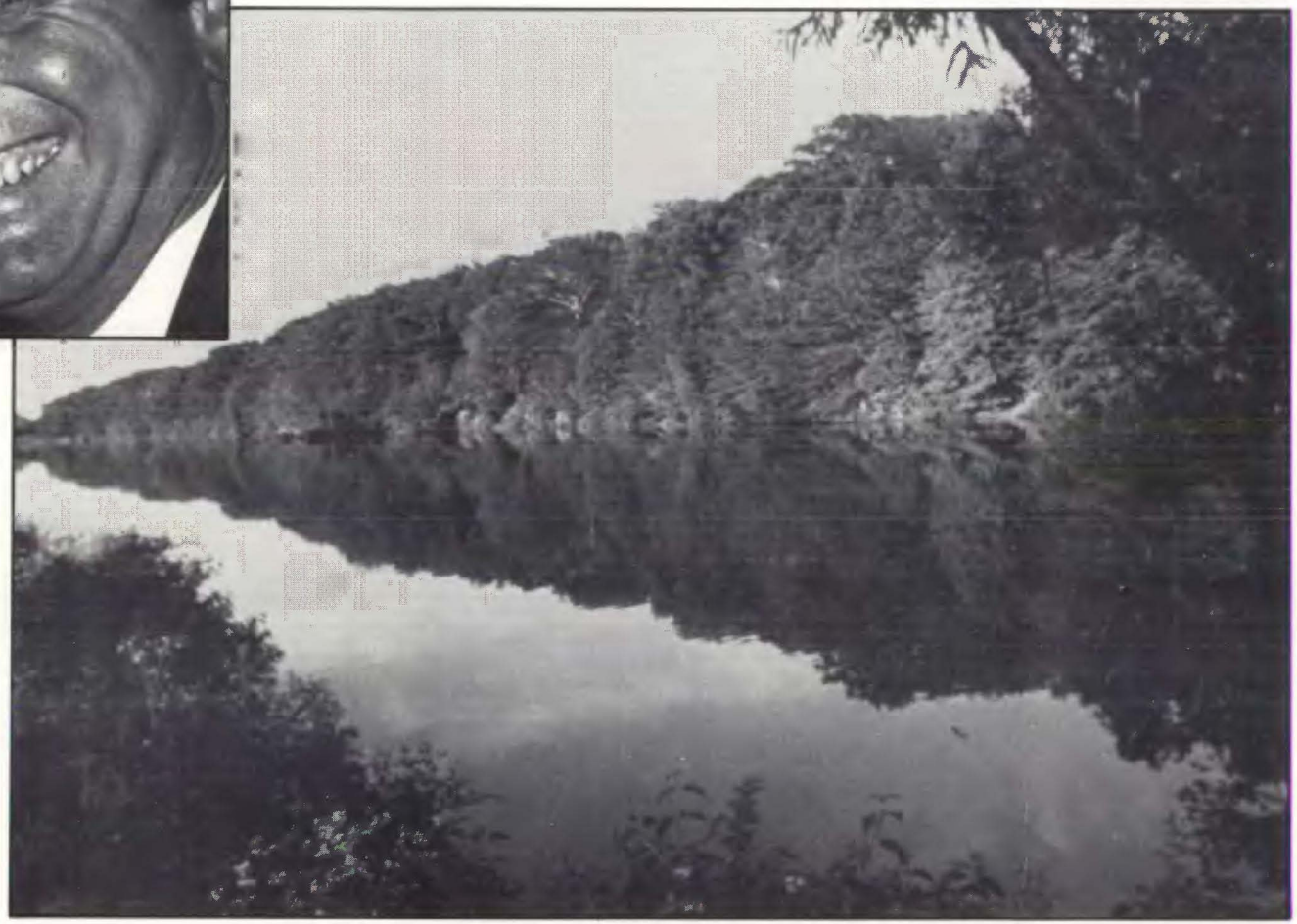
The Woodlands of Hopewell Valley

Mercer County, New Jersey

Report prepared for the
Friends of Hopewell Valley Open Space
by Douglas W. White, Ph.D.

Jack Gleeson was the first president of the Friends of Hopewell Valley Open Space. His initiative, concern for environmental issues, and interest in preserving the Curlis Lake Woods helped to start the organization. His intelligence and good humor kept it going.



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Friends of Hopewell Valley Open Space
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Douglas W. White, Ph.D.
Rutgers University
Department of Biological Sciences

May 1990

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Liriodendron tulipifera

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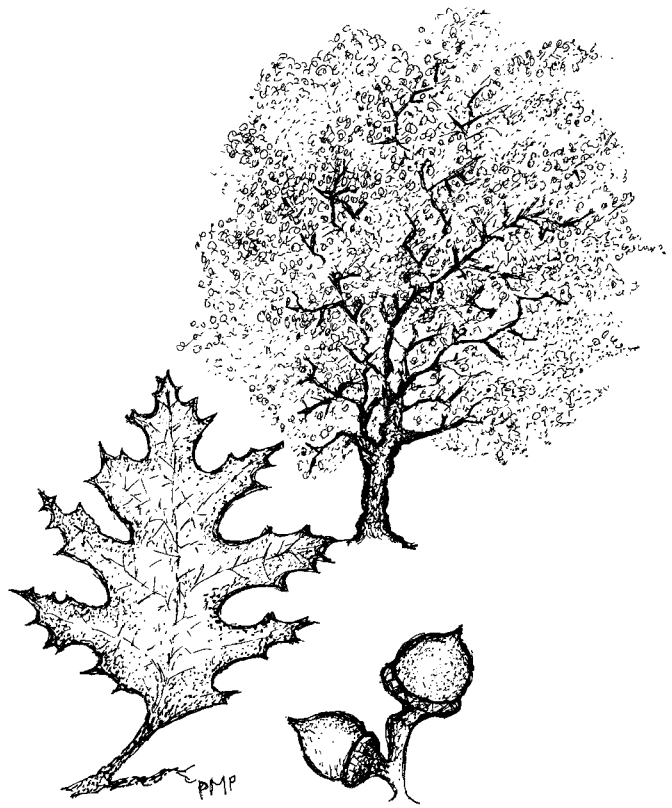


Northern Red Oak
Quercus borealis

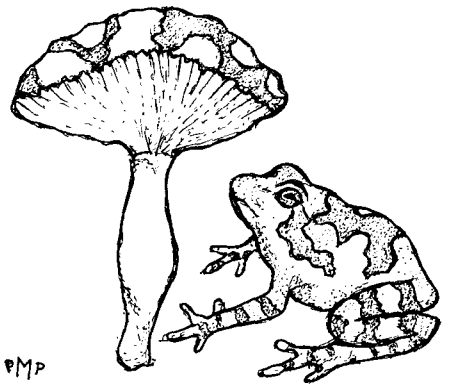
INTRODUCTION

Trees are valuable. Around homes, trees provide seclusion, quiet, and cool shade. Woodlands are sources of firewood and provide places for hunting. Trees block storm runoff, thereby limiting soil erosion, flooding, and water pollution and encouraging groundwater recharge. Trees mitigate the effects of global warming by removing carbon dioxide from the atmosphere. Because of their imposing size, great age, varied form, and changing colors, trees appeal to our aesthetic senses.

Trees are hallmarks of our natural inheritance. Today's woodlands are the descendents of the great forest that originally blanketed central New Jersey. But there is more to a woods than trees. Today's woodlands are also havens for most of the interacting organisms and ecological processes of that primeval forest ecosystem. Large trees are only the most obvious members of a rich, complex community of canopy and understory trees, shrubs, vines, wildflowers, ferns, mosses, lichens, mammals, birds, turtles, snakes, frogs, salamanders, spiders, butterflies, moths, beetles, bugs, flies, ants, wasps, bees, worms, mushrooms, and microbes. A wooded lawn, however attractive, clearly falls short of being a living woodland. Moreover, the diversity of life in a central New Jersey woodland is particular to this region, and its conservation is foremost a local responsibility. Although our food may be grown more cheaply on farms outside New Jersey, freeing our area for development, the loss of our wild woodlands cannot be made good by saving forests elsewhere. Even the parks in the Pinelands of southern New Jersey and on the ridges and highlands of northern New Jersey protect forests that differ substantially with those in Hopewell.

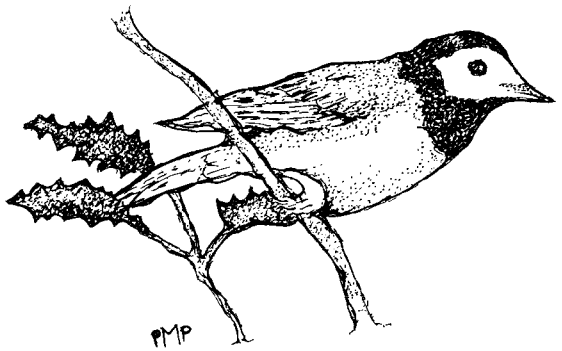
Hopewell Township is in the midst of a land-use revolution. A once rural landscape rapidly is becoming suburbanized as the pressures favoring residential and commercial construction increase. Many desirable land uses and necessary improvements, both public and private, are competing for a dwindling supply of costly open space. These circumstances add urgency to the need to protect existing woodlands. They also underscore the importance of allocating wisely the limited resources available for conserving the biological wealth of Hopewell's woodlands.

As a first step in that protection effort, this report provides an exhaustive inventory of the woodlands of Hopewell Township, Mercer County, New Jersey, detailing their location, size, history, condition, and vegetational composition. The report also suggests priorities for conservation efforts based on this survey.



Gray Treefrog and Mushroom
Hyla versicolor and *Russula emetica*

. . . the variety of life in a central New Jersey woodland is particular to this region, and its conservation is a local responsibility. Although our food may be grown more cheaply on farms outside New Jersey, freeing our area for development, the loss of our wild woodlands cannot be justified by saving forests elsewhere.



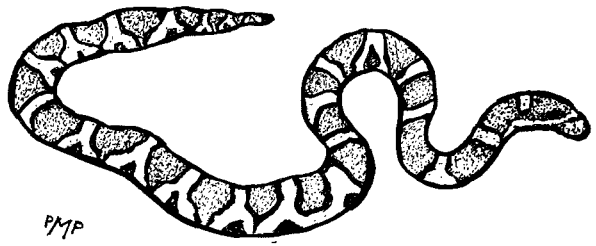
Hooded Warbler

Several factors are important in assessing the environmental or conservation value of a woodland. In thinking about woodland development and maturity, a generous time scale must be adopted. On the Piedmont of central New Jersey, a mixture of oak species most likely was dominant in much of the original forest. Individual oaks may grow 300 to 400 years before being felled by disease, a lightening strike, or a wind storm. For secondary woodlands developing on former pasture or cropland, where oaks may be slow to recolonize, one to two centuries are needed to produce something resembling a mature oak woods. Thus, components of the original forest ecosystem usually are preserved on sites that have been wooded continuously since settlement by Europeans and that have experienced low levels of disturbance. Such woodlands may be recognized by the presence of trees with large diameters and characteristic old-growth species compositions.

