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Autor: Lane, David M.
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Ecology of the Coastal Plain *Sphagnum* of North Carolina

by

David M. LANE

There are some twenty or so species of *Sphagnum* in the Coastal Plain region of North Carolina. Counting varieties the total number of taxa may reach twenty-five. Though these taxa were illustrated and discussed briefly by BLOMQUIST (1938) following the taxonomy of ANDREWS (1913), little information is available about the ecological relationships of Coastal Plain *Sphagnum*. This is in sharp contrast to the extensive information available on *Sphagnum* ecology in the once glaciated areas of North America, Europe, and Asia.

For further references on *Sphagnum* ecology, see the section on *Sphagnum* in CRUM (1976). Peatland ecology in general is reviewed by MOORE and BELLAMY (1974), and the chapter on classification of muskeg and the glossaries by STANEK in RADFORTH and BRAUNER (1977) are also helpful. It should be noted that the term "pocosin" which refers to certain unique vegetational features of the Coastal Plain is included in STANEK's glossary as an internationally recognized term.

It is the intent of this introductory paper to describe briefly the Coastal Plain habitats in which *Sphagnum* occurs and the geographic affinities of the species present. In addition the interspecific ecological relationships are summarized in an overall diagram which is then discussed in some detail. Also indicated are promising areas for future study.

For the most part *Sphagnum* does not occur in such habitats as pine flat woods, oak-hickory-pine forest, wire-grass sandhills, or any seaside habitats inclu-

ding maritime forest and salt marshes. One species, *S. lescurii*, can occur in freshwater marshes and in wet parts of bottomland hardwoods and is joined occasionally by *S. imbricatum*. *Sphagnum* is common in certain swamps especially non-riverine cypress and gum swamps which may include Atlantic White Cedar (*Chamaecyparis thyoides*) as well. *Sphagnum* forms a significant portion of wet evergreen shrub bogs, or pocosins, and grass-sedge bogs also known as savannahs. *Sphagnum* is generally not found in inland or freshwater marshes and curiously is almost never found in association with cattails (*Thypha latifolia* and *T. angustifolia*).

Much of the Coastal Plain is under cultivation or is managed as pine plantations for the paper industry. Of course, *Sphagnum* rarely grows in these areas. Yet in certain artificial habitats such as roadside ditches or powerline right-of-ways through pocosins especially, *Sphagnum* may be abundant. Although these habitats do facilitate collecting, the fact that much of the land has been disturbed makes the determination of the original vegetational relationships quite difficult.

One frequent natural disturbance in savannahs in particular is fire. Dry *Sphagnum* burns quite readily and completely. Wet *Sphagnum* clumps just after a fire often appear white or even bluish-gray or sometimes mottled white and green. The color change may be confined to the surface of a mound and is apparently due to a loss of pigmentation which may be due to bleaching by high temperatures or ash chemicals. One species, *S. strictum*, like the moss *Funaria* and the liverwort *Marchantia*, seems to be very abundant for a few years following a fire.

Several species of *Sphagnum* are restricted almost entirely to the Atlantic Coastal Plain of eastern North America. These include *S. bartlettianum*, *S. cyclophyllum*, *S. fitzgeraldii*, *S. macrophyllum*, *S. portoricense*, *S. torreyanum*, and *S. trinitense*. *Sphagnum perichaetiale* is more widespread in the tropics and ranges up the coast to about New Jersey, extending slightly into the Piedmont. The remaining species range to the mountains or tend to be more widespread to the north. *Sphagnum papillosum* is exceptional in its disjunct distribution from New Jersey, New York, and Pennsylvania to the Coastal Plain of North and South Carolina where it reaches its outermost extension.

The relationships among the species of *Sphagnum*, Coastal Plain habitats, and local and regional ecological gradients are tentatively summarized in figure 1.

A list of species known to occur in the Coastal Plain is also given, following the taxonomy of ANDRUS (1974), for further discussion see LANE (1979). Species are arranged under habitats in a sequence from species found in standing water to species found on nearly dry substrates. Species such as *S. portoricense* that tend to grow at the water's edge only partially submerged are preceded and followed by asterisks. Species that typically occur in the ecotone (natural or artificial) between habitats are placed adjacent to the double brackets. The best example is *S. fitzgeraldii*. The habitat substrate and the pattern of seasonal high and low water table are indicated to one side.

Specifically, the habitat labelled "young swamp" refers to a single instance of an old artificial lake bed in Richmond Co. that now supports Atlantic White Cedar, cypress, sedges, and other aquatic vascular plants. Two species of *Sphagnum*, *S. torreyanum* and *S. papillosum*, which reach their southern limit in the Coastal Plain of North and South Carolina are present there along with a few other species. Recently however, several beaver dams have flooded the area so its continued existence is uncertain.

Swamps of the Coastal Plain usually contain some mixture of dominant tree species including cypress (*Taxodium distichum* and *T. ascendens*), gum (*Nyssa sylvatica* and *N. aquatica*), and Atlantic White Cedar. On the shore of bay lakes, where cypress may dominate, the bizarre "wave form" of *Sphagnum macrophyllum* var. *floridanum* occurs on submerged pieces of branches and roots. More typical looking plants of both this and the typical variety (var. *macrophyllum*) occur floating in deep pools in completely vegetated cypress swamps. Swamps along creeks dominated by various gums provide perhaps a more shaded habitat for *S. recurvum* and *S. palustre* which are found there on moist banks. The common aquatic species *S. cuspidatum* and *S. trinitense* grow in shallow pools, while the emergent species *S. portoricense* is found at the pool margins. The nearly ubiquitous *S. lescurei* can occur submerged, partially exposed, or fully exposed and often exhibits variation in color from dark reddish brown to light orange to pale green. The rather uncommon species, *S. molle*, may form small clumps on soil at the margins of pools. Swamps dominated by Atlantic White Cedar have not been thoroughly investigated due to their extreme scarcity and impenetrable nature.

