RESULTS FOR MATRIX-FORMING ECOSYSTEMS*

Modifications to Standard Method

Disturbance Scaling in CBY

The disturbance scaling approach proved more challenging in the Chesapeake Bay Lowlands ecoregion than elsewhere, because studies examining climatic and other large-scale catastrophic disturbances to native vegetation in CBY are almost totally lacking. What little information exists suggests that *large-scale disturbances in the coastal plain of the Mid-Atlantic are extremely rare*.

Hurricanes

Remarkably, Delaware, Maryland and Virginia are less likely to be struck by hurricanes than almost all other states along the East Coast, from Massachusetts to Florida, in spite of having a considerable amount of land area in the Coastal Plain. Between 1898 and 1992, only a single storm of hurricane strength (> 74 mph) passed through Maryland, Hurricane Hazel (Category 2) in 1954 (Neumann et al. 1993). In that same hundred-year period, no hurricanes struck Delaware, and only four hurricanes (two unnamed storms, Category 2 in 1933, and Cat. 3 in 1944, Connie, Cat. 1 in 1955, and Charley, Cat. 1 in 1986) took paths that crossed into Virginia (Neumann et al. 1993). New York and Connecticut are actually more likely to be struck by hurricane-strength storms than are Delaware and Maryland; from 1898 to 1992, 9 hurricanes hit New York and 8 struck Connecticut. For states south of Virginia, of course, hurricanes are common; from 1898 to 1992, North Carolina was hit by 24 hurricanes, and South Carolina by 15 (Neumann et al. 1993). The reason for this pattern was not investigated for this document, but would appear to reflect a complex meteorological interaction between hemispheric circulation patterns, oceanic currents, prevailing winds and the geometry of the U.S. coastline.

Considerable information is available describing the impact of hurricanes on coastal plain forests in the southeastern U.S., with many studies evaluating the impact of Hurricane Hugo (Category 4) on coastal forests in South Carolina in 1989 (USDA 1997). Incredibly, an area of 4.5 million acres was significantly impacted by this storm, with damage to many trees in a large portion of this area, including parts of Congaree National Forest. Many of the forest areas affected, however, were dominated by even-aged stands of relatively young (< 40 years old) loblolly pines on lands used primarily for timber/pulpwood harvest. Because large stands of even-aged loblolly pine plantations also characterize extensive areas of CBY, a large hurricane striking the region might be expected to cause damage similar to that seen from Hurricane Hugo. At the same time, this pattern of damage is unlikely to resemble what would have been typical for undisturbed, mature upland (i.e., long-leaf pine dominated) and lowland (mixed hardwoods) forests on the southern coastal plain in pre-colonial periods. So this event provides little, if any, guidance for assessing either historical patterns of hurricane damage to Mid-Atlantic coastal plain forests, or patterns likely to characterize contemporary hurricane damage to natural forest stands in the region.

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* Anderson, M.G. and S.L. Bernstein (editors). 2003. Results for matrix-forming ecosystems. Based on Samson, D.A. 2002. Chesapeake Bay Lowlands Ecoregional Plan; First Iteration. The Nature Conservancy, Conservation Science Support, Northeast & Caribbean Division, Boston, MA.

Tornadoes

Tornadoes are uncommon but not rare in the Chesapeake Bay Lowlands ecoregion. Between 1950 and 1995 there were 55 recorded in Delaware, 103 in Maryland (CBY counties only) and 59 in Virginia (CBY counties only) (Tornado Project 2002), or an average of almost five per year for the ecoregion. Of those 217 tornadoes, 28% (60) were categorized as F0 (Weak; winds 40-72 mph), 56% (121) as F1 (Moderate; winds 73-112 mph), and 15% (32) as F2 (Strong; winds 113-157 mph). Only 4 tornadoes recorded from 1950 to 1995 were categorized as F3 (Severe; winds 158-206 mph), and no storms in any of the three states during that time period have ever reached the two highest categories on the Fujita scale, F4 (Devastating; winds 207-260 mph) and F5 (Incredible; winds 261-318 mph).

Ranked by total number of tornadoes between 1950 and 1994, Virginia placed 29th, Maryland 34th, and Delaware 44th among all states in the U.S. (NOAA website, 2002). Standardizing the ranks by taking size differences among states into account, however, Delaware ranked an amazing 6th among all states (ranks of Maryland and Virginia not available; NOAA website, 2002).

Data on path widths and lengths for tornadoes that have occurred in the service area of the Baltimore/Washington National Weather Service Forecast Office are available on-line (NOAA website, 2002). For 50 tornadoes recorded between 1926 and 1996 in four counties on Maryland's western shore, the average length was 1.9 miles, and average width was 85 yards (lengths ranged from 0.1 to 17.8 miles, and widths from 15 to 500 yards, and there was no obvious correlation between F-scale and length or width). The "severe" impact area from an average tornado in this area, then, would be only about 59 acres (and in a long, narrow line), with the degree of impact depending on the specific intensity (F-scale) of the event. (*Note: The discussion and calculations here should be viewed as a "back-of the-envelope" exercise, rather than a scientifically rigorous analysis. There are a number of qualifications related to the analysis of this data that will not be discussed further here*).

There are no published articles available describing tornado damage to large forested tracts in CBY, or even to natural areas more generally in the ecoregion (versus extensive records of damage to homes, businesses, utility lines, developed areas, etc.). Tornado damage effects to forests have been described at other sites around the U.S. Above threshold wind speeds, areas of complete blowdown can occur, but at lower storm intensities, the nature and scope of the damage varies among species, tree ages/sizes, and community types (e.g., upland versus floodplain) as a function of wind speed and direction, storm velocity, and other factors. Forest recovery from tornado damage, however, may more typically resemble gap vegetation dynamics, given the linear geometry and limited scale of the typical disturbance. At the same time, some tornadoes are spawned by hurricanes and accompanied by flooding rains, and others produce hailstorms, so additional disturbance impacts to natural areas may be associated with certain storm events.

