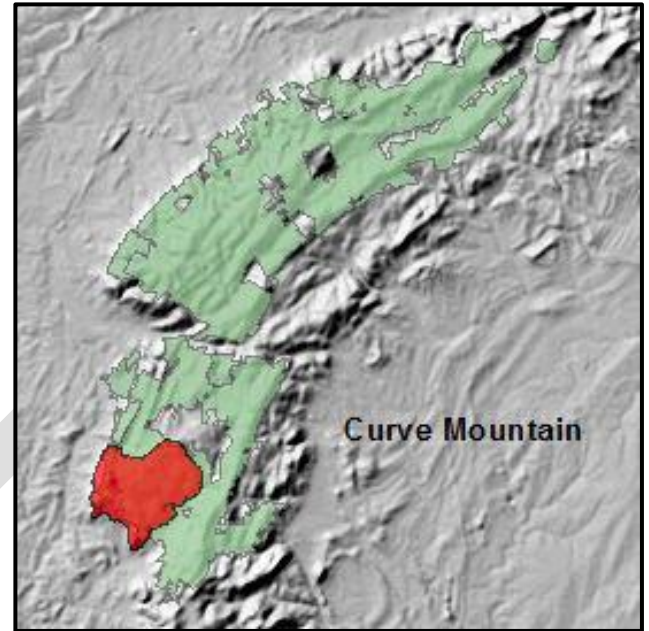
LMU Name	Core Forest Index
Culp Ridge	91

# Curve Mountain

## Landscape Management Unit

### Abstract

The Curve Mountain LMU encompasses 8,852 acres in Quincy and Washington Townships in Franklin County. The LMU lies within the South Mountain ecoregion, which is the northern terminus of the Blue Ridge Physiographic Province. On the LMU, the individual northeastward trending ridges are separated by narrow, somewhat discontinuous valleys with slopes that average 15 percent; however, slopes of 20 to 30 percent are not uncommon along the flanks of many of the deep V-shaped stream valleys. To the east, the mountain range borders the Great Valley eco-region and the west borders the South Mountain eco-region. The LMU is comprised of 7,250 acres of state forest land, which is 82 percent of the landmass of the LMU. Elevations range from 800 to 1,900 feet. The LMU is primarily forested and has approximately 252 acres of developed open space. There are 2 Columbia Gas transmission line right-of-ways that cross this LMU.



The LMU lies in the oak-pine and mixed oak forest group. Oak species, including chestnut, scarlet, northern-red, black, and white oak, along with yellow-poplar dominate the lower slopes. A white pine-hemlock forest type is found along the streams, while a mix of oak-pitch pine forest type is common on dry ridge top sites and southwest facing slopes.

Many factors have influenced the Curve Mountain LMU over the last 100 years that contribute to its current conditions. These influences include, but aren't limited to timber harvesting, fire, wind and ice storms, insects, diseases, white tailed deer over browsing, invasive species, and drought. There were 3 iron companies who owned much of the land that makes up the Michaux prior to the Commonwealth of Pennsylvania acquiring. Mont Alto Iron Company owned the area within this LMU. Between 1780 and 1900 when the furnaces operated, the local forests were harvested 2 or 3 times for charcoal. The original timber had all been removed between 1870 and 1885, and the young second growth was cut immediately once the trees became large enough to make charcoal to supply the iron furnace at Mont Alto. Remnants still exist on the landscape from the charcoal industry in the form of charcoal hearth depressions which can still be seen throughout the LMU. Iron operations became uneconomical in the late 1800's, when less expensive ore became available from Lake Superior. By the 1890's, the forest in the area had been almost completely harvested and were repeatedly burned until the active fire suppression efforts of the 1930's.

This LMU suffered heavily from the ice and windstorm that occurred on March 4, 1993. Approximately 3,971 acres of this LMU (55% of the LMU's state forest acres) was heavily impacted by this natural disaster and many of the stands were regenerated without sufficient amounts of desirable advanced regeneration. The result across much of this landscape was a profound type-shift from oak and pine

dominated stands to red maple and black birch dominated, pole-timber sized stands which now make up the bulk of this unit's vegetative cover type and age class. Of the 7,250 state forest acres in this LMU 5,689 acres (78%) have had some sort of silvicultural treatment and 5,021 (69%) of those treatments have been salvage induced harvests by either the ice storm or subsequent gypsy moth outbreaks.

The combination of past ecological impacts has led to current conditions where there is a lack of landscape level age class and forest type diversity across much of this landscape, which is further compounded by a wide range of threats from invasive plant species. One of the most prevalent invasive plant threats on this landscape is Japanese angelica tree which has become prolific in a large portion of the four-hundred-acre Curve Mountain gypsy moth salvage sale. Japanese angelica tree, along with a wide range of other invasive plant species, negatively impact landscape level biological diversity by shading out our native tree, shrub, and wildflower species which in turn limits the abundance and diversity of both game and non-game species supported at the landscape level. Critical habitat bottlenecks to landscape level ecosystem functions and carrying capacity include a lack of both structural and species diversity that do not support optimal reproduction or recruitment due to lack of suitable nesting conditions, suitable diversity of forage or host plant species; or insufficient winter survival food or cover, due to the amount of large acreages of stem exclusion stands. Specifically, for Ruffed grouse, migratory birds, that require well developed vertical structure and large amounts of large woody debris. The South Mountain has been designated by the PA Fish & Boat Commission as a special protection area for the timber rattlesnake. Timber rattlesnake collection is not permitted in any part of the Michaux State Forest; even with a collection permit.

Despite the challenges facing this LMU from a wildlife habitat perspective, the Curve Mountain LMU continues to be a popular destination for outdoor recreation due to its proximity to both surrounding population centers such as Mont Alto, Waynesboro, Blue Ridge Summit, and Rouzerville as well as larger metropolitan areas within a couple hours' drive (Baltimore, Washington D.C, Harrisburg, York). Hunting, fishing, birding, hiking, horseback riding, snowmobiling and mountain biking opportunities draw outdoor enthusiasts to this landscape. Three scenic vistas: Chimney Rocks, Oak Road vista, and Snowy Mountain vista, are also frequented by the public. Adjoining land-use and stakeholder expectations provide both challenges and opportunities for meeting articulated objectives of state forest management. Local sportsman's clubs on adjoining parcels and connectivity with local municipal park trail systems provides targeted opportunities for information sharing and engagement with significant stakeholder groups interested in management decisions on this landscape. Challenges include the negative impacts to state forest management goals from issues such as illegal ATV and Off highway vehicle use and trash dumping. Inadequate planning and development of a sustainable trail system designed to meet forest user expectations has led over the past decades to miles of informal trail creation that may not optimize articulated forest management goals while creating conflicts and distrust between different recreational groups utilizing this informal trail system.

This LMU also contains significant acreage in borderline commercial sites above 1800' in elevation which we are identifying as high priority sites to begin managing for permanent patches of pitch pine/scrub oak/heath barrens through periodic burning. The two potential patches for true barrens restoration on this landscape represent 1,480 acres and would be the largest high elevation barrens patches south of Route 30, providing some important dispersion of and patch size diversity in permanently restored barrens patches within the Michaux.



Another critical habitat feature of the landscape is three permanent Special Wildlife Management Areas (SWMAs) which function ecologically as small forest glade communities of native warm season grasses and wildflowers. Originally established as part of the American wild turkey recovery efforts on South Mountain through a partnership with the Pennsylvania Game Commission (PGC) and National Wild Turkey Federation (NWTF), these small habitat communities and their surrounding forest edge nesting habitat are incubator areas important to the reproductive success of a wide range of species from pollinators, songbirds, and reptiles to nationally and regionally declining game species such as American woodcock and Ruffed grouse. Most specifically managed to optimize reproductive success of precocious, ground nesting bird species; these areas require periodic disturbance in the form of prescriptive cutting to sustain desired nesting conditions within the woody edge buffer, as well as rejuvenation and/or prescribed fire to establish or sustain the fire dependent native grass and wildflower species in the openings. Currently, of the three SWMAs in this LMU, 2 of the 3 have an acceptable community of native grasses and forbs and are currently on a prescribed burn schedule to maintain these species on the site. Rejuvenation and establishment of native grass/forb cover is needed on 1 of the openings in this landscape. Forest edge conditions around the three openings is considered (poor, acceptable, good, optimal). One of the three currently have commercial levels of stocking to facilitate edge habitat improvement within the next five years, and 2 of the 3 would require non-commercial treatments to enhance nesting habitat in this management zone.

This LMU contains 6 stream tributaries: Vineyard Run, Red Run, Tumbling Run, Black Andy Run, Truckers Run and Biesecker Run that make up 14 miles of high quality streams. It also contains 2 vernal ponds that serve as temporal forested wetlands within the hydrologic system of this landscape. These streams and wetlands are part of the Potomac River Basin, which feeds the Chesapeake Bay, a vitally important ecological and economic resource in the mid-Atlantic region. Species such as black gum, black birch, and red maple considered undesirable in more xeric upland sites are adapted to grow in palustrine forests, and provide additional cavity and dead woody cover material within the aquatic edge nesting habitat zone. Additional target species to sustain or restore within the palustrine management acres within this LMU include Hemlock, White pine, Tulip Poplar, Red oak, Sugar Maple, Hickory, and Aspen. Shrub species of interest include winterberry holly, leatherwood, spice bush, service berry, dogwood, American holly, high bush blueberry, and maple leafed and other viburnums. Buffer management zones will be manageable areas within this landscape to help restore large woody debris, which is a high management priority. Dead and down woody materials provide to the reproductive success of many forest species whose life histories are dependent on forest/water habitat interactions.

## Priority Goals

1. Implement intermediate or restoration treatments, such as crop tree, group selection harvests, herbicide treatments, and/ or prescribed fire, in areas of the landscape currently “bottlenecked” in less than desirable successional stages for establishment of intermediate cover types (savannah, scrub/shrub, native pine mix plantation, etc.) that secure short-term habitat needs

from invaded stands while enhancing the opportunity for more desirable successional pathways to develop in coming years.

