

RAPID ASSESSMENT FIELD SURVEYS FOR ECOLOGICAL COMMUNITY GROUPS WITHIN PROPOSED WIND ENERGY PROJECT AREAS

Virginia Dept. of Conservation and Recreation / Division of Natural Heritage (DCR-DNH)
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This document outlines procedures to document natural communities within the disturbance zone of a proposed wind energy development. The disturbance area is first stratified into vegetation blocks with homogeneous physiognomy and phenology. Sample locations are chosen within these vegetation blocks, with the objective of capturing the environmental variation across the area. Information on site characteristics and species composition are collected over a 0.1 ha (2.5 ac) area around the pre-selected sample point. Additional targeted reconnaissance within each vegetation block is conducted for small scale habitats that are not visible on air photos. Each observation location is classified to Ecological Community Group following the DCR-DNH classification of ecological communities (Fleming et al. 2010). The previously delineated vegetation blocks are subdivided / edited so that each polygon represents one Ecological Community Group and each polygon is ranked for Ecological Integrity. A final report outlining the methods used and including a summary and map of Ecological Community Groups is prepared and submitted.

I. Aerial photo review and sampling design

Using recent aerial photography, delineate areas of potential natural communities (vegetation blocks). Delineate undisturbed vegetated areas of homogenous physiognomy and phenology. Examples of natural vegetation zones that can be interpreted from aerial photography are:

Upland Deciduous Forest

Upland Evergreen Forest

Open Woodland / Barren

Rock Outcrops / Cliffs

Shrubland / Scrub

Herbaceous Wetlands

Forested Floodplains

Forested Wetlands (non-alluvial)

Areas of disturbed (modified, non-natural) vegetation such as fields, young abandoned clearings, and clear-cuts should be delineated using the descriptor "Disturbed," with an

indication of habitat type in parentheses, e.g. Disturbed (field). Disturbed vegetation blocks do not need to be further classified or sampled for characterization.

Within each natural vegetation block, select potential sampling locations that represent the environmental variation across vegetation block in terms of aspect, slope, elevation, topographic position, and geology. The USGS surficial geology map of Virginia may aid in sample site selection <http://tin.er.usgs.gov/geology/state/state.php?state=VA>

The minimum number of sample points (field observations) recommended per vegetation block is as follows:

Vegetation block is less than 10 acres ≥ 1 observation

Vegetation block is 10 to 100 acres ≥ 2 observations

Vegetation block is 100-500 acres ≥ 3 observations

Vegetation block Greater than 500 acres ≥ 5 observations

II. Field Surveys

Suggested materials: GPS with 1-3 m accuracy with preloaded navigation points, DBH tape (cm), compass, data sheets, clinometer, 50 m measuring tape, chaining pins, surveyors' tape or flagging

Seasonality of sampling

Observations of vegetation should occur between May 1 and Sept. 30 with special considerations applied to the following vegetation:

- Vegetation occurring over 3000 feet (914 meters) elevation should be observed between June 1 and September 1.
- Coastal Plain or Piedmont vegetation with early spring diagnostic plant species (e.g. Basic Mesic Forest) should be observed in April; in the mountains, Rich Cove and Slope Forest and High Elevation Cove Forest, Piedmont/Mountain Small-stream Alluvial Forest, Piedmont / Mountain Floodplain Forest) should be observed in May.
- Vegetation of rock outcrops and rocky woodlands should be observed late in the season (July 15 – Sept 30). These community groups have vegetation in this category: Central Appalachian Shale Barren, High-Elevation Outcrop Barren, Limestone / Dolomite Barren, Low-Elevation Acidic Outcrop Barren, Low-Elevation Basic Outcrop Barren, Mountain / Piedmont Acidic Woodland, Mountain / Piedmont Basic Woodland, Riverside Outcrop Barren, Ultramafic Woodland / Barren.
- Maritime grasslands and marshes should be observed in August and September.

Field observations

Within each delineated vegetation zone, navigate to the general area of the preselected sample point. The observation area should be approximately 0.1 hectares (2.5 acres) around this point. An area this size covers a circle of radius 17.8 meters (or 58.5 feet) or a rectangle of 20 m x 50 m (65 ft x 164 ft). If vegetation occurs in a smaller patch than 0.1 ha, the entire area should be observed. Vegetation patches less than 400 square meters (i.e., 20 m x 20 m, 10 m x 40 m, or a circle of 11.28 meters radius) should not be sampled. The actual observation area may be moved from the pre-selected location in order to capture the most representative part of a stand. The observation area should be deliberately placed away from field edges, clearcuts, roadsides, and other anthropogenically disturbed areas, and should be moved to avoid these kinds of disturbances. It is important that the observation be in vegetation that is floristically and structurally homogeneous, avoiding ecotones or transitions in vegetation and habitat conditions.

In addition to observations at the preselected points, targeted reconnaissance within each vegetation block should be conducted for small scale occurrences of streamhead seeps or rock outcroppings that are not visible on air photos. Vegetation patches in these habitats that meet the above requirements should be documented using the provided data collection form.

