Chapter 2:

The Human-Influenced Forest

Key Findings

- The Chesapeake Bay watershed contains some of the most extensive hardwood forests in the world's temperate latitudes.
- We have lost forestland at a rate of 100 acres per day since the mid-1980s.
- Nearly all of Chesapeake forests have been altered to some degree by human activities and are legacies of past land use decisions.
- More than 750,000 acres of forest—equal to 20 Washington D.C.s—have been lost since 1982, primarily to sprawling development.
- At least 36% of Chesapeake forests are vulnerable to development.
- Sixty percent of Chesapeake forests are fragmented by housing subdivisions, farms, and other human uses.
- Forty percent of all forestland occurs within the wildland-urban interface, a zone where human effects are particularly significant.
- More people own forests than ever before, but they own increasingly smaller parcels with nearly 70% of all family forest owners holding less than 10 acres. This trend, known as "parcelization," threatens forest sustainability.
- Financial incentives for forest conservation and stewardship are insignificant. As a result, forests are primarily managed for short-term economic gains, not managed at all, or sold for development.

Shifting Trends in Forest Cover

The Chesapeake Bay watershed contains some of the most significant reserves of hardwood forests in the world's temperate latitudes.[1] However, human-influenced shifts in the extent and pattern of this globally significant resource are altering the ability of Chesapeake forests to provide habitat, high quality drinking water, recreational opportunities, and other services that plants, animals, and people depend on.

Losing Ground after a Century of Growth

Today, forests cover 58% of the Bay watershed and are the dominant landscape feature of all Bay watershed states except Delaware, where land is primarily agricultural.[2] But after a century of expansion, the extent of Chesapeake forests is declining. The amount of forestland available for wildlife, recreational opportunities, water purification, and other uses has declined by approximately 2%, translating to a loss of over 60 acres per day since 1973 and 100 acres every day since the mid-1980s.[3,4]

Development has been the largest cause of forestland loss for at least the past 15 to 20 years. Between 1982 and 1997, the Bay watershed lost more than 750,000 acres of forestland to development—an area equal to 20 Washington D.C.s.[5] The conversion of forestland to development represents a permanent loss of water filtering capacity, wildlife habitat, and many other functions. Much of this development takes place in recently built suburban areas, away from existing community services such as schools, businesses, and wastewater treatment facilities.

Most forestland is lost through sprawling suburban development, where development consumes more land than is necessary. Even though the average household size decreased over the past 30 years, the average home size increased by 50% and the average residential lot size increased by 60%.[6] This low density, automobile-dependent development now ranks among the top threats to the Bay's recovery and the chief threat to forests.[7] In a study of the 83 most sprawling cities in the United States, Washington, D.C., ranked 26th. Norfolk, Virginia Beach, and Newport News, Virginia, ranked 37th, and Baltimore, Maryland, ranked 64th.[8] Maryland (8th) and Pennsylvania (13th) are also among the top 15 most sprawling states.[9]

Shifts in Chesapeake Forests 1982 - 1997

Source: USDA NRCS / NRI 2005
Note: Statistics are estimates
*Estimates are marginal in terms of statistical reliability.

At-least 36% of all forestland is at high risk to development over the next 5-10 years. For more information, see Chapter 7.

Between 1982 and 1987, nearly 900,000 acres of cropland and pastureland reverted to forest.[5] Much of this forestland likely emerged on marginal agricultural lands because of abandonment and natural succession rather than deliberate replanting. Because the land coming into forests is almost certainly of lower soil quality than the land going out of forest production, it is likely that the overall forest productivity or growth rate has also declined. In addition, the pioneer trees (such as tulip poplar and black locust) that first claim abandoned farmland have resulted in lower quality habitat and economic potential than in surrounding forests.[10]

While forest trends at the Bay watershed scale are instructive, they hide important local and regional trends in Chesapeake forests:

- Virginia: In the 18 years between 1984 and 2002, Virginia lost more than 5% (461,000 acres) of its forestland. Almost 60% of Virginia's counties lost forestland, most from the areas surrounding Richmond, Norfolk, and Washington, D.C.

- Maryland: Maryland lost 6% (141,000 acres) of its forestland between 1986 and 1999. While there were large gains of forestland along the lower Eastern Shore, more than 60% of all counties lost forestland. Most of the loss occurred in the Washington, D.C.- Baltimore area.

- Pennsylvania: Between 1989 and 2003, Pennsylvania lost approximately 1% (100,000 acres) of its forestland. More than 50% of its counties lost

forestland. Most of the loss occurred in the Harrisburg area. Statewide losses were tempered by increases of as much as 24% in more rural counties.

