

Natural Resources

Given an area of only 429 square miles, Hunterdon County's landscape is tremendously diverse. This is as much a function of its intricate, interconnected system of natural resources as it is human activities that occurred over time. Sometimes these activities work in unity with the natural environment whereas other times, they cause significant, if not irreversible change. Maintaining a delicate balance between a healthy economy and healthy environment demands a basic understanding of Hunterdon County's unique ecological complexion.

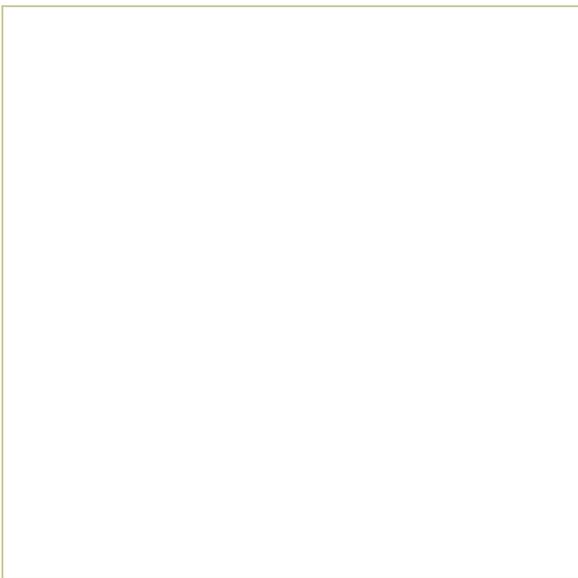


Photo. Steep topography characterizes the Highlands Region of Hunterdon County. Point Mountain, Lebanon Township, Hunterdon County, NJ.

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Physiography

Hunterdon County falls within two of five regions passing through New Jersey known as “physiographic provinces.” Each province reflects distinct characteristics associated with its topography, soils, hydrology and vegetation (Map 1).

The Highlands

The Highlands physiographic province, extending from Pennsylvania to Connecticut, crosses all or portions of 15 municipalities in northwestern Hunterdon County. It comprises one-third of the County's land base.

The hard igneous and metamorphic rocks of the Precambrian Era, including gneiss and granite, are resistant to erosion. They form broad, flat-topped ridges and steep-sided valleys. The valleys consist of softer carbonate rock and shales, which are less resistant to erosion.

Rock outcroppings, typical of carbonate rock landscapes, coupled with ridgetops and slopes, provide varied conditions to support a healthy diversity of plant and animal habitats. The broader fertile valley of the Musconetcong River is an important grassland habitat and contains prime agricultural soils that are still farmed today.

Despite the development constraints posed by steep slopes, ridges, wetlands and geology, significant growth has occurred in the Highlands of Hunterdon County. Highway, sewers and public water supplies have made more intensive development possible, however much of the new development in recent years has also spread beyond, into agricultural areas, forested areas and in headwater areas of streams.

The Piedmont

The Highlands drop abruptly to the Piedmont physiographic province which occupies the remaining two-thirds of Hunterdon County. The Piedmont contains gently rolling, moderately sloping terrain and wide valleys. High rocky ridges and hills, such as Cushetunk Mountain and the Sourland Mountain, interrupt rise above the lowlands. A broad plateau called the Hunterdon Plateau, sweeps through the center of the Piedmont from the Delaware River.

A variety of important habitats are located in the Piedmont region. These include a large grasslands in East Amwell and portions of neighboring townships, the forested Sourland Mountain and the Delaware River bluffs.

Prime agricultural soils are prevalent in the Piedmont, especially in the eastern reaches of the County. It is in these same areas where some of the most extensive development has occurred and continues to occur.

