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FROM: Bruce Bayne, URS
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PROJECT: DuPont Brevard Ecological Inventory

URS JOB NO.: 18986041

cc :

SUBJECT: DuPont Brevard Ecological Inventory Summary Report

INTRODUCTION

At the request of DuPont, URS Corporation (URS) completed an ecological assessment of the DuPont Brevard, North Carolina site (Site). The purpose of this effort was to identify, evaluate, and document the presence of unique features and/or significant ecological resources. This memorandum summarizes the findings of these efforts. Table 1 lists ecological communities found to occur at the Site, and the areal extent of each, based on the *Classification of the Natural Communities of North Carolina* (Schafale and Weakley, 1990). Table 2 lists rare, threatened, and endangered species confirmed at the Site. Table 3 lists bird and non-avian species observed at the Site during field assessments. A map specifying the location of ecological communities is provided in Figure 1. Figure 2 illustrates the juxtaposition of ecological communities relative to those contained within DuPont State Forest. Site topography and the locations of Significant Natural Heritage Areas and National Wetland Inventory wetlands occurring at the Site are depicted in Figure 3. Appendix A provides a list of Transylvania County species with state and/or federal status. A description of ecological communities, along with a list of species associated with each community, is detailed in Appendix B. A photographic log of observations is presented in Appendix C. A 2006 summary prepared by others of reported significant natural features is provided as Appendix D. The following sections detail the methodology used in the assessment and present findings regarding the extent and condition of ecological communities by geographic area, verification of the presence of rare, threatened, and endangered species, and notes regarding Site-specific ecological concerns.

METHODS

The ecological assessment consisted of a desktop review and two Site reconnaissance field surveys. The desktop review was conducted in April, 2011 and included collection and evaluation of online data to assess potential significant natural heritage areas and vegetative communities, rare plants, state and federal rare, threatened, or endangered species, wetlands/waters, and flood hazard areas at the Site.

The first ecological field survey (Spring Survey) was conducted May 2 through May 4, 2011 to coincide with the emergence of ephemeral vegetation and breeding bird activities. During the Spring Survey, Chet Meinzer, Site Manager (Parsons, on behalf of DuPont), provided

[1] Revision 1 (rev1) inclusion of Appendix D, Dupont Facility Property: Significant Natural Features: February 3, 2006

background on the Site along with a Site tour. The second ecological survey (Summer Survey) was conducted August 8 through August 10, 2011 to document species not present during the Spring Survey and to further verify the presence and extent of significant ecological resources when vegetation was in full cover.

During both surveys, URS conducted extensive field assessments of all wetlands and waters, ecological communities, unique geologic features, and threatened and endangered species at the Site. Photographs, notes and a hand-held Global Positioning System Unit (GPS) were used to categorize ecological resources and document Site conditions. Vegetation communities were classified according to the *Classification of the Natural Communities of North Carolina* (Schafale and Weakley, 1990) to be consistent with classifications used for the DuPont State Forest presented in the *DuPont State Forest Preliminary Draft Land and Resource Management Plan* (North Carolina Division of Forest Resources, 2011).

DESKTOP REVIEW

Prior to the field reconnaissance, URS conducted a desktop review of existing/available information to identify unique features and/or significant ecological resources potentially present at the Site. The following sections detail the findings of these efforts. A site description along with summaries of significant natural heritage areas and vegetative communities, state and federal threatened or endangered species, wetlands/waters, and flood hazard areas at the Site are provided below.

Site Description

The Site is located southeast of the Brevard corporate line within Transylvania County, North Carolina and is situated centrally within the DuPont State Forest. The approximately 400-acre Site is comprised of former industrial facility components (concrete building foundations, asphalt parking lots, roads network, landfills, and adjacent maintained grounds) primarily located in the eastern portion of the Site as well as relatively undeveloped areas to the west and south. Two right-of-ways (ROWs) are located on the north and west sides of the Site and a pipeline exists in the northeast portion of the Site to the east of the industrial components. Lake DERA, also known as Lake DuPont, is located in the northwestern section. Little River meanders along the southern and eastern borders of the Site and several of its unnamed tributaries occur on the Site. One larger unnamed tributary feeds Lake DERA and flows east-west through the Site to its confluence with Little River. In the southwest corner of the Site, Little River traverses Bridal Veil Falls, which is located at the Site boundary (Figure 1).

Topographically, the Site and surrounding areas are characterized as mid-elevation and range from 2,500 to 2,900 feet above mean sea level (MSL). The lowest elevations of the Site occur along Little River and its floodplain, while the highest points are located in the southwest corner of the Site, north of Bridal Veil Falls. Between these extremes lies an additional elevational zone that is slightly up-gradient of the riparian floodplain, though well below the Site's topographic high point. The majority of the Site falls within this mid-range elevational zone.

Significant Natural Heritage Areas and Vegetative Communities

Per a review of Transylvania County natural area inventories (Swartzman, 2008), portions of the Site have been included within the boundaries of Significant Natural Heritage Areas (SNHAs) of

national significance as designated by the North Carolina Natural Heritage Program (NCNHP). This designation identifies unique features and ecological resources of high quality and importance to biodiversity values and is commonly used as a guideline for conservation planning. SNHAs that include the Site within their boundaries are Buck Forest Macrosite, Lake DERA Marsh, and Little River/Cedar Mountain Natural Area (Figure 3). Descriptions of each SNHA are provided as follows:

Buck Forest Macrosite: The Site is located centrally within the boundary of the Buck Forest Macrosite, a 27,982 acre core area designated by NCNHP for linking multiple significant ecological sites across the landscape. Distinctive communities in this macrosite are based on a unique geologic setting including moderate slopes and stream valleys alternating between flat, sinuous sections and steep falls over exposed bedrock. Buck Forest Macrosite includes the other two SNHAs, Lake DERA Marsh and Little River/Cedar Mountain Natural Area, which are summarized below.

Lake DERA Marsh: Lake DERA Marsh SNHA includes two areas located within the Site adjacent to the east and west shorelines of Lake DERA. Significant ecological communities associated with Lake DERA Marsh include Swamp Forest-Bog, Piedmont Semi-Permanent Impoundment, and fringe wetland. Rare plants include populations of swamp pink (*Helonias bullata*), patches of French Broad heartleaf (*Hexastylis rhombiformis*), Collin's sedge (*Carex collinsii*) and square-stem spike-rush (*Eleocharis quadrangulata*).

Little River/Cedar Mountain Natural Area: Little River/Cedar Mountain Natural Area traverses portions of the Site along the Little River and its associated floodplain. Rare communities include Swamp Forest-Bog, Southern Appalachian Bog, Spray Cliff, Low Elevation Granitic Dome, Floodplain Pools, and Acidic Cove Forest. Rare plants in this SNHA include, but are not limited to, swamp pink, French Broad heartleaf, and goldenclub (*Orontium aquaticum*). This area also contains unique geologic features such as granitic domes, waterfalls (Bridal Veil Falls) and broad alluvial floodplains.

State and Federal Threatened or Endangered Species

NCNHP county-wide heritage data were reviewed to identify state and/or federal rare, threatened and endangered (T&E) species potentially present at the Site (NCNHP, 2011). Notable species include swamp pink, French Broad heartleaf, green salamander (*Aneides aeneus*), and timber rattlesnake (*Crotalus horridus)*. Appendix A provides a complete list of Transylvania County species with state and/or federal status.

Wetlands and Waters

National Wetland Inventory maps classify wetlands on Site as emergent, forested, and scrub-shrub wetlands within the Site. Waters at the Site are classified as riverine and lake systems (USFWS, 2011). Little River, the main water body located at the Site, is a tributary to the French Broad River. Little River and its unnamed tributaries on Site, are classified by Surface Water Quality Classification as a Class C Trout stream (NCDENR DWQ, 2011) (Figure 3).

Class C waters are protected for secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival, and maintenance of biological integrity, and

agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. No specific restrictions apply to Class C waters. However, the Trout designation mandates that waters shall have an undisturbed buffer zone 25 feet wide, or of sufficient width to confine visible siltation within the twenty-five percent (25%) of the buffer zone nearest the land-disturbing activity, whichever is greater.

Flood Hazard Areas

Per review of information available on the North Carolina Floodplain Mapping Program website (North Carolina Statewide Floodplain Mapping Program, 2011), portions of the Site are within the floodway and the 100-year floodplain associated with Little River.

FIELD ASSESSMENT

Two field surveys were conducted to document the presence and extent of significant ecological resources at the Site, detail Site conditions, and map ecological resources. Prior to assessment the Site was divided into geographic areas to facilitate field surveys. Specific observations regarding these areas are documented below. It's important to note that no boundaries distinguish the areas from each other; geographic areas were merely used to enable assessment. Descriptions of ecological communities observed to occur within each area are fully described in Appendix B.

Lake DERA: Lake DERA features a silty bottom, with limited amounts of submerged aquatic vegetation (SAV) along its shallower reaches (Figure 1). An assessment of Lake DERA was conducted by the North Carolina Wildlife Resources Commission on August 10, 2010. The assessment consisted of a snorkel survey and use of a YSI® Pro20 to develop a temperature and dissolved oxygen profile of the Lake. The snorkel survey revealed that the northern portion of the lake is shallow and contains some emergent vegetation which serves as habitat for young-of-the-year and adult littoral fish species. Overall, fish density and diversity were low; three fish species were observed: largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and redbreast sunfish (*Lepomis auritus*). YSI® measurements confirmed that the relatively shallow Lake is fully mixed by wind and has adequate dissolved oxygen levels throughout the water column. Herein, the ecological quality of Lake DERA is considered moderate due to limited aquatic vegetation and a low diversity of aquatic life.

