

SECTION 2. LAND RESOURCES

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2-1. Introduction

The New York–New Jersey Highlands Regional Study: 2002 Update was coordinated by the USDA Forest Service, Northeastern Area, State and Private Forestry and carried out in cooperation with the State Foresters of New York and New Jersey, Rutgers University, the U.S. Geological Survey, and the Regional Plan Association. The Forest Service provided funding for various components of the Study, including planning assistance, linkage among Study participants, and coordination of public outreach and involvement.

The update of the Study was guided by the 1992 Highlands Regional Study contents in regard to the Vision and Goals for the Highlands Region. However, the resource assessment and analysis portions of the Study were expanded based on the availability of spatial data and improved analytical techniques. The assessment and analysis portions of the Study, as documented in this Technical Report, were organized around questions that were developed using available knowledge and listening session input. These questions were:

- *What are the natural resources important to the Highlands?*
- *Where are these resources located?*
- *How will these resources change in the future?*
- *How can we measure the impacts of these expected changes?*
- *Where are the natural resource conservation priority areas?*

This New York–New Jersey Highlands Regional Study Technical Report, accompanies the New York–New Jersey Highlands Regional Study: 2002 Update. The Study Update synthesizes and provides findings and some interpretation of the analyses conducted, but does not provide an exhaustive compilation of all possible scenarios for change. The Technical Report provides greater detail on the data sources, methodology, and results concerning the assessment and analysis conducted as part of the Study Update.

The overarching question that the New York–New Jersey Highlands Regional Study Technical Report addresses is: what are the implications of continued land use change patterns on Highlands resources? In this respect the report focuses on an assessment of five main natural resources: water, biodiversity, recreation/open space, forest land and farmland. Trends in population and land use/land cover change are analyzed. Several future land change scenarios are developed and the possible consequences of this projected future land use change and population growth examined. The Technical Report focuses on a 1.4 million acres study area covering the New York and New Jersey portions of the Highlands physiographic province (**Figure 2-1**).

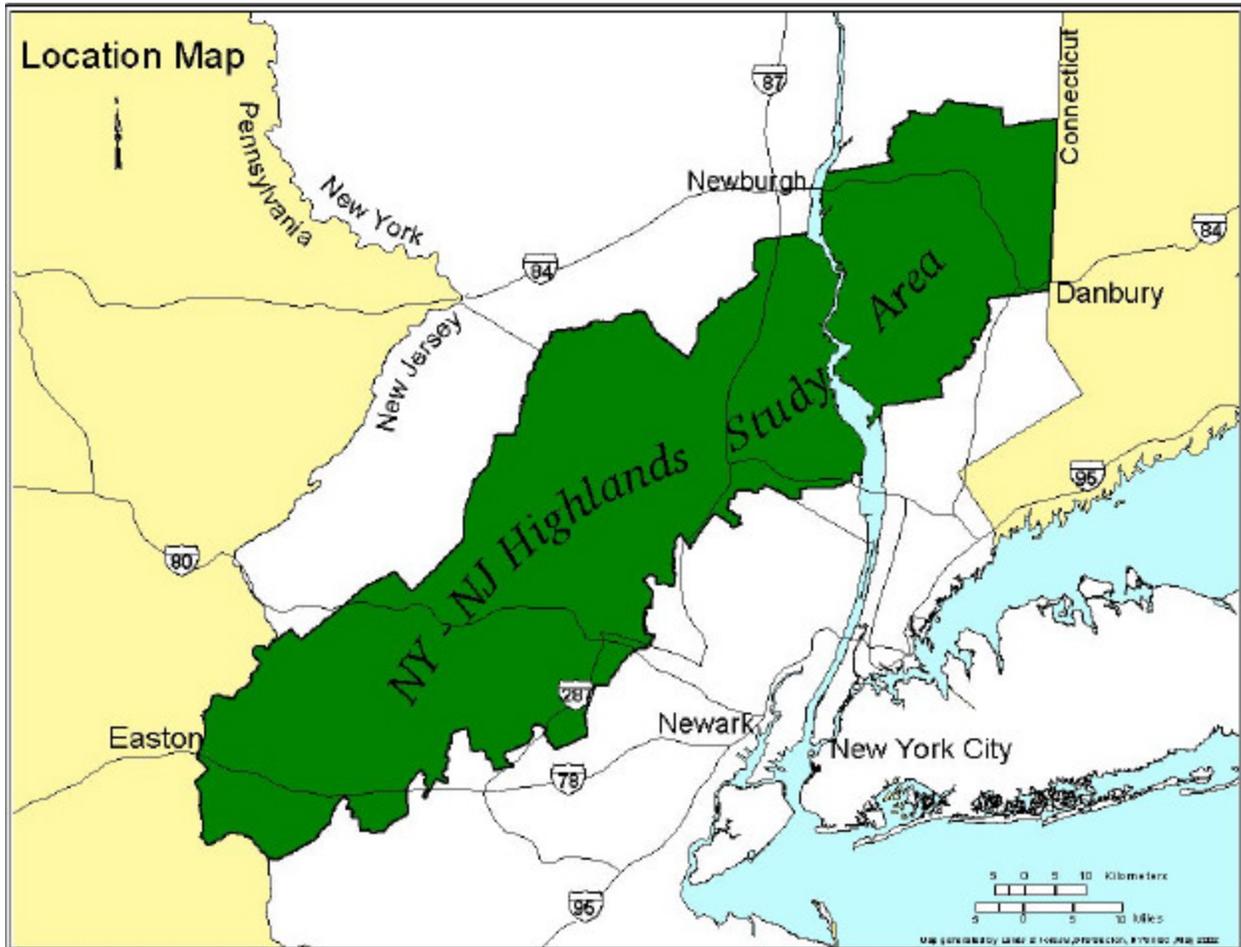


Figure 2-1. Location map of New York–New Jersey Highlands study area.

2-2. Resource Assessment and Conservation Values Forest and Timber

Introduction

The ridges and uplands of the Highlands are noted for their rich and diverse forests with the exception of major farming areas in the lower river valleys of the Delaware, Musconetcong / Pohatcong, and Wallkill Rivers. These forests serve as a great timber resource among many other purposes. The active management of the Highlands forests as a “working landscape” to produce wood and other forest products was a major goal of the 1992 New York–New Jersey Highlands Regional Study and is still an issue of concern today.

Objectives

The primary objective was to examine the status of forests and timber resources in the New York–New Jersey Highlands study region. A secondary objective was to map the lands under active forestry management through the Forest Stewardship Program, a Federal-State cooperative program designed to promote responsible forest management and the maintenance of forest lands in timber production.

