RESULTS FOR TERRESTRIAL COMMUNITIES AND SYSTEMS[*]

Development of a Vegetation Classification for CBY

The initial draft of 164 NVC associations thought to occur in CBY was carefully evaluated by state ecologists, and 86 were judged not to occur in the ecoregion. About 20 associations not previously identified as within CBY were added, and several new associations were described for consideration for inclusion in a revised NVC. A tentative total of 95 associations known or thought to occur in the CBY ecoregion were described through this effort. Every association within CBY was also categorized into a coarser scale vegetation system or **group** (see below), of which 17 were initially identified. These results were reviewed by the participating ecologists and assembled into a single document for CBY natural communities.[1]

In the course of assembling Natural Heritage program Element Occurrence data (EORs), linking ("tagging") occurrences to NVC associations, and conducting viability analyses (see below) over several months, additional consultations occurred between ECS ecologists and state Community Ecologists, which resulted in a slightly revised ecoregional classification. Eighteen additional associations were included in the classification, and another vegetation group (Dune Woodlands) was added for CBY. Thus, a total of 113 associations in 18 groups were included in this plan (Appendix nc1). An additional 38 NVC associations are under consideration for inclusion in a future revised community classification for the ecoregion. For comparison, 126 associations were described for CAP and 153 for LNE. Thus, in spite of its relatively small size and limited topographic relief, and the short distance from northern to southern boundaries within the ecoregion, CBY contains a comparable number of vegetation associations relative to neighboring ecoregions.

Natural communities in CBY range from dry upland forests, to forested and herbaceous wetlands, to barrier island dunes and beaches (Table nc1). Not surprisingly in this ecoregion, almost a quarter of the described associations are tidal marsh communities, and the diversity of wetlands associated with dunes along the coast is also high. Moving inland, the diversity of nonalluvial forests and herbaceous coastal plain pond communities ("Delmarva bays") is also high, each making up almost a tenth of the total number. Tidal forests and shrublands, on the other hand comprise very few distinct associations. There is only one sea-level fen community currently described (Table nc1).

---

[*] Anderson, M.G. and S.L. Bernstein (editors). 2003. Results for terrestrial communities and systems. Based on Samson, D.A. 2002. Chesapeake Bay Lowlands Ecoregional Plan; First Iteration. The Nature Conservancy, Conservation Science Support, Northeast & Caribbean Division, Boston, MA.
[1] See Sneddon, Zaremba, et al. draft with latest editing notations as of 1/02/2002.

Table nc1. Numbers of natural community types in CBY by vegetation group, patch type and rangewide distribution.

No.	Group Name	Number of NVC Types	Patch Types[1]				Rangewide Distribution[2]				
			Mat.	LgP	LnP	SmP	W	P	L	R	U
1	Dry-Mesic Oak Forests	5	1	5		1	3				2
2	Mesic Hardwood Forests	6	1	1		3	2		1	3	1
3	Evergreen or Mixed Coastal Plain Forests	6	1			2			2		4
4	Alluvial Forests and Shrublands	6				6			2	3	1
5	Cypress-Gum Swamps	2			1	2		1		1	
6	Nonalluvial Wetland Forests	10		6		9	2		2	6	
7	Woody Vegetation of Coastal Plain Ponds	4				4	1		1	3	
8	Herbaceous Coastal Plain Ponds	10				10	5		2	4	
9	Sea-level Fens	1				1			1		
10	Freshwater Nontidal Marshes	5		1	2	3	4	1			
11	Tidal Swamp Forests	2			2					2	
12	Tidal Shrublands	2			2		2				
13	Tidal Marshes	27	1	11	7	19	13	1	3	5	6
14	Submerged Saline Tidal	3		1	1	3	3				
15	Maritime Shrub	7		2	1	6	2		3	2	
16	Interdunal Wetlands	9			2	8	4		2	3	
17	Dune Grasslands/Beaches	4		1	2	4	2		2		
18	Dune Woodlands	4		2		3			3	1	
Total for Ecoregion		113	4	30	20	84	43	3	24	33	14

[1]Mat. = matrix; LgP = large patch; LnP = linear patch; SmP = small patch
[2]W = widespread; P = peripheral; L = limited; R = restricted; U = unknown