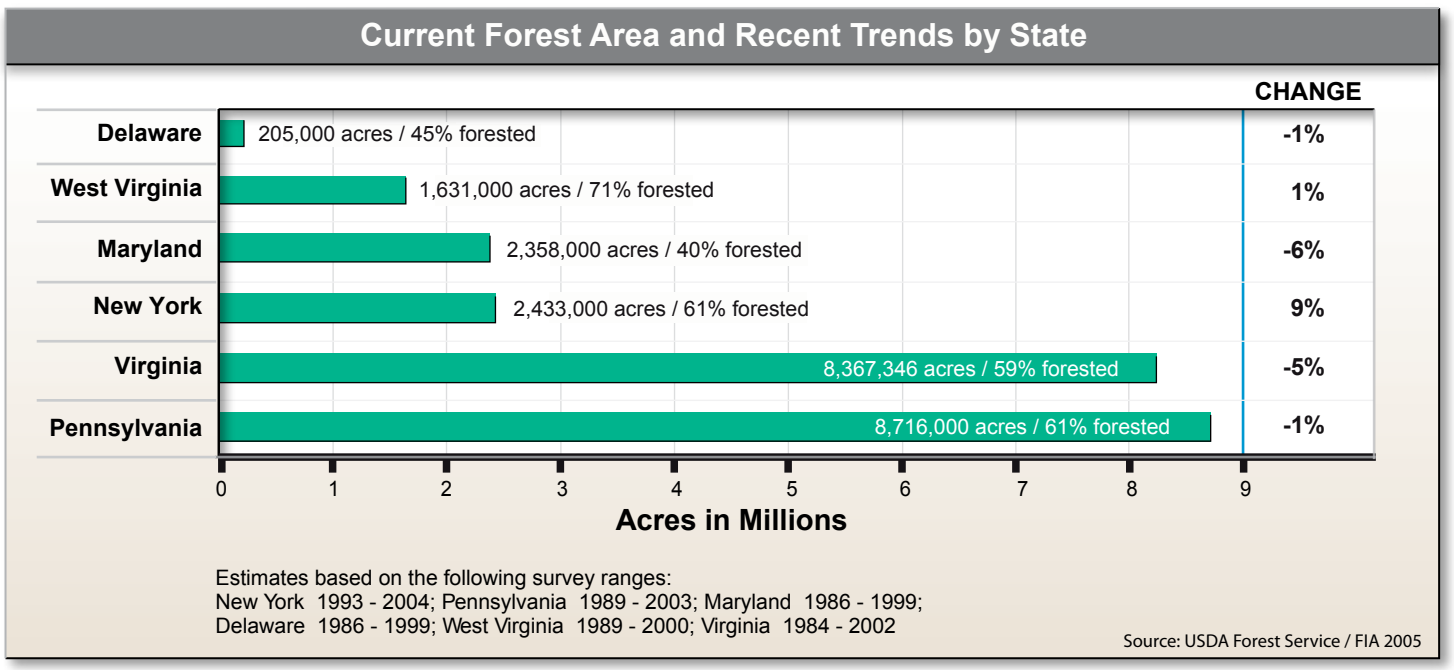
- Delaware: Between 1986 and 1999, Delaware forestland decreased by 1% (3,000 acres).

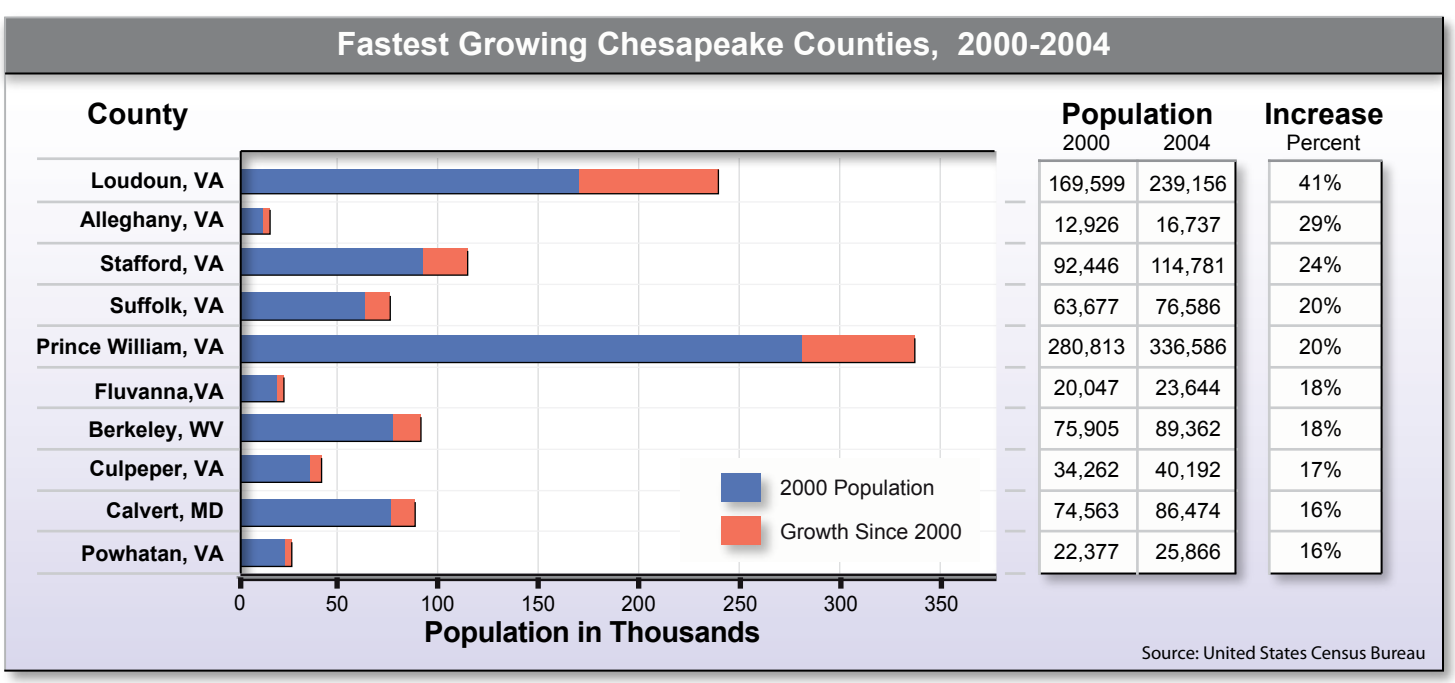
- West Virginia: Between 1989 and 2000, West Virginia gained forestland in more than 70% of its counties. West Virginia gained only 1% (21,000 acres) of Chesapeake forestland, due to large declines in Hampshire County.