2. Create high quality habitat in Site 3 areas through a combination of commercial and non-commercial timber management and prescribed fire.
3. Increase the amount of large woody cover and floral diversity in riparian and wetland areas, with a special emphasis on increasing the diversity of palustrine adapted species within those communities.
4. Conduct commercial thinnings along the forest road edges (300' buffers) to create quality wildlife habitat to create a mix of patch size and successional stages.
5. Implement a sustainable trail system providing optimal recreational opportunities for legal state forest uses while protecting habitat values and the wild character of this landscape is a high priority management need on this landscape.
6. Formally and constructively engage existing stakeholder groups in both citizen monitoring of wildlife and recreational ecology, as well as increasing and more strategically targeting volunteerism towards landscape and district level management needs.
7. Combat the plethora of non-native invasive species within this landscape by conducting inventories of existing populations and monitoring areas with hyperspectral imagery. Create plans to protect threatened habitats through EDRR and implement recovery plans to ensure the protection of these areas.
8. Providing a thoughtfully designed recreational infrastructure that invites desired forest uses to engage constructively and take responsible ownership of both the recreational opportunities and natural beauty and wildness of this landscape will go a long way towards mitigating some of the current challenges this landscape faces given its proximity to population centers. Additional work can be done to more formally and constructively engage existing stakeholder groups in both citizen monitoring of wildlife and recreational ecology, as well as increasing and more strategically targeting volunteerism towards landscape and district level management needs. Implementing strategies and projects to move this type of work forward within the district in an era of declining staff and personnel resources will require better integration of managers, foresters, rangers, and maintenance staff working in concert to both build fruitful relationships within the local community of forest stakeholders as well as to better apportion district time and resources to help optimize both the recreational and ecological assets available on this landscape.
9. Provide low-density recreational opportunities while understanding the existing recreational infrastructure isn't established to sustain the use.
10. Curb dumping and illegal use of 4-wheeled drive/ATV's throughout this LMU. Continue public notices and interpretive signage.
11. Target community conditions on Site 3 stands within this LMU include commercially stocked stands of xeric adapted hard pines (pitch and shortleaf) and mixed oak/pine dominated stands which optimize both the ecological and economic values of these less productive growing sites. Pitch pine/scrub oak heath barrens managed through periodic burning should also be an intentionally managed community type within the complex of site 3 areas within this landscape where commercial stocking of desirable tree species is not achievable.

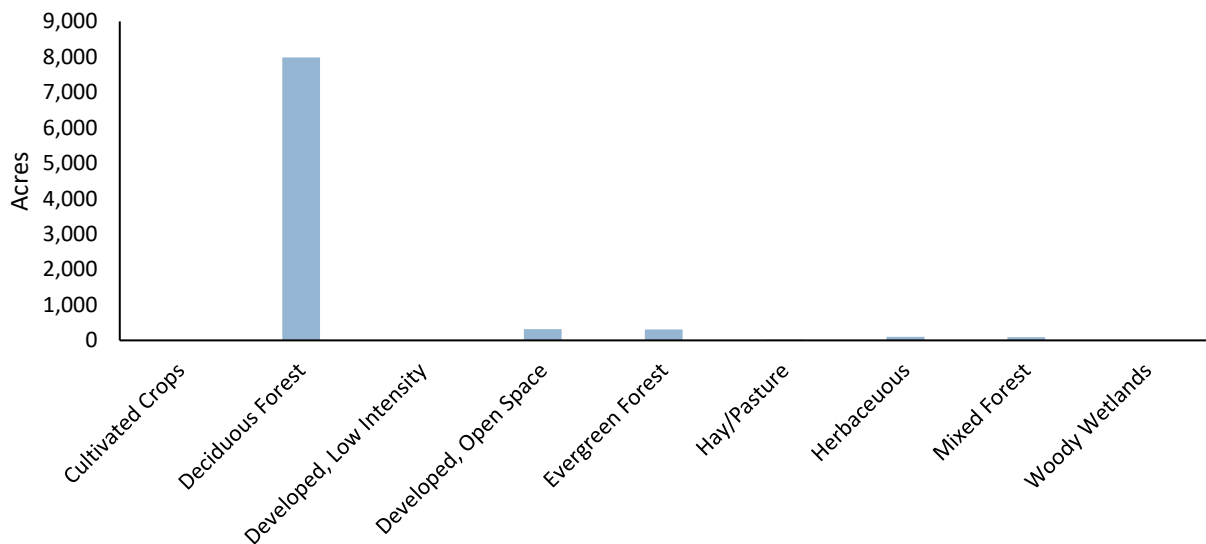
12. This LMU also contains significant acreage in borderline commercial sites above 1800' in elevation which we are identifying as high priority sites to begin managing for permanent patches of pitch pine/scrub oak/heath barrens through periodic burning.
13. Species such as black gum, black birch, and red maple considered undesirable in more xeric upland sites are adapted to grow in palustrine forests, and provide additional cavity and dead woody cover material within the aquatic edge nesting habitat zone. Additional target species to sustain or restore within the palustrine management acres within this LMU include Hemlock, White pine, Tulip Poplar, Red oak, Sugar Maple, Hickory, and Aspen. Shrub species of interest include winterberry holly, leatherwood, spice bush, service berry, dogwood, American holly, high bush blueberry, and maple leafed and other viburnums.
14. Maintain core forest values by blocking access from the 4-wheeled drive/ATV community by cooperating with the local jeep clubs to spread the word about the destruction illegal use has on the LMU, especially niche communities.  
Provide low-density recreational opportunities while understanding the existing recreational infrastructure isn't established to sustain the use.

## Profile

**Table 1.** LMU Area: total and state forest land only.

	Acres
State Forest Land	7,250
LMU Total	8,852

**Ecoregion:** South Mountain



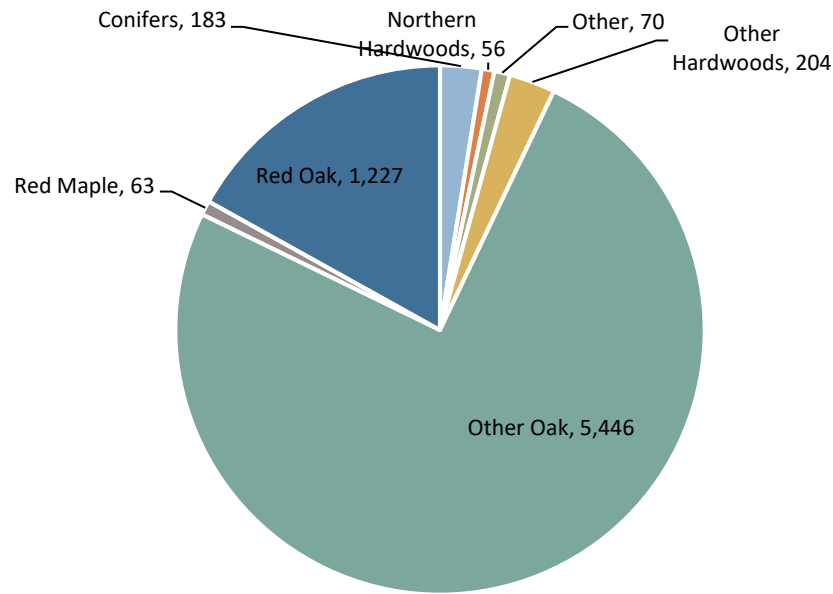
**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU. The LMU is primarily forested and has approximately 252 acres of developed open space. There are 2 Columbia Gas transmission line right-of-ways that cross this LMU.

**Table 2.** Miles of roads by category on state forest land in this LMU. Road categories are described on p. 199 of the 2016 SFRMP. Within this LMU there's 7 Z1 roads. Some of the most heavily used Z1 roads area: Oak Road, Rothrock Road, Snowy Mountain Road, Staley Road, Swift Run Road and Wirt Road. Biesecker Gap is the other Z1 road which doesn't get traveled much due to low maintenance on this road. These Z1 roads get heavy use due to the proximity of the local population densities. The aggregate on most of these roads are shale and most of the roads are in close proximity to water and current dirt and gravel road aggregate is currently be used.

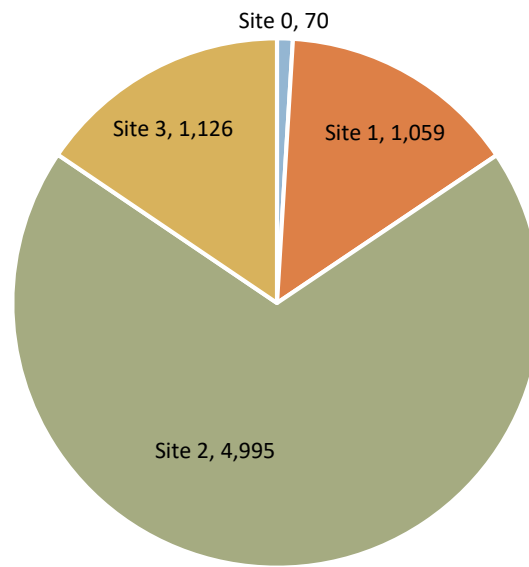
Road Category	Total Miles
Z1 - Public Use Road	16
Z3 - Administrative Road	35
<b>Total</b>	<b>51</b>

**Table 3.** Miles of trails on state forest land in this LMU open to various types of recreational use.

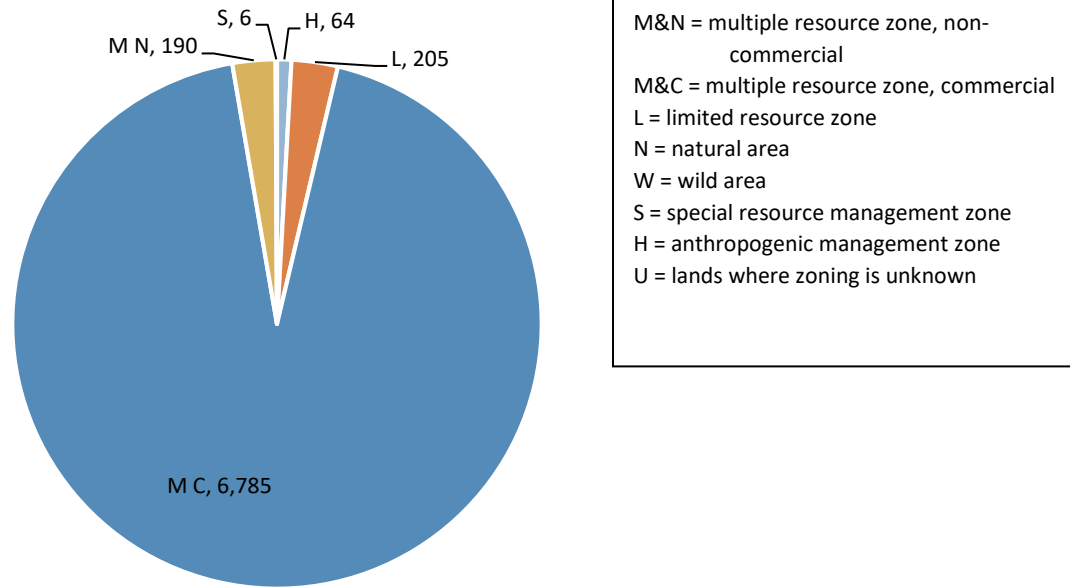
Trail Category	Total Miles
Hiking	22
Biking	18
Equestrian	18
X-Skiing	18
ATV I	0
ATV II	0
Snowmobile/ Joint Use Road	6



**Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. The LMU lies in the oak-pine and oak-hickory forest type groups. Oak species, including chestnut, scarlet, northern-red, black, and white oak, along with yellow-poplar dominate the lower slopes. A white pine-hemlock forest type is found along the streams, while a mix of oak-pitch pine forest type is common on dry ridge top sites and southwest facing slopes. Red maple, black birch and black gum are common shade tolerant species in the understory of the site 1 areas. This LMU also contains significant acreage in borderline commercial sites above 1800' in elevation which we are identifying as high priority sites to begin managing for permanent patches of pitch pine/scrub oak/heath barrens through periodic burning. The two potential patches for true barrens restoration on this landscape represent 1,480 acres and would be the largest high elevation barrens patches south of Route 30, providing some important dispersion of and patch size diversity in permanently restored barrens patches within the Michaux.

