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Soil-Tree Growth Relationships in an Upper Coastal Plain Swamp

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A STUDY WAS MADE in a mature mixed-water tupelo and swamp tupelo (*Nyssa aquatica* L. and *N. sylvatica* var. *biflora* (Walt) Sarg.) stand to determine the variