

Maryland Coastal Bays Forestry Strategy

April 2002



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The Mission of the Department of Natural Resources: To inspire people to enjoy and live in harmony with their environment, and to protect what makes Maryland unique- our treasured Chesapeake Bay, our diverse landscapes, and our living and natural resources.

Abstract

Forests are a preferred land use for providing water quality and habitat, basic needs for a healthy environment. The Maryland Coastal Bays watersheds cover more than 117,000 acres in eastern Worcester County and are 38% forested, compared to a statewide average of 41% forest cover. Development is concentrated in the northern areas near Ocean City, a trend that is expected to continue, while the southern Bays are remaining primarily rural. The forest composition is estimated to be 21% pine, 53% mixed pine/hardwood, 20% hardwood, 4% oak/sweetgum/cypress, and 2% elm/ash/red maple, based on 1998 GAP data. Forest stocking (volume/acre) in the region has expanded 12.9% in the last decade, and the harvesting rate is estimated to be 1.2%, based on 2000 data.

Issues for the Coastal Bays Program include improving habitat for forest interior dwelling species and maintaining rural landscapes with working forests. Opportunities for increasing forest cover, with a focus on hardwoods for bird habitat, include increases in cost-share rates for hardwood establishment, more favorable treatment of forests in tax policies, and streamlining use of the alternative management plan option in the Seed Tree Law for hardwood management. Outreach and education efforts can assist landowners interested in managing forests for a range of benefits. During development, afforestation and forest easements can be further encouraged on required open space and designed to maximize size of forest patches. Efforts also need to be made to retain a healthy forest industry, a fundamental factor in encouraging the widest range of landowners to favor forests as an economically viable land use and maintain forests on the landscape.

Acknowledgements

This report was prepared with the advice of and for the use of a forestry work group convened by the Coastal Bays Program in January 2002: Dave Wilson, Jr., Coastal Bays Program; Bill Grogran, Salisbury University; Bob Cadwallader, Ocean Pines forester; Bruce Nichols, NRCS; Carol Cain; Carolyn Cummins, Worcester County Council; David Honick; Gere Redden; John Roeder; Keith Lackie; Kip Powers and Rachel Egolf, MD DNR Forest Service; Scott Smith, MD DNR Wildlife and Heritage Service; Tony DiPaolo, Cropper Bros. Lumber Co. Pat Patterson provided expert assistance with creating GIS coverages of GAP data for the Coastal Bays. Jon Chapman provided management plan and harvesting data for Worcester County. Brent Harding, the Coastal Bays forester in 2000 and 2001, provided detailed harvesting data for 2000, much of the information for issues and opportunities, and laid the groundwork for the report through his work with Coastal Bays landowners. Many thanks to all! This project was funded in part by the U.S. EPA Section 319 Nonpoint Source Program. Although this project is funded in part by the Environmental Protection Agency, it does not necessarily reflect the opinion or position of the EPA.

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Introduction: The Coastal Bays Forest

The Coastal Bays spread over more than 117,000 acres, and are 35% forested, lower than the current statewide average of 41%. They comprise the eastern portion of Worcester County, about 39% of its land base. Five watersheds of the Maryland Coastal Bays are discussed in this report (Figure 1). The Atlantic Ocean watershed (02130101) is small and has very limited forest area, and is not included in the forest analysis here.

Forests are an important natural resource, forming the backbone of habitat for many wildlife species and supplying critical elements for aquatic habitat in streams and rivers. Forests have one of the lowest nutrient export rates of any major land use. Forest canopies and soils create a very moderate hydrology, infiltrating most rainfall and sustaining base flows in streams essential for aquatic life. Forests provide an underpinning of the rural economy and an integral part of traditional lifestyles on the Delmarva Peninsula.

The Coastal Bays Management Plan identified several issues related to Coastal Bays forests, ranging from improving habitat for forest interior dwelling birds to sustaining working forests for a natural-resource-based rural economy. This report will:

- identify existing pressures and conditions in the forests of Maryland's Coastal Bays,
- outline some existing programs available to moderate impacts of pressures, and
- describe opportunities to improve forest condition to better meet environmental and socioeconomic goals.

This report is not intended to identify forestry prescriptions on a stand by stand basis or identify particular parcels for a practice. The Coastal Bays watersheds are predominantly privately owned, so any watershed-wide management strategy should acknowledge and incorporate private property rights and restrictions. Landowner objectives are the fundamental basis for forest management plans, and offer tremendous opportunity for meeting both environmental and economic goals. Most forestry programs are voluntary, although some are required by law (e.g., Forest Conservation Act for development, seed tree law for pine harvesting, sediment and erosion control for any forest harvesting).

Developed land uses are concentrated in the northern portion of the watershed, especially in Isle of Wight and Assawoman watersheds (Figure 2). DiPaolo (1988) reported an average parcel size of 12 acres in the Coastal Bays north of Route 50, the main highway into Ocean City, compared to 113 acres south of Rt. 50, almost ten times the parcel size. The southern Coastal Bays (Newport and Chincoteague) have a more rural landscape, primarily farm and forest. Forests management is much more likely and more cost-effective on parcels greater than 10 to 25 acres. Population density is related to parcel size, and trends since 1988 can be seen. The Chincoteague basin averaged over 28 acres of land/person in 1990, a ratio that remained essentially the same in 2000 (Table 1). The Assawoman basin averaged 2.1 acres/person in 1990, but only 1.3 acres in 2000.

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**MARYLAND'S
COASTAL BAYS**

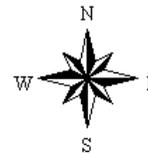
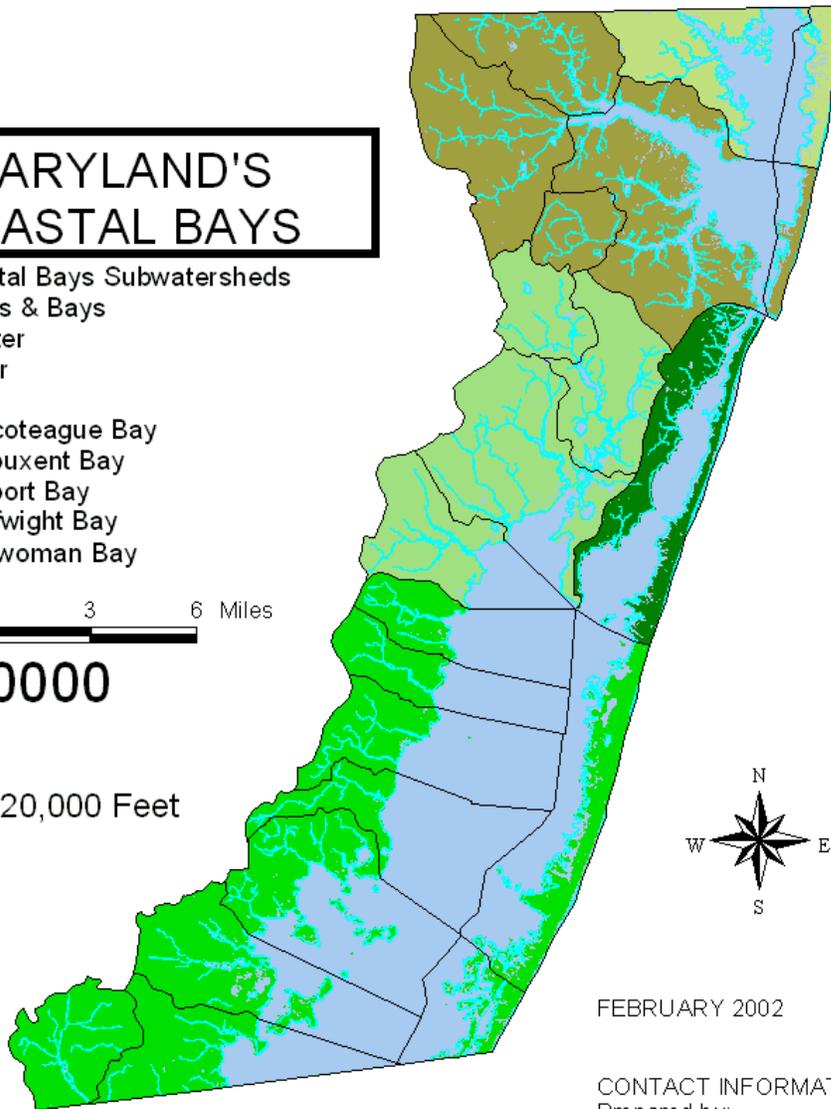
-  Coastal Bays Subwatersheds
-  Rivers & Bays
- Land - Water**
-  Water
-  Land
-  Chincoteague Bay
-  Sinepuxent Bay
-  Newport Bay
-  Isleofwight Bay
-  Assawoman Bay

3 0 3 6 Miles



1:240000

SCALE:
1 Inch = 20,000 Feet



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Figure 1: Maryland Coastal Bays Watershed Drainages

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LAND USE LAND COVER
(MD Office of Planning Based)

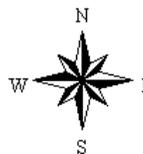
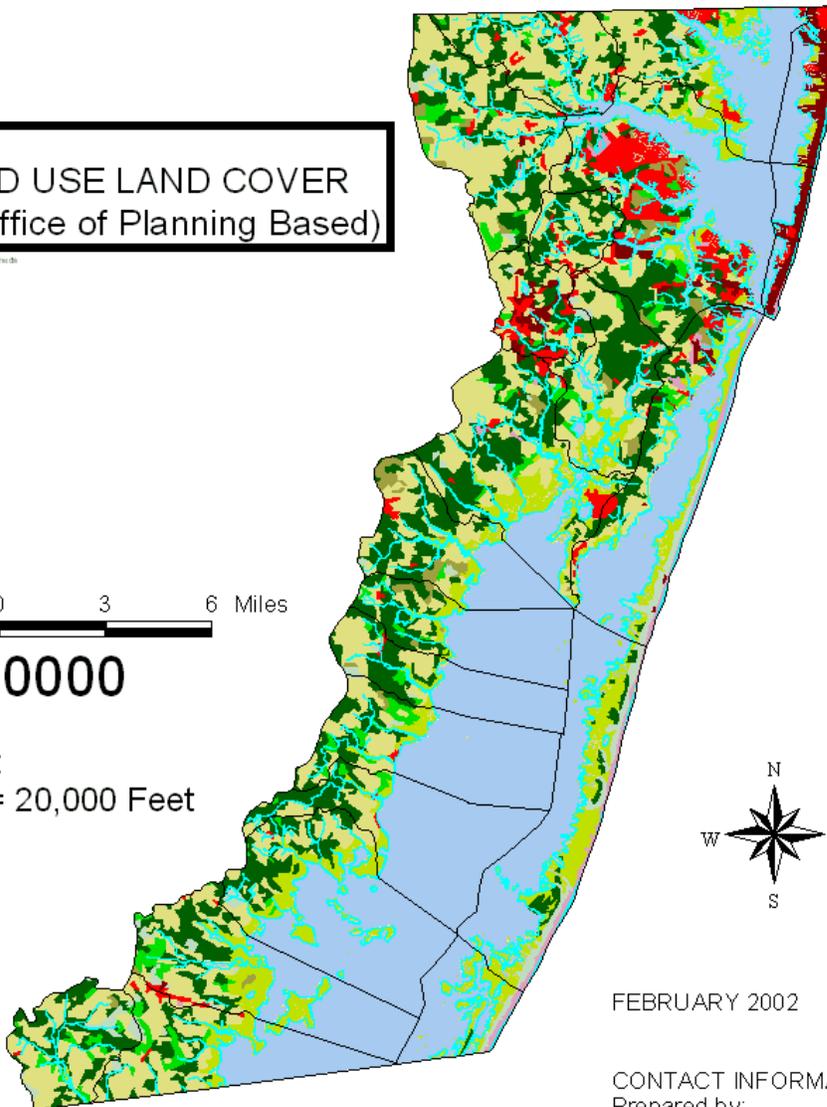
-  Coastal Bays Subwatersheds
-  Rivers & Bays
-  Low-Density Urban
-  Medium-Density Urban
-  High-Density Urban
-  Commercial
-  Industrial
-  Institutional
-  Recreative
-  Open Urban
-  Crop Land
-  Pasture
-  Orchard
-  Row-Crop
-  Hardwood Forest
-  Mixed Forest
-  Mixed Pine Forest
-  Shrub - Cuts
-  Water
-  Marsh
-  Beaches
-  Bare Ground
-  Subwatershed - Ag
-  Forest Operations
-  Agricultural Buildings
-  Land - Water
-  Land

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Figure 2: Land use in Maryland Coastal Bays watersheds, 1994 data from Maryland Department of Planning (then Office of Planning)

Table 1: Population density trends in the Maryland Coastal Bays watersheds, Worcester County Regional Geographic Information Technology Program population and Maryland Department of Planning acreage

Watershed	Acres in MD	1990 Population	2000 Population	1990 Ac./person	2000 Ac./person
Assawoman Bay	6,856	3,216	5,109	2.1	1.3
Chincoteague Bay	42,728	1,511	1,448	28.3	29.5
Isle of Wight Bay	33,496	11,470	19,595	2.9	1.7
Newport Bay	27,186	5,071	6,030	5.4	4.5
Sinepuxent Bay	7,505	601	1,188	12.5	6.3
All Coastal Bays	117,771	23,859	35,370	4.9	3.3

Forest Inventories in the Coastal Bays

The earliest standardized inventory relevant to the Coastal Bays forests is the 1916 publication, “The Forests of Maryland”, by F. W. Besley, Maryland’s first State Forester. It provides estimates by county and election district for forest cover, species groups, board feet, and stumpage value. Regular forest inventories are conducted every ten to fifteen years by the USDA Forest Service in cooperation with the State. The most recent inventory, “Forest Statistics of Maryland: 1986 and 1999”, was just completed in 2001, and is based on field data (Frieswyk, 2001). It includes estimates of forest acreage, stocking, volume, size classes, and species groups by region and county. Regional estimates have a smaller standard error (+/- 3300 acres for regional data versus +/- 7400 acres for county data). Other inventories are based on remotely sensed digital images that can be classified based on spectral signatures of different cover types. The USDA Natural Resources Conservation Service developed the Natural Resources Inventory, which provides 1997 estimates of land cover and forest type by Major Land Resource Areas, based on physiographic provinces. The Mid-Atlantic GAP project has collected data on a much greater variety of land cover/habitat types, and is based on data sources from 1998 and 1999.