Taking all of this frequency, intensity, and impact-area-size information into account, it appears that tornadoes are likely to be only a minor disturbance event affecting forests in CBY, both currently and in pre-colonial times.

Downbursts, Floods, Ice Storms, Insect/Disease Outbreaks

Studies describing the scale and frequency of downbursts, floods, ice storms and insect outbreaks in the Mid-Atlantic coastal plain, or the ecological effects of such disturbances on native forests in the region, are lacking. Speculating in the absence of data, floods in the Chesapeake Bay Lowlands would be unlikely to function as major disturbance events for matrix forest communities; impacts would be confined to floodplains (where vegetation is adapted to flooding) or adjacent edges in higher elevations of the ecoregion (i.e., western shore of MD), while on the Delmarva Peninsula high infiltration rates and low, flat topography would minimize the destructive force of floodwater flows. Even the excessive regional flooding that resulted from Tropical Storm Agnes in 1972, caused little measurable destruction of forested communities in the ecoregion.

Ice storms are not infrequent in the Mid-Atlantic, but most of the evaluation of the impacts of these events focuses on damage to private property, utility lines, and commercial development, rather than natural areas. Again, speculating in the absence of scientific research, the argument could be made that pre-colonial forests in the region were unlikely to have been significantly affected by ice storms; most of the damage from these events is caused by excess weight that develops on horizontal or angled tree limbs, a growth form that is typically lacking in trees growing in dense forest stands.

Individual tree species and entire forest stands have certainly been devastated by insect and disease outbreaks – e.g., chestnut blight, gypsy moths, southern pine bark beetle - in the CBY region in the past. But most of these well-known known cases are the result of the introduction of exotic pests by humans, or have largely impacted “artificial” forest stands (i.e., pine plantations established for tree farming). The pre-European impact of native insects and disease organisms on coastal plain forest stands is unknown, and probably unknowable.

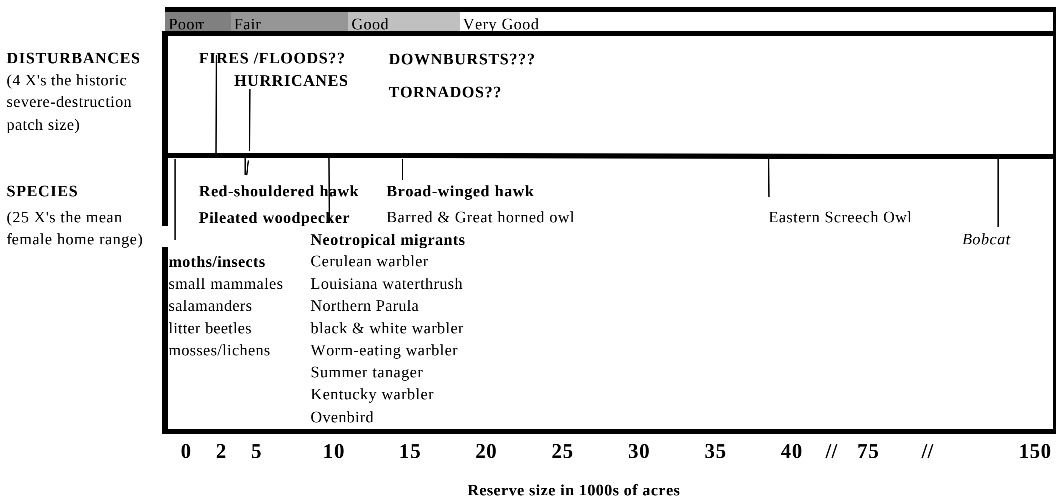
Fires

The fire history of the Mid-Atlantic region has received far less scientific attention than other areas of the U.S., presumably because in a landscape characterized by moist temperate climate and extensive cover of mesic deciduous forests, fire is unlikely to have been a major disturbance factor in structuring vegetation patterns. Currently, we are not aware of a single article or publication that attempts to reconstruct the natural fire history of forests in the Mid-Atlantic coastal plain region prior to European colonization. Authors who have written about fire use by Native Americans inhabiting the ecoregion generally describe fire as being used only locally and at low-intensity to clear forest understory for settlements and garden areas (e.g., Rountree and Davidson 1999). While wildfires undoubtedly occurred in CBY forests prior to 1500, except for periods of extended drought, the scale and frequency of canopy-level, catastrophic wildfires was likely to have been low.

Scaling Criteria in CBY

Using Figure 3, we set our minimum size criteria for matrix forest occurrences in CBY at 10,000 acres. At this point in time, 10,000 acres is a *minimum* threshold; that is, it is not necessarily large enough for the reserve to fully function as a coarse filter for common species in the ecoregion over time. The actual size needed for each reserve to remain functional depends on what happens to the entire landscape of the ecoregion over the next two centuries. Ten thousand acres *is* intended to define a reserve size below which matrix forest conservation will likely not succeed, or will become increasingly expensive and labor intensive to maintain.

Figure 3. Scaling factors and minimum reserve size for matrix forest occurrences in the Chesapeake Bay Lowlands ecoregion.