Methods

In addition to the land use and land cover analysis undertaken as part of this study, reports produced by the USDA Forest Service as part of the Forest Inventory and Analysis (FIA) provided the basis for an updated assessment of forest and timber resources of the New York–New Jersey Highlands study region. FIA data were analyzed for the counties included in the New York–New Jersey Highlands study region (Dutchess, Orange, Putnam, Rockland and Westchester in NY; and Bergen, Hunterdon, Morris, Passaic, Somerset, Sussex, and Warren in NJ). Reports for New York State were available for the years of 1980 and 1993 (Considine and Frieswyk, 1982; Alerich and Drake, 1995). Reports for New Jersey were available for 1987 and 1999 (DiGiovanni and Scott, 1990; Griffith and Widmann, 2001).

Both the New Jersey Department of Environmental Protection’s (NJ DEP) Department of Parks and Forestry and the New York State Department of Environmental Conservation (NYS DEC) compiled information on lands under Forest Stewardship. Stephanie Diamond of the NYS DEC digitized the centroid location for each Forest Stewardship property. These data were plotted and the attributes analyzed.

Results

Forest represents the largest land cover class in the Highlands and occupies approximately 825,000 acres of land (**Figure 2-2**). The majority of the Highlands timberland is classified by the FIA as deciduous forest. Oak/hickory is the dominant forest type composing 53 percent of the Highlands timberland. Three oak species: black (*Quercus velutina*), white (*Quercus alba*) and red (*Quercus rubra*), are the most frequently occurring species. Northern hardwoods cover 25 percent and swamp hardwoods (i.e., elm/ash/red maple) at 11 percent of the Highlands (**Table 2-1**). These forest types include sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), tulip tree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), and birch (*Betula* spp.). Conifer-dominated forest types, represented as white/red pine/spruce/fir and the oak/pine forest types, compose approximately 5 percent of the Highlands

forests. The Eastern hemlock (*Tsuga canadensis*) is intermixed with other species in cooler, moister areas.

The amount of forest land classified as timberland by the USDA Forest Service is holding steady in the New York–New Jersey Highlands. The USDA Forest Service classifies timberland as forested land that is capable of both sustaining good tree growth, and that is not legally or administratively reserved from timber harvesting. In New York, the amount of timberland decreased by approximately 7.5 percent from 1980 to 1993 (**Table 2-2**). In New Jersey, the amount of timberland increased by over 6 percent during the 1987 to 1999 time period and the amount of forest land increased by approximately 10 percent over the same time period (**Table 2-2**). Some of this increase is likely due to a change in the definition of forest land in New Jersey’s most recent FIA inventory (Griffith and Widmann, 2001). The more recent inventory uses a more inclusive definition of forest land and therefore small forested areas (e.g., rights-of-way and in certain urban areas) that were previously classified as nonforest were reclassified as forest (Widmann, per. comm.). Due to sampling errors associated with the FIA estimates, the change in timberland may not be statistically significant. The FIA estimates that the Highlands have experienced a 24 percent increase in net volume of total stock between the 1980’s and 1990’s (**Table 2-2**). The annual removal is less than half of the net growth of growing stock (16,827 removal vs. 38,046 growth, in thousands of cubic feet) and approximately one third for sawtimber (43,267 removal vs. 123,000 growth, in thousands of board feet) (**Table 2-3**).

A comparatively small percentage of forest in the Highlands is enrolled in the Forest Stewardship program (10,867 acres in New York and 5,627 acres in New Jersey) (**Figure 2-2**). This represents 1.5 percent of New York State’s greater Highlands timberland, and less than 1 percent of New Jersey’s greater Highlands timberland. 180 properties in the New York–New Jersey Highlands are enrolled in the Forest Stewardship Program with an average size of 90 acres per property.

Discussion

The FIA reports for New York and New Jersey give a somewhat different picture concerning trends in timberland area as compared to the land use and land cover analysis undertaken as part of the study and discussed in Section 2-3. of this report. The land use and land cover analysis suggests that area of forest land has decreased during the same 1980’s to 1990’s time period. We estimate that, between the years of 1995 and 2000, the amount of forest land (including both upland and wetland forest) in the Highlands decreased at a rate of 3,400 acres per year. This is an increase over the estimated loss of 1,534 acres per year between 1984 and 1995. The FIA reports suggest that timberland area is holding steady. These differences may be due to a number of reasons, including differences in definition (i.e., the more inclusive category of forest land vs. FIA’s more restrictive definition of timberland) and methods (i.e., the FIA’s sampling methodology vs. “wall-to-wall” land cover mapping).

With the abandonment of farming and extensive timber harvesting in the late 19th and early 20th century, Highland forests are continuing to mature and increase in volume. The FIA data suggests that the timber stocks between the 1980’s and 1990’s increased by nearly 25 percent. With annual removals at less than half of the net growth of growing stock and approximately one

third for sawtimber, it would appear that the Highlands timber resource is comparatively underutilized and could sustain higher harvesting rates.

The Forest Stewardship program actively promotes sustainable forest management. It is a preferential assessment program that gives landowners a reduced tax rate in exchange for their promise not to develop the land, as well as put their land in active forest management. Whereas a majority of the New York–New Jersey Highlands forest area is in private ownership only a comparatively small percentage of the forest land is enrolled in the Forest Stewardship program. Continued suburban and exurban development, and increased fragmentation of large contiguous forest tracts and land ownerships will result in fewer parcels of a size that is efficient for forestry management. This trend will make it more difficult for the USDA Forest Service to achieve its goals of promoting active forest management on private lands and responsible utilization of timber resources in the New York–New Jersey Highlands region.

