National Park Service
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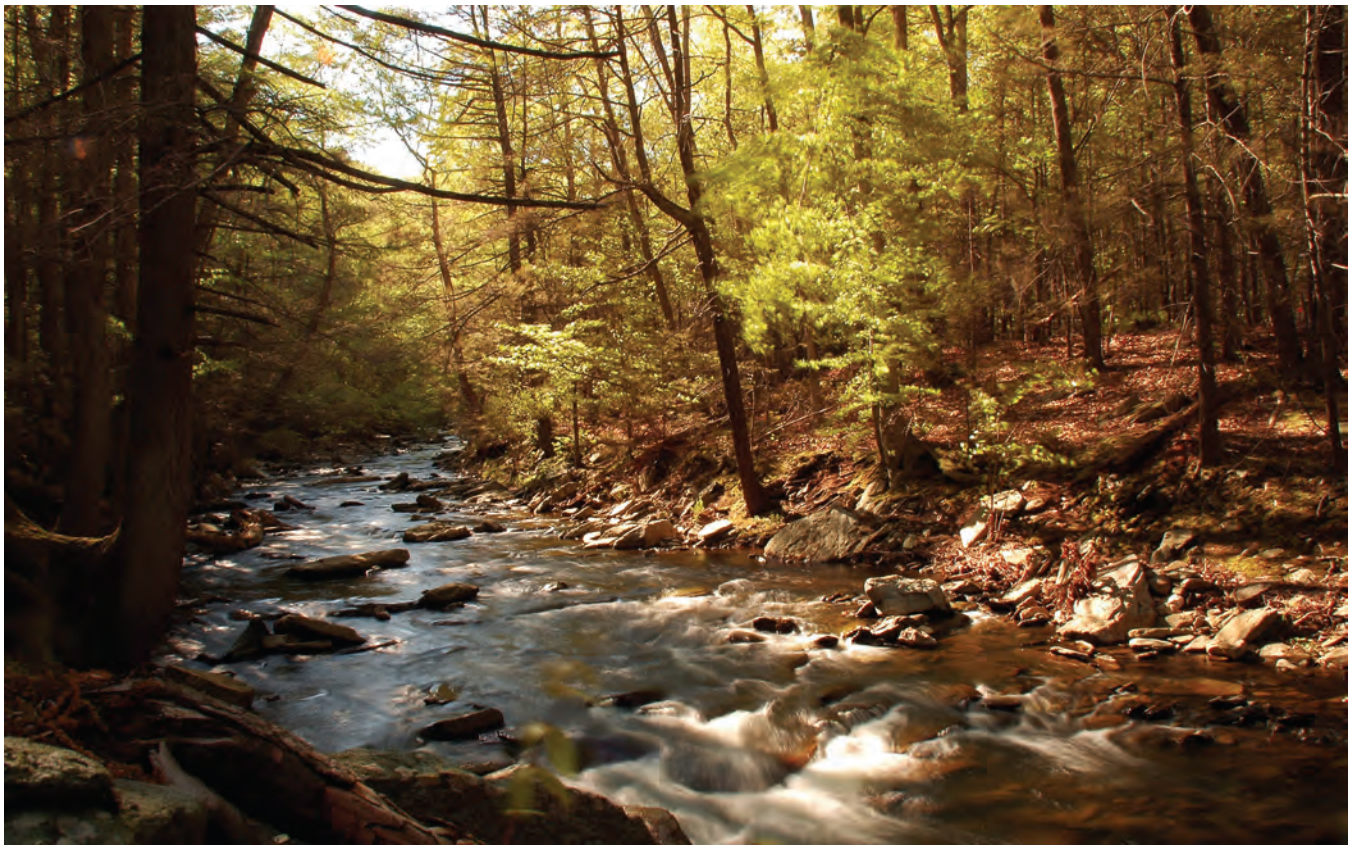
Natural Resource Stewardship and Science

Catoctin Mountain Park
Natural Resource Condition Assessment—SUMMARY

National Capital Region



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Natural Resource Condition Assessment—SUMMARY

National Capital Region

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This document has adapted the Executive Summary of the Natural Resource Condition Assessment report that the University of Maryland Center for Environmental Science produced in collaboration with staff from the National Capital Region Network Inventory & Monitoring Program and Catoctin Mountain Park.

The full 170-page report can be accessed via *https://irma.nps.gov/App/Reference/Profile/2205987* and *http://www.ian.umces.edu/press*.

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ON THE COVER

Catoctin stream.
Photo by Melanie Lukesh.