Data Collection Form:

The DCR-DNH Rapid Vegetation Assessment Form is provided in Appendix A. The following provides general instructions for completing the DCR-DNH rapid vegetation assessment data collection form.

Page 1: Plot Documentation

General Information

Record the alphanumeric code for the plot, the project with which it is associated, date of sampling, and the full names of surveyors participating in the data collection. Record the size of the area observed, either a demarcated area of a circle or rectangle, or an estimated area of observation.

Plot Documentation

Photographs are useful for recording the general aspect of the vegetation, and serve as a permanent record of conditions at the time of the data collection. Take at least one representative photograph and record identifying digital file numbers or film frame numbers of images taken. The subject of the photo can also be described (e.g. "Largest trees in the stand" or "general vegetation aspect")

GPS Data

Use a global positioning system (GPS) unit to determine plot coordinates, and record UTM zone, datum, GPS file name, estimated horizontal accuracy, and number of positions averaged, and receiver status. It is a good practice to write down coordinates in the field, in case something happens with your GPS file. If GPS satellites are not available, estimate plot location, as precisely as possible, on a USGS quadrangle map.

Estimated Stand Size

In order to provide information about the relative size of the patch of vegetation being sampled, check the most appropriate category on the form. Notes can also be made about the actual or estimated size vegetation patch (or stand) and its pattern on the landscape (e.g. Forests of this composition are continuous along the ridgeline above 4,000 feet elevation, covering hundreds of acres)

Page 1: Site Characteristics

Slope

Record slope inclination in degrees from the center of the observation using a clinometer. In cases where slope is variable within an observation, take multiple measurements and average the results. If a clinometer is not available, estimate slope using the percentage classes on the form.

Aspect

Record aspect in degrees; measuring it from the observation center with a compass. If slope inclination is less than 5 degrees, record aspect as "flat." If the plot contains two or more slopes with different aspect, record aspect as "variable." Indicate if the compass used was corrected for declination by checking "corrected" or "magnetic" at the bottom of this section.

Soil Moisture Regime

Estimate the appropriate class of soil moisture based on the definitions provided on the field form. Check only one class in the range from very xeric to hydric. If the habitat is an upland or rock outcrop with periodic ephemeral seepage or subsurface groundwater in part of the observation area, also check this category.

Hydrologic Regime

Estimate the appropriate class of hydrologic regime. Definitions of wetland regimes from Cowardin (1979) are:

Tidal (estuarine sites):

IRREGULARLY EXPOSED – The land surface is exposed by tides less often than daily. Area encompasses the range from height of mean low tide to height of extreme low spring tide.

REGULARLY FLOODED – Tidal water alternately floods and exposes the land surface at least once daily, caused by lunar attraction. Area encompasses the range from height of mean low tide to height of mean high tide.

IRREGULARLY FLOODED – Tidal water floods the land surface less often than daily but at least once a year, due to extreme high spring tide. Area encompasses the range from height of mean high tide to maximum extent of tide plus splash zone.

WIND TIDAL – A special type of irregular flooding in which wind tidal influence clearly or likely prevails. Wind tidally flooded is not necessarily an exclusive hydrologic modifier.

SUBTIDAL – Tidal water covers the land surface at all times of the year in all years. This modifier applies only to permanently flooded habitats that are irregularly flooded by fresh tidal water.

Non-tidal (palustrine, lacustrine, riparian sites):

PERMANENTLY FLOODED – Water covers the land surface at all times of the year in all years.

SEMI-PERMANENTLY FLOODED – Surface water persists at least throughout the growing season in most years. The land surface is normally saturated when water level drops below the soil surface.

SEASONALLY FLOODED – Surface water is present for extended periods, especially early in the growing season, but is absent by the end of the growing season in most years. When surface water is absent, the water table is often near the land surface, but is highly variable after flooding ceases, extending from saturated to a water table well below the ground surface.

INTERMITTENTLY FLOODED – The substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable and is dependent upon highly localized precipitation events. Long periods of time may elapse between inundation events. This modifier can apply to both wetland and non-wetland habitats.

TEMPORARILY FLOODED – Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season. Vegetation is characterized by both upland and wetland plants. This regime often characterizes floodplain wetlands.

SATURATED – The substrate is saturated at the surface for extended periods during the growing season, but surface water is seldom present.

Salinity / Halinity:

For tidal sites, estimate the salinity class. If salinity is determined with a refractometer, list the measurement in parts per thousand.

Soil Texture

Note the soil texture from a sample taken from the top 10 centimeters of mineral soil. Use the soil texture key provided in Appendix B to assess the average soil texture.

Rock Types

Note any rock types observed in the area; describe the physical characteristics of rocks if rock type is unknown.

Cover by unvegetated rock

Note the percentage of the observation area that is covered by bedrock, boulders/stones, or gravel/cobble

Evidence of Disturbance

Record any evidence of past disturbance (old stumps, fire scars, charcoal in soil, plant diseases, insect pathogens, etc.) observed in observation area or in the stand. Check off appropriate categories and provide comments as needed. Any evidence of stand age (time of last clearing, age of trees) should be provided here, as well as notes on exotic plants species.