- New York: New York gained nearly 9% (200,000 acres) of forestland between 1993 and 2004. Most of these gains were due to the abandonment of grazing lands used in the dairy industry.[3]

Population Growth

Between 2000 and 2004, nine of the 100 fastest growing counties in the United States were located in the Bay watershed. Loudon County, Virginia, located a few miles from Washington, D.C., was the fastest growing county in the nation. However, population growth has not been restricted to urban areas. Allegheny County, Virginia, nestled in the Appalachian Mountains, was the 12th fastest growing county over the same period.[11] The Bay watershed population will continue to rise—approaching 19 million by 2030—and more homes, roads, and other types of development will be built in order to accommodate these new residents.[12] The ways in which this growing population is accommodated will have a large effect on the extent, condition, and management of Chesapeake forests.



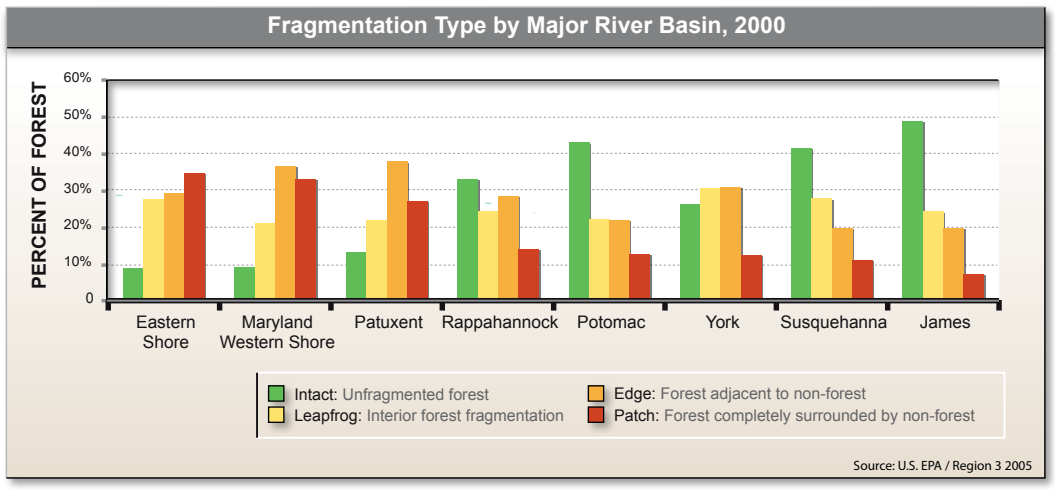


County	Population 2000	Population 2004	Increase Percent
Loudoun, VA	169,599	239,156	41%
Alleghany, VA	12,926	16,737	29%
Stafford, VA	92,446	114,781	24%
Suffolk, VA	63,677	76,586	20%
Prince William, VA	280,813	336,586	20%
Fluvanna,VA	20,047	23,644	18%
Berkeley, WV	75,905	89,362	18%
Culpeper, VA	34,262	40,192	17%
Calvert, MD	74,563	86,474	16%
Powhatan, VA	22,377	25,866	16%