Most estimates of forest cover, like the USDA Forest Service Forest Inventory and Analysis and the USDA Natural Resources Conservation Service Natural Resources Inventory, are designed to be reliable at a larger scale than the Coastal Bays watersheds. Other digital land cover datasets do not have much distinction among forest types. GAP vegetation data provides enough detail to make estimates of different forest types specifically for Coastal Bays, and is used primarily to distinguish species types. For easier comparison to regional forest cover estimates that can illustrate trends over time, the GAP vegetation types were condensed into categories similar to those used by the USDA Forest Service (Appendix A). The Pine category represents almost pure pine, and would include plantations. The Mixed Pine-Hardwood category includes stands with a range of mixtures of pine and hardwood, with most areas having over 50% pine but sharing canopy dominance with hardwoods; these are likely to be naturally regenerated stands, not plantations. The Oak/Hickory category includes upland stands clearly

dominated by hardwoods, likely naturally regenerated. The Oak/Gum/Cypress category covers poorly drained areas with sweetgum, bottomland oaks, bald cypress, or Atlantic white-cedar. The Elm/Ash/Red Maple category includes yellow-poplar, sycamore, mixed riverine hardwoods, maple, ashes, and beech. Harvested areas were not included in the GAP acreages because a species type could not be assigned; most harvested areas will remain in forest use, particularly in the southern watersheds, so a summary of acreage by species type underestimates total forest extent in the Coastal Bays.

GAP vegetation analysis was based on remote sensing imagery (30m resolution) and a 2-hectare minimum map unit. Estimates are likely to be most accurate for forest types occurring in larger blocks, and least accurate for types likely to occur in linear configurations (e.g., riparian forests) or in small patches less than 2 hectares. Categories that may be underrepresented here include oak/gum/cypress and elm/ash/maple, the types least frequently seen and most likely to be associated with riparian areas.

Character of the Coastal Bays Forest

Forest Extent

F. W. Besley (1916) characterized the state of the forests in Worcester County just after the turn of the century:

“Worcester has the greatest percentage of forest of any county on the Eastern Shore, 47 per cent of its total area in land being wooded, in spite of the fact that in different parts of the county, the northeastern section especially, large areas have been cleared of forest during the past 10 years. The principal species at present here, as in most of the Eastern Shore counties, is the loblolly pine. There are a few small areas of cypress along the Pocomoke and its tributaries, this county containing more cypress timber than any other in Maryland. The southwestern half of the county contains the greatest areas in pure pine stands, while in the northeastern section the pine is generally in mixture with hardwoods. The stands of hardwood are for the most part small and scattered, usually occurring along the shores of streams. Principal among them are some of the oaks- white, swamp white, black, Spanish, and willow- red maple, red gum, and black gum. Hardwoods are of relatively minor importance, but the amount of standing pine timber is only exceeded in Dorchester County, and the total stumpage in Dorchester and Garrett.”

Forests throughout the state had been extensively cleared during three centuries of settlement. As mechanization increased in the early 1900's and reduced dependence on animals for labor and transport, many pastures and fields reverted to forests. Statewide, forests generally increased during most of the 1900's, until the mid-1970's, when increasing rates of development offset a slowing rate of reversion to forest. Besley (1916) listed percent forest by election district; the lowest rates ranged from 31 to 39% (Districts 3, 5, and 9), with the remaining districts ranging from 46 to 69% forest. If the less forested districts are the northeastern portion of the County where “large areas had

recently been cleared of forest during the past 10 years”, then the areas may be comparable to the northern Coastal Bays.

A 1988 estimate found an average of 43% of the Coastal Bays in forest cover, with substantial contrast from north to south (DiPaolo, 1988). In 1988, the northern Coastal Bays watersheds were 29% forested, slightly lower than the least forested election districts in 1914 (Besley, 1916) and the southern Coastal Bays were 51% forested. In 2000, MD Department of Planning estimates almost 38% forest cover in the Coastal Bays, 44,225 acres, with a low of 25% in Assawoman Bay watershed and a high of 43% in Newport Bay watershed (Table 2). While these estimates were based on different methods, the trend of declining forest area since the mid-1980’s is clear.

Table 2: Forest acreage in Maryland’s Coastal Bays watersheds based on 2000 Maryland Department of Planning land use data

Watershed	Forest Acres	Percent Forest	Total Acres in MD
Assawoman Bay	1683	24.5 %	6856
Chincoteague Bay	16714	39.1 %	42728
Isle of Wight Bay	11874	35.4 %	33496
Newport Bay	11600	42.7 %	27186
Sinepuxent Bay	2354	31.4 %	7505
All Coastal Bays	44225	37.6 %	117771

Coastal Bays watersheds tend to have less forest cover than other areas of the region. Frieswyk (2001) estimates forest cover at 41% statewide, and forested acreage on the Lower Eastern Shore (Dorchester, Somerset, Wicomico, and Worcester counties) at 45%. The Lower Eastern Shore has a fairly uniform physiography and modest changes in climate within the region, but with its stronger ocean influence, the Coastal Bays watersheds could be expected to differ naturally from other portions of the region. However, the greatest differences apparent in forest extent over time appear to be distance from Ocean City and land value for development, rather than local climatic influences. In 1997, Worcester County forest is estimated at 55.4 %, substantially higher than the Coastal Bays area (Weller and Edwards, 2001).

Forests in the county were more extensive earlier, estimated at 57.4% in 1973, so the 55.4% in 1997 represents a 4.1% loss of forest (Weller and Edwards, 2001). Projections by Maryland Department of Planning for all of Worcester County for 2020 show continued decline from 166,974 acres of forest in 1997 to 164,457 acres in 2020, another 1.5% decrease (Weller and Edwards, 2001). The Coastal Bays are expected to see much greater losses of forest than other portions of the county. From 2000 to 2020, 11.5% of the forest in the Coastal Bays watersheds is expected to be lost, leaving only 33% of the watershed forested (Table 3). Projected losses are concentrated almost entirely in the northern watersheds near Ocean City, where rates of loss of over 30% in 20 years exceed the 2000 forest harvest rate of 1.2%. Forests harvested in the southern watersheds are likely to regenerate a new forest, maintaining benefits for water quality.

Forests lost and converted to development are likely to generate additional changes in watershed characteristics, such as stormwater runoff.

Table 3: Projected forest cover in Maryland Coastal Bays watersheds, Maryland Department of Planning estimates

Watershed	Forest Acres in 2000	Forest Acres Predicted in 2020	% Forest Lost over 20 yrs	% Watershed forested in 20 years
Assawoman Bay	1683	1093	35.1%	15.9%
Chincoteague Bay	16714	16678	0.2%	39.0%
Isle of Wight Bay	11874	8255	30.5%	24.6%
Newport Bay	11600	11415	1.6%	42.0%
Sinepuxent Bay	2354	1854	21.2%	24.7%
All Coastal Bays	44225	39295	11.1%	33.4%

Forest Cover Types

Besley (1916) estimated that 22% (34,110 acres) of Worcester County’s woodlands were mixed hardwoods, 59% (85,289 acres) were in pine, and 19% (28,783 acres) in mixtures of each. Comparison to the current county data (Table 4) shows a relative increase in hardwood types since 1914, from 22% to 39.1%. The increased proportion of mixed stands and decreased area of pine stands could be due to increases in hardwood components, or could be partly affected by procedural differences in how much hardwood was allowed for stands in the pine category. Hardwoods usually increase in importance as major disturbances such as wildfire decrease; most pines are light-demanding and are regenerated after a disturbance opening large portions of the canopy. Besley (1916) commented that “Worcester County’s forests do not suffer much from fire, the low elevation, to a certain degree, preventing this”. Fires are thought to have been more frequent in earlier centuries, particularly when burns were deliberately set by Native Americans to clear brush and improve browse for game. With our increase in capability for fire suppression, wildfires have declined in extent in more recent decades.

Table 4: 1999 Forest Species Type Distribution for Lower Eastern Shore and Worcester County, USDA Forest Service Inventory

Forest Type	Acres in Worcester Co.	County %	Acres on Lower E. Shore	LES %
Loblolly (>50% pine)	37200	23.7	178700	35.9
Oak/Pine (25-50% pine)	58200	37.1	107600	21.6
Oak/Hickory (<25% pine)	23700	15.1	117500	23.6
Oak/Gum/Cypress (“)	25600	16.3	70600	14.2
Elm/Ash/Redmaple	12000	7.7	23200	4.7
All acres	156700	100.0	497600	100.0

Currently, mixed stands predominate in the Coastal Bays, at 53% of forest cover (Figure 3). Hardwood and pure pine (including plantations) occur in similar proportions, 20 and 21% respectively. Oak/gum/cypress was estimated at 4% of forest acres and elm/ash/red maple at 2%. In 1988, the overall averages were 28% hardwood, 30% pine, and 43% mixed (DiPaolo, 1988). While some of the differences could be due to different methods and standards for categories, the pure hardwood component seems to have declined over the last decade, concurrent with increases in mixtures of conifers and hardwoods.

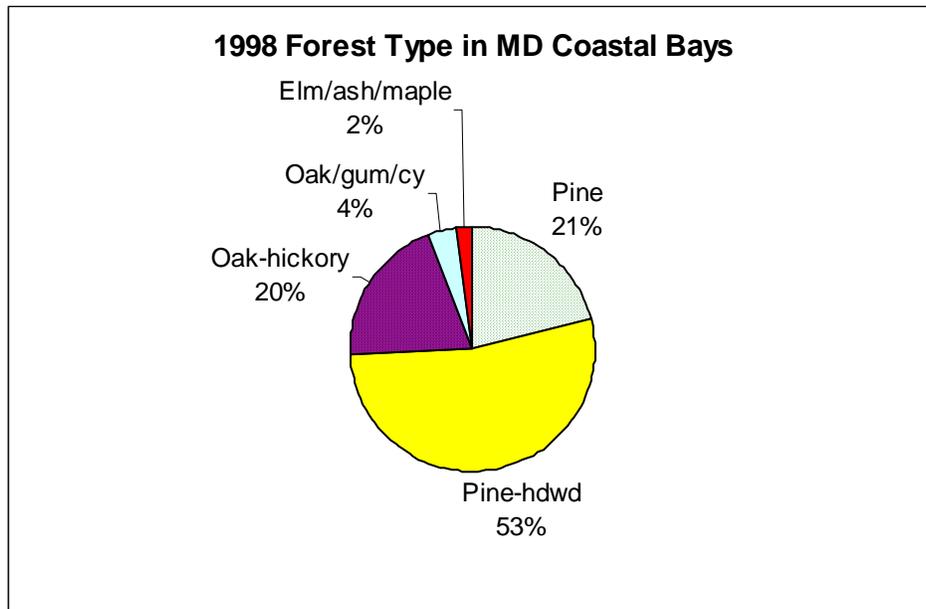


Figure 3: 1998 Forest Types in Maryland Coastal Bays, acres from Mid-Atlantic GAP

DiPaolo (1988) pointed out the contrast between the northern and southern watersheds; hardwoods were more important north of Rt. 50, with 43% hardwood, 15% pine, and 42% mixed, compared to only 23% hardwood, 34% pine, and 43% mixed in the southern Coastal Bays watersheds. That distinction generally remains, with Assawoman Bay watershed in the north averaging 45% hardwood, 13% pine, and 42% mixed, and Chincoteague Bay in the south averaging 12% hardwood, 30% pine, and 58% mixed (Figure 4, Table 5). However, the other major watershed south of Rt. 50, Newport Bay, had a greater proportion of hardwood, with 38% hardwood, 15% pine, and 47% mixed.

Table 5: Forest type in the Maryland Coastal Bays by watershed, based on 1998 data, Mid-Atlantic GAP vegetation

Watershed	% Pine	% Pine-Hdwd	% Oak-Hickory	% Oak/gum/cypress	% Elm/ash/maple
Assawoman Bay	12.7	42.3	38.7	3.5	2.8
Chincoteague Bay	30.3	57.9	6.1	5.1	0.6
Isle of Wight Bay	17.9	53.5	24.6	2.2	1.8
Newport Bay	14.7	47.6	29.3	3.7	4.6
Sinepuxent Bay	24.5	58.3	10.4	3.1	3.6
All Coastal Bays	21.1	53.1	19.8	3.6	2.3

MARYLAND DEPARTMENT OF NATURAL RESOURCES
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**FOREST COVER TYPES
BASED ON GAP DATA**

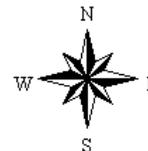
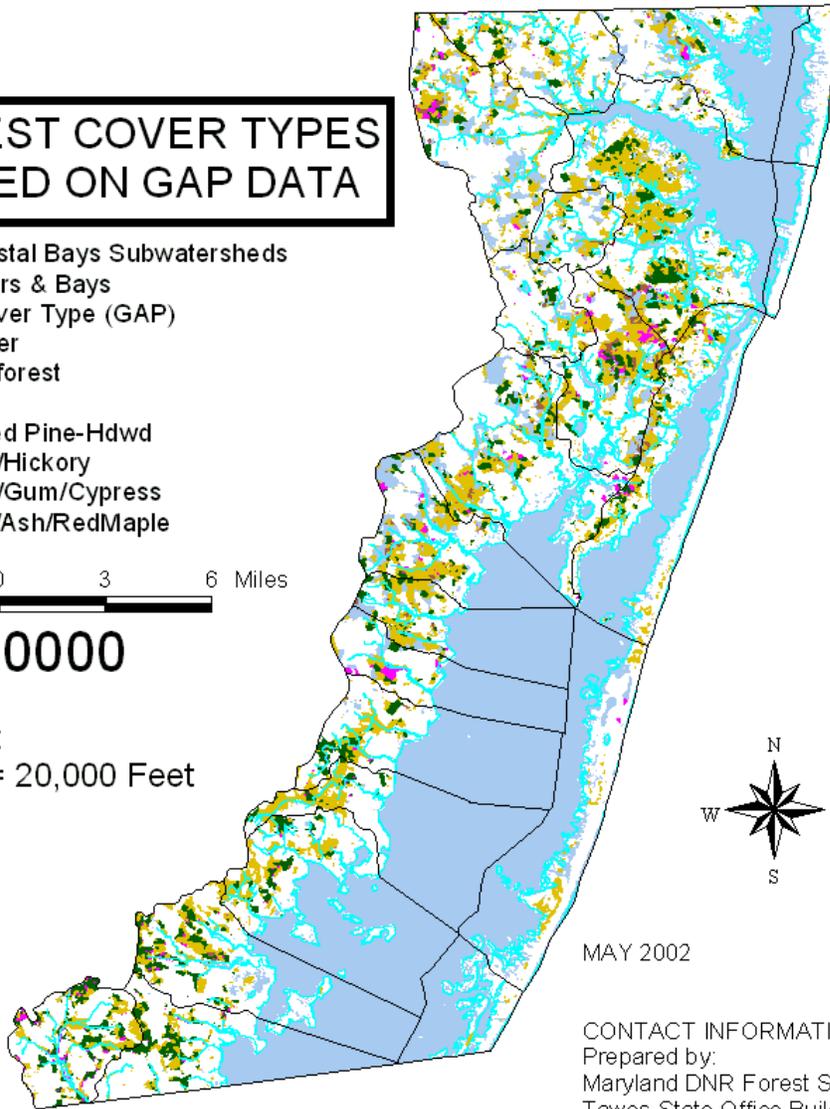
-  Coastal Bays Subwatersheds
-  Rivers & Bays
- Forest Cover Type (GAP)**
-  Water
-  Nonforest
-  Pine
-  Mixed Pine-Hdwd
-  Oak/Hickory
-  Oak/Gum/Cypress
-  Elm/Ash/RedMaple