Maps of historic woodlands and various other features (e.g., old walls or fences, soil topography) can give additional evidence of woodland tenure. The size and distance between habitat patches can also influence the diversity and survival prospects of species in a fragmented landscape (Forman et al. 1976, Burgess and Sharpe 1981, Lynch and Whigham 1984, Peterken and Game 1984, Terborgh 1989). As woodland size decreases, species populations become smaller and their risk of extirpation increases. Species are unlikely to recolonize isolated woodlands.

The shape of a woods also can be important as some species are affected negatively by conditions on the edge of the woods that intrude too much on its interior. Thus, for a given total area of woods, many small, isolated, and elongated patches are less environmentally beneficially than a single, rounded parcel linked to nearby parcels by natural migration corridors such as hedgerows or stream galleries.

As woodland size decreases, species populations become smaller and their risk of extirpation increases.



Milk Snake
Lampropeltis triangulum

METHODS

Study Area

The Woodlands of Hopewell Township study was conducted in the area defined by the outer borders of Hopewell Township, Mercer County, a part of the Piedmont physiographic region along the Delaware River north of Trenton, New Jersey. Hopewell Township itself surrounds the two autonomous boroughs of Hopewell and Pennington. Although beautiful shade trees are abundant in these two small boroughs, true woodlands are essentially precluded by long histories of residential and commercial land use. The only exception is a small, heavily wooded park in Pennington that abuts a township woods along the Stony Brook. Hopewell Township is predominantly rural and suburban and occupies 150 square kilometers (58 square miles). To avoid confounding relationships between woodlands and historic patterns of development in a town-and-country landscape, statistical statements about the density and coverage of woods were calculated using Hopewell Township area alone. Thus, in comparison to presettlement conditions, rates of deforestation are underestimated in this report.

The area has a moderate continental climate with mean January and July temperatures of about 0° and 24°C (32° and 75°F), respectively, and average annual precipitation of about 113 centimeters (44") spread throughout the year (Robichaud and Buell 1973). The township can be bisected into nearly equal north and south regions differing in general topography, geology, soils, and consequent land use (Wolfe 1977). For this study, the line dividing these two regions follows Fiddlers Creek Road, Bear Tavern Road, Woosamonsa Rood, Route 31, Crusher Road (along the ridge base), Carter Road, and Cleveland Brook Road (see Map 2). In the north, the dominant land types are southern trap (diabase) ridges, rolling coarse sandstone sections, and steep bluffs along the Delaware River. The trap rock ridges rise 60 to 120 meters above the surrounding terrain with a maximum elevation of about 150 meters. The ridges make poor farmland because of their sloping, boulder strewn, and poorly drained soils. The south region consists of gently rolling to nearly level red shale and silt sections, mostly between 30 to 60 meters elevation.

Hopewell Township has a long history as a rural landscape beginning with settlement in the late seventeenth century. The land has been used for harvesting wood, raising dairy cows and poultry, growing hay and corn, horse farms, and general agriculture. The population history of the township is recorded in U.S. census records. Despite the growth of the towns of Pennington and Hopewell, the population of the township itself remained stable throughout most of the nineteenth and early twentieth centuries at about 3,500 people (23 per square kilometer; Table 1). Over the past 40 years, the population has more than doubled from 4,731 in 1950 to an estimated 11,282 in 1987 (Horner 1989). However, this growth is modest in comparison to that seen in some of the surrounding formerly rural townships.

Identifying woodlands

Woodlands to be included in the study were identified initially from United States Geological Survey (USGS) 7.5 minute topographic maps (quadrangles Lambertville, Hopewell, Rocky Hill, Pennington, and Princeton). Woodland locations on these maps are based primarily on 1943 aerial photography; reliance on old cartography is justified as contemporary mature woods must have long histories. To catalog information conveniently, all distinct woods and major blocks from more sprawling woods marked on the USGS maps were identified by a latitude/longitude code corresponding to their position on a one centimeter grid superimposed on the quadrangle sheets. Latitudes ranged

from 1 (north) to 65 (south); longitudes ranged from 1 (west) to 79 (east).

Woods from three periods were compared to assess trends in woodland coverage and to identify sites likely to have been continuously wooded. The earliest complete survey of Hopewell area woodlands was made in 1883 (Smock and Vermeule 1895). Next, USGS maps were used to determine woodland coverage for 1943. Aerial extent of individual woodlands were estimated from these maps using a computer imaging system. Finally, areas of present woods were determined by estimating changes in area observed in April 1987 aerial photographs (Keystone Aerial Surveys, Inc., Northeast Philadelphia Airport, P.O. Box 21059, Philadelphia, PA 19114) and 1989 field work.

Continuous woodland patches were combined in determining individual woodland areas; however, patches joined only by narrow strips and patches divided by paved roads were defined as separate woods. Open-canopied successional patches, inconsequential or intermittently wooded sites (e.g., copses, fencerows), and wooded sites with highly disturbed understories (e.g., wooded lawns, cemeteries) were not counted as woods. By using the 1943 baseline, a few young woods were omitted from the study; however, as a control, areas wooded in 1883 but not 1943 were also investigated. Areas are necessarily approximate and should not be substituted for ground surveys.

Woodland inventories

Field reconnaissances were made of all woods. Woods were examined for current area, tree species composition, tree size, understory vegetation, and evidence of disturbance. Because of its importance to wildlife, presence of surface water was also noted. From these observations, woods were classed as young, intermediate, or mature. Young woods have small trees, and, in suitable habitats, successional red cedar or gray birch were canopy trees (see Bard 1952). Mature woods contained one or more stands of large trees (diameter at breast height, dbh > 12-18" [30-46 centimeters]). Intermediate-aged woods fell between these age extremes.

Mature stands were sampled for basal area, frequency, and density of each tree taxon by the Bitterlich, variable-radius plotless method (Shanks 1954) using a 3.03 diopter wedge prism. Ten-point, linear transects were used in all woods of adequate size resulting in samples of ca. 100 trees per stand. Interpoint spacing was adjusted to the size of the stand. In large woods, multiple stands were chosen for sampling to reflect differences in slope, aspect, or soils. Sampled trees were tallied in 6" (15.2 centimeters) dbh classes to allow calculations of density (see Grosenbaugh 1952). With the Bitterlich method, sampling effort and accuracy are concentrated on the large trees characteristic of mature woods because the probability of sampling a given tree is proportional to that tree's basal area. Note that a tree's basal area increases with the square of its radius; thus, a tree 12" in diameter has only one quarter the basal area of a tree 24" in diameter.

Because the sampling technique was plotless, frequency data express the frequency of each taxon's contribution to stand basal area, not presence itself. An overall importance value (IV) was determined for each taxon by summing relative density, relative frequency, and relative basal area; thus, the importance values of all species in a stand sum to 300. Plants are identified by common names throughout. A cross reference with scientific names is provided in Appendix 1.

The methods of this study are comparable to those used in a previous study of woodlands in Franklin Township, Somerset County, New Jersey (White and Worthen 1986, White et al. 1990). Woods 29/72 (Western Electric woods) located southwest of Mount Rose was included in a previous study by Forman and Elfstrom (1975).

RESULTS AND DISCUSSIONS

History of woodland number and area

Before European settlement of the Hopewell Township area in the seventeenth century, the region was most likely completely forested. No comprehensive records are available to trace the cutting and clearing of the original forests; however, woodland cover probably declined continuously from the time of settlement until the mid to late 1800s when agriculture began its westward expansion and coal began to replace wood as a fuel (Cronon 1983). Thus, woodland cover was at or near its all time low when woods were surveyed systematically for the first time in 1883 (Smock and Vermeule 1895). In 1883, 131 woods covered only about 11% of Hopewell Township (Table 2). Local agriculture declined from the 1880s through the 1930s because of continued competition from the west, soil depletion, and economic downturns. Woodlands staged a modest recovery during this period of relative neglect so that by 1943 almost 19% of Hopewell Township was wooded. In the postwar decades, reforestation has not kept pace with accelerating development, and woodland coverage has again begun to shrink. In 1989, 152 woods covered about 17% of the township.

Throughout the past century of changes, woodland coverage in the hilly northern half of the township has remained three times as great as that in the south where gentle slopes favor crop culture and, now, development (Table 2). In both north and south physiographic regions today, mature woods account for about 72% of total woodland coverage (Table 3). Most present woodlands date back to at least the mid 1880s. Comparisons of original and contemporary topographic maps show that 97 of today's 152 woodlands (64%) were at least partly wooded in 1880. Remarkably, only 9 of the 131 areas with woods in 1883 do not, in some part, support woods today. Moreover, trees that were part of some of the "missing" 1883 woodlands persist on wooded residential yards.

Further evidence for the stability of Hopewell woodlands is provided by the similar distributions of woodland sizes in 1883, 1942, and 1989 (Table 4). Median woodland size has remained small at 5.7 ha in 1883, 6.2 ha in 1943, and 6.1 ha in 1989. Since 1883 at least, Baldpate Mountain has been the site of the largest continuous woodland in the township with an area of 205-567 ha (Appendix 2).

Recent disturbances

Although Hopewell's woodlands have been relatively stable in terms of location, numbers, and average size, they have been far from disturbance free. Woodlands are categorized by disturbance type in Table 5 with the degree of disturbance generally decreasing from the top to the bottom of the table. A total of 111 separate woods have been directly disturbed by humans within the last decade or two. The single most common disturbance, affecting 64 woodlands, was the construction of one or more houses within a woods and the accompanying clearing and modification of surrounding vegetation to create open or semiopen yards. Although many canopy trees sometimes remained on such developed lots, disturbance of wildlife and understory vegetation, including regenerating trees, is usually severe. Quarry excavation; nonresidential construction; right-of-ways for roads, pipelines, and powerlines; or various other development have reduced or fragmented 43 woodlands.

Extensive deaths of large trees, such as might be caused by severe defoliation by introduced gypsy moth caterpillars, was the leading disturbance in only eight woods. In the seven of these woods that were sampled quantitatively, the number and sizes of standing dead trees suggested an average loss of about 11% of the predamage timber. In 54

sampled woods overall, standing dead trees represented about 4% of predamage timber. Over the long term, gypsy moth damage may have little impact on the tree-species composition of New Jersey woodlands with intact understories (Ehrenfeld 1980).

Mature, relatively undisturbed woods were rare; of the 43 woods free of recent disturbance, only 13 were mature.

Composition of mature woods

Overall, Hopewell's woodlands contained at least 43 tree species, including 32 taxa encountered in samples from mature woods (Table 6, 7). Tulip, ash, red oak, and beech were the most frequently dominant tree species in woodlands of northern Hopewell Township; taken together, these four species accounted for nearly one half of overall tree importance value (Table 6). Red oak and beech were the most frequent dominants in the south (Table 7), but eight other species were dominant in at least one woods each.

The largest trees that were sampled exceeded 42" in diameter at breast height (dbh) and belonged to the species white oak, red oak, and ash. In reconnaissance-only woods, a sugar maple tree also exceeded 42" dbh, and red oak, pin oak, and sycamore trees exceeded 48" dbh.

Although the relative importances of tree species varied from stand to stand, mature woods could be divided into one of five general types (see Robichaud and Buell 1973): oak (23 samples), tulip (13 samples), beech (9 samples), mixed woods (5 samples) or moist woods (4 samples). In oak woods, a mixture of upland oaks (red, white, black, chestnut, and scarlet oak) accounted for 32-66% of total importance value. Hickories, ash, and maples were also often important in oak woods. Tulip poplar was the first or second dominant tree in tulip woods, accounting for 15% to 46% of total importance value. Upland oaks typically accounted for an additional 20% of the importance value total. Tulip woods occurred predominantly on the rocky hills found in the northern portion of the township; only one tulip woods occurred in the south.

On rocky terrain, tulip may become a leading species as it establishes well and grows quickly in openings created by heavy cutting. Given histories of less broad-scale clearing, oak woods (perhaps originally mixed with American chestnut) would likely occur in place of tulip woods. American beech was the first or second dominant in beech woods, accounting for 26% to 40% of total importance value. Because beech often spreads through suckers instead of seed, it is likely that woodlands with abundant beech are old and relatively undisturbed.

Mixed woods were intermediate between the other upland woods types, resembling the sugar maple/mixed hardwood forest type described by Robichaud and Buell (1973). Because of the deep shade cast by sugar maples, the understory and ground layer is typically open where large sugar maples reach the canopy. Moist woods occurred along streams and other poorly drained sites and were characterized by abundant red maple, pin oak, or sweetgum. Woods in most wetland areas had not reached the mature age class.

Regional similarities in community traits

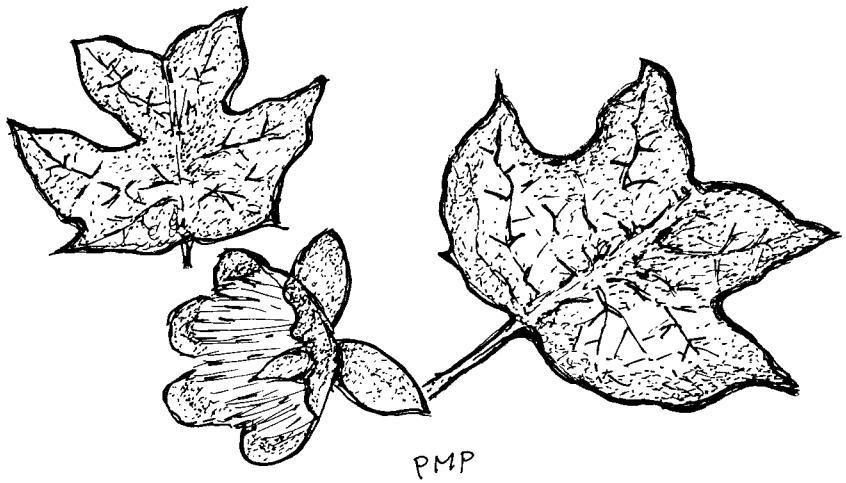
Although mature woodlands differed between physiographic regions in average species composition (Tables 6 and 7), only minor regional differences were observed for several composite woodland traits (Table 8). Overall, sampled forests had an average basal area of 96.9 square feet per acre. The high basal area and density in the north region resulted from the biased distribution of tulip woods. The growth form of tulip favors dense stands and large trees, and 12 of 13 tulip woods occurred in the north because of their association with trap rock ridges.

Woodland maturity

Several approaches may be used to assess the relative maturity of individual sampled woodlands. As a woodland matures and trees compete for space in the canopy, a natural thinning occurs as the woods' total basal area becomes concentrated in fewer, larger trees. Thus, the ratio of basal area to density (proportional to average basal area per stem or average tree size) can be examined as an index of maturity (Table 9). Among sampled stands, this ratio ranged from 0.69 to 1.60. For comparison, a ratio of 1.32 was found previously for Hutcheson Memorial Forest, a recognized primeval mixed-oak woods near East Millstone, New Jersey (White and Worthen 1986). Only four Hopewell Township woods have ratios (=average tree sizes) greater than this benchmark; however, high ratios were observed for stands from each of the five types of woods defined above. The ratio of basal area:density was positively correlated with percent basal area in trees over 12" diameter ($r=0.743$, $P<0.0001$) and negatively correlated with tree density ($r=-0.740$, $P<0.0001$). There was no significant relation between the ratio and total basal area ($r=0.110$, $P>0.2$). As explained above, however, even among stands with equally large trees, differences in species composition may point to differences in maturity (e.g., dominance of beech vs. tulip). Maximum tree size is another index of maturity (Table 9). Large forest-grown upland oaks have roughly fifteen growth rings per radial inch. Thus, each six-inch diameter class should span approximately 45 years in age. Based on this relationship, the oldest trees in sampled oak woodlands may range from 150 to 300 years old.

The generality of woodland patterns in Hopewell Township

The extent, history, and composition of woodlands in Hopewell Township were remarkably similar to that observed previously in Franklin Township, Somerset County (Table 10). Franklin is located along the Millstone and Raritan Rivers only 8 kilometers northeast of Hopewell. Both townships are part of the Piedmont, contain regions of diabase ridges and more level plains, and have rural, agricultural histories. Franklin's population density is much greater than that in Hopewell indicating greater pressures towards deforestation. The population difference is only partially explained by the fact that, in Hopewell Township, two major communities (Pennington and Hopewell boroughs) have been separated politically from the township. The plains regions of the two townships are more different than their hilly sections. Compared to Franklin, the woods of Hopewell's plains (south) region are larger, younger, and wetter. Whereas upland oaks tended to dominate woods on Franklin's red shale plains, Hopewell's plains include areas with silty and poorly drained soils conducive to beech and red maple as well as oaks.



Tulip Poplar
Liriodendron tulipifera

Conservation recommendations

As outlined in the introduction, the environmental value of a woodland may be reflected in (1) the presence of many large diameter trees, (2) the dominance of trees characteristic of mature New Jersey forests growing under similar soil and moisture conditions, (3) a large area of woods interior, (4) a long or continuous history as a wooded site, and (5) limited recent human disturbance. In addition, the presence of wetlands or streams or uncommon biological features can add to the conservation value of a woodland. No virgin woods were identified in Hopewell, and no woods excelled in all categories. Therefore, the compensating strengths and weaknesses of each woods have to be weighed in setting out the specific conservation priorities recorded in Table 11.

As a first, simplifying step, a category was established for woods already protected or under public ownership. These woods occur on land owned by Mercer County, New Jersey State Division of Parks and Forestry, or the Stony Brook/Millstone Watershed Association. As their ownership status suggests, most of these woods contain amenities for recreational users including trails, picnic facilities, and exercise equipment. In this group, the two woods of greatest environmental interest occupy parts of the floodplain of the Stony Brook and are relatively undisturbed by recreational uses. The stream-side woods in Rosedale Park are graced by towering sycamores, tulip poplars, and oaks. The best, currently protected, upland stand is the Brick Yard (51/31) beech woods used as a group camp site in Washington Crossing State Park. Although this is a fine woods, the township contains many woods which are larger, older, or less disturbed.

Surviving large woods are a precious rarity in central New Jersey and should command top conservation priority. Hopewell contains all or part of three extensive wilderness blocks associated with the southern trap ridges called Baldpate Mountain, Pennington Mountain, and Mount Rose (the bulk of this woods is in Princeton Township). Among these three areas, the Baldpate Mountain woods is exceptional. It is outstandingly large; with about 509 hectares (1260 acres) in woods overall it accounts for about one out of every five wooded hectares in the township. Large woodlands were recorded on this site in 1943 and in 1883. Moreover, the woods are near other valuable habitats along the Delaware River and in state parks in New Jersey and Pennsylvania. A wide diversity of physical environments are provided by differences in grade, aspect, slope position, and drainage. Such environmental heterogeneity could be important in buffering species against changes in the atmosphere and climate projected to occur over the coming decades. The woods contain a mosaic of successional and mature patches of varying composition. The table-top mountain supports a majestic stand of tulip poplar and offers spectacular vistas. The potential of the site as a park and natural area is suggested by the success of the smaller Bowman Hill section of nearby Washington Crossing State Park in Pennsylvania.

Fine, extensive stands of mature woods also occur around the quarry on the eastern portion of Pennington Mountain and on Mount Rose. The Quarry woods on Pennington Mountain, although less than one half the size of the Baldpate woods, are still equivalent in size to the largest woods in Franklin Township.