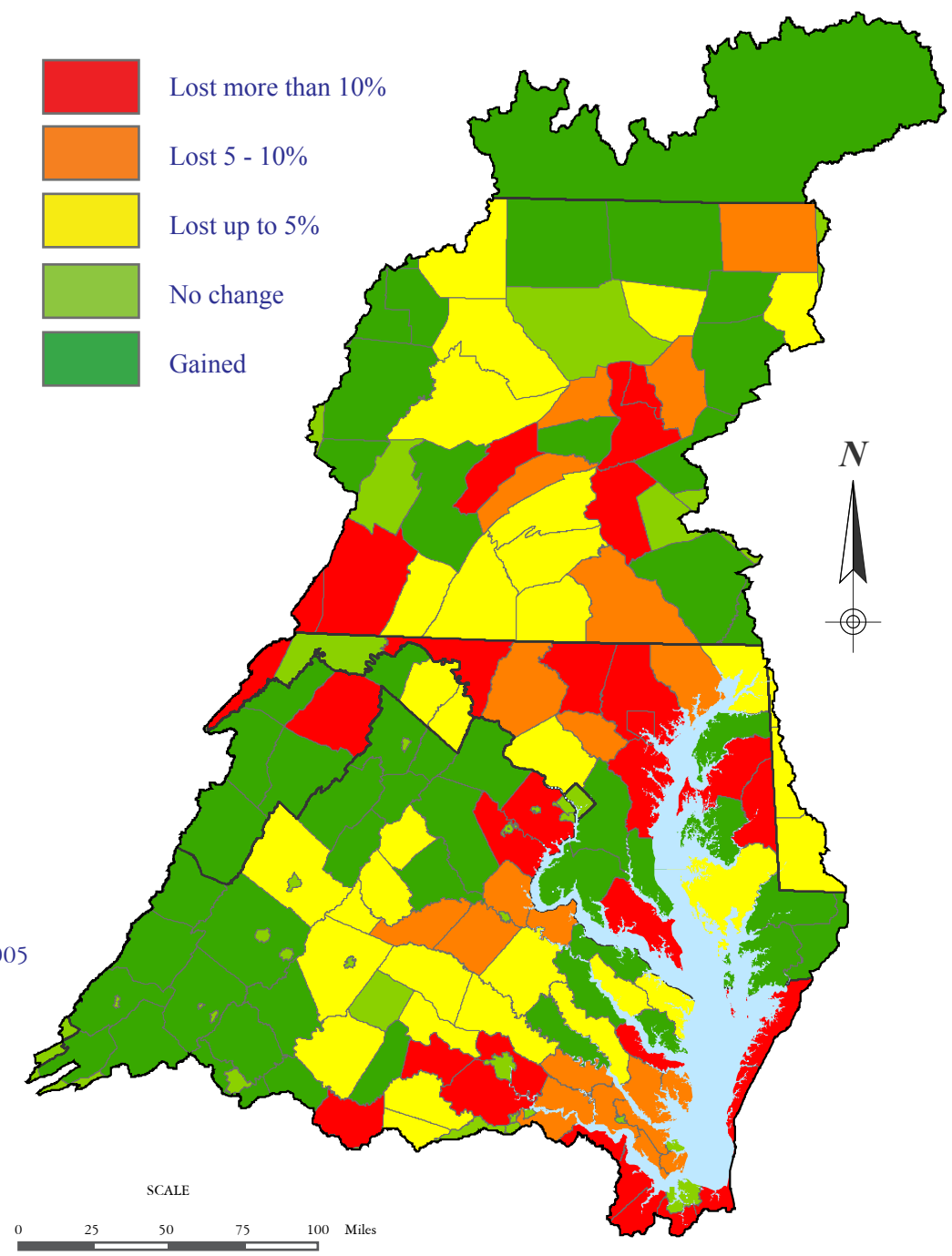
The Fragmented Forest

Roads, housing subdivisions, farms, and other human uses divide 60% of Chesapeake forests into disconnected fragments surrounded by other land uses.[13] Fragmentation reduces total habitat area and isolates animal and plant populations. It also introduces negative influences—known as edge effects—to nearby forestland, leaving it more vulnerable to invasive species and sources of wildfire. The increase of forest stressors and nearby human populations makes forest management increasingly difficult, particularly for invasive species and forest products.[14] Road construction also increases stormwater runoff and nutrient delivery to streams.

More than 40% of forestland is characterized by "leapfrog fragmentation," where human uses have jumped over existing development and punched holes in forest interiors.[13] Leapfrog fragmentation is especially damaging because it introduces edge effects deeper into intact forests and tends to attract further development.[15]



County Forest Cover Trends



TIME PERIODS:
New York 1993 - 2004
Pennsylvania 1989 - 2003
Maryland 1986 - 1999
Delaware 1986 - 1999
West Virginia 1989 - 2000
Virginia 1984 - 2002

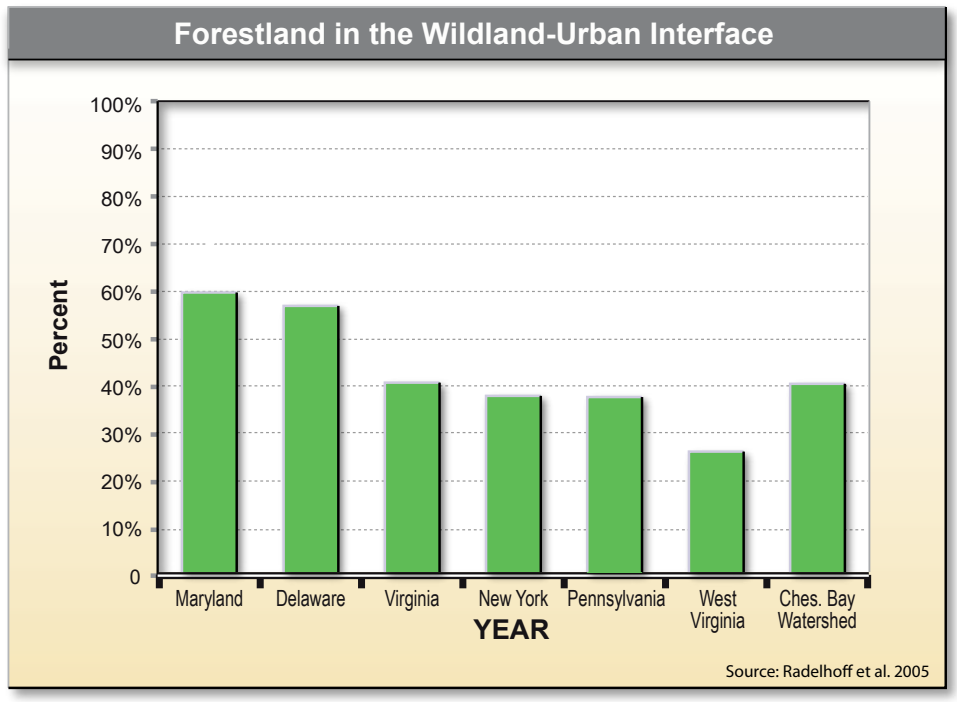
INTERPRETATION:
Over the past 20 years, the Chesapeake Bay Watershed has lost around 2% of forestland. The amount of change varies significantly however across the region. The greatest loss occurs in rapidly suburbanizing regions.