3 0 3 6 Miles



1:240000

SCALE:
1 Inch = 20,000 Feet



MAY 2002

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Figure 4: Map of Forest type in Maryland Coastal Bays watersheds, 1998 vegetation from Mid-Atlantic GAP

The Natural Resources Inventory, prepared by the USDA Natural Resources Conservation Service, also presents species information, although using different regions. The Coastal Bays are in the Northern Tidewater Major Land Resource Area, which extends from southern Cecil County down the Delmarva Peninsula over to the eastern portions of Worcester and Wicomico Counties. The proportion of Loblolly-Shortleaf pine is 22%, similar to the USDA Forest Service field data estimates for Worcester County. Other species breakouts seem to be classified differently than the USDA FS ones. No category for Elm-Ash-Maple was listed, but the Oak-Gum-Cypress category was estimated at 22%, making the NRI estimate similar to the combination of the Elm-Ash-Oak and Oak-Gum-Cypress for USDA FS. In NRI, Oak-Hickory was only listed at 1%, compared to 15% for USDA FS Worcester County. NRI has a higher proportion list as Oak-Pine, 55%, so may have used a smaller proportion of pine in the many mixed hardwood/pine stands to classify as part pine.

Soils and Geology

Soils in the Coastal Bays are formed from alluvial sediments (sands, silts, and clays), a gift from glacial outwash approximately 12,000 years ago. Land surfaces that we see today have also been modified by past changes in sea levels, shaping and further sorting the glacial outwash sediments into terraces and depressions. Soil types and drainage affect the types of vegetation best suited to growing there. Based on the SSURGO soils dataset, hydric soils are extensive in the Coastal Bays (Figure 5). Many of the hydric soils would be suitable for pine or hardwood, and both commonly grow in the areas on Figure 5. Common native pines such as loblolly and pond pine grow on many poorly drained, hydric soils, although loblolly is generally not found on consistently saturated sites. The wettest sites are often well-suited to growing bottomland hardwoods, bald-cypress, or Atlantic white-cedar that can tolerate longer periods of saturation. Some of the wetter soil types such as Evesboro or Lakeland could be identified as particularly well-suited to hardwoods, cypress, or cedar.

The Coastal Bays watersheds are underlain by sands, the Ironshire and Sinepuxent Formations (Bachman and Wilson, 1984). These formations are part of the Columbia aquifer, a major water-supply source on the Lower Eastern Shore. Most of the Lower Eastern Shore has confined aquifers, where fine-textured sediment limit the speed of water movement into drinking water aquifers below and provide some measure of protection against pollution from surface sources. Confining layers are absent in portions of the Coastal Bays, particularly in the more inland portions, increasing the potential for contamination of the aquifer (Bachman and Wilson, 1984). Salt-water contamination has limited the use of the Columbia aquifer around Ocean City.

MARYLAND DEPARTMENT OF NATURAL RESOURCES
FOREST SERVICE

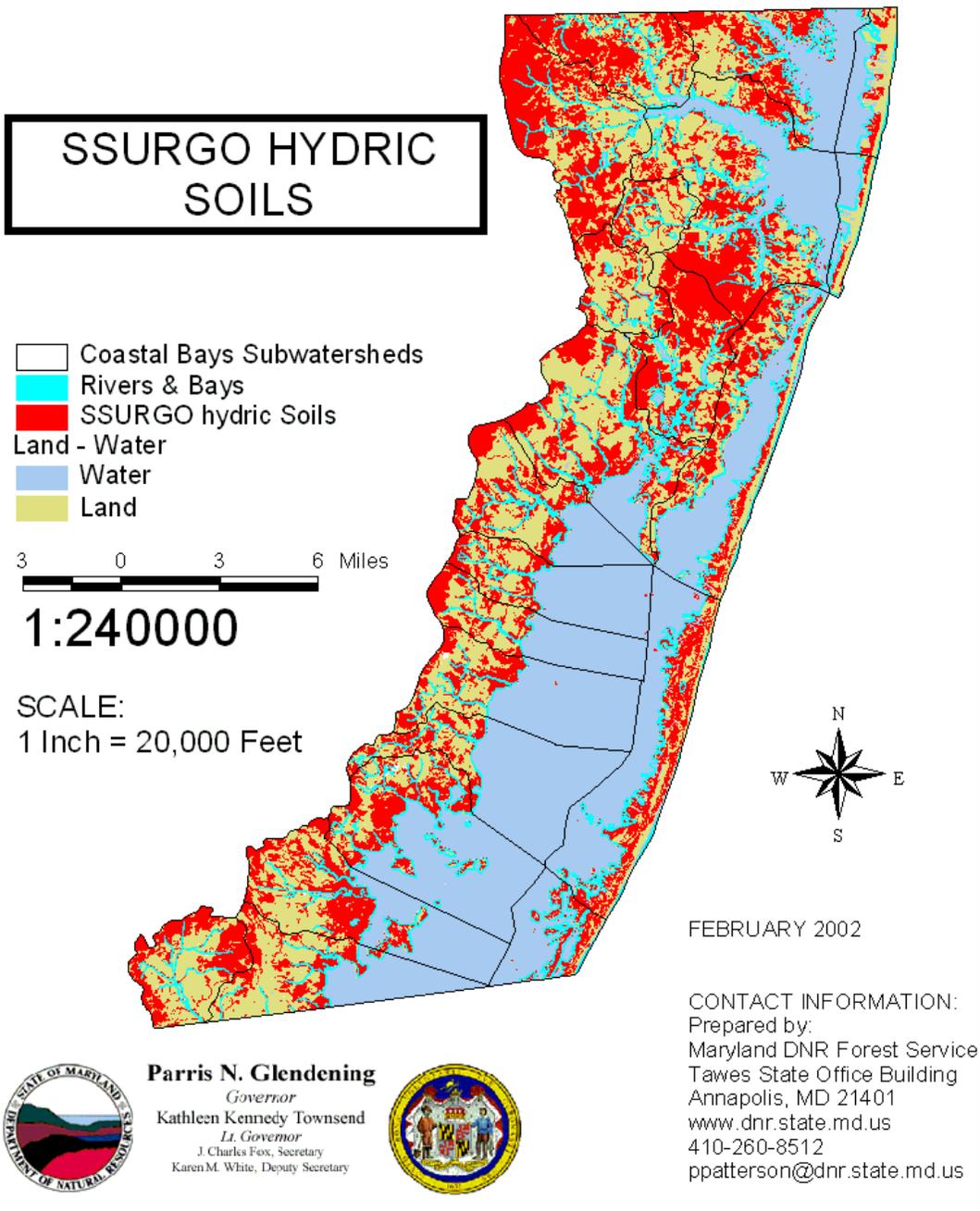


Figure 5: Hydric soils in Maryland Coastal Bays watersheds

Forest Health

Gypsy Moth Defoliation

Defoliation by exotic pests like gypsy moth poses a threat to forest health and water quality. In Western Maryland, watersheds with high levels of tree defoliation by gypsy moths have been found to have elevated levels of nitrogen in streamwater at the time of leaf loss and addition of insect frass. Regrowth of some type of vegetation usually occurs quickly, so the elevation in nutrients would not be expected in following years unless the same areas are defoliated again. While most trees are not killed from a single year's defoliation, defoliation in successive years can lead to tree death, usually selectively on oak species. Unless controlled, the continued presence of gypsy moth could favor pine and less palatable hardwood species over oaks during severe outbreaks. Most of the levels seen in the Coastal Bays have not constituted a severe outbreak, although gypsy moth damage is a persistent influence.

Gypsy moth defoliation has occurred most years in the Coastal Bays between 1985 and 2001, and, over time, has affected a significant proportion of forested acres, with 24% of the acres having had some impact at least one year (Table 6). Averaging out the rate over the 17-year period of record, 1.4% of the area is likely to be affected in any one year, a rate similar to the average harvest rate for the area. Newport Bay has had the greatest proportion of forest acreage defoliated, with over a third of the forest having received defoliation at some time (Figure 6, Table 6). On an average annual basis, 2 percent of Newport Bay's forests have been affected by gypsy moths per year.

Table 6: Gypsy Moth Defoliation in the Maryland Coastal Bays watershed, 1985 to 2001.

<i>Watershed</i>	<i>Acres Defoliated from 1985 to 2001</i>	<i>Forest Acres (% of watershed)</i>	<i>Percent of Forest Defoliated over 17 yrs</i>	<i>Average Annual % Forest Defoliated</i>	<i>Percent Watershed Defoliated over 17 years</i>
Assawoman Bay	358	1323 (19%)	27.1%	1.6%	5.2%
Chincoteague Bay	2395	17478 (41%)	13.7%	0.8%	5.6%
Isle of Wight Bay	2442	12263 (37%)	19.9%	1.2%	7.3%
Newport Bay	3941	11448 (42%)	34.4%	2.0%	14.5%
Sinepuxent Bay	581	2338 (31%)	24.9%	1.5%	7.7%
All Bays	9717	44850 (38%)	24.0%	1.4%	8.1%

Gypsy Moth Defoliation in Coastal Bay Watersheds 1985-2001

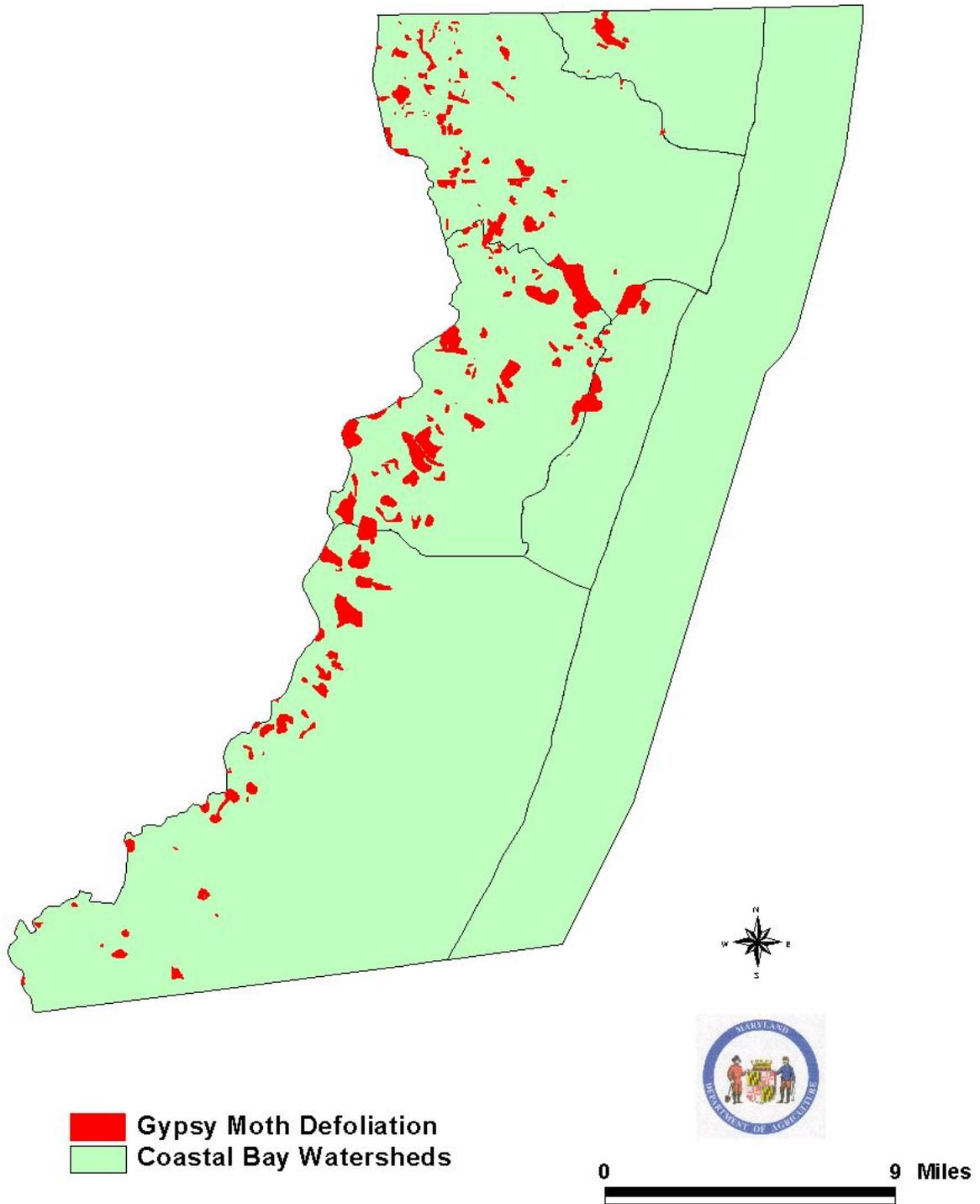


Figure 6: Gypsy moth defoliation in Maryland Coastal Bays watersheds, 1985 to 2001

Forestland Trends

Forest land use trends

Identifying trends requires repeated inventories, best supplied by the USDA Forest Service Forest Inventory and Analysis. Change information is presented for the Lower Eastern Shore region, the most detailed breakdown offered in the report (Frieswyk, 2001).