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Geology

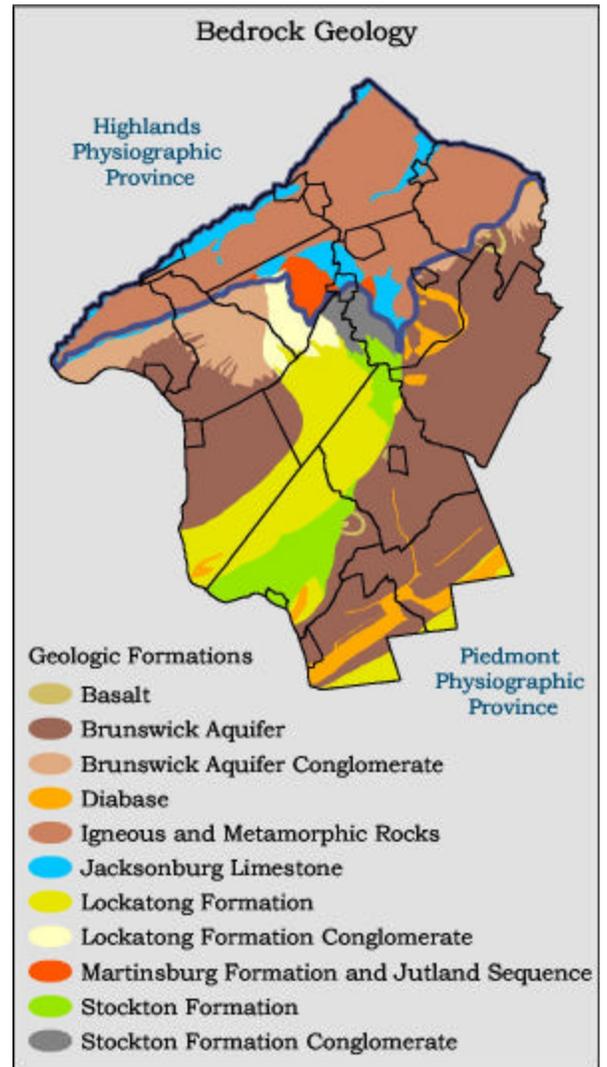
Unlike formations in Southern New Jersey, bedrock geology of the Highlands and Piedmont is complex and unpredictable. Therefore, general descriptions of various formations and their water bearing characteristics must be tempered with the reality that they will often vary from site to site.

Very few parts of Hunterdon County have aquifers that are highly porous and permeable. These areas are limited to sand and gravel deposits within the Delaware and Musconetcong River valleys. Here, ground water travels freely through openings between rock grains.

In most other reaches of the County, bedrock is nonporous. Therefore, ground water must travel through irregular fractures, joints and solution openings within the various formations. Igneous and metamorphic rocks occupy the largest area of the Highlands. These are unproductive aquifers except for fractured or weathered areas. Other Highland rock formations include Kittatinny and Jacksonburg limestones and Martinsburg shale. Martinsburg shale underlies only about 1.5% of Hunterdon's land area. Ground water almost always occurs in fractures in Martinsburg shale. Kittatinny and Jacksonburg limestones, together with other limestones and dolomite rock, are collectively called "carbonate bedrock." Carbonate formations are generally good sources of well water. However, the unique nature of these formations create opportunities for ground water contamination and its rapid spread. In addition, carbonate rock poses risks to buildings and infrastructure because of the potential for land surface collapse and sinkhole formation.

Bedrock in the Piedmont includes shale (interbedded with sandstone, siltstone and argillite) of the Brunswick formation, argillite (interbedded with shale) of the Lockatong formation and sandstone (interbedded with shale) of the Stockton formation. It also includes basalt and diabase. Well yields in the fractured rocks of the Stockton formation and Brunswick shale are more predictable than in areas of dense, hard, poorly fracture rocks such as diabase or Lockatong argillite. Although sandstones of the Stockton formation are somewhat porous and permeable, wells must tap water from cracks and fissures, as they must do in nonporous rock conditions. The Stockton formation is among the better aquifers in Hunterdon County.

Argillite of the Lockatong formation is resistant to erosion, much like diabase and basalt. It underlies much of the Hunterdon Plateau and Sourland Mountain. This formation is one of the least



Map 1. Geology of Hunterdon County, NJ.
Primary data source: NJ Geological Survey.

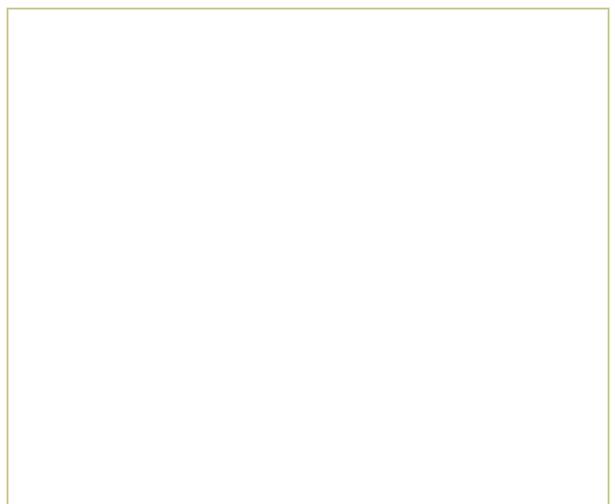


Photo. Rolling terrain of the Piedmont Region—
farmstead in East Amwell Township.