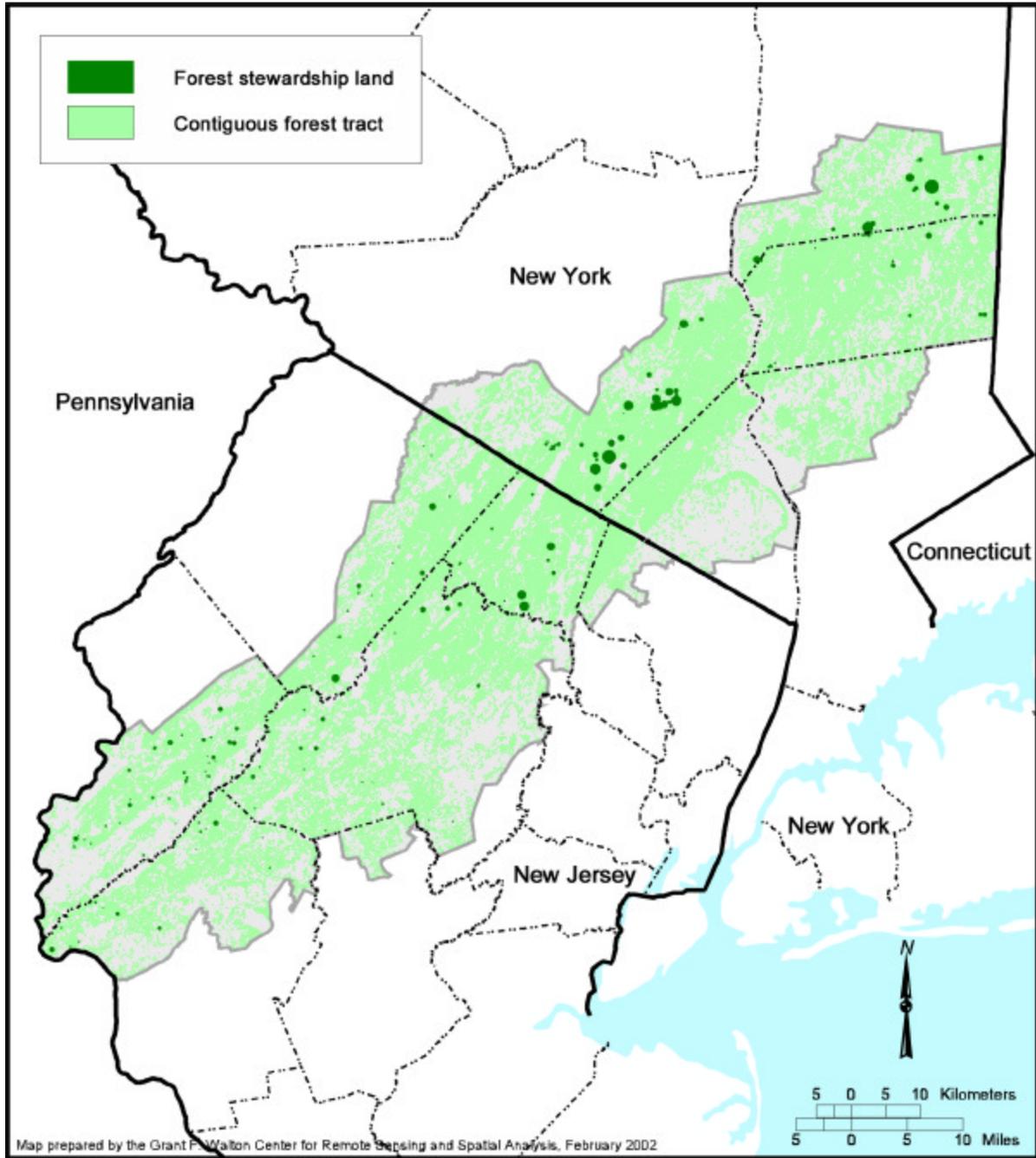


Figure 2-2. Map of forest lands and location of Forest Stewardship properties.

Table 2-1. FIA data for New York and New Jersey Highlands counties: dominant forest types.

| Totals thousands of acres | | | | | | |
|--------------------------------------|----------------------------------|-------------|--------------|-----------------------|-----------------------|--------|
| County | White/Red Pine/ Spruce/Fir | Oak/Pine | Oak/Hickory | Elm/Ash/ Red Maple | Northern Hardwoods | Totals |
| Dutchess | 9.9 | 25.7 | 109.2 | 30.9 | 79.4 | 264.8 |
| Orange | 25.5 | 4.9 | 141.2 | 23.2 | 53.3 | 253.4 |
| Putnam | | | 49.4 | 8.3 | 23.9 | 90.6 |
| Rockland/ Westchester | | | 56.0 | 4.6 | 44.7 | 105.3 |
| Hunterdon | | | 56.4 | 17.2 | 24.5 | 120.8 |
| Morris | | | 68.9 | 6.1 | 46.5 | 121.5 |
| Sussex | | 5.8 | 109.4 | 29.0 | 44.8 | 193.5 |
| Warren | | 4.1 | 50.4 | 13.3 | 29.1 | 97.0 |
| Passaic/ Bergen | | | 74.6 | 4.5 | 12.7 | 91.9 |
| Somerset (Middlesex/Mercer) | | | 78.4 | 32.8 | 20.4 | 155.6 |
| | | | | | | |
| NY Total | 35.4 | 30.6 | 355.8 | 67 | 201.3 | 714.1 |
| Percent of NY | 5.0 percent | 4.3 percent | 49.8 percent | 9.4 percent | 28.2 percent | |
| NJ Total | 0.0 | 9.9 | 438.1 | 102.9 | 178.0 | 780.3 |
| Percent of NJ | 0.0 percent | 1.3 percent | 56.1 percent | 13.2 percent | 22.8 percent | |
| Totals | 35.4 | 40.5 | 793.9 | 169.9 | 379.3 | 1494.4 |
| Percent of whole | 2.4 percent | 2.7 percent | 53.1 percent | 11.4 percent | 25.4 percent | |

Table 2-2. FIA data for New York and New Jersey Highlands counties: timberland, total forested and net volume total stock.

| County | Timberland | | | Total Forested | | | Net Volume Total Stock | | |
|--------------------------------|------------------------|------------------------|-------------------|------------------------|------------------------|-------------------|------------------------|------------------------|-------------------|
| | Thousands of acres | | | Thousands of acres | | | Millions of cubic feet | | |
| | 1980 (NY) 1987 (NJ) | 1993 (NY) 1999 (NJ) | Percent Change | 1980 (NY) 1987 (NJ) | 1993 (NY) 1999 (NJ) | Percent Change | 1980 (NY) 1987 (NJ) | 1993 (NY) 1999 (NJ) | Percent Change |
| Dutchess | 298.6 | 264.8 | -11.3% | 301.9 | 276.9 | -8.3% | 302.4 | 407.3 | 34.7% |
| Orange | 259.0 | 253.4 | -2.2% | 290.5 | 286.3 | -1.4% | 291.7 | 317.0 | 8.7% |
| Putnam | 89.9 | 90.6 | 0.8% | 99.4 | 103.0 | 3.6% | 120.7 | 139.3 | 15.4% |
| Rockland/ Westchester | 125.7 | 105.3 | -16.2% | 164.6 | 162.1 | -1.5% | 107.9 | 164.0 | 52.0% |
| Hunterdon | 96.7 | 120.8 | 24.9% | 99.6 | 120.8 | 21.3% | 148.8 | 212.8 | 43.0% |
| Morris | 122.5 | 121.5 | -0.8% | 141.2 | 145.8 | 3.3% | 232.2 | 278.8 | 20.1% |
| Sussex | 181.8 | 193.5 | 6.4% | 205.9 | 226.1 | 9.8% | 237.6 | 356.5 | 50.0% |
| Warren | 95.9 | 97.0 | 1.1% | 108.9 | 109.2 | 0.3% | 171.8 | 192.1 | 11.8% |
| Passaic/ Bergen | 103.6 | 91.9 | -11.3% | 111.2 | 119.4 | 7.4% | 190.5 | 189.7 | -0.4% |
| Somerset (Middlesex/Mercer) | 134.0 | 155.6 | 16.1% | 141.6 | 168.8 | 19.2% | 233.0 | 276.9 | 18.8% |
| Totals | | | | | | | | | |
| NY by year | 773.2 | 714.1 | -7.6% | 856.4 | 828.3 | -3.3% | 822.7 | 1027.6 | 24.9% |
| NJ by year | 734.5 | 780.3 | 6.2% | 808.4 | 890.1 | 10.1% | 1213.9 | 1506.8 | 24.1% |