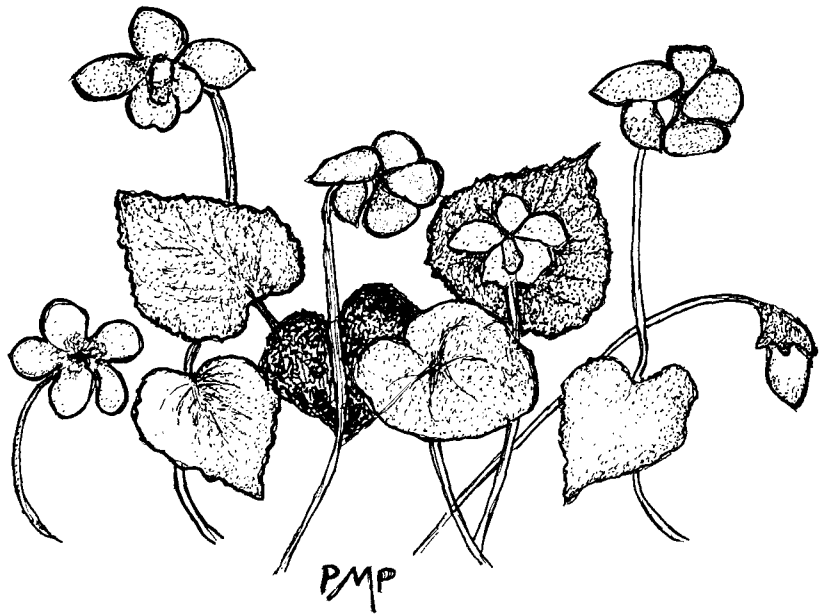
The remaining smaller, individual woodlands in Hopewell can be divided by maturity class as a first step in establishing conservation priorities. As a rule, environmental value will decline from mature to intermediate to young woods. Although the effects of differences in woodland age could diminish as a young woods matures, the time scales involved dwarf human institutions and isolated woods regenerating from agricultural land may be irreversibly impoverished. Nearly all top ranking, mature woods were sampled quantitatively to document tree development and composition. Most small mature woods occupy residential lots. In these circumstances, most further development and conservation initiative are precluded, and the remaining woods are subject to the stewardship of individual home owners.

The top ranking individual mature woods is the Curlis Lake beech woods near Pennington. In agricultural landscapes, good land is cleared and wetlands and ridges are left wooded. Woodlots in cropland areas tend to be small

and isolated. Thus, the Curlis Lake beech woods is important first because it occupies a large patch (57 hectares) of prime lowland. The woods also stands out because it is strongly dominated, especially to the south, by American beech. The Curlis Lake woods is one of only eight mature beech woods sampled township wide. Although forest of this type may have originally been widespread, very few large lowland stands of mature beech remain in central New Jersey.

There are many environmental benefits to woods of intermediate and even young age. Such stands may be reasonably protected where possible, and they have been ranked with this in mind. Prohibitions against construction in stream corridors and wetlands may provide a degree of protection in many cases.

Recommended conservation priorities are based on biological criteria. The practicality of protecting or preserving any given woods, however, will depend overwhelmingly on a varied mix of nonbiological factors including the number and type of owners, zoning regulations, and present development status. The presence of survey markers or percolation test pits suggested that development may already be underway in some woods. Because this region is old, well populated, and prosperous, woodland ownership patterns are complex. The 152 woods in Hopewell Township are spread over at least 492 lots with roughly 380 different owners including residents and nonresidents, incorporated organizations, institutions, businesses, and township, county, and state government. Few woods today are restricted to a single lot or owner. Historically, this may be true because peripheral sites were often chosen for farm woodlots and because areas near natural boundaries such as ridges and streams were often best left in woods.



Violets
Viola sp.

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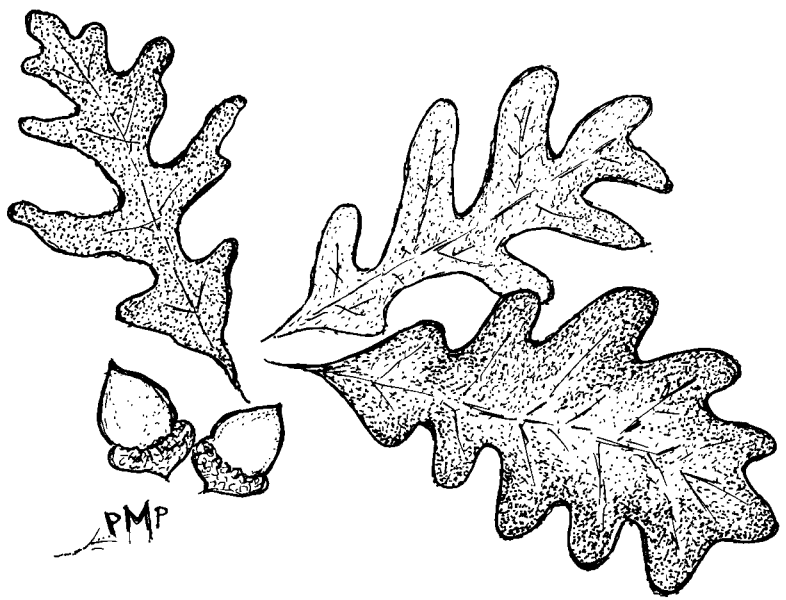
Appendix 1

Scientific equivalents for common plant names. Plants are classified in six growth forms: canopy (CA), subcanopy (SC), and understory trees (UN), and vines (VN), shrubs (SH), and herbs (HB). Three site associations are indicated: wet or lowland (LO), open or edge (ED), and closed canopy (CL).

Common name	Scientific binomial	Form, Site
Arrowwood	*Viburnum dentatum*	SH, LO
Ash	*Fraxinus* spp.	CA
Aster	*Aster* spp.	HB
Basswood	*Tilia americana*	SC, CL
Barberry	*Berberis thunbergii*	SH
Beech, American	*Fagus grandifolia*	CA, LO
Beech-drops	*Epifagus virginiana*	HB, CL
Bellwort	*Uvularia* spp.	HB
Birch		
Sweet	*Betula lenta*	CA
Gray	*Betula populifolia*	SC, ED
River	*Betula nigra*	SC, LO, ED
Blackberry	*Rubus* spp.	SH, ED
Blackhaw	*Viburnum prunifolium*	SH
Blackgum	*Nyssa sylvatica*	SC, LO, ED
Bloodroot	*Sanguinaria canadensis*	HB, CL
Blueberry, Lowbush	*Vaccinium vacillans*	SH
Boxelder	*Acer negundo*	SC, LO
Cherry		
Bird	*Prunus avium*	SC, ED
Black	*Prunus serotina*	SC, ED
Chestnut, American	*Castanea dentata*	UN, CL
Christmas fern	*Polystichum acrostichoides*	
Dogwood, Flowering	*Cornus florida*	UN
Elm, Red	*Ulmus rubra*	CA, LO
Enchanter's nightshade	*Circaea* sp.	HB
Euonymous, Winged	*Euonymous alatus*	SH
False Lily of the Valley	*Maianthemum canadense*	HB
False Solomon's Seal	*Smilacina racemosa*	HB, CL
Garlic mustard	*Alliaria officinalis*	HB
Ginseng	*Panax quinquefolium*	HB
Grape	*Vitis* spp.	VN
Greenbrier	*Smilax* spp.	VN
Hackberry	*Celtis occidentalis*	UN, LO, CL
Hawthorn	*Crataegus* spp.	SH, ED
Hay-scented fern	*Dennstaedtia punctilobula*	
Hepatica	*Hepatica* sp.	HB
Hickory		
Bitternut	*Carya cordiformis*	CA, CL
Mockernut	*Carya tomentosa*	CA, CL
Pignut	*Carya glabra*	CA, CL
Shagbark	*Carya ovata*	CA, CL

Common name	Scientific binomial	Form, Site
Holly, American	*Ilex opaca*	SC
Hop Hornbeam	*Ostrya virginiana*	UN, CL
Honeysuckle, Japanese	*Lonicera japonica*	VN, ED
Hornbeam, American	*Carpinus caroliniana*	UN, LO, CL
Huckleberry, Black	*Gaylussacia baccata*	SH
Indian cucumber root	*Medeola virginiana*	HB
Indian pipe	*Monotropa uniflora*	HB
Interrupted fern	*Osmunda claytoniana*	
Jack-in-the-pulpit	*Arisema triphyllum*	HB, CL
Jewelweed	*Impatiens biflora*	HB, LO, ED
Maidenhair fern	*Adiantum pedatum*	
Maple		
Norway	*Acer platanoides*	SC
Red	*Acer rubrum*	SC
Silver	*Acer saccharinum*	CA, LO
Sugar	*Acer saccharum*	CA, CL
Mayapple	*Podophyllum peltatum*	HB
Multiflora rose	*Rosa multiflora*	SH, ED
Oak		
Black	*Quercus velutina*	CA
Chestnut	*Quercus prinus*	CA
Pin	*Quercus palustris*	CA, LO, ED
Red	*Quercus borealis*	CA
Scarlet	*Quercus coccinea*	CA
Swamp White	*Quercus bicolor*	CA, LO
White	*Quercus alba*	CA
Osage-orange	*Maclura pomifera*	UN, ED
Partridgeberry	*Mitchella repens*	HB
Pine		
Scotch	*Pinus sylvestris*	CA
White	*Pinus strobus*	CA
Poison Ivy	*Toxicodendron radicans*	VN
Pokeweed	*Phytolacca americana*	HB
Rattlesnake root	*Prenanthes alba*	HB
Red cedar	*Juniperus virginiana*	UN, ED
Rue anemone	*Anemonella thalictroides*	HB
Sarsaparilla, Bristly	*Aralia hispida*	HB
Sassafras	*Sassafras albidum*	SC, ED
Serviceberry	*Amelanchier arborea*	UN, CL
Shagbark hickory	*Carya ovata*	CA, CL
Skunk cabbage	*Symplocarpus foetidus*	HB, LO
Snakeroot, Black	*Cimicifuga racemosa*	HB
Solomon's Seal	*Polygonatum biflorum*	HB
Spicebush	*Lindera benzoin*	SH, LO, CL
Spotted wintergreen	*Chimaphila maculata*	HB
Sweetgum	*Liquidambar styrifuca*	CA, LO
Sycamore	*Platanus occidentalis*	CA, LO, ED
Tulip Poplar	*Liriodendron tulipifera*	CA
Twisted stalk	*Streptopus amplexifolius*	HB

Common name	Scientific binomial	Form, Site
Viburnum, Mapleleaf	*Viburnum acerifolium*	SH, CL
Violet	*Viola* spp.	HB
Virginia Creeper	*Parthenocissus virginiana*	VN
Walnut, Black	*Juglans nigra*	SC
Wild geranium	*Geranium maculatum*	HB
Wild leek	*Allium tricoccum*	HB
Willow	*Salix* sp.	SC, LO, ED
Wineberry	*Rubus phoenicolasius*	SH
Winterberry	*Ilex verticillata*	SH
Wintergreen	*Gaultheria procumbens*	SH
Witch hazel	*Hamamelis virginiana*	SH, CL