SOURCE: USDA Forest Service / FIA 2005

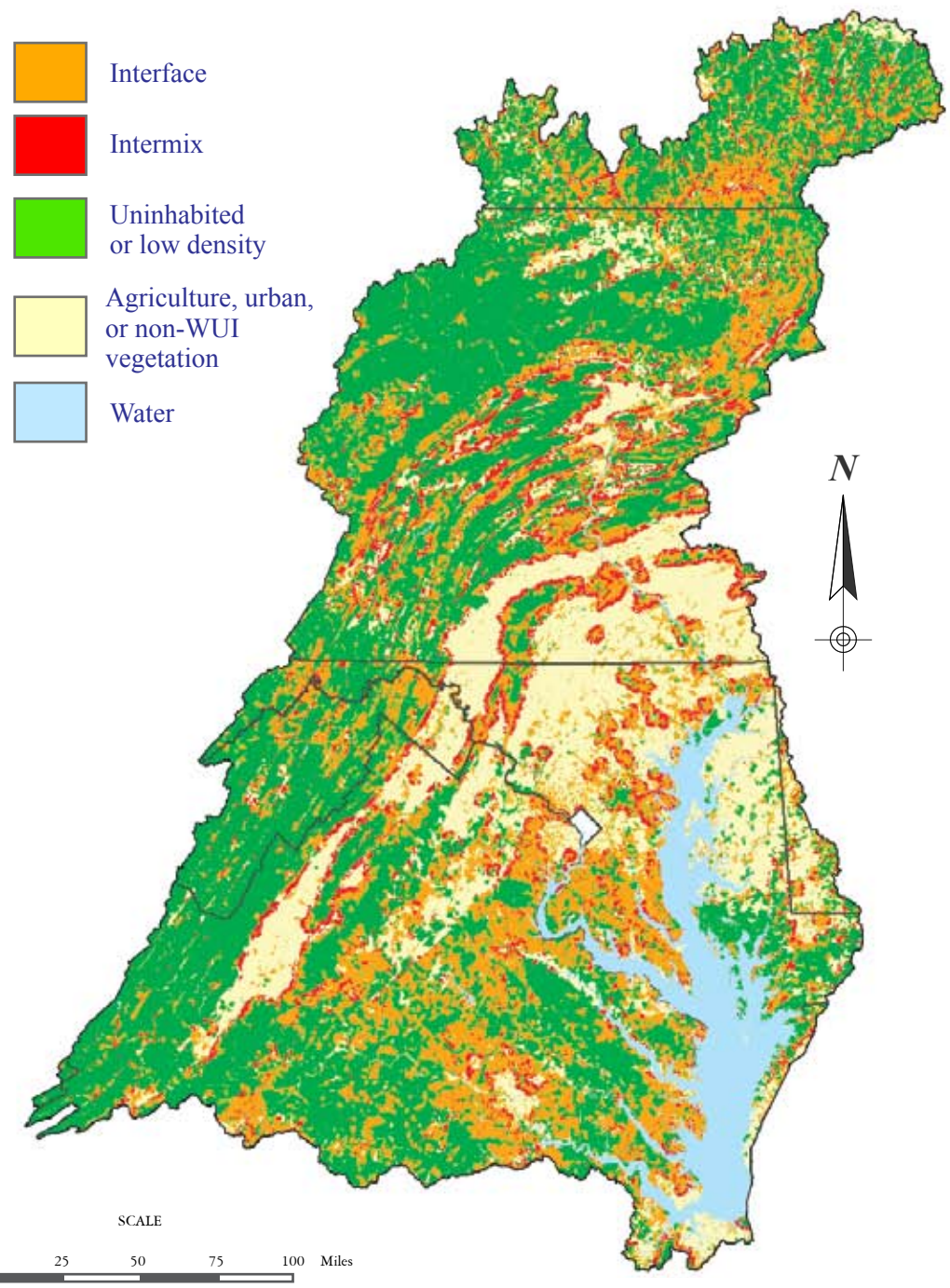
The Wildland-Urban Interface

Currently, 40% of all Chesapeake forests are influenced by development.[16] These forests exist in areas that are transitioning from rural forest to mixed uses dominated by development, known as either the wildland-urban interface or intermix. The interface includes residential development with at least one house per 40 acres. The intermix contains the same residential density range, but is nested within intact forests. An analysis of deforestation patterns in the Baltimore, Maryland region, revealed that the wildland-urban intermix is common with large lot residential development,[17] which consumes more land and requires greater amounts of infrastructure than more compact forms of development that include a variety of land uses.[18]

Another way to describe the pattern of forests across the Chesapeake landscape is to consider how much land is relatively free from human influence. The Wilderness Society mapped the degree of "wildness" in the Bay watershed. The term "wildness" reflects the land's naturalness and freedom from human control. As such, wildness captures not only important elements of ecological integrity, but aspects of the land relating to the human experience of a place, like remoteness and provision of solitude.[19] The wildest remaining areas are mostly located in southern and western Virginia and northern Pennsylvania. These regions have low population density, little development, and few pollution sources. Virginia still has more than 387,000 acres of roadless areas—the most of any state east of the Mississippi.[20]