Locating, Selecting, and Prioritizing Matrix Forest Areas in CBY

The ELU analysis and block-group selection process proceeded somewhat differently in CBY, for several reasons. First, given the low elevation and the lack of relief in the coastal plain, the total number of ELU types in CBY was significantly less, and the geographic extent of each type was far greater, than in other ecoregions in the eastern U.S. (Map 2 and Map 13). Six ELU groupings were identified by the cluster analysis, which combined with the small number (20) of draft matrix blocks mapped for the ecoregion, meant that only 2-4 blocks per ELU group were present in CBY. This result, together with the spatial arrangement of the blocks in the ecoregion, vis a vis the number per group and number per state, was such that selecting a subset of only the highest rated blocks per group was deemed to be unnecessary. At the second meetings held state-by-state, the ELU block groupings were confirmed as reasonable, the condition, characteristics and boundaries of the blocks were reviewed, and 10 Year Action blocks were chosen by each state. All 20 blocks are considered to be in the CBY portfolio.

Numerical Goals for Matrix Forest Examples in CBY

Numerical goals, per se, were not set for matrix forest occurrences in CBY, except to include at least one example of each ELU-group, as noted above. Given the geologic and topographic homogeneity of the CBY ecoregion, and the fact that several of Bailey’s sectional boundaries extend beyond the ecoregion (due to the Conservancy’s subdivision of Bailey’s original, much larger Coastal Plain ecoregion), no attempt was made to stratify matrix forest occurrences across sections in the ecoregion.

Results: Locations and Characteristics of Matrix Forest Blocks

Twenty matrix forest blocks totaling almost 1 million acres were included in the Chesapeake Bay Lowlands ecoregional portfolio (Map 2, Table m1). Four blocks occur in Delaware, with three of those overlapping into Maryland. Thirteen blocks fall entirely in Maryland, five on the Eastern

Shore and eight on the western side of the Chesapeake Bay. Three matrix forest blocks occur in Virginia, two of which share a portion of a common boundary formed by a large highway (Map 2).

The CBY matrix forest blocks range considerably in size, from just over 10,000 acres (Calvert Cliffs and McIntosh in southern Maryland) to as much as 225,000 acres (Dragon Run in Virginia; Table m1). The Virginia blocks, except for Nassawango on Maryland’s Lower Eastern Shore, are the largest in the ecoregion. The average size of the matrix blocks in CBY is just over 48,000 acres, or almost five times the minimum size for a single viable matrix forest occurrence (above).

As expected, forest cover is quite high (average of 71%) for the majority of the blocks, and more than half the blocks exceed 80% total natural vegetative cover (Table m1). The three blocks with forest cover values below 50% (Aberdeen, Upper Rappahannock, Lower Pocomoke) have more than 20% of the area within the block in emergent marsh and/or open water, so the total natural cover values remain above 70% for two of the three. Although several blocks approach 90% total natural cover, only A.P. Hill exceeds that value.

The proportion of the land area in agriculture within CBY matrix forest blocks averages 18.5%, considerably less than the value (33%) for the ecoregion as a whole (Introduction, above). However, agricultural land use is 25% or higher for four blocks, and two of those (Blackbird-Millington and Upper Rappahannock) have more than a third of their total acreage in agricultural use (Table m1). Developed land cover is less than 1% for almost half the blocks, but it is 4% or higher for four blocks. However, only Aberdeen has a developed land cover value that exceeds the overall average (7.7%) for the ecoregion. Among blocks, there is no discernable correlation (positive or negative) between developed land cover and forest cover, agricultural land, or total natural cover.

Road density values vary less than developed land cover, and here, too, variation among blocks follows no apparent pattern. For example, the two highest values (7.7 mi. per 1000 acres) occur in a block with high agricultural land cover (Redden-Ellendale) and a block with very low agricultural land cover but high forest cover (A.P. Hill), while the next two highest values occur in blocks with average forest cover and agricultural land cover (Calvert Cliffs and Nassawango; Table m1). At the same time, the five blocks with the lowest road densities (about a mile of roads per 1000 acres) vary quite a bit in their forest cover, and/or agricultural land cover, and/or developed land cover. Stream density shows relatively little variation among blocks, suggesting that surface water drainages are more or less homogeneously distributed across the landscape in the ecoregion.

Managed Area Lands in Matrix Forest Blocks

The amounts, proportions and types of managed area lands in the CBY matrix forest blocks varies considerably among sites (compare Maps 2 and 9, Table m1). Two blocks, Aberdeen (MD) and A.P. Hill (VA) consist almost entirely of military lands owned by the Defense Department and used for training by the Army. Federal land also makes up over 70% of the area of the Patuxent WRC block, but here it is a wildlife research center owned and managed by the U.S Fish & Wildlife Service (Dept. of the Interior). On the other hand, the only other block with more than half of its land in managed area is the Great Cypress Swamp block (in DE and MD), where a private conservation organization (Delaware Wildlands) owns about 12,000 acres. Most of the managed area land within the other 16 matrix forest blocks in the CBY ecoregion consists of state forests, parks, and wildlife management areas in the three states. The only major exception would be the Blackwater and Transchic blocks in Maryland, which include several thousand acres of federal national wildlife refuge lands (Blackwater NWR).

At the other end of the scale, four blocks—including one of the smallest (McIntosh in southern Maryland) and the largest in the ecoregion (Dragon Run in Virginia)—have little or no managed area (Table m1). Three other blocks have less than 10% of their total acreage in managed area, while six have between 10 and 20% in managed area. Ignoring the Great Cypress Swamp and the three blocks dominated by federal lands, only two blocks—Redden-Ellendale and Elk Neck—have more than 20% of their acreage in managed area. The former block, however, has the third highest percentage of agricultural land cover in the ecoregion (Table m1).