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BACKGROUND AND CONTEXT

Emerging as a 10,000-acre Recreational Demonstration Area (RDA) out of New Deal legislation in the 1930s, Catoctin was transferred to the National Park Service by Executive Order 7496 dated November 14, 1936. Public Law 2852 dated June 6, 1942 required that all RDA project areas be maintained for "public park, recreational and conservation purposes". Despite mostly forested land use surrounding the park, there are threats to the park from exotic species, nearby development, and regionally poor air quality.

Catoctin Mountain Park provides a wealth of natural resource values, largely resulting from the maintenance of forest and wetland habitats. The secondary growth forest, dominated by mixed oak–hickory communities, functions as a regional refuge for native flora and fauna.

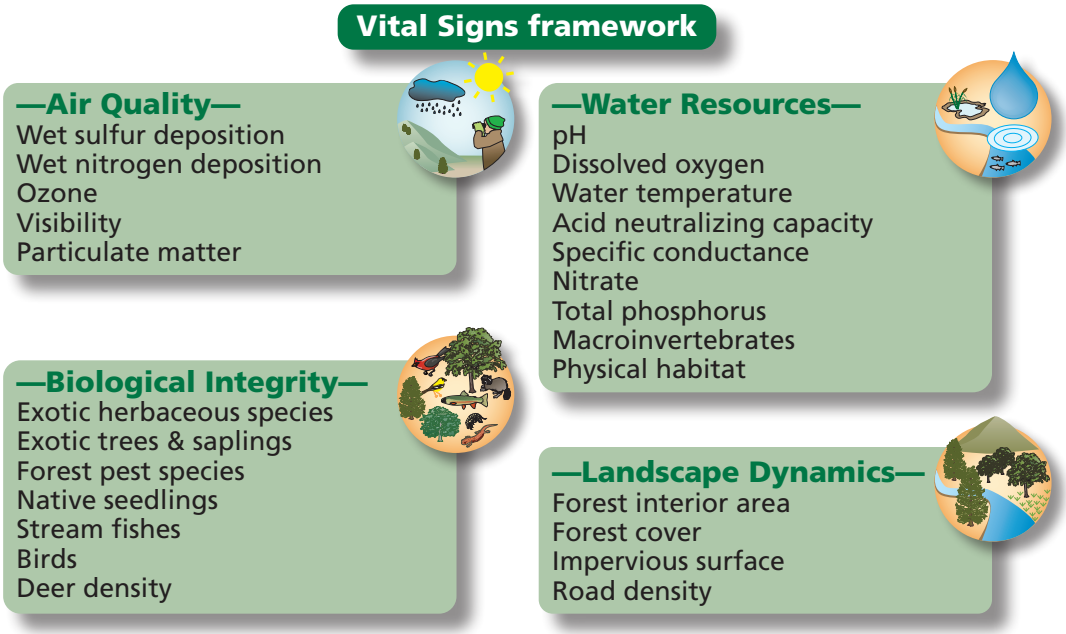
Catoctin Mountain Park's natural resources are challenged by multiple regional and local stressors. Air pollution from power plants, industry, and vehicle emissions result in reduced air quality through large regions of the central eastern seaboard of North America. The park is therefore subjected to high ozone and atmospheric deposition, potentially impacting flora, fauna, and park visitors. Watershed-wide urbanization and development result in challenges to water quality. Increased nutrients, pollutants, and flashiness of river flow can result in impacts to wetland flora and fauna as well as streambank erosion.

The streams of Catoctin are just one of the valuable natural resources in the park. Photo by M. Valcarcel.

APPROACH

The Vital Signs framework was used to assess natural resource condition within Catoctin Mountain Park. Within each Vital Sign, indicators were identified that would inform the assessment and data was sourced for these indicators. Reference conditions were established for each indicator, and the percentage attainment of reference condition was calculated. Once attainment was calculated for each indicator, an unweighted mean was calculated to determine the condition for each Vital Sign category and then similarly to combine Vital Sign categories to calculate an overall park assessment. Based on these key findings, management recommendations and data gaps were developed.

Vital Signs framework used in this assessment.



FEATURES OF CATOCTIN MOUNTAIN PARK

Catoctin Mountain Park is situated on the eastern slopes of Catoctin Mountain in the northern end of the Blue Ridge physiographic province of the Appalachian Mountains. The hills, ridges, valleys, and ravines of the park are mostly forested, with wetlands and streams interspersed throughout. Two of the wetland areas in the park (Owens Creek and Hog Rock wetlands) are recognized as rare plant habitats. Two main perennial streams flow through the park and drain its two principal watersheds—Big Hunting Creek and Owens Creek. These creeks drain to the Monocacy River and ultimately the Potomac River, Chesapeake Bay, and the Atlantic Ocean.