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prolific aquifers in the County. On the Plateau, argillite — combined with heavy, clay soils — generates very high runoff potential. Brunswick shale represents the largest geologic unit in Hunterdon County. Like argillite, shale is nonporous rock. However, since it is highly fractured, it can provide reasonable well yields.

Along the border of the Highlands and Piedmont regions, the Stockton, Lockatong and Brunswick formations grade into conglomerates. Conglomerates are rocks composed of gravel and stone, cemented together by other material. Well yields tend to be better than those in the Lockatong formation but not as good as yields in either the Stockton formation or Brunswick shale. Like the Stockton formation, conglomerates tend to occur in moderately sloping, topographically high areas.

Sourland Mountain and Cushetunk Mountain are composed of diabase. A small intrusion of diabase also occurs just north of Raven Rock in Kingwood Township. Several very small areas of basalt are located in the eastern half of the county. Basalt and diabase are the poorest aquifers in Hunterdon County. Reported median well yield on the Sourland Mountain taken in 1995 by the US Geological Survey was 5 gallons per minute in East Amwell Township.

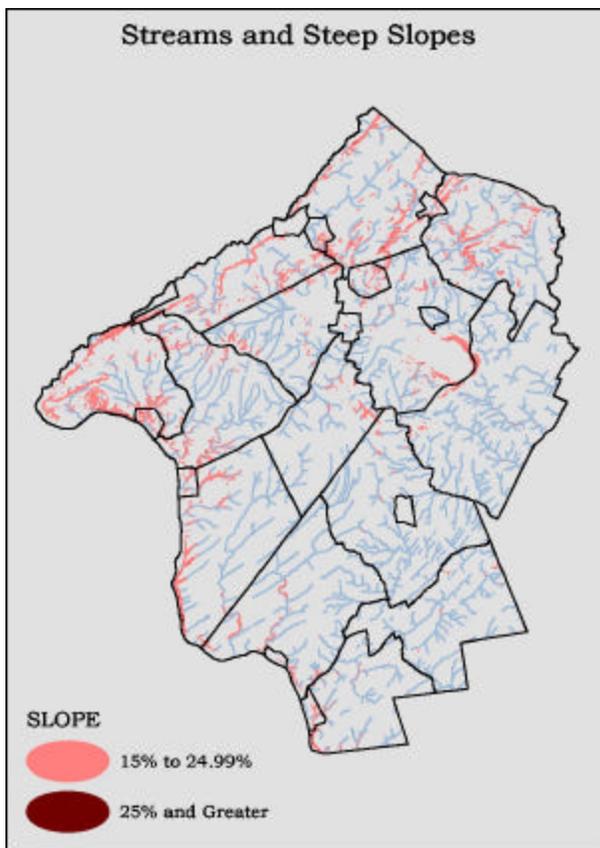
Steep Slopes

Steep slopes occur primarily in the Highlands region (Map 2). They rise out of the valleys to form ridges. Steep slopes parallel the Musconetcong River valley, about the headwaters of some streams, and border the northern reaches of the South Branch of the Raritan River. Within the Piedmont, steep slopes form the bluffs along the Delaware River and follow along its tributary streams.

Absent adequate preventive measures, significant alterations to the landscape can present serious environmental impacts on steep slopes. For instance, steep slopes create greater potential for soil erosion and increase the quantity and magnitude of stormwater flows.

Infrastructure installation and construction costs can be greater on steep slopes. Deep cuts and fills increase roadway construction costs and may potentially cause slope instability if handled improperly. Often, cuts and fills consume larger areas and roads require more frequent maintenance in the event of deposition of debris or slope failure. Although engineering solutions anticipate and attempt to minimize such problems, failure can still occur due to inadequate design, construction practices or long term enforcement and maintenance measures. In the end,

Photo. Building underlined by a sinkhole. The cost of repairing the street and installing a new sewer line was \$372,000 in 1983. The building was demolished.



Map 2. Streams & Steep Slopes, Hunterdon County, NJ.

Primary data source: NJDEP.