Three (possibly four) associations within CBY were described as matrix forming (Table nc1). These are: the mixed oak/black huckleberry-blueberry forest community (Dry-Mesic Oak Forests group), the beech-white oak-tulip poplar-hickory forest community (Mesic Hardwood Forests group), and the loblolly pine-southern red oak/dangleberry forest community (Evergreen or Mixed Coastal Plain Forests) (see Appendix nc1). The smooth cordgrass/algae (*Ascophyllum nodosum*) community was also categorized as a matrix-forming type in CBY, because tidal marshes cover tens of thousands of acres of shoreline habitat in the Chesapeake Bay and Atlantic coastal bays. Aside from the obvious differences in dominant ecological processes, species composition, energy and nutrient flow, etc., the applicability of the matrix-forming vegetation concept – which was developed for terrestrial forests – to tidal wetland communities remains to be determined.

The 30 communities that can or do occur as large patches on the landscape make up about 25% of all known NVC associations in CBY (Table nc1). They occur in nine of the 18 different vegetation groups, but more than two-thirds are found in only three groups; Dry-Mesic Oak Forests, Nonalluvial Wetland Forests, and Tidal Marshes. Given the hundreds of embayments, and thousands of tributary rivers and streams around the Chesapeake Bay in the ecoregion, as well as long, narrow barrier islands along the Atlantic coast, it is not surprising that almost 20% of all confirmed natural communities in the ecoregion occur as linear patch types associated with tidal areas along rivers and bays, and with barrier islands (Table nc2).

Table nc2. Numbers of natural community associations in CBY by vegetation group, documented by Heritage occurrences (EORs) and judged to be viable portfolio occurrences for the ecoregion (see Appendix nc1 for details).

		NVC Types		Total Occurrences		Viable Occurrences	
No	Group Name	in CBY	w/EORs	All	Tagged	All	Tagged
1	Dry-Mesic Oak Forests	5	3	3	3	2	2
2	Mesic Hardwood Forests	6	5	27	25	15	13
3	Evergreen or Mixed Coastal Plain Forests	6	6	42	18	34	13
4	Alluvial Forests and Shrublands	6	2	2	2	2	2
5	Cypress-Gum Swamps	2	1	6	4	2	2
6	Nonalluvial Wetland Forests	10	8	43	41	25	25
7	Woody Vegetation of Coastal Plain Ponds	4	3	32	32	21	21
8	Herbaceous Coastal Plain Ponds	10	7	32	26	22	21
9	Sea-level Fens	1	1	9	9	8	8
10	Freshwater Nontidal Marshes	5	0	6	0	3	0
11	Tidal Swamp Forests	2	2	7	7	5	5
12	Tidal Shrublands	2	1	2	2	1	1
13	Tidal Marshes	27	15	59	58	41	40
14	Submerged Saline Tidal	3	0	0	0	0	0
15	Maritime Shrub	7	3	5	4	4	4
16	Interdunal Wetlands	9	7	34	26	31	24
17	Dune Grasslands/Beaches	4	2	10	5	8	4
18	Dune Woodlands	4	2	17	8	9	6
	Total for Ecoregion	113	68	336	270	233	191

At the other end of the gradient, 75% (84) of the natural communities in CBY were categorized as small patch types (or which can occur as small patches; Table nc1), a result that is consistent with the patterns seen in surrounding ecoregions (see plans for Central Appalachian Plateau and Lower New England/Northern Piedmont ecoregions). Among vegetation groups, small patch communities are particularly prevalent in Alluvial Forests and Shrublands, Nonalluvial Wetland

Forests, Coastal Plain Ponds (both Woody and Herbaceous), Tidal Marshes, and the four vegetation groups that make up barrier island systems (Table nc1, Appendix nc1).

For 28 associations, the patch size was either uncertain or believed to be intermediate between patch types (Appendix nc1); hence the number of associations tallied by patch size exceeds the total number of associations with the ecoregion (Table nc1). For about a third of the associations, the patch type was assigned based on best available knowledge, but with less certainty than for the majority of the communities. For a small number of associations the patch size was completely unknown at the time of this assessment, but these cases were too few to affect the overall results presented here.