Wildland-Urban Interface



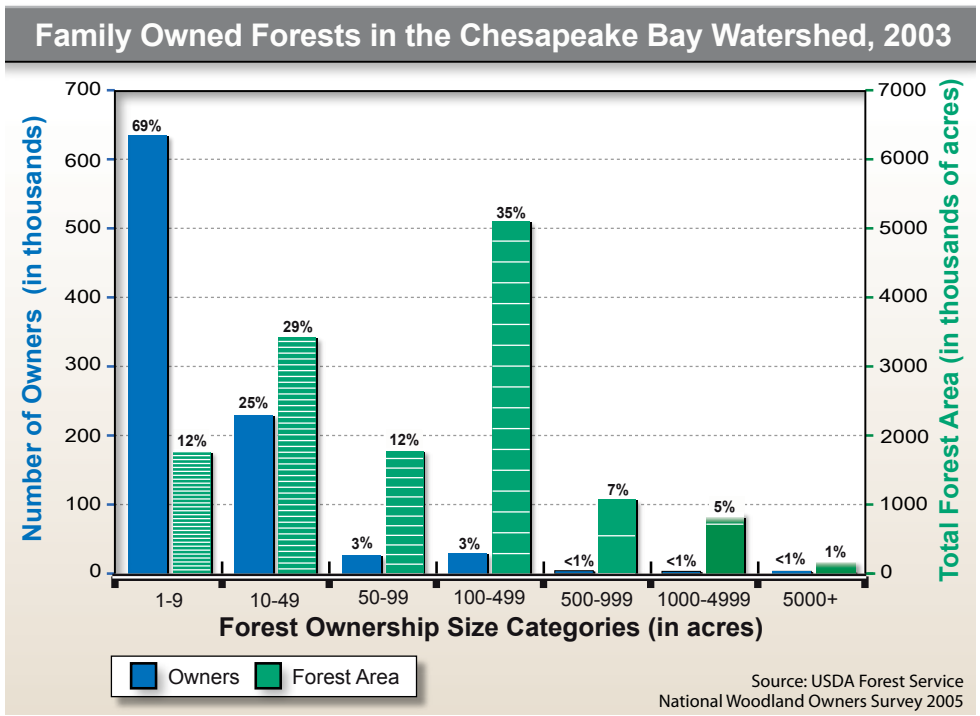
INTERPRETATION:
Around 40% of all Chesapeake forests occur in areas of transition between forestland and development known as the wildland-urban interface and intermix. The interface is essentially development with more than one house per 40 acres within 1.5 miles of intact forest. Intermix is development in the same density range that occurs within intact forests - a type of fragmentation that leapfrogs forestland edges to create holes in the interior.