When is a slope “steep”? The Soil Survey of Hunterdon County considers slopes of 12% or higher to be moderate to severe for a variety of planning and engineering activities. Local ordinances often impose more stringent regulations on land development that occurs on slopes of 15% or greater. State regulations prohibit siting of septic system disposal fields on slopes of 25% or more.

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this leads to significant costs – both structural and environmental.

Soils

Soils can be classified in many ways. Classification systems group soils according to similar characteristics. One such grouping is called soil series. Physical properties associated with each series pose opportunities and limitations for various types of land use activities. For example, soil particle size, slope and permeability, and ground cover are features that influence erosion. (Map 3).

Soils composed of deep, well drained sands or gravels tend to have high infiltration rates and lower surface water runoff potential. Other soils have low infiltration rates and higher surface water runoff potential (Map 4).

Soil compaction, slope disturbance or placement of impervious surfaces in areas with high surface water runoff potential can exacerbate runoff problems. On the other hand, soil compaction or placement of impervious surfaces in areas of high ground water infiltration may undermine the value of ground water recharge areas. Therefore, employment of best management practices for new development is critical.

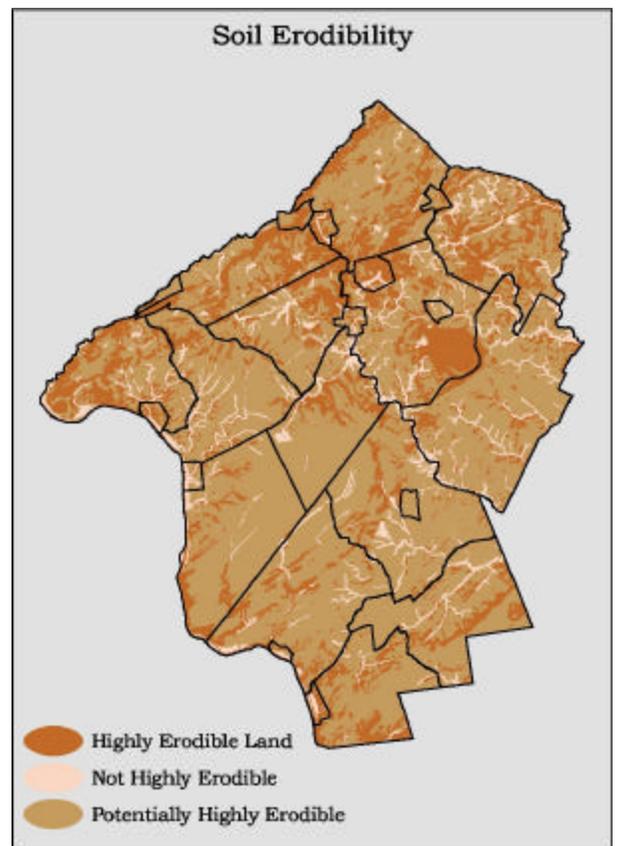
Another important soil classification system provides useful information for farmland preservation and agricultural planning purposes. Soils are grouped according to their suitability for a variety of field crops. The Hunterdon County Soil Survey classifies them into Land Capability Classes. The higher the Class, the fewer the limitations for agriculture. The Hunterdon County Agriculture Development Board uses this system to identify Agriculture Development Areas, and to rank applications for the Farmland Preservation Program (see Agriculture Profile for discussion of agriculture and farmland preservation). The State Plan uses the presence of these soils, in combination with other criteria, to delineate the Rural Planning Area, where agriculture and farmland preservation should be supported.

Prime agricultural soils (Map 5) include all soils in Land Capability Class I—the highest of eight Classes, and some soils in Land Capability Class II. These soils offer the best combination of physical and chemical characteristics to produce sustained high yields of a variety of crops when treated and managed according to accepted farming practices.

Soils of statewide importance fall in Land Capability Class II and III. Although they do not meet the criteria for prime agricultural soils, they do produce high yields of crops and some may produce yields as high as prime agricultural soils if conditions support this.

Natural Communities and Habitats

Hunterdon County's varied landscape, including forests, grasslands, wetlands and streams, provides the habitats needed to support a diverse population of plant and animal species. However, encroachment into environmentally sensitive areas, air pollution, water pollution, soil contamination, introduction of invasive species, and habitat fragmentation are examples of problems that can threaten natural ecosystems and, ultimately, the abundance and variety of flora and fauna. These factors have certainly influenced the landscape in Hunterdon County over the past several decades.