Pocosins are quite variable as to both the dominant shrub species and individual site conditions. Two extremes may be recognized: high pocosins and low pocosins. So-called high pocosins with physically higher vegetation can form large wet expanses such as the Green Swamp in Brunswick Co., North Carolina and may even grade into cypress swamps. Besides the usual aquatic and emergent species, members of the *Sphagnum* section of the genus, such as *S. perichaetiale*, *S. imbricatum*, *S. henryense*, and *S. magellanicum* may form medium-sized mounds. *Sphagnum perichaetiale* itself is quite variable in both gross morphology, and habitat and can occur submerged in muck filled pools as well as on sandy soil in more exposed situations. So-called low pocosins, characterized by low seemingly depauperate vegetation, can be found near the center of pocosin filled Carolina Bays in the vicinity of Bladen Co. and elsewhere. The sequence of species from *S. cuspidatum* to *S. magellanicum* to *S. bartlettianum*, which can form moderate hummocks in such areas, is reminiscent of the hummock-hollow complexes in certain bogs of northern Michigan (VITT, CRUM, and SNIDER 1975). *Sphagnum bartlettianum* is related to *S. tenerum* which tends to occur on drier sandier substrates such as the margin of the sand rim around most Carolina Bays. This is an example of the potential ecological separation of closely related taxa that would be a fruitful area for further study.

The habitat with the most unusual assemblage of species of *Sphagnum* is the savannah. Savannahs also vary from a wet extreme bordering high pocosins to drier sandier situations where long leaf pine (*Pinus palustris*) and wiregrass (*Aristida*) may predominate. In wet savannahs are found the rare and unusual species *S. cyclophyllum* and *S. fitzgeraldii*. Savannah species such as these seem to grow mostly in the winter months during the short period when the water table is high. In fact, *S. fitzgeraldii*, one of the rarest species in North America, which grows in water-filled depressions in the ecotone between savannahs and pocosins, seems to produce mature capsules in early spring as much as several months before other species. *Sphagnum cyclophyllum*, a species remarkable for its lack of fasciculate branches and simple monopodial growth, tends to occur on wet mineral soil. In drier situations, the compact clumps of *S. perichaetiale*, *S. tenerum*, *S. strictum*, *S. compactum*, and even *S. molle* may be found.

Finally, the "sandhills region" of Harnett, Moore, Hoke, Richmond, and Scot-

land Counties in an area of higher relief between the low flat Pocosin Plain and the rolling Piedmont with a high diversity of *Sphagnum* species in narrow strips of vegetation between the sand ridges. Aquatic species are found in slow-moving creeks or those flooded by roadways. Gum swamp species are found along vegetated creeks. A few other species may inhabit narrow pocosin-like areas of low shrubs along the creek banks; and where the xeric sandhill vegetation extends over the moist sandy soil a few meters from the creek, several savannah species may occur. All of the Coastal Plain species of *Sphagnum* except *S. fitzgeraldii* may be found within a short distance of each other in the sandhills region.

Much of this information is based on extensive observation and collecting in the field that needs to be confirmed by further study. There are many opportunities for future research including the effects of fire, the seasonal growth period, chemistry of the substrate, and species establishment and maintenance in disturbed areas. Data relating species presence to water level, substrate pH, and specific conductivity are currently being analyzed by the author and a coworker (Stephanie DUBOIS). Whether Coastal Plain species of *Sphagnum* follow the ecological patterns described for more northern areas of North America (VITT, CRUM, and SNIDER 1975; VITT, ACUFF, and ANDRUS 1975) will only be determined after further investigation. The results of such studies will help place the unique habitats of the Coastal Plain into the spectrum of bogs, fens and mires recognized in Europe.

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Summary

The approximately twenty species of *Sphagnum* in the Coastal Plain region of North Carolina show definite patterns of habitat preference and relative position along local moisture gradients. Although some species are found in many habitats (*S. lescurii*), others are restricted to a single habitat (*S. cyclophyllum*), or specialized set of conditions (*S. fitzgeraldii*). Some species are strictly aquatic (*S. macrophyllum* for example), or emergent (*S. portoricensense*), while others are more variable in this respect (*S. perichaetiale*). Nearly all of the species can be found in close proximity in the sandhills region.

Zusammenfassung

Die ungefähr 20 *Sphagnum*-Arten im Gebiet der Küstenebene (Coastal Plain) von North Carolina zeigen ein ausgeprägtes Muster in ihren Standortsansprüchen und in ihrer Stellung zueinander längs lokaler Feuchtigkeitsgradienten. Einige Arten kommen an vielen Standorten vor (z.B. *S. lescurii*), andere sind indessen auf ein einziges Biotop beschränkt (z.B. *S. cyclophyllum*) oder auf ganz bestimmte Bedingungen spezialisiert (z.B. *S. fitzgeraldii*). Streng unter Wasser lebende Arten (z.B. *S. macrophyllum*) stehen solchen gegenüber, die stets über dem Wasserspiegel leben (z.B. *S. portoricense*); wieder andere stellen in dieser Hinsicht weniger enge Ansprüche (z.B. *S. perichaetiale*). Fast alle Arten können in nächster Nähe der Gegend der Sandhügel angetroffen werden.

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Address of the author: David M. LANE
University of Michigan Herbarium
North University Building
Ann Arbor, Mi 48109, U.S.A..