Table 2-3. FIA data for New York and New Jersey Highlands counties: net growth and annual removals of growing stock and sawtimber.

| County | Net Growth All Groups | | Annual Removals | |
|--------------------------------|------------------------|------------------------|------------------------|------------------------|
| | Growing Stock | Sawtimber | Growing Stock | Sawtimber |
| | Thousands of cubic ft. | Thousands of board ft. | Thousands of cubic ft. | Thousands of board ft. |
| | 1993 (NY) 1999 (NJ) |
| Dutchess | 8,578 | 37,131 | 3,922 | 10,562 |
| Orange | 7,486 | 25,371 | 4,293 | 14,472 |
| Putnam | 2,459 | 12,046 | 1,252 | 3,739 |
| Rockland/ Westchester | 3,148 | 12,623 | 2,721 | 10,356 |
| Hunterdon | 6,501 | 20,101 | 785 | 3,256 |
| Morris | 8,533 | 23,343 | 10,187 | 32,334 |
| Sussex | 6,485 | 27,368 | 1,300 | 0.0 |
| Warren | 2,190 | 8,046 | 2,165 | 7,677 |
| Passaic/ Bergen | 7,351 | 23,209 | NA | NA |
| Somerset (Middlesex/Mercer) | 6,986 | 20,933 | 2,390 | 0 |
| Totals | | | | |
| NY by year | 21,671 | 87,171 | 12,188 | 39,129 |
| NJ by year | 38,046 | 123,000 | 16,827 | 43,267 |

Forest Health

Introduction

Mixed oak hardwood forests are the dominant forest variety in the New York–New Jersey Highlands. Three oak species: black, white and red, are the most frequently occurring species. Other species including sugar maple, red maple, hickories, tulip tree, American beech, white ash, elm and birch are interspersed throughout the forests. The Eastern hemlock is intermixed with other species in cooler, moister areas. Forest represents the largest land cover class in the Highlands and occupies approximately 825,000 acres of land.

Objectives

The objective of this component of the study was to document the status of the forest health in the Highlands. The predominant vegetation cover of the Highlands is forest, and threats to forest health potentially threaten the character and integrity of the natural setting of the Highlands. Threats to forest health were identified and discussed.

Methods

Environmental factors and biological agents that threaten the health of deciduous hardwood forests in the Highlands and northeast were identified. Concerns and management efforts at the Federal, State and local levels were documented with information provided by New York State Department of Environmental Conservation, Division of Lands and Forest; and the New Jersey Department of Environmental Protection, Division of Parks and Forestry.

Results

Eastern forests, including the Highlands, experience a number of stresses that potentially impact ecological and ecosystem processes in forest systems. In many instances, a single stressor does not actually kill trees or seriously impact a forest but the single stressor can weaken trees increasing susceptibility to other stressors. Multiple stressors reduce vigor, increase the potential for tree mortality and can lead to changes in forest community structure. A large-scale stressor such as acid rain affects forests throughout the northeast. Acid rain alters nutrient availability by binding essential nutrients making them unavailable for forest vegetation. Even if acid rain deposition is reduced, there is concern that the residual effects on ecosystem processes may be long-lasting (Lawrence 2002).

Forest pest species also affect forest health of the Highlands. Perhaps the most widely known and documented is the gypsy moth (*Lymantria dispar*). This species was introduced into the United States from Europe over 100 years ago when a French scientist imported the moth in an attempt to increase silk production by crossing the heartier gypsy moth with the silk worm. Today the gypsy moth is widely spread throughout the northeastern portion of the country and intensive management efforts are underway being implemented for both public and private lands.

The gypsy moth feeds on a wide range of tree species but preferentially targets oak species. The gypsy moth can completely defoliate trees and large tracts of forest in a relatively short period of time. The moth does not kill the tree and in many instances the tree will re-leaf after being defoliated. However, producing new leaves consumes resources that can weaken the trees defenses to other stressors.

Gypsy moth populations tend to be cyclical with outbreak years followed by years of decline. Concerted effort in management and education has helped to reduce outbreaks in the Highlands over the past 10 years. The last outbreak of significance occurring in the early 1990s when over 400,000 acres of deciduous forest in New Jersey alone were defoliated. A natural biological pesticide that targets the early stages in gypsy moth development has helped keep moth population numbers in check. However, a combination of factors including several consecutive years of draught resulted in increased gypsy moth damage in 2001. Over 100,000 acres of forest in the New Jersey Highlands were defoliated in 2001 (**Figure 2-3**) compared to less than 1,400 acres in 1999. The dramatic increase in damage is a combination of the natural cyclical nature of the moth population combined with environmental conditions that facilitated the spread of the moth. Efforts are underway to ramp up management efforts to prevent further spread.

A pest species that threatens the character and health of the Highlands forests and many forests throughout the east is the hemlock wooly adelgid (*Adelges tsugae*, HWA). This aphid-like insect was introduced from Japan and specifically targets hemlocks. It was first noted in the mid-Atlantic States in the late 1950's but its current distribution extends from the southeastern United States up into New England. Every county in the Highlands region has reported the presence of HWA on hemlocks. As of 1998, approximately 30 percent of the approximately 20,000 acres of hemlock stands in the New Jersey show evidence of HWA infestation with approximately 5,000 acres showing severe to complete defoliation (Royle, 2002).

HWA feeds at the base of the hemlock needles sucking on sap which leads to the death of needles and twigs. The loss of needles and twigs impairs tree health and slows growth. Hemlocks can generally tolerate low infestation levels but heavy infestations limit resources available for growth. As the new growth declines so does HWA infestation levels. The lower infestation levels allow the tree to support new growth but the new growth leads to higher HWA infestations and a cyclical pattern is established. The cycle of decline and recovery maintains a downward trend in hemlock vigor ultimately leading to tree mortality and loss of hemlocks from the forest. In some instances, the infestation may be severe enough and the tree stressed enough that mortality can occur in as short a period of three years. Generally, the more marginal hemlock habitats are where tree mortality occurs the fastest. Forests that have heavy infestations for long periods of time experience the highest mortality rates (Mayer et al., 2001). In some instances, HWA weakens the hemlocks sufficiently that other pests such as the hemlock borer become numerous and further weaken the trees. Presence of several pests is generally an indication of a hemlock stand that has gone beyond recovery.