The Nature Conservancy owns land within only five matrix forest blocks in CBY, and the overall percentage of Conservancy-owned matrix forest land is extremely low. Even the 3,700 acres of Conservancy land within the Nassawango Creek block (MD), accounts for barely 3% of the land area of that block. The proportional representation of Conservancy lands in matrix forest blocks in CBY is probably between 0.5 and 1.0% (i.e., 4,800-9,600 acres) or about the same as the Conservancy's proportional ownership of land for the ecoregion as a whole (see Portfolio Overview).

Table m1. Characteristics of the twenty portfolio matrix forest blocks in CBY (10 Year Action sites in bold).

Name (State)	Size (ac)	%MA[1]	%For[2]	%Wetld[3]	%Ag[4]	%Devel[5]	TotNat[6]	Streams[7]	Roads[8]
Aberdeen (MD)	26,202	95.5	49.6	24.9	13.7	11.6	74.7	2.4	1.9
Blackbird-Millington (DE/MD)	52,280	11.2	52.4	1.8	44.3	0.8	54.9	1.0	2.8
Patuxent WRC (MD)	15,041	71.6	82.8	1.9	10.1	4.8	85.1	3.9	1.9
Redden-Ellendale (DE)	46,206	23.9	69.1	1.0	28.1	1.5	70.4	2.6	7.7
Nanticoke (MD/DE)	47,041	13.8	67.2	9.6	18.4	0.4	81.2	2.5	3.3
Mattawoman (MD)	15,485	19.6	85.3	0.7	10.1	4.0	86.0	3.3	1.2
Calvert Cliffs (MD)	10,461	5.7	76.9	2.8	14.0	6.2	79.8	2.1	5.7
Nanjemoy (MD)	44,983	8.1	82.4	3.9	9.9	2.2	88.0	2.0	4.1
Zekiah (MD)	21,554	0.5	71.7	0.4	25.0	2.9	72.1	3.2	1.3
Transchic (MD)	39,329	10.8	64.6	20.2	15.1	0.1	84.8	1.3	1.2
Great Cypress Swamp (DE/MD)	19,434	63.5	79.5	1.3	18.4	0.6	81.0	0.9	2.6
Blackwater (MD)	48,131	15.6	75.1	13.0	11.0	0.9	88.1	1.3	2.1
McIntosh (MD)	10,480	0	81.1	0.5	17.3	1.1	81.6	2.3	0.9
Nassawango (MD)	122,326	6.3	75.0	1.6	19.9	0.4	79.7	1.3	5.8
St. Mary's (MD)	17,699	12.0	79.3	1.9	16.4	2.4	81.3	2.3	1.2
A.P. Hill (VA)	76,678	94.2	88.6	2.1	4.6	0.7	94.7	2.3	7.7
Upper Rappahannock (VA)	85,028	0.5	42.2	20.7	34.8	2.1	63.1	2.3	1.8
Lower Pocomoke (MD/VA)	20,924	13.1	49.4	25.9	23.9	0.6	75.4	1.0	3.6
Dragon Run (VA)	225,169	0	76.5	4.7	17.3	0.7	82.1	2.6	3.0
Elk Neck (MD)	21,568	26.7	76.4	3.4	17.7	2.5	79.9	1.7	2.9
CBY Average	48,301	24.6	71.3	7.1	18.5	2.3	79.2	2.1	3.1

[1]Managed Area
[2]Forest cover, including forested wetlands
[3]Emergent herbaceous + open water cover
[4]Agricultural land cover (all types)
[5]Residential, commercial, industrial development
[6]Total natural cover = sum of all forest types, wetland types, open water, transitional barrens, bare rock/sand
[7]Miles of streams per 1,000 ac
[8]Miles of roads (primary, secondary, major, minor) per 1,000 ac

Potential Forest Communities

An analysis of the Ecological Land Unit (ELU) composition of the 20 matrix blocks suggested that the blocks could be partitioned into the following ecologically consistent groups (Map 2 and Appendix m2).

First the blocks were divided into A) those that exhibited sideslopes, coves, low hills and extensive dry flats, and B) those that lacked those features but contained peatlands, tidal marshes and estuarine features

Within Group A, the Virginia blocks (group A1): A.P Hill, Dragon Run, Upper Rappahannock plus the Nanjemoy block across the Potomac, were largely flat landscapes characterized by silts, clays or fine floodplain soils, and few freshwater wet lands. Elk Neck Run block was later added to this group, based on its high proportion of wetlands and other similar features on silt/clay sediments.

The other blocks on Maryland's Western Shore (Group A2 – Mattawoman, Zekiah, Pautuxent)) also were characterized by upland forests, with large proportions of flats, toeslopes and slower sideslopes on alluvial coarse soils as well as similar moderate terrain features on clays and silts.

More distinct were the strongly upland (90-92%) Maryland blocks with many moderate relief features on loamy soils (group A3 – St. Marys, Calvert Cliffs, MacIntosh). Last, two Delaware blocks (Group A-4 – Redden and Blackbird Creek) were on loamy soil settings and comprised entirely of flats and freshwater wetlands.

Among the more estuarine blocks, the three blocks on the Delmarva Peninsula, (Group B1 – Blackwater, Transchic, and Lower Pocomoke) - were characterized by large proportions of tidal wetland systems, extremely flat terrain, and organic or coarse estuarine soils. The Aberdeen block, near the head of the Bay on Maryland's Western Shore, was grouped with this set of blocks but was somewhat anomalous in its composition. It was composed of low relief and considerable tidal wetlands (though much fresher than the southern, Eastern Shore blocks) .

Also on the Peninsula, the Nanticoke, Nassawango and Great Cypress Swamp blocks (Group B2) grouped together, with generally flat terrain, extensive peatlands and forested wetlands with the Nassawango block being further distinct in having 45% of its extent on eolian sands. The Kiptopeke block was similarly distinct in having a large proportion of features on Marine loams. It was later rejected as a matrix forest block and is not shown on any maps.