Page 2: Site Characteristics continued

Landscape Context

Describe the landscape context of the vegetation, including adjacent vegetation types and any other important features that influence the area. Provide information that will help determine the ecological integrity of the surrounding landscape. Note if natural ecological processes are intact (hydrology, fire, sand movement, flooding, etc.)

Tree diameter and height

Identify and measure the diameter and height of, at least, the three largest trees in the stand. Diameter should be measured to the nearest centimeter using a diameter tape at 1.4 m above the ground. Height can be measured using a clinometer, and should be measure to the nearest meter. Estimate the average tree diameter for the stand. Comments regarding the range in tree sizes and any evidence of tree age can be made here.

Page 2: Species composition and abundance by stratum

In this table, list all tree and shrub species, and all other vascular plants that cover at least one square meter (in total) within the observation area. For vascular plant taxonomy, use the standard list of the Virginia vascular flora developed by VANHP botanists and ecologists and available as at download at

http://www.dcr.virginia.gov/natural_heritage/nchome.shtml#pdf

Indicate the abundance of each species in the appropriate column for each height stratum in which the species occurs. Height strata are defined on the form. Which stratum an individual plant belongs in is determined by its maximum height. However, all herbaceous plants, regardless of their height are recorded in the H layer. Vines are recorded in the maximum height strata in which they are observed. Species with questionable or uncertain identifications should be flagged by checking the box in the "ID" column on the right side of the table. If specimens are collected for later identification, check the box or write a collection number in the "Coll./#" column at the far right. Vegetative plants that cannot be identified to species may be identified only to genus, e.g., *Carex* sp.

Abundance of each species is indicated using these qualitative measures:

D = dominant The most abundant species in the stratum. More than one species can be designated as dominant. Dominant species generally make up over 50 % of the total vegetative cover.

LD = Locally dominant = Species that occur as patch dominants, distributed unevenly in the stand, but dominant a scale smaller than the observation.

C = Common = The species occurs with some frequency and is commonly encountered, but is not dominant.

R = Rare = Only one or few individual plants seen within the observation area.

P = Present = The species is present, but its abundance could not be determined

III. Classification

Determine the physiographic province(s) the project is in, using the shapefile of physiographic provinces provided with this document. Use the Ecological Community Group by physiographic province table to determine which Ecological Community Groups are possible in the project area (available as a sortable spreadsheet and in Appendix C). Ecological Community Groups are listed in Appendix D and described on the DCR-DNH website. The website is updated periodically and should be checked to obtain that latest version of the classification and descriptions. Compare the observed vegetation to descriptions of Ecological Community Groups on the Natural Communities of Virginia website and record classification of the observation.

(http://www.dcr.virginia.gov/natural_heritage/ncintro.shtml). Label each observation with the Ecological Community Group that best describes the vegetation found there. If more than one Ecological Community Group describes the observation, list a primary and secondary Ecological Community Group. If the Ecological Community Group cannot be determined, classify the observation as “Undefined”. Provide this classification on both the data form and in a shapefile containing the spatial location of the observation.

IV. Mapping

Using the classified points and ancillary spatial datasets (hypsography, hydrography, surficial geology, aerial imagery) subdivide / edit the natural vegetation blocks delineated in step one, as needed, so that each polygon represents a single Ecological Community Group as defined by DCR-DNH. Label each polygon with an Ecological Community Group. Rank each polygon as to Ecological Integrity on a scale of A-D, using the following values:

Rank Value	Description
A	Excellent. A high quality example of this Ecological Group. Characteristics include: the landscape context contains natural habitats that are essentially unfragmented (reflective of intact ecological processes) and with little to no stressors; the stand is mature; the size is very large for the type; vegetation structure and composition, soil status, and hydrological function are well within natural ranges of variation, exotics (non-natives) are essentially absent or have negligible negative impact; and, a comprehensive set of key plant and animal indicators are present.
B	Good. This is not among the highest quality examples of this Ecological Group, but nevertheless exhibits favorable characteristics with respect to major ecological attributes functioning within the bounds of natural disturbance regimes. Characteristics include: the landscape context contains largely natural habitats that are minimally fragmented with few stressors; The stand is of moderate maturity; the size is large for the type, the vegetation structure and composition, soils, and hydrology are functioning within natural ranges of variation; invasives and exotics (non-natives) are present in only minor amounts, or have or minor negative impact; and many key plant and animal indicators are present.
C	Fair. This example has a number of unfavorable characteristics with respect to the major ecological attributes, natural disturbance regimes. Characteristics include: the landscape context contains natural habitat that is moderately fragmented, with several stressors; The stand is young or may contain some early successional species; the size is average to small for the type; the vegetation structure and composition, soils, and hydrology are altered somewhat outside their natural range of variation; invasives and exotics (non-natives) may be a sizeable minority of the species abundance, or have moderately negative impacts; and many key plant and animal indicators are absent. Some management is needed to maintain or restore these major ecological attributes.
D	Poor. Occurrence has severely altered characteristics (but still meets minimum criteria for the Ecological Group), with respect to the major ecological attributes. Characteristics include: the landscape context contains little natural habitat and is very fragmented; size is very small for the type; the vegetation structure and composition, soils, and hydrology are severely altered well beyond their natural range of variation; invasives or exotics (non-natives) exert a strong negative impact, and most, if not all, key plant and animal indicators are absent. There may be little long-term conservation value without restoration, and such restoration may be difficult or uncertain.