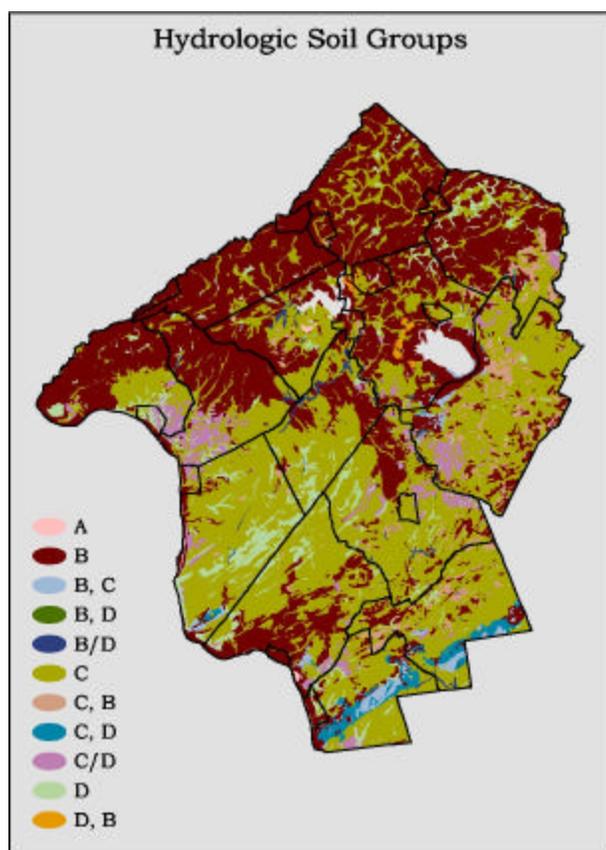
Map 3. Erodible Soils, Hunterdon County, NJ.
Primary data source: Natural Resources Conservation Service.

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Between 1972 and 1995, Hunterdon County lost an estimated 11,075 acres of grasslands/cultivated land (9.1% loss), 23,567 acres of upland forest cover (20% loss) and 14,418 acres of wetlands (60% loss). As development encroached upon these areas, it disrupted the contiguity of habitats, creating increasingly fragmented landscapes.

NJDEP has amassed a wealth of information on flora and fauna and their habitat requirements. The Division of Fish and Wildlife constructed a statewide map showing priority conservation areas for protection of forests, wetlands, and grassland areas (Map 5). This project—called The Landscapes Project—identifies locations that satisfy habitat requirements for threatened or endangered species of animals as well as neotropical migratory birds that use habitats in New Jersey for stopping over and/or breeding grounds.

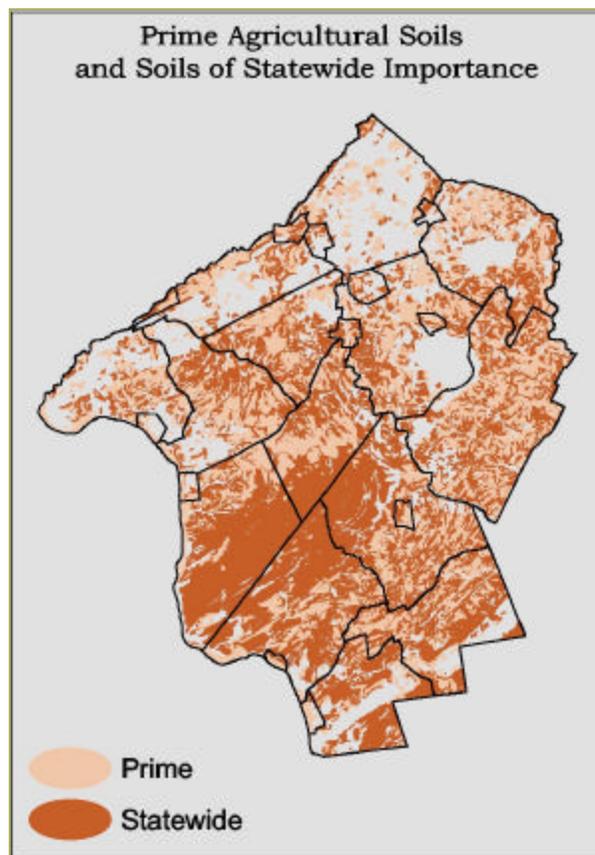
Although small patches of forests, fields or wetlands support some of the more common wildlife species, they do not provide the habitat necessary to sustain many other species. This is why the project focuses on identifying large, con-



Map 4. Infiltration v. Runoff, Hunterdon County, NJ.