10-Year Action Sites

Thirteen of the 20 blocks in the portfolio have been selected as 10-year Action Sites by the Conservancy, including all of the blocks in both Delaware and Virginia, and seven of the fourteen blocks in Maryland (Map 2, Table m1). In Virginia, the Dragon Run block overlaps geographically with the Chesapeake Rivers Project Area, a landscape-scale, community-based conservation initiative led by the Virginia Chapter. At the A.P. Hill and Upper Rappahannock blocks, the Conservancy is assisting public and private partners who are actively pursuing conservation initiatives at those sites.

In Maryland and Delaware, four blocks (Blackwater, Transchic, Nanticoke, and Redden-Ellendale) fall within the Nanticoke River Project Area, formerly a Conservancy bioreserve and now a cross-border, landscape-scale, community-based conservation initiative. Still within Maryland, the Calvert Cliffs and Zekiah blocks represent priority areas for conservation by the Department of Natural Resources, with the Conservancy as a major partner at the former but not the latter site. The last two 10-Year Action blocks in Maryland, Nanjemoy and Nassawango, capture two watersheds that have been major focus areas for conservation by the Chapter since its inception in 1977. In Delaware, the Conservancy is partnering with the Department of Forestry in the Blackbird-Millington block and with Delaware Wildlands at the Great Cypress Swamp block.

CHESAPEAKE BAY MATRIX BLOCK ASSESSMENT		01/21/01																				
		Matrix-landscape group	**A4**		**A3**			**A2**			**A1**				**B2**				**B1**			
UP/Wet	Surficial / total	Topography	Redden - Ellendale	Black Bird Creek / Mil	St. Marys	Calvert Cliffs	MacIntosh	Patuxent WRC	Zekiah	Mattawoman	A. P. Hill	Dragon Run	Nanjemoy	Upper Rappahannock	Kiptopeke*	Nanticoke	Great Cypress Swamp	Nassawango	Transchic	Blackwater	Lower Pocomoke	Aberdeen
UPLAND TOPOGRAPHY SUMMARY																						
Upland	Totals	Flat summit/ridge Total	-	-	-	0	-	-	-	-	0	0	-	0	-	-	-	-	-	-	-	-
Upland	Totals	Steep slope Total	-	-	-	0	-	-	-	-	-	0	-	0	-	-	-	-	-	-	-	-
Upland	Totals	low hill Total	-	0	0	2	1	1	1	1	2	1	1	1	0	0	-	0	-	-	-	0
Upland	Totals	low rounded summit Total	-	0	0	9	4	3	4	3	5	2	2	3	0	0	-	0	-	-	-	-
Upland	Totals	lower sideslope Total	-	0	1	21	7	4	9	8	11	3	3	5	0	0	-	0	-	-	0	-
Upland	Totals	upper sideslope Total	-	0	0	9	2	1	2	1	2	1	1	2	0	-	-	0	-	-	-	-
Upland	Totals	valley flat Total	-	0	0	2	1	1	1	1	1	1	0	0	0	0	-	0	-	-	-	-
Upland	Totals	Cove, draw Total	-	0	0	8	1	0	1	1	2	1	0	1	0	-	-	-	-	-	-	-
Upland	Totals	drawbottom Total	-	0	0	8	3	2	3	3	4	2	1	2	0	0	-	0	-	-	0	0
Upland	Totals	toeslope/swale Total	0	3	24	23	37	35	23	28	41	26	29	22	5	2	0	1	0	-	0	1
Upland	Totals	Flat Total	77	78	66	9	34	30	30	34	26	51	51	36	74	56	13	75	37	25	33	53
		UPLAND TOTAL	**77**	**82**	**91**	**92**	**90**	**76**	**74**	**80**	**93**	**87**	**89**	**72**	**79**	**58**	**13**	**76**	**37**	**25**	**33**	**54**
WETLAND TOPOGRAPHY SUMMARY																						
Wetland	Totals	stream Total	3	2	3	2	4	2	3	4	3	3	2	2	1	2	1	1	0	1	1	1
Wetland	Totals	fresh wetland Total	20	16	5	4	7	22	24	16	4	7	6	8	3	24	68	21	37	45	30	11
Wetland	Totals	lake/pond Total	0	0	1	-	-	0	-	0	0	0	-	0	1	0	-	0	1	1	0	0
Wetland	Totals	saline wetland Total	-	0	-	2	-	-	0	-	-	1	3	3	4	2	-	-	21	27	19	14
Wetland	Totals	estuary/river Total	-	-	-	-	-	-	-	-	-	1	0	15	12	4	-	1	0	2	4	6
Wetland	Totals	water Total	-	-	-	-	-	-	-	-	-	0	-	0	0	0	-	-	0	-	0	46
Wetland	Totals	peatland Total	-	-	-	-	-	-	-	-	-	-	-	-	-	9	18	1	4	-	13	-
		WETLAND TOTAL	**23**	**18**	**9**	**8**	**10**	**24**	**26**	**20**	**7**	**13**	**11**	**28**	**21**	**41**	**87**	**24**	**63**	**75**	**67**	**79**
SURFICIAL GEOLOGY SUMMARY																						
	Alluvial coarse Total		11	0	1	0	5	18	19	22	0	8	0	0	0	31	0	7	0	0	0	0
	Loam Total		66	82	70	58	57	7	25	27	0	0	23	0	12	19	1	0	0	0	0	0
	Silt/clay Total		0	0	20	34	28	51	30	29	92	55	0	30	0	0	0	0	0	0	0	0
	Estuarine fine Total		0	0	0	0	0	0	0	1	1	24	63	39	0	0	0	0	0	0	0	0
	Marine Loam Total		0	0	0	0	0	0	0	0	0	0	0	0	54	1	11	18	0	0	0	0
	Eolian sand Total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	46	0	0	0	0
	Estuarine coarse Total		0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	5	29	15	28	0
	Peat/Saline/Marsh Total		0	0	0	0	0	0	0	1	0	1	3	2	13	0	0	0	8	9	5	54
		SURFICIAL TOTAL	**77**	**82**	**91**	**92**	**90**	**76**	**74**	**80**	**93**	**87**	**89**	**72**	**79**	**58**	**13**	**76**	**37**	**25**	**33**	**54**
ELU DETAILS -UPLANDS																						