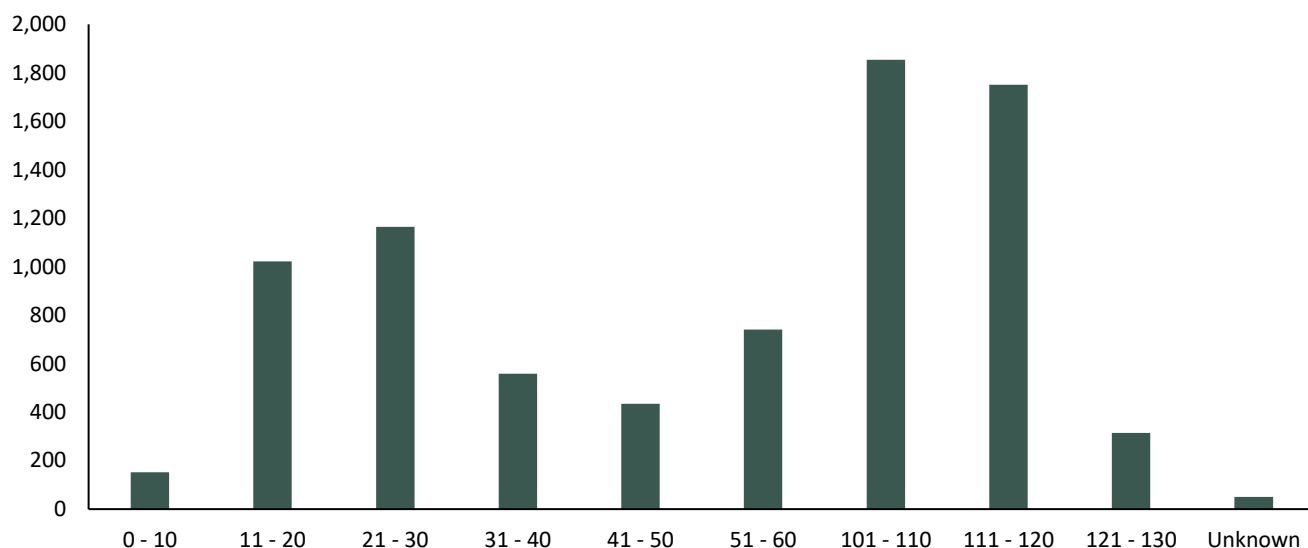


**Figure 3.** Acreage of state forest land in this LMU by site class. Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP. Red maple, black birch and black gum are common shade tolerant species in the understory of the site 1 areas. These areas are hard to regenerate with target species such as tulip poplar, red and white oak, white pine due to the heightened competitiveness of these shade tolerant species in the absence of fire. Increasing dominance of black gum, red maple, sassafras, and laurel in more xeric site 2’s and 3’s is also trending towards the potential for significant shifts in forest composition across this landscape depending on the types of impacts and disturbance at the time of overstory decline or removal. The site class distribution is 1,633 acres of site 1 stands, 5,160 acres of site 2 stands and 1,172 acres of site 3 stands.



**Figure 4. Acreage by management zoning on state forest land in this LMU.** Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP. The result across much of this landscape was a profound type-shift from oak and pine dominated stands to red maple and black birch dominated, pole-timber sized stands which now make up the bulk of this unit's vegetative cover type and age class. Of the 7,250 state forest acres in this LMU 5,689 acres (78%) have had some sort of silvicultural treatment and 5,021 (69%) of those treatments have been salvage induced harvests by either the ice storm or subsequent gypsy moth outbreaks.

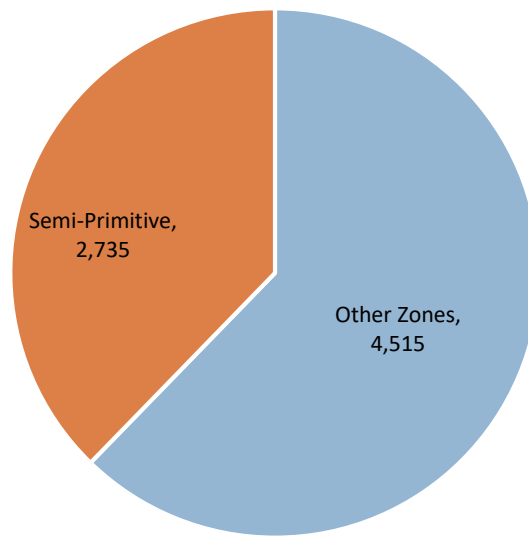




**Figure 5.** Acres of forest age classes on state forest land in this LMU. Many factors have influenced the Curve Mountain LMU over the last 100 years that contribute to its current conditions. These influences include, but aren't limited to timber harvesting, fire, wind and ice storms, insects, diseases, white tailed deer over browsing, invasive species, and drought.

**Table 4.** Miles of stream by classification within entire LMU. Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. This LMU contains 6 stream tributaries: Vineyard Run, Red Run, Tumbling Run, Black Andy Run, Truckers Run and Biesecker Run that make up 14 miles of high quality streams. It also contains 2 vernal ponds that serve as temporal forested wetlands within the hydrologic system of this landscape. These streams and wetlands are part of the Potomac River Basin, which feeds the Chesapeake Bay, a vitally important ecological and economic resource in the mid-Atlantic region.

Class	Total (miles)
High Quality Waters	17
<b>Total</b>	<b>17</b>



**Figure 6.** Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications. ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones. Providing a thoughtfully designed recreational infrastructure that invites desired forest uses to engage constructively and take responsible ownership of both the recreational opportunities and natural beauty and wildness of this landscape will go a long way towards mitigating some of the current challenges this landscape faces given its proximity to population centers.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. This score is the 3rd within the district. The score falls within the 17<sup>th</sup> percentile of all state forest LMUs, making it a relatively unfragmented areas relative to other portions of state forest land. Even though this LMU has a “Core Forest Index” of 90 there’s a lot of fragmented forest within the LMU, specifically illegal mountain biking trails. The forest canopy is contiguous, but what’s happening on the forest floor is completely different. There’s a tremendous amount of fragmentation occurring on the forest floor, mainly from the mountain biking community. Overall this rating could be really deceiving to the public.

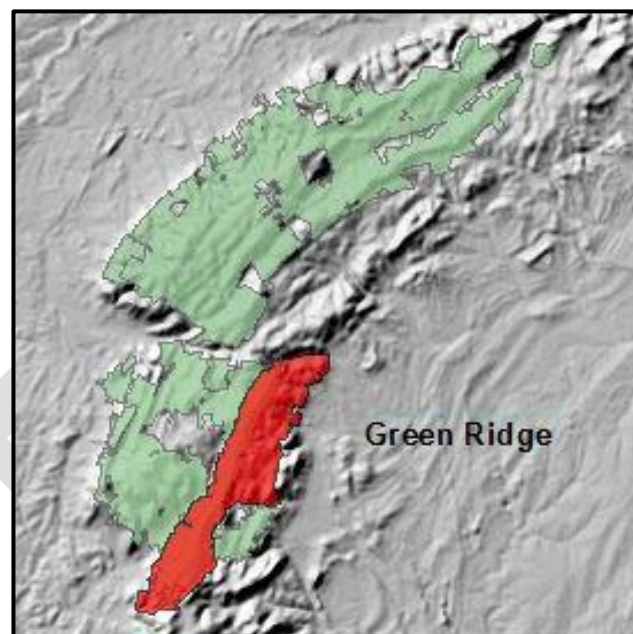
LMU Name	Core Forest Index
Curve Mountain	90

# Green Ridge

## Landscape Management Unit

### Abstract

The Green Ridge LMU is located on the southeastern side of the Michaux State Forest predominantly in western Adams County with the southernmost portion in southeastern Franklin County. The LMU totals 16,810 acres with 8,531 acres (51%) in state forest. The LMU is in the South Mountain ecoregion and is comprised mainly of the Green Ridge on the Michaux along with the descending-elevation private forested areas to the east. The eastern side of the Green Ridge itself has a steep, rocky slope whereas the western side has a very gradual descending slope. The LMU runs from US Route 30 at the north to PA Route 16 on the south near the Maryland border and is approximately 13 miles long and 1 ½ to 2 ½ miles wide. Adjacent to the west are the East Branch Antietam Creek and Carbaugh Run (EV), two significant waterways on the Michaux which this LMU feeds into from the western side. Waynesboro Reservoir is located just to the west on the headwaters of the Antietam.



The timber was harvested repeatedly in the late 1700's to late 1800's to produce charcoal for iron furnaces as evidenced by the hundreds of charcoal hearths in the LMU. Most notable nearby furnaces were Mont Alto Furnace and Caledonia Furnace.

The commercial forest comprises 81% of the zoning and is mostly an oak-heath forest type of chestnut oak and scarlet oak with an understory of ericaceous shrubs. The oak-heath forest comprises 65% of the forest with red oak on 16% and other hardwoods which includes tulip poplar, pitch pine-mixed oak, or white oak on 15%. Due to the better growing sites, timber sales have occurred throughout much of the LMU with less concentration in the site 3 area in the northern portion. 64% is site 2 with 24% site 1. Invasive species such as Japanese angelica, mile-a-minute, and *Ailanthus* are a major problem in much of the southern portion of the LMU.

Notable features of the LMU consist of mostly recreation related infrastructure. The Appalachian Trail runs through the southern section of the LMU for about 4.2 miles. The southern Michaux shared-use trail covers about 18 miles in the LMU. The Teaberry parking area along Cold Springs Road is a trailhead for hikers, bikers, equestrians, and snowmobiles and for large group activities. The ROS analysis shows two areas totaling 860 acres as semi-primitive non-motorized which is not very common on the Michaux.

A large Special Resource Management Zone (typed "S" and locally called the Smokey Hole or Wert Wild Area) is in between Old Forge Road, High Rock Road, and Rattlesnake Run Road, a small part of which is in the adjacent Antietam Creek LMU. There are over a thousand acres of "S" typing in this LMU with a few of those acres in wildlife openings. This designation is due to the lack of public-use roads and timber sales in the area. The idea to designate this as a Wild Area has been considered but not proposed due to

the smaller acreage than what is normally recommended for Wild Areas. Several unauthorized and undesignated trails have been built here. Therefore, there is no activity planned for this area.

South of PA Route 16 is the Beartown Woods Natural Area, a 27-acre relic of the northern hardwood forest type typically found in northern Pennsylvania which includes sugar maple, yellow birch, American beech, and eastern hemlock. An interpretive Bi-Centennial Tree Trail is in the natural area with markers describing the use of the specific tree species in the colonial years.