Chimney Rock in Catoctin Mountain Park. Photo by NPS.

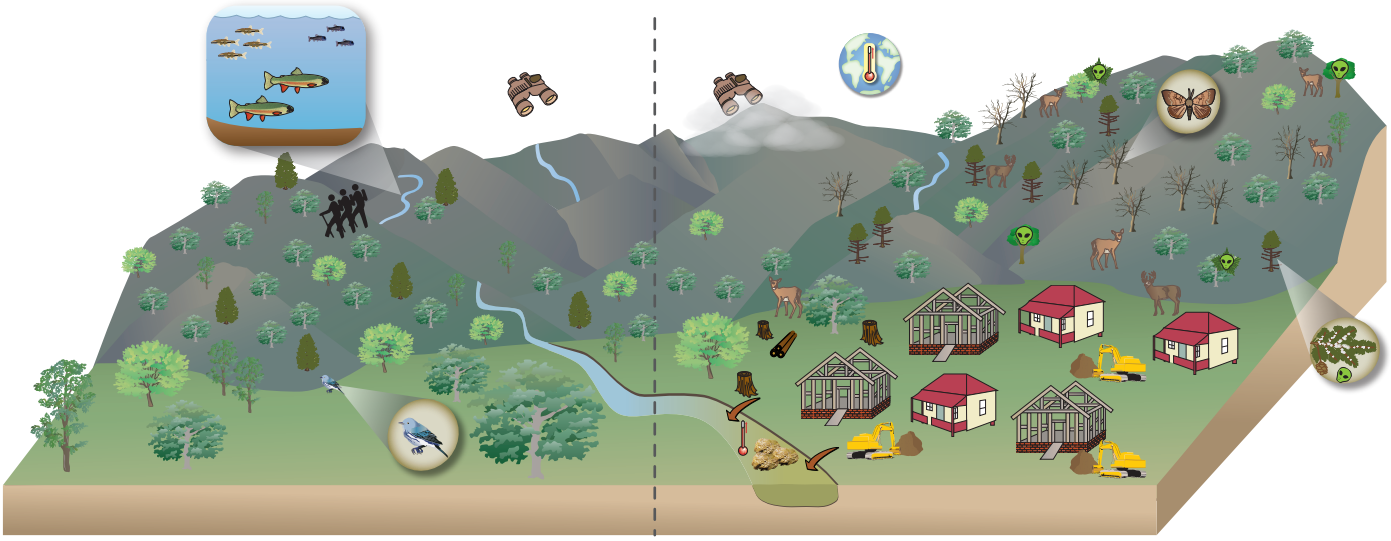
The forests of the park are mostly eastern deciduous forest, with vegetation communities largely controlled by the underlying geology and soils. Several state-listed plant species occur within or adjacent to the park. The park is also home to a diversity of mammals, birds, fish, herpetofauna, and invertebrates. Visitors also come to Catoctin to seek a variety of experiences which are mostly related to the natural soundscapes and lightscapes found in the park.

THREATS TO CATOCTIN MOUNTAIN PARK

Exotic plants and diseases are prevalent within the park. Approximately 100 invasive species of plants have been documented within the park. Exotic and invasive plants compete with native species, while insect and other pests cause damage to forest trees. Several pests and diseases threaten forest resources, among them the gypsy moth (*Lymantria dispar*), hemlock woolly adelgid (*Adelges tsugae*), Dutch elm disease, and dogwood anthracnose. Excessive numbers of white-tailed deer use the park as a refuge, resulting in overgrazing of native flora, particularly tree seedlings. Population and housing densities continue to increase in the areas adjacent to the park, which reduces the habitat available for native flora and fauna. Both Big Hunting Creek and Owens Creek are habitat for trout, which are sensitive to several water quality parameters, including water temperature. Studies have shown that brook trout cannot tolerate sustained water temperatures exceeding 25°C and prefer water temperatures less than 20°C. Trees growing in riparian buffers provide shade that keeps the streams cool. On a regional scale, degraded air quality associated with vehicular traffic affects aquatic habitats and sensitive species.

Deer browse line visible in a Catoctin forest. Photo by NPS.