Lake DERA Marsh: Lake DERA Marsh (Figure 1; Appendix C, Photo 1), which surrounds the northern and western edges of Lake DERA, is a nationally ranked SNHA. The resource is classified herein as Southern Appalachian Fen because it is a palustrine emergent wetland (marsh) that is not common to the Mountain Region. This habitat is likely present as a result of creating Lake DERA. In its current state, Lake DERA marsh is a high quality ecological resource due to its diversity of vegetation and undisturbed nature. Lake DERA Marsh is surrounded by hazel alder thickets (*Alnus serrulata*) which give way to a narrow fringe of red maple (*Acer rubrum*) with increasing elevation. Thick stands of highland doghobble (*Leucothoe fontanesiana*) and witch hazel (*Hamamelis Virginiana*) are also present along the southern portions of Lake DERA. To the east and west of Lake DERA, Swamp Forest-Bog and Acidic Cove Forest were found to occur along an unnamed tributary of the Lake. These areas have previously been included as part of Lake DERA Marsh in earlier assessments but have been

separated herein because they differ significantly from the Southern Appalachian Fen community. In maintained areas adjacent to Lake DERA, up-gradient of the alder thicket and red maple, invasive early-successional species such as privet (*Ligustrum spp.*), greenbriar (*Smilax rotundifolia*), and multiflora rose (*Rosa multiflora*) are present in annually mowed grasslands.

Lake DERA Marsh earned its classification as a nationally ranked SNHA due to the presence of the federally threatened swamp pink. However, no populations of swamp pink or other rare plants were found within the Marsh during either the Spring or Summer Survey, though populations of swamp pink were observed in nearby areas (see the following descriptions of each geographic area and Figure 1). Additionally, it should be noted that comprehensive plant species surveys were not completed as part of this effort and, therefore, there is the possibility that T&E plant species occur in Lake DERA Marsh and elsewhere on the Site.

Little River Floodplain: The floodplain surrounding Little River predominantly consists of Acidic Cove Forest (Appendix C, Photo 2). The overstory of this community is dominated by red maple, scarlet oak (*Quercus coccinea*), eastern hemlock (*Tsuga canadensis*), yellow birch (*Betula alleghaniensis*), black gum (*Nyssa sylvatica*), and sourwood (*Oxydendrum arboretum*) with white pine (*Pinus strobus*), white oak (*Quercus alba*), and flowering dogwood (*Cornus florida*) also present, though these species are scattered and less abundant. Great rhododendron (*Rhododendron maximum*) is the predominant species in the shrub layer, and ferns, such as New York fern (*Thelypteris noveboracensis*), comprise much of the understory. Other herbaceous species present include pink lady's slipper (*Cypripedium acaule*) and galax (*Galax urceolata*).

Several unique features were observed within the Little River floodplain. Two Floodplain Pools (Figure 1; Appendix C, Photo 3) with standing water were documented in the northeastern portion of the Site, and remnant, abandoned channels forms additional Floodplain Pools on the south bank of Little River (river right) in the south central portion of the Site. All but one of these features were documented as providing breeding habitat for several amphibian species, such as spotted salamander (*Ambystoma maculatum*) (Appendix C, Photo 4) and green frog (*Rana clamitans*). Additional depressions were observed within the floodplain that likely serve as similar habitat following larger flood events; some of which may also serve as vernal pool habitat, though not documented.

A large Swamp Forest-Bog is located in the south-central portion of the site in the Little River floodplain (Figure 1; Appendix C, Photo 5). A second similar wetland habitat is located at the northeastern edge of site, also in the Little River floodplain. Both wetlands are classified as Swamp Forest-Bog complexes**.** These communities are characterized by an open canopy of red maple, black gum, yellow birch, and white pine over a dense bed of ferns, sphagnum moss (*Sphagnum spp.*), and various sedges (*Carex spp.*). Hazel alder is also present in great abundances and forms a dense thicket in these communities where openings in the canopy allow. Several clusters and individuals of goldenclub were observed in each wetland.

A Vernal Pool (Figure 1; Appendix C, Photo 6) was also observed in the south-central portion of the site in the Little River floodplain. This feature appears to be seasonally inundated when the existing access road prohibits drainage. Possibly anthropogenically created, this pool has the

potential to serve as critical habitat for amphibians such as those observed to be breeding in Floodplain Pools.

Slightly up-gradient and surrounding these features is Montane Alluvial Forest (Appendix C, Photo 7). This community contains a mixture of bottomland tree species and features an open understory. Typical overstory components include red maple, tulip popular (*Liriodendron tulipifera*), eastern hemlock, yellow birch, and black gum.

Ecological quality of all communities found within the floodplain surrounding Little River is considered high due to a diversity of habitats, vegetation, and structure, along with low levels of disturbance. The primary concerns in this location are Site maintenance activities and erosion associated with access roads along smaller tributaries to Little River, and hemlock woolly adelgid (*Adelges tsugae*) negatively impacting existing eastern hemlock trees found throughout Acidic Cove Forests.

Central Site: The relatively undisturbed central portions of the Site are classified as Montane Oak-Hickory Forest (Figure 1; Appendix C, Photo 8). The overstory of this community is dominated by chestnut oak (*Quercus prinus*), scarlet oak, and pitch pine (*Pinus rigida*). White oak, white pine, and red maple are also common. Sassafras (*Sassafras albidum*) is present throughout the midstory, and dense clusters of mountain laurel (*Kalmia latifolia*) and huckleberry species (*Gaylussacia spp.*) form the understory. American chestnut (*Castanea dentata*) sprouts are also widespread indicating the likely presence of this species as an overstory component prior to the onset of the chestnut blight. Herbaceous species including bracken fern (*Pteridium aquilinum*) and galax are also present throughout the understory. Relatively undisturbed central portions of the Site are considered to be of high ecological quality due to this areas prevalence of interior forest (habitat that is greater than 100 meters from a forest edge) and the connections it provides to surrounding habitats (i.e., Acidic Cove Forest, Montane Alluvial Forest, etc.) which facilitates wildlife movement.

Disturbed forested portions of the site resemble Montane Oak-Hickory Forest; however, they have a slightly different age structure and species composition due to past Site activities and current maintenance practices. Maintained areas in the central portions of the Site include managed grass/meadow areas along access roads, on areas of former facility structures/operations, and on landfills. While anthropogenically created, these habitats potentially serve as important habitat for grassland songbirds. This portion of the Site was not assessed as having high ecological quality because of its highly fragmented nature and the numerous boundaries it shares with disturbed areas that have the potential to negatively impact interior forest habitat.

Southwestern Site: The higher elevations found in the southwestern portion of the Site contain Montane Oak-Hickory Forest (Figure 1). At elevation, this community differs slightly from the Montane Oak-Hickory community observed in the lower elevations of the central Site. The overstory of this area is similarly dominated by scarlet oak, white oak, and chestnut oak with black oak (*Quercus velutina*), red maple, magnolia (*Magnolia fraseri*) and sourwood also found in limited abundances. As elevation increases, however, mountain laurel thickets become more common and denser, as do blueberry (*Vaccinium spp.*) and huckleberry species. Additionally,

the size structure of the forest shifted to trees that were smaller in height and basal area (an average of approximately ten inches diameter at breast height (dbh) compared to 18 inches for lower elevations) with less canopy cover (60 percent as opposed to greater than 90 percent).

Eight Low Elevation Granitic Domes (Figure 1; Appendix C, Photos 9 and 10) were observed in this portion of the Site. A thin fringe of Pine-Oak/Heath surrounds each Low Elevation Granitic Dome (Appendix C, Photos 11 and 12). These communities are characterized by an overstory dominated by a stunted and gnarled canopy of pitch pine in conjunction with dense understories of mountain laurel and huckleberry species. A White Pine Forest (Appendix C, Photo 13) is also located in this portion of the site. It is unknown whether this is a planted stand (i.e., plantation) or a natural community that resulted from soil conditions and elevation.

This portion of the Site was assessed as having high ecological quality due to the diversity of habitats present, the rare nature of Low Elevation Granitic Domes, and the prevalence of interior forest habitat.

Rare, Threatened and Endangered Species

Swamp Pink: To the east of Lake DERA is a small patch of Acidic Cove Forest which occurs east of the Lake DERA dam and adjacent to the outfall stream from the Lake (Figure 1). Bluegill and bass were observed in the outfall pool, just east of the Lake DERA dam, however, sediments in this area were notably marked by iron flocculant (Appendix C, Photo 15). The adjacent Acidic Cove Forest appears healthy and is dominated by an overstory of red maple and tulip popular. American holly (*Ilex opaca*) is common in the midstory, as is greenbriar, while the understory is dominated by cinnamon fern (*Osmundastrum cinnamomeum*). Within this fragmented patch of forest, several wetland areas support a large community of federally threatened swamp pink which, based on visual observation, consists of more than one thousand individuals (Appendix C, Photo 14).

A second, smaller community of swamp pink (approximately 40 individuals) that was previously undocumented was identified to the south and west of Lake DERA (Figure 1; Appendix C, Photo 16). This community is also located in a patch of Acidic Cove Forest which surrounds a small unnamed tributary feeding Lake DERA.

French Broad Heartleaf: The North Carolina candidate for endangered/threatened listing and federal species of concern French Broad heartleaf (*Hexastylis rhombiformis*) was previously reported to occur in the Montane Oak-Hickory Forest upslope of the Little River floodplain (DuPont, 2006). The presence of this species was confirmed during the Summer Survey (Appendix C, Photo 17). The species was also observed in the northwest portion of the Site within Montane Oak-Hickory Forest west of State Road 1594 (Staton Road) (Appendix C, Photo 18) and in the western portion of the Site in Acidic Cove Forest (Figure 1; Appendix C, Photo 19). Its presence in both of these areas was not previously noted. Its presence on the Site is considered significant, given that French Broad heartleaf is reported to occur only within the French Broad River basin of North and South Carolina.

