

VEGETATION CLASSIFICATION SYSTEM
FOR
CONGAREE SWAMP NATIONAL MONUMENT
SOUTH CAROLINA



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May 27, 1992

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Floodplains containing bottomland hardwoods are transitional in the aquatic continuum between permanent water and terrestrial uplands, and are thus, difficult to classify (Wharton, et al., 1982). There exist many different schemes and categories used in classifying wetlands such as those found in COSW. Some of these categories include: "forested wetlands in palustrine and estuarine ecosystems" (Cowardin et al., 1979); "seasonally flooded basins or flats" (Shaw and Fredine, 1956); "mixed bottomland hardwoods and tupelo-cypress swamps" (Stubbs, 1973); "oak-gum-cypress" and "elm-ash-cottonwood" (Boyce and Cost, 1974); and "deep swamps, narrow stream margins, and broad stream margins" (U.S. Forest Service Resource Bulletins 1970, 1972, 1974, 1978).

The development of vegetation and land use/land cover classification system for Congaree Swamp is essential for the photointerpretation and image processing of false-color, infrared, aerial photography and satellite imagery. This classification system has been developed principally from vegetation classes proposed by Gaddy (1979) and mapped (Figure 1) by Smathers (1980). They also represent a combination of the 29 vegetation classes identified and mapped by Smathers (1980) to a resulting 13 vegetation classes and 6 land use/land cover categories. These classes/categories were determined by park staff and cooperating scientists to be extractable from the National Aerial Photography Program (NAPP) and SPOT satellite imagery. Land use/land cover categories have been described by and are adopted from Anderson, et al. (1976).

Vegetative communities will be delineated from aerial photography. Both aerial photography and SPOT images will be provided by the South Carolina Land Resources Commission (SCLRC). The aerial photographs are false-color infrared imagery taken in February 1989 and February 1991 as part of the National Aerial Photography Program (NAPP). These images are 1:40,000 scale with an on-the-ground resolution of 1.5 meters. These photos have been flown on flight lines which correspond to 7.5 minute quadrangles with 60% overlap for stereo effect. They will be scanned at 500 - 600 dpi yielding a resolution of 1.5 - 2.0 meters. Adjacent land use/land cover will be classified from SPOT satellite imagery. SPOT images of the Monument and its adjacent area (watersheds) are available for 1987, 1989, and 1991 from the SCLRC. The images have been processed and the land use/land cover classified using the basic classes found in Anderson, et al. (1976) and defined later in this report. The images can be displayed and manipulated using workstation ERDAS software (Version 7.5 or 8.0).

Georectification of scanned images will be done using known surveyed points provided by USGS, USSCS, and various researchers that have surveyed plots in the Monument in conjunction with Geographic Positioning System (GPS) equipment.

Field verification (ground truthing) will be done by a temporary employee (GS-7) during the summer of 1992. This field data will be used to check the photointerpreters classification and to resolve any unidentifiable vegetation signatures in the image processing and georectification steps of producing the vegetation maps/GIS themes. This classified data layer will be cross-indexed to Cowardin, et al. (1979) (U.S. Fish and Wildlife Service, National Wetlands Inventory maps); the Society of American Forestry cover-types; and, the Federal Interagency Manual for Wetland Delineation (1989).

With the exception of the SWAMP-TUPELO class, the following vegetation classes and the plant species found within them are common to large river floodplains. According to Smathers (1980), this class is uncommon in South Carolina and unknown on any other flood plains, although the plant species which comprise it are found growing in somewhat different combinations in other physiographic situations on the Coastal Plains, notably in Carolina bays. Smathers (1980) also found one rare plant, the serviceberry holly (Ilex amelanchier M. A. Curtis) and one uncommon exotic plant, the climbing Japanese fern (Lygodium japonicum (Thunberg) Swartz), on the Beidler Tract.

VEGETATION CLASSES OF THE CONGAREE SWAMP

1. CYPRESS-TUPELO

Found in sloughs and large depressions, baldcypress (Taxodium distichum (L.) Richard) and water tupelo (Nyssa aquatica L.) are the dominants. Carolina ash (Fraxinus caroliniana Miller), red maple (Acer rubrum L.), and planer tree (water elm)--(Planera aquatica Walter ex. J. F. Gmelin) dominate the understory of this community. [Gaddy class #26, NWI class PF01/2F or PF06F, SAF types 102 and 103, and FIMWD type OBL/III].

2. CYPRESS/BOTTOMLAND HARDWOOD

This class is a combination of vegetation types including cypress, bottomland hardwoods, and overcup oak where subhydric to hydric soil conditions prevail. It occupies wet flats that periodically are flooded and hold water slightly longer than the rest of the floodplain. Dominate species are: baldcypress and overcup oak (Quercus lyrata Walter). Other associates include: water hickory (Carya aquatica (Michaux f.) Nuttall) and American elm (Ulmus americana L.). Understory is dominated by saplings of the above species. [Gaddy class #6, 14, & 15, NWI class PF01/2C, SAF type 96, and FIMWD type OBL/III].

3. CYPRESS

This class is composed of pure stands of baldcypress. Smathers (1980) suggests that it represents a transitory stage of vegetation class #1 (Cypress/Tupelo). This class occurs as small stands in the sloughs and large depressions in the northern portion of the floodplain. [Gaddy class #5, NWI class PF02F, and FIMWD type OBL/II].

4. TUPELO

This class occurs in large depressions, bogs and sloughs in the floodplain. It consists primarily of pure stands of water tupelo. This community type regenerates after a severe cut of cypress. [Gaddy class #25, NWI class PF01F, and FIMWD type OBL/II].

5. SWAMP TUPELO

Swamp tupelo (Nyssa sylvatica var. biflora Walter, Sargent) is found in almost pure stands in bogs or depressions along the edge of the floodplain. These bogs have pure organic soil and are fed by underground springs surfacing from the bluffs of the flood plain. It also occurs near the north bluffs of Congaree Swamp. In the bluffs area, the total canopy consists primarily of swamp tupelo but is shared with associates of red maple, Carolina ash, and baldcypress. To a lesser extent sweetgum (Liquidambar styraciflua L.) and American holly (Ilex opaca Aiton) are also found in the canopy. The understory is thick and is dominated by sweet bay (Magnolia virginiana L.), red bay (Persea borbonia (L.) Springel), and TiTi (Cyrilla racemiflora L.). Leucothe axillaris var. axillaris (Lam.) D., Don and sweet pepperbush (Clethra alnifolia var. alnifolia L.) are the most abundant shrubs along with various acid-tolerant plants such as Ilex sp. [NWI class PF01Ba and FIMWD type OBL/III].

Occurring along the base of the bluffs and associated with seepage slopes typified by acid organic soils adjacent to and grading into pure stands of swamp tupelo is a community co-dominated by Loblolly pine (Pinus taeda L.) and swamp tupelo. Sweetgum, swamp chestnut oak (Quercus michauxii Nuttall), and red maple are present in sizable proportions. Leucothoe axillaris var. axillaris (Lam.) D., Don and sweet pepperbush dominate the shrub layer with an abundance of ferns and mosses in the herbaceous layer. [Gaddy class #18, 19, & 13, NWI class PF01/4Ba or PSS3Ba, SAF types 99 & 104, and FIMWD type FACW/III].

6. LOBLOLLY PINE/BOTTOMLAND HARDWOOD

This class occurs on "ridges" in the flood plain and is dominated by old loblolly pines and mixed oaks and hickories. Pawpaw (Asimina triloba (L.) Dunal) is the most common plant in the shrub layer. [Gaddy class #12, NWI class PF01/4A, SAF type 82, and FIMWD type FAC/VI].

7. LOBLOLLY PINE

This class consists of pure stands of loblolly pine that are primarily located along the mid-region of the low bluffs of the northern edge of the floodplain. [Gaddy class #11, NWI class UPLAND, and FIMWD type UPL/VI].

8. SWEETGUM/BOTTOMLAND HARDWOOD

This class can be composed of practically pure stands of sweetgum. This is the most common community type encountered in the Beidler Tract. It occurs in all areas of the floodplain. Codominant species include: swamp chestnut oak, laurel oak (Quercus laurifolia Michaux), and green ash (Fraxinus pennsylvanica Marshall). Ironwood (Carpinus caroliniana Walter) dominates the understory. [Gaddy classes #20 & 21, NWI class PFO1C & PFO1A, SAF type 92, and FIMWD type FAC/III or IV].

9. MIXED BOTTOMLAND HARDWOOD

This class consists of those species that find their optimal distribution between subhydric and mesic sites of the floodplain. No one species dominates the forest canopy but is a combination of laurel oak, sweetgum, American elm, green ash, water hickory, and overcup oak (Quercus lyrata Walter). Dwarf palmetto (Sabal minor Jacquin) Persoon, possum haw (Ilex decidua Walter), and ironwood dominate the understory. Hydrology (wetness) in this class varies widely with laurel oak and sweetgum occupying the wetter sites and overcup oak and American elm being found on the dryer sites. This class may be confused with vegetation class #8 (Sweetgum/Bottomland Hardwood). [NWI class PFO1C & PFO1A].

Also, found in this class are hardwoods occurring on natural levees and on newer alluvium along the river and bordering Ceder Creek. These areas are higher than the surrounding floodplain and have a better drained soil. Dominants are sugarberry (Celtis laevigata Willd.), sycamore (Platanus occidentalis L.) and cherrybark oak (Quercus falcata var. pagodaefolia Ell.). Box elder (Acer negundo L.) almost completely dominates the understory, and spicebush (Lindera benzoin (L.) Blume) and pawpaw are the most common shrubs. [Gaddy classes #2, 9, 10, 15 & 17, NWI class PFO1A, SAF types 92, 93 & 94, and FIMWD type FAC/III or IV].

10. GREEN ASH/RED MAPLE

Occasionally, nearly pure stands of ash (Fraxinus spp) occur as pioneer seral stages (Smathers, 1980). This highly variable community is found in wet flats, and usually grades into class #1 (Cypress/Tupelo). Various ashes (Fraxinus spp.), red maple, American elm, sycamore, cypress, and sweetgum are found in this class. This class is rare, being found in the northeastern section of the floodplain. [Gaddy classes #7 & 8, NWI class PFO1C, and FIMWD type FACW/IV].

11. COTTONWOOD AND WILLOW

This class is a combination of cottonwood (Populus deltoides Marshall) which occurs in practically-pure stands, and may grade into willow where the two occur together along the river banks. Willow occurs in pure to mixed stands with swamp cottonwood (Populus heterophylla L.) on sandy bars along the Congaree River. Willow is the major pioneer woody colonizer of sandy substrates. [Gaddy classes #4 & 27, NWI class PSS1C, and FIMWD type FACW/III].

12. SCRUB/SHRUB

The more submesic species with wide ecological amplitudes such as tulip poplar, pignut hickory, shumard oak, beech, white ash, and red maple tend to dominate the canopy cover. [Gaddy class #3, NWI class PSS1A, and FIMWD type FACW-FAC/III-IV].

13. BLOWDOWNS

These are areas where trees and other dominant woody vegetation has been blown down by winds and the canopy opened. It is dominated by seedlings and saplings of various adjacent species and class #12 (SCRUB/SHRUB). Wharton, et al. (1982) listed windthrow or blowdowns as a primary disturbance to plant succession on floodplains containing bottomland hardwoods. Gaps in the canopy caused by blowdown stimulate the understory woody and herbaceous growth. The factors that influence successional response to such gaps include gap size, existing composition of seedlings and saplings, and their relative shade tolerances, possible inhibition due to shading by extensive understory tree development, site characteristics, and the probability of propagule recruitment (Wharton, et al., 1982). Additionally, Gaddy, et al. (1975) states that understory shading may limit the development of diverse, well-stocked seedling and sapling layers; thereby, retarding succession.

Legend:

Gaddy class from Smathers (1980).

NWI class from Cowardin, et al. (1979) [see Appendix A].

SAF types from the Society of American Forestry cover-types

FIMWD type from the Federal Interagency Manual for Wetland Delineation (1989). [see Appendix B; format plant/hydrological zone].

LAND USE/LAND COVER CLASSES

These classes are adopted from Anderson, et al. (1976) and will be used to classify SPOT imagery and for areas from scanned photographs that are not described from the vegetation classes described above.

1. URBAN

This class is comprised of areas of intensive use with much of the land covered by structures. Included in this category are cities, towns, villages, strip developments along highways, transportation, power, and communications facilities, and areas such as those occupied by mills, shopping centers, industrial and commercial complexes, and institutions that in some cases can be isolated from urban areas.

2. AGRICULTURE/GRASSLAND

This class is broadly defined as land used primarily for the production of food and fiber. It includes: cropland, pasture, orchards, groves, vineyards, nurseries, ornamental horticultural areas, and feed lots.

This class also includes the "Rangeland" category described by Anderson, et al. (1976) and is defined as land where potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs and where natural herbivory was an important influence in its precivilization condition. This class includes: herbaceous range and mixed rangeland.

3. SHRUB/SCRUB

This class is adapted from the "rangeland" category of Anderson, et al. (1976) and is described by the "shrub and brush rangeland" definition. It includes: former croplands and/or pasture lands which have now been allowed to succeed back to forest land.

