



impacts from flooding, increased impervious surface and pollutants from cars, homes, and businesses continues to increase.

- Abandoned mine lands occur throughout the region and continue to contribute sedimentation and other pollutants into various water bodies. Without reforestation they will continue to erode and pollute waters with acidic drainage.
- The Marcellus shale region within the Appalachians has increased gas exploration, is impacting water resources, and contributes to forest land disturbance and fragmentation.
- Competition with invasive and exotic species is impacting forests. Species of significant concern include, but are not limited to hemlock woolly adelgid, beach bark disease, emerald ash borer, gypsy moth, Asian long-horned beetle, tree of heaven, Japanese stiltgrass, and garlic mustard.
- Keeping forests in forests through sustaining traditional timber markets and developing non-traditional markets is an ongoing challenge.
- With the majority of land use in forests and private ownership, biomass, carbon trading, ecosystem services, and carbon credit issues need to be introduced into this region.
- Conservation education programs across the region are inadequate for the magnitude of the benefits, issues and trade-offs related to forest conservation. The ultimate outcome is greater integration of the benefits of forest cover, forestry, and natural resource conservation into public education and public policy decisions. The need for public understanding of the importance of forests, and the trade-offs involved when forest cover is degraded or removed is critical. The lack of understanding of the local and global trade-offs stemming from degraded forest cover, results in a lack of support for natural resources issues and adverse decisions for forests.
- Water resources need protected for the nearly 25 million area residents, and for public water uses downstream from the headwaters of this region, e.g., Chesapeake Bay.
- Conservation of the natural landscape important to wildlife habitat. Many landscape-scale habitat areas and wildlife corridors necessary for wide-ranging animals are unique to the region and will need protection from fragmentation.
- Protection of critical long-term ecological health of the region.
- Retention of green space for outdoor recreation, as an important living filter/buffer between growing urban areas.
- Protection of the region's attributes to ensure its economic viability and livability.
- Suburban sprawl threatens the drinking water supply, forests, farms, wildlife habitat, historic, recreational, and scenic resources.



9. Key references

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Appendix A

Major Landform Descriptions and Other Attributes of the Appalachian Region:

1. Northern Ridge and Valley (includes MD, NC, NY, PA, VA, WV, and VA)

Geomorphology. This section is a series of parallel, southwest to northeast trending, narrow valleys and mountain ranges (high ridges) created by erosion of tightly folded, intensely faulted bedrock. The eastern boundary is the Great Valley low land; the western boundary is a steep, high ridge, the Allegheny Front. Some of the strip-mined lands exhibit hummocky or gouged topography. Elevation ranges from 300 to 4,000 ft.

Soil Taxa. Soils are derived from heavily-weathered shale, siltstone, sandstone, cherty limestone, and limestone.

Potential Natural Vegetation. Because much of this area lies in the rain shadow of the Allegheny Mountains Section, vegetation conditions are drier. Kuchler types are mapped as Appalachian oak forest, oak-hickory-pine forest, and some northern hardwoods forest. Before arrival of the blight that decimated the chestnut, it was the dominant species in this Section. Oaks now dominate and generally red and white oaks occur on more productive, moderately moist sites. Eastern white pine can occur with white oak on the lower portions of slopes. Scarlet and black oaks are more common on drier sites. On the driest sites, oaks are mixed with pitch, table-mountain, or Virginia pines. The latter can also occur as pure stands.

Wildlife/Fauna. The black bear is the largest carnivore of the area. White-tailed deer are abundant and can have a major impact on understory flora. The endangered Virginia big-eared bat and Indiana bat are associated with the karst areas of the region. Bird species are diverse and include a wide variety of both residents and neo-tropical migrants. Game birds include ruffed grouse and wild turkey. In recent years bald eagles have increased in the area, and falcons have been reintroduced. Brook trout occur at higher elevations, with smallmouth bass, rock bass, minnows, and darters at lower elevations. Amphibians and reptiles are abundant. Insect life is highly diverse. Some butterfly and moth species are still being identified. In recent years, gypsy moth has become established and is affecting forests.

Climate. Mean annual precipitation is generally 30 to 45 inches. In the transition zone with the Allegheny Plateau, rainfall may range as high as 60 inches. Approximately 20 percent falls as snow, with 30 percent at elevations above 3,500 feet. Mean annual temperature is approximately 39 to 57 degrees F. The growing season ranges from 120 to 180 days, with local variation.

Disturbance Regimes. Fire was used extensively by Native Americans. Major historical disturbances include grazing from about 1780 onward and extensive logging from 1880 to 1920. Many logging operations were followed by fire. Since the 1930s, many fires have been suppressed through Federal and State agency efforts.



Land Use. Farming, grazing, and hay production are common on river flood plains and in the nutrient rich limestone valleys. On forested sites, timber production is an important industry. This Section receives light but extensive recreation pressure for fishing, hunting, camping, and hiking. Canoeing and rock climbing occur in certain areas. Settlements tend to be small and dispersed.

2. The Blue Ridge Mountains (includes PA, MD, WV, VA, NC, GA, and TN)

Geomorphology. The Blue Ridge is a physiographic province of the larger Appalachian Mountains range. The northern half is narrow, about 14 miles wide but broadens to 70 miles in its southern half. The mountain range starts at its southern-most portion in Georgia, and terminates in south-central Pennsylvania. To the west of the Blue Ridge, between it and the bulk of the Appalachians, lies the Great Valley, which is bordered on the west by the Ridge and Valley province. Elevation ranges from 1,000 to over 6,000 feet. Local relief ranges from 500 to 1,000 feet. Mt. Mitchell, the highest point in eastern North America (6,684 feet,) occurs here.

Within the Blue Ridge province are two distinct sections: the Shenandoah in the northern section and the Great Smoky Mountains in the southern section. The Blue Ridge also contains the Blue Ridge Parkway, a 469-mile long scenic highway that connects the two parks and is located along the ridge crestlines along the Appalachian Trail.

Soil Taxa. Soils are generally moderately deep and medium textured. Boulders and bedrock outcrops are common on upper slopes. Colder soils are typically present at elevations above 4,800 feet. Soils receive adequate moisture for growth of vegetation throughout the year.

Potential Natural Vegetation. Kuchler classified vegetation as Appalachian oak forest, southeastern spruce-fir forest, and northern hardwoods. Forests are dominated by oaks, consisting of black, white, and chestnut oaks that are found on dry mountain slopes; pitch pine is often a component along ridge tops. Yellow-poplar, red maple, northern red oak, and sweet birch dominate the valleys and moist slopes. Smaller sections of forests between mountains are dominated the hardwood-pine cover type of scarlet, white, blackjack, and post oaks and shortleaf and Virginia pines. Table-mountain pine, a fire-dependent species with serotinous cones, occurs on dry ridge tops where fire was historically more common. Eastern white pine dominates small areas of the Blue Ridge escarpment joining the Southern Appalachian Piedmont Section. Mesic sites at higher elevations (4,500 feet) are occupied by northern hardwoods (e.g., sugar maple, basswood, and buckeye); drier sites are dominated by northern red oak. Red spruce and Fraser fir are found above altitudes of about 5,000 to 6,000 feet.

Wildlife/Fauna. Many species of small mammals and birds with northern or boreal affinities reach their southernmost range in the Blue Ridge. These include the New England cottontail rabbit, northern water shrew, rock vole, northern flying squirrel, Blackburnian warbler, and saw-whet owl. This Section supports the largest diversity of salamanders in North America. Most species are found in the central and southern subsections, where topographic relief is greater, peaks are more isolated, and higher rainfall occurs. Isolated populations of the green salamander and bog turtle are found in the southernmost subsection.



Climate. Average precipitation is 40 to 50 inches but ranges up to 60 inches on the highest peaks. Along parts of the southern Blue Ridge escarpment bordering the Southern Appalachian Piedmont Section, rainfall averages over 80 inches, the highest in the eastern U.S. Precipitation is about equally distributed throughout the year and relatively little occurs as snow. Mean annual temperature is 50 to 62 degrees F and ranges from 38 degrees F in January to 76 degrees F in July. The growing season lasts 150 to 220 days, but varies according to elevation and the influence of local topography.

Disturbance Regimes. Fire, wind, ice, and precipitation are the principal causes of natural disturbance. Fire caused by lightning is more prevalent in some areas, especially in the vicinity of Grandfather Mountain. Tornadoes are uncommon, but localized "micro-bursts" of intense winds are more prevalent, which cause small patches of trees to be up-rooted, especially on mountain slopes. Winter ice storms are common at mid-to-high elevations and intense rainstorms have been known to cause localized scouring and erosion of drainage channels, followed by siltation, sedimentation, and flooding downstream. The chestnut blight caused considerable disturbance to the composition of most forest stands from 1920 to 1940. Gypsy moth has caused a major impact because of the dominance by oaks.

Land Use. About 35 percent of the area is in agriculture and urban development, mostly in broad valleys between major mountain ranges. Hunting, hiking, and trail biking are major forest recreational uses. Two national parks were authorized in 1926, the Great Smoky Mountains (517,014 acres) in western North Carolina and Shenandoah (193,000 acres) in northern Virginia. The parks are connected by the 469 mile-long Blue Ridge Parkway, which follows the highest ridge lines. Limited high-quality water supplies, waste disposal, and air pollution have caused concern about the pace of future development.

3. Northern Appalachian Plateau (Allegheny Mountains – includes PA, MD, and WV)

Geomorphology. This Section is a dissected plateau with high, sharp ridges, low mountains, and narrow valleys. It has broad, northeast to southwest trending folds in the bedrock. Elevation ranges from 1,000 to 4,500 feet, with a few peaks higher, notably Spruce Knob (4,861 feet), the highest point in West Virginia. Local relief generally ranges from 1,000 to 2,500 feet.