Purple Pitcherplant: While the purple pitcherplant (*Sarracenia purpurea*) is widely distributed and not considered a listed species, the patchiness of its distribution provides some rarity to its

presence on a given site. This species was identified in a small patch of Swamp Forest-Bog habitat located to the east of Lake DERA. Though not confirmed during the brief field reconnaissance, there are characteristics of the observed pitcherplants that suggest the possibility that this may be a patch of the variety *montana* given the clasping nature of the pitcher hood (Figure 1; Appendix C, Photo 20).

Goldenclub: Several communities of goldenclub were found to occur within the Swamp Forest Bog communities of the Site (Figure 1; Appendix C, Photo 21). As with purple pitcherplant, goldenclub is not a listed species in North Carolina, but is considered noteworthy on Site given its patchy distribution and rarity in other states in the broader regions (e.g., Kentucky, threatened).

Green Salamander: North Carolina has 66 known salamander species, of those however, only the green salamander is listed by the state as endangered. In North Carolina, green salamanders are found in parts of Macon, Jackson, Rutherford, Transylvania, and Henderson Counties.

Green salamanders are considered a "crevice" salamander because they prefer heavily shaded rocks with moist crevices for habitat. These habitats typically occur only in pockets, most often on mountain sides and in dense mountain laurel or rhododendron (*Rhododendron spp.*) thickets. Generally, rocks found on flat terrain with sparse canopy cover are less likely to serve as habitat.

Alan Cameron, a volunteer with the North Carolina Wildlife Resources Commission, has been identifying habitat and surveying the green salamander population in Dupont State Forest for the last several years. In September, 2011 Cameron extended his search to the southern portion of the Site where hillsides and thick cover had the potential to serve as habitat. Over two days (September 13 and 14) Cameron identified five sites where green salamanders were observed, and an additional five sites where they are very likely to be present, but were not observed. These locations are mapped in Figure 1 as 'Green Salamander', and 'Potential Green Salamander', respectively. Descriptions of potential sites are provided below. Summary information was provided by Alan Cameron (pers. comm., Dupont Visitor Center Green Salamander Survey, provided by Chet Meinzer).

Potential Green Salamander-1: Twelve or more rocks were identified as potential habitat on the north side of Little River (river left) at the base of Bridal Veil Falls, up-gradient of the access road. Rocks were located under rhododendron cover and were assessed as having very good potential for harboring green salamanders.

Potential Green Salamander-2: Two rocks were identified as potential habitat between the riverside access road and Little River, downstream and within earshot of Bridal Veil Falls. Rocks were located underneath hemlocks and were assessed as having fair potential for harboring green salamanders.

Potential Green Salamander-3: Two to three large rocks with deep crevices, approximately 25 feet up-gradient (north) of the access road, were identified as potential habitat. These rocks were located in flat terrain under rhododendron and mountain laurel cover. One additional rock was identified approximately 100 feet to the west of the rocks previously noted. All locations were

assessed as having excellent potential for harboring green salamander. Two gray-cheeked salamanders (*Plethodon montanus*) were found in this location.

Potential Green Salamander-4: Four rocks were identified as potential habitat under rhododendron cover on flat terrain. These were assessed as having very good potential for harboring green salamanders. One seal (*Desmognathus monticola*) and one dusky salamander (*Desmognathus fuscus*) were found at this location.

Potential Green Salamander-5: Several large rocks were identified as potential habitat on an east-facing slope approximately 130 feet up-gradient of the access road. These were located in a compact group under rhododendron cover. Another very large overhanging rock ledge was identified approximately 100 feet up-gradient of this rock cluster. It contained crevices that have the potential to provide habitat for green salamanders, however, many of these were inaccessible for assessment due to topography. All locations were assessed as having very good potential to harbor green salamanders.

Relative Ecological Conditions

Based on the conditions observed during the two Site surveys, the above ecological communities when viewed individually represent moderate to high quality resources on a relative basis. However, aside from the former plant area, the overall Site resources when considered collectively are considered to represent a significant natural area that encompasses approximately 316 acres and supports an important complex of high quality environments and a broad diversity of species. As identified by the NC Natural Heritage Program, there are rare and unique resources present at the site that are valuable as linkages with similar communities in the adjacent DuPont State Forest (i.e., Acidic Forest Cove) or represent unique patches of regionally and nationally rare habitats (e.g., Low Elevation Granitic Domes). These resources provide a suite of both common and unique habitats for both resident and migrant wildlife, including documented T&E species. The juxtaposition of the Site with the DuPont State Forest provides largely intact resource connectivity that compliments the quality and function of both areas. While of lesser ecological importance, the former plant area provides relatively moderate quality grassland habitat in an otherwise primarily forested environment. Thus, potentially provided important forage, breeding, and cover habitat for resident and migratory species of birds and other wildlife.

The primary current issues that have potential to diminish the quality of the Site resources are expansion of invasive plant species such as multiflora rose (*Rosa multiflora*) and European privet (*Ligustrum vulgare*) into undisturbed portions of the Site; continued erosion in riparian areas caused by Site maintenance activities; and hemlock woolly adelgid negatively impacting existing eastern hemlock trees found throughout Acidic Cove Forests.

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TABLES

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TABLE 1

Ecological Communities	Approximate Areal Extent (Acres)
Southern Appalachian Fen	4.68
Swamp Forest-Bog	18.44
Floodplain Pool	0.89
Acidic Cove Forest	47.41
Vernal Pool	0.09
Montane Alluvial Forest	5.56
Montane Oak-Hickory Forest	234.90
Low Elevation Granitic Dome	2.16
Pine-Oak/Heath	1.30
White Pine Forest	1.62

Table 1: Ecological communities found to occur at the Site based on the *Classification of the Natural Communities of North Carolina* (Schafale and Weakley, 1990).

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TABLE 2

Threatened and Endangered Species Confirmed at the Site

Common Name	Latin Name	NC Status[1]	Fed Status[1]
Swamp Pink	*Helonias bullata*	T	T
French Broad Heartleaf	*Hexastylis rhombiformis*	SR-L	FSC
Green Salamander	*Aneides aeneus*	E	FSC
Timber Rattlesnake	*Crotalus horridus*	SC	

Notes:
[1] Source: NCNHP, 2011

Status Codes:
E – Endangered
T – Threatened
FSC – Federal Special Concern
SC – Special Concern
SR – Significantly Rare (Qualifers: H-Historic, V-Vulnerable, L-Limited Range, T-Throughout, D-Disjunct, P-Peripheral)
S/A – Similarity of Appearance

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TABLE 3

Species Observed at the Site

Common Name	Latin Name
Birds	
tufted titmouse	*Baeolophus bicolor*
broadwinged hawk	*Buteo platypterus*
northern cardinal	*Cardinalis cardinalis*
American goldfinch	*Carduelis tristis*
turkey vulture	*Cathartes aura*
chimney swift	*Chaetura pelagica*
northern flicker	*Colaptes auratus*
American crow	*Corvus brachyrhynchos*
blue jay	*Cyanocitta cristata*
yellow warbler	*Dendroica petechia*
common yellowthroat	*Geothlypis trichas*
barn swallow	*Hirundo rustica*
black-and-white warbler	*Mniotilta varia*
osprey	*Pandion haliaetus*
indigo bunting	*Passerina cyanea*
eastern towhee	*Pipilo erythrophthalmus*
black-capped chickadee	*Poecile atricapillus*
eastern phoebe	*Sayornis phoebe*
ovenbird	*Seiurus aurocapillus*
nuthatch	*Sitta sp.*
chipping sparrow	*Spizella passerina*
brown thrasher	*Toxostoma rufum*
hummingbird	*Trochilidae sp.*
American robin	*Turdus migratorius*
unidentified vireo	*Vireo sp.*
hooded warbler	*Wilsonia citrina*
Non-Avian	
spotted salamander	*Ambystoma maculatum*
North American beaver	*Castor canadensis*
common snapping turtle	*Chelydra serpentina*
land snail	*Helix sp.*
spring peeper	*Pseudacris crucifer*
green frog	*Rana clamitans*
unidentified newt	*Salamandridae sp.*
eastern gray squirrel	*Sciurus carolinensis*
eastern cottontail	*Sylvilagus floridanus*
unidentified mole	*Talpidae sp.*
Japanese hornet	*Vespa mandarinia japonica*
whitetail deer	*whitetail deer*
unidentified snake	*Unidentified snake*

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FIGURES

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DuPont State Forest

French Broad Heartleaf

Goldenclub

Purple Pitcher Plant

Unnamed Tributary

Little River

Lake DERA Outfall

Lake DERA

Lake DERA Marsh

Swamp Pink

Green Salamander

GS 4

GS 3

GS 5

GS 2

GS 1

Bridal Veil Falls

DuPont State Forest

DuPont State Forest

Legend

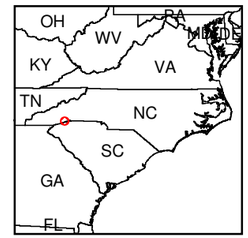
- Lake/Stream
- Flow Direction
- DuPont Brevard Facility
- Former Structure
- Maintained Former Developed Lands
- Rare Plant Community Location

Green Salamander

- Known Site
- Potential Site

Ecological Communities (317.04 acres total)

- Southern Appalachian Fen (4.68 ac)
- Swamp Forest-Bog (18.44 ac)
- Floodplain Pool (0.89 ac)
- Acidic Cove Forest (47.41 ac)
- Vernal Pool (0.09 ac)
- Montane Alluvial Forest (5.56 ac)
- Montane Oak-Hickory Forest (234.89)
- Low Elevation Granitic Dome (2.16)
- Pine Oak/Heath Forest (1.30 ac)
- White Pine Forest (1.62 ac)



Key Map
Not to Scale

N

NAD 1983 State Plane North Carolina
FIPS 3200 Feet
Lambert Conformal Conic

Data Sources:
2010 Aerial Imagery provided by Transylvania County, NC
ESRI Street Map North America
URS Field Reconnaisance Data
Additional GIS data provided by Parsons

0 350 700 1,400 Feet

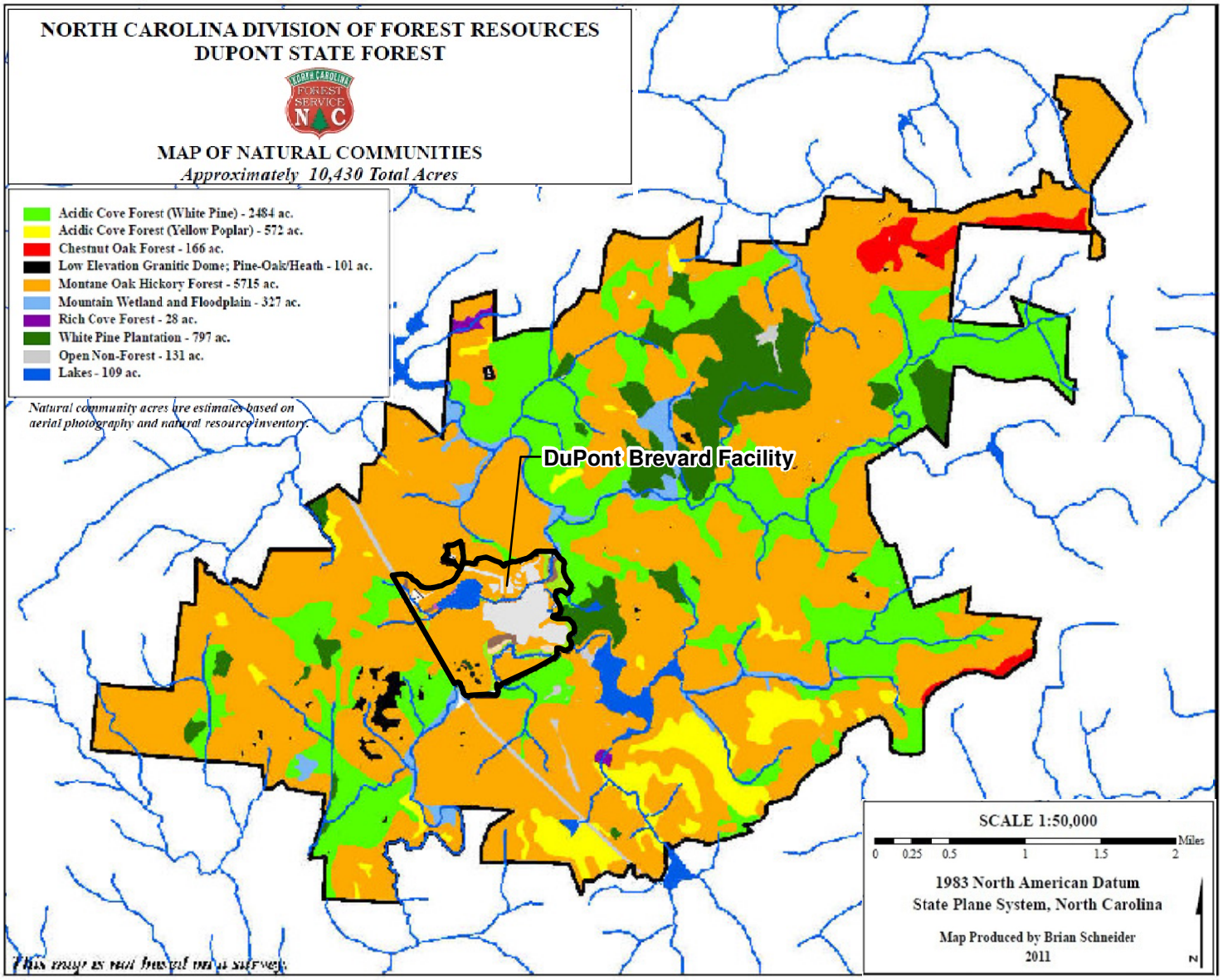
1 inch = 700 feet

URS

Figure 1
DuPont Brevard Facility
Ecological Survey
Significant Ecological Communities

Brevard, Transylvania County, North Carolina

Prepared By: PLJ	Checked By: BB
Job:18986041.00003	Q:\GIS_Data\DUPONT\BREVARD\Maps\ Figure 1 Vegetative Communities.mxd



Data Sources:
2011 North Carolina
Division of Forest Resources
Map of Natural Communities
URS Field Reconnaisance Data

Note: Figure and scale have been reinterpreted. Acreages provided on the figure are for the Dupont State Forest and exclude the Dupont Brevard Facility area. See Figure 1 for facility acreages.

URS

Figure 2
DuPont Brevard Facility
Ecological Survey
DuPont State Forest
Map of Natural Communities

Prepared By: PLJ	Checked By: BB
Job:18986041.00003	Q:\GIS_Data\DUPONT\BREVARD\Maps\Figure 2 State Forest Communities.mxd

913934 915434 916934 918434 919934 921434

544296

542796

541296

539796

Brevard 3
2860

Forest

UFB 85 Field
2516

Mile 8

2600

Sewage Disposal

ROAD

1593

591

Waste ponds

Lake Derra Marsh

Lake Derra Marsh

Substa

Pumping sta

Substation

Water

Chemical

Oil Tanks

2800

Cedar Rock

FOREST

rest

Little River/Cedar Mountain Natural Areas

Bridal Veil Falls

2600

913934 915434 916934 918434 919934 921434

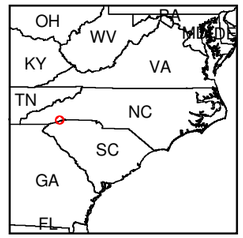
Legend

DuPont Brevard Facility

Significant Natural Heritage Area

- National Significance
- Regional Significance
- NWI Wetlands

Note: Significant Natural Heritage Areas as identified by the North Carolina Natural Heritage Program and summarized in Swartzman (2008).



Key Map
Not to Scale

NAD 1983 State Plane North Carolina
FIPS 3200 Feet
Lambert Conformal Conic

Data Sources:
USGS 24K Topos: Standingstone Mountain (1997) and Brevard (1997)
National Wetlands Inventory, Brevard 24K

Significant Natural Heritage data provided by NC Dept. of Environment and Natural Resources/Division of Parks and Recreation /Natural Heritage Program NCSCIO/Center for Geographic Information and Analysis

Swartzman, E. 2008. An Inventory of the Natural Areas of Transylvania County, North Carolina. Department of Environment and Natural Resources. Office of Natural Resource Planning and Conservation. North Carolina Natural Heritage Program. Funded by North Carolina Natural Heritage Trust Fund. Raleigh, NC. 413 pp.

N

0 350 700 1,400 Feet

1 inch = 700 feet

URS

Figure 3
DuPont Brevard Facility
Ecological Survey
Topographic Map

Brevard, Transylvania County, North Carolina

Prepared By: PLJ	Checked By: BB
Job:18986041.00003	Q:\GIS_Data\DUPONT\BREVARD\Maps\ Figure 3 Topographic Map.mxd

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APPENDICES

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APPENDIX A: THREATENED AND ENDANGERED SPECIES LIST

TABLE A.1

State and Federal Status Species - Transylvania County, North Carolina

Common Name	Latin Name	NC Status[1]	Fed Status[1]
Nonvascular Plants			
liverwort	*Acrobolbus ciliatus*	SC-V	
hornwort	*Aspiromitus appalachianus*	SR-L	FSC
gorge moss	*Bryocrumia vivicolor*	SR-T	FSC
worthy shield lichen	*Canoparmelia amabilis*	SC-V	FSC
liverwort	*Chiloscyphus muricatus*	SC-V	
liverwort	*Drepanolejeunea appalachiana*	SC-V	
rock gnome lichen	*Gymnoderma lineare*	E	E
liverwort	*Lejeunea blomquistii*	SC-V	
liverwort	*Plagiochila sharpii*	SR-L	FSC
liverwort	*Plagiochila sullivantii var. sullivantii*	SR-T	FSC
liverwort	*Plagiochila virginica var. caroliniana*	SR-T	FSC
liverwort	*Porella wataugensis*	SR-L	FSC
Vascular Plants			
bog rose	*Arethusa bulbosa*	E	
single-sorus spleenwort	*Asplenium monanthes*	E	
American barberry	*Berberis canadensis*	SC-V	
mountain bittercress	*Cardamine clematitis*	SR-T	FSC
fort mountain sedge	*Carex communis var. amplisquama*	SR-T	FSC
longstalk sedge	*Carex pedunculata*	SC-V	
Radford's sedge	*Carex radfordii*	T	FSC
American bittersweet	*Celastrus scandens*	E	
Cuthbert's turtlehead	*Chelone cuthbertii*	SC-V	FSC
plains sunrose	*Crocanthemum bicknellii*	SC-V	
creeping sunrose	*Crocanthemum propinquum*	T	
bog oatgrass	*Danthonia epilis*	SR-T	FSC
Alexander's rock aster	*Eurybia avita*	SR-T	FSC
lobed barren-strawberry	*Geum lobatum*	E	FSC
spreading avens	*Geum radiatum*	E	E
Smoky Mountain mannagrass	*Glyceria nubigena*	SR-L	FSC
swamp pink	*Helonias bullata*	T	T
French Broad heartleaf	*Hexastylis rhombiformis*	SR-L	FSC
gorge filmy fern	*Hymenophyllum tayloriae*	SR-O	FSC
small whorled pogonia	*Isotria medeoloides*	T	T
rough blazing-star	*Liatris aspera*	T	

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State and Federal Status Species - Transylvania County, North Carolina (Continued)

Common Name	Latin Name	NC Status[1]	Fed Status[1]
Vascular Plants (Continued)			
Fraser's loosestrife	*Lysimachia fraseri*	E	FSC
sweet pinesap	*Monotropsis odorata*	SC-V	FSC
rock muhly	*Muhlenbergia sobolifera*	SC-V	
perennial sundrops	*Oenothera perennis*	SC-V	
divided-leaf ragwort	*Packera millefolium*	T	FSC
large-leaved grass-of-parnassus	*Parnassia grandifolia*	T	FSC
northern beech fern	*Phegopteris connectilis*	E	
large purple-fringed orchid	*Platanthera grandiflora*	T	
purple fringeless orchid	*Platanthera peramoena*	T	
white rattlesnakeroot	*Prenanthes alba*	T	
robin runaway	*Rubus dalibarda*	E	
mountain sweet pitcher plant	*Sarracenia jonesii*	E	E
Alabama grape-fern	*Sceptridium jenmanii*	SC-V	
sweet Indian-plantain	*Senecio suaveolens*	SC-H	
southern Oconee bells	*Shortia galacifolia var. galacifolia*	SC-V	FSC
granite dome goldenrod	*Solidago simulans*	SR-L	FSC
freshwater cordgrass	*Spartina pectinata*	SC-V	
Virginia spiraea	*Spiraea virginiana*	T	T
small-leaved meadowrue	*Thalictrum macrostylum*	SR-L	FSC
mountain thaspium	*Thaspium pinnatifidum*	T	FSC
ash-leaved golden-banner	*Thermopsis fraxinifolia*	SC-V	
sticky bog asphodel	*Triantha glutinosa*	SC-V	
mottled trillium	*Trillium discolor*	T	
cranberry	*Vaccinium macrocarpon*	T	
Invertebrate Animals			
Appalachian elktoe	*Alasmidonta raveneliana*	E	E
slippershell mussel	*Alasmidonta viridis*	E	
Chauga crayfish	*Cambarus chaugaensis*	SC	
French Broad River crayfish	*Cambarus reburrus*	SR	FSC
mountain river cruiser	*Macromia margarita*	SR	FSC
Tennessee clubshell	*Pleurobema oviforme*	E	FSC
creeper	*Strophitus undulatus*	T	
Vertebrate Animals			
southern Appalachian northern saw-whet Owl	*Aegolius acadicus pop. 1*	T	FSC
green salamander	*Aneides aeneus*	E	FSC
brown creeper	*Certhia americana*	SC	
Rafinesque's big-eared bat - mountain subspecies	*Corynorhinus rafinesquii rafinesquii*	T	FSC
timber rattlesnake	*Crotalus horridus*	SC	
hellbender	*Cryptobranchus alleganiensis*	SC	FSC

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State and Federal Status Species - Transylvania County, North Carolina (Continued)

Common Name	Latin Name	NC Status[1]	Fed Status[1]
Vertebrate Animals (Continued)			
cerulean warbler	*Dendroica cerulea*	SC	FSC
southern pigmy salamander	*Desmognathus wrighti*	SR	FSC
turquoise darter	*Etheostoma inscriptum*	T	
wounded darter	*Etheostoma vulneratum*	SC	FSC
peregrine falcon	*Falco peregrinus*	E	
Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	E	E
bog turtle	*Glyptemys muhlenbergii*	T	T(S/A)
rosyface chub	*Hybopsis rubrifrons*	T	
loggerhead shrike	*Lanius ludovicianus*	SC	
southern Appalachian red crossbill	*Loxia curvirostra pop. 1*	SC	FSC
common mudpuppy	*Necturus maculosus*	SC	
yellowfin shiner	*Notropis lutipinnis*	SC	
blackbanded darter	*Percina nigrofasciata*	T	
southern Appalachian black-capped chickadee	*Poecile atricapillus practica*	SC	FSC
paddlefish	*Polyodon spathula*	E	FSC
long-tailed shrew	*Sorex dispar*	SC	
Appalachian cottontail	*Sylvilagus obscurus*	SR	FSC
Appalachian Bewick's wren	*Thryomanes bewickii altus*	E	FSC

Notes:
[1] Source: NCNHP, 2011

Status Codes:
E – Endangered
T – Threatened
FSC – Federal Special Concern
SC – Special Concern
SR – Significantly Rare (Qualifers: H-Historic, V-Vulnerable, L-Limited Range, T-Throughout, D-Disjunct, P-Peripheral)
S/A – Similarity of Appearance

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APPENDIX B: ECOLOGICAL COMMUNITIES

A description of the ecological communities observed at the Site is detailed below ordered by those that typically occur at lower elevations to those that are most often found at higher elevations. Species lists of associated vegetation are included in the descriptions with observed species in bold type. The following was adapted from Schafale and Weakley (1990). Communities are mapped in Figure 1.

Southern Appalachian Fen: Southern Appalachian Fens occur on flat or gently sloping areas that are not subject to flooding and are fed by flow of mineral rich circumneutral or only mildly acidic water. In these habitats, mucky soil overlays shallow bedrock. These sites are palustrine, semi-permanently to permanently saturated, and fed by seepage water. Vegetation in Southern Appalachian Fens consists of complex of zones of herbaceous wetland vegetation (Table B.1) which vary based on small differences in hydrology and substrate. Because of the complex zonation, small changes in drainage or water supply have the potential to cause major shifts in vegetation. The natural factors that prevent succession to woody cover are not known. The Southern Appalachian Fen type is distinguished from the Southern Appalachian Bog type by species composition. Distinguishing species include several northern fen indicators: spike muhly (*Muhlenbergia glomerata*), sticky tofieldia (*Tofieldia glutinosa*), and sphagnum (*Sphagnum subsecundum*).

TABLE B.1

Southern Appalachian Fen Species

Common Name	Latin Name
Herbaceous	
white beaksedge	*Rhynchospora alba*
brownish beaksedge	*R. capitellata*
woodland rush	*Juncus subcaudatus*
smooth sawgrass	*Cladium mariscoides*
tussock sedge	***Carex stricta***
common sneezeweed	*Helenium autumnale*
little bluestem	***Schizachyrium scoparium***
Canadian burnet	*Sanguisorba canadensis*
clustered goldenrod	*Solidago glomerata*
fir clubmoss	*Huperzia selago*
bog goldenrod	*Solidago uliginosa*
tawny cottongrass	***Eriophorum virginicum***
azure bluet	*Houstonia caerulea*
horned bladderwort	*Utricularia cornuta*
cinnamon fern	***Osmunda cinnamomea***
royal fern	***Osmunda regalis***
tall blazing star	*Liatris aspera*
spiked muhly	*Muhlenbergia glomerata*
sticky tofieldia	*Tofieldia glutinosa*
openfield sedge	*Carex conoidea*
Buxbaum's sedge	*Carex buxbaumii*
largeleaf grass of Parnassus	*Parnassia grandifolia*
hazel alder	***Alnus serrulata***

Southern Appalachian Fen Species (Continued)

Common Name	Latin Name
Herbaceous (Continued)	
sphagnum	***Sphagnum subsecundum***
rhytidium moss	*Rhytidium rugosum*
hypnum moss	*Hypnum pratense*
star campylium moss	*Campylium stellatum*
heart-leaved spear-moss	*Calliergon cordifolium*
pointed spear-moss	*Calliergonella cuspidata*

Swamp Forest-Bog: Swamp Forest-Bogs consist of either a closed or open canopy, and an open or dense shrub layer interspersed with small boggy openings in depressions. Red maple (*Acer rubrum*) or eastern hemlock are usually the dominant trees. Species associated with this habitat type are listed in Table B.2.

The factors responsible for creating and maintaining Swamp Forest-Bog communities are not well known, though it's been hypothesized that they were caused by paludification following tree blowdown or logging in wet alluvial forests (Gaddy, 1981). However, some examples appear to be very old, and most logged bottomlands do not contain boggy vegetation. The boggy openings are generally associated with small depressions. They may be successional remnants of once more extensive bog areas. As in Southern Appalachian Bogs, beaver activities may be a significant factor in these communities. The frequency and role of flooding in these communities is not known. They often occur near streams and undoubtedly are periodically flooded. Some occur near the outer edge of floodplains and also receive seepage water.

Swamp Forest-Bog complexes are distinguished from Southern Appalachian Bogs by their structure, which consists primarily of forested thickets with only small boggy openings. Boggy areas are less than one acre in size. Swamp Forest-Bog Complexes are distinguished from Montane Alluvial Forests and Acidic Cove Forests by being wetter, having open boggy vegetation in small depressions, and having scattered sphagnummats. The Floodplain Pool type occurs in deeper bottomland depressions, containing standing water for much or all of the year, and lacking dense boggy vegetation.

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TABLE B.2

Swamp Forest Bog Species

Common Name	Latin Name
Forest Canopy	
black willow	***Salix nigra***
river birch	***Betula lenta***
yellow birch	***B. alleghaniensis***
white pine	***Pinus strobus***
Shrub Layer	
white oak	***Quercus alba***
great rhodedendron	***Rhododendron maximum***
mountain laurel	***Kalmia latifolia***
mountain doghobble	***Leucothoe fontanesiana***
hazel alder	***Alnus serrulata***
silky dogwood	***Cornus amomum***
smooth witherod viburnum	*Viburnum nudum*
poison sumac	***Toxicodendron vernix***
Herbaceous Layer	
roundleaf goldenrod	*Solidago patula*
New England aster	*Aster novae-angliae*
robin runaway	*Dalibarda repens*
cinnamon fern	***Osmunda cinnamomea***
northern long sedge	*Carex folliculata*
nodding sedge	*C. gynandra*
eastern rough sedge	*C. scabrata*
bristlystalked sedge	*C. leptalea*
tussock Sedge	***C. stricta***
purple pitcher plant	***Sarracenia purpurea***
broadleaf arrowhead	***Sagittaria latifolia***
whitegrass	*Leersia virginica*
melic mannagrass	*Glyceria melicaria*
rare clubmoss	*Lycopodium obscurum*
sensitive fern	***Onoclea sensibilis***
Canada mayflower	*Maianthemum canadense*
New York fern	***Thelypteris noveboracensis***
royal fern	***Osmunda regalis***

Vernal Pool: Vernal Pools are small, seasonally flooded depressions, with gently sloping sides, which usually in sandy uplands. Vernal Pools can feature either a dense or sparse herbaceous layer. Species vary significantly among examples. Little bluestem (*Schizachyrium scoparium*) and panic grasses (*Panicum spp.*) are the most common dry-season dominants, although other examples are dominated by sedges (*Carex spp.*) or ferns such as Virginia chainfern (*Woodwardia virginica*). During the wet season aquatic plants may be important. A few individual wetland trees or shrubs may be present in the pool interior and a shrub border is sometimes present though it is not usually well developed. Typically Vernal Pools are only found in the Coastal Plain and Sandhills.