Data Assembly

Natural community data were assembled at the ECS Office for the three states within the ecoregion. A total of 356 occurrences were initially in this dataset: 119 for DE, 83 for MD, and 154 for VA. Each occurrence was crosswalked or "tagged" to the NVC classification by the state Heritage ecologist, or by staff from ECS with review by the state ecologist. Each association was also categorized to one of the 18 vegetation systems or groups.

Unlike many community occurrences in other ecoregions, most community occurrences documented by the Natural Heritage Programs in CBY were very detailed and scaled similarly to associations within the NVC, so that occurrences could be effectively tagged to specific associations (Table nc2, Appendix nc1). Others were a mosaic of identifiable associations and could be considered to be occurrences of multiple associations. For some associations, however, it was not possible to crosswalk them to the CBY classification given available data. In such cases, where it was clear that the occurrence was high quality and identifiable to the courser-scale, group level of classification, occurrences were analyzed at the vegetation group level. Most of these "untagged" occurrences (66, or 20% of the total) are thought to belong to one of the documented NVC associations—rather than a new type—in CBY (Appendix nc1).

In several cases, a documented Heritage occurrence was determined not to represent a natural community and so was set aside from the analysis. There were several BCD occurrence records where the habitat of a rare species which occurred in an anthropogenic setting had been described as a natural community by the field biologist; these were discarded. It also became apparent that duplicate records existed in several state databases, due to differences in nomenclature for early community EORs; these, too, were eliminated. Twenty records were eliminated for these several reasons.

Slightly more than half of the known associations in CBY have been recorded in field surveys conducted by the Natural Heritage Programs and documented in Element Occurrence Records (EORs) in Delaware, Maryland or Virginia. Of the 336 natural community EORs available in CBY that were evaluated for inclusion in the ecoregional portfolio, 270 could be clearly tagged to an NVC association (Table nc2). This facilitated both the viability analysis and the process of setting ecoregional conservation goals. Natural community occurrences were fully tagged to NVC associations in six of the vegetation groups; in several other groups all but one or two occurrences belonged to one or another association (Table nc2). However, in several groups (esp., Evergreen or Mixed Coastal Plain Forests, Dune Grassland/ Beaches, and Dune Woodlands), half or more of the available occurrences could not be clearly assigned to one of the NVC associations within that group (Table nc2). Additional fieldwork will be necessary to be able to classify these occurrences to specific NVC associations.

Several of the CBY natural community groups (esp., Tidal Marshes, Coastal Plain Ponds – both Woody and Herbaceous – Nonalluvial Wetland Forests, and Evergreen or Mixed Coastal Plain Forests) have received far more field sampling effort than others (Table nc2). But several of those groups also have a large number of associations, so the number of occurrences sampled per association is not high; across all groups, 3–5 EORs (average = 4) are currently available for each of the documented natural communities in CBY. No EORs have been recorded for Submerged Saline Tidal communities as a group, and none of the six EORs for Freshwater Nontidal Marshes have been tagged to one of the five NVC associations known to occur in the ecoregion (Table nc2).

Modifications to the Standard Methods

Combining Viability Criteria in CBY

For CBY, the viability criteria of size, condition, and landscape context were combined according to Table nc3 below. In addition, a fourth criterion was initially applied to natural community records in the Heritage database:

Age of element occurrence records: All element occurrence records with a LASTOBS (last observation) date before 1988 were assigned at most a "?," because it was unclear if the occurrence data remained valid.

Table nc3. Natural community (small, large, and linear patch) viability ranking grid.

Landscape context	Condition/Rank	Size: Large (linear) patch	Size: Small (linear) patch	Viability estimate
1	A, AB, B,	>100	>0	Yes
1	BC,C, ?, E			Maybe = ?
2	A,AB,B	>100	>0	Yes
2	BC,C,?,E			Maybe = ?
3	A,AB,B	>100	>25	Yes
3	BC,C,?,E,			No
4	A,AB,B	>100	>50	Maybe = ?
4	BC,C,?,E			No
1,2,3,4	D			No

Note that linear patch communities were variously evaluated on small or large patch size criteria depending on our best understanding of the growth and habitat characteristics of the vegetation type. Also, where there was uncertainty about the classification of a community to patch type (e.g., large vs. small), generally the more conservative criteria was applied.

Setting Numerical and Distribution Goals in CBY

As in other ecoregions, CBY was divided into groups of subsections to reflect the range of physiographic variability throughout the ecoregion. Unlike other ecoregions, CBY was constructed as a subdivision of Bailey's Outer Coastal Plain Mixed Forest Province, centered around one major environmental feature, the Chesapeake Bay. Subsection boundaries (created by Bailey) in CBY, therefore do not always correspond to the ecoregional boundaries; several

subsections that border the Bay fall entirely within CBY, while several other subsections extend beyond CBY into adjacent ecoregions (Table nc4).

For purposes of stratification, the CBY ecoregion was divided into three areas, based on the US Forest Service sectional divisions (Bailey 1994). Two of these sections (232A, 232C) have only one subsection each (with 232Ch extending beyond the ecoregion), while the third (232B) has four subsections (two of which extend beyond the ecoregion; Table nc4).

Table nc4. Sectional and subsection classification (USFS categories) and geographic extent in CBY ecoregion.

Section Category	CBY area covered	Geographic extent
Middle Atlantic Coastal Plain: 232A		
232Ad	Western shore, MD; northern DE	CBY only
Coastal Plains & Flatwoods: 232B		
232Br	Western shore, VA	CBY, VA and NC in MAC
232Bt	Central Delmarva Peninsula, MD and DE	CBY and southern edge of NAC
232Bx	Eastern shore, bayside, MD and VA	CBY only
232Bz	Atlantic coast lowlands, DE, MD, VA	CBY only
Atlantic Coastal Flatlands: 232C		
232Ch	Western shore bayside, MD and VA	CBY, VA and NC in MAC

The combination of stratification levels across the ecoregion and minimum number of occurrences per section produces a set of numerical conservation goals for natural community targets in CBY that ranges from four to 15 (Table nc5).

Table nc5. Minimum conservation goals for CBY patch natural communities as a function of patch size and rangewide distribution of the type.

Patch-forming Ecosystems Rangewide Distribution	Minimum Stratification (# sections)	Patch Size	
		Large or Linear (4)	Small (5)
Restricted	3	12	15
Limited	2	8	10
Widespread	1	4	5
Peripheral	1	4	5

Portfolio Results

Two hundred and thirty three (69%) of the total natural community occurrences were judged to be viable (Table nc6) and included in the CBY ecoregional portfolio as conservation targets (Map 5). Of these, 191 are classified in 62 different NVC associations (see Appendix nc1 for details). Forty two additional untagged occurrences in 11 of the vegetation groups were viable

and included in the portfolio (Appendix nc1); some of these may represent known NVC associations which have no documented occurrences in CBY at present.

Most of the portfolio occurrences are found in Delaware and Virginia. Within Virginia, occurrences are well distributed on the Delmarva Peninsula, but on the western Shore, occurrences are clumped around the York and James rivers, at Fort A. P. Hill and at a few scattered sites along the western shoreline of the Potomac River (Map 4). The numbers of viable occurrences within the 18 vegetation groups is discussed in more detail below.

Progress Towards Goals

The current portfolio identifies just 25% of the natural community occurrences needed to meet the replication goals set for CBY, based on community patch size and rangewide distribution. Among vegetation groups, identification of viable occurrences ranged from less than 10% to 80% and above, but 14 of the 18 vegetation groups did not exceed 30% of goals (Table nc6). Among individual NVC associations across groups, only nine types met or exceeded the numerical goal set for that community type (Appendix nc1). Twenty four associations met the stratification goal (i.e., occurred in 1, 2 or 3 different ecoregional sections), including eight of the nine associations that met the numerical goal (Appendix nc1).

In order to identify enough viable examples of each community type to meet the replication goals of this plan there must be: 1) adequate (or complete) sampling among all community associations; 2) sufficient sampling of occurrences within associations (i.e., numerous replicates) relative to patch type and rangewide distribution; 3) good viability of documented occurrences. For example, Sea-level Fens (one community type only) are well-sampled, and all but one of the occurrences was judged to be viable, so that portfolio representation of this community is high (Table nc6). Similarly, for Evergreen or Mixed Coastal Plain Forests, all of the six associations have been well-sampled (average of 7 EORs per type), and many of those were viable, yielding a success rate of almost 90% for the portfolio.