White Oak
Quercus alba

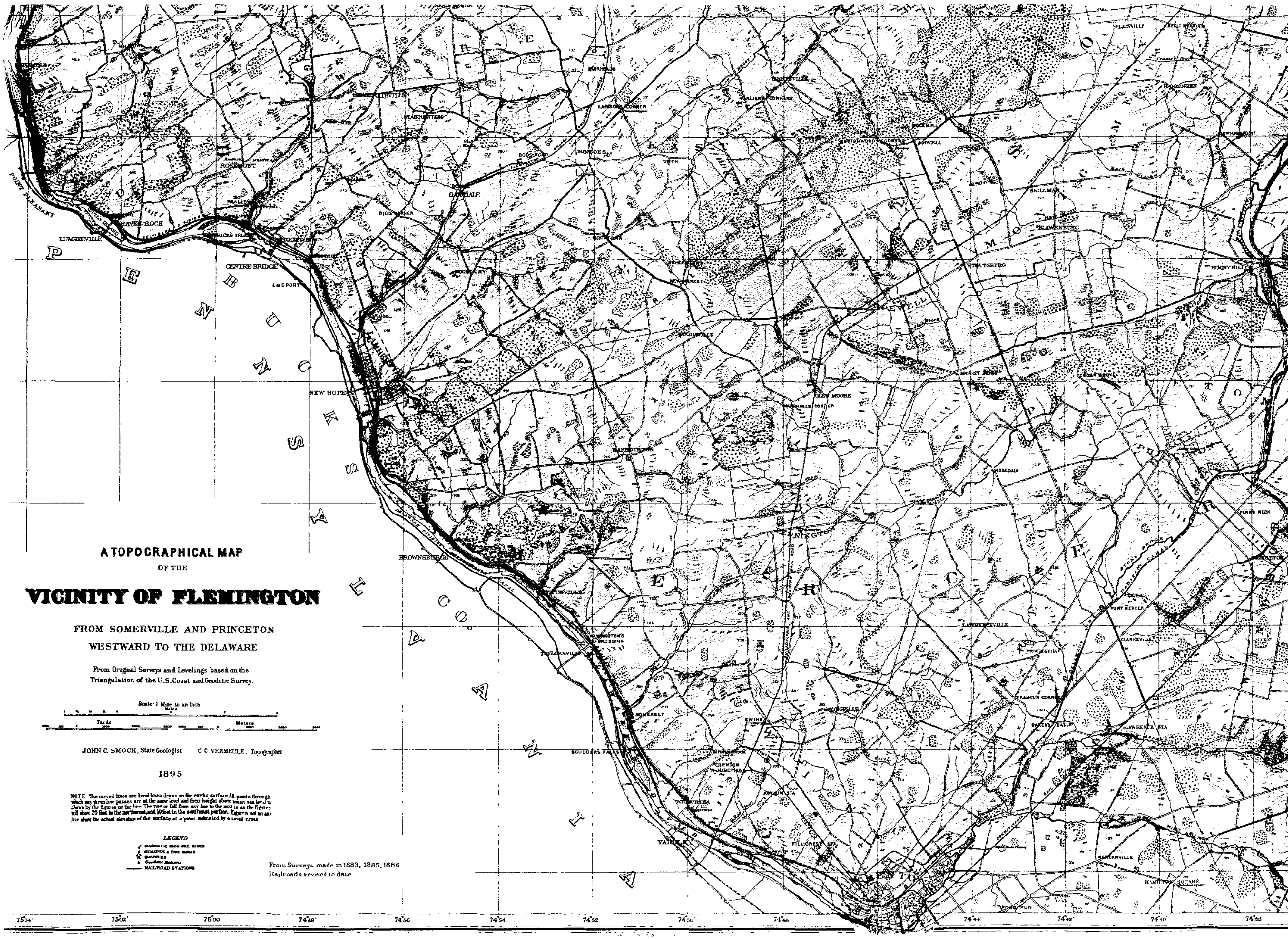
Appendix 2

Areas of individual woodlands in Hopewell Twp., Mercer Co., NJ, in 1883, 1942, and 1989. Woods are identified on Map 2 (in pocket) with unique north-south/east-west coordinates based on a one centimeter grid on USGS 7.5 minute quadrangle sheets. Regions are N=north and S=south. Location notes indicate the coordinates under which the cumulative area of currently contiguous patches are recorded. Area is in hectares (ha); one hectare equals 2.47 acres.

Woods	Region	Location notes	Area 1883 (ha)	Area 1942 (ha)	Area 1989 (ha)
2/67	N			1.3	1.1
2/69	N			9.2	8.3
4/55	N	+ 5/52	34.9	59.2	58.7
4/57	N		6.9	2.4	2.4
4/66	N		3.0	9.8	9.8
5/52	N	see 4/55			
5/58	N	+ 7/54 8/53	79.5	101.3	99.8
5/58	N		1.8		
5/58	N		1.4		
5/61	N		34.6	68.6	67.6
5/61	N		4.6		
5/72	N		0.3	13.3	12.4
5/72	N		0.5		
5/72	N		1.0		
6/64	N		8.3	18.4	17.9
6/67	N			8.6	6.1
6/69	N			2.7	1.9
7/54	N	see 5/58	2.5		
7/63	N		5.1	10.6	10.6
7/75	N		4.6	6.5	6.2
8/53	N	see 5/58			
9/60	N			2.9	0.9
9/67	N		46.3	30.7	28.7
9/71	N		17.0	15.8	12.8
11/53	N		5.3	3.5	2.6
11/65	N			5.7	4.7
12/54	N		4.0	5.9	5.6
12/59	N	+13/60 14/58	21.9	79.3	76.3
13/55	N			8.5	8.5
13/60	N	see 12/59	6.5		
13/65	N		2.3	2.4	1.6
13/66	N		5.2	6.2	
14/58	N	see 12/59			
14/76	N			1.1	1.1
16/77	N			2.1	1.7
17/53	N			7.2	7.2
17/56	N		14.5	22.1	16.1
17/73	N			5.8	5.8
19/57	N			0.8	0.0
20/48	N			2.3	2.3
20/50	N			3.9	3.9
20/64	N			3.4	3.4
20/68	N			2.6	2.1
20/77	N		6.2	13.6	13.6
21/40	N		14.3	8.1	8.1
21/54	N		7.6	6.2	6.2
21/58	N			3.9	0.6
21/59	N		1.7	3.8	3.8
22/31	N			1.6	1.6
22/48	N		13.1	14.8	14.3
22/63	N	+ 22/66	47.9	50.0	50.0
22/66	N	see 22/63			
22/69	N		1.6	28.9	25.0
22/69	N		4.5		
22/69	N		7.6		
22/69	N		5.7		
22/73	N		1.9	13.9	13.4
22/73	N		3.5		
22/74	N		4.1	2.2	2.2
23/33	N		24.8	22.5	22.5
23/37	N		13.8	12.7	12.0
23/53	N			10.6	11.6

Woods	Region	Location notes	Area 1883 (ha)	Area 1942 (ha)	Area 1989 (ha)
24/38	N			4.0	0.9
24/61	S			0.7	0.7
24/79	N	+ 28/78	11.2	120.1	108.0
25/30	N			7.4	7.4
25/42	N	+ 27/4	48.3	63.6	59.6
25/42	N		12.3		
25/52	N		2.4	1.6	1.6
25/54	N		8.1	5.9	7.0
25/57	N		2.7	0.0	
25/61	S			1.6	1.6
25/68	N		26.1	38.6	35.6
26/52	N			10.0	6.7
26/62	S		3.7	3.8	3.8
26/66	S			1.9	1.9
27/44	N	see 25/42			
27/47	N		10.5	2.6	2.0
27/57	N		4.8	5.3	5.3
27/73	S			4.1	3.5
28/32	N			12.2	12.2
28/40	N		4.7	33.7	32.7
28/40	N		19.6		
28/78	N	see 24/79	45.3		
29/45	N			5.0	3.5
29/72	S			31.2	31.2
30/38	N		12.5		
30/38	N		0.9	17.0	17.0
30/38	N		1.6		
30/50	N	+32/49 35/49	131.6	201.8	189.0
30/62	S		4.8	7.2	7.2
30/66	S		4.7	0.0	
31/34	N		2.8	4.3	3.3
31/43	N			3.3	1.6
31/46	N		4.3	22.2	21.0
31/46	N		5.8		
31/58	S		45.8	33.4	30.4
32/32	N		7.6	7.0	6.5
32/37	N		6.7	9.8	9.8
32/49	N	see 30/50			
32/63	S			7.8	7.8
32/65	S			1.4	0.0
32/69	S		11.6	5.4	3.3
33/74	S		2.1	3.1	3.1
33/76	S			1.1	0.0
34/64	S			0.7	1.4
34/69	S			17.2	9.8
34/74	S			1.8	1.1
35/36	N			1.8	5.5
35/36	N			0.7	
35/40	N	+ 38/41		21.4	75.2
35/44	N			4.5	2.0
35/49	N	see 30/50			
35/59	S				2.2
35/64	S				1.4
35/67	S				1.0
35/72	S			4.3	6.2
36/72	S			1.6	2.9
37/33	N			1.8	8.2
37/43	N				6.7
37/64	S			2.7	3.3
37/74	S	+ 38/72		9.5	21.7
38/20	N				10.1
38/36	N			1.7	1.5
38/41	N	see 35/40		4.2	
38/41	N			19.0	
38/44	S				7.4
38/68	S				5.0
38/72	S	see 37/74			2.7
39/25	N	+ 42/30		29.2	89.1
39/36	S			1.6	1.4
39/39	S				7.3
39/67	S			9.8	4.5
40/ 7	N			8.8	10.3
40/11	N				2.2
40/73	S			27.8	14.9
41/ 6	N			13.7	2.0
41/41	S			17.3	10.8
41/59	S			13.0	27.9
42/ 9	N			3.6	9.7
42/24	N	+Baldpate Mt.		35.7	567.0
42/30	N	see 39/25		19.3	
42/37	S				1.5
42/70	S				24.2
43/33	N	see 42/24		36.6	
44/51	S			5.8	0.0
44/62	S			2.2	0.0