Primary data source: Natural Resources Conservation Service.

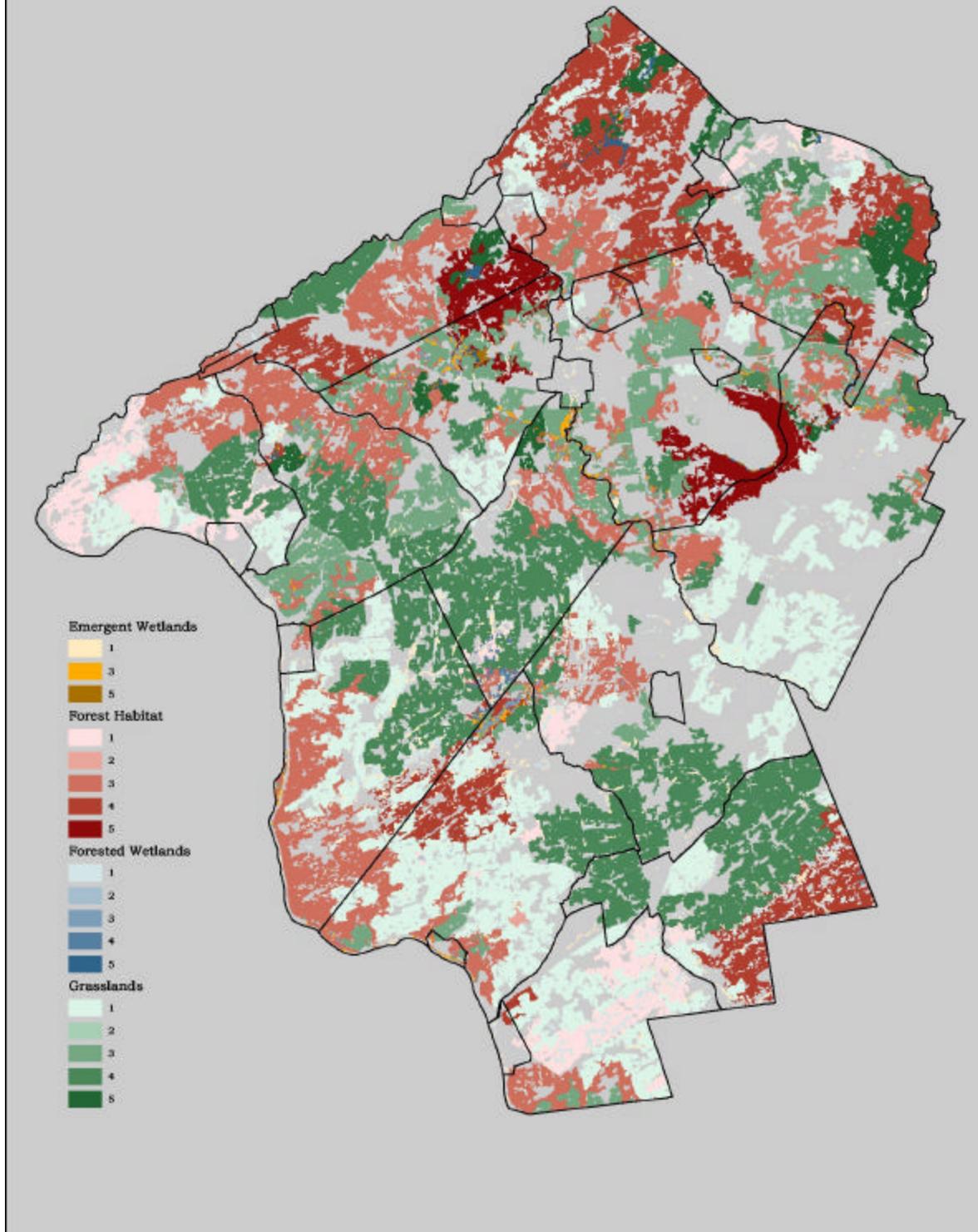
Class A soils have high infiltration and low runoff capacity. Class D soils have high runoff and low infiltration capacity. Two soils distinguished by a comma indicates that two soil types are classified together. Two soils distinguished by a back slash refers to wet soils that are either in an undrained condition (thus Class D) or in a drained condition (which changes the soil class reflecting increased infiltration capacity).



Map 5. Agricultural Soils, Hunterdon County, NJ.