The most promising effort to control the spread and damage done by HWA is through the use of a biological agent. A predatory beetle, *Psuedoscymnus tsugae*, found in the native habitat of the adelgid in Japan specifically targets the HWA. The beetle has been imported to the US and released in test areas that are infested with HWA. Careful monitoring and repeated releases of the biological control agent has led to limited success in the four years the program has been in operation (Scudder et al., 2001). Continued efforts are underway to develop better methods to monitor success of the beetle releases and the impacts they are having on HWA. The pressing concern is that there not be sufficient time to get the beetles at densities high enough to have an impact on HWA. For sites that experience a rapid decline (three to four years), the outlook is not

good. The hope is to target key areas for hemlock protection primarily on public lands and focus resources and efforts for biological control of HWA in these areas. Studies to date for areas in the Highlands and the broader northeastern region indicate that the insect has already infested many of the hemlock stands and the biological agent appears to have the most promise for reducing the devastating impact of HWA which could lead to the eventual removal of hemlocks from the Highlands forests.

Beech bark disease is another introduced disease that has been in the New York and New Jersey area for many years. This disease can cause significant mortality and damage to the American beech and particularly targets older, larger beech trees. The disease is actually a complex of an exotic scale insect that punctures the bark, causing an entry wound for infection by the fungal pathogen *Nectria* sp. The appearance of fungal cankers gives the bark a roughened, pockmarked appearance, and eventually girdle the tree. Beech bark disease was first recorded in the Canadian Maritime Provinces in the early 1900's and has now spread to Michigan and as far south as North Carolina. The mature forest trees are most affected, as well as the beech sprouts formed after the tree dies. At the scale of entire forests, there is no known control for beech bark disease. It does appear to have a cyclical pattern suggesting that environmental factors might influence the scale insect (Houston and O'Brien, 1998). There is a ladybird beetle that parasitizes the scale insect and a fungus that parasitizes the *Nectria* sp., but their effectiveness as biological control agents have not been critically evaluated.

Dogwood anthracnose has essentially eliminated flowering dogwood in many areas of the eastern United States, both in the natural forests and ornamental plantings (Mielke and Daughtrey, 1989; Daughtrey and Hibben, 1983). Southeastern New York and northern New Jersey are included in the infected area. The origin of the disease is unknown; it may be an introduced pathogen or it may be a fungus that is native to North America. Infection occurs on the leaves or through the shoots, causing leaf blight symptoms and eventually leading to twig dieback. As a result of the twig mortality, prolific sprouting can occur on the stem and main branches. Multiple cankers can kill the tree after several years of infection.

Whitetail deer (*Odocoileus virginianus*) also pose a serious threat to forest health and regeneration as well as the future vegetation composition of the Highlands forests (Anderson and Loucks, 1979). Overpopulation and lack of adequate forage have resulted in low regeneration for native trees and herbaceous plants throughout the region. In many instances, preferential browsing on native species has given invasive species the competitive advantage to reproduce and spread throughout the area unabated (Russell, Zippin and Fowler, 2001; Augustine and Frelich, 1998).

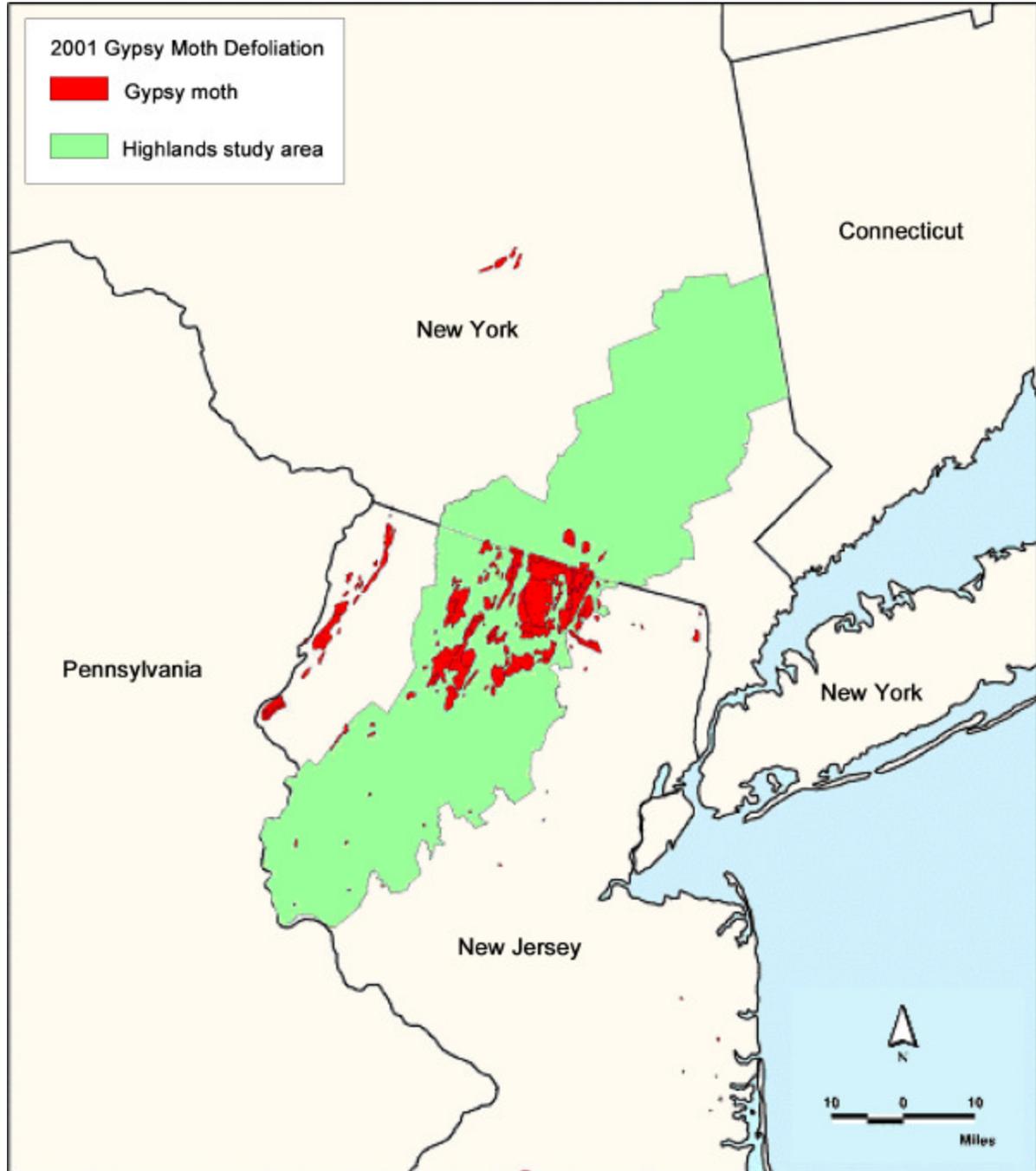


Figure 2-3. Map of 2001 gypsy moth defoliation in the New York–New Jersey Highlands region. Data sources: NJ Dept. of Agriculture–Division of Plant Industry; NY Department of Environmental Conservation–Division of Lands and Forests.