Where community associations lack field documentation, or only a few occurrences have been recorded, or where viability of known occurrences is low—or some combination of all of these factors—success at identifying sufficient occurrences will be poor. For example, no occurrences have been recorded to date for Submerged Saline Tidal communities, and minimal sampling has been done for most of the community associations in the Dry-Mesic Oak Forests, Alluvial Forests and Shrublands, and Maritime Shrub groups (i.e., an average of less than 1 EOR per NVC type within the group; Table nc6). In other groups, sampling effort has been good across all/most NVC associations (i.e., 3-5 EORs per type), but viability of the recorded occurrences was only moderate (e.g., Mesic Hardwood Forests, Nonalluvial Wetland Forests, Woody Vegetation of Coastal Plain Ponds, Herbaceous Coastal Plain Ponds), so there is a large deficit for these types in the portfolio.

Table nc6. Assessment of success towards identifying replicate viable examples for each natural community target, by group, as measured against minimum conservation goals for each association.

No.	Group Name	NVC Association in CBY	NVC Association w/EORs	Total Occurrences All	Total Occurrences Viable	Success by Group Goal	Success by Group %
1	Dry-Mesic Oak Forests	5	3	3	2	20	10
2	Mesic Hardwood Forests	6	5	27	15	50	30
3	Evergreen or Mixed Coastal Plain Forests	6	6	42	34	39	87
4	Alluvial Forests and Shrublands	6	2	2	2	65+	3
5	Cypress-Gum Swamps	2	1	6	2	20	10
6	Nonalluvial Wetland Forests	10	8	43	25	115	22
7	Woody Vegetation of Coastal Plain Ponds	4	3	32	21	55	21
8	Herbaceous Coastal Plain Ponds	10	7	32	22	95	38
9	Sea-level Fens	1	1	9	8	10	80
10	Freshwater Nontidal Marshes	5	0	6	3	23	13
11	Tidal Swamp Forests	2	2	7	5	24	21
12	Tidal Shrublands	2	1	2	1	8	13
13	Tidal Marshes	27	15	59	41	156	26
14	Submerged Saline Tidal	3	0	0	0	25	0
15	Maritime Shrub	7	3	5	4	67	6
16	Interdunal Wetlands	9	7	34	31	82	38
17	Dune Grasslands/Beaches	4	2	10	8	33	24
18	Dune Woodlands	4	2	17	9	42	21
	Totals for Ecoregion	113	68	336	233	929	25

In some cases where the sampling effort was good and the viability of occurrences was high (e.g., Tidal Swamp Forests, Interdunal Wetlands), the identification of enough replicates still fell short of the conservation goal, because for communities Restricted to CBY the numerical goal is high relative to field efforts to date (Table nc6). For example, several of the small patch Interdunal Wetlands communities with Limited or Restricted distributions (Appendix nc1), have conservation goals of 10 to 15, respectively. Although there are an average of almost 5 EORs per NVC community type in state Natural Heritage Program databases—and 90% of the known occurrences were judged to be viable—we only identified 38% of the occurrences judged necessary to conserve this target.

This assessment of unmet goals for natural communities in CBY points to a need to improve some aspects of the ecoregional vegetation classification, and to conduct additional inventories for many vegetation associations. At the same time, we assume that many additional but undocumented community occurrences needed to meet goals in CBY may be found at sites included in the portfolio because they harbor occurrences of other biodiversity targets. For example, viable occurrences of alluvial forests, tidal communities, and dune and barrier beach

vegetation associations are likely to be captured at portfolio sites identified for other targets. Similarly, viable examples of some of the upland forest associations are assumed to be present in the matrix forest blocks included in the portfolio.

Conversely, the lack of occurrences for some community associations no doubt reflects the fact that viable examples of some types may now be rare or absent in the ecoregion, and/or degraded or reduced in size such that finding viable occurrences is problematic. Thus there is also a need to explore the restoration potential for some communities that are no longer present in CBY at appropriate, representative scales. Restoration may be particularly appropriate or possible at landscape level portfolio sites identified for other biodiversity features, such as matrix forests/blocks and aquatic features.