Note: These are soils classified as Prime Agricultural Soils and Soils of Statewide Importance. Primary data source: Natural Resources Conservation Service.

Priority Habitat Conservation Areas



Map 6. Priority Habitat Conservation Areas, Hunterdon County, NJ.
Primary data source: NJDEP Endangered and Nongame Species Program.
Explanation of rankings: 1 = lowest ranking; 5 = highest ranking.

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tiguous regions for habitat needs.

The Office of Natural Lands Management maintains a database of threatened and endangered species of plants and animals, as well as natural vegetative communities of statewide significance.

These are compiled in a Natural Heritage Sites database and map (Map 7). The compilation cites 28 species of threatened/ endangered animals, 82 plants, and 16 Natural Heritage Sites in Hunterdon County. Natural Heritage Sites are some of New Jersey's best habitats for rare and endangered species and natural communities.

The Landscapes Project:: High Priority Habitats

Forests

High priority forested areas encompass much of the Highlands region in Hunterdon County. Other notable forests occur on the Sourland Mountain, Cushetunk Mountain and along the Delaware River. Ecologists at the NJDEP have identified the Sourland Mountain as the only remaining large forest patch within the entire Piedmont region in New Jersey.

Grasslands

Grasslands are open fields dominated by grasses, sedges, rushes and herbaceous plants. In Hunterdon County, they are either abandoned farm fields, actively farmed fields or other managed fields like airports.

High priority grasslands occur throughout Hunterdon County. Notable areas include the Amwell Valley in East Amwell Township, adjacent lands in Raritan Township, the southeastern reaches of Franklin and Alexandria Townships, the Musconetcong River valley in Bethlehem Township, and the eastern half of Tewksbury Township. Among these notable grasslands is one that extends from Frenchtown to Everittstown along County Route 513 in Alexandria Township. Like many others, it supports a healthy diversity of habitats.

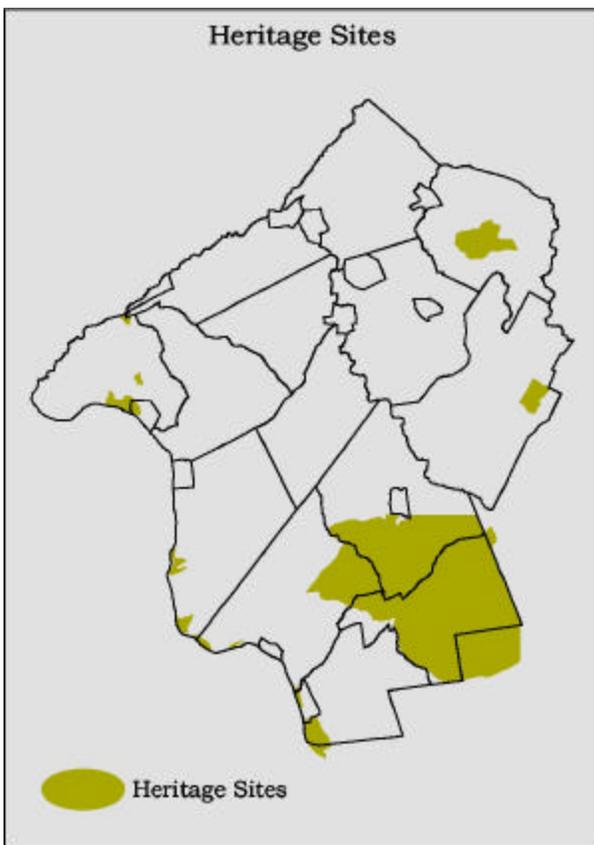
Wetlands

Among the more prominent wetlands considered high priority conservation areas are the South Branch of the Raritan River along the Franklin/Clinton Township border; headwaters to the Wickecheoke Creek; portions of the Mulhockaway Creek and tributaries to Spruce Run Reservoir in Union Township; portions of Spruce Run in Lebanon Township; and portions of the Rockaway Creek.

Watersheds

A watershed is the land area that drains into a body of water such as an ocean or a river, stream or lake. Each watershed is sepa-

Photo. Endangered neotropical bird that breeds in the Sourland Mountain.



Map 7. Natural Heritage Sites in Hunterdon County, NJ.

Primary data source: NJDEP, Office of Natural Lands Management.

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rated by ridge top boundaries. Watersheds can vary widely in size. A small lake may drain a few acres.