Map prepared by: USDA Forest Service–Information Management and Analysis, Durham, NH.
 Map edited by: Center for Remote Sensing and Spatial Analysis, November, 2002.

Discussion

The magnitude of forest cover in the Highlands requires that forest health be an important consideration in planning and management related issues in the region. Recognition of the importance of forests and the necessity to manage them requires a collective effort at virtually every level of government. Owners of private forest lands and environmental groups are also important players in effective forest management decisions at the local to the regional level.

The fate of the eastern hemlock remains uncertain. The loss of this species will change the community composition and character of the Highlands forests and would mark the loss of a keystone species. Keystone species are those species that have a disproportionate impact on a community relative to their relative abundance (Power, 1996). The eastern hemlock is a critical member of the forest community, providing essential cover and protection for many wildlife species. Many bird species utilize the hemlock for nesting and some species, such as the Northern Goshawk (*Accipiter gentiles*) and Magnolia warbler (*Dendroica magnolia*) nest predominantly in hemlocks. The hemlock will be replaced with early successional tree species such as red maple and black birch in the near term and eventually other deciduous hardwood trees including oaks.

The forests of the Highlands experience many different stressors and the individual impact from a forest stressor is partially dependent on additional contributing factors. One of the more recent significant factors is drought related, especially since the early 1990's. Drought stressed trees are more vulnerable to other stressors. For example, the impact and severity of gypsy moth damage can be exacerbated when a gypsy moth outbreak occurs during a drought year and which can result in tree mortality when under non-drought conditions the tree can withstand the moth related damage. Since the forests of the Highlands are more than 52 percent oak, any increase in gypsy moth populations in combination with drought, other insects and root disease, could have an increased impact on the health of the forest. Drought can also increase the impact on American beech from beech bark disease, causing a higher incidence of thin crowns and yellowing foliage.

Whitetail deer overpopulation is a widespread problem throughout the United States and presents one of the greatest challenges that face wildlife managers (Warren, 1997). Controlling deer numbers is increasingly more difficult to manage. The combination of reduced hunter access to deer, local ordinances that prohibit hunting, declining numbers of hunters and housing patterns are all contributing to a higher deer population than is sustainable. There has been over a 51 percent drop in the number of hunting licenses sold in New Jersey in the last 25 years. It will require aggressive deer management to reduce the impact and long-term implications of deer damage on the Highlands forest ecosystem.

Continued vigilance is necessary to retard the impacts of pests such as the gypsy moth. Our knowledge base in how to control gypsy moth outbreaks has come a long way since almost one million acres were defoliated in New Jersey and New York during the early 1990's. However, increased coordination and education of the public and private landowner are essential in effectively controlling massive outbreaks in the future.

Individual stressors rarely work singly or independently and forests experience a variety of stressors simultaneously. These stressors may be derived from anthropogenic sources, from biological agents or from the natural variability inherent in the environment. The greatest damage and threat to the forest ecosystem occurs when stressors coincide. Coincidence of stressors can be additive or multiplicative but rarely do they cancel each other out. Considering the multiple stressors that the Highland forests experience, active management to maintain forest health will require a concerted and collective effort at all levels of government as well as by the private landowner. The incidence of forest stressors is monitored and updated on an annual basis through the Cooperative Forest Health Program and the Forest Health Monitoring Program in each State (New York Department of Environmental Conservation, Division of Lands and Forest and New Jersey Department of Environmental Protection, Division of Parks and Forestry).

Forest Land Ownership

The forest land of the Highlands region of northern New Jersey and southeastern New York is owned primarily by individuals as part of their residences, so that they can enjoy the surrounding green space and wildlife. These and the other ownerships in the Highlands region will determine how the land is to be used and what the rest of society may expect from these lands. Whether the land is to remain in forest to replenish and purify groundwater or be subdivided and developed into residential lots with a proliferation of impervious surfaces is ultimately the decision of the individual owners in the region. But these land holdings do not exist in a vacuum. Market, social, and political forces are largely determined by the majority of the population that do not own land. In the following section, we provide an overview of the characteristics of the forest land ownerships of the Highlands region, discuss some of the factors that influence these individuals and organizations, and discuss the potential for forest land ownerships in the future.

A Snapshot of Forest Land Ownerships in the Greater Highlands Region

In the *greater* Highlands region¹, 84 percent of the forest land is owned by private individuals and organizations; the remainder of the land is owned by public agencies. Most of the public lands are owned by State agencies, but a significant area is also owned by various local and, to a lesser extent, Federal agencies. The authority and regulations used to purchase and manage these lands makes the fate of these lands more predictable, although not immutable, than that of the lands owned by private individuals and organizations. These public lands are predominately owned to provide the general public with clean drinking water and recreational opportunities.

There were between 50,000 and 75,000 private forest land ownerships in the greater Highlands region in 1991². The average private forest land ownership controlled approximately 20 acres of forest land. Well over half of the forest land ownerships owned less than 10 acres and over 90 percent owned fewer than 50 acres (**Figure 2-4**). But nearly 60 percent of the forest land in the area was controlled by the 8 percent of the forest land ownerships that each owned 50 or more acres. In 1991, the average forest land ownership had owned forest land for approximately 30 years, but over 30 percent had owned forest land for fewer than 10 years. The newer forest land ownerships tended to own less forest land than the forest land ownership that had owned forest land for longer. The vast majority of the private forest land ownerships, over 80 percent, were individual and joint ownerships with the next most common ownership types being partnerships and corporations that collectively controlled one-third of the forest land. The average forest land owner was 50 years old and nearly 40 percent of the forest land owners were retired.

The predominant reasons for these people to own forest lands was that the forests were a part of their residences and for the enjoyment that they gained from owning “green space” (**Figure 2-5**). The importance of forest land as part of a residence makes sense because nearly 90 percent of the owners lived on or near their forest land. But the average amount of land owned was greater for

¹ Unless otherwise noted, the discussion of forest-land ownership refers to the *greater* Highlands Region which includes Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Morris, Passaic, Somerset, Sussex, Union, and Warren counties in New Jersey and Dutchess, Orange, Putnam, Rockland, Westchester counties in New York.

² The principal data sources are forest land ownership surveys conducted in 1994 and 1988 in New York and New Jersey, respectively.

people that did not live on their land (44 versus 17 acres). Although enjoyment of green space is the major expected benefit for owning forest land, nearly a quarter of the owners expressed increase in land value as a primary expected benefit (**Figure 2-6**).

Many of the goods and services that will be provided by these forest lands cannot be easily quantified. Two of the major services provided, water purification/recharge and aesthetics are very difficult to quantify and assess their values. Some of the more traditional services and products supplied can be more easily assessed. For example, over two-thirds of the ownerships that own nearly 80 percent of the forest land have at least part of their land posted to restrict access and/or recreational uses. Nearly a third of the ownerships that own about half of the forest land have harvested some type of forest products from their land, predominately fire wood for their own use, and an even larger percentage plan to harvest in the future.