Natural resources | **Threats to park natural resources**



- Scenic views (good air quality)
- Native plant communities
- Cold-water streams
- Bird habitat
- Sustainable visitor use

- Obstructed scenic views (poor air quality)
- Invasive exotic species (including gypsy moth, hemlock woolly adelgid, 'rock snot', and plant species)
- Deer overpopulation
- Exotic diseases and tree death
- Adjacent land use
- Stream sedimentation
- Global climate change (including increasing stream temperature)

Features of and threats to the natural resources of Catoctin Mountain Park.

KEY FINDINGS, RECOMMENDATIONS, AND DATA GAPS

Overall, the natural resources of Catoctin Mountain Park were in *moderate condition*.

The Vital Signs framework showed that air quality condition was generally very degraded, water resources condition was generally very good, biological integrity condition was variable but moderate overall, and landscape dynamics condition was generally very good.

Natural resource condition assessment of Catoctin Mountain Park.

Vital Sign	Reference condition attainment	Current condition
Air Quality	13%	Very degraded
Water Resources	80%	Very good
Biological Integrity	44%	Moderate
Landscape Dynamics	81%	Very good
Catoctin Mountain Park	**55%**	**Moderate**

Air quality was in a very degraded condition. Degraded air quality is a problem throughout the eastern United States, and while the causes of degraded air quality are out of the park's control, the specific implications to the habitats and species in the park are less well known. Gaining a better understanding of how reduced air quality is impacting sensitive habitats and species within the park would help prioritize management efforts.

The close connection between climate and air quality is reflected in the impacts of climate change on air pollution levels. In particular, the U.S. EPA has concluded that climate change could increase ozone concentrations and change amounts of particle pollution.

Air Quality. Key findings, management implications, and recommended next steps for air quality in Catoctin Mountain Park.

Key findings	Management implications	Recommended next steps
• Air quality is very degraded	• Habitats and species in the park may be affected	• Monitor for local effects by maintaining the air quality monitoring station within the park and identifying sensitive species and habitats • Identify top sources of air pollution
• Air quality is a regional problem	• Habitats and species in the park may be affected	• Support regional air quality initiatives such as Climate Friendly Parks (*www.nps.gov/climatefriendlyparks*) • Stay engaged with the wider community in terms of air quality education and activities

Air Quality. Data gaps, justification, and research needs for air quality in Catoctin Mountain Park.

Data gaps	Justification	Research needs
• Ecological thresholds for mercury wet deposition	• Wet deposition is monitored but the only available guideline is for fish tissue concentration	• Relate fish tissue concentrations to wet deposition
• Park-scale air quality data	• Need to implement park-specific management actions	• Use transport and deposition models • Calibrate with roadside data within the park
• Effects of poor air quality on park habitats and species	• Need to implement park-specific management actions	• Investigate effects of poor air quality on sensitive habitats and species within the park

Water resources were in very good condition overall. However, total phosphorus was in a very degraded condition, which is similar to results found in parks throughout the region. Specific conductance is currently in very good condition but is showing a general degrading trend, also in keeping with trends throughout the region. The Physical Habitat Index is on the borderline of being classified as being in degraded condition, so more data about sensitive locations and which parts of the index are failing would be informative. Data gaps and research recommendations revolve around maintaining good water quality by identification of nutrient sources and sensitive organisms.

The cold temperatures of streams in Catoctin Mountain Park support several species of trout. Water temperature increase is one of the most immediate threats from climate change, and this would result in the loss of trout from Catoctin's streams.

Water Resources. Key findings, management implications, and recommended next steps for water resources in Catoctin Mountain Park.

Key findings	Management implications	Recommended next steps
• Very degraded condition for phosphorus	• Affects stream flora and fauna • Reduces quality of visitor experience	• Continue riparian buffer establishment and minimize soil disturbance • Upgrade sewer and water systems in the park
• Physical Habitat Index (PHI) is borderline degraded	• Affects stream flora and fauna • Reduces quality of visitor experience	• Identify sensitive locations and unpack the Index to identify which measurements are showing degraded condition
• Specific conductance is showing a degrading trend	• Affects stream flora and fauna	• Implement intensive monitoring to identify sources and patterns and then develop management alternatives

Water Resources. Data gaps, justification, and research needs for water resources in Catoctin Mountain Park.