Woods	Region	Location notes	Area 1883 (ha)	Area 1942 (ha)	Area 1989 (ha)
44/71	S			9.5	7.5
45/20	N	see 42/24	205.1		
45/30	N	see 42/24	6.5		
45/30	N	see 42/24	28.8		
45/39	S			3.7	3.7
45/48	S			1.4	1.4
45/49	S			3.3	0.0
45/52	S		5.1	3.7	2.2
46/51	S			3.4	2.5
46/68	S		4.3	4.5	3.0
48/17	N	see 42/24			
48/21	N	see 42/24	3.8		
48/21	N	see 42/24	1.4		
48/62	S		35.7	61.0	56.9
48/62	S		2.8		
49/37	S		6.4	11.9	11.9
49/49	S		8.3	10.6	10.6
49/68	S		3.2	2.5	2.3
50/40	S		4.8	8.4	7.2
50/54	S		2.0	1.7	1.3
50/70	S			1.1	0.0
51/24	S		5.2	16.1	13.6
51/31	S		8.7	11.4	11.4
51/45	S	+ 51/46		24.6	5.7
51/46	S	see 51/45	5.5		13.9
51/50	S		2.7	0.8	0.8
51/64	S		2.3	6.1	6.1
51/70	S			1.7	0.0
52/64	S		1.9	0.3	0.3
52/65	S			0.7	0.7
52/69	S			1.4	0.0
53/29	S		1.9	29.1	29.1
53/38	S		2.4	0.0	
54/64	S		6.0	1.9	1.4
55/56	S		7.1	5.1	1.1
55/56	S				2.1
55/58	S			1.7	1.7
56/30	S			25.9	18.0
56/33	S		9.6	28.3	26.3
56/49	S		2.0	2.8	2.8
56/60	S		2.9	4.1	3.7
58/44	S			31.9	20.0
58/50	S		5.7	6.0	6.0
58/56	S	+ 59/56	10.9	17.7	3.7
58/64	S			8.7	2.0
58/64	S				3.2
59/56	S	see 58/56			10.0
59/62	S	+ 63/62	10.2	50.5	6.0
59/62	S				34.0
60/40	S			45.2	42.0
60/43	S		5.6	12.0	9.0
61/49	S		3.6	2.7	1.8
62/32	S		7.5	4.6	4.6
62/36	S		1.8	0.3	0.0
62/46	S		2.6	9.9	3.3
62/55	S		3.2	12.2	12.2
63/42	S			1.6	0.3
63/62	S	see 59/62	37.0		1.9
65/32	S		18.1	0.0	



A TOPOGRAPHICAL MAP
OF THE
VICINITY OF FLEMINGTON
FROM SOMERVILLE AND PRINCETON
WESTWARD TO THE DELAWARE
From Original Surveys and Levelings based on the
Triangulation of the U.S. Coast and Geodetic Survey.
Scale: 1 Mile to an Inch
Miles
Yards
Meters
JOHN C. SMOCK, State Geologist
C C VERMEULE, Topographer
1895
NOTE The curved lines are level lines drawn on the earths surface. All points through which any given line passes are at the same level and their height above mean sea level is shown by the figures on the line. The rise or fall from one line to the next is as the figures will show 20 feet in the northwest, and 10 feet in the southeast portion. Figures not on any line show the actual elevation of the surface at a point indicated by a small cross
LEGEND
MAGNETIC IRON-ORE MINES
HEMATITE & ZINC MINES
QUARRIES
Geodetic Stations
RAILROAD STATIONS
From Surveys made in 1883, 1885, 1886
Railroads revised to date
POINT PLEASANT
LUMBERVILLE
CENTRE BRIDGE
LIME PORT
NEW HOPE
BROWNSBURG
TAYLORSVILLE
SCUDDERS FALLS
YARDLEY
P E N N S Y L V A N I A
B U C K S C O
ROSEMONT
RAVEN ROCK
OAKDALE
RINGOES
STOUTSBURG
ROCKY HILL
MOUNT ROSE
GLEN MOORE
MARSHALL'S CORNER
ROSEDALE
PRINCETON
PENNS NECK
PORT MERCER
CLARKSVILLE
LAWRENCEVILLE
PRINCESSVILLE
FRANKLIN CORNER
BAKERS BASIN
LAWRENCE STA
MERCERVILLE
HAMILTON SQUARE
EWING
BIRMINGHAM
TRENTON JUNCTION
ASYLUM STA
HILL CREST STA
SKILLMAN
BLAWENBURG
NEW MARKET
HARBOURTON
WASHINGTON'S CROSSING
SOMERSET
75°04'
75°02'
75°00
74°58'
74°56
74°54
74°52
74°50'
74°48
74°44'
74°42'
74°40'
74°38

Table 1. Population history of Hopewell Township, Mercer County, New Jersey.

Year	Population	Change from last census	Density (#/sq km)
1810	2565		17
1830	3154	589	21
1840	3205	51	21
1850	3698	493	25
1860	3900	202	26
1870	4276	376	28
1880*	3580	-696	24
1890	3750	170	25
1900**	3360	-390	22
1910	3171	-189	21
1920	3249	78	22
1930	3907	658	26
1940	3738	-169	25
1950	4731	993	31
1960	7818	3087	52
1970	10030	2212	67
1980	10893	863	73
1987	11282	389	75

* Pennington borough first excluded from township count.
** Hopewell borough first excluded from township count.

Table 3. Number and extent of wooded areas in Hopewell Township, Mercer County, New Jersey, listed by region for 1989 with woods separated by age class.

	Young		Intermediate		Mature	
Region	n	Area (ha)	n	Area (ha)	n	Area (ha)
North	5	152	37	391	37	1369
South	13	36	26	138	34	444
Total	18	188	63	529	71	1813

Table 4. Frequency distribution of the areas of individual woodlands in Hopewell Township, Mercer County, New Jersey, for 1883, 1942, and 1989.

	1883		1942		1989	
Area (ha)	n	(%)	n	(%)	n	(%)
0-1.9	21	(16)	29	(18)	33	(22)
2-4.9	39	(30)	37	(24)	35	(23)
5-19.9	51	(39)	60	(38)	57	(38)
20-567	20	(15)	31	(20)	27	(18)

Table 2. Number, extent, and cover of wooded areas in Hopewell Township, Mercer County, New Jersey, listed by region for the years 1883, 1942, and 1989. One hectare equals 2.47 acres.

		1883			1943			1989		
Region	Area (ha)	n	Area (ha)	Cover (%)	n	Area (ha)	Cover (%)	n	Area (ha)	Cover (%)
North	7416	79	1243	16.8	80	2081	28.1	79	1913	25.8
South	7606	52	424	5.6	77	750	9.9	73	617	8.1
Total	15022	131	1667	11.1	157	2831	18.8	152	2530	16.8

Table 5. Woodlands categorized by type of disturbance. Woods with multiple disturbances are listed under each category.

Disturbance	Number	Woodlands affected Designation
Quarry or nonresidential construction	8	Baldpate Mt, 28/78, 30/50, 41/59, 45/52, 50/54, 55/56, 60/40
House(s) with clearing of some part of the woods understory	64	2/67, 2/69, 4/55, 5/58, 5/61, 5/72, 6/64, 6/67, 6/69, 7/75, 9/67, 9/71, 11/53, 11/65, 12/54, 12/59, 17/56, 19/57, 21/58, 22/63, 22/69, 22/73, 23/37, 24/79, 25/42, 25/68, 26/52, 27/47, 27/73, 28/40, 29/45, 30/50, 31/34, 31/43, 31/46, 32/32, 32/69, 33/76, 34/69, 35/40, 35/59, 35/67, 35/72, 36/72, 37/33, 37/43, 37/74, 38/44, 38/68, 38/72, 39/25, 39/36, 39/39, 45/49, 46/68, 50/40, 51/24, 56/33, 58/44, 58/56, 62/36, 62/46, 63/42, 65/32
Road, right-of-way	16	Baldpate Mt, 35/40, 40/7, 41/6, 51/45, 51/46, 51/64, 54/64, 55/56, 55/58, 58/56, 58/64, 59/56, 59/62, 61/49, 63/62
Other development or woodland conversion*	25	Baldpate Mt, 6/67, 13/65, 16/77, 17/56, 20/68, 21/58, 22/48, 22/69, 24/38, 31/58, 32/65, 35/44, 40/73, 41/41, 41/59, 42/9, 44/71, 45/49, 46/51, 46/68, 48/62, 51/70, 56/30, 56/60
Heavy cutting or logging	11	Baldpate Mt, 30/50, 37/74, 39/25, 41/41, 41/59, 42/30, 49/37, 58/44, 60/43, 62/55
Light cutting or logging	19	4/66, 5/52, 21/40, 23/33, 22/63, 22/69, 23/37, 25/30, 31/46, 32/37, 34/74, 35/49, 38/41, 40/73, 49/49, 50/40, 51/31, 51/46, 59/56
Trail, understory disturbance	17	Baldpate Mt, 6/64, 21/59, 29/72, 32/63, 37/43, 38/41, 42/9, 42/37, 48/62, 51/31, 51/45, 51/46, 53/29, 56/30, 62/32, 59/62
Canopy deaths	8	17/53, 23/33, 25/30, 28/32, 34/74, 35/49, 37/74, 53/29
Perc holes	8	5/52, 20/77, 22/48, 25/68, 28/78, 32/37, 37/74, 51/64
Undisturbed: young or intermediate	30	4/57, 7/63, 9/60, 13/55, 13/66, 14/76, 17/73, 20/48, 20/50, 20/64, 22/31, 22/74, 23/53, 24/61, 25/52, 25/61, 26/66, 30/62, 33/74, 34/64, 35/36, 38/20, 38/36, 42/37, 45/48, 49/68, 52/64, 52/65, 56/49, 58/50
Undisturbed: mature	13	20/77, 21/54, 25/54, 26/62, 27/57, 30/38, 35/64, 37/64, 39/67, 40/11, 42/70, 45/39, 51/50

* Includes clearing for agriculture, pond, golf course, park, or cemetery.

Table 6. Important tree species in 33 mature woods in northern Hopewell Township, Mercer County, New Jersey. Importance value in each stand is the sum of relative basal area, relative density, and relative frequency. Overall, importance value sums to 300%. Tree diameters were tallied in six-inch classes (A 0-6"; B 6-12"; C 12-18"; D 18-24"; E 24-30"; F 30-36"; G 36-42"; H 42-48".

Species	Stands present (dominant)	Mean importance value (%)	Largest sampled tree
Ash	32 (7)	41.0	H
Tulip	26 (9)	40.9	G
Red Oak	31 (6)	36.6	F
Beech	29 (4)	27.5	E
White Oak	30 (1)	24.5	H
Hickory	33	23.0	E
Red Maple	24 (2)	20.0	D
Black Oak	28 (1)	15.1	E
Birch	22 (1)	14.1	C
Sugar Maple	17 (1)	12.4	G
Shagbark	23	11.6	C
Chestnut Oak	8 (1)	7.5	F
Dogwood	22	4.8	A
Red Elm	12	3.6	D
Basswood	11	3.1	C
Bird Cherry	5	2.0	C
Sassafras	10	1.7	C
Blackgum	7	1.7	D
Pin Oak	6	1.6	D
Other	5	1.5	D
Hop Hornbeam	7	1.4	B
Scarlet Oak	3	1.3	D
Am. Hornbeam	4	1.0	B
Black Cherry	2	0.8	B
Swamp White	2	0.5	E
Boxelder	1	0.2	B
Silver Maple	1	0.2	B
Serviceberry	1	0.1	A
Hackberry	1	0.1	B

Table 7. Important tree species in 21 mature woods in southern Hopewell Township, Mercer County, New Jersey. Importance value in each stand is the sum of relative basal area, relative density, and relative frequency. Overall, importance value sums to 300%. Tree diameters were tallied in six-inch classes (A 0-6"; B 6-12"; C 12-18"; D 18-24"; E 24-30"; F 30-36"; G 36-42"; H 42-48".