SOURCE: Radelhoff et al. 2005

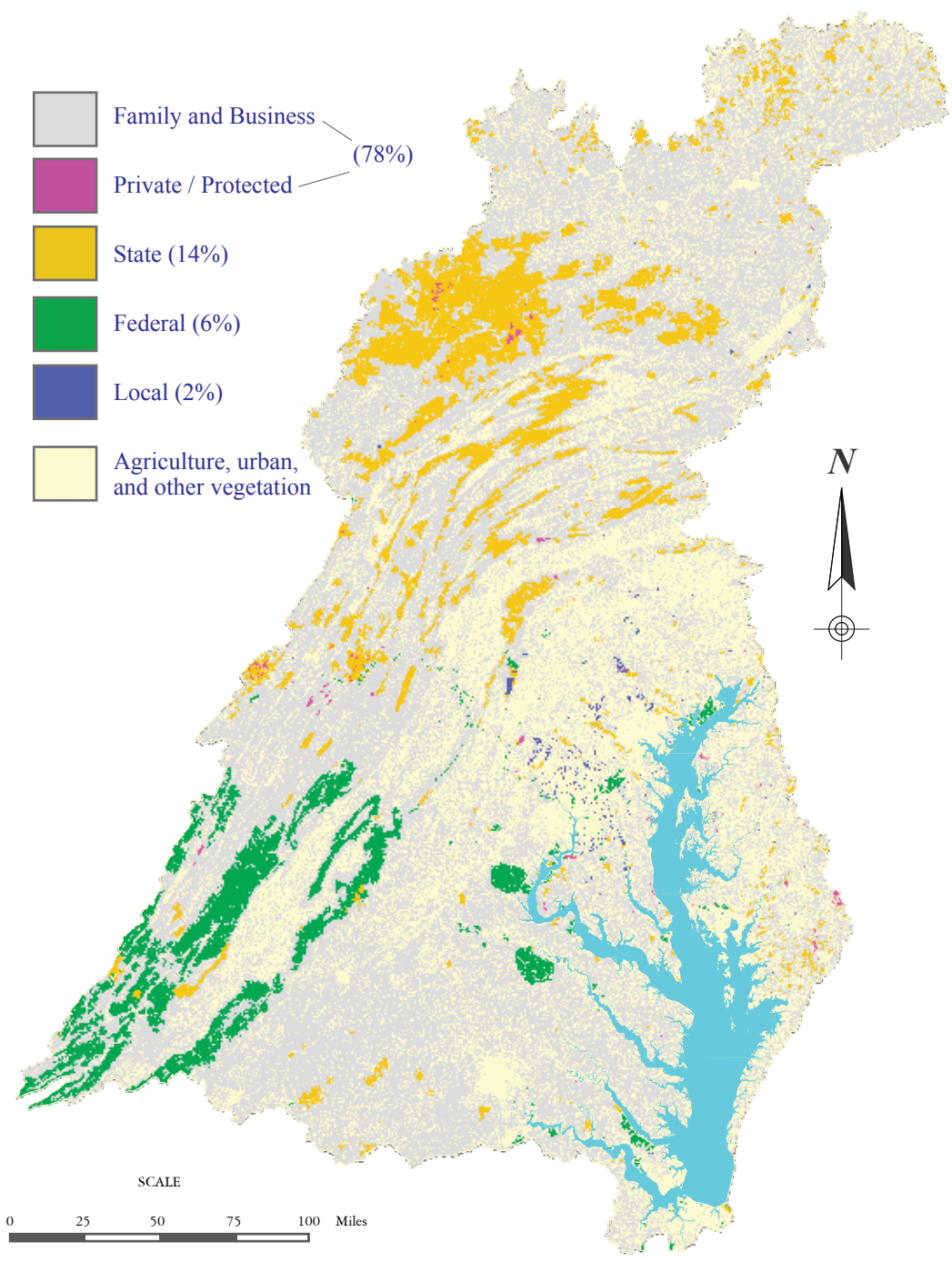
Parcelized Forests

Forest parcelization occurs when large tracts are sub-divided and sold to multiple owners. The land may remain mostly forested, but the complexity of the ownership pattern changes dramatically. This trend has dominated Chesapeake forests in recent decades and is increasing the risk of forest loss. Forest parcelization is caused by a number of factors, including rising land values, the sale of industrial forestland, and use of large lot zoning by local governments. This condition often creates a self-reinforcing cycle, as development brings new roads, sewers, and other infrastructure to formerly forested areas, and the surrounding forest becomes increasingly accessible for development. As land values rise, forest owners consider further parcelization to offset increased tax rates.[21]

In the past decade alone, the Bay watershed has experienced a 25% increase in the number of family forest owners. Their numbers will continue to rise in the near future, in part because more than 70% of family forest owners are more than 55 years old. Over the same period, the average size of family forests decreased by 24%. Today, almost 70% of family forest owners own less than 10 acres. A large contiguous forest broken into many smaller ownership tracts, brings added difficulties in reaching landowners, reduces the likelihood of active management, and increases the risk of forest loss to other uses. While there are exceptions, the size of a forest holding is an important factor in determining whether the owner is likely to use expert forest information, feels "connected" to the forest as a resource, and become engaged with the larger forestry community.[10]



Forestland Ownership



INTERPRETATION:
Nearly 80% of forests are privately owned (64% Family and 14% Business). Therefore, forestland conservation, restoration, and management on private lands will determine the future breadth and condition of Chesapeake Forests.

SOURCE: Chesapeake Bay Program 2005, USDA Forest Service/National Woodland Owners Survey 2005

Photo: Baltimore County, Maryland

In Baltimore County, Maryland, dozens of ownerships (blue) dissect the riparian forest corridor (red) increasing the difficulty of managing and conserving the forest.

Forest Management

Sustainable Management

Over the past 400 years, change has affected forest conditions in almost every area of the Chesapeake Bay watershed. In many areas, the forest we see as just a collection of trees belies the legacy of historic changes that affect the health and future growth of the forest and the benefits it will provide to wildlife, water, and people. Historic and current forces of change are limiting the natural ability of forests to sustain their long-term health, growth, diversity, and overall integrity. For example, the few areas of forest that were never cleared for logging or farming are too small to withstand disturbances like insect outbreaks or hurricanes.

Often, active management of surrounding forests can enhance their sustainability. While governments and forest product companies have worked hard to increase the use of sustainable management, the practice is still limited on family-owned land. There remains a substantial debate among professional foresters and many in the public about the role and nature of forest management and forest harvesting. However, without the use of sustainable forest management, the vital watershed services of Chesapeake forests—their ability to clean water, nurture wildlife, and store carbon—are significantly diminished.

In rural landscapes, sustainable forest management can focus on restoring functioning, self-sustaining forest ecosystems. The removal of trees through harvesting is one of many management tools. Many Chesapeake forests are overcrowded due to their regrowth on abandoned fields, fire suppression, and the use of poor harvesting methods in the past. Thinning a forest at the right age can relieve these conditions and provide space for trees to grow. Other methods such as controlled fire, reforestation, and deer fencing can be used to improve overall forest conditions. Harvesting can also be used to imitate the effect of natural fire by creating forest openings and controlling the dominance of undesirable or competing tree species. The removal of individual or small groups of trees can mimic the natural small canopy openings that develop when trees die.