Three major state forest roads run the southern two-thirds of the LMU; from north to south, Teaberry Road, High Rock Road, and Rattlesnake Run Road total 14 miles. Over 5 miles of two Columbia gas line rights-of-way cross the LMU.

Additional state forest acreage is anticipated through a land acquisition from Strawberry Hill Nature Preserve to the north of Mount Hope Road. This new tract will be inventoried through compartment exams to delineate stands and to identify potential sensitive natural features upon acquisition.

## Priority Goals

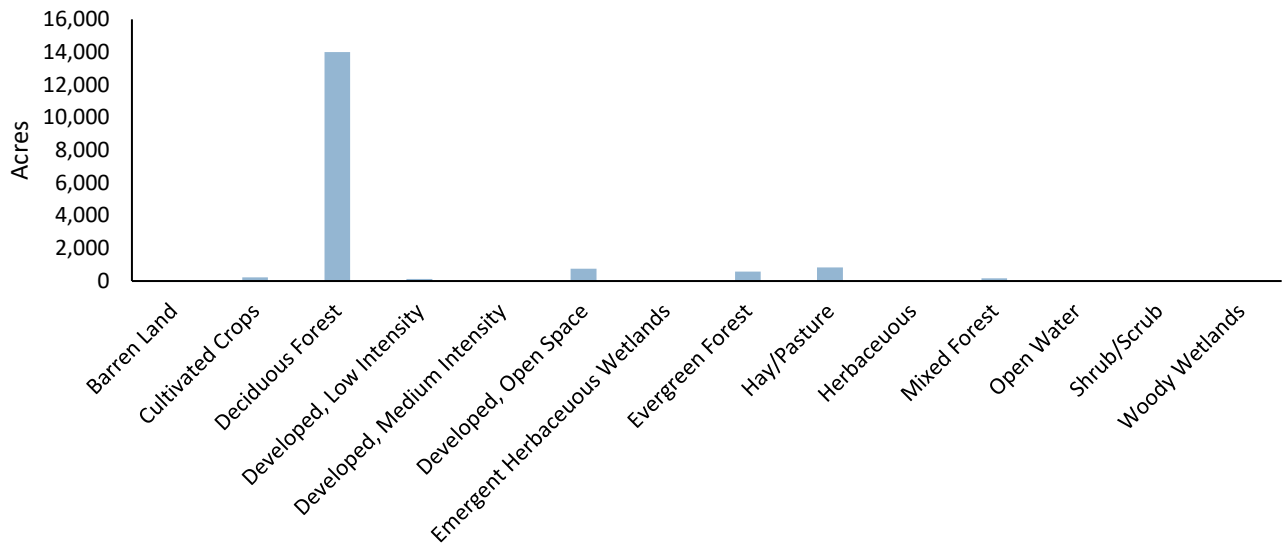
1. Improve Bi-Centennial Tree Trail signage and trail through eagle scout project and district
2. Site 3 timber management to regenerate pitch pine/scrub oak through sales or prescribed fire in the north portion
3. Designate and create map of the Michaux southern shared-use trail system
4. Propose designation and obtain approval for Wild Area
5. Improve ROW management of gas lines to create better wildlife habitat through planting native grasses and tree harvesting to create soft edges
6. Control mile-a-minute and *Ailanthus*, as appropriate and feasible. Control all Japanese angelica occurrences north of Cold Springs Road.
7. Continue to investigate solutions to illegal dumping along Rattlesnake Run Road.
8. Continue to seek solutions to unauthorized trail construction by various user groups

## Profile

**Table 1.** LMU Area: total and state forest land only.

	Acres
State Forest Land	8,531
LMU Total	16,810

**Ecoregion:** South Mountain



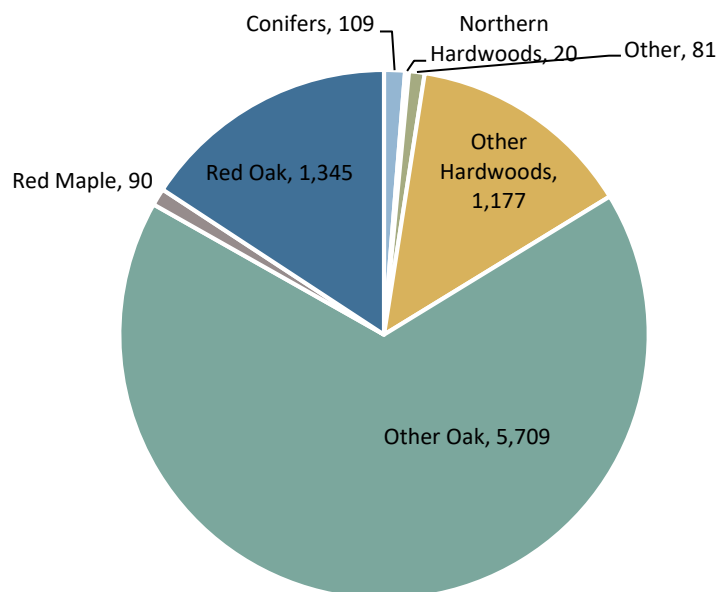
**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU. This area is mostly forested, both state and private. The cultivated crops, including apple orchards, and pasture land lie mostly in the eastern section which is interspersed with the forest. Developed, open space is concentrated in the extreme south near Route 16.

**Table 2.** Miles of roads by category on state forest land in this LMU. Road categories are described on p. 199 of the 2016 SFRMP. Three major state forest roads run the southern two-thirds of the LMU; from north to south, Teaberry Road, High Rock Road, and Rattlesnake Run Road total 14 miles. Over 5 miles of two Columbia gas line rights-of-way cross the LMU.

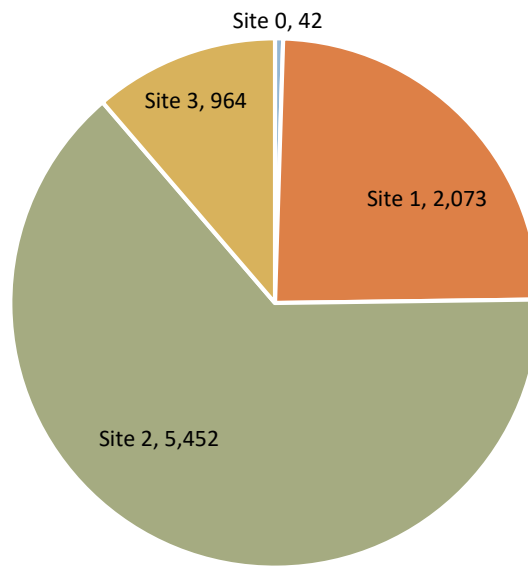
Road Category	Total Miles
Z1 - Public Use Road	14
Z3 - Administrative Road	31
<b>Total</b>	<b>45</b>

**Table 3.** Miles of trails on state forest land in this LMU open to various types of recreational use. The Appalachian Trail runs through the southern section of the LMU for about 4.2 miles. The southern Michaux shared-use trail covers about 18 miles in the LMU. The Teaberry parking area along Cold Springs Road is a trailhead for hikers, bikers, equestrians, and snowmobiles and for large group activities. There is an interpretive Bi-Centennial Tree Trail located in the Beartown Woods Natural Area with interpretive signs describing the use of specific tree species in the colonial years.

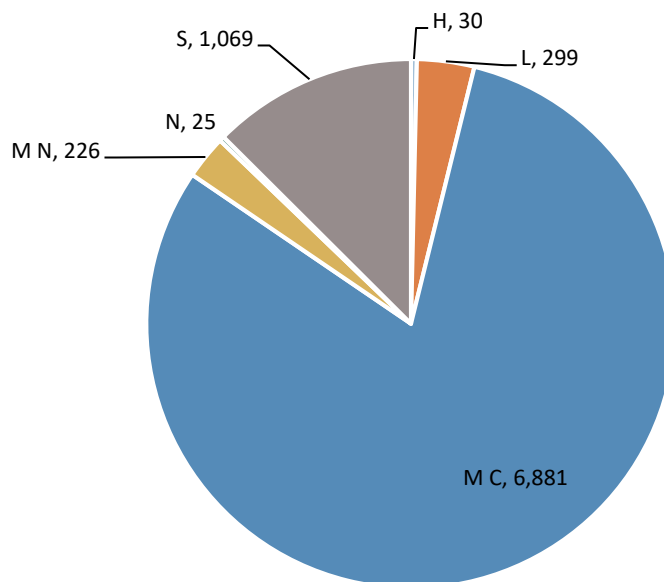
Trail Category	Total Miles
Hiking	22
Biking	18
Equestrian	18
X-Skiing	18
ATV I	0
ATV II	0
Snowmobile/ Joint Use Road	5



**Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. The oak-heath forest comprises 65% of the forest with red oak on 16% and other hardwoods which includes tulip poplar, pitch pine-mixed oak, or white oak on 15%. South of PA Route 16 is the Beartown Woods Natural Area, a 27-acre relic of the northern hardwood forest type typically found in northern Pennsylvania.

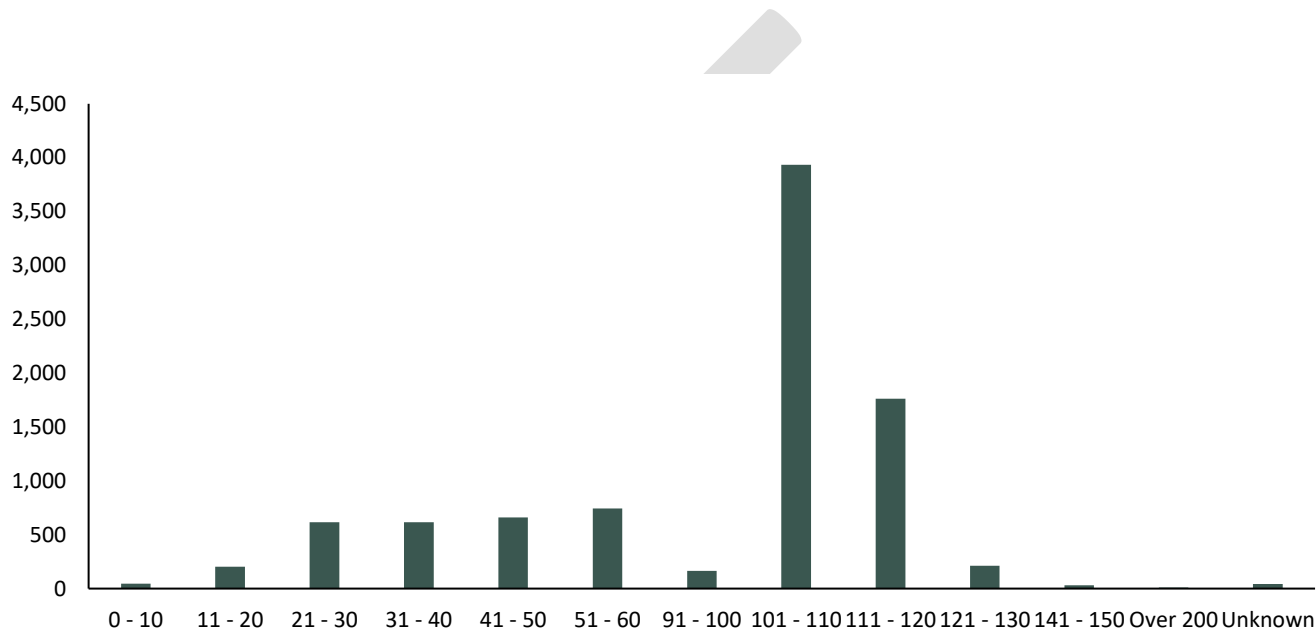


**Figure 3. Acreage of state forest land in this LMU by site class.** Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP. Due to the better growing sites, timber sales have occurred throughout much of the LMU with less concentration in the site 3 area in the northern portion. 64% is site 2 with 24% site 1.