4. FORESTED/NON-FORESTED WETLANDS

This class is described by Anderson, et al. (1976) in the "wetland" category. Forested wetlands are wetlands dominated by woody vegetation and includes seasonally flooded bottomland hardwoods, shrub swamps, and bogs. Most of the Monument would be considered as this type of wetland. Non-Forested wetlands are wetlands dominated by herbaceous vegetation or are nonvegetated. This type of wetland includes: nontidal fresh, brackish and salt marshes and wet prairies.

5. BARREN

Barren land is described as land of limited ability to support life in which less than one-third of the area has vegetation or other cover. This class includes: beaches, dry salt flats, bare exposed rock, strip mines, quarries and gravel pits.

6. WATER

This class is described as all areas that persistently are covered by water , provided that, if they are linear, they are at least 1/8 mile (200 m.) wide and, if extended, cover at least 40 acres (16 hectares). This category includes: streams, canals, lakes, reservoirs, bays and estuaries.

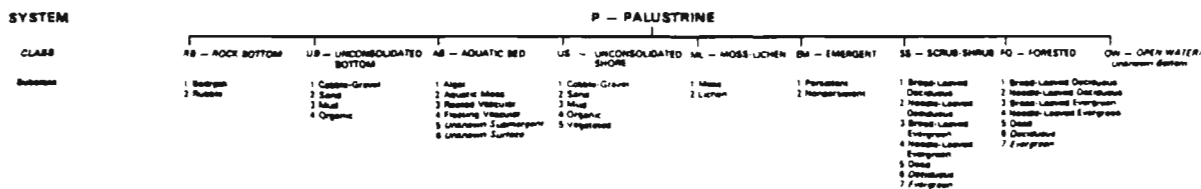
7. FOREST

This class comprises lands having a tree-crown areal density (crown closure percentage) of 10% or more, are stocked with trees capable of producing timber or other wood products, and exert an influence on the climate or water regime. It includes: deciduous, evergreen, and mixed forest land.

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WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



Classification of Wetlands and Deepwater Habitats of the United States
 Revision EF AL 1979 as modified for National Wetland Inventory Mapping Convention

APPENDIX B. - Code Legend/Description of Terms used by Federal Interagency Committee for Wetland Delineation (1989). [From: Corps of Engineers Wetlands Delineation Manual. January 1987. Env. Lab., WES-COE, Tech. Rept. Y-87-1, 169p.]

Plant Indicator Status Categories*

Indicator Category	Indicator Symbol	Definition
OBLIGATE WETLAND PLANTS	OBL	Plants that occur almost always (estimated probability >99%) in wetlands under natural conditions, but which may also occur rarely (estimated probability <1%) in nonwetlands. Examples: <i>Spartina alterniflora</i> , <i>Taxodium distichum</i> .
FACULTATIVE WETLAND PLANTS	FACW	Plants that occur usually (estimated probability >67% to 99%) in wetlands, but also occur (estimated probability 1% to 33% in nonwetlands). Examples: <i>Fraxinus pennsylvanica</i> , <i>Cornus stolonifera</i> .
FACULTATIVE PLANTS	FAC	Plants with a similar likelihood (estimated probability 33% to 67%) of occurring in both wetlands and nonwetlands. Examples: <i>Gleditsia triacanthos</i> , <i>Smilax rotundifolia</i> .
FACULTATIVE UPLAND PLANTS	FACU	Plants that occur sometimes (estimated probability 1% to <33%) in wetlands, but occur more often (estimated probability >67% to 99%) in nonwetlands. Examples: <i>Quercus rubra</i> , <i>Potentilla arguta</i> .
OBLIGATE UPLAND PLANTS	UPL	Plants that occur rarely (estimated probability <1%) in wetlands, but occur almost always (estimated probability >99%) in nonwetlands under natural conditions. Examples: <i>Pinus echinata</i> , <i>Bromus mollis</i> .

Hydrologic Zones* - Nontidal Areas

Zone	Name	Duration**	Comments
I†	Permanently inundated	100%	Inundation >6.6 ft mean water depth
II	Semipermanently to nearly permanently inundated or saturated	>75% - <100%	Inundation defined as ≤6.6 ft mean water depth
III	Regularly inundated or saturated	>25% - 75%	
IV	Seasonally inundated or saturated	>12.5% - 25%	
V	Irregularly inundated or saturated	≥5% - 12.5%	Many areas having these hydrologic characteristics are not wetlands
VI	Intermittently or never inundated or saturated	<5%	Areas with these hydrologic characteristics are not wetlands

* Zones adapted from Clark and Benforado (1981).

** Refers to duration of inundation and/or soil saturation during the growing season.

† This defines an aquatic habitat zone.