Vernal Pools are quite variable, depending on depth, length of flooding, and substrate. Because they are small and isolated, much variation may also result from accidents of dispersal and establishment of species. The seasonal fluctuation in water levels and variation among years is the primary environmental factor in these communities. As a result, significant seasonal variation in presence and activity of species occurs. Some Vernal Pools are wet enough to

accumulate muck on the bottom, while others remain sandy. Most have little or no watershed and probably do not receive much runoff or nutrient inputs from overland flow. These communities are often extremely important breeding sites for amphibians.

Floodplain Pool: Floodplain Pools occur in depressions in abandoned river channels on floodplains in the Mountain and Piedmont regions, and hold standing water for much or all of the year. Floodplain Pools vary temporally, largely as a function of the frequency with which they dry out which determines the nature of aquatic or amphibian animal communities. Major floods may also flush the pools or alter their shape. In the absence of floods, pools probably slowly fill and succeed to other floodplain communities or to boggy vegetation. Pools that are permanently flooded may support fish; however, those that dry out fairly frequently will lack fish though they may be important breeding sites for amphibians. Several species are largely dependent on these pools, including the marbled salamander (*Ambystoma opacum*), yellow-spotted salamander (*A. maculatum*), mole salamander (*A. talpoideum*), four-toed salamander (*Hemidactylium scutatum*), and the spotted turtle (*Clemmys guttata*).

Permanently flooded portions of Floodplain Pools may lack higher plants, or may contain aquatics. Edges may have zoned aquatic and wetland vegetation (Table B.3). Floodplain Pools gradually transition into the Swamp Forest-Bog Complex type, which contains shallower, boggy depressions that may be saturated much of the year but don't flood. These depressions are of similar origin and may have originated as floodplain pools. Floodplain Pools are distinguished from Swamp Forest-Bog Complexes, which also may contain wet depressions, by having standing water and generally muddy bottoms, rather than being filled with organic material and boggy vegetation. Floodplain Pools are widespread but generally small and uncommon in the Piedmont and are extremely rare in the mountains.

TABLE B.3

Floodplain Pool Species

Common Name	**Latin Name**
Shrub Layer	
hazel alder	***Alnus serrulata***
Herbaceous Layer	
royal fern	***Osmunda regalis***
northern long sedge	*Carex folliculata*
fringed sedge	*C. crinita*
white edge sedge	*C. debilis*
broadwing sedge	***C. alata***
smallspike false nettle	*Boehmeria cylindrica*
Oriental lady's thumb	*Polygonum cespitosum*
marsh seedbox	***Ludwigia palustris***
sphagnum	***Sphagnum spp.***

Acidic Cove Forest: Acidic Cove Forests occur throughout the Mountain Region and foothills of North Carolina in sheltered low and moderate elevation sites, narrow or rocky gorges, steep ravines, and low gentle ridges within coves. This type of forest is considered a stable, climax type community with treefall gaps being the typical natural disturbance regime. The acidic soils likely serve to prevent or slow the invasion of most mesophytic tree species. These communities often occur in areas which may occasionally be disturbed by floods.

Vegetation in Acidic Cove Forests generally consists of a dense forest canopy with a fairly limited number of mesophytic tree species. The shrub layer in Acidic Cove Forest is well developed, often forming a dense thicket. The most common species are great rhodedendron (*Rhododendron maximum*), and highland doghobble. The herb layer is generally not well developed and consists of only a few acid-loving species. Species associated with each structural layer are listed in Table B.4.

TABLE B.4

Acidic Cove Forest Species

Common Name	Latin Name
Forest Canopy	
red maple	***Acer rubrum***
yellow birch	***Betula alleghaniensis***
eastern hemlock	***Tsuga canadensis***
tulip popular	***Liriodendron tulipifera***
black birch	***Betula lenta***
red oak	*Quercus rubra*
mountain magnolia	***Magnolia fraseri***
Carolina silverbell	*Halesia tetraptera*
Herbaceous Layer	
galex	***Galax urceolata***
Christmas fern	***Polystichum acrostichoides***
New York fern	***Thelypteris noveboracensis***
partridge berry	***Mitchella repens***
trailing arbutus	*Epigaea repens*
Jack-in-the-pulpit	***Arisaema triphyllum***
violet	*Viola spp.*
Indian cucumber	*Medeola virginiana*
pink lady's slipper	***Cypripedium acaule***
sedges	***Carex spp.***

Montane Alluvial Forest: Montane Alluvial Forests contain a mixture of bottomland and mesophytic tree species and feature an open to dense shrub, and a sparse to dense herb layer (Table B.5). Flood-carried sediment undoubtedly provides some nutrient input to these communities, as well as serving as a natural disturbance factor. Forests may be eroded or disturbed by catastrophic floods, sometimes frequently enough to remain in early succession. Beavers may create impoundments which will give way to successional forest. Alluvial sites are not uncommon in montane areas, but very few examples of their communities remain intact. Surrounded by more rugged terrain, the alluvial valleys were generally the first areas to be cleared for farming and to become sites for houses, towns, highways, and reservoirs.

TABLE B.5

Montane Alluvial Forest Species

Common Name	Latin Name
Forest Canopy	
red maple	***Acer rubrum***
tulip popular	***Liriodendron tulipifera***
eastern hemlock	*Tsuga canadensis*
yellow birch	***Betula alleghaniensis***
river birch	***Betula nigra***
white oak	*Quercus alba*
American hornbeam	*Carpinus caroliniana*
American sycamore	***Platanus occidentalis***
Shrub Layer	
great rhodedendron	***Rhododendron maximum***
hazel alder	***Alnus serrulata***
mountain doghobble	***Leucothoe fontanesiana***
Herbaceous Layer	
Golden groundsel	*Senecio aureus*
melic mannagrass	*Glyceria melicaria*
dotted smartweed	*Polygonum punctatum*
Virginia springbeauty	*Claytonia virginica*
poison hemlock	*Conium maculatum*
Jack-in-the-pulpit	***Arisaema triphyllum***
Blazing-Star	*Chamaelirium luteum*
goldenrod	*Solidago spp.*
Beth root	*Trillium spp.*
violet	*Viola spp.*

Montane Oak Hickory Forest: Montane Oak-Hickory Forests typically occur along dry-mesic slopes and partly sheltered ridgetops at moderate to fairly high elevations (approximately 2,500 to 5,000 feet). This type of forest occurs throughout the Mountain Region of North Carolina, though it is predominantly found in the southern part of the state, south of the Asheville Basin.

Montane Oak-Hickory forests are naturally uneven-aged climax forests, with reproduction occurring in canopy gaps. The open, fairly dry slopes are exposed to a variety of natural disturbances such as fires, winds, and ice storms. All of these forests are in a state of transition following the loss of chestnut as a canopy dominant. In most stands it appears that chestnut has been replaced initially by existing canopy and understory species. Species that respond favorably to disturbance, such as Liriodendron tulipifera, Acer rubrum, Robinia pseudoacacia (black locust), and Pinus spp. have increased. Kalmia latifolia has also greatly increased in density (Monk *et al.*, 1985). Stands that had large amounts of chestnut may now have an open canopy, with a denser shrub layer. It is not yet known what the eventual composition of these forests will be.

The canopy of Montane Oak-Hickory Forest is dominated by a mixture of oaks, hickories, and other hardwoods. Beneath the canopy, the shrub layer varies in density and herbs are generally sparse but may be fairly diverse. Species associated with this habitat type are listed in (Table B.6).

TABLE B.6

Montane Oak-Hickory Forest Species

Common Name	Latin Name
Forest Canopy	
white oak	***Quercus alba***
red oak	***Q. rubra***
chestnut oak	***Q. prinus***
mockernut hickory	***Carya alba***
pignut hickory	*C. glabra*
eastern black oak	***Q. velutina***
red maple	***Acer rubrum***
tulip popular	***Liriodendron tulipifera***
scarlet oak	*Q. coccinea*
white pine	***Pinus strobus***
sourwood	***Oxydendrum arboretum***
flowering dogwood	***Cornus florida***
black gum	***Nyssa sylvatica***
common serviceberry	*Amelanchier arborea*
American chestnut	***Castanea dentata***
Shrub Layer	
great rhodedendron	***Rhododendron maximum***
mountain laurel	***Kalmia latifolia***
bear huckleberry	*Gaylussacia ursine*
blueberry	***Vaccinium spp.***
mapleleaf virburnum	*Viburnum acerifolium*
common witchhazel	***Hamamelis virginiana***
Indian cucumber	*Medeola virginina*
treacleberry	*Maianthemum racemosum*
smooth Solomon's seal	*Polygonatum biflorum*
New York fern	***Thelypteris noveboracensis***
hay-scented fern	***Dennstaedtia punctilobula***
mountain bellwort	*Uvularia puberula*
tall rattlesnakeroot	*Prenanthes altissima*
wild yam	*Dioscorea villosa*
squaw root	*Conopholis americana*
bedstraw	*Galium spp.*

Low Elevation Granitic Dome: Low Elevation Granitic Dome communities occur on steep to gently sloping exposures of smooth, exfoliating granite, or similar massive igneous or metamorphic rock such as granitic gneiss. These communities vary both spatially and temporally. Though they are primarily xeric due to lack of soil and exposure to wind, in some instances deep crevices and seepage zones may retain more moisture, and depressions may hold water for short periods after rainfall. To be considered a Low Elevation Granitic Dome, the dome must occur at a point in the landscape below 3,000 feet. The higher temperatures, lower rainfall, and less frequent fog make Low Elevation Granitic Domes drier than High Elevation Granitic Domes (which occur above 3,000 feet).

The smooth surface and lack of crevices on Low Elevation Granitic Domes create an environment which lacks many of the microhabitats found on outcrops of fractured rock. The bare rock which comprises Low Elevation Granitic Domes is typically vegetated by mats of distinctive species, zoned with soil depth (Table B.7). Vegetation mats expand as pioneers establish at their edges, and transition to communities dominated by different species as

vegetation decomposes in the center and soil accumulates and deepens. Old mats with well-developed soils are quite rare. The steep slopes cause frequent destruction of these mats, leaving the face dominated by young mats and bare rock. Mats are also frequently destroyed by falling under their own weight or by spalling of the rock before they become well established. Windthrow of trees may also destroy the mats in which they are rooted. However, the tops of faces and domes often have small level areas which provide some of the distinctive microhabitats associated with flatrocks. These are usually minor in extent and not worth distinguishing separately, but substantial areas may occur.

TABLE B.7

Low Elevation Granitic Dome

Common Name	Latin Name
Limited Soil	
racomitrium moss	***Racomitrium heterostichum***
ciliate hedwigia moss	*Hedwigia ciliate*
lichenized fungi	*Cladonia spp.*
juniper polytrichum moss	*Polytrichum juniperinum*
common haircap moss	***Polytrichum commune***
bridel	***Grimmia laevigata***
brid	***Philonotis Fontana***
northern selaginella	*Selaginella rupestris*
Developed Soil	
elf orpine	*Diamorpha smallii*
Allegheny stonecrop	*Sedum telephioides*
quill flameflower	*Talinum teretifolium*
hairy lipfern	*Cheilanthes lanosa*
wooly lipfern	*Cheilanthes tomentosa*
star tickseed	*Coreopsis pubescens*
smallflower phacelia	***Phacelia dubia***
poverty oatgrass	*Danthonia spicata*
greater tickseed	*Coreopsis major*
panic grasses	***Dichanthelium spp.***
striped garlic	*Allium cuthbertii*
orangegrass	*Hypericum gentianoides*
coppery St. Johnswort	*Hypericum denticulatum*
yellow fumewort	*Corydalis flavula*
Small's ragwort	*Senecio smallii*
mountain mint	*Pycnanthemum sp.*
hairy forked nailwort	*Paronychia fastigiata*
common dittany	*Cunila origanoides*
tall thimbleweed	*Anemone virginiana*
blackseed speargrass	***Piptochaetium avenaceum***
Hentz's phlox	*Phlox nivalis*
piedmont false pimpernel	*Lindernia monticola*
toothed whitetop aster	*Aster paternus*
sedge	***Carex spp.***
Virginia pine	*Pinus virginiana*
pitch pine	***P. rigida***
chestnut oak	***Quercus prinus***
hickory	***Carya spp.***
bristly locust	*Robinia hispida*
winged sumac	***Rhus copallina***

Low Elevation Granitic Dome (Continued)	
Common Name	**Latin Name**
Developed Soil (Continued)	
deerberry	*Vaccinium stamineum*
common hoptree	*Ptelea trifoliata*
white fringetree	*Chionanthus virginicus*
eastern red-cedar	***Juniperus virginiana***
fragrant sumac	*Rhus aromatic*
coralberry	*Symphoricarpos orbiculatus*

Pine-Oak/Heath: The Pine-Oak/Heath community typically occurs adjacent to Low Elevation Granitic Dome areas. Areas containing Pine-Oak/Heath are typically xeric due to shallow soil, rapid drainage, and predominantly south aspects. These areas are distinguished from the Montane Oak-Hickory Forest community by the overstory dominance of pitch pine in conjunction with dense understories of mountain laurel and huckleberry species. Species commonly found in Pine-Oak/Heath communities are listed in Table B.8.

Pine-Oak/Heath primarily consists of a stunted and gnarled canopy. It has been hypothesized that this type of forest is dependent on periodic severe fires, which open seedbeds for shade-intolerant species, such as pines, to regenerate (Harmon *et al.* 1984). In the prolonged absence of fire, it's believed that Pine-Oak/Heath might become shrub dominated as pines die and are not regenerated, or succeed to oak and Carolina hemlock dominance. The natural fire regime needed to maintain these communities is not known; however the topographical location of these communities makes them among the driest in the landscape and also highly exposed to lightening. Even relatively low-intensity surface fires spreading from adjacent communities may increase in intensity when they reach the dense vegetation, thick dry litter, and openness to wind of Pine-Oak/Heath sites. At one time, American chestnut was a major component of these communities. Its death has undoubtedly made some communities feature a more open canopy and become more heath dominated than they were originally.

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TABLE B.8

Pine-Oak/Heath Canopy Species

Common Name	Latin Name
Forest Canopy	
Virginia pine	*Pinus virginiana*
pitch pine	***P. rigida***
table mountain pine	*P. pungens*
scarlet oak	***Quercus coccinea***
chestnut oak	***Quercus prinus***
chinkapin	*Castanea pumila*
American chestnut	***C. dentata***
sassafras	***Sassafras albidum***
black gum	***Nyssa sylvatica***
red maple	*Acer rubrum*
Carolina hemlock	*Tsuga caroliniana*
sourwood	***Oxydendrum arboreum***
Shrub Layer	
mountain-laurel	***Kalmia latifolia***
black huckleberry	***Gaylussacia baccata***
Blue Ridge blueberry	***Vaccinium pallidum***
bear huckleberry	***Gaylussacia ursine***
deerberry	*Vaccinium stamineum*
Catawba rhododendron	*Rhododendron catawbiense*
great laurel	***Rhododendron maximum***
common sweetleaf	***Symplocos tinctoria***
sweet fern	*Comptonia peregrine*
redtwig doghobble	*Leucothoe recurva*
Herbaceous Layer	
trailing arbutus	*Epigaea repens*
striped prince's pine	***Chimaphil amaculata***
galex	*Galax urceolata*
little bluestem	***Schizachyrium scoparium***
narrowleaf cowwheat	*Melampyrum lineare*
greater tickseed	*Coreopsis major*
bracken fern	***Pteridium aquilinum***
goat's rue	*Tephrosia virginiana*
mountain bellwort	*Uvularia pudica*
eastern teaberry	*Gaultheria procumbens*
eastern turkeybeard	*Xerophyllum asphodeloides*

White Pine Forest: White Pine Forest features a canopy dominated by white pine either with or without associated trees such as eastern hemlock and chestnut oak. The shrub layer is often dense; shrubs include blueberry, rhodedendron, and huckleberry. The dynamics of natural White Pine Forests are not known. They may be successional to some other community, or they may be maintained by poor soil conditions and possibly fire.

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APPENDIX C: PHOTOGRAPHIC LOG

Client Name: DuPont	**Site Location:** Brevard, North Carolina	**Project No.** 18986041.00002

Photo No. 1	**Date:** 8/9/11

Direction Photo Taken:

East

Description:

Lake DERA Marsh.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
2	5/3/11

Direction Photo Taken:

South

Description:

Acidic Cove Forest located in the south central portion of the site looking at the south bank (river right) of Little River.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
3	5/4/11

Direction Photo Taken:

North

Description:

Floodplain Pool located in the northeast corner of the Site, west of Little River.

URS

Client Name: DuPont	Site Location: Brevard, North Carolina	Project No. 18986041.00002

Photo No.	Date:
4	5/3/11

Direction Photo Taken:

East

Description:

Spotted salamander egg masses identified in Floodplain Pool habitat in the northeast corner of the Site, west of Little River.

URS

Client Name: DuPont	Site Location: Brevard, North Carolina	Project No. 18986041.00002

Photo No.	Date:
5	5/4/11

Direction Photo Taken:

North

Description:

Swamp Forest-Bog located in the northeast portion of the Site, west of Little River.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
6	8/9/11

Direction Photo Taken:

West

Description:

Vernal Pool habitat under dry conditions located in the south central portion of the Site, north of Little River.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
7	5/3/11

Direction Photo Taken:

South

Description:

Montane Alluvial Forest located in the south central portion of the Site, north of Little River.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
8	5/3/11

Direction Photo Taken:

South

Description:

Montane Oak-Hickory Forest in the undisturbed central portions of the Site.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
9	8/9/11

Direction Photo Taken:

Northeast

Description:

A Low Elevation Granitic Dome located in the southwest portion of the Site.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
10	8/9/11

Direction Photo Taken:

North

Description:

A Low Elevation Granitic Dome located in the southwest portion of the Site.

URS

Client Name: DuPont	Site Location: Brevard, North Carolina	Project No. 18986041.00002

Photo No.	Date:
11	5/3/11

Direction Photo Taken:

Northeast

Description:

Pine-Oak/Heath habitat located adjacent to Low Elevation Granitic Domes in the southwest portion of the Site.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
12	5/3/11

Direction Photo Taken:

Northeast

Description:

Pine-Oak/Heath habitat located adjacent to Low Elevation Granitic Domes in the southwest portion of the Site.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
13	5/3/11

Direction Photo Taken:

East

Description:

White Pine Forest located near the Low Elevation Granitic Domes in the southwest portion of the Site.

URS

Client Name: DuPont	Site Location: Brevard, North Carolina	Project No. 18986041.00002

Photo No.	Date:
14	5/3/11

Direction Photo Taken:

East

Description:

Community of swamp pink located in acidic cove forest east of Lake DERA.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
15	5/3/11

Direction Photo Taken:

West

Description:

Stream outfall from Lake DERA heavily marked by iron flocculant.

URS

Client Name: DuPont	Site Location: Brevard, North Carolina	Project No. 18986041.00002

Photo No. 16	Date: 8/9/11

Direction Photo Taken:

West

Description:

Individuals in the community of swamp pink identified in Acidic Cove Forest southwest of Lake DERA.

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
17	8/8/11

Direction Photo Taken:

West

Description:

Community of French Broad heartleaf identified on the up-gradient of the Little River Floodplain north of Little River.

URS

Client Name: DuPont	Site Location: Brevard, North Carolina	Project No. 18986041.00002

Photo No. 18	Date: 8/8/11

Direction Photo Taken:

West

Description:

Community of French Broad heartleaf identified within Montane Oak-Hickory Forest west of State Road 1594 (Staton Road).

URS

Client Name: DuPont	Site Location: Brevard, North Carolina	Project No. 18986041.00002

Photo No.	Date:
19	8/8/11

Direction Photo Taken:

West

Description:

Community of French Broad heartleaf identified within Acidic Cove Forest in the western portion of the Site.

URS

Client Name: DuPont	Site Location: Brevard, North Carolina	Project No. 18986041.00002

Photo No.	Date:
20	8/10/11

Direction Photo Taken:

South

Description:

Community of purple pitcher plants located east of Lake DERA; possibly *Sarracenia purpurea L. ssp. purpurea var. montana*

URS

Client Name:	Site Location:	Project No.
DuPont	Brevard, North Carolina	18986041.00002

Photo No.	Date:
21	5/4/11

Direction Photo Taken:

South

Description:

Community of goldenclub located in the Swamp Forest-Bog complex in the northeast portion of the Site.

URS

APPENDIX D: DUPONT FACILITY PROPERTY: SIGNIFICANT NATURAL FEATURES: FEBRUARY 3, 2006

Prepared by others

Dupont Facility Property: Significant Natural Features
February 3, 2006

The Dupont facility property is located in southeastern Transylvania County. The property is 503-acres and is surrounded by Dupont State Forest on all sides. The Little River flows through the property just downstream of Bridal Veil Falls, which lies adjacent to the property in the state forest. The central and eastern portion of the property is the site of the former AGFA plant and associated facilities. One large unnamed tributary flows east-west through the property to its confluence with the Little River. Several other smaller tributaries lie on the property and two lakes lie within the property, including Lake Derra. The primary natural areas lie to the south and west of the former AGFA plant as well as within the Little River floodplain corridor that wraps around the plant to the south and east.

Lake Derra Marsh is a nationally ranked significant natural heritage area. The site is comprised of two separate areas to the east and west of Lake Derra. These areas are primarily open and wooded wetlands, though there are some uplands, several roads, and disturbed areas within the site boundary as well as. The site was reported to have been a swamp forest-bog complex in the floodplain of the unnamed tributary to the Little River before the stream was dammed. The area to the west is approximately 8-ac in area and is located along the shore of the lake. The eastern wetland area is approximately 5.9-ac and lies in the floodplain of the unnamed tributary to the Little River on the backside of the Lake Derra dam. The latter wetland area is also bisected by roads and is bordered by a parking lot to the south.

Lake Derra Marsh earned its site significance due to the presence of two populations of the federally threatened Swamp Pink (*Helonias bullata*). Unfortunately, the largest and best documented of the two populations was reported to have been decimated in 2002 by careless campers. The other population located east of the lake and below the dam is quite large and occurs over an area of approximately 1 acre. A report from 1998 estimates a population of 600 plants. Additional unique wetland habitats occur along the shore of Lake Derra.

The Little River/Cedar Mountains is also a nationally significant natural heritage area that occurs in the Dupont facility property. The site begins southeast of the Dupont property on Cedar Mountain in Dupont State Forest, follows the floodplain of the Little River alongside the former AGFA plant, and continues approximately 1.5-miles north-northeast within the state forest. The significance of this site is based on the presence of several high quality, rare natural communities and several populations of rare plants and animals.

The portion of the site that occurs in the Dupont facility property represents a flat floodplain of the Little River with some areas of depressional topography. The floodplain supports two separate wetland communities: primarily swamp forest-bog complex and an isolated occurrence of floodplain pool. The swamp forest-bog complex community type is common along the Little River within Dupont State Forest and vicinity. The floodplain pool is a depressional pocket within the swamp forest that holds water into the growing

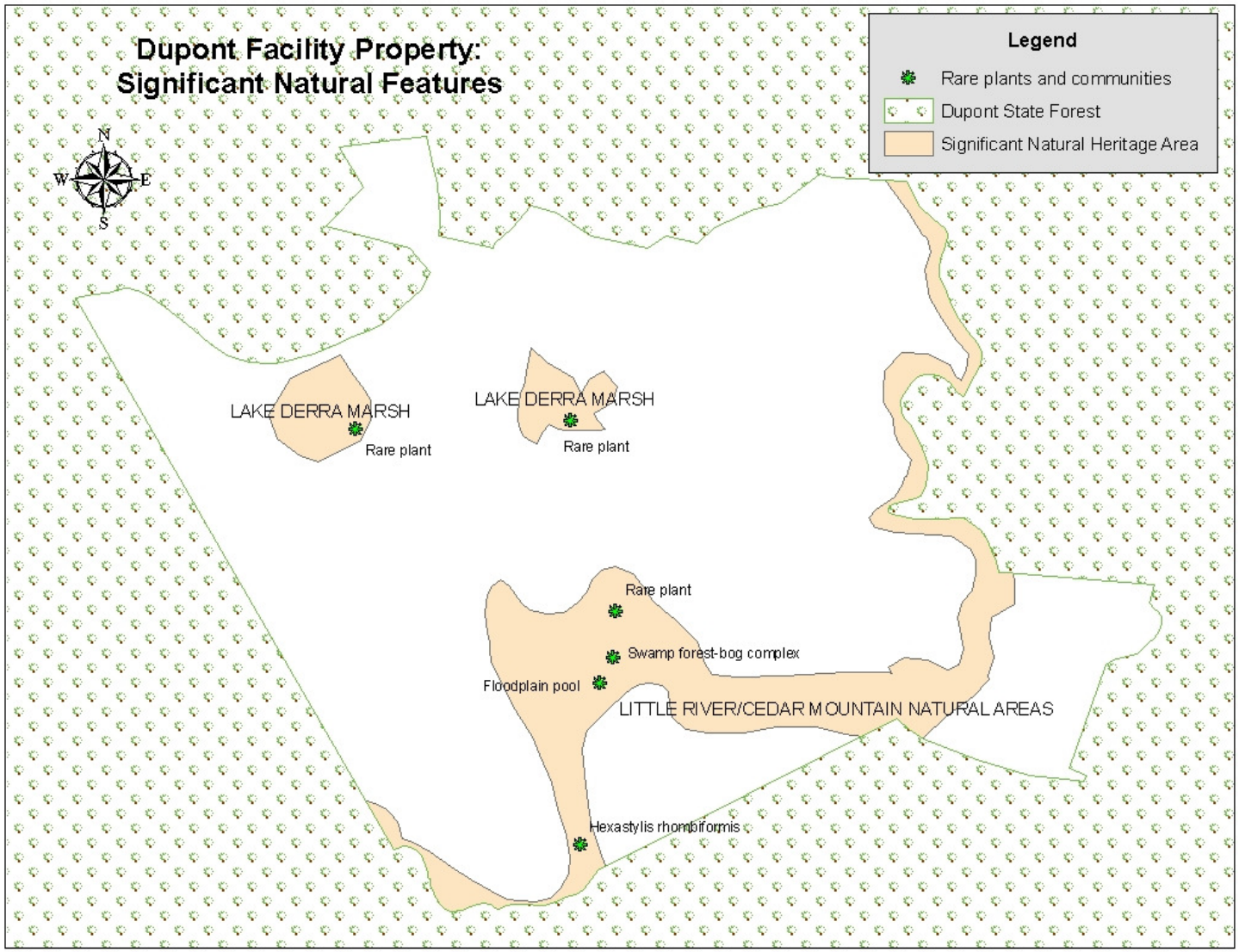
season. Both of these occurrences are considered good examples of their respective community types.

The swamp forest bog-complex is significant in that it harbors one of the best populations of federally threatened Swamp Pink (*Helonias bullata*). Over 1000 individuals of Swamp Pink were estimated as occurring in this site in 1998, which could make this the second best population in the state after the Pink Beds in the Pisgah National Forest. The swamp forest also contains Cuthbert's turtlehead (*Chelone cuthbertii*) and bog jack-in-the-pulpit (*Arisaema triphyllum* ssp. *stewardsonii*), rare wetland plants that are characteristic of wetlands in the Cedar Mountain area.

Also within Little River/Cedar Mountain SNHA on the Dupont facility property is a record for Federal Special Concern French Broad Heartleaf (*Hexastylis rhombiformis*). The Heartleaf occurrence is reported from oak-dominated forest upslope of the Little River floodplain. There is no information as to the extent of the population; however, its presence is significant, as the plant is known only to occur in North and South Carolina within the French Broad River basin.

Other species and natural communities of interest may occur within the Dupont facility property. An historic record for state rare Bog Goldenrod (*Solidago uliginosa*) occurs just upstream of the Dupont facility property in swamp forests along the Little River. Additional surveys in the Little River floodplain should be carried out to relocate this species.

Additionally, a small peak with rock outcrops occurs in the southwest corner of the Dupont facility property. This site lies due north of Bridal Veil Falls and is contiguous with the Cedar Mountain SNHA. This area of rock outcrops potentially provides habitat for the Federal Special Concern Green Salamander (*Aneides aeneus*), which was reported just outside the Dupont facility property in 2002.


Dupont Facility Property:
Significant Natural Features
N
W
E
S
Legend
Rare plants and communities
Dupont State Forest
Significant Natural Heritage Area
LAKE DERRA MARSH
Rare plant
LAKE DERRA MARSH
Rare plant
Rare plant
Swamp forest-bog complex
Floodplain pool
LITTLE RIVER/CEDAR MOUNTAIN NATURAL AREAS
Hexastylis rhombiformis