V. Report preparation

A summary report should include:

A general description of methods used for the survey and mapping, as well as the version of the DCR-DNH website used to classify the vegetation observations.

A list of Ecological Community Groups identified in the project zone and total acreage of each type, with a summary of the overall Ecological Integrity of each Ecological Community Group on the site.

A shapefile of observation locations, including attributes of plot code, ecological community group, and mapping method (i.e. GPS or estimated location on a topo map).

A shapefile of polygons covering the vegetation on the site; including the attributes of polygon ID, Vegetation Condition (i.e. Disturbed or Natural); Ecological Community Group, and Ecological Integrity ranking. Areas mapped "Disturbed" will not received an Ecological integrity ranking, but will have a descriptor of habitat type in the Ecological Community Group field (eg. Disturbed (pasture)).

The report should also include the locations of rock outcrops, wetlands, and cliffs that were found on the site, but not included within the vegetation observations

All vegetation observation data forms.

Works cited:

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service. FWS/OBS-79/31. 103 pp.

Fleming, G.P., K.D. Patterson, K. Taverna, and P.P. Coulling. 2010. The natural communities of Virginia: classification of ecological community groups. Second approximation. Version 2.3. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

<http://www.dcr.virginia.gov/natural_heritage/ncintro.shtml>

APPENDIX A: VIRGINIA DCR-DNH RAPID VEGETATION ASSESSMENT FORM
(version 4-14-2011)

GENERAL INFORMATION

Plot code / identifier: _____

Project: _____

Date: _____

Surveyors: _____

Community name (DCR-DNH Ecological Community Group): _____

Observation area:

Circle of radius _____ m; or area _____ m by _____ m; or area = _____

PLOT DOCUMENTATIONPhotographer: _____ ☐ NO photos taken

Camera _____

File / frame #s: _____

Description of image(s): _____

GPS DATA

GPS Unit: _____ GPS Datum: _____

GPS point or file name: _____

est accuracy: _____ m/ft # of positions averaged: _____

Receiver status: 2D / 3D / 2D WAAS / 3D WAAS

Field Coordinates:

UTM X _____ E Y _____ N

LAT _____ LONG _____

Estimated stand size

- ☐ extensive (greater than 100 acres (> 40 hectares))
- ☐ large (greater than 10, but less than 100 acres (4 - 40 hectares))
- ☐ small (greater than 1 acre, but less than 10 acres (0.4 - 4 hectares))
- ☐ very small (less than 1 acre; less than 0.4 hectare)
- ☐ Unknown

Notes on stand size:**SITE CHARACTERISTICS****Slope (degrees)** _____ °single measure ☐ or: avg of _____

- ☐ 0-3% (level or nearly so) ☐ 16-30% (moderate/hilly)
- ☐ 3-8% (gentle/undulating) ☐ 30-65% (steep)
- ☐ 8-16% (sloping/rolling) ☐ 65-75% (very steep)
- ☐ 75+% (extremely steep)

Slope Aspect (N = 0 degrees): _____ °

- single measure ☐ avg. of _____
- ☐ area is flat, no slope (e.g. ridgetops or flat plains)
- ☐ aspect is variable over stand

N 338-22 ° W 248-292 ° SW 203-247 °

E 68-112 ° NE 23-67 ° NW 293-337 °

S 158-202 ° SE 113-157 °

compass: magnetic corrected**Soil Moisture Regime**

- ☐ very xeric (moist for a negligible time after precipitation)
- ☐ xeric (moist for brief time)
- ☐ somewhat xeric (moist for short time)
- ☐ submesic (moist for moderately short time)
- ☐ mesic (moist for significant time)
- ☐ subhygric (wet for significant part of growing season; mottles <20cm)
- ☐ hygric (wet for most of growing season; permanent seepage/mottling)
- ☐ subhydic (water table at or near surface for most of the year)
- ☐ hydric (water table at or above surface year round)

Hydrologic Regime

____ Site is terrestrial (i.e. not a wetland)

Tidal

- ☐ Irregularly exposed (< daily)
- ☐ Regularly flooded (>=daily)
- ☐ Irregularly flooded (< daily, but >=once/yr)
- ☐ Wind tidally flooded
- ☐ Subtidal (permanently flooded)

Non-Tidal

- ☐ Permanently flooded
- ☐ Semipermanently flooded
- ☐ Seasonally flooded
- ☐ Intermittently flooded
- ☐ Temporarily flooded
- ☐ Saturated

Salinity/Halinity

- ☐ Saltwater
- ☐ Brackish
- ☐ Oligohaline
- ☐ Freshwater

Refractometer
Measurement:

ppt _____

Evaluate separately from above:

- ☐ ephemeral seepage/subsurface water present locally in plot (non-wetland habitats)

Soil Texture (top 10 cm of mineral soil)