Between 1986 and 1999, the Lower Eastern Shore lost 1.1% of its timberland to alternate land uses (Frieswyk, 2001). The Coastal Bays watersheds have experienced a more rapid growth rate than most of the region. Although the Coastal Bays occupy only 39% of Worcester County's land base, they supported 67.4% of the County's population in 2000 (Worcester County Department of Planning, Permits, and Inspections). Maryland Department of Planning projects an 18.5% increase in developed land between 1997 and 2020, a 0.8% annual increase in acres. Both forest and agricultural land will be converted to accommodate this growth in development.

Timber trends

Timber growing stock averaged 1890 cubic feet/acre, a 12.9% increase since 1986. Because of the increase in volume per acre, overall growing volume in the region expanded 11.6%. These trends represent a lower rate of forest loss and similar rates of growing stock volume/acre compared to the statewide average (Figure 7).

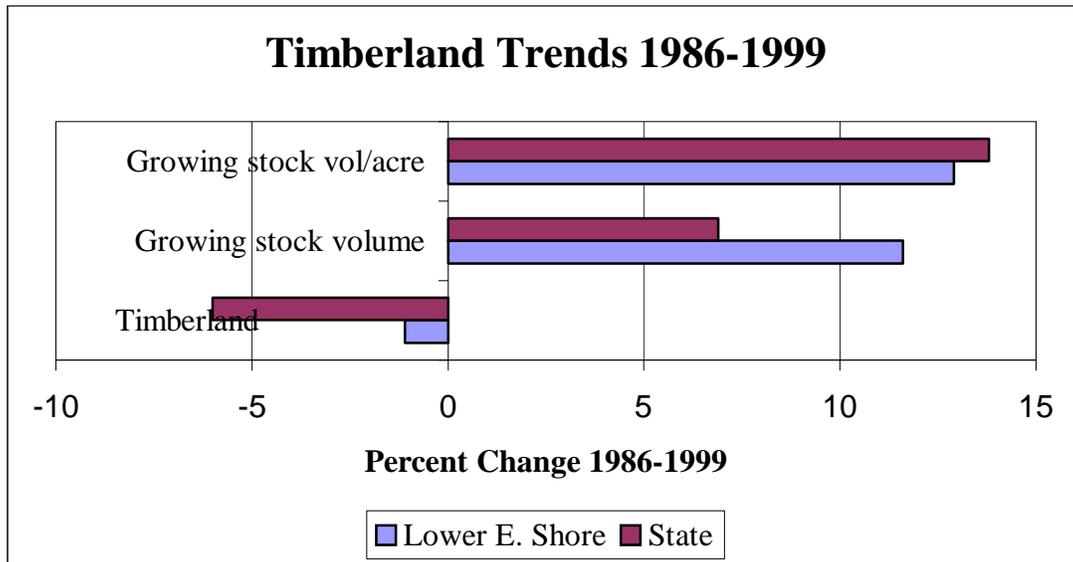


Figure 7: Timberland trends from 1986 to 1999 on Maryland's Lower Eastern Shore.

The major changes in the region in forest type appeared to be increases in acreage of pine (+6%) and mixed oak/pine (+2%) types, with a decrease in the oak/hickory (-4%) and oak/gum/cypress (-4%) types (Figure 8). Looking just at the sawtimber acreage, stands with average diameters at breast height of 9 inches or more, the trends for the older stands can be seen. Acreage of sawtimber stands increased for both pine and hardwood (oak/hickory), while it decreased for the oak/pine type (Figure 9). Pine accounted for a smaller proportion of the sawtimber stands compared to stands with a hardwood component (Figure 9).

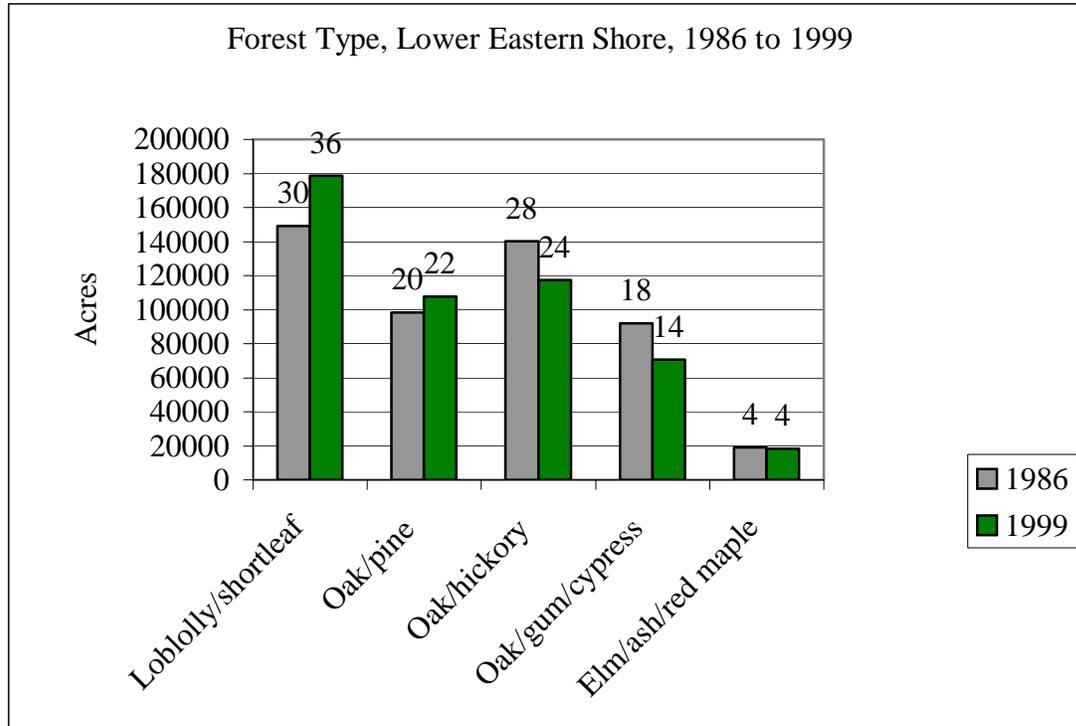


Figure 8: Change in forest type on the Lower Eastern Shore of Maryland between 1986 and 1999 (% total forested acres as bar labels).

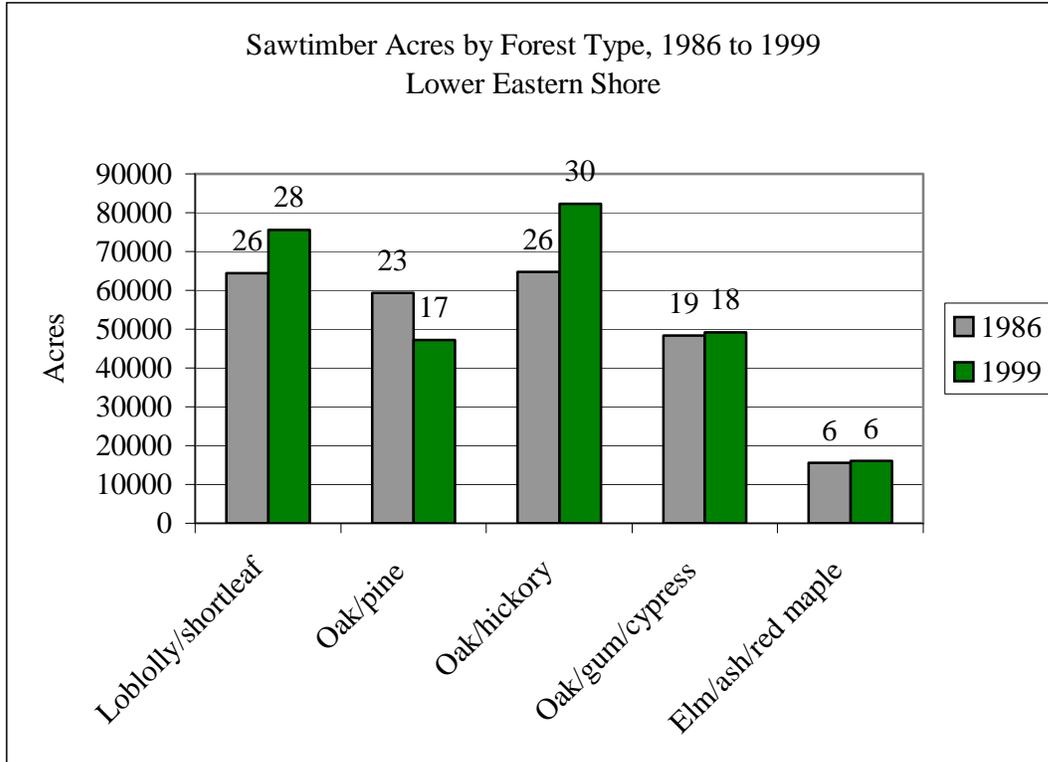


Figure 9: Change in forest type of sawtimber acres (>9 in. dbh) on the Lower Eastern Shore of Maryland between 1986 and 1999 (% of total forested acres as bar labels).

Forest Harvesting

County/Regional data

The recent forest inventory data suggest that more wood is growing than is being cut on the Lower Eastern Shore, based mostly on an increase in volume of trees per acre. Even considering forest lost to recent development, overall wood volumes are increasing on the Shore. Worcester County harvested 1.9% of its forests from 1996 to 2001, from the third highest rate of harvest in the state. Sediment Erosion and Control Plans for timber harvests were issued for a total of 18,106 acres over 6 years, averaging 3,018 acres/year. Statewide, the average harvest rate is 1.1% per year. Breakout of historical harvesting data by subwatershed is not currently available, although it will be upon completion of the Maryland Strategic Forest Assessment. Not all the county is in the Coastal Bays drainage, so less than half of the annual harvest is likely to have occurred in those watersheds.

Coastal Bays Harvest Data for 2000

A total of 709.6 acres were harvested in the Maryland Coastal Bays during 2000, based on data compiled from Sediment Erosion and Control Plans. Sediment and Erosion Control Plans are a legal requirement for harvesting in Maryland. Stand types harvested

were nearly evenly split between pine and mixed pine/hardwood stands, with thinning comprising 21% of other operations (Figure 10). Harvests of pure hardwood stands were not seen in the plans during 2000.

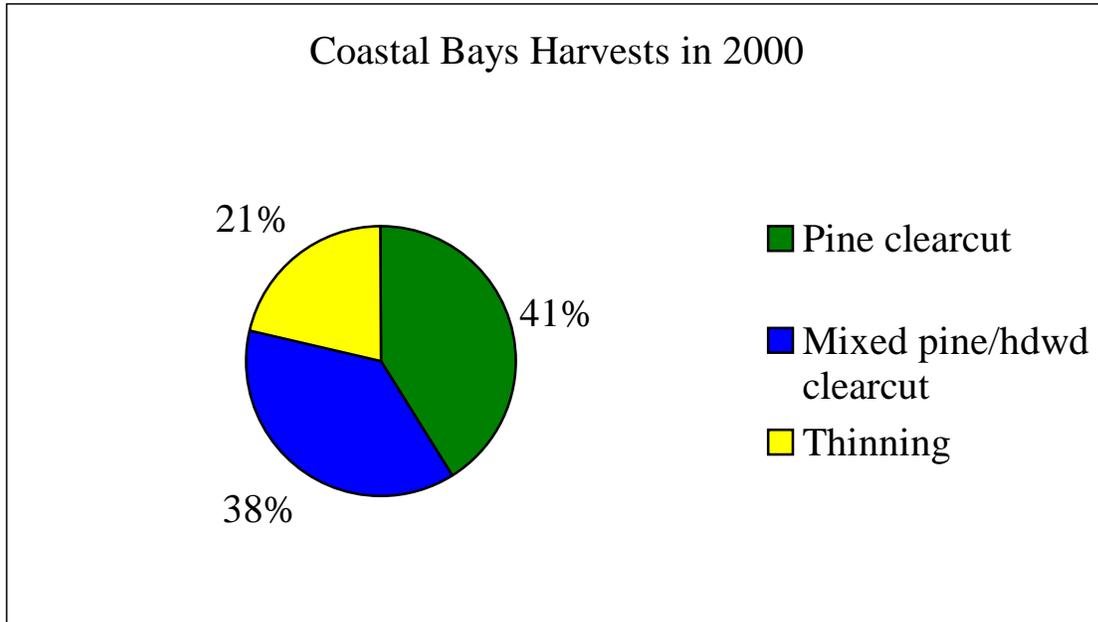


Figure 10: Timber harvests in Maryland Coastal Bays watersheds in 2000 by harvest type

The Chincoteague Bay watershed had the most acres harvested (338.5 acres), followed by Isle of Wight watershed at 225.6 acres (Figure 11). The greatest amount of thinning, 132 acres, occurred in the Chincoteague Bay watershed, leaving 206.5 acres receiving a final (regeneration) harvest. The two large rural watersheds, Chincoteague Bay and Newport Bay, are the watersheds supporting thinning, and are the areas where long-term forest management is likely. The absence of thinning in the Isle of Wight watershed, despite its substantial extent of harvesting, may reflect development plans in the future.

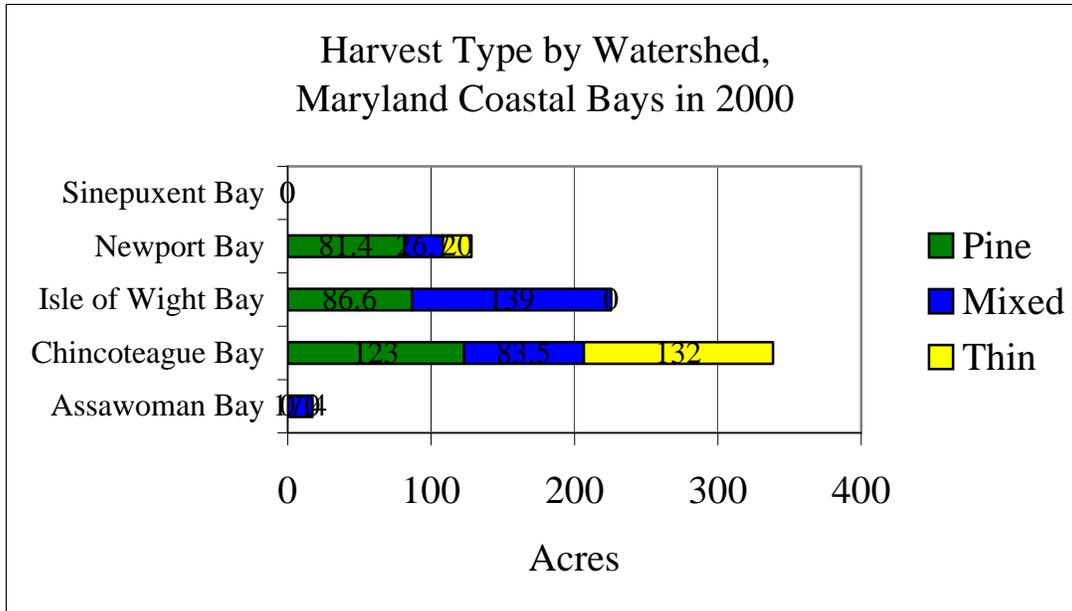


Figure 11: Timber harvests in Maryland Coastal Bays watersheds in 2000 by harvest type and subwatershed.

The rate of harvesting of forested lands in the Maryland Coastal Bays watersheds during 2000 averaged 1.2%, lower than the average county rate and slightly higher than the statewide average of 1.1% from 1996 to 2001 (Table 7). If thinned acres were included, the rate of treated acres was 1.6% of forested acres. At 1.8%, the Isle of Wight watershed had the highest rate of harvesting during 2000.

Table 7: Rate and Extent of Clearcut Harvest in Maryland’s Coastal Bays during 2000.

Watershed	Total Acres in MD	Forest Acres	Harvested Acres	Percent Harvest
Assawoman Bay	6,856	1,323	17.4	1.3 %
Chincoteague Bay	42,728	17,478	206.5	1.2 %
Isle of Wight Bay	33,496	12,263	225.6	1.8 %
Newport Bay	27,186	11,448	108.1	0.9 %
Sinepuxent Bay	7,505	2,338	0.0	0.0 %
All Coastal Bays	117,771	44,850	557.6	1.2 %

Forest Management Plans

Most landowners requesting forest management plans have a strong interest in being able to harvest at some point, indicated by the vast majority of primary objectives being forest products (Figure 12). Even those expressing primary interest in natural heritage or recreation objectives also express interest in some level of forest products and income. However, most of landowners interested in harvesting for forest products also have interest in other objectives, most commonly fish/wildlife or soil/water protection.

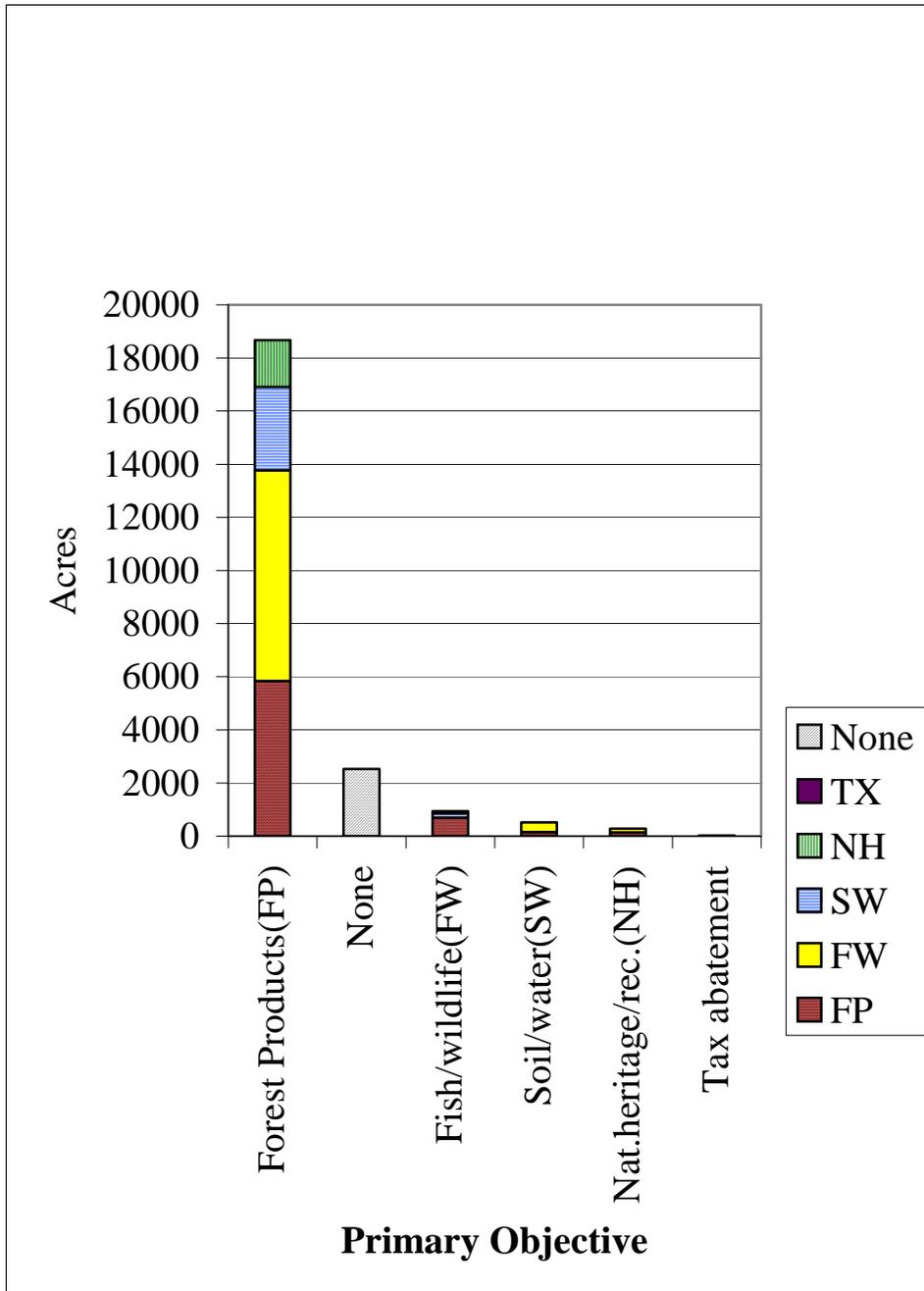


Figure 12: Management Objectives stated in 254 Forest Management Plans in Worcester County, 1990-2000; Primary objectives on axis, secondary objectives in legend

Forestry Assistance Programs

A range of assistance programs is available, but not all are widely used. Often funding is limited, or eligibility requirements are very restrictive. Brief descriptions are presented here, in part excerpted from a summary of incentives for forest buffers

prepared for Stream ReLeaf, an umbrella program promoting establishment of riparian forest buffers (Shaughnessy and Messaris, 1999). A cross-reference of programs relevant to specific forest management activities is provided in Table 8.

A. Technical Assistance

Technical assistance to landowners interested in managing their forests for any of their objectives is available from a variety of sources. MD Department of Natural Resources Forest Service staff offers forest management plans for a nominal fee and deliver programs that help with tree planting, timber stand improvement, tax abatement, and forest stewardship. The expertise of other resource specialists can be sought from the MD Department of Natural Resources Wildlife and Heritage Service and the Watershed Restoration Division. Maryland Environmental Trust specializes in conservation easements. Natural Resources Conservation Service and Soil Conservation Districts deliver programs that assist landowners in various aspects of land management, including wetland restoration, tree planting, and creating habitat for wildlife. Maryland Cooperative Extension has workshops, education programs, and fact sheets on forests and riparian areas. Consulting foresters are available for a range of services, including ongoing land management and timber sales. Worcester County Planning and Zoning is involved in implementing the Forest Conservation Act, land use issues related to forestry, and urban forestry programs. Other sources of expertise in local forest management issues are the Worcester County District Forest Conservancy Board, Ocean Pines forester, Maryland Forest Association, and Association of Forest Industries.

B. Regulatory Programs

Major rules for forest management are summarized below. Additional information on these and other forest-related laws such as the roadside tree law and licenses for forest operators is available in a recent publication, “A Guide to Maryland Regulations of Forestry and Related Practices”, published in December 2001 by the Department of Natural Resources Office of the Attorney General.

B1: Forest Conservation Act

The Forest Conservation Act requires specific levels of forest conservation to be maintained during land development. Developers must conduct a detailed forest inventory and prepare a forest conservation plan for a construction site prior to construction. The plan must locate areas of forest to be retained or replanted. Under the Act, a forest is at least 35 feet wide and covers 2,500 square feet of area. A stream buffer includes all the land lying within 50 feet from the top of each normal bank of a stream. The Act limits forest clearing and requiring replanting where needed. “Priority areas” for retention or replanting include 50-foot buffer area streams, critical habitats and 100 year floodplains. Forest stand delineations and forest conservation plans are required for subdivision or grading, and sediment control project permits are needed on areas greater than 40,000 square feet. The Act requires minimum density standards for restoring cleared

land. It also establishes forest conservation funds (State and local) to be used for restoring forests, and forest mitigation banks in priority areas.

B2: Pine seed tree law

Primary landowners and forest product operators in Calvert, Caroline, Charles, Dorchester, Queen Anne's, St. Mary's, Somerset, Talbot, Wicomico and Worcester counties are required to observe the provisions of the Pine Tree Reforestation Act. Loblolly, shortleaf and pond pine trees that constitute 25 per cent of the live trees on an acre cannot be commercially cut for timber from five acres or more of land unless seed trees have been reserved or a reforestation plan has been approved by the Department of Natural Resources, Forest Service. Upon completion of a cutting operation, owners or operators must leave uncut and uninjured at least eight cone-bearing loblolly, short-leaf or pond pine trees 14 inches or larger in diameter, on each acre cut for the purpose of reseeding. If eight trees of that diameter are not available on the acre, the owner or operator is required to leave at least two trees of the next diameter standing. The trees remaining must be healthy, wind-firm, well-distributed and well-developed. If there are 400 trees per acre or more of loblolly, short leaf or pond pine, seed trees not need not be left. Cutting may not begin until either the seed trees have been reserved or a reforestation plan has been approved. Landowners may not cut or permit to be cut any pine tree required to be reserved for three years after completion of the cutting operation. The landowner must agree that any purchaser of the land will also be bound by this requirement. The act does not apply to cutting trees for reservoirs, military installations, agriculture, and other special uses. Area foresters are available to assist in compliance with this law in preparation for a reforestation plan. Landowners can also submit an alternative management plan that would develop an adequately stocked future forest stand.

B3: Sediment and Erosion Control Plans

A sediment and erosion control plan is required for commercial harvest of woodlands with 5000 square feet of disturbed area, r on an area that crosses any perennial or intermittent watercourse. Operators must use Best Management Practices such as road layout to minimize stream crossings and seeding roads and landings after use to stabilize soils. The plans must be approved by the Soil Conservation District. A nontidal wetland permit is required for stream crossings. Maryland Department of the Environment Water Management Administration investigates complaints for enforcement.

B4: State Highway Reforestation Act

The Reforestation Act provides that State-funded highway construction projects subject to the Act must replace an equal amount of forest in the county and watershed where the clearing occurred. If sites cannot be located for reforestation, the constructing agency must pay a fee into a reforestation fund amounting to 10 cents per square foot of forest cleared. The Act minimizes forest loss, and replaces unavoidable losses from highway construction projects. Highest priority is placed on forests near or adjacent to

streams. For wooded areas of one acre or more, where construction projects involve the cutting or clearing of one acre or more of forest, the contractor must locate an equivalent area of publicly owned land to be reforested at the rate of 10 cents per square foot. The alternate land must be within the same county and watershed; if not, the contractor may turn to the county's mitigation bank. The preferred location is on-site, within the right of way.

C. Voluntary Assistance Programs

C1: American Tree Farm System

Assists with: managing forests

Part of the American Tree Farm System of the American Forest Foundation, the Maryland Tree Farm Program encourages landowners to manage their forests by using best management practices to increase production of tree crops while improving wildlife habitats, watersheds and aesthetics. Landowners must first develop forest management plans. Their property is then recognized as a pioneer tree farm. Subsequently, a professional forester reinspects the land and, if the required management practices are followed, the property is designated as a certified tree farm. All tree farms must meet the criteria for the Forest Stewardship Program. To qualify, the landowner must have ten or more acres of forest, and must manage the property according to certain criteria. The American Tree Farm System also has developed a green certification for sustainably managed forest products that would allow participants access to some markets or preferred pricing.

C2: Buffer Incentive Program (BIP)

Assists with: tree planting near waterways.

Under the Buffer Incentive Program (BIP), private landowners may be eligible for a one time, \$300 payment per acre up to a maximum of \$15,000. These payments are for planting and maintenance of minimum 50-foot forested buffers along streams/shorelines. Once established, this management practice must remain in place for 10 years. A one-acre minimum planting area is required.

C3: Conservation Reserve Program (CRP)

Assists with: tree planting on agricultural land.

The Conservation Reserve Program provides financial incentives from the US Department of Agriculture to farmers to take highly erodible or environmentally sensitive land out of agricultural production. A voluntary program, CRP uses ten to 15 year contracts with the Department of Agriculture offering annual land rent payments and cost-share assistance for establishing effective land preservation practices.

C4: Conservation Reserve Enhancement Program (CREP)

Assists with: tree planting on agricultural land.

The Conservation Reserve Enhancement Program is an expansion of CRP that allows states to tailor benefits and land eligibility to the conservation needs in their area, including water quality, soil erosion, and wildlife habitat. It is a partnership of state, federal, and nonprofit groups that offers unprecedented financial assistance for rental rates, reimbursement of practice installation costs, one-time sign-up bonuses, and voluntary easement purchases. Agricultural landowners are eligible for contracts of ten to 15 years to establish riparian buffers, wetlands, or permanent cover on highly erodible land. Enrollment is voluntary and offered continuously and noncompetitively.

C5: Ducks Unlimited Stewardship Assistance (DU)

Assists with: creating wetlands, including forested
Ducks Unlimited offers technical assistance and reimbursement of some installation costs for wetlands.

C6: Environmental Quality Incentives Program (EQIP)

Assists with: tree planting on agricultural land.
Environmental Quality Incentives Program (EQIP) provides farmers and ranchers for cost-share assistance of up to 75 percent of the cost of certain conservation practices including grassed waterways, filter strips, manure management facilities, capping abandoned wells, and wildlife habitat enhancement. Incentive payments may be made for up to three years to encourage farmers to perform such land management practices. Cost-share and incentive payments, are, however, limited to \$10,000 per person, per year, and to \$50,000 person, per year for the length of the contract, which can run from five to ten years. Applications for EQIP are accepted throughout the year. NRCS evaluates the benefits the farmer offers, then ranks offers according to previous criteria. Farm Service Agency county committees can approve funding for the highest priority applications. EQIP seeks to maximize environmental benefits per dollar spent.

