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The Vegetation of the Great Dismal Swamp: a Review and an Overview

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ABSTRACT

The vegetation of the Great Dismal Swamp is recovering from 200 years of anthropogenic disturbance which included numerous fires, repeated logging operations and primarily during this century, the construction of over 100 miles of drainage ditches, many with parallel roads. Most plant communities consist of second- or third-growth forest and dense shrub-dominated communities that represent a variety of seral stages. The storied cypress-tupelo gum swamps are represented by remnants and the extensive Atlantic White Cedar stands have been decimated. The once common "lights", composed of reeds and aquatic grasses, have succeeded to red maple dominated communities. In fact, red maple dominates or is an important component of most community types which have been delimited.

THE VEGETATION OF THE GREAT DISMAL SWAMP

The Great Dismal Swamp of Virginia and North Carolina, which covers about 104,000 ha, has been greatly disturbed by fire and 200 years of logging and draining (Meanley, 1968; Dean, 1969). Most of its vegetation consists of second growth communities in various seral stages (Levy and Walker, 1979).

The Virginia portion of the Dismal Swamp includes the eastern part of the City of Suffolk and the western part of the City of Chesapeake. In North Carolina it constitutes parts of Currituck, Camden, Perquimans, Gates and Pasquotank counties.

The southeastern coastal plain of the United States harbors a great diversity of communities. Since the region's climate is "relatively uniform" it is reasonable to attribute its vegetative mosaic to individual species' responses to edaphic and physiographic variation (Wells, 1942). The vegetation of the Great Dismal Swamp is influenced by the geological processes which formed its western boundary (the Suffolk Scarp), the five lagoonal strata of Pleistocene Age that underlie the surface peat deposits, and below them the Yorktown Formation (Oaks and Coch, 1963, Oaks et al., 1974). The Yorktown Formation, which in this area is mainly compact, impermeable clay, slopes eastward at about 0.25 m/km. It forms a barrier which prevents downward groundwater percolation and thereby provides the major hydrological impedance that has delimited the area's ecological diversity.

Palynological studies of Dismal Swamp peat (Cocke et al., 1934; Whitehead, 1972; Whitehead and Oaks, 1979) have provided insight into the vegetational history of this area. Whitehead and Oaks (1979) have concluded that the surface upon which the Dismal Swamp formed dates from the last (Sangamon) interglacial ($<$80,000 B.P.). Indications of a dendridic drainage system in the surface of the sediment beneath the peat, peat radio-carbon data, and pollen analysis provided the basis for their estimate of 11,000-12,000 years B.P, for the swamp's initiation.

It appears that forest vegetation was initially confined to the margins of the Dismal Swamp basin or to mesic islands within it. The major portion of the basin likely had aquatic and semiaquatic communities associated with meandering creek margins, sloughs and ponds. Peat seems to have first begun to form in the eastern portion of the basin within ponded areas. Due to its high water retaining capacity the peat created the conditions for its subsequent accumulation and expansion. Ultimately much of the basin was covered by a peat blanket ranging from a maximum reported depth of 5.5 m east and northeast of Lake Drummond (Osbon, 1919) to none at other sites (Oaks and Whitehead, 1979).

In summary, Oaks and Whitehead (1979) concluded that since the swamp's inception the region has undergone an overall warming trend. They identified four pollen assemblages: 1) pine-spruce, 2) beech-hemlock-birch; 3) oak-hickory; and 4) cypress-gum. The cypress-gum assemblage was dated from 3,500 B.P. to the present. This last assemblage was found to consist of the pollen of many species presently found in the Great Dismal Swamp.

Historical descriptions of the Dismal Swamp's vegetation began with the observations of William Byrd II (1958), who in 1728 helped supervise the Virginia--North Carolina boundary line survey. He described areas on the eastern edge as having a dense undergrowth, including reeds 10-12 ft. high, intertwined with briers. Scattered throughout this portion were a few cypresses and white cedars. He wrote, "... the ground was moist and trembling under our feet like a quagmire in-so-much that it was an easy matter to run a ten-foot pole up to the head in it without exerting any uncommon strength to do it." Byrd reported that the surveyors encountered large, blown down cypresses. As they further penetrated the swamp they found an increase in white cedars. They continued making good progress until on the third day when about five miles into the swamp they encountered an ". . .impenetrable cedar thicket." The following day they traversed ". . . a cedar bog where the trees were smaller and grew more into a thicket." On the ninth day having run out of supplies the surveyors ". . . marched from morning till night, and completed . . ." the remaining four miles through a cedar swamp.