Species	Stands present (dominant)	Mean importance value (%)	Largest sampled tree
Red Oak	21 (6)	43.2	H
Red Maple	19 (1)	35.5	D
White Oak	20 (2)	35.4	G
Beech	16 (4)	32.1	G
Black Oak	17 (2)	23.5	F
Ash	20 (1)	22.8	G
Hickory	19	22.5	G
Sugar Maple	15 (1)	21.1	C
Tulip	11 (1)	17.6	E
Shagbark	13 (2)	15.6	D
Pin Oak	7 (1)	7.9	D
Red Elm	8	3.2	C
Dogwood	10	2.8	A
Black Cherry	6	2.7	B
Chestnut Oak	1	2.2	D
Sweetgum	1	2.0	C
Blackgum	8	2.0	C
Bird Cherry	3	1.5	C
Scarlet Oak	4	1.1	C
Hop Hornbeam	2	1.1	B
Sassafras	3	1.0	C
Am. Hornbeam	2	0.9	A
Birch	2	0.6	B
Other	2	0.5	B
Serviceberry	1	0.4	A
Hackberry	1	0.4	E
Norway Maple	1	0.3	B

Table 8. Summary characteristics of mature woods in two regions of Hopewell Township, Mercer County, New Jersey. n=number of sampled stands. SD=standard deviation. BA=basal area.

	North (n=33)		South (n=21)	
Trait	mean	(SD)	mean	(SD)
Sampled tree species	12	(2)	11	(2)
Basal area (ft2/a)	106	(12)	97	(15)
Density (stems >6"/a)	110	(25)	100	(16)
Basal area:Density	1.01	(0.21)	0.98	(0.16)
BA in trees >12" dbh (%)	58	(11)	58	(13)
Standing dead BA (ft2/a)	5	(5)	4	(4)

Table 9. Sampled stands ranked by the ratio of basal area to density. Woods in which large mature tree predominate have high ratios of basal area to density. Basal area is in square feet per acre; density is in stems over 6'' dbh per acre. Percent total basal area in trees over 12'' dbh and diameter class of the largest tree are given as additional measures of maturity.

Stand	Region	Woods type	Basal area	Density	Ratio basal area: density	Percent basal area in trees over 12''	Largest tree size class	Wood's name
23/33	N	Oak	83	121	0.69	24	D	Coopers Corner West
32/37	N	Beech	110	154	0.71	42	D	Old Farm South
41/41	S	Oak	80	110	0.72	42	D	Management Area
42/ 9	N	Oak	112	148	0.76	42	D	Belle Mt
37/43	N	Tulip	115	150	0.77	54	E	Woosamonsa School
31/58	S	Moist	94	122	0.77	26	D	Watershed Assoc.
49/37	S	Oak	80	103	0.78	32	E	Jacobs Creek West
40/ 7	N	Oak	104	129	0.81	44	E	Substation
32/63	S	Oak	81	100	0.81	49	E	Circle Trail
39/25	N	Oak	105	127	0.82	42	E	Hunter
37/33	N	Oak	114	139	0.82	51	E	Corner School
25/42	N	Tulip	96	113	0.85	46	E	Woodsville South
9/67	N	Beech	110	130	0.85	60	E	Amwell
59/62	S	Moist	108	126	0.86	55	D	Orchard Lane South
51/46	S	Oak	89	100	0.88	63	E	Scotch Road East
30/50	N	Tulip	130	146	0.89	61	E	Quarry East
25/54	N	Tulip	127	143	0.89	59	F	Mine
21/54	N	Tulip	100	112	0.89	54	F	Brunswick
42/24	N	Mixed	100	111	0.90	57	E	Moore Creek
22/48	N	Beech	124	139	0.90	61	E	Woodsville East
48/62	S	Beech	119	132	0.90	62	E	Curlis Lake South
20/77	N	Mixed	87	95	0.92	59	F	Province Line
28/78	N	Tulip	111	121	0.92	61	E	Mt Rose
53/29	S	Oak	90	95	0.95	60	E	Nature Center
49/49	S	Oak	111	117	0.95	68	G	Woolsey Brook
27/57	N	Mixed	109	115	0.95	61	H	Glenmoore
51/31	S	Beech	91	95	0.96	54	H	Brick Yard
38/41	N	Oak	76	78	0.97	51	E	Woosamonsa
50/40	S	Oak	97	99	0.98	60	F	Jacobs Creek East
48/62	S	Beech	97	98	0.99	76	E	Curlis Lake North

Stand	Region	Woods type	Basal area	Density	Ratio basal area: density	Percent basal area in trees over 12''	Largest tree size class	Wood's name
51/24	S	Oak	99	99	1.00	61	E	Titusville
56/30	S	Mixed	95	95	1.00	62	G	Steele Run WCSP
22/63	N	Tulip	118	117	1.01	69	F	Crusher North
51/45	S	Oak	96	94	1.02	60	F	Scotch Road West
30/38	N	Moist	120	113	1.06	58	F	Old Farm North
51/64	S	Oak	96	91	1.06	65	E	Blackwells
29/72	S	Oak	88	83	1.07	51	D	Western Electric
25/68	N	Tulip	107	99	1.08	65	F	Crusher South
7/75	N	Tulip	99	92	1.08	71	E	Spring Hill
25/30	N	Oak	96	88	1.09	52	H	County Line Corner
37/74	S	Oak	73	65	1.11	59	E	Bayberry
32/49	N	Beech	121	107	1.13	64	E	Quarry North
21/59	N	Oak	100	89	1.13	58	E	American Legion
9/71	N	Tulip	108	95	1.13	66	E	Stoutsburg Cemetery
45/20	N	Tulip	97	84	1.16	65	E	Baldpate Mt
62/32	S	Tulip	143	122	1.17	72	F	Morgan
17/53	N	Oak	90	77	1.17	59	E	Stony Brook Road
21/40	N	Oak	112	94	1.19	72	G	Woodsville North
28/32	N	Mixed	103	82	1.26	68	E	Harbourton
59/56	S	Moist	103	81	1.27	60	F	Reed
35/49	N	Tulip	91	69	1.33	64	F	Pennington Mt
37/64	S	Beech	110	82	1.35	81	G	Mobil
23/37	N	Oak	105	71	1.48	75	F	Coopers Corner East
35/40	N	Beech	110	69	1.60	80	H	Harwood
Mean			102	106	1.00	58		
SD			14	23	0.19	12		

Table 10. Comparison of woodlands in two central New Jersey townships. Data for Franklin Township, Somerset County, New Jersey, are for upland regions only (White and Worthen 1986, White et al. 1990). Unless stated otherwise, values are for contemporary woodlands (Hopewell in 1989, Franklin in 1986).

Trait	Hopewell Township, Mercer County	Franklin Township, Somerset County
Population density (#/km2)		
1880	24	32
1940	25	49
1980	73	259
Woodlands, overall		
Density (wooded areas/km2)		
1880s	0.87	0.52
1943	1.05	1.53
1980s	1.01	1.65
Coverage (%)		
1880s	11	9
1943	19	17
1980s	17	15
Median area (ha)	6.1	3.3
Mature (% wooded area)	72	69
Undisturbed (% woods)	28	28
Woodlands, hilly region		
Density (wooded areas/km2)	1.07	1.52
Coverage (%)	26	32
Tree basal area (ft2/a)	106	104
Tree density (stems >6" dbh/a)	110	101
Dominants (Importance value %)	Ash (41)	Red Oak (45)
	Tulip (41)	Tulip (38)
	Red Oak (37)	Red Maple (28)
	Beech (28)	Ash (26)
Woodlands, plains region		
Density (wooded areas/km2)	0.96	1.69
Coverage (%)	8	8
Tree basal area (ft2/a)	97	91
Tree density (stems >6" dbh/a)	100	88
Dominants (Importance value %)	Red Oak (43)	Red Oak (60)
	Red Maple (36)	White Oak (45)
	White Oak (35)	Black Oak (41)
	Beech (32)	Ash (36)

Table 11. Conservation priorities for woodlands in Hopewell Township, Mercer County, New Jersey. Conservation classes and woods within classes are ranked in order of decreasing conservation priority. Priority "x" woods are small woods (<3 ha) ranked by area only. Areas are for total continuous woodlands. Woods in which trees were sampled quantitatively are identified by woods type and name (see Appendix 4 for detailed results).

Woods	Area (ha)	Priority	Woods type	Name
Currently protected woodlands				
31/58 S	30.4	1	Moist	Watershed Assoc.
42/70 S	24.2	2		
51/31 S	11.4	3	Beech	Brick Yard
40/ 7 N	7.0	4.1	Oak	Substation
41/ 6 N	2.0	4.2		
53/29 S	29.1	5	Oak	Nature Center
32/63 S	7.8	6	Oak	Circle Trail
42/ 9 N	5.7	7	Oak	Belle Mt
56/30 S	18.0	8	Mixed	Steele Run WCSP
46/68 S	3.0	9		
44/71 S	7.5	10		
Candidates for preservation as large wilderness blocks				
Baldpate Mountain 509 ha				
45/20 N		1.1	Tulip	Baldpate Mt
45/30 N		1.2		
42/24 N		1.3	Mixed	Moore Creek
43/33 N		1.4		
48/21 N		1.5		
48/17 N		1.6		
Pennington Mountain 189 ha				
32/49 N		2.1	Beech	Quarry North
30/50 N		2.2	Tulip	Quarry East
35/49 N		2.3	Tulip	Pennington Mt
31/46 N		2.4		
Mt Rose 108 ha				
28/78 N		3.1	Tulip	Mt Rose
24/79 N		3.2		

Table 11, continued.