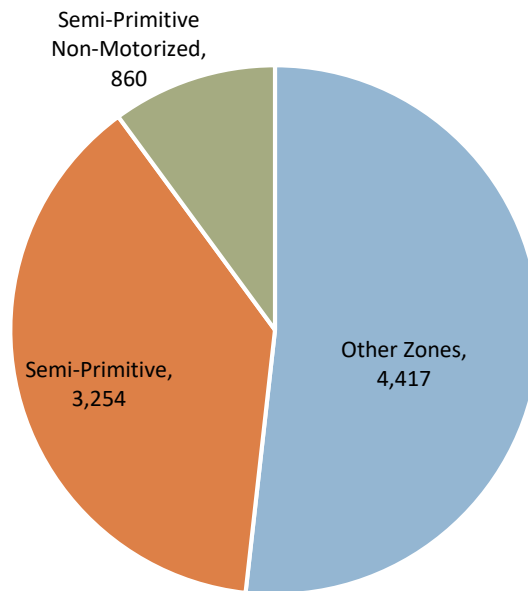
**Figure 4. Acreage by management zoning on state forest land in this LMU.** Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP. The commercial forest comprises 81% of the zoning and is mostly an oak-heath forest type of chestnut oak and scarlet oak with an understory of ericaceous shrubs. There are over a thousand acres of “S” type zone, which mostly includes a potential wild area, with a few acres in wildlife openings. This designation is due to the lack of public-use roads and timber sales in the area. South of PA Route 16 is the Beartown Woods Natural Area, a 27-acre relic of the northern hardwood forest type typically found in northern Pennsylvania.



**Figure 5. Acres of forest age classes on state forest land in this LMU.** The timber was harvested repeatedly in the late 1700’s to late 1800’s to produce charcoal for iron furnaces as evidenced by the hundreds of charcoal hearths in the LMU. The last sixty years of harvest show the goal of balancing the age classes on the state forest.

**Table 4. Miles of stream by classification within entire LMU.** Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. The East Branch Antietam Creek and Carbaugh Run (EV) are two significant waterways on the Michaux which this LMU feeds into from the western side. Waynesboro Reservoir is located just to the west on the headwaters of the Antietam.

Class	Total (miles)
Undesignated	7
High Quality Waters	37
Exceptional Value Waters	5
<b>Total</b>	<b>49</b>



**Figure 6.** Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications. ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones. The ROS analysis shows two areas totaling 860 acres as semi-primitive non-motorized which is not very common on the Michaux.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. The score falls within the 40<sup>th</sup> percentile of all state forest LMUs, making it a relatively unfragmented area on par with other portions of state forest land. It is the highest rating in the Michaux district.

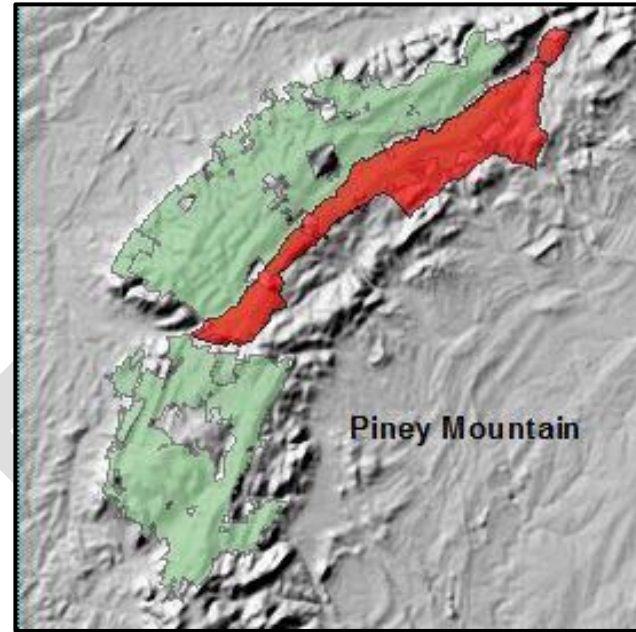
LMU Name	Core Forest Index
Green Ridge	94

# Piney Mountain

## Landscape Management Unit

### Abstract

The Piney Mountain LMU is located on the eastern side of the Michaux State Forest predominantly in western Adams and southern Cumberland Counties. The LMU totals 23,123 acres with 13,221 acres (57%) in state forest. The LMU is in the South Mountain ecoregion and is comprised mainly of the Piney Mountain ridgeline which runs from US Route 30 northeast to just south of the town of Mount Holly Springs and is approximately 20 miles long and 1 to 3 miles wide. Adjacent to the northwest are Mountain Creek and Conococheague Creek, two major waterways on the Michaux which this LMU feeds into from the western portion.



The timber was harvested repeatedly in the late 1700's to the late 1800's to produce charcoal for iron furnaces as evidenced by the hundreds of charcoal hearths in the LMU. Most notable nearby furnaces were Pine Grove Furnace and Caledonia Furnace.

The commercial forest comprises 92% of the zoning and is mostly an oak-heath forest type of chestnut oak, scarlet oak, and pitch pine with an understory of mountain laurel and ericaceous shrubs. The oak-heath forest comprises 77% of the forest with pitch pine-mixed oak on 11%. White pine saplings and small trees are becoming more common in many of the stands. Timber sales are scattered in the LMU due to the poorer site and timber quality plus the lack of desirable regeneration due to the understory interference. Timber sales have been more common on the better lower slope sites than the ridgetop. 56% is site 2 with 28% site 3. Scattered groups of mature aspen in the north can provide opportunity for regenerating aspen.

Notable features of the LMU consist of mostly recreation related infrastructure. Pole Steeple may be the most visited vista on the Michaux which is east of Pine Grove Furnace State Park and a short walk from the Appalachian Trail, which runs through the northern section of the LMU for about 8.5 miles. The ATV trail is located predominately in this LMU with 32 miles here along with the Piney Mountain ATV trailhead parking area along Bendersville Road. This parking area is the site for many large group special events such as mountain bike races. Piney Mountain Ridge Road essentially bisects the LMU from Route 30 to the Bendersville Road. This entire road is gated during the winter for ATV riding in the northern section north of Shippensburg Road and in the spring for nesting turkeys and other wildlife.

An Allegheny chinquapin site is in the northwest area of the LMU. Work to enhance the chinquapin has been done to promote seed production to collect seed for planting at Penn Nursery and our district nursery. A timber sale that successfully regenerated aspen is near the chinquapin site, which originally led to the discovery and accidental release of the chinquapin.

The ROS analysis show 1386 acres in the semi-primitive non-motorized zone (not common on the Michaux) in the northern section near the Appalachian Trail.

## Priority Goals

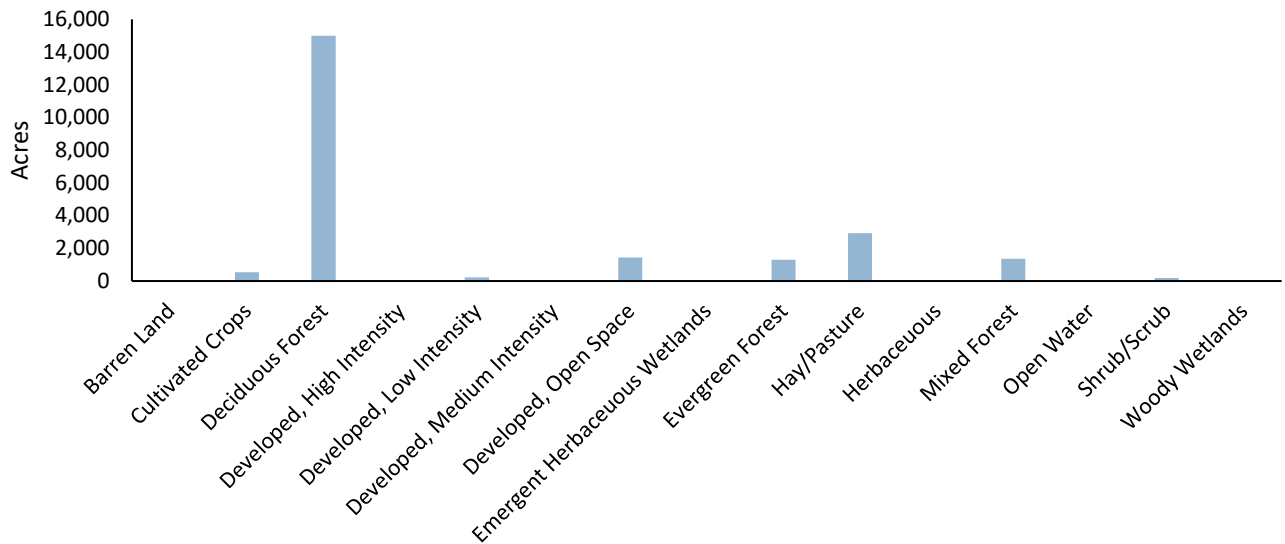
1. Improve ATV riding experience through maintaining trail system and parking area, improve signage, reroute Fuzzy Trail.
2. Manage Site 3 areas to regenerate pitch pine through seed tree harvests or prescribed fire where necessary.
3. Regenerate aspen where scattered aspen is present, mostly in charcoal hearth areas in the north.
4. Maintain/enhance chinquapin populations to collect seed and to regenerate more individuals naturally.
5. Consider options for promoting turkey and grouse when considering management.
6. Coordinate with electric utilities ROW management to improve and create better wildlife habitat through planting native grasses and tree harvesting to create soft edges.
7. Patrol high use areas for illegal activities, esp. renegade ATV trails throughout the LMU and graffiti around Pole Steeple.