A brief summary of the progress towards identifying viable occurrences of natural communities in the CBY portfolio is presented below, with observations on inventory needs, likelihood of additional occurrences at other portfolio sites, and restoration potential.

Dry upland forests: (Groups 1 and 2; 11 associations, goal = 70, portfolio = 17). Progress poor. May actually not be very many good examples of these communities left to document. Large patch types will be most difficult to find. Best remaining examples may be on current portfolio sites. Some associations may need restoration to meet goals.

Mixed upland forests: (Group 3; 6 associations, goal = 39, portfolio = 34). Progress very good. Much attention given to Loblolly and Virginia pine Communities. Many occurrences are not tagged to specific associations. Additional field work may be needed at these occurrences to make meaningful connections to vegetation types.

Alluvial forests: (Group 4; 6 associations, goal = 65+, portfolio = 2). Progress minimal. All of these are likely small patch and there should be a fair number around and along the numerous rivers. Many of these areas are in matrix blocks. Should be possible to capture these with more focused inventory. There are likely to be additional alluvial forest associations in CBY.

Gum and Cypress forests: (Group 5; 2 associations, goal = 20, portfolio = 2). Progress poor. There may not be many of these left to document that are sizable. There are several more associations under consideration for inclusion in the classification.

Nonalluvial forests: (Group 6; 10 associations, goal = 115, portfolio = 25). Progress fair. Quite a lot of subdivision of these communities. Some types may warrant lumping, resulting in reduced goals. Examples left in CBY may be in poor condition. A fair number of associations are large patch and may not be represented on the landscape in large units anymore. Restoration may be needed for some associations.

Coastal plain ponds: (Group 7 and 8; 14 associations, goal = 150, portfolio = 43). Progress fair. There are a large number of vegetation associations in Delmarva bays; some of them exist as very small occurrences and in mosaics. It was difficult to crosswalk these occurrences because data were often collected for the physical feature and were only partially expressed floristically. There are likely many more associations present in the occurrences documented already. This part of the classification needs work. Some associations currently acknowledged in the National Vegetation Classification may be too small or detailed to be effective classification entities.

Sea level fens: (Group 9; 1 type, goal = 10, portfolio = 8). Progress great. As a globally rare community, this has been the focus of inventories. Should be possible to find at least two more and meet goal.

Freshwater nontidal marshes: (Group 10; 5 associations, goal = 23, portfolio = 3). Progress poor. These marshes have not been a focus for inventory work. Some of these communities are successional. Furthermore, there are likely to be many more associations identified in CBY.

Woody tidal communities: (Groups 11 and 12; 4 associations, goal = 32, portfolio = 6). Progress poor. There may not be many of these communities remaining, of good size. These types are all large patch. Many remaining occurrences should be in matrix blocks. Restoration should be considered.

Tidal marshes: (Group 13; 27 associations, goal = 156, portfolio = 41). Progress fair. Many of the communities in this group are very finely divided and should/will be combined. There are a few new associations to consider as well, however. Inventory work has been good and there is likely to be a fair number associated with protected areas and sites identified for the portfolio for other reasons.

Subtidal communities: (Group 14; 3 associations, goal = 25, portfolio = 0). Progress none at all. No inventory work has been conducted for these communities. Marine sites selected for the portfolio should include examples of all of these associations. Restoration is likely needed in some.

Maritime shrubs: (Group 15; 7 associations, goal = 67, portfolio = 4). Progress poor. Not much attention has been paid to these communities. Most are likely on protected land or at sites identified for the portfolio for other targets.

Interdunal wetlands: (Group 16; 9 associations, goal = 82, portfolio = 31). Progress fair. There seems to be a large number of communities for this group, some of which may warrant combining. There has been good inventory work done within this group to date. Most additional occurrences are likely to be on protected land, which may, however, not be managed for these communities.

Dunes: (Group 17 and 18; 8 associations, goal = 75, portfolio = 17). Progress fair. Most remaining examples are likely to be on protected land or at sites identified for the portfolio for other biodiversity features. It may be difficult to find good examples for some of the large patch types. Restoration may be needed for some associations.