- ☐ Sand ☐ Loam ☐ Clay
- ☐ Sandy Loam ☐ Silt Loam ☐ Clay loam
- ☐ Peat ☐ Muck ☐ other

Rock Types Present:**Cover by unvegetated rock (bare rock or lichen covered):**

_____ % bedrock

_____ % boulders/stones

_____ % gravel/cobbles

Evidence of Disturbance

- ☐ ditching/hydrologic alternation ☐ trails/roads ☐ wind/ice damage ☐ hemlock adelgid ☐ fire
- ☐ dogwood anthracnose ☐ clearing ☐ logging ☐ gypsy moth ☐ erosion
- ☐ exotic plants ☐ grazing/browsing ☐ oak decline ☐ spruce decline ☐ Other

Notes re: Disturbance: (past land use, list exotics species, other natural or anthropogenic disturbance, evidence of stand age)

P. 2/3

SPECIES	DBH (cm)	HT (m)

Average tree diameter for stand:

List all trees and shrub species, and all herbaceous species that cover at least one square meter within the observation area. Indicate relative abundance for each species in each layer in which it occurs.

[illegible]

H: herbaceous or woody
under 0.5 m tall

S: shrub 0.5 - 6 m tall

SC: subcanopy; trees
6 - 20 m tall

TC: canopy; trees
over 20 m tall

D = Dominant

LD = Locally dominant

C = Common

R = Rare

P = Present

Strata	
H :	herbaceous or woody under 0.5 m tall
S:	shrub 0.5 - 6 m tall
SC:	subcanopy; trees 6 - 20 m tall
TC:	canopy; trees over 20 m tall

APPENDIX B : Field Key to Soil Texture

The following simplified soil key was adapted from Brewer,R. and M.T. McCann. 1982.
Laboratory and Field Methods in Ecology, Saunders College Publishing, Philadelphia, PA

APPENDIX B

Simplified Key to Soil Texture (Brewer and McCann 1982)

A1 Soil does not remain in a ball when squeezed	sand
A2 Soil remains in a ball when squeezed	B
B1 Squeeze ball between thumb and forefinger, attempting to make ribbon to push up over finger. Soil makes no ribbon	loamy sand
B2 Soil makes a ribbon	C
C1 Ribbon extends < 1 in before breaking	D
C2 Ribbon extends \geq 1 in before breaking	E
D1 Add excess water to small amount of soil. Soil feels at least slightly gritty.....	loam OR sandy loam
D2 Soil feels smooth	silt loam
E1 Soil makes a ribbon that breaks when 1-2 in long and cracks when bent into a ring	F
E2 Soil makes a ribbon \geq 2 in long and doesn't crack when bent into a ring	G
F1 Add excess water to small amount of soil. Soil feels at least slightly gritty	sandy clay loam OR clay loam
F2 Soil feels smooth	silty clay loam OR silt
G1 Add excess water to small amount of soil. Soil feels at least slightly gritty ...	sandy clay OR clay
G2 Soil feels smooth	silty clay

APPENDIX C: Ecological Community Groups by Physiographic Province (also available as a sortable spreadsheet)

Physiographic province abbreviations:

AM	Allegheny Mountains
CM	Cumberland Mountains
RV	Ridge and Valley
NB	Northern Blue Ridge
SB	Southern Blue Ridge
NP	Northern Piedmont
SP	Southern Piedmont
NC	Northern Coastal Plain
SC	Southern Coastal Plain
OC	Outer Coastal Plain

Presence in Province:

C	Common; often extensive in region
U	Uncommon; of irregular or scattered distribution, may be locally common in limited suitable habitats
R	Rare; usually in very small patches
p	no documentation in province but of potential occurrence

APPENDIX C

Ecological Community Group	AM	CM	RV	NB	SB	NP	SP	NC	SC	OC
Spruce / Fir Forest	R		R		R					
Northern Hardwood Forest	C	R	U	U	C					
Southern Appalachian Shrub / Grass Bald			R		R					
High-Elevation Boulderfield Forest / Woodland	p		R	R	R					
High-Elevation Cove Forest	U	R	U		U					
Northern Red Oak Forest	U	R	C	C	C					
High-Elevation Outcrop Barren			R	R	R					
Rich Cove / Slope Forest	U	C	C	C	C	R	R			
Basic Mesic Forest			U	U		C	C	R	R	
Acidic Cove Forest	U	C	C	C	C	R	R			
Mesic Mixed Hardwood Forest						C	C	C	C	U
Eastern Hemlock - Hardwood Forest	R	R	U	U		R	R			
Northern White-Cedar Slope Forest			R							
Dry-Mesic Calcareous Forest	p	C	C			R				
Basic Oak - Hickory Forest				C	U	C	U	R		
Acidic Oak - Hickory Forest			C	C	R	C	C	R	R	
Montane Mixed Oak / Oak - Hickory Forest	C	C	C	C	C	U	R			
Oak / Heath Forest	C	C	C	C	C	C	C	C	C	C
Eastern White Pine - Hardwood Forest			C	U		U	U			
Piedmont / Coastal Plain Oak - Beech / Heath Forest						U	U	C	U	R
Carolina Hemlock Forest			R	R	R					
Pine - Oak / Heath Woodland			C	C	C	R				
Mountain / Piedmont Acidic Woodland		R	U	R		R	R			
Mountain / Piedmont Basic Woodland			R	R	R	R	R			
Montane Dry Calcareous Forest / Woodland	p	U	C	R						
Coastal Plain Dry Calcareous Forest / Woodland								R	R	R
Oak - Hickory Woodland / Savanna						R	R			
Piedmont Hardpan Forest						R	R			
Low-Elevation Boulderfield Forest / Woodland	p	p	C	C	U	R				
Low-Elevation Acidic Outcrop Barren		R	R	R						
Low-Elevation Basic Outcrop Barren			R	R	R	R	R			
Limestone / Dolomite Barren			R							
Mountain / Piedmont Calcareous Cliff		p	R	R	p	R				
Mountain / Piedmont Acidic Cliff		R	R	R	R	R				
Central Appalachian Shale Barren			U	R	R					
Granitic Flatrock							R			
Piedmont Prairie						R				
Ultramafic Woodland / Barren					R	R	R			
Riverside Outcrop Barren						R				
Lichen / Bryophyte Nonvascular Boulderfields and Outcrops	p	p	U	U	R	R	p			
Maritime Dune Grassland										R
Maritime Dune Scrub										R
Maritime Dune Woodland										R
Maritime Upland Forest								R		R
Pine / Scrub Oak Sandhill									R	
Fluvial Terrace Woodland								R	R	

APPENDIX C (continued)

Ecological Community Group	AM	CM	RV	NB	SB	NP	SP	NC	SC	OC
Loblolly Pine Savanna							R	R	R	
Bald Cypress - Tupelo Swamp							R	U	C	C
Coastal Plain / Piedmont Bottomland Forest						C	C	C	C	C
Floodplain Pond / Pool						R	R	R	R	
Semipermanent Impoundment			U			U	U	U	U	U
Piedmont / Mountain Floodplain Forest			U	U	U	C	C			
Piedmont / Mountain Swamp Forest			R			R	R			
Piedmont / Mountain Small-stream Alluvial Forest	U	U	U	U	U	U	U			
Sand / Gravel / Mud Bar/Shore			R	R		R	R	R		
Rocky Bar / Shore				R	R	R	R			
Riverside Prairie			R	R		R				
Mountain / Piedmont Basic Seepage Swamp			R	R		R				
Mountain / Piedmont Acidic Seepage Swamp			R	R	R	R	R			
High-Elevation Seepage Swamp	R		R	R	R					
Appalachian Bog	R		R		R					
Montane Woodland Seep	R	R	R	R	R	R	R			
Montane Depression Wetland			R							
Calcareous Fen			R		R					
Mesic / Wet-Mesic Prairie			R		R					
Calcareous Spring Marsh / Muck Fen			R							
Mafic Fen / Seep				R	R					
Spray Cliffs		p	R	p	p					
Inland Salt Marsh			R							
Coastal Plain Depression Wetland						R	R	R	R	R
Non-Riverine Flatwood / Swamp						R		R	R	U
Coastal Plain / Piedmont Seepage Bog						R	R	R	R	R
Coastal Plain / Piedmont Acidic Seepage Swamp						R	R	U		R
Coastal Plain / Piedmont Basic Seepage Swamp						R	R	R	R	
Upland Depression Swamp						R	R	R		
Pond Pine Woodland / Pocosin										R
Peatland Atlantic White Cedar Forest										R
Sea-Level Fen										R
Interdune Pond										R
Maritime Shrub Swamp										R
Maritime Wet Grassland										R
Maritime Swamp Forest										R
Riverine Aquatic Beds		U	U	U	U	U	U	U	U	
Tidal Freshwater Marsh								U	R	R
Tidal Oligohaline Marsh								U	U	U
Wind-Tidal Oligohaline Marsh								R		U
Tidal Mesohaline / Polyhaline Marsh								U	U	C
Tidal Shrub Swamp								R		R
Tidal Bald Cypress Forest / Woodland								R	R	R
Tidal Hardwood Swamp								U		
High-Energy Tidal River Shore						R		R		
Tidal Freshwater / Oligohaline Aquatic Bed								R	p	R
Tidal Mesohaline / Polyhaline Aquatic Beds								p	p	U

APPENDIX C (continued)

Ecological Community Group	AM	CM	RV	NB	SB	NP	SP	NC	SC	OC
Salt Flat										U
Salt Scrub								R	R	U
Upper Beach / Overwash Flat										R

APPENDIX D: List of Ecological Groups listed in a Classification Hierarchy

The divisions of the Virginia classification hierarchy, from the top down, are: System, Ecological Class, Ecological Community Group, and Community Type.