Without professional assistance or education, most landowners are not aware that sustainable forest management can provide long-term income and healthy wildlife habitat. Too often, the decision by a landowner to harvest trees is made to maximize short-term profit at the expense of future sustainability. In the long run, these approaches can shift plant composition, reduce average tree size, limit regrowth, and lower biodiversity, making the entire forest less productive for both timber and wildlife. One problematic practice is to "cut the best, and leave the rest"—also known as high grading. Removing all of the biggest, best, and most valuable trees can leave only less fit or poorer quality trees to regenerate the forest. High grading not only reduces future economic return, but also reduces the overall health of the forest for generations and eliminates wildlife food sources and important habitat features.

The Vital Role of Family Forest Owners

While land use decisions by all owners are important, family-forest owners in the Chesapeake Bay watershed will ultimately decide whether forests are managed sustainably, converted to other land uses, or left alone. Currently, more than 900,000 family forest owners hold 64% of all forestland in the Bay watershed. Fewer than 20% of owners (2,500 acres) have written forest management plans and only a third (5,000 acres) have sought professional advice, even though the benefits of sustainable forest management are becoming better known.[22]

Most forest owners would likely agree with the principles of sustainable forest management, since most want to protect the scenery, wildlife, and long-term integrity of their land.[21] There is also a strong public desire to protect forestland and other natural resources throughout the Bay watershed. For instance, between November 1996 and May 2005, citizens in Bay watershed states voted "yes" on more than 88% of measures introduced to support the conservation of

Public Support for Land Conservation, 1996-2005

State	Total Measures	% of Measures Approved	Funds Approved (in millions)
Delaware	1	100%	$4,250,000
Maryland	9	100%	$31,044,000
New York	64	91%	$1,273,088,957
Pennsylvania	73	82%	$463,455,644
Virginia	17	94%	$288,089,696
West Virginia	2	100%	$12,000,000
Total	166	88%	Total Public Support $2,071,928,297

Source: Land Vote Database, Trust for Public Land 2005

natural and scenic landscapes, making more than $2 billion available for these efforts. In more than 40% of the measures, citizens actually voted to directly tax themselves.[25]

Why, then, are the majority of family forest owners not managing their land or seeking professional assistance? Although state and federal forestry agencies have created professional landowner assistance programs, the availability of these programs alone has not been enough incentive. One key reason is that no comprehensive program exists to adequately reward small tract family forest owners who sustainably manage their land, despite the multiple economic, societal, and ecological benefits that these forests bring to the Bay watershed and its residents.[26] In contrast, agricultural landowners can currently avail themselves to a plethora of programs that provide millions in financial support for conservation practices. In 2004, Chesapeake states received over $130 million to provide financial assistance to farmers to support conservation practices on their land.[27] These agricultural incentives totaled more than 11 times the amount that forestry received from the USDA Forest Service.[28] Furthermore, forestry funding was mainly to make technical assistance available, unlike the farming programs that provided financial incentives directly to landowners.

Also, traditional methods of providing education and assistance to forest landowners are simply not able to reach the thousands of new forest owners being created by continued parcelization. The difficulty of educating so many landowners reduces the likelihood of sustainable forest management and increases the opportunity for forest loss or harmful harvesting practices. Owners of small private forests are also less likely to accommodate public access for recreation.

What is Sustainable Forest Management

Sustainable forest management considers the entire forest ecosystem—all the parts of a forest—and not just the valuable timber trees. Forestry is sustainable if it plans for the future health of the forest ecosystem and considers wildlife, soil, and water resources. Consideration of both short- and long-term economic returns is compatible with sustainable management. Forestry is not sustainable when it removes value from the forest in the short term while sacrificing future regeneration or regrowth of a new forest.

The specific goals and practices of sustainable forest management depend on the nature of the forest itself and its place in the surrounding landscape. Because forests exist in a variety of settings—rural, suburban, and urban—they have a different mix of stressors and desired benefits. Rural management may focus on enhanced wildlife habitat, drinking water supplies, and the value of products the forest produces. Suburban forest management may strive to connect forest habitats separated by development, infiltrate rainfall for groundwater recharge, and protect the health of streams. Urban management emphasizes increased tree cover to remove air pollution, reduce storm water runoff, enhance communities, create parks, and provide other social and environmental benefits.

Forest certification legitimizes and ensures sustainable public and private forest management and provides access to new markets like green builders by providing a "seal of approval." The American Tree Farm system has certified over 3,500 forests representing sustainable management on nearly 900,000 acres in the Chesapeake Bay watershed.[23] The Forest Stewardship Council has certified nearly 2 million acres of Chesapeake forests—the majority occurring on state forestland in Pennsylvania.[24]

Photo: Don Outen

A Sustainably Managed Forest

Indicators for Sustainable Chesapeake Forests

As human influences grow in the Chesapeake Bay watershed, indicators will be critical to tracking forest conditions and progress towards sustainability. The following indicators will help organizations address key findings presented in this chapter:

- Forest and total land area
- Forestland lost to development
- Net change in forestland

Chapter in Perspective

After a century of expansion, forests now cover 58% of the Chesapeake Bay watershed and again provide a "sense of place" for most of the region. However, sprawling development and other human activities are compromising the condition of Chesapeake forests and redefining their value to the Bay watershed's environment, economy, and quality of life. For example, fragmentation is defining which forest-dependent plant and animal species thrive in the Bay watershed by altering the mix of forest habitats. The degree of human activity is also influencing whether the forest products industry can still provide a valuable source of jobs and income to many rural areas. The connection between forest condition and the function of forests for biodiversity, water quality, quality of life, and economics is explored throughout this report.