## Profile

**Table 1.** LMU Area: total and state forest land only.

	Acres
State Forest Land	13,221
LMU Total	23,123

**Ecoregion:** South Mountain



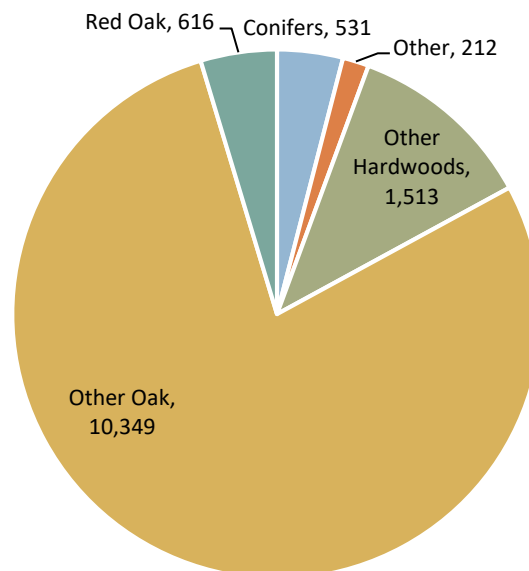
**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU. Most of the developed, open space and hay/pasture are near the eastern border on private land. Cultivated crops would include orchards, mostly apple and peach.

**Table 2.** Miles of roads by category on state forest land in this LMU. Road categories are described on p. 199 of the 2016 SFRMP. Piney Mountain Ridge Road essentially bisects the LMU from Route 30 to the Bendersville Road. This entire road is gated during the winter for ATV riding in the northern section north of the Shippensburg Road and in the spring for nesting turkeys and other wildlife.

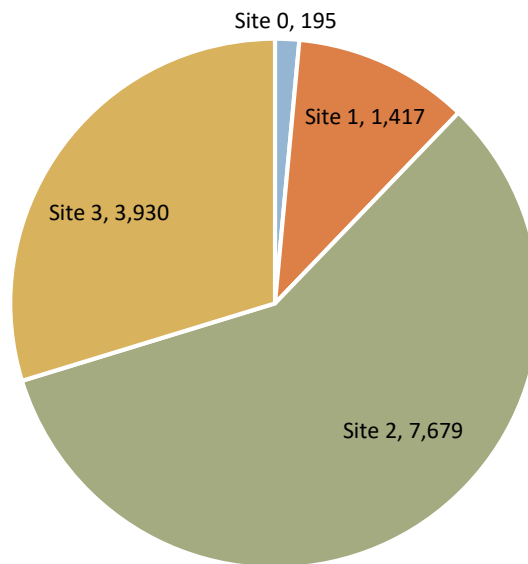
Road Category	Total Miles
Z1 - Public Use Road	26
Z2 - Drivable Trail	0
Z3 - Administrative Road	33
<b>Total</b>	<b>60</b>

**Table 3.** Miles of trails on state forest land in this LMU open to various types of recreational use. Pole Steeple may be the most visited vista on the Michaux which is east of Pine Grove Furnace State Park and a short walk from the Appalachian Trail, which runs through the northern section of the LMU for about 8.5 miles. The ATV trail is located predominately in this LMU with 32 miles here along with the Piney Mountain ATV trailhead parking area along Bendersville Road. This parking area is the site for many large group special events such as mountain bike races.

Trail Category	Total Miles
Hiking	59
Biking	51
Equestrian	50
X-Skiing	50
ATV I	32
ATV II	0
Snowmobile/ Joint Use Road	25

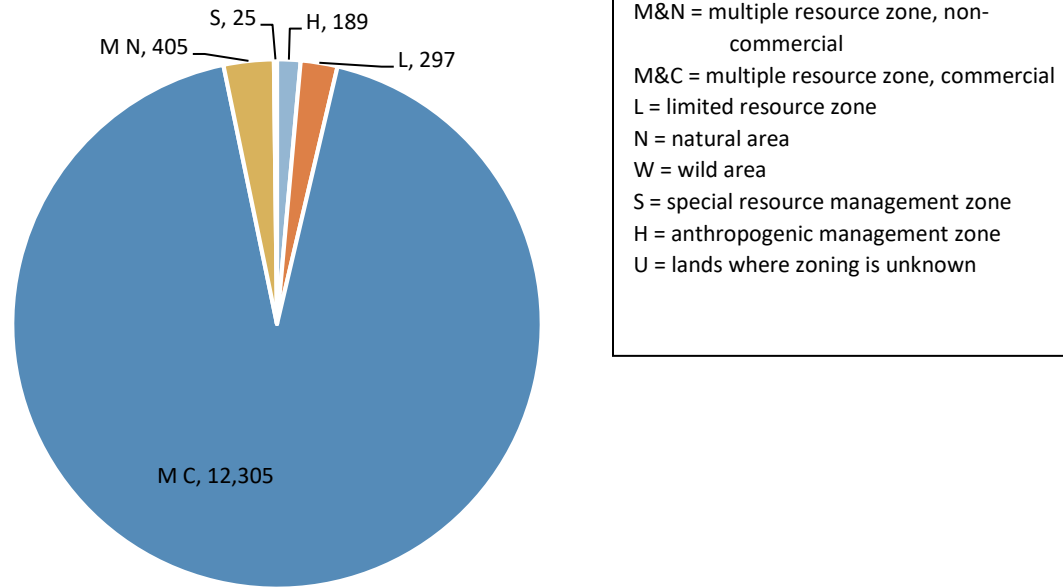


**Figure 2.** Acreage of aggregated forest types on state forest land in this LMU. The forest types are described on p. 108 of the 2016 SFRMP. The oak-heath forest comprises 77% of the forest and is mostly chestnut oak, scarlet oak, and pitch pine with an understory of mountain laurel and ericaceous shrubs. Pitch pine-mixed oak type is found on 11%. White pine saplings and small trees are becoming more common in many of the stands. Scattered groups of mature aspen in the north can provide opportunity for regenerating aspen.

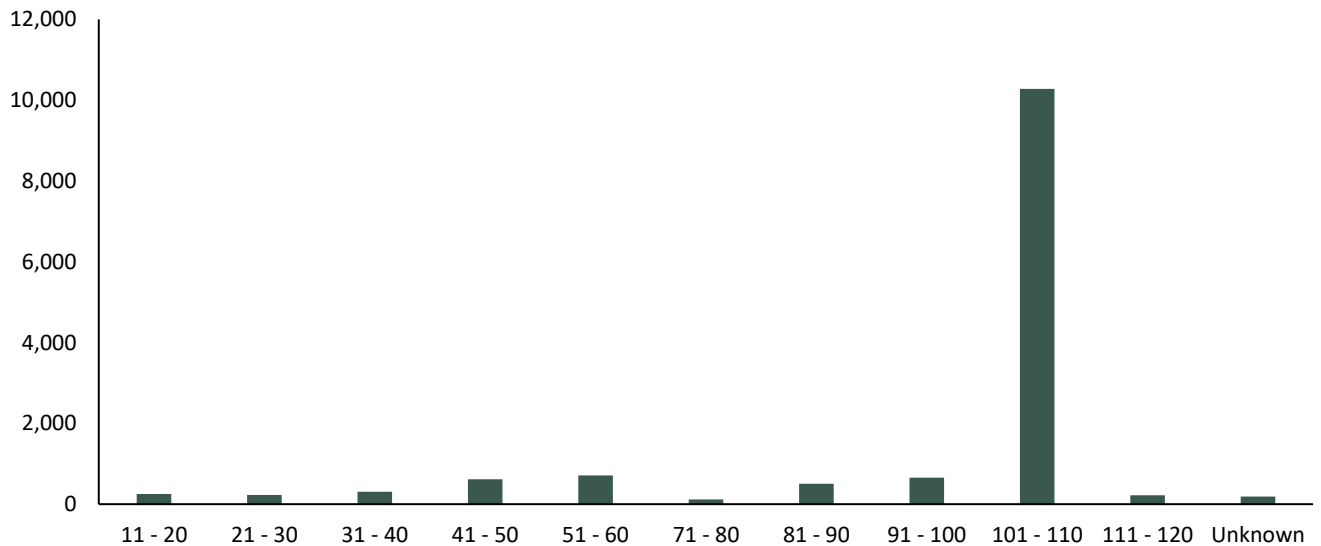


**Figure 3.** Acreage of state forest land in this LMU by site class. Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP. Timber sales are scattered in the LMU due to the poorer site and timber quality plus the lack of desirable regeneration due to the understory interference. Timber sales have been more common on the better lower slope sites than the ridgetop. 56% is site 2 with 28% site 3.





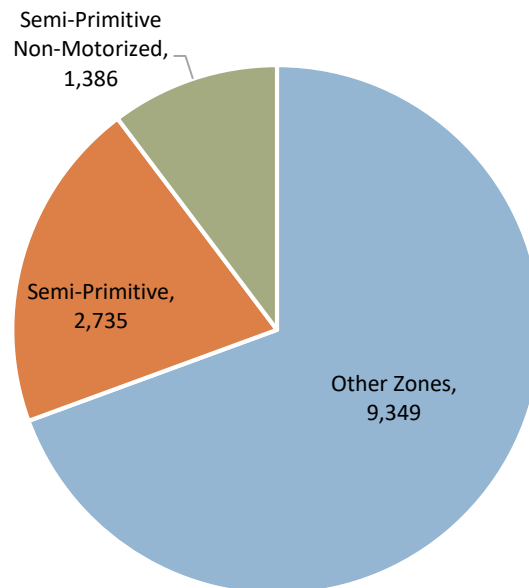
**Figure 4.** Acreage by management zoning on state forest land in this LMU. Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP. The commercial forest comprises 92% of the zoning with minimal acreage in other zones.



**Figure 5.** Acres of forest age classes on state forest land in this LMU. The timber was harvested repeatedly in the late 1700's to the late 1800's to produce charcoal for iron furnaces as evidenced by the hundreds of charcoal hearths in the LMU. Timber harvesting over the past 60 years is lower in this LMU than the forest due to lower site class and sparse regeneration.

**Table 4. Miles of stream by classification within entire LMU.** Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. Most of the streams are unnamed tributaries of Mountain Creek and Conococheague Creek to the west, Conewago Creek and Opossum Creek to the east, and Carbaugh Run and Clear Run to the south. Tagg Run is located near Goodyear in the northeast section.

Class	Total (miles)
Undesignated	6
High Quality Waters	40
Perennial Cold Water Streams	0
Human-made Impoundment/ Pond	2
Natural Lake/ Pond	0
<b>Total</b>	<b>48</b>



**Figure 6. Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications.** ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones. The ROS analysis show 1386 acres in the semi-primitive non-motorized zone (not common on the Michaux) in the northern section near the Appalachian Trail.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. The score falls within the 31<sup>st</sup> percentile of all state forest LMUs, making it a fairly connected but somewhat fragmented area, relative to other portions of state forest land.