The **System** is the upper-most level of the classification hierarchy. The System level is based on gross hydrologic regime and includes five divisions: the **Terrestrial System** includes all upland (non-wetland) habitats, while the **Palustrine System** encompasses all non-tidal wetlands dominated by woody plants and herbaceous emergents. The **Estuarine System** includes emergent and floating / submergent tidal wetlands, extending to the upstream limits of tidal influence. The **Riverine System** and the **Marine System** are each represented by a single ecological group that supports vascular plants. This system-level treatment generally follows Cowardin et al. (1979), except that freshwater tidal wetlands are included in the Estuarine System, and some communities that would be placed in the Lacustrine System of Cowardin et al. (1979) are included in the Palustrine System. Classifications of deepwater Lacustrine, Riverine, Estuarine, and Marine System communities that lack vascular plants, as well as of Subterranean System (cave) communities, are currently under study or development by other groups of specialists.

Ecological Class is a level of the classification that is meant to aid in organizing ecological community groups. We have defined 14 Ecological classes to organize the natural communities of Virginia. These classes are not necessarily mutually exclusive, but serve to group physiographically and topographically related community groups, which often co-occur on the landscape.

The **Ecological Community Group** is the level of the classification that organizes community types. Ecological community groups are aggregations of community types with topographic, edaphic, physiognomic, and gross floristic similarities. Community types within an ecological community group are often distributed in different regions of the state and have floristic differences that result from biogeographic influences. Ecological Community Groups define natural communities at a relatively coarse scale that may be more appropriate for large-scale applications such as ecological modeling and vegetation mapping. In addition, they employ concepts and terminology that are communicable, familiar, and useful to a wide range of potential users.

This list of Ecological Groups can be used somewhat like a key, to help place vegetation within the vegetation classification hierarchy. The Ecological Community Groups are listed below the Ecological Class. The DCR-DNH websites should be consulted for the latest classification and descriptions. http://www.dcr.virginia.gov/natural_heritage/ncintro.shtml

APPENDIX D

TERRESTRIAL SYSTEM: Upland, non-wetland environments

High-Elevation Mountain Communities: Ecological community groups with distributions centered above 1,070 m (3,500 ft) elevation (but often occurring down to 975 m [3,000 ft] elevation) and representing structurally and compositionally diverse vegetation rich in northern species.

- Spruce / Fir Forest
- Northern Hardwood Forest
- Southern Appalachian Shrub / Grass Bald
- High-Elevation Boulderfield Forest / Woodland
- High-Elevation Cove Forest
- Northern Red Oak Forest
- High-Elevation Outcrop Barren

Low-Elevation Mesic Forests: Ecological community groups with distributions centered below 1,070 m (3,500 ft) elevation and representing mesophytic to submesophytic forest vegetation. A few community types of the Rich Cove and Slope Forests, Acidic Cove Forests, and Eastern Hemlock - Hardwood Forests occasionally extend into the high-elevation zone (> 1,070 m).

- Rich Cove / Slope Forest
- Basic Mesic Forest
- Acidic Cove Forest
- Mesic Mixed Hardwood Forest
- Eastern Hemlock - Hardwood Forest
- Northern White-Cedar Slope Forest

Low-Elevation Dry and Dry-Mesic Forests and Woodlands: Ecological community groups with distributions centered below 1,070 m (3,500 ft) elevation and representing xerophytic to submesophytic forest and woodland vegetation. A few community types of the Montane Mixed Oak and Oak-Hickory Forests, Oak / Heath Forests, and Pine – Oak / Heath Woodlands extend significantly into the high-elevation zone (> 1,070 m), but are retained in this Class because of their compositional similarity to other members of these groups.

- Dry-Mesic Calcareous Forest
- Basic Oak - Hickory Forest
- Acidic Oak - Hickory Forest
- Montane Mixed Oak / Oak - Hickory Forest
- Oak / Heath Forest
- Eastern White Pine - Hardwood Forest
- Piedmont / Coastal Plain Oak - Beech / Heath Forest
- Carolina Hemlock Forest
- Pine - Oak / Heath Woodland
- Mountain / Piedmont Acidic Woodland
- Mountain / Piedmont Basic Woodland

APPENDIX D (continued)

Montane Dry Calcareous Forest / Woodland
Coastal Plain Dry Calcareous Forest / Woodland
Oak - Hickory Woodland / Savanna
Piedmont Hardpan Forest
Low-Elevation Boulderfield Forest / Woodland

Low-Elevation Rock Outcrops and Barrens: Ecological community groups with distributions centered below 1,070 m (3,500 ft) elevation and representing edaphically (or in one case, fire-) controlled woodland, scrub, herbaceous, and moss/lichen vegetation.

Low-Elevation Acidic Outcrop Barren
Low-Elevation Basic Outcrop Barren
Limestone / Dolomite Barren
Mountain / Piedmont Calcareous Cliff
Mountain / Piedmont Acidic Cliff
Central Appalachian Shale Barren
Granitic Flatrock
Piedmont Prairie
Ultramafic Woodland / Barren
Riverside Outcrop Barren
Lichen / Bryophyte Nonvascular Boulderfields and Outcrops

Maritime Zone Communities: Ecological community groups with distributions and vegetation controlled by oceanic influences (e.g., deep sand deposits, salt spray, maritime microclimates). In Virginia, these are confined to narrow zones along both flanks of the Eastern Shore, the western shore of the Chesapeake Bay, and the Atlantic shore in extreme southeastern Virginia.