In 1763 George Washington joined eleven other distinguished Virginians in forming a company which eventually became known as the Dismal Swamp Land Company. A scattering of comments through his letters and diaries provides some sparse descriptions of the swamp's vegetation. Cypress, juniper and growths of cane are noted.

From May 25th to the 28th 1763, Washington and some companions rode around the perimeter of the Swamp. At this time he noted relatively dry conditions in places. Near Cypress Swamp, on its western edge, they penetrated more than a half mile and noted, "... Pine and Galeberry bushes, the soil being much intermixed with sand but afterwards it grew blacker and richer with many young Reeds and few pines, and this it may be observed here is the nature of the Swamp in general." Continuing around the Swamp and through the southern portion they passed through "Newland", an area with little timber ". . . but very full of Reeds . . ." (Fitzpatrick, 1925).

In 1795 J.F.D. Smyth's travels and adventures led him to hide from rebel militia in the Great Dismal Swamp (Smyth, 1968). His account entitled, "A Tour in the United States of America; [etc.]" includes observations on the Dismal. He

describes ". . . innumerable quantities of large straight lofty cypress trees." Their knees are described as being from 3 to 15 inches in height, suggesting that mean water levels then were much as they are today (Kernell and Levy, 1990). He especially mentions ridges of higher ground that had been accidentally set on fire in very dry summers producing ". . . dreadful conflagrations . . . burning into the earth for vast depth. . .", these places soon becoming small lakes. He specifically mentions a particular fire which produced a lake, ". . .a mile and a half by three long and up to 12 feet deep." He wrote, "It is imagined that the great lake in the center [Lake Drummond] was formed by some dreadful conflagration far beyond human memory; as burnt wood is frequently found . . . throughout."

Stewart (1981) provides various descriptions of the shingle and lumber industries in the Great Dismal. From his gleanings of the various records of economic activity some ideas of the dominant vegetation of the swamp from the 1760's through more recent times can be deduced and the factors which influenced this vegetation inferred.

It seems apparent, as J.F.D. Smyth originally summarized in 1775, that drought, fire and storms have played a significant role in effecting the Swamp's vegetative characteristics. Certainly William Byrd II's earlier descriptions of the hardships involved in setting the dividing line supports the on-going influences of both blow down and fire, as does Washington's reports of extensive areas with little timber, "Galeberry bushes" and reeds.

Fires are reported by Stewart (1981) as having adverse economic effects in various portions of the Dismal Swamp in the first two decades of the nineteenth century and in 1836. In 1913 fires and a hurricane are noted as ". . . reducing the enthusiasm" for the lumber business in the Dismal Swamp by the steel men who ran the Norfolk Southern Rail Road.

Dean (1969) presents historical descriptions of some interest and some details on the history of 20th century fires and fire suppression efforts. Worthy of note are the fires of the 1920's, 1930 and 1931. From 1932 to 1941 fires were allowed to burn without interference. Additional important fires are reported for 1942 and 1952. Currently, although fire suppression is a priority, parts of the swamp burn almost every year. In times of drought, ground fires still become established in the peat and despite great human effort, natural precipitation often plays the decisive role in suppressing them.

The historical impact of fire has likely been exacerbated by lumbering and ditch building activities. Prior to the 1760's most lumbering activities appear to have been small scale, individual efforts on the edges of the swamp. However, beginning in the 1760's logging efforts became more organized and roads and ditches were constructed to facilitate access and removal of forest products (Stewart, 1981).

Since the first five mile ditch was constructed at some time prior to 1772 (Berkeley and Berkeley, 1976), approximately 120 miles of ditches have been dug. These ditches have almost obliterated all the natural streams within the Great Dismal (U.S. Dept. of the Interior, 1979). Although some ditches date from the 18th and 19th centuries, the majority of the ditches were constructed during the 20th century. The impact of these ditches has been to accelerate the successional process, by drying the peat and increasing the risk of fire.