Data gaps	Justification	Research needs
• Origins of nitrogen and phosphorus pollution are uncertain	• Affects stream flora and fauna • Reduces quality of visitor experience	• Identify sources of phosphorus
• Specific conductance is showing a degrading trend	• Affects stream flora and fauna	• Identify conductance-sensitive organisms and locations for management initiatives

Biological integrity was in a moderate condition overall,although results for individual metrics were variable. Deer density and the seedling stocking index were both in very degraded condition. Studies show a relationship between high deer density and poor forest regeneration and as such, deer management should continue to be a top priority. Other monitoring recommendations include exotic species monitoring and education, and continuing to monitor pests and diseases. Data gaps and research needs include developing a bird index for non-forest species and modeling the effects of climate change and other stressors on the region's forests.

How climate change may affect the park's resources and habitats should be an ongoing research focus, in particular how it might affect the introduction and spread of exotic species and forest pests and diseases.

Biological Integrity. Key findings, management implications, and recommended next steps for biological integrity in Catoctin Mountain Park.

Key findings	Management implications	Recommended next steps
• Deer overpopulation may be impacting forest regeneration and agriculture	• Increased herbivory reducing desired plant and bird species, and lowering yields in agricultural areas • More road collisions • Potential for spread of chronic wasting disease	• Continue implementing the deer management plan and deer population control measures
• Presence of exotic plants	• Displacement of native species, reducing biodiversity	• Prioritize species and locations/habitats for implementing control measures • Restore and maintain native species and communities
• Other exotic species ('rock snot,' *Didymosphenia geminata*)	• Can result in dense algal blooms that block sunlight and disrupt ecological processes, causing a decline in native plant and animal life	• Educate visitors on how to stop the spread of this species
• Forest pests were in moderate condition	• Hemlock woolly adelgid and gypsy moth are both present in the park • Emerald ash borer has not been observed but are expected to be found in the park in the future • Dead trees become fire and maintenance hazards and can pose a threat to the cultural resources and historic structures in the park	• Continue to monitor all forest pest species in the park and implement management actions • Plan for the future forest with the absence of hemlock and ash trees • Establish a seed bank of hemlock and ash seeds

Biological Integrity. Data gaps, justification, and research needs for biological integrity in Catoctin Mountain Park.

Data gaps	Justification	Research needs
• Bird data is limited to forest species only	• Knowledge about usage of other habitats by birds is needed	• Development of indices related to bird use of other habitats (e.g., wetlands)
• Limited knowledge on how forests might change in light of new and future stressors (climate change, pests, and diseases)	• These stressors are already present or will be present in the near future	• Research and modeling into the effects of these stressors on the region's forests

Landscape dynamics were in a very good condition overall. Forest interior area, forest cover, and impervious surface (at both spatial scales) were all in good or very good condition, as was road density within the park. This is due at least in part to the proximity of several protected areas—Cunningham Falls State Park immediately to the south of Catoctin Mountain Park, South Mountain Park to the north-east, and Seymour B. Cooper Memorial Wildlife Sanctuary to the east of the park. However, road density adjacent to the park was in very degraded condition, mostly due to the proximity of the towns of Thurmont to the south-east of the park and Cascade to the north of the park.

Research needs for the park mostly relate to its function as a habitat corridor in the region. Catoctin Mountain Park has conducted workshops to plan for different climate change scenarios. Even under a plausible climate future with the least change from existing climate conditions, impacts and implications to the park are substantial and include a dryer landscape, increased storms and wildfire, decrease in brook trout habitat, increase in floods and erosion, and less annual snowfall. How climate change may affect the park's resources and habitats should be an ongoing research focus.

Landscape Dynamics. Key findings, management implications, and recommended next steps for landscape dynamics in Catoctin Mountain Park.