Trends in Forest Land Ownership

Although the information presented above is somewhat dated, the general trends will still hold true today because of the relatively slow pace of change in ownership characteristics and land use conversions. Changes will invariably occur, but most of these changes will be continuations of the trends that have already been observed. The land will continue to be parcelized—a reduction in the average size of the land held per ownership—and more and more land will be held because it is a part of a residence and for the aesthetic enjoyment that it provides to the owner. These trends will occur as long as the population pressures continue to increase, the urban fringe continues to expand, and the goal of a “house in the country” continues. These trends will have direct impacts on what the general public can expect from these lands—a gradual reduction in the lands’ ability to supply clean water and green space.

Additional Information

Forest land ownerships in the region are currently being surveyed again and information on these on-going surveys can be found on the National Woodland Owner Survey website (<http://www.fs.fed.us/woodlandowners>). Additional information on forest land ownerships can be obtained from this website or from the following publications:

Best, C., Wayburn, L.A. 2001. America's private forests: status and stewardship. Island Press, Washington, DC.

Birch, T.W., Butler, B.J., 2001. Private Forest Land Ownerships of New York: 1980 and 1994. U.S. Department of Agriculture, Forest Service, Northeastern Research Station Resource Bulletin NE-153, 75 p.

Birch, T.W., 1996. Private forest land owners of the Northern United States, 1994. U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station Resource Bulletin NE-136, 293 p.

Kingsley, N.P., 1975. The forest land owners of New Jersey. U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station RB-NE 39, 24 p.

National Research Council. 1998. Forested landscapes in perspective: prospects and opportunities for sustainable management of America's nonfederal forests. National Academy Press, Washington, DC.

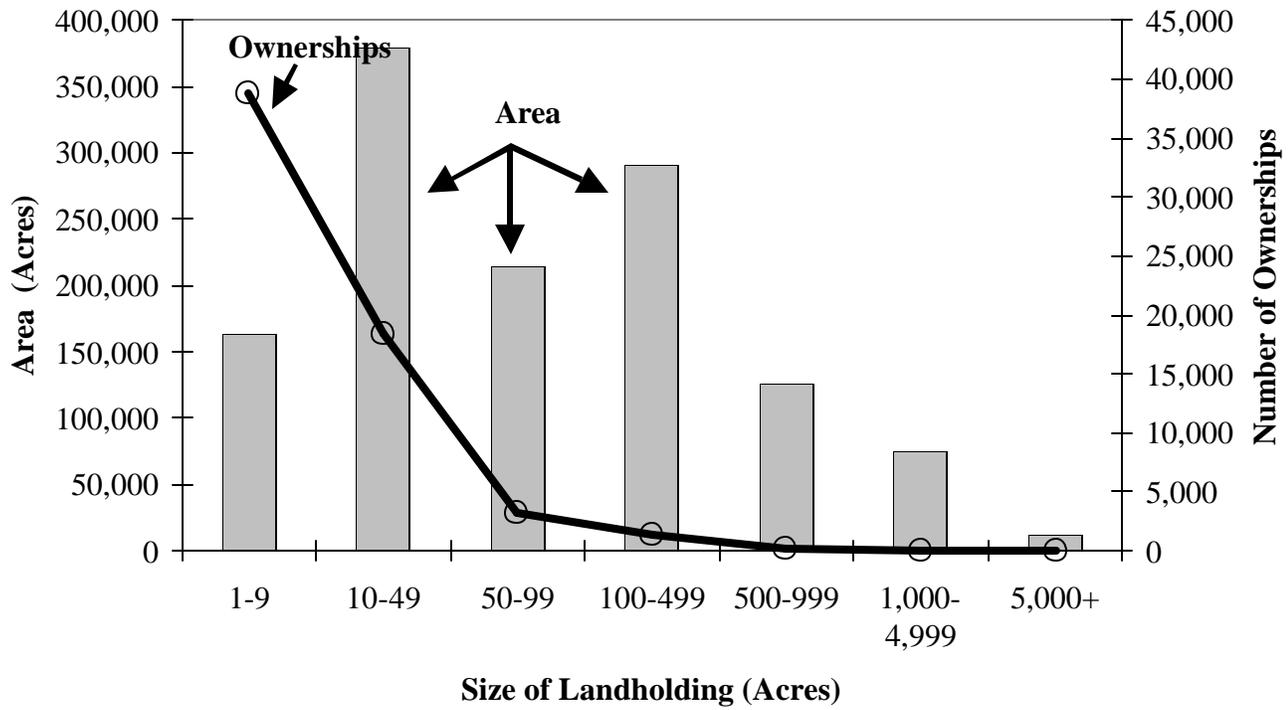
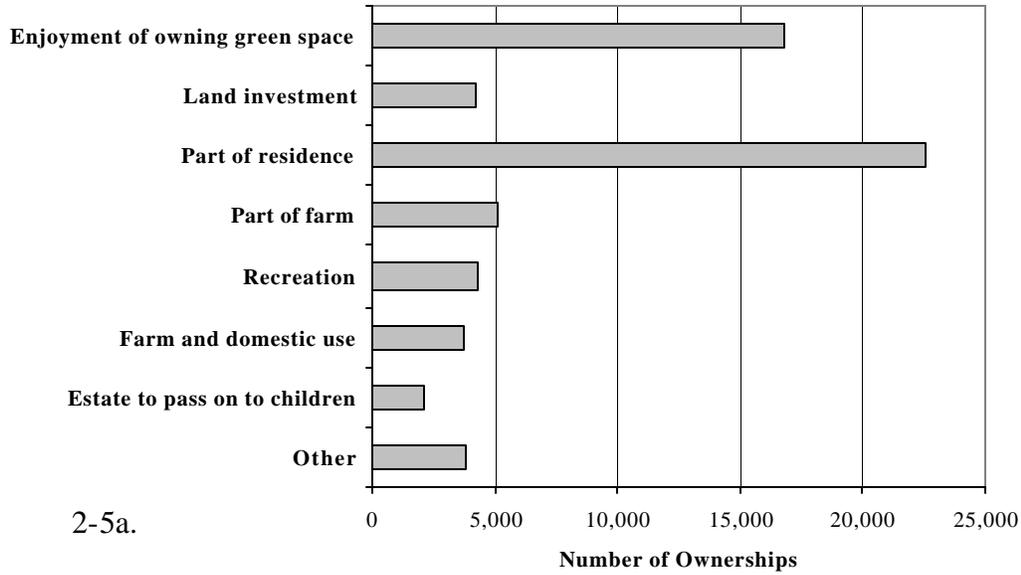
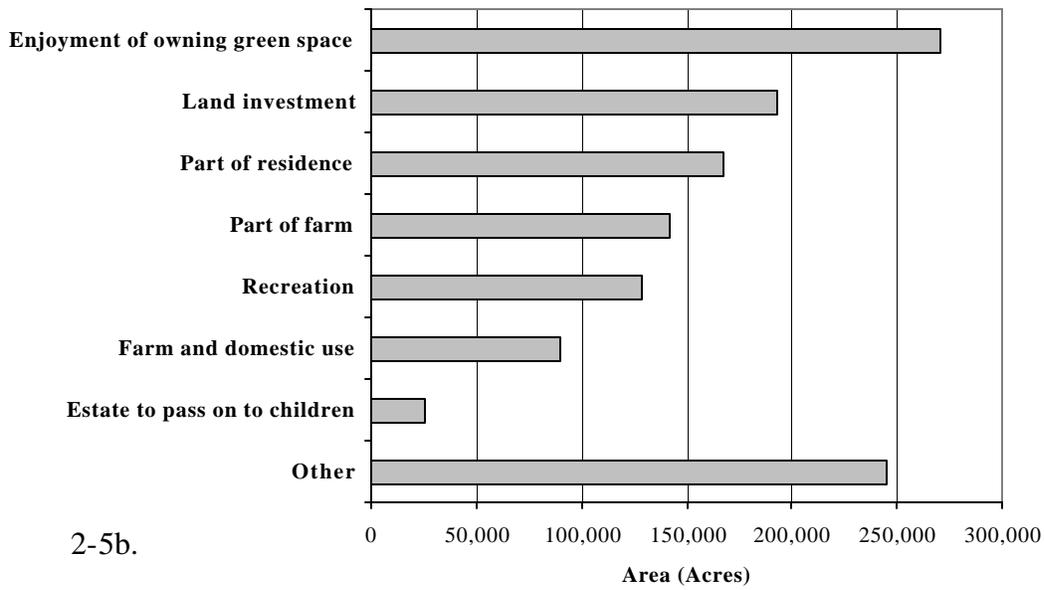