When rain falls into a particular watershed, it takes any of three courses. Water can infiltrate into the ground. It can return to the atmosphere through evaporation from land or water surfaces. It can also return to the atmosphere as vapor from plant leaves, a process known as transpiration. Alternatively, water can flow off the surface of the land into receiving surface waters.

Increases in impervious surfaces lead to greater volumes of surface runoff and reduced ground water recharge. In turn, this can generate higher stream flows following storm events and lower stream flows during dry periods between storms, when ground water might otherwise discharge water to streams as “base flow.” This is an especially important concern in Hunterdon County, where base flow accounts for up to 50% of stream flow in the Piedmont Region and 60% or more in the Highlands.

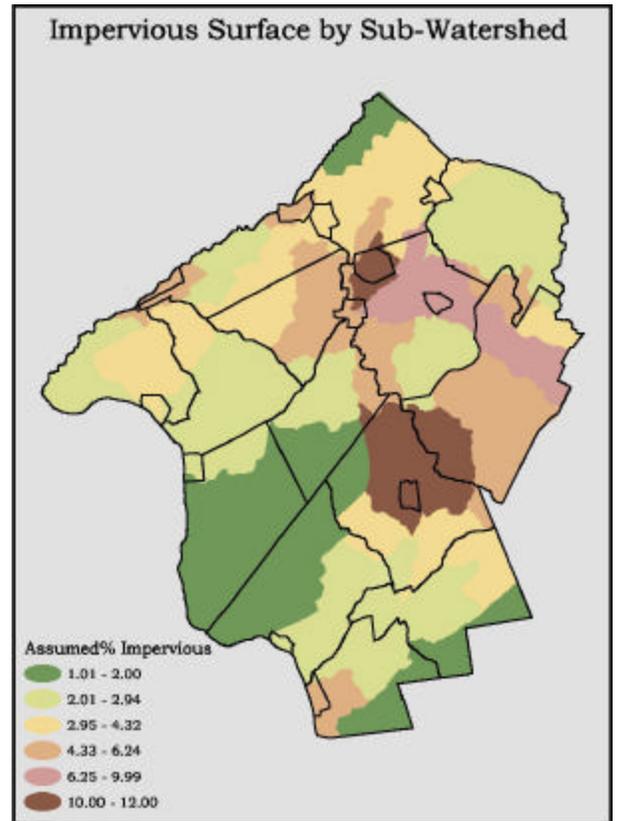
Alterations to the landscape can affect the ability of a watershed to naturally cleanse the water. As water travels into the ground, soils help to filter out impurities. Vegetation does the same. If vegetation is removed, soil compacted or impervious surfaces created, then water quality can be affected.

Imperviousness is often used as a predictive variable to estimate pollutant loads to streams and a general indicator of problems. Numerous studies have established general thresholds for measuring overall stream health and suggest that once impervious cover exceeds 10% of the watershed, water quality impairment is evident. At 25% - 30%, stream health is clearly degraded*. In Hunterdon County, impairment is evident in the greater Flemington area and to the east of Spruce Run Reservoir (Map 8).

Recognizing the value in approaching water resource protection from a watershed basis, the NJDEP created the Division of Watershed Management to oversee and coordinate watershed-based planning activities. The State is divided into 20 watershed management areas. Through a collaborative effort involving county, local and state governments, interested organizations and individuals, a characterization and assessment is being conducted for each watershed. This process will result in a description of existing environmental and land use conditions and future desirable conditions within each watershed. It will also lead to recommended actions and programs to address water quality and water quantity problems unique to each watershed. Hunterdon County falls within four of the 20 watershed management planning areas delineated by the State (Map 9).

Rivers and Streams

Hunterdon County is traversed by 849 linear miles of mapped rivers and streams, connecting rural areas, suburban areas, villages and towns. These waterways include rivers as large as the Delaware, which spans four states. They also include numerous smaller waterways, some of which originate in other counties and others which begin in



Map 8. Impervious Surface by Subwatershed, Hunterdon County, NJ.

Data on this map represents an assumption in the percent impervious cover belonging in each subwatershed. DEP Land Use/Land Cover digital data on impervious cover was manipulated in order to estimate impervious cover by subwatershed. Certain land areas, represented by polygons, were split at subwatershed boundaries, recalculated, and were redistributed to each subwatershed.

*This type of analysis is most useful at the subwatershed level of 1 - 10 square miles or smaller areas of 50—500 acres.