Woods	Area (ha)	Priority	Woods type	Name
Candidates for protection as individual mature woodlands				
48/62 S	56.9	1.1	Beech	Curlis Lake North
48/62 S	56.9	1.2	Beech	Curlis Lake South
38/41 N	65.0	2.1	Oak	Woosamonsa
35/40 N	65.0	2.2	Beech	Harwood
22/63 N	50.0	3	Tulip	Crusher North
39/25 N	80.0	4	Oak	Hunter
20/77 N	13.6	5	Mixed	Province Line
17/53 N	7.2	6	Oak	Stony Brook Road
29/72 S	31.2	7	Oak	Western Electric
59/62 S	6.0	8	Moist	Orchard Lane South
25/30 N	7.4	9	Oak	County Line Corner
9/67 N	28.7	10	Beech	Amwell
25/68 N	35.6	11	Tulip	Crusher South
30/38 N	17.0	12.1	Moist	Old Farm North
28/40 N	32.7	12.2		
25/42 N	59.6	13	Tulip	Woodsville South
23/37 N	12.0	14	Oak	Coopers Corner East
49/49 S	10.6	15.1	Oak	Woolsey Brook
51/50 S	0.8	15.2		
37/64 S	3.3	16	Beech	Mobil
59/56 S	10.0	17	Moist	Reed
22/48 N	14.3	18	Beech	Woodsville East
60/40 S	42.0	19		
27/57 N	5.3	20	Mixed	Glenmoore
51/24 S	13.6	21	Oak	Titusville
28/32 N	12.2	22	Mixed	Harbourton
21/40 N	8.1	23	Oak	Woodsville North
23/33 N	22.5	24	Oak	Coopers Corner West
21/54 N	6.2	25	Tulip	Brunswick
25/54 N	7.0	26	Tulip	Mine
7/75 N	6.2	27	Tulip	Spring Hill
37/74 S	12.0	28	Oak	Bayberry
37/43 N	6.5	29	Tulip	Woosamonsa School
51/46 S	13.9	30	Oak	Scotch Road East
32/37 N	9.8	31	Beech	Old Farm South
50/40 S	7.2	32	Oak	Jacobs Creek East

Table 11, continued.

Woods	Area (ha)	Priority	Woods type	Name
Candidates for protection as individual mature woodlands				
49/37 S	11.9	33	Oak	Jacobs Creek West
62/32 S	4.6	34	Tulip	Morgan
51/64 S	6.1	35	Oak	Blackwells
9/71 N	12.8	36	Tulip	Stoutsburg Cemetery
41/41 S	10.7	37	Oak	Management Area
37/33 N	6.7	38	Oak	Corner School
21/59 N	3.8	39	Oak	American Legion
51/45 S	5.7	40	Oak	Scotch Road West
40/73 S	10.0	41		
26/62 S	3.8	42		
17/56 N	16.1	43		
60/43 S	9.0	44		
26/52 N	6.7	45		
45/39 S	3.7	46		
40/11 N	2.2	47		
39/67 S	4.5	48		
35/64 S	1.4	49		
34/74 S	1.1	50		
58/56 S	3.7	51		
35/44 N	1.4	52		
13/65 N	1.6	53		
27/47 N	2.0	54		
63/62 S	1.9	55		

Table 11, continued.

Candidates for protection as intermediate-aged woodlands

Woods	Area (ha)	Priority
4/55 N	58.7	1
5/58 N	99.8	2
8/53 N	99.8	2
7/54 N	99.8	2
41/59 S	22.0	3
42/30 N	80.0	4
14/58 N	76.3	5
6/64 N	17.9	6
7/63 N	10.6	7
4/66 N	9.8	8
22/69 N	25.0	9
2/69 N	8.3	10
22/73 N	3.5	11
5/72 N	12.4	12
38/20 N	10.1	13
62/55 S	12.2	14
23/53 N	11.6	15
30/62 S	7.2	16
56/33 S	26.3	17
58/44 S	20.0	18
6/67 N	6.1	19
13/55 N	8.5	20
12/54 N	5.6	21
32/32 N	6.5	22
20/50 N	3.9	23
31/34 N	3.3	24
35/36 N	5.5	25
33/74 S	3.1	26
38/44 S	6.4	27
20/64 N	3.4	28
27/73 S	3.5	29
32/69 S	3.3	30
62/46 S	3.3	31
11/65 N	4.7	32
29/45 N	3.5	33
17/73 N	5.8	34
56/60 S	3.7	35
11/53 N	2.6	x
46/51 S	2.5	x
4/57 N	2.4	x
20/48 N	2.3	x
22/74 N	2.2	x
20/68 N	2.1	x
26/66 S	1.9	x
16/77 N	1.7	x
22/31 N	1.6	x
25/52 N	1.6	x
25/61 S	1.6	x
31/43 N	1.6	x
38/36 N	1.5	x
54/64 S	1.4	x
45/48 S	1.4	x
50/54 S	1.3	x
2/67 N	1.1	x
55/56 S	1.1	x
35/59 S	0.9	x
39/36 S	0.9	x
24/61 S	0.7	x
52/65 S	0.7	x
52/64 S	0.3	x

Table 11, continued.

Candidates for protection as young woodlands

Woods	Area (ha)	Priority
5/61 N	67.6	1
12/59 N	76.3	2
13/60 N	76.3	3
27/44 N	59.6	4
39/39 S	6.8	5
58/64 S	3.2	6
13/66 N	6.2	7
58/50 S	6.0	8
38/68 S	3.5	9
56/49 S	2.8	x
38/72 S	2.7	x
49/68 S	2.3	x
61/49 S	1.8	x
55/58 S	1.7	x
42/37 S	1.5	x
34/64 S	1.4	x
14/76 N	1.1	x
9/60 N	0.9	x
63/42 S	0.3	x

The Friends of Hopewell Valley Open Space is organized to promote the preservation of open space and the conservation of natural resources, to help local governments in open space decision-making, to foster environmental education, and to encourage farmland preservation.

For additional information, write:

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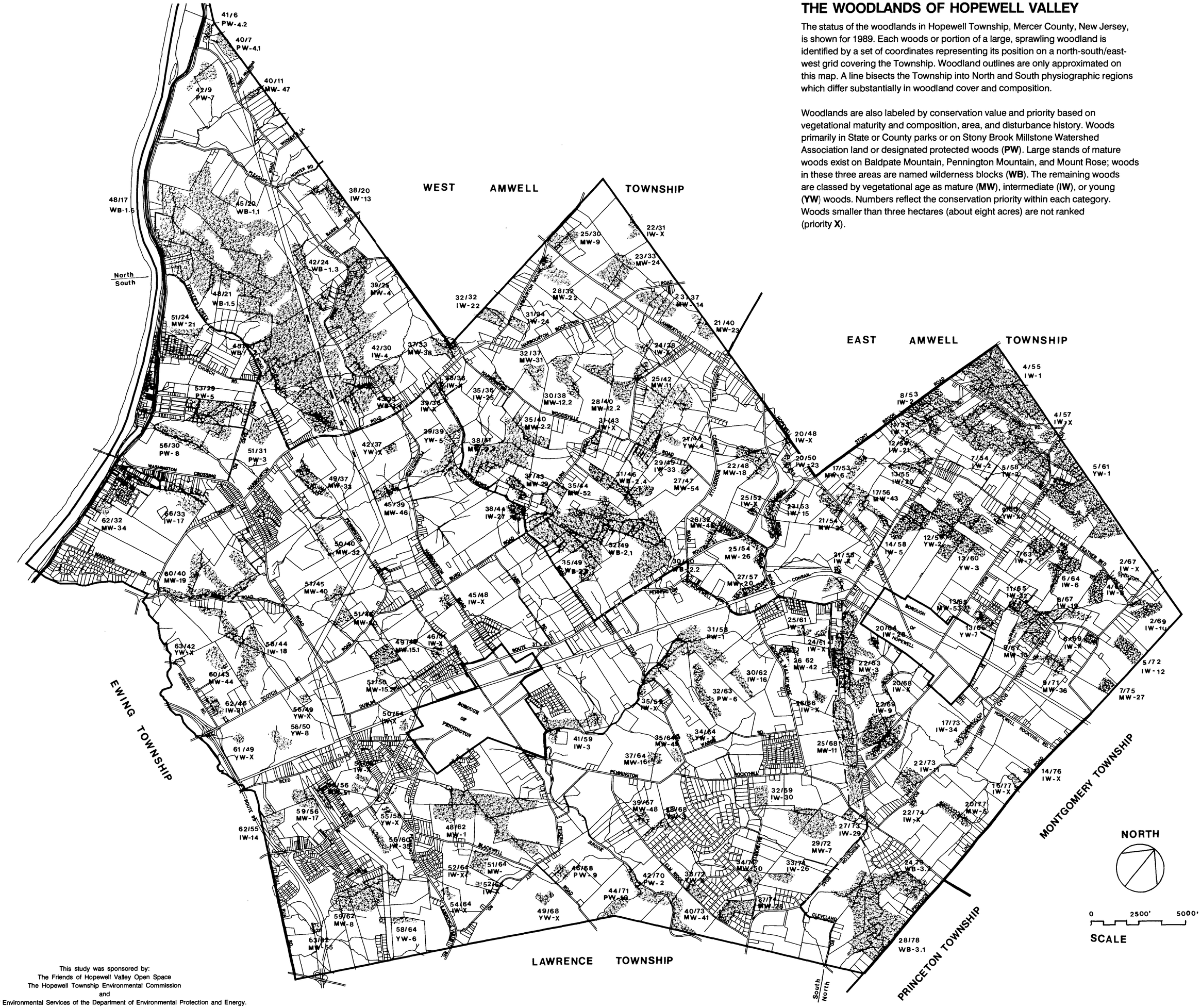
THE WOODLANDS OF HOPEWELL VALLEY

The status of the woodlands in Hopewell Township, Mercer County, New Jersey, is shown for 1989. Each woods or portion of a large, sprawling woodland is identified by a set of coordinates representing its position on a north-south/east-west grid covering the Township. Woodland outlines are only approximated on this map. A line bisects the Township into North and South physiographic regions which differ substantially in woodland cover and composition.

Woodlands are also labeled by conservation value and priority based on vegetational maturity and composition, area, and disturbance history. Woods primarily in State or County parks or on Stony Brook Millstone Watershed Association land or designated protected woods (**PW**). Large stands of mature woods exist on Baldpate Mountain, Pennington Mountain, and Mount Rose; woods in these three areas are named wilderness blocks (**WB**). The remaining woods are classed by vegetational age as mature (**MW**), intermediate (**IW**), or young (**YW**) woods. Numbers reflect the conservation priority within each category. Woods smaller than three hectares (about eight acres) are not ranked (priority **X**).



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