Most descriptions of the Dismal Swamp's vegetation are floristic listings and qualitative descriptions of community-types. Kearney (1901) distinguished two hydrophilic forest formations: Dark Swamp and Light Swamp. The former was described as dense deciduous virgin forest and the latter as almost pure stands of Atlantic white cedar (*Chamaecyparis thyoides*). Meanley (1968) reported the following "major" plant communities: "Cypress-Tupelo Gum, Swamp Black Gum, Mixed Swamp (Red Maple -Swamp Black Gum or Tupelo Gum), Pocosin or Evergreen Shrub Bog, Atlantic White Cedar, Switch Cane, and Upland Border (oaks, ashes, elms,loblolly pine and others)." Dean (1969) identified gum swamps along natural drainage composed of "... small maples, bays, cypress ... larger ones may contain great hollow snags of cypress, gum, water oak and associated species." He also describes a pine zone of loblolly and pond pine (*P. serotina*) along ditch and canal banks; "lights" composed of reeds and water grass; and white cedar stands on acidic peat overlying a sandy subsoil.

In 1972 the first quantitative vegetative studies of the Dismal Swamp's forests were begun (Levy and Walker, 1979). Fourteen forested sites (all located in Virginia) were selected through the use of series DFU/1963 and DGF/1970 black and white aerial photographs. After extensive ground truthing and sampling of the 14 stands, they concluded that they had adequately represented the Virginia portion of the swamp. Subsequently it was learned that a cypress (*Taxodium disticum*) dominated community type had been overlooked. To date no quantitative vegetation studies have been made in the pocosin, bog or marsh communities.

Among the types included in their study, Levy and Walker (1979) concluded that the prevalent community of peat soils was dominated by red maple (*Acer rubrum*) and black gum (*Nyssa sylvatica*) with only a few additional tree species. This community appears to have been established on logged over Atlantic white cedar stands. Stewart's (1981) report of commercial shipments of cedar shingles and staves and reports of fires suggests that the extensive cedar stands noted by Byrd in 1728 were cut between 1730 and 1836. A switch to cypress logging in the 1850's is evident from commercial records. After the Civil War, new stands of cedar, likely established as a result of fires which followed the logging, are noted. The period from 1868 -1910 was a time of renewed cedar cutting.

From 1900-1910 the Richmond Cedar Works company extensively cut the eastern side of the Dismal Swamp and in the 1920's the Camp corporation started to log off the western portion including the last virgin tract in 1937 (Dean, 1979). It is likely that it was these later cedar cuttings, coupled with fire and draining caused by ditch construction, that provided the environment for the red maple - black gum community described by Levy and Walker (1979).

Levy and Walker (1979) found mixed swamps to generally occur on mineral soils. These communities have lower densities of red maple and black gum and a greater species richness than the community of peaty substrates (a mean of 8.80 tree species compared to 6.12). Ash (*Fraxinus spp.*) species had higher importance values in wetter areas, and sweet gum (*Liquidambar styraciflua*) and loblolly pine (*Pinus taeda*) grow on relatively drier sites. The latter sites usually had a low species richness (a mean of 4.0). Their study of the understory composition of these stands led Levy and Walker (1979) to conclude that the future forests would be generally more uniform and that the vegetation would be a continuum with red maple

important throughout, ash more important in wetter portions, sweet gum important in areas which are a little drier, and holly (*Ilex opaca*) and red bay (*Persea borbonia*) more important in those areas that fluctuated seasonally between wet and dry conditions.

Dabel and Day (1977) studied four forest communities in the Dismal Swamp, including three stands sampled in Levy and Walker's (1979) study. Their fourth type was a cypress dominated stand, the forest type Levy and Walker previously overlooked. This stand had an overstory which included 8 species. Cypress comprised 46.7% of the relative dominance and 18.6% of the relative density. Green ash (*F. caroliniana*) had the second highest relative density (20.5%) but the second lowest relative dominance (3.5%). Other species included red maple, black gum, water gum (*Nyssa aquatica*), sweet gum, beech (*Fagus grandifolia*) and laurel oak (*Q. laurifolia*).