C7: Federal Estate Tax Incentives (FETI)

Assists with: forest management and conservation easements
Owners of forest land within 25 miles of metropolitan areas, national parks or wilderness areas, or within 10 miles of an urban national forest are eligible for estate tax reduction. The amount of estate value exempt from estate tax is raised to \$600,000, thus reducing pressure on estate administrators to sell forest land to pay estate taxes. Provides an exclusion of up to 40 percent of the value of the land if the land is placed in a qualified conservation easement.

C8: Forest Legacy

Assists with: conservation easements
Funded by the USDA Forest Service, the Forest Legacy program in Maryland purchases easements or fee simple interest on forest land, within predefined areas.

In the Coastal Bays, the Forest Legacy Area is in the Chincoteague Bay watershed.

C9: Forest Stewardship Program (FSP)

Assists with: forest management, technical assistance

Private landowners with at least five acres of forested land are eligible. Foresters assist landowners to develop a resource conservation plan to help them reach personal and environmental objectives focusing on wildlife, fisheries, streams, wood production, recreation, and aesthetic enjoyment. These services are available free of charge and recommended practices may be eligible for cost share payments. In addition, foresters provide technical assistance for implementing conservation practices while meeting harvesting needs. Forest Stewardship Plans are required for participation in other federal cost-share programs. Applicants must submit Forest Stewardship plans that are approved by a state forester.

C10: Forestry Incentive Program (FIP)

Assists with: tree planting or timber stand improvement

A landowner must have at least ten but no more than 1,000 acres of eligible forest land (exceptions are available). The landowner must commit to the same management practices for 10 years and have a forest management plan. The land must be capable of producing marketable timber crops and meet minimum standards for FIP. FIP allows for cost sharing of up to 65 percent of the costs of tree planting, timber stand improvements, and related practices on non-industrial private forest land, although rates may have caps. Cost share money is available with a limit of \$10,000 per person per year.

C11: Glatfelter cost-share program (GF)

Assists with: tree planting

Sponsored by the Glatfelter Pulp Wood Company, this program provides 50 percent cost share assistance to landowners for planting eligible seedlings. For Worcester County, the eligible species is loblolly pine. Before planting, the site must be approved by a DNR forester and a forest management plan must be in effect or developed. The minimum order of seedlings under the program is 1,000 seedlings, and the maximum is 20,000 seedlings.

C12: Income Tax Incentives (Federal)

Assists with: planting trees or managing forest

Expenses from reforestation or forest management can be treated as deductions from income only if a landowner is “active”, that is, materially participating in a business in a regular, continuous, and substantial fashion. For landowners not meeting those standards, expenses can’t be deducted, but timber harvest income can be treated as long-term capital gains rather than regular income and taxed at a lower rate.

Reforestation Tax Credit and Amortization

The federal reforestation tax credit and seven year amortization is one of the best tax breaks for forest landowners that materially participate in their forest management. In the first year of reforestation, it allows a landowner to claim a ten percent investment tax credit for the final amount spent for reforestation during the tax year. Over the next seven years, the landowner can amortize or deduct all of the reforestation costs (up to \$10,000) less half of the credit the landowner took in the first year. Landowners may forfeit these tax benefits, however, if they dispose of the trees within five to 10 years of planting.

Capital Gains and Self-Employment Taxes

Some landowners may benefit from treating timber sale income as capital gains. Effective May 8, 1998, the rate on long-term capital gains dropped from 28% to 20% for most landowners, and from 15% to 10% for owners in the lowest income tax bracket. To qualify for the new long-term capital gains, a landowner must hold onto the timber for 18 months.

Cost-Share Payments: Exclusions or Deductions

Landowners must report on their income tax forms the amounts they received in cost-share assistance under federal or state cost-share programs. Landowners have two options. The IRS permits exclusion of cost-share under the Forestry Incentives Program (FIP), the Forest Stewardship Incentive Program (SIP), the Environmental Quality Incentives Program (EQIP) and several State programs. Under the Conservation Reserve Program (CRP), landowners must report their annual payment and cost-share assistance as ordinary income. If they received CRP cost share assistance funds for planting your trees, they must report these as ordinary income. But CRP cost-share payments, unlike the other cost-share payments already discussed, cannot be excluded from income. Instead, CRP cost-share payments may be claimed as reforestation expenses under the reforestation tax credit and 7-year amortization program.

Management and Maintenance Expenses

Generally, annual expenses for managing and maintaining an existing stand of timber can be expensed or capitalized.

C13: TAXMOD Income Tax Incentives (State)

Assists with: tree planting, timber stand improvement

Reforestation or timberland improvement (TAXMOD) certificates are available to individuals who own or lease ten to 500 acres of land that is capable of growing more than twenty-cubic feet of wood per acre per year and available for harvesting forest tree species. With TAXMOD, reforestation and timberland expenses can be deducted from state income tax. Landowners of small forestry operations can deduct from adjusted gross income double the costs associated with reforestation activities, including those in the riparian zone.

C14: Maryland Agricultural Cost-Share Program (MACS)

Assists with: planting trees near waterways

MACS provides up to 87.5% cost-share to farmers that develop and install best management practices such as filter strips to combat agricultural pollution.

Priority is given to projects within 100 feet of water. Farmers must complete installation within one year, and maintain the project for five to 15 years. Maximum assistance is \$10,000 per project or a total of \$35,000 per farm.

C15: Maryland Environmental Trust

Assists with: conservation easements

The Maryland Environmental Trust (MET), a quasi-public agency, sponsors the Conservation Easement Program to preserve farmland, waterfront and wetlands as well as other unique areas in the state. MET works with prospective donors to tailor conservation easement deeds to the individual landowner's needs. Conservation easements secure the protection of the land for conservation, but also permit private ownership and use as well as the sale of the property. Properties involved are periodically monitored by MET to ensure compliance and the landowner is still responsible for all maintenance and upkeep. Public access is not required. All private landowners of rural land are eligible for the program.

C16: Partners for Wildlife (PFW)

Assists with: tree planting on hydric soils, degraded wetlands

The U.S. Fish & Wildlife Service provides technical and financial assistance to landowners informally or by cooperative agreement to restore degraded wetlands and implement a management plan. The agreements tend to be lengthy, but may be for less than 10 years. Projects for more than \$10,000 must involve large acreage or at least a 50% non-federal cost-share.

C17: Property Tax Incentives (State)-FCMA

Assists with: managing forest land

Forest Conservation Management Agreements (FCMA) require management plans prepared by registered professional foresters and provide reduced tax assessments for forest land as long as the landowner agrees to adhere to a forest stewardship plan. An FCMA is a contract between a landowner and the Maryland Department of Natural Resources to provide for the freezing woodland property assessments at the contract time for a period of up to 15 years. A registration fee is required and every five years a periodic inspection must be made for a fee. Property assessments are frozen at \$100 per acre for the life of the contract. Penalties are assessed if the contract term is not kept.

Other tax incentives include a Forest Management Plan without an FCMA agreement and reduced tax assessments for land under a conservation easement. A Forest Management Plan prepared by a registered professional forester is filed in the county tax assessor's office. The land is then assigned an assessed value of \$150 per acre, but, unlike in the FCMA, the value is not frozen but is subject to change during the three-year term of the agreement.

C18: Rural Environmental Conservation Program

Assists with: conservation easements

The Department of Agriculture enters into contracts of three, five, 10 or 25 years with eligible owners and operators of farms, ranches, wetlands, forests or other lands to purchase perpetual lease easements to promote the sound use and management of flood plains, shore lands, and aquatic areas. Eligible landowners and operators are required to submit a plan of farming operations or land use approved by a state forester. The landowner must carry out the provisions of the land use plan in return for which the landowner will receive a minimum cost share of 50 percent and a maximum cost share of 75 percent of the actual costs of implementing the practices, including labor. In addition, the Department of Agriculture may provide materials such as seed, seed inoculates, soil conditioning materials, trees, plants, and, if appropriate, fertilizer and liming materials.

C19: Rural Legacy (RL)

Assists with: conservation easements

Rural Legacy is a state-funded program that purchases conservation easements in priority areas around the state. For the Coastal Bays, the Rural Legacy area is in the southern Chincoteague Bay area, the lower half of the Forest Legacy area.

C20: Shore Erosion Control (SEC)

Assists with: shoreline stabilization

MD Department of Natural Resources Shore Erosion Control offers interest-free loans and technical advice on preserving shorelines and existing buffers. All owners or occupants of property adjacent to State waters interested in non-structural shoreline or stream bank erosion control are eligible

C21: Stewardship Incentive Program (SIP)

Assists with: tree planting and stream and wetland habitat improvement.

SIP subsidizes up to 65 percent of the cost of creating new buffers and protecting existing ones for owners of non-industrial private forest land, less than 1,000 acres with an approved 10-year Forest Stewardship Plan. SIP provides cost-sharing for tree planting, stream fencing, riparian and wetland improvement, tree shelters, and fisheries habitat improvement.

C22: Tree-mendous Maryland (TM)

Assists with: tree planting on public property

Tree-mendous offers assistance to communities more than individual landowners. It offers low-cost containerized trees for planting on public lands and helps organize volunteers for planting and maintenance of trees.

C23: Urban and Community Forestry (UCF)

Assists with: tree planting and maintenance in communities

Maryland Department of Natural Resources Forest Service provides financial, technical and other assistance to help local governments plan urban forestry programs and plant, protect and maintain trees in open spaces, greenbelts, roadsides, greens, parks, woodlands, curb areas, and residential development. Federal USDA Forest Service, state, or Forest Conservation Act mitigation funds may be available. The Department provides technical assistance to counties, municipalities and individuals to retain and manage forest and trees, including street tree inventories; technical evaluation of site development plans; management recommendations for the retention of forest and trees; assistance in planning and zoning; advice on insect and disease control; and advice in conducting and implementing local urban and community forestry programs.

C24: Wetlands Reserve Program (WRP)

Assists with: planting trees on hydric soils or degraded wetlands, conservation easements

Owners and operators of farmland are eligible to apply for WRP for restoring and protecting farmed wetland, wetland converted before December 23, 1985, farmed wetland enrolled in the Conservation Reserve Program that is likely to return to production, and riparian areas that link areas already protected by easements. Conservation Reserve lands with tree stands or pasture established to trees are ineligible. WRP allows farmers to sell permanent or 30-year easements to US Department of Agriculture. The easement must provide for a wetland easement conservation plan that restores the wetland and restricts public access. The program provides for cost-share to restore altered wetlands to natural condition, even if the land is not placed in an easement.

C25: Wildlife Habitat Incentive Program (WHIP)

Assists with: wildlife habitat creation

WHIP funds establishment of feeding areas for migratory fowl and other wildlife. Farmers of grains, grasses and legumes in selected counties are eligible, and in some cases, must have at least 20 acres or more. WHIP provides grants to farmers to leave a portion of crops unharvested to provide a food source for migratory birds and other wildlife. This enhances wildlife habitat by providing a stable food source for migratory birds and other wildlife. The farmer must work the buffer and maintain it. No hunting is allowed within 400 ft of the property. Maximum grant is \$10,000 for a period of one to three years.

C26: Woodland Incentive Program (WIP)

Assists with: tree planting, timber stand improvement

WIP is a state-funded cost-share program that pays up to 50 % of actual costs for reforestation and timber stand improvement practices. Cost-share payments are limited to \$5,000/year or \$15,000 over 3 years. Landowners must own at least 10 acres of forest or be planting enough land to reach 10 acres, but not more than 500 acres. Approved practices including tree planting, seeding, timber stand improvement, burning and site preparation and must be followed for up to 15 years. Applicants must submit a woodland management plan, including the practice to be used and the cost, plus a statement of intent that the applicant plans to use the assistance for long range timber growing and is not receiving federal funds for the same land.

Table 8: Cross-reference for technical or financial assistance for selected forestry practices
See list above for names and descriptions

Practice	Technical Assistance	Financial Assistance
Tree planting	MFS, CF, NRCS	C2, C3, C4, C6, C7, C10, C11, C12, C13, C14, C21, C26
Forest Management Plans	MFS, CF	C1, C9, C12
Timber Stand Improvement	MFS, CF	C10, C13, C26
Conservation Easements	MET, Land trusts, MFS	C7, C8, C15, C18, C19
Forest wetland creation	DU, NRCS, MFS	C5, C6, C14, C29
Urban tree planting	MFS, Worcester Co.	B1, B4, C22, C23
Tax abatement for forest land	MFS	C7, C12, C13, C17
Wildlife habitat creation	NRCS, MFS, MWHS, USFWS	C14, C16, C21, C25
Timber Harvest	CF	C12, C13
Shoreline Stabilization	SEC	C20

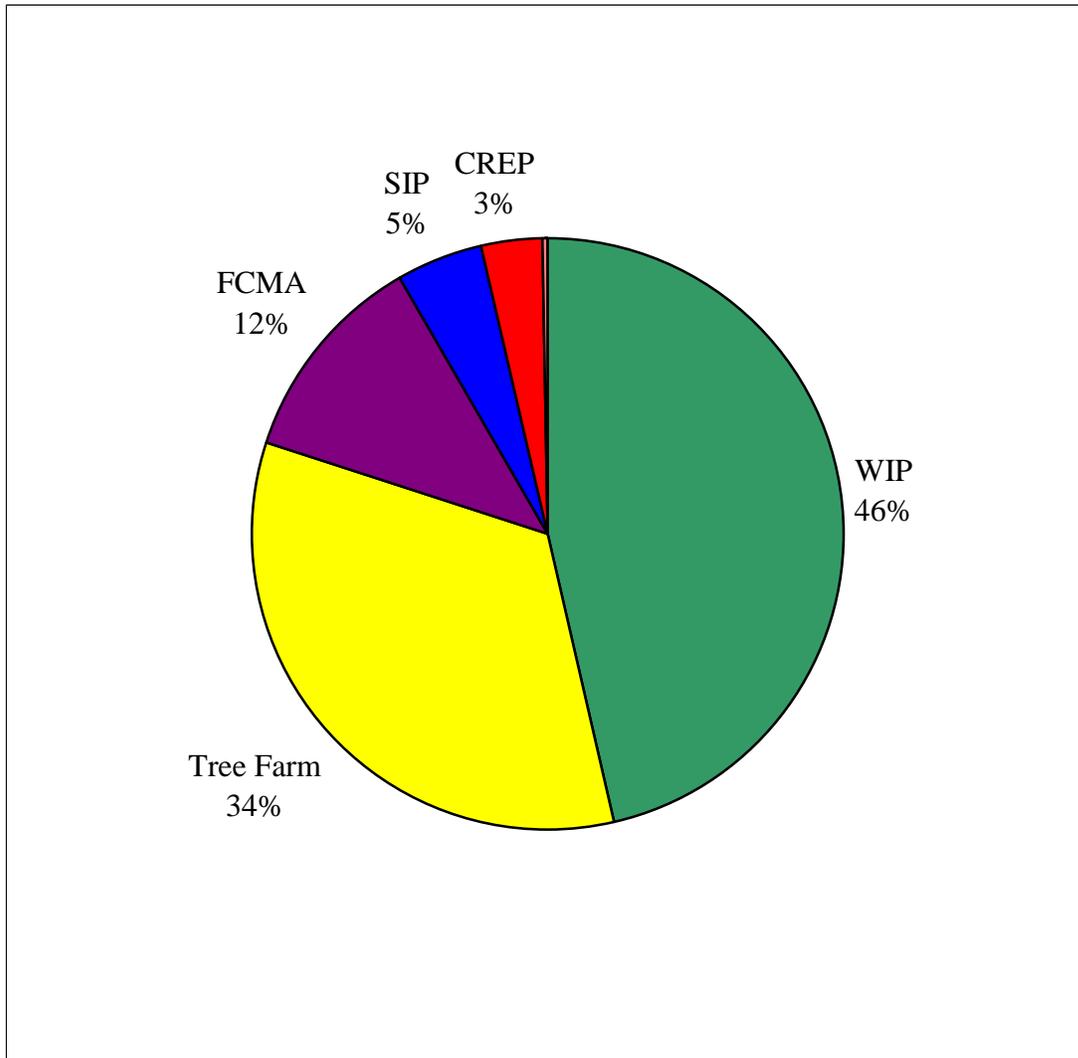


Figure 13: Use of Forestry Assistance Programs in Worcester County, based on acreage in Forest Management Plans from 1990 to 2000 (note: half of acreage with management plans used no program).