Soil Taxa. Soils are derived from heavily weathered shales, siltstones, sandstones, and limestone.

Potential Natural Vegetation. The Allegheny Mountains can be placed in four broad groups: red spruce, northern hardwoods, mixed mesophytic, and oaks. Red spruce is usually found above 3,500 feet and includes stands of American beech and yellow birch. The northern hardwood group features sugar maple occurring with beech and black cherry. The mixed mesophytic species are red oak, basswood, white ash, and yellow-poplar. The productive, diverse cove hardwoods are included in this group. Oak sites occur mostly on foothills, but are much less common in this Section than in the Northern Ridge and Valley Section.

Wildlife/Fauna. The black bear is the largest carnivore. White-tailed deer are abundant and can impact understory flora. Elk were reintroduced in Pennsylvania around 1913 and are also found



in New York. Varying (snowshoe) hare, red squirrel, and the endangered northern flying squirrel are associated with the red spruce vegetation zone above 3,500 feet. Elsewhere gray and fox squirrels and smaller mammals are more abundant. Bird species include a wide variety of both residents and neo-tropical migrants. Ruffed grouse and wild turkey are prominent game species. Brook trout are found at higher elevations, with smallmouth bass, rock bass, minnows, and darters at lower elevations. The Cheat minnow is listed as a sensitive species, and some minnow and darter species in the New River basin are endemic. Amphibians and reptiles are abundant. The threatened Cheat Mountain salamander is found on high elevation red spruce and northern hardwood sites. New butterfly and moth species are still being identified. Gypsy moth is established in this Section.

Climate. Precipitation averages 45 to 60 inches per year; about 20 percent of this is snow (30 percent at higher elevations). Mean annual temperature is approximately 39 to 54 degrees F. The growing season ranges from 140 to 160 days, with local variation.

Disturbance Regimes. Erosion is the primary disturbance agent; however, within the last three years gas extraction has increased. In the pre-European settlement era, fire was not a significant element of change because of the relatively high precipitation. The current forest was largely shaped by logging and associated fires from about 1880 to 1920. In some areas, notably those in



the red spruce zone above 3,500 feet elevation, some areas burned so severely that soil was removed to the bedrock. These areas are now stunted forests with blueberry understories. Gypsy moth is established in this Section. Its effect may be less than on the Northern Ridge and Valley Section, because oak is less extensive here. The western-most section is characterized by livestock operations and crop farming, and much of the region has been mined for bituminous coal. It also contains the highest reserves of natural gas. The potential

reserves from the Marcellus shale formation have increased exploration in Pennsylvania and West Virginia causing concern for water quality and forest fragmentation. The average well site usually requires five acres and various miles of access roads. In areas of high potential gas concentrations there may be as many as one drilling site for every 160 acres. These disturbances will impact fragmentation and the way forests are managed. In addition, hundreds of thousands of gallons of water are used for the fracturing process that releases the gas. Waste water may contain heavy metals, salts, and other gases including radon gas. Treating the waste water can be difficult and expensive.

Land Use. Timber harvesting of high-valued hardwoods is a major industry. Agricultural pastures and hay meadows are common on river and stream flood plains and on limestone soils. Recreation use is relatively light but extensive, and includes hunting, fishing, camping, and hiking. Tourism is a growing industry. Settlements are small and dispersed. Strip-mining for coal has been and continues to be an important activity in some parts of this Section.



4. Cumberland Mountains (western and eastern coalfields of WV, Black Mountain section of KY, and southern Cumberlands in KY)

Geomorphology. This section contains mountains and dissected uplands. Landforms are mainly low mountains where less than 20 percent of the area is gently sloping. Elevation ranges from 2,000 to 2,600 feet.

Soil Taxa. Soils have formed in material weathered from sandstone, siltstone, and shale on nearly level surfaces.

Potential Natural Vegetation. Kuchler classified vegetation as mixed mesophytic forest, Appalachian oak forest, and northern hardwoods. The predominant vegetation is hardwoods with a mixture of pine. Existing forest types consist of oak-hickory - white, black, scarlet, and blackjack oaks; common hickories include mockernut and pignut.

Wildlife/Fauna. White-tailed deer occurs throughout much of this Section. Black bear is present in many areas. Red fox and gray fox are widespread, as is the bobcat. Several species of squirrels and a number of smaller rodents inhabit the forest floor. The turkey, ruffed grouse, bobwhite, and mourning dove are the major game birds in various parts of this Section. Neotropical songbirds are abundant.

Climate. Precipitation averages 40 to 47 inches; snow averages about 35 inches. Mean annual temperature averages 45 to 50 degrees F. The growing season lasts 140 to 160 days.

Disturbance Regimes. Fire has probably been the principal historical source of disturbance. Climatic influences include occasional summer droughts and ice storms. Strip mining for coal has disturbed about 5 percent of the area.

Land Use. Natural vegetation has been cleared for agriculture on most of the area.