Figure 2-4. Distribution of private forest land ownerships and forest land by size of landholdings in the greater Highlands region of New Jersey and New York, 1991.



2-5a.



2-5b.

Figure 2-5. Ownership objectives of private forest land ownerships in the greater Highlands region of New Jersey and New York by a) number of ownerships and b) area, 1991.

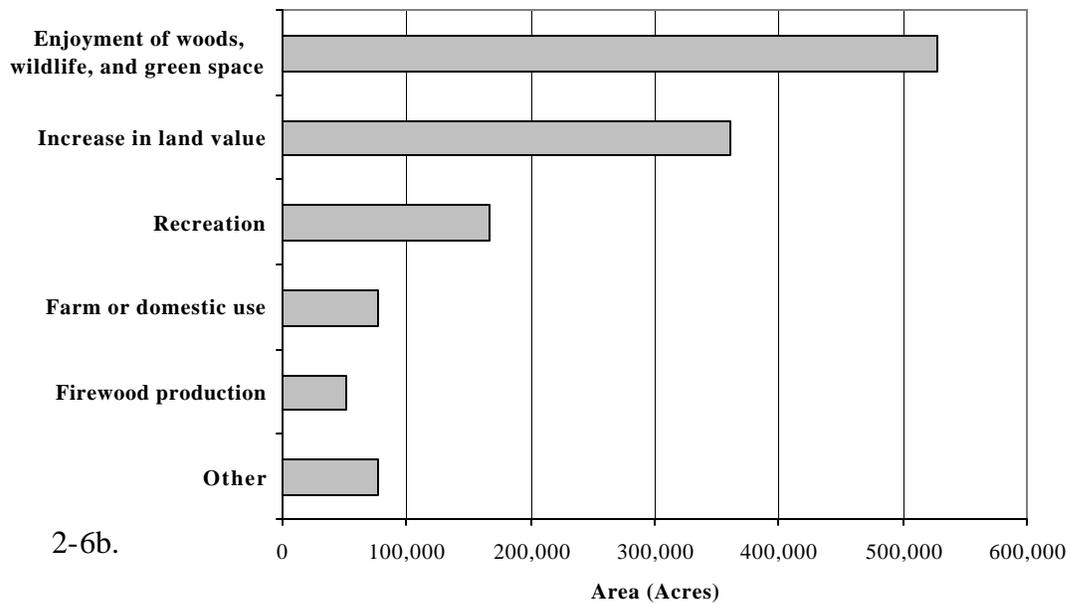
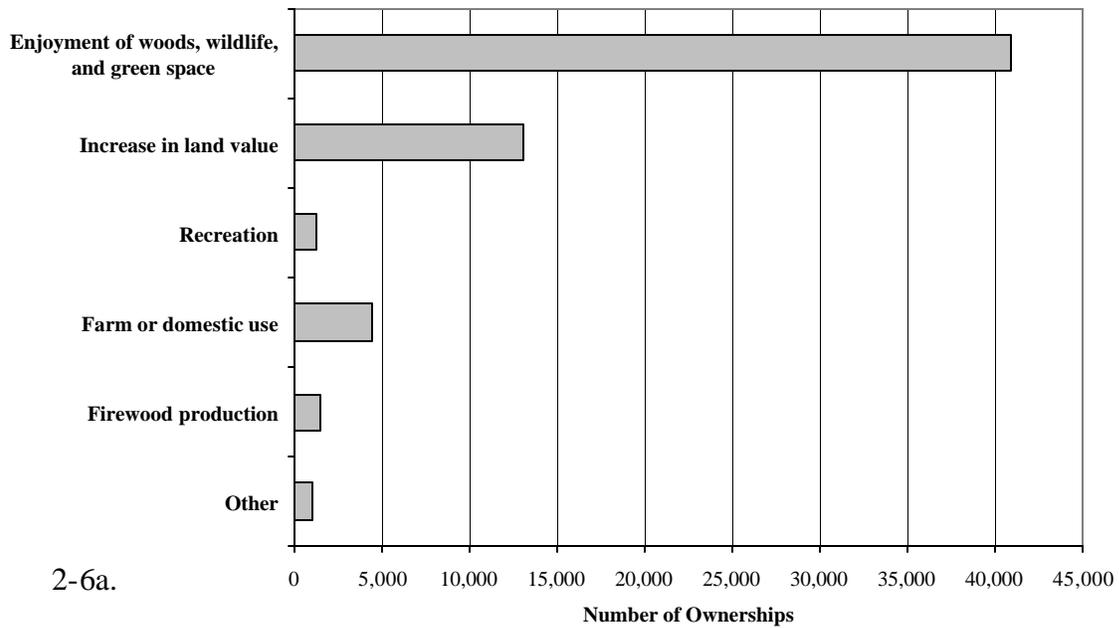


Figure 2-6. Expected benefits of private forest land ownerships in the greater Highlands region of New Jersey and New York by a) number of ownerships and b) area, 1991.