Table m2. Chesapeake Bay Lowlands Matrix Block Assessment

CHESAPEAKE BAY MATRIX BLOCK ASSESSMENT 01/21/01

UP/Wet	Surficial / total	Topography	Redden - Ellendale	Black Bird Creek / Mil	St. Marys	Calvert Cliffs	MacIntosh	Patuxent WRC	Zekiah	Mattawoman	A. P. Hill	Dragon Run	Nanjemoy	Upper Rappahannock	Kiptopeke*	Nanticoke	Great Cypress Swamp	Nassawango	Transchic	Blackwater	Lower Pocomoke	Aberdeen
		Matrix-landscape group	**A4**		**A3**			**A2**			**A1**				**B2**				**B1**			
Upland	Alluvial coarse	Steep slope	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
Upland	Alluvial coarse	Flat summit/ridge	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
Upland	Alluvial coarse	low hill	-	-	-	-	0	0	0	0	-	0	-	-	-	0	-	0	-	-	-	-
Upland	Alluvial coarse	low rounded summit	-	-	0	-	0	1	1	1	-	0	-	-	-	0	-	0	-	-	-	-
Upland	Alluvial coarse	upper sideslope	-	-	0	-	0	0	0	0	-	0	-	-	-	-	-	-	-	-	-	-
Upland	Alluvial coarse	Flat	11	-	1	-	1	10	10	11	-	4	-	-	-	30	-	7	-	-	-	-
Upland	Alluvial coarse	toeslope/swale	0	-	0	-	2	6	4	7	-	2	-	-	-	1	-	0	-	-	-	-
Upland	Alluvial coarse	lower sideslope	-	-	0	-	1	1	2	2	-	0	-	-	-	0	-	-	-	-	-	-
Upland	Alluvial coarse	valley flat	-	-	-	-	0	0	0	0	-	0	-	-	-	-	-	0	-	-	-	-
Upland	Alluvial coarse	drawbottom	-	-	0	-	0	0	1	0	-	0	-	-	-	0	-	0	-	-	-	-
Upland	Alluvial coarse	Cove, draw	-	-	-	-	0	0	0	0	-	0	-	-	-	-	-	-	-	-	-	-
Upland	Loam	Flat summit/ridge	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Upland	Loam	low hill	-	0	0	2	1	0	0	0	-	-	0	-	-	-	-	-	-	-	-	-
Upland	Loam	low rounded summit	-	0	0	5	2	0	1	0	-	-	0	-	0	0	-	-	-	-	-	-
Upland	Loam	upper sideslope	-	0	0	4	1	0	1	0	-	-	0	-	-	-	-	-	-	-	-	-
Upland	Loam	Flat	66	78	55	7	23	2	11	16	-	-	12	-	11	19	1	-	-	-	-	-
Upland	Loam	toeslope/swale	0	3	15	16	23	3	7	9	-	-	9	-	1	0	-	-	-	-	-	-
Upland	Loam	lower sideslope	-	0	0	12	4	1	2	1	-	-	1	-	0	-	-	-	-	-	-	-
Upland	Loam	valley flat	-	0	0	1	1	0	0	0	-	-	0	-	0	0	-	-	-	-	-	-
Upland	Loam	drawbottom	-	0	0	6	2	0	1	1	-	-	0	-	0	0	-	-	-	-	-	-
Upland	Loam	Cove, draw	-	0	0	4	1	0	0	0	-	-	0	-	-	-	-	-	-	-	-	-
Upland	Silt/clay	Steep slope	-	-	-	0	-	-	-	-	-	0	-	0	-	-	-	-	-	-	-	-
Upland	Silt/clay	Flat summit/ridge	-	-	-	0	-	-	-	-	0	-	-	0	-	-	-	-	-	-	-	-
Upland	Silt/clay	low hill	-	-	0	1	0	1	1	1	2	0	-	1	-	-	-	-	-	-	-	-
Upland	Silt/clay	low rounded summit	-	-	0	4	1	2	2	2	5	1	-	2	-	-	-	-	-	-	-	-
Upland	Silt/clay	upper sideslope	-	-	0	5	0	0	1	1	2	1	-	1	-	-	-	-	-	-	-	-
Upland	Silt/clay	Flat	-	-	10	2	10	18	8	7	25	32	-	8	-	-	-	-	-	-	-	-
Upland	Silt/clay	toeslope/swale	-	-	9	7	13	26	11	11	41	17	-	12	-	-	-	-	-	-	-	-
Upland	Silt/clay	lower sideslope	-	-	0	9	2	2	5	5	11	2	-	3	-	-	-	-	-	-	-	-
Upland	Silt/clay	valley flat	-	-	0	1	0	0	0	0	1	0	-	0	-	-	-	-	-	-	-	-
Upland	Silt/clay	drawbottom	-	-	0	3	1	1	2	1	4	1	-	1	-	-	-	-	-	-	-	-
Upland	Silt/clay	Cove, draw	-	-	0	3	0	0	1	1	2	1	-	1	-	-	-	-	-	-	-	-
Upland	Estuarine fine	Steep slope	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-

Table m2. Chesapeake Bay Lowlands Matrix Block Assessment

CHESAPEAKE BAY MATRIX BLOCK ASSESSMENT 01/21/01																						
		Matrix-landscape group	A4		A3			A2			A1				B2				B1			
UP/Wet	Surficial / total	Topography	Redden - Ellendale	Black Bird Creek / Mil	St. Marys	Calvert Cliffs	MacIntosh	Patuxent WRC	Zekiah	Mattawoman	A. P. Hill	Dragon Run	Nanjemoy	Upper Rappahannock	Kiptopeke*	Nanticoke	Great Cypress Swamp	Nassawango	Transchic	Blackwater	Lower Pocomoke	Aberdeen
Upland	Estuarine fine	Flat summit/ridge	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Upland	Estuarine fine	low hill	-	-	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	-	-	-
Upland	Estuarine fine	low rounded summit	-	-	-	-	-	-	-	0	0	1	1	1	-	-	-	-	-	-	-	-
Upland	Estuarine fine	upper sideslope	-	-	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	-	-	-
Upland	Estuarine fine	Flat	-	-	-	-	-	-	-	1	1	14	38	27	-	-	-	-	-	-	-	-
Upland	Estuarine fine	toeslope/swale	-	-	-	-	-	-	-	0	0	7	20	9	-	-	-	-	-	-	-	-
Upland	Estuarine fine	lower sideslope	-	-	-	-	-	-	-	0	0	1	2	1	-	-	-	-	-	-	-	-
Upland	Estuarine fine	valley flat	-	-	-	-	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-
Upland	Estuarine fine	drawbottom	-	-	-	-	-	-	-	0	0	0	1	0	-	-	-	-	-	-	-	-
Upland	Estuarine fine	Cove, draw	-	-	-	-	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-
Upland	Marine Loam	low hill	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	0	-	-	-	-
Upland	Marine Loam	low rounded summit	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	0	-	-	-	-
Upland	Marine Loam	upper sideslope	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
Upland	Marine Loam	Flat	0	-	-	-	-	-	-	-	-	0	-	-	51	1	11	18	-	-	-	-
Upland	Marine Loam	toeslope/swale	-	-	-	-	-	-	-	-	-	0	-	-	3	0	0	0	-	-	-	-
Upland	Marine Loam	lower sideslope	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	-	-	-	-
Upland	Marine Loam	valley flat	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	-	-	-	-
Upland	Marine Loam	drawbottom	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	-	-	-	-
Upland	Marine Loam	Cove, draw	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
Upland	Eolian sand	low hill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
Upland	Eolian sand	low rounded summit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
Upland	Eolian sand	upper sideslope	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
Upland	Eolian sand	Flat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	45	-	-	-	-
Upland	Eolian sand	toeslope/swale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Upland	Eolian sand	lower sideslope	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
Upland	Eolian sand	drawbottom	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
Upland	Estuarine coarse	Flat	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	5	29	15	28	-
Upland	Estuarine coarse	toeslope/swale	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	0	-	0	-
Upland	Estuarine coarse	lower sideslope	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Upland	Estuarine coarse	drawbottom	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Upland	Peat/Saline/Marsh	low hill	-	-	-	-	-	-	-	0	-	0	0	0	0	-	-	-	-	-	-	0
Upland	Peat/Saline/Marsh	low rounded summit	-	-	-	-	-	-	-	0	-	0	0	0	0	-	-	-	-	-	-	-
Upland	Peat/Saline/Marsh	upper sideslope	-	-	-	-	-	-	-	0	-	0	0	0	0	-	-	-	-	-	-	-

Table m2. Chesapeake Bay Lowlands Matrix Block Assessment

CHESAPEAKE BAY MATRIX BLOCK ASSESSMENT		01/21/01																				
		Matrix-landscape group	A4		A3			A2			A1				B2				B1			
UP/Wet	Surficial / total	Topography	Redden - Ellendale	Black Bird Creek / Mil	St. Marys	Calvert Cliffs	MacIntosh	Patuxent WRC	Zekiah	Mattawoman	A. P. Hill	Dragon Run	Nanjemoy	Upper Rappahannock	Kiptopeke*	Nanticoke	Great Cypress Swamp	Nassawango	Transchic	Blackwater	Lower Pocomoke	Aberdeen
Upland	Peat/Saline/Marsh	Flat	-	-	-	-	-	-	-	0	-	0	2	1	12	-	-	-	8	9	5	53
Upland	Peat/Saline/Marsh	toeslope/swale	-	-	-	-	-	-	-	0	-	0	1	1	1	-	-	-	0	-	0	1
Upland	Peat/Saline/Marsh	lower sideslope	-	-	-	-	-	-	-	0	-	0	0	0	0	-	-	-	-	-	-	-
Upland	Peat/Saline/Marsh	valley flat	-	-	-	-	-	-	-	0	-	0	0	0	-	-	-	-	-	-	-	-
Upland	Peat/Saline/Marsh	drawbottom	-	-	-	-	-	-	-	0	-	0	0	0	0	-	-	-	-	-	-	0
Upland	Peat/Saline/Marsh	Cove, draw	-	-	-	-	-	-	-	0	-	0	0	0	0	-	-	-	-	-	-	-
ELU DETAILS -WETLANDS+B53																						
Wetland	Alluvial coarse	stream	0	-	0	-	0	1	1	2	-	0	-	-	-	1	-	0	-	-	-	-
Wetland	Alluvial coarse	lake/pond	-	-	-	-	-	0	-	0	-	0	-	-	-	0	-	0	-	-	-	-
Wetland	Alluvial coarse	estuary/river	-	-	-	-	-	-	-	-	-	0	-	-	-	1	-	0	-	-	-	-
Wetland	Alluvial coarse	saline wetland	-	-	-	-	-	-	0	-	-	0	-	-	-	0	-	-	-	-	-	-
Wetland	Alluvial coarse	fresh wetland	2	-	0	-	0	16	14	12	-	2	-	-	-	7	-	2	-	-	-	-
Wetland	Loam	stream	2	2	2	1	2	0	1	1	-	-	1	-	0	1	0	-	-	-	-	-
Wetland	Loam	lake/pond	0	0	0	-	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-
Wetland	Loam	estuary/river	-	-	-	-	-	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-
Wetland	Loam	water	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-
Wetland	Loam	saline wetland	-	0	-	-	-	-	-	-	-	-	0	-	0	-	-	-	-	-	-	-
Wetland	Loam	fresh wetland	18	16	3	1	3	1	2	0	-	-	1	-	1	3	4	-	-	-	-	-
Wetland	Silt/clay	stream	-	-	1	1	1	1	1	1	3	2	-	1	-	-	-	-	-	-	-	-
Wetland	Silt/clay	lake/pond	-	-	1	-	-	0	-	-	0	0	-	0	-	-	-	-	-	-	-	-
Wetland	Silt/clay	estuary/river	-	-	-	-	-	-	-	-	-	0	-	0	-	-	-	-	-	-	-	-
Wetland	Silt/clay	water	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
Wetland	Silt/clay	saline wetland	-	-	-	2	-	-	-	-	-	0	-	0	-	-	-	-	-	-	-	-
Wetland	Silt/clay	fresh wetland	-	-	2	3	4	5	9	3	3	2	-	1	-	-	-	-	-	-	-	-
Wetland	Estuarine fine	stream	-	-	-	-	-	-	-	0	0	1	2	1	-	-	-	-	-	-	-	-
Wetland	Estuarine fine	lake/pond	-	-	-	-	-	-	-	0	0	0	-	0	-	-	-	-	-	-	-	-
Wetland	Estuarine fine	estuary/river	-	-	-	-	-	-	-	-	-	0	0	3	-	-	-	-	-	-	-	-
Wetland	Estuarine fine	water	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Wetland	Estuarine fine	saline wetland	-	-	-	-	-	-	-	-	-	1	2	2	-	-	-	-	-	-	-	-
Wetland	Estuarine fine	fresh wetland	-	-	-	-	-	-	-	0	0	3	4	5	-	-	-	-	-	-	-	-
Wetland	Marine Loam	stream	0	-	-	-	-	-	-	-	-	0	-	-	0	0	0	0	-	-	-	-
Wetland	Marine Loam	lake/pond	0	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-
Wetland	Marine Loam	estuary/river	-	-	-	-	-	-	-	-	-	-	-	-	6	0	-	-	-	-	-	-

Table m2. Chesapeake Bay Lowlands Matrix Block Assessment

CHESAPEAKE BAY MATRIX BLOCK ASSESSMENT			**01/21/01**																			
		Matrix-landscape group	**A4**		**A3**			**A2**			**A1**				**B2**				**B1**			
UP/Wet	Surficial / total	Topography	Redden - Ellendale	Black Bird Creek / Mil	St. Marys	Calvert Cliffs	MacIntosh	Patuxent WRC	Zekiah	Mattawoman	A. P. Hill	Dragon Run	Nanjemoy	Upper Rappahannock	Kiptopeke*	Nanticoke	Great Cypress Swamp	Nassawango	Transchic	Blackwater	Lower Pocomoke	Aberdeen
Wetland	Marine Loam	water	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-
Wetland	Marine Loam	saline wetland	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
Wetland	Marine Loam	fresh wetland	0	-	-	-	-	-	-	-	-	0	-	-	2	2	13	3	-	-	-	-
Wetland	Eolian sand	stream	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Wetland	Eolian sand	lake/pond	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
Wetland	Eolian sand	estuary/river	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
Wetland	Eolian sand	fresh wetland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	12	-	-	-	-
Wetland	Estuarine coarse	stream	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	0	0	0	-
Wetland	Estuarine coarse	lake/pond	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0	1	0	-	-
Wetland	Estuarine coarse	estuary/river	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0	0	1	-
Wetland	Estuarine coarse	water	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-
Wetland	Estuarine coarse	saline wetland	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	8	12	4	-
Wetland	Estuarine coarse	fresh wetland	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	1	24	18	6	1
Wetland	Peat/Saline/Marsl	stream	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0
Wetland	Peat/Saline/Marsl	lake/pond	-	-	-	-	-	-	-	-	-	-	-	-	0	0	-	0	1	0	0	6
Wetland	Peat/Saline/Marsl	estuary/river	-	-	-	-	-	-	-	-	-	1	0	12	6	3	-	0	0	1	3	14
Wetland	Peat/Saline/Marsl	water	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	0	-	0	14
Wetland	Peat/Saline/Marsl	saline wetland	-	-	-	-	-	-	-	-	-	0	1	1	1	2	-	-	13	16	15	11
Wetland	Peat/Saline/Marsl	fresh wetland	-	-	-	-	-	-	-	-	-	0	0	2	0	8	49	3	12	27	24	-
Wetland	Peat/Saline/Marsl	peatland	-	-	-	-	-	-	-	-	-	-	-	-	-	9	18	1	4	-	13	
			* Kiptopeke was later dropped. The Elk Neck Run block was added later.																			