Maritime Dune Grassland
Maritime Dune Scrub
Maritime Dune Woodland
Maritime Upland Forest

Sandy Woodlands of the Coastal Plain and Outer Piedmont: Ecological community groups representing woodland vegetation of oligotrophic, fire-influenced or edaphically stressful, non-marine sandy habitats at very low elevations.

Pine / Scrub Oak Sandhill
Fluvial Terrace Woodland
Loblolly Pine Savanna

PALUSTRINE SYSTEM: Non-tidal wetlands dominated by woody plants (trees, shrubs), and emergent herbaceous plants

Alluvial Floodplain Communities: Ecological community groups of alluvial habits with overland, non-tidal flooding regimes. Structurally and compositionally diverse vegetation is represented.

Bald Cypress - Tupelo Swamp
Coastal Plain / Piedmont Bottomland Forest
Floodplain Pond / Pool
Semipermanent Impoundment
Piedmont / Mountain Floodplain Forest
Piedmont / Mountain Swamp Forest
Piedmont / Mountain Small-stream Alluvial Forest
Sand / Gravel / Mud Bar/Shore
Rocky Bar / Shore
Riverside Prairie

Non-Alluvial Wetlands of the Mountains: Ecological community groups of groundwater-controlled, non-alluvial wetlands in the mountain region, including seeps, bogs, fens, and ponds. Structurally and compositionally diverse vegetation is represented.

Mountain / Piedmont Basic Seepage Swamp
Mountain / Piedmont Acidic Seepage Swamp
High-Elevation Seepage Swamp
Appalachian Bog
Montane Woodland Seep
Montane Depression Wetland
Calcareous Fen
Mesic / Wet-Mesic Prairie
Calcareous Spring Marsh / Muck Fen
Mafic Fen / Seep
Spray Cliffs
Inland Salt Marsh

Non-Alluvial Wetlands of the Coastal Plain & Piedmont: Ecological community groups of groundwater-controlled, non-alluvial wetlands in the Coastal Plain and Piedmont. Structurally and compositionally diverse vegetation is represented.

Coastal Plain Depression Wetland
Non-Riverine Flatwood / Swamp
Coastal Plain / Piedmont Seepage Bog
Coastal Plain / Piedmont Acidic Seepage Swamp
Coastal Plain / Piedmont Basic Seepage Swamp
Upland Depression Swamp

APPENDIX D (continued)

Saturated Peatlands of the Coastal Plain: Ecological community groups of fire-influenced, groundwater controlled, non-alluvial, Coastal Plain wetlands with deep organic soils and a saturated hydrologic regime. This class is represented in Virginia by woodland and forest vegetation, although shrublands are components further south.

Pond Pine Woodland / Pocosin
Peatland Atlantic White Cedar Forest

Non-Tidal Maritime Wetlands: Ecological community groups of mostly groundwater-controlled wetlands subject to oceanic influences (*e.g.*, deep sand deposits, salt spray, maritime microclimates). In Virginia, these are confined to narrow zones along both flanks of the Eastern Shore, the western shore of the Chesapeake Bay, and the Atlantic shore in extreme southeastern Virginia.

Sea-Level Fen
Interdune Pond
Maritime Shrub Swamp
Maritime Wet Grassland
Maritime Swamp Forest

RIVERINE SYSTEM: All non-tidal wetlands and deepwater habitats contained within stream channels, except those dominated by woody plants or herbaceous emergents

Riverine Vegetation: Ecological communities of freshwater river channels, including floating and submergent herbaceous vegetation at water depths that exclude emergent species but permit bottom rooting of aquatic species. Vegetation with emergent species is included in the Palustrine Ecological classes.

Riverine Aquatic Beds

ESTUARINE SYSTEM: Bodies of water that have a connection (open, partly obstructed, or sporadic) to the ocean and where fresh water from overland drainage is mixed with oceanic salt water; usually characterized by tidal activity; extending upstream to the inland limits of tidal flooding, thus including a zone of strictly freshwater tidal habitats on coastal rivers.

Tidal Wetlands: Ecological community groups of regularly or irregularly flooded, lunar tidal wetlands and irregularly flooded, wind-tidal wetlands. Structurally and compositionally diverse vegetation is represented. In the descriptions that follow, the terms "high" and "low" marsh refer to the relative elevation of stands within the intertidal zone.

Tidal Freshwater Marsh
Tidal Oligohaline Marsh
Wind-Tidal Oligohaline Marsh
Tidal Mesohaline / Polyhaline Marsh

APPENDIX D (continued)

Tidal Shrub Swamp
Tidal Bald Cypress Forest / Woodland
Tidal Hardwood Swamp
High-Energy Tidal River Shore
Tidal Freshwater / Oligohaline Aquatic Bed
Tidal Mesohaline / Polyhaline Aquatic Beds
Salt Flat
Salt Scrub

MARINE SYSTEM: The ocean from the outer edge of the continental shelf to the flood line on the beach.

Marine Vegetation: Ecological community groups of sparsely vegetated ocean shores and flats where the substrate is exposed and flooded by ocean tides; includes vegetation of the splash zone.

Upper Beach / Overwash Flat