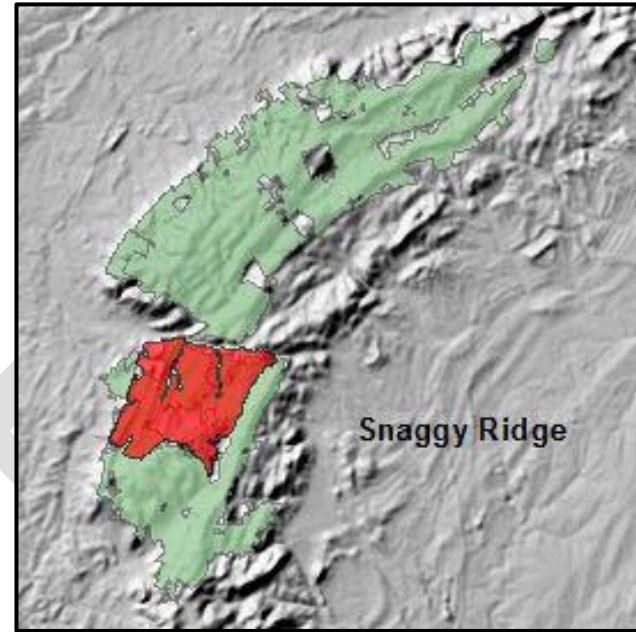
LMU Name	Core Forest Index
Piney Mountain	94

# Snaggy Ridge

## Landscape Management Unit

### Abstract

The Snaggy Ridge LMU is a unique landscape situated in the southcentral portion of the Michaux State Forest. Totalling 14,717 acres the landscape is bounded by Cumberland Valley to the west, Green Ridge to the east and US Route 30 to the North. The LMU covers parts of western Adams and southeastern Franklin County. Snaggy Ridge LMU is part of the South Mountain ecoregion. Located at the northern edge of the Blue Ridge Mountains the ecoregion divides the Gettysburg-Newark Lowlands to the east from the Cumberland Valley portion of the Great Appalachian Valley to the west. State forest land makes up 68% (9,978 acres) of the landscape. The remainder of the LMU consists of mostly private-owned land with much of it located in and around the village of South Mountain. Parts of Caledonia and Mt. Alto State Park(s) also lie within the landscape. The headwaters of Carbaugh Run (EV), West Branch Antietam Creek (HQ) and Rocky Mountain Creek (HQ) originate within the LMU. Situated in the greater Potomac river basin the landscape is a part of the Conococheague-Opequon Watershed. The LMU plays a vital role in public water supply with the Waynesboro Reservoir located just south of the landscape and the Carbaugh Reservoir largely surrounded by the landscape.



Historically this landscape was altered when most of the forested tracts were harvested repeatedly for charcoal production to fuel the iron forges from the late 1700's into the late 1800's. Frequently occurring and unchecked wildfires around this time played a role in shaping the landscape as well. The early 20<sup>th</sup> century saw a change in land ownership across the landscape from largely private to mostly state owned public tracts. The shift in ownership brought with it the creation of a nearby forestry academy, resulting in the application of many new and emerging forest management techniques across the Snaggy Ridge landscape in subsequent years. A seed orchard was also established to supply a state operated seedling nursery. These endeavors along with the presence of Dr. Joseph T. Rothrock earned this landscape and the surrounding area the title of "The Cradle of Conservation." A Civilian Conservation Corps or CCC camp located just to the south of the LMU also performed a variety of tasks that impacted the landscape including, road building, forest fire fighting and tree planting. In addition, some small scale agricultural development has taken place on private land holdings in the South Mountain area. More recently several salvage logging operations were conducted during the mid-1990's and early 2000's that were the result of a severe ice storm and several gypsy moth outbreaks. A privately-owned sand quarry operates in the northwest corner of the LMU.

The Appalachian oak forest is the overarching forest type of the Snaggy Ridge landscape. Commercially accessible forest makes up 73% of the zoning acreage with another 13% listed as non-commercial. Currently the most common stand type is dry-oak heath. Chestnut oak is the dominant oak species mixed with scarlet oak, red oak, black oak and white oak. A pine/hemlock component still exists on the

landscape today though not as abundantly as it did prior to charcoal production. Remnants of CCC era work exist in a handful of pine plantations across the landscape. Conifer stands are the 2<sup>nd</sup> most common stand type totaling just over 1,000 acres. Overall timber quality is good with most of the landscape (>60%) classified as site class 2. The current forest age class distribution across the landscape resides mostly in the 100-110-year-old classification, while most of the rest falls in the 20 to 60-year-old classification. There are 61 miles of roadway crossing the landscape including 24 miles of public use-road and 37 miles of administrative road. Invasive plant species of concern across the LMU include Japanese Angelica tree, Japanese barberry, multiflora rose, mile-a-minute and bush honeysuckle. Insecticide treatments have been selectively conducted to curb the spread of Hemlock Woolly Adelgid in hemlock stands throughout the LMU.

With its proximity to the Lincoln Highway providing ease of access, coupled with a large leased campsite community, the Snaggy Ridge landscape hosts numerous recreational user groups. The LMU hosts an array of recreational infrastructure including 10 miles of cross country ski trail, a golf course and 7 miles of shared-use trail available to hikers, bikers and horseback riders. In addition, there are a number of informal mountain bike trails scattered throughout the landscape. A densely populated leased campsite community located in the northcentral portion of the LMU encourages use of the surrounding formal and informal trail systems. Bisected north to south by the Appalachian Trail the LMU contains 6 miles of this National Scenic Hiking Trail. White Rocks and Sheaffer Rocks in the southeastern portion of the LMU are popular rock climbing and bouldering destinations. A relatively short slice of snowmobile trail is available; however, several miles of trail are located just south of the LMU. Partially located within the LMU and preserved to protect several archeological sites the 780-acre Carbaugh Run Natural Area also carries designation as a reptile and amphibian protection area. The 611-acre Meeting of the Pines Natural Area, an example of a xeric central conifer natural community, is home to five native pine species, the only location in PA where this is known to occur.

The LMU is also home to five Special Wildlife Management Areas. Referred to as SWMA's for short, these permanently maintained herbaceous openings provide forage and habitat for a variety of wildlife. Within the past decade an ongoing initiative was implemented to replace non-native plantings on these openings with native grasses, forbs and shrubs to promote greater wildlife diversity and minimize the threat of invasive plants on the landscape.

## Priority Goals

1. Utilize prescribed fire and timber stumpage sales in Site 3 timber stands to promote desirable regeneration and establish early successional habitat patches for target wildlife.
2. Use Early Detection Rapid Response protocols to map and control satellite populations of high-threat invasive plant species within this LMU, including Japanese angelica tree, poison-hemlock, cork tree, and mile-a-minute.
3. Work with Ecological Services and Planning for the inventory and management of sensitive natural resources within the Snaggy Ridge LMU including wetlands.
4. Inventory, map, interpret, and protect Carbaugh Run and Meeting of the Pines Natural Areas.

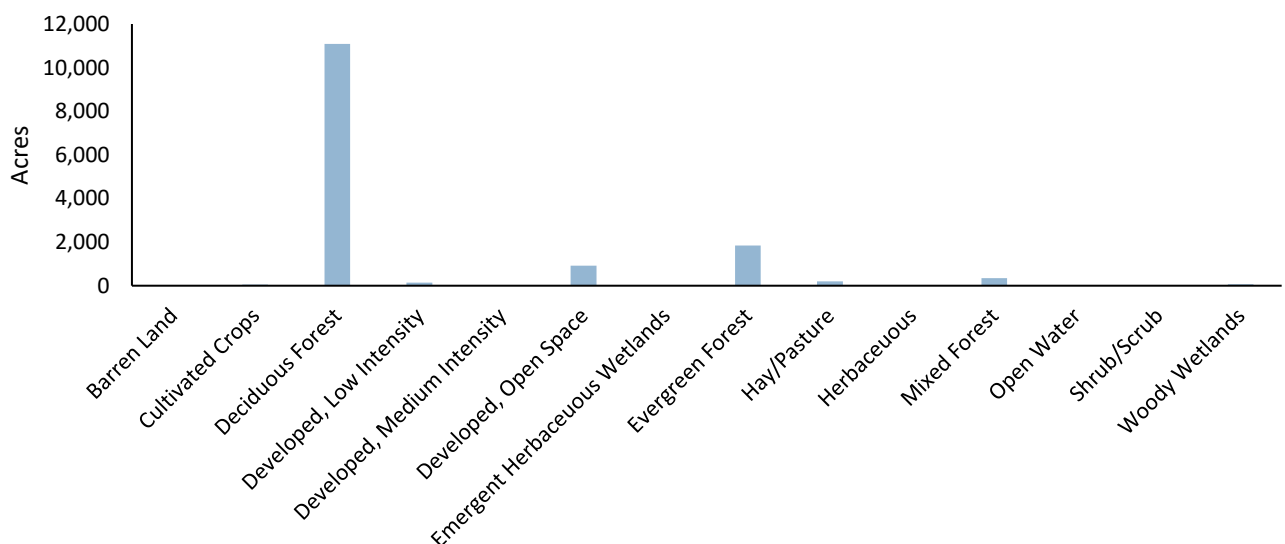
5. Improve aquatic habitat connectivity by conducting aquatic organism passage assessments at stream culvert crossings and evaluating for replacement.
6. Preserve Eastern hemlock stands across the LMU through monitoring, insecticide applications and biological controls targeting Hemlock Woolly Adelgid.
7. Develop and promote effective partnerships with the leased campsite community and other recreational user groups who frequent the LMU.
8. Work with the PA Game Commission on implementing measures to slow the spread of Chronic Wasting Disease across the LMU.

## Profile

**Table 1.** LMU Area: total and state forest land only.

	Acres
State Forest Land	9,978
LMU Total	14,717

**Ecoregion:** South Mountain



**Figure 1.** Land cover data from the National Land Cover Dataset for the entire LMU. State forest land makes up 68% (9,978 acres) of the landscape. The remainder of the LMU consists of mostly private-owned land with much of it located in and around the village of South Mountain. Parts of Caledonia and Mt. Alto State Park(s) also lie within the landscape.

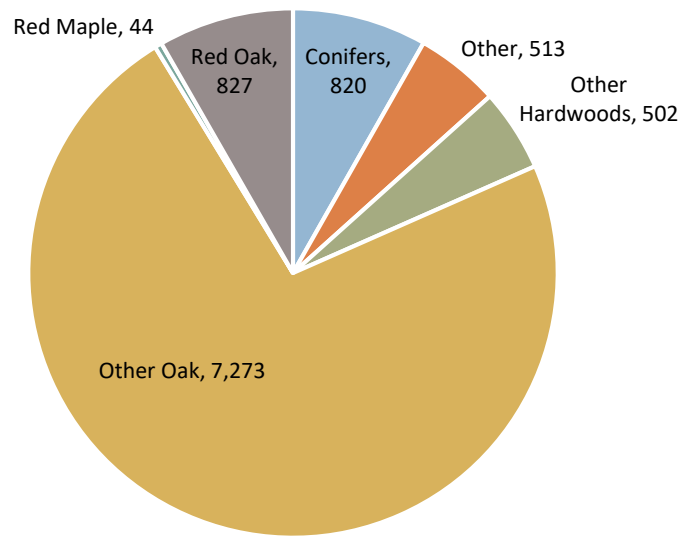
**Table 2.** Miles of roads by category on state forest land in this LMU. Z1 roads partially or wholly within the LMU include Kettlesprings Rd., Golf Course Rd., District Rd., Three Springs Rd., Teaberry Rd., Newman Rd., Carbaugh Rd., Cold Springs Rd., Old Forge Rd., South Mountain Rd., Snowy Mountain Rd., Swamp Rd., Corl's Ridge Rd., Perry Dr., Corls Rd., White Rocks Rd. and US Route 233. Road categories are described on p. 199 of the 2016 SFRMP.