The most commonly used programs have been Woodland Incentive Program (WIP) and Tree Farm (Figure 13). Forest Conservation Management Agreements also are common, used to gain agricultural tax assessment on acres that otherwise could be taxed at full development value in exchange for a 15-year commitment to forest use. Conservation Reserve Enhancement Program, used to establish forest cover near water or on erodible soils, was only a small part of the assistance programs used over the 10-year time span for management plan data summarized here. However, CREP was available only the last few years of the period, and only a limited acreage is eligible; program use has been growing rapidly, and may be used more widely than indicated here. Stewardship Incentive Program was not funded for several years during the period, and may otherwise have been used more widely. Several forest incentive programs may be

replaced by a Forest Landowner Enhancement Program in the next federal Farm Bill, which authorizes federal assistance programs. FLEP is expected to provide financial assistance to landowners for afforestation and stand improvement activities similar to those previously covered by WIP, FIP, and SIP.

Forest Buffer Creation

Restoring forest buffers along streams and waterways is a common practice for improving water quality and stream habitat. The establishment of forest buffers has expanded rapidly in the last few years with the advent of attractive cost-share programs, particularly the Conservation Reserve Enhancement Program. In 2000, 5.3 miles and 126 acres were established in Coastal Bay watersheds. In 2001, over 14 miles and 216 acres of forest buffers were created. Since 1996, over 366 acres and 21 miles have been established in Coastal Bays watersheds, primarily in agricultural areas in the south (Table 9).

In Worcester County, 21% of the 907 acres of CREP plantings received hardwoods in 2001. Additional hardwoods commonly naturally regenerate. The average number of species found in buffers in the Eastern Region was 7.8 species, and in three sites in Worcester County was 6.7 species (Pannill et al., 2001). The number of species reflects both the diversity of species being planted and the additional contribution of natural regeneration.

Table 9: Riparian forest buffers in Maryland Coastal Bay watersheds established since 1996

Watershed	Buffer length (ft)	Average buffer width (ft)	Buffer area (acres)
Assawoman Bay	8300	120	22
Chincoteague Bay	78925	160	246.5
Isle of Wight Bay	7198	161	30.9
Newport Bay	14880	126	46.4
Sinepuxent Bay	5412	210	20.5
All Coastal Bays	114715		366.3

Seedling Supply

One issue for hardwood restoration has been sufficient supply of native tree seedlings. The State Nursery outside Preston has more than doubled production of hardwood seedlings over the last four years, along with a significant expansion of number of species (Table 10). The great majority of species are native to Maryland, and most seeds are collected from Maryland trees. Seedlings of native hardwoods are available from other suppliers as well. Containerized trees are produced by private growers.

Genotypes and species specific to the Coastal Bays would not be differentiated from any of these sources.

Table 10: Seedling production at the Maryland State Nursery

Year	# Hardwoods Sold	# Hardwood Species Grown	Conifers	All
1999	881,750	27	3,375,325	4,257,075
2000*	1,254,565	30	4,842,425	6,096,990
2001	1,241,975	34	5,276,400	6,518,375
2002	1,862,550 est.	42	5,130,000 est.	6,992,550 est.

*Includes 400,000 locusts grown on contract.

Forestry goals in the Coastal Bays Management Plan

The Coastal Bays Management Plan, “Today’s Treasures for Tomorrow: Towards a Brighter Future”, identified goals for water quality, fish and wildlife habitat, recreation and navigation, and community and economic development. Most of the goals that could be met through forestry are related to fish and wildlife, with one in community and economic development. The most relevant goals and actions are listed below as the basis for initially identifying issues.

Goal 2 under Fish and Wildlife is: Enhance forest habitats to protect songbirds, other wildlife populations, and aquatic resources.

FW 2.1: Determine the extent, spatial distribution and composition of forested habitat needed for neotropical and migrating birds in order to retain viable populations.

FW 2.2: Develop a comprehensive county forest conservation strategy to enhance forest and other critical habitats in order to protect water quality, aquatic resources, wildlife populations and improve the stability of the forest products industry.

FW 2.3: Promote diverse forests by providing funding, consolidating overlapping programs and educating the public on options.

FW 2.6: Promote forest products industry by providing economic incentives and improving management strategies that decrease conversion of forestland to other uses.

Goal 2 for Community and Economic Development is: Foster a community consensus on the desired future condition of the Maryland Coastal Bays region and a vision of how

to promote the county as a vacation destination, farming region, resource protection area, and retirement community, while protecting and preserving the Coastal Bays.

CE 2.1 Promote the culture and character of the region by continuing to preserve, restore, and enhance wetlands, forests, and cultural resources and educating the public about available tools.

Summary of desired benefits

- Forest land use retained
- Terrestrial and aquatic habitat and species diversity improved (quantity and quality)
- Rural character of the watersheds maintained
- Forest industry stable and sustainable

Issues

The data presented above suggest that with existing trends, forest land cover is likely to continue to be lost, particularly in the northern portions of the Coastal Bays. The threat of forest loss is primarily from conversion to developed land uses. There is room to pursue greater levels of the desired benefits outlined in the Coastal Bays Management Plan, including wildlife habitat and a robust resource-based economy.

Retaining forest land use: Although the rate of conversion of forest land to other uses is lower than in some areas of the state, the ten-year regional trend was an increase in the rate of land conversion from previous decades and County growth is expected to be concentrated in the Coastal Bays. There is no indication that harvesting is occurring at an unsustainable rate. The 1.2% harvest rate seen in 2000 is close to the 1.1% statewide average over the last fifteen years. The recent forest inventory showed an expansion in tree volume in total and on a per acre basis for the region.

Improved habitat and species diversity: The historic forest in the region was adapted to a wildfire regime that is not and cannot be part of the modern landscape. Forest were regenerated after events such as wind or ice storms and fires, both natural and set by Native Americans. Fires generally favor pines and oaks with their thicker bark, stored seed, and intolerance to shade. In the settled landscape, fires are smaller and areas burn less frequently, so other actions are needed to maintain some of the historical stand types, usually cutting, herbicide, or prescribed fire. The regional trend over the last period saw a modest increase in pine forest types, while most hardwood forest types decreased slightly or stayed level. However, in the sawtimber stands where larger trees would be found, the region saw an increase in oak/hickory types from 26% to 30%.

Forest health issues such as Gypsy moth defoliation are pervasive and persistent, although damage usually has not been near epidemic levels. The feeding preference of gypsy moths for oak should be noted. The most commonly recommended way to maintain resilience of forests on the landscape in the case of pest outbreaks is to

encourage a variety of species types in forest composition. While pines have been favored by planting and management, oaks have not been actively managed as a usual practice.

Neotropical migrant birds, many of which are termed forest interior dwelling birds, are generally favored by large blocks of forest, probably the most limiting factor in the current landscape (Figure 14). Greater proportions of hardwoods in stands are also thought to provide higher quality habitat for many, but not all, migratory birds. Edge is an abundant part of the current landscape, so creation of more edge habitat is unlikely to help meet goals to diversify habitat. The two major approaches to address likely terrestrial habitat needs would be to 1) afforest near forest blocks to increase interior forest, and 2) to increase hardwood components in interior forests.

Delmarva Fox squirrel habitat core areas in the Coastal Bays are primarily in the south, at the E. A. Vaughn Wildlife Management Area and portions of the Pocomoke State Forest. Private land between these areas could be voluntarily managed to favor the squirrels, if the landowners chose, by maintaining relatively mature stands and some mast-producing hardwoods such as oaks or beech. Other species that depend on mixed or hardwood stands and older forests are listed in Appendix B.

The information about landowner management objectives suggested a strong interest in multiple purpose forest management, so many may be receptive to information about how to balance forest products and wildlife goals. Currently, some of the silvicultural techniques are recommended in management plans, but not carried out when harvest occurs. The expense of foregoing part of the harvest becomes very clear to the landowner, while the wildlife benefits are less well-understood or quantified. Often the most effective way of sharing technical information with landowners is one-on-one contact with a forester, an approach that is limited by resources for sufficient staff. Printed information on multiple use forest management may be of some use, particularly as a reminder following a personal visit or an incentive to contact a forester; information should include possible financial impacts and benefits to landowners and/or consultants to clarify short-term and long-term consequences.

Increasing a hardwood component in forests can mean financial tradeoffs in a region where the pine market has been the most lucrative and reliable. Pine markets show every sign of continuing to be the most reliable market into the future. Recommendations to accommodate wildlife goals may want to maintain a core pine component for most rural landowners, because they often need to assure income from their land. Mixed stand management with high-quality oaks managed on a longer rotation may provide a balance for economic and environmental objectives of a landowner, although the greater cost, longer planning horizon, and skill required during logging should be taken into account. Training for loggers and consulting foresters in optimizing income with more complex product merchandizing and minimizing residual damage to hardwoods retained in stands could be offered. Use of natural regeneration, particularly on land naturally suited to reproduction of a merchantable pine component could prove an economically attractive alternative to some landowners. Although natural

regeneration carries more uncertainty and possibly longer times to establish a new forest, it avoids the cost investment in planting stock that the landowner would have to carry for decades until harvest.

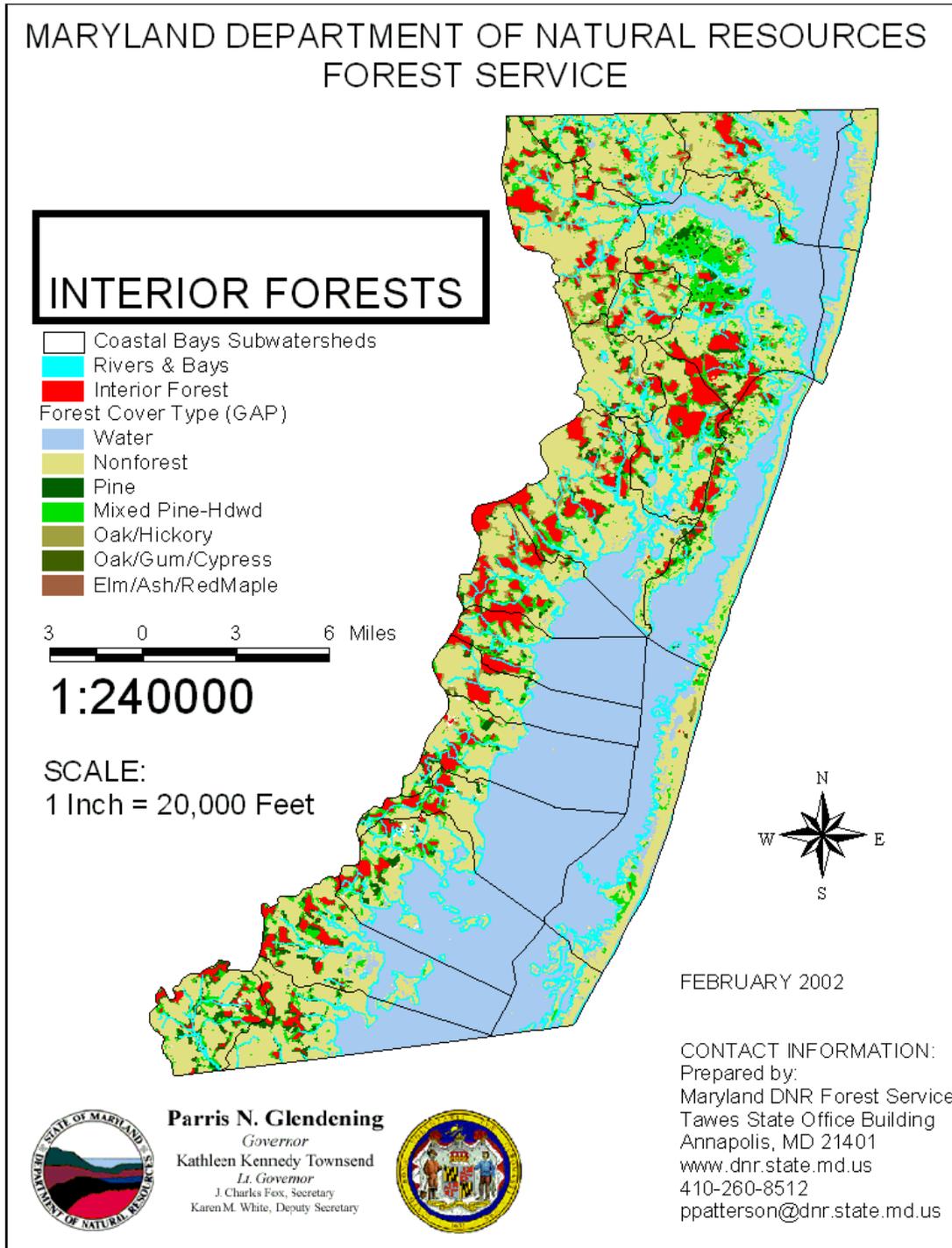


Figure 14: Interior Forest in the Coastal Bays watersheds

Aquatic habitat is most affected by riparian forests, which supply organic debris as the base of the food chain and large wood for in-stream habitat structure (cover and pool formation). Continuing to pursue policies to afforest streambanks is most likely to improve aquatic habitat, although it may not contribute to interior forest.