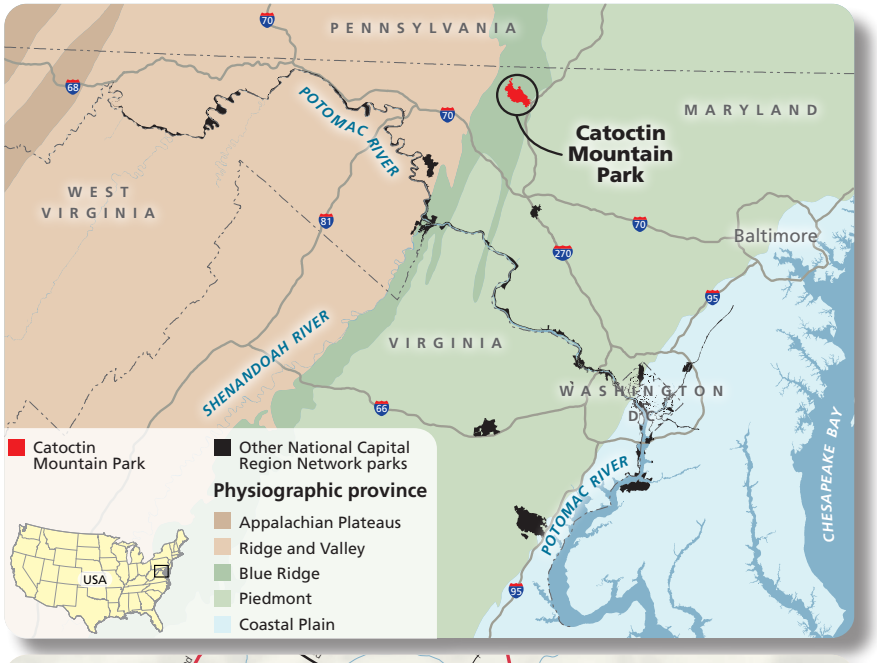
Key findings	Management implications	Recommended next steps
• Forest interior area, forest cover, and impervious surface are in good to very good condition	• Supports wildlife and slows the flow of stormwater entering park streams	• Maintain quality of existing forest habitat by managing for exotic species and forest pests
• Road density is very good inside the park but very degraded adjacent to the park	• Road density outside the park may increase surface runoff/stormwater entering the park, and may increase wildlife mortality	• Continue to maintain pervious surfaces within the park and consider installing stormwater retention basins in areas of high stormwater input

Landscape Dynamics. Data gaps, justification, and research needs for landscape dynamics in Catoctin Mountain Park.

Data gaps	Justification	Research needs
• Implications of external land use changes on park resources	• Connectivity of ecological processes from park to watershed	• Landscape analysis at multiple scales
• Impacts of climate change on habitat connectivity	• The park acts as a habitat corridor through the region	• Modeling of the potential effects of climate change on habitats within the park and surrounding region

CONCLUSIONS

Natural resoures in Catoctin Mountain Park are in moderate condition overall but are under threat from surrounding land use, regionally poor air quality, and overpopulation of deer. Climate change is predicted to negatively affect many of the natural resources of the park, including increasing ozone levels and particle pollution, raising the water temperature of these cold-water, trout-supporting streams, changing forest composition, and affecting exotic species and forest pests and diseases.


PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA
WASHINGTON D.C.
POTOMAC RIVER
SHENANDOAH RIVER
CHESAPEAKE BAY
Catoctin Mountain Park
Baltimore
Catoctin Mountain Park
Other National Capital Region Network parks
Physiographic province
Appalachian Plateaus
Ridge and Valley
Blue Ridge
Piedmont
Coastal Plain
USA

1 mi
1 km
Hiking trail
Steep trail; arrows point uphill
Overlook
Horse and hiking trail
Unpaved road
Poplar
Group camp; check at park headquarters for availability
Parking
Ranger station
Picnic area
Wheelchair-accessible
Public campground
Park Central Road is closed for 2.5 miles from the visitor center for winter recreation mid-December to mid-March.
CATOCTIN MOUNTAIN PARK
PINEY MOUNTAIN
Lantz
Owens Creek
Sawmill
Deerfield Nature Trail Loop
Owens Creek
Browns Farm Trail
Poplar Grove
Chestnut
Spicebush Nature Trail
Blue Ridge Summit Overlook
Foxville
Round Meadow
Greentop
Hog Rock Nature Trail
Misty Mount Cabins
(reservations needed)
Charcoal Trail
Thurmont Vista
Blue Blazes Whiskey Still
Accessibility parking only
Visitor Center
Wolf Rock
Falls Nature Trail
Cunningham Falls
William Houck Area
Chimney Rock
Hunting Creek Lake
Dam
Snack bar
Boat rental
Boat launch
Fishing pier
CUNNINGHAM FALLS STATE PARK
Catoctin Mountain Park Headquarters
Store
Campground registration
Dump station
Cunningham Falls State Park Headquarters
Frank Bentz Memorial Lake
Bear Branch
Foxville Road
Big Hunting Creek
Park Central Road
Manahan Road
Raven Rock Road
Raven Rock Park Road
Mt. Zion Road
Foxville-Deerfield Road
Owens Creek
Eylers Valley Flint Road
Sabillasville Road
Hells Delight Road
Quirauk School Road
Foxville Church Rd
Scottsmeyer Road
Tower Road
Western Maryland Railroad
Edgemont Creek
491
550
77
15