Road Category	Total Miles
Z1 - Public Use Road	24
Z3 - Administrative Road	37
<b>Total</b>	<b>61</b>

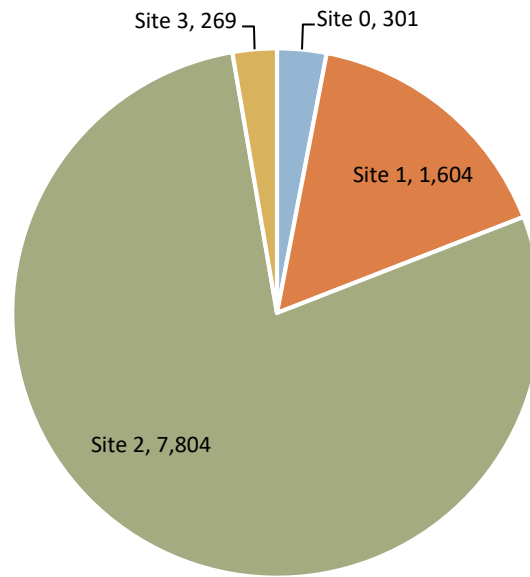
**Table 3.** Miles of trails on state forest land in this LMU open to various types of recreational use. The LMU hosts an array of recreational infrastructure including 10 miles of cross country ski trail, a golf course and 7 miles of shared-use trail available to hikers, bikers and horseback riders. Bisected north to south by the Appalachian Trail the LMU contains 6 miles of this National Scenic Hiking Trail. White Rocks and Sheaffer Rocks in the southeastern portion of the LMU are popular rock climbing and bouldering destinations. A relatively short slice of snowmobile trail is available; however, several miles of trail are located just south of the LMU.

Trail Category	Total Miles
Hiking	14
Biking	10
Equestrian	10
X-Skiing	10
ATV I	0
ATV II	0
Snowmobile/ Joint Use Road	1

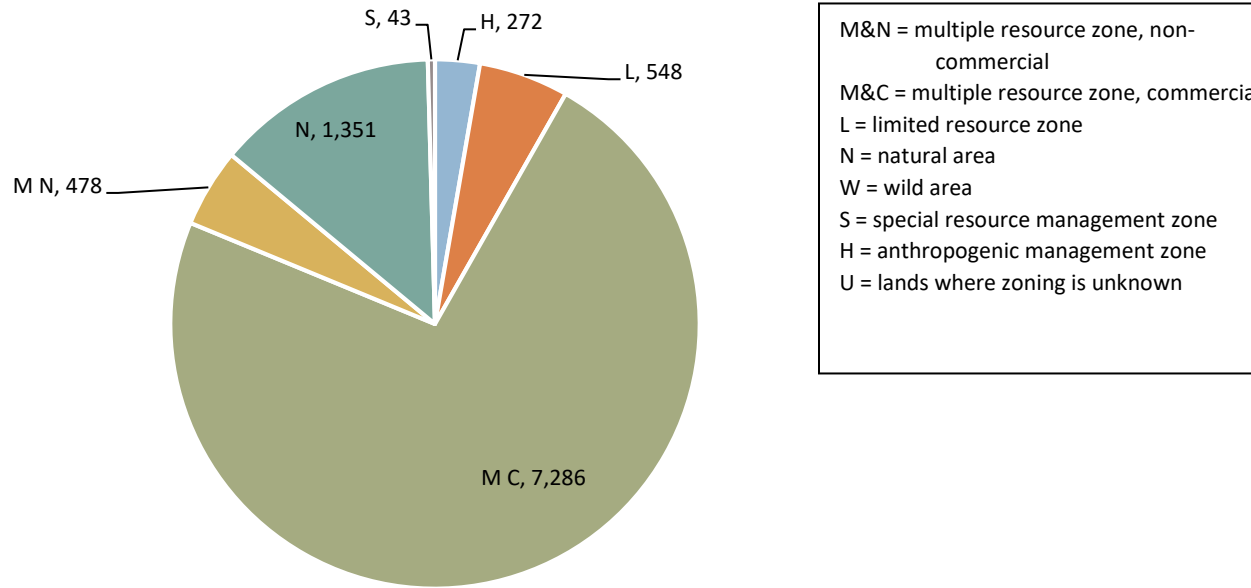




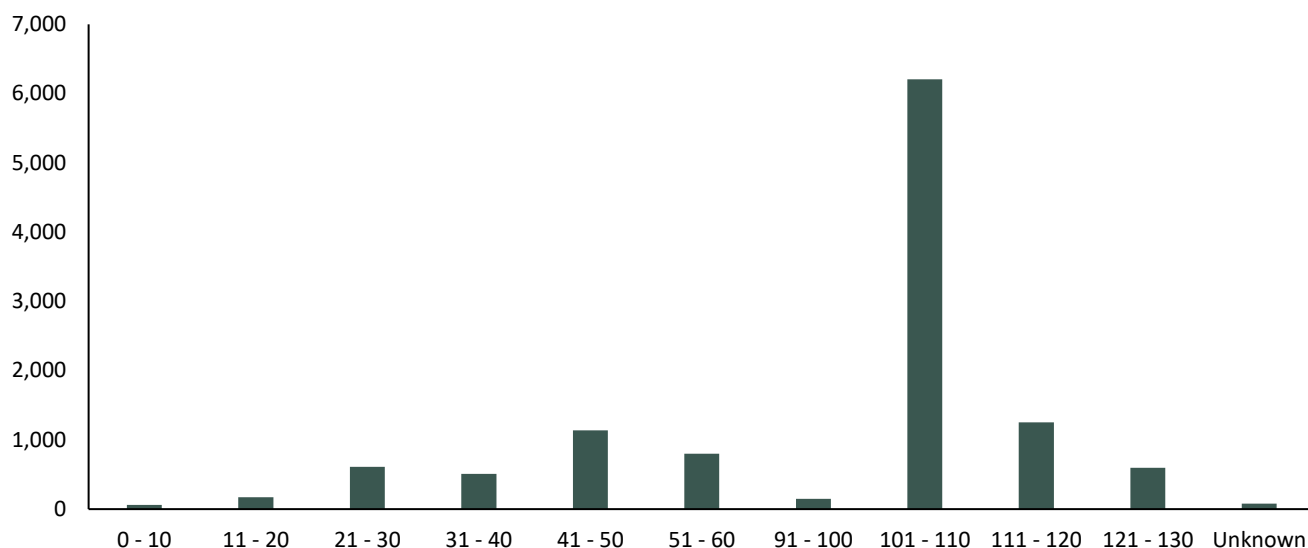
**Figure 2. Acreage of aggregated forest types on state forest land in this LMU.** The forest types are described on p. 108 of the 2016 SFRMP. The Appalachian oak forest is the overarching forest type of the Snaggy Ridge landscape. Currently the most common stand type is dry-oak heath. Chestnut oak is the dominant oak species mixed with scarlet oak, red oak, black oak and white oak. A pine/hemlock component still exists on the landscape today though not as abundantly as it did prior to charcoal production. Remnants of CCC era work exist in a handful of pine plantations across the landscape. Conifer stands are the 2<sup>nd</sup> most common stand type totaling just over 1,000 acres.



**Figure 3.** Acreage of state forest land in this LMU by site class. Site classes denote the potential quality of the growing site. “Site 0” indicates non-forested lands or forested lands where the vegetation has not yet been typed. Other site classes are described on p. 53 of 2016 SFRMP. Overall timber quality is good with most of the landscape (>60%) classified as site class 2.



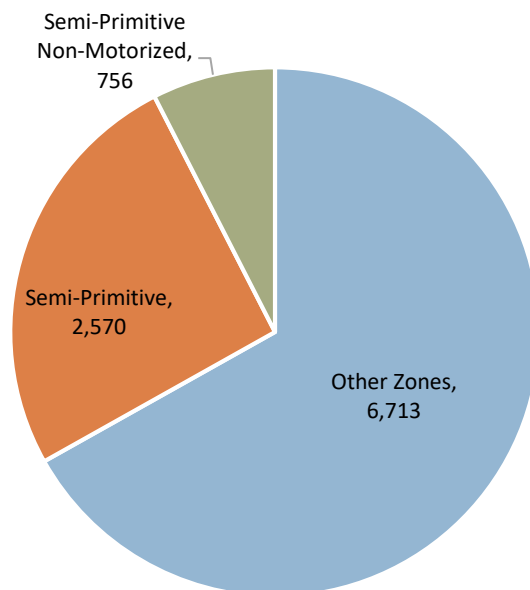
**Figure 4. Acreage by management zoning on state forest land in this LMU.** Management zone is dictated by primary land use and land capability. Further descriptions of commerciality and zoning are found on p. 54 of the 2016 SFRMP. Commercially accessible forest makes up 73% of the zoning acreage with another 13% listed as non-commercial. Partially located within the LMU and preserved to protect several archeological sites the 780-acre Carbaugh Run Natural Area also carries designation as a reptile and amphibian protection area. The 611-acre Meeting of the Pines Natural Area, an example of a xeric central conifer natural community, is home to five native pine species, the only location in PA where this is known to occur.



**Figure 5.** Acres of forest age classes on state forest land in this LMU. The current forest age class distribution across the landscape resides mostly in the 100-110-year-old classification, while most of the rest falls in the 20 to 60-year-old classification.

**Table 4.** Miles of stream by classification within entire LMU. Department of Environmental Protection stream classifications are described in Chapter 93 Water Quality Standards of Title 25 in the Pennsylvania Code. The headwaters of Carbaugh Run (EV), West Branch Antietam Creek (HQ) and Rocky Mountain Creek (HQ) originate within the LMU. Situated in the greater Potomac river basin the landscape is a part of the Conococheague-Opequon Watershed. The LMU plays a vital role in public water supply with the Waynesboro Reservoir located just south of the landscape and the Carbaugh Reservoir largely surrounded by the landscape.

Class	Total (miles)
U4	0
Undesignated	1
High Quality Waters	22
Exceptional Value Waters	10
Wilderness Trout Streams	1
<b>Total</b>	<b>33</b>



**Figure 6.** Acres of state forest land in this LMU by Recreation Opportunity Spectrum (ROS) classifications. ROS is an inventory system developed by the U.S. Forest Service, to characterize land by types of recreation experiences. ROS is described on p. 42 of the 2016 SFRMP. “Other Zones” refers to Semi-Developed and Developed zones.

**Table 5.** Core forest index value for state forest land in this LMU. The core forest index is a rating value out of 100 that expresses the proportion of the area within the LMU that is increasingly far away from dense areas of fragmenting features. The score falls within the 23<sup>rd</sup> percentile of all state forest LMUs, making it a somewhat fragmented area relative to other portions of state forest land.

LMU Name	Core Forest Index
Snaggy Ridge	92