Maintaining rural character of watershed: Retaining forest and farm land use provide a backbone for maintaining rural character. The rural character also depends on maintaining traditional uses, such as farming and forestry, where landowners are supported by income from their land, not from outside sources. Forests would be periodically harvested using practices that generate income and provide incentive for landowners to continue forest uses. The income would be at levels that make forestry an investment competitive with other rural land uses over the long term.

Financially stable forest industry: Retaining forest land use is a necessary step to keeping a healthy forest industry, but it is not sufficient. Timber markets provide a widely understood economic incentive to retain forest land use. If more hardwoods are a goal for the Coastal Bays, stronger hardwood markets would be desirable, particularly for low-value hardwoods that would be the first products from hardwood stands being managed selectively. Green energy markets that include wood biomass are developing on the Shore, and may help provide some outlet for low-quality hardwoods. Greater diversity in markets and products would help maintain forest operators during the typical cyclical trends. More local processing would enhance economic contributions. Currently the eastern region of the state leads in economic activity for growing and managing trees, but most secondary processing occurs in the more urban areas. Overall demand for forest products is expected to increase, but so is foreign competition.

Changes in harvesting equipment can also greatly affect feasibility of more complex harvest techniques and can reduce water quality and site quality impacts during a harvest. Smaller equipment and extendable harvesting heads can be more suitable for partial harvests and handling smaller trees. Equipment size can also greatly affect area needed for landings and roads. Narrower haul road widths would reduce impacts crossing wetland areas or any area where borrow material is needed to create a stable road. An issue of concern is building roads to standards greater than needed for forest management, and planned for later conversion to development; this increases impact of road and ditch construction and can possibly result in avoidance of the appropriate mitigation at the time of development. Site preparation techniques that also minimize ground disturbance can further contribute to limiting water quality impacts. Most of the area in the Coastal Bays watersheds has little slope, which greatly limits the likelihood of sediment transport beyond the harvest site.

Opportunities

The Maryland Forestry Task Force met from 1999 to 2000 to identify ways to promote a healthy and abundant forest in Maryland (Maryland Forest Task Force, 2000). Substantial time and effort went into developing recommendations that address many of

the same issues important to the Coastal Bays watersheds, and are referenced below where relevant. Some additional opportunities were identified by the Coastal Bays Program forestry work group.

Retaining forest land use

Fund assistance programs for afforestation and management: A number of state and federal programs are available (see Forestry Assistance Programs chapter). Some, such as Stewardship Incentive Program, have been limited by lack of funding, or the small amount of funding has limited use to only a few individuals in any particular county. A new forest landowner assistance program is in the 2002 USDA Farm Bill and is funded this year, but support for continued full funding is necessary. The Maryland Forestry Task Force recommended expansion of state incentives to private landowners to retain and manage forests (Recommendation 9).

Improve information on assistance programs: Materials on most programs is produced regularly but often is not available in locations frequented by landowners. Some improvement could be gained from assuring stocking of information materials at the Forest Service office, NRCS/Soil Conservation District office, county permits office, library, Coastal Bays Program office, and Cooperative Extension Service office.

More favorable tax treatment for forest land: Delaware waives property taxes on forest land under a management plan, a strong incentive to retain and manage forest. The Maryland Forestry Task Force recommended several tax-related actions, including: #10, a one-time State income tax credit for cost of developing a forest stewardship plan; and #12, statewide enabling legislation to allow counties to grant property tax credits on agricultural land with a nutrient management plan or forest land with a forest management plan. The drawback is that these strategies result in less revenue to the state or local jurisdiction, and can be difficult to enact into law.

Improved habitat and species diversity

Most recommendations for habitat or diversity involve maximizing forest patch size or increasing a hardwood component (although it should be noted that the Coastal Bays forests already have a much higher hardwood component than in 1914).

Open space reservations in developments: The Forest Conservation Act and other county requirements during development call for certain portions of the property to be reserved. Consideration should be given to retaining areas adjacent to existing forest to maximize forest area retained, whether it is voluntary or required.

Educate Homeowners Associations on forest management: Forests retained during development may be transferred to the development's Homeowners Association, which typically has little expertise in managing forests. Information provided to HOAs should

include the ecological functions of forests, protection needed to maintain desired functions, and appropriate sustainable management of forests.

Target afforestation using FCA mitigation funding: Opportunities for afforesting near new or existing forests include sites adjacent to CREP buffers and parcels receiving easements through Forest Legacy or Rural Legacy where owners have interest and opportunity for increasing forests. Mitigation banks can be developed, allowing small mitigation payments to purchase new forest in a larger block.

Provide GAP data to county: Several of the recommendations for the development process require greater spatial information on forest area and type that the county currently has available to use in plan review. Both the GAP forest type coverage and GIS software necessary to use it should be provided to the county planning office.

Continue planting buffers: As forest buffers mature, they improve aquatic habitat and water quality. To limit impact on rural character, highly productive farmlands should be maintained in agriculture, and only marginally productive, droughty, or excessively wet lands planted for buffers.

Promote multiple objective forest management techniques: A variety of information and education actions can be used to help landowners understand why mixed stand or hardwood management might be desirable for meeting their goals and where in the landscape it might be most suitable. Examples include:

- Develop a sample alternate plan in Seed Tree Law to encourage management of hardwoods (e.g., for wildlife objectives);
- Create a fact sheet on Seed Tree Law explaining rights and responsibilities of landowners and options for use of alternate plan;
- Create a fact sheet on management options being used on public lands to incorporate multiple-use objectives;
- Develop a demonstration area for hardwood management that could be used for professional and landowner training;
- Create fact sheets on mixed stand management, indicators and rationale for maintaining hardwood sites, benefits for habitat from prescribed burning and restrictions on its use; and
- Use demonstration areas on Chesapeake Forest lands in the region to show results of lower rates of herbicide in maintaining oak components, cost-effective thinning techniques, natural regeneration, and prescribed burning.

Pursue forest certification on state forest lands: State-owned lands should be used to demonstrate a practical application of sustainable forest management that could be extended to private ownerships. Forest certification is a documented method of identifying and documenting compliance with a variety of principles of sustainable management, and should include independent third-party auditing to maximize credibility.

Offer training and support for alternative logging methods: Partial harvests such as thinning or group selection typically are more complex to carry out. Training could help operators address issues on worker safety, residual tree damage, and techniques for maximizing return with different product types. The Master Logger Program is one existing avenue to offer training.

Pursue limits on road widths: Safety issues must be met, but limiting width of woods roads usually reduces total impact of new road construction for silviculture, and would prevent overbuilding to accommodate future development.

Maintaining rural character of watershed

Promote management plans on forests, particularly for forest products: The central recommendation of the Maryland Forestry Task Force suggests increasing landowner outreach efforts by a variety of stakeholders to result in 75% of private forest land having forest stewardship plans over the next 10 years. Forest stewardship plans help landowners clarify their goals for managing woodlands and identify techniques and timing of activities to achieve their goals. Plans convey information on a range of values and benefits, including the value of the timber, so that owners understand the potential opportunities and effects of forest activities. Regeneration of the future forest is considered in management recommendations. The desired outcome is more deliberate decisions on management and harvesting, with more information for landowners to use in weighing the immediate financial gain possible with activities needed to realize their long-term management goals. Current estimates in Maryland are that 25% of the forested acres and 10% of the owners have plans. The 75% goal is based on a desire for a sustainable pool of land to support a forest industry, given that 90% of Maryland's forests are privately owned.

Conservation easements/ estate planning: The Potomac Conservancy is developing easement language that preserves landowners rights to future harvests when conservation easements are sold or donated for tax benefits. Maintaining these rights allows more options for landowners to generate natural resource-based income and support a local rural economy.

Financially stable forest industry:

The Maryland Forestry Task Force identified several opportunities to strengthen forest industry as part of a priority on renewable natural resource investment. One recommendation on making axle weight variance allowances for timber equivalent to those used for crops has already been enacted to create greater parity between forestry and agriculture. Other recommendations include:

11, provide a sales tax exemption for all equipment and pollution control devices directly used in the primary and secondary wood manufacturing process in counties eligible for the 1999 One Maryland Economic Development Program for Distressed

Counties, which includes Worcester County. This is designed to encourage modernization of sawmills and creation of furniture-making companies or other value-added companies.

#14, provide leadership that promotes public understanding and support of renewable energy projects that utilize biomass as a fuel source. This is designed to increase the use of forest residues in generating clean energy and the 0.85 cents/kilowatt hour income tax credit for producing energy with these fuels. Energy plants fueled by biomass could also supply a market for small hardwoods that would be removed in partial harvesting techniques.

#16, create a Renewable Natural Resource Investment Priority, for State financial assistance. A Task Force on Natural-Resource Based Industries is currently authorized and is examining the need for a finance development authority to assist Maryland's farming, fishing, forestry and mining industries with loans, financing, training, and technical and business planning assistance services. This recommendation was advanced for their consideration.

17, encourage the Dept. Business and Economic Development to work with local offices to promote an understanding of the environmental benefits of forest stewardship and the economic benefits of assisting forest industry in modernizing equipment and creating new businesses. An assistance program could include favorable treatment for low-impact harvesting equipment or equipment used in thinning or partial cuts that would be more suitable for partial cuts and mixed stand management.

In summary, the forests in the Coastal Bays watersheds are dominated by mixed stands of pines and hardwoods and are at greatest risk of loss in the northern Coastal Bays watersheds. The southern Coastal Bays watersheds have the greatest potential for maintaining a rural landscape and optimizing habitat values provided by large blocks of forest. Opportunities to maintain or expand forest extent include:

- supporting incentives for forest ownership and management, and
- expanding availability of incentive information.

Opportunities for improved habitat and species diversity include:

- maximizing forest blocks during development,
- protecting and expanding riparian forest buffers, and
- supporting multiple objective management with education and incentives.

Opportunities for maintaining rural character and a healthy forest industry include:

- promoting management and planning of forest lands,
- providing incentives and leadership for diversifying forest products markets.

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Appendix A. List of vegetation types used in condensing GAP data

Note: Some of the GAP vegetation types are mountain ecotypes that would not occur within the Coastal Bays region, but all codes were assigned to a category to avoid errors in condensing the data.

Pine: 411-coastal upland pine forest (planted or natural), 416-Virginia pine forest, 435-red pine forest, 444-redcedar woodland, 448-pitch pine wet woodland

Mixed Pine-Hardwood: 407-lowland pine woodland, 410-coastal lowland pine forest (pine-mixed hardwood), 415-loblolly-mixed oak forest(shared dominance between P. taeda and oaks), 417-Virginia pine-mixed oak forest, 418-Coastal Plain pine-mixed hardwood lowland forest, 434-mixed pines forest (white pine-hemlock w/ maple, birch, beech or oak), 447-short-needle pine-mixed dry oak forest(pine barrens), 451-hemlock-mixed hardwood forest

Oak/Hickory: 421-coastal plain beech-oak forest, 428-lowland mixed oak forest, 436-red oak–white oak forest, 438-chestnut oak forest, 441-mixed oak-sugar maple forest, 445-Piedmont beech-oak forest

Oak/Gum/Cypress: 419-sweetgum swamp, 420-mixed wet oak forest, 423-sweetgum forest, 426-bald-cypress tidal swamp, 446-tidal Atlantic white-cedar forest, 459-non-tidal mixed hardwood-conifer swamp (red maple-black gum swamp, pockets of bald-cypress/Atlantic white-cedar), 461-non-tidal Atlantic white-cedar forest

Elm/Ash/Red Maple: 422-yellow-poplar forest, 424-sycamore-mixed hardwood riverside forest, 425-red maple-pumpkin ash swamp, 439-beech-yellow-poplar forest, 442-rich northern hardwood forest (maple/ash/basswood dominant), 458-red maple-green ash swamp

Water: 400-water, 401-tidal shallow/turbid

Non-forest: 402-row crops, 403-tidal herbaceous beach community, 404-tidal high marsh, 405-tidal marsh, 406-tidal tall grass marsh, 408-mixed grass/low shrubs, 409-tidal maritime shrublands, 412-non-tidal flooded herbaceous, 413-bare sand, 414-cultivated trees(orchards, vineyards), 427-urban, 429-bare/exposed/manmade features(mines, quarries, gravel pits), 430-clearcut/transitional(dominated by grasses and shrubs, in future could be pine, hardwood, or shrub), 431-beachgrass shrublands, 432-dwarf beach shrublands, 433-tidal cattail marsh, 437-non-tidal sparsely vegetated beach alliance, 440-high mountain shrub swamp, 443-freshwater tidal emergent marsh, 449-highbush blueberry-leatherleaf shrub swamp, 450-inland graminoid marsh, 452-urban recreational grasses, 453-pasture/hay, 454-dune grassland, 455-non-tidal tall grass marsh, 456-non-tidal mixed grass/low shrub, 457-non-tidal maritime shrublands, 460-non-tidal cattail marsh

Appendix B. Species that cannot survive without mixed, hardwood, or older forest stands

Information developed by Dave Wilson, Jr., Coastal Bays Program, Scott A. Smith, MD DNR Wildlife and Heritage Service, and Dr. William L. Grogran, Jr., Department of Biology, Salisbury University

Birds:

Red-shouldered hawk
Broad-winged hawk
Barred owl
Whip-poor-will
Hairy woodpecker
Pileated woodpecker
Acadian flycatcher
Brown creeper
Veery
Wood thrush
Yellow-throated vireo
Red-eyed vireo
Northern parula
Black-throated green warbler
Cerulean warbler
Black and white warbler
American redstart
Prothonotary warbler
Worm-eating warbler
Swainson's warbler
Ovenbird
Louisiana waterthrush
Kentucky warbler
Hooded warbler
Scarlet tanager

Reptiles and amphibians:

Ringneck snake
Scarlet snake
Northern pine snake
Red-bellied snake
Smooth earth snake
Red-bellied watersnake
Wood frog
Gray treefrog
Carpenter frog
American toad
Red-spotted newt
Marbled salamander
Tiger salamander
Dusky salamander
Two-lined salamander
Mud salamander
Mud turtle
Stinkpot
Spotted turtle
Eastern box turtle
Broad headed skink