Messmore (1975) utilized satellite data from Landsat I and the LARS data processing system to map the Dismal Swamp's vegetation. Unfortunately the low resolution of this system allowed only the most general delimitation of vegetation types.

Gammon and Carter (1979) produced a Great Dismal Swamp vegetative Cover Map (Carter and Gammon, 1976). Utilizing color IR photography they delimited 10 canopy classes, 3 understory classes and 3 altered vegetation classes. Of the canopy classes Pine, Atlantic white cedar and Cypress constituted individual species units. The remaining classes were delimited by two or more frequently associated species. Red maple, which occurs throughout the Swamp under all moisture conditions, dominated 1 class, co-dominated a second and was a sub-dominant in all other classes.

It was estimated by planimetry that a gum-cypress community (including water and swamp black gum) covers about 5100 ha mostly in the western portion on sites covered by standing water during the winter months. Hydric Hardwoods (red maple, swamp black gum and ash) occupy about 23,800 ha, and Mesic Hardwoods about 240 ha in areas near the Suffolk Scarp and on a series of low sandy ridges which occur across the southern portion of the Swamp (North Carolina). This latter community includes beech, various oaks, sweet gum, yellow poplar (*Liriodendron tulipifera*), pine and sourwood (*Oxydendrum arboreum*).

A pine community covers about 8,000 ha in the northern and southeastern sections. Loblolly pine tends to occur on drier sites while pond pine is more prevalent on wetter ones. A 160 ha Evergreen Shrub Bog community, composed principally of inkberry (*I. glabra*) with other *Ilex* species and bays (*Persea borbonia* and *Magnolia virginiana*), forms a matrix for scattered red maples, pond pines and Atlantic white cedars.

In the northeastern portion an Atlantic White Cedar community occurs as solid blocks of "single" age stands and as an important component of more diverse composition. However the greatest coverage of Atlantic White Cedar occurs south of Lake Drummond, with the largest stands confined to North Carolina. For the Swamp as a whole about 2800 ha are dominated by Atlantic White Cedar.

Prior to 1955 (just south of the Virginia line) a 120 ha remnant marsh community existed. Since then ditching has reduced water levels and all but about 12 ha is covered by a young red maple stand (U.S. Dept. of the Interior, 1979).

The vegetation of the Great Dismal Swamp continues to change, and the rate of change has accelerated as we approach the 21st century. Beginning about 12,000 B.P. Native Americans begin to have impact on the swamp. By the woodland period (ca. 1,000 B.P.), their fires, cutting and agricultural activities began to make recognizable impacts on the Great Dismal (Bottoms and Painter, 1979).

Early European colonists accelerated the destruction of the virgin swamp. By the 20th century, areas in the swamp had been logged two or three times and perhaps most important, ditch and road construction may have irreversibly altered the swamp's hydrographic regime. The "Green Sea" first mentioned by Byrd in 1728 (Byrd, 1958) had become only a label on the 1977 topographic map of the City of Chesapeake. Much of this once vast reed-dominated community now only exists under the canopy of periodically flooded, upland, hardwood swamps. Other portions are covered by shopping centers and subdivisions.

The "mysterious lights" described by Dean (1969) have changed to red maple - swamp black gum forests. Gone are the forests of giant cypress trees; only their scattered stumps can be seen today. The extensive stands of Atlantic white cedar which once supplied millions of shingles to the market places of a growing American economy have been reduced to scattered remnant stands.

The Great Dismal Swamp National Wildlife Refuge, exists today as a product of the conservation activism of the 1970's . We may no longer have to be concerned that any of the numerous get rich quick schemes that have been proposed since Byrd first recommended that the, "horrible desert" which was ". . . a blot on His Majesty's Kingdom.", be drained (Byrd, 1958), will be brought to fruition. With careful management, some day our grandchildren may be able to experience some aspects of what George Washington described in his letters to Light Horse Harry Lee (Fitzpatrick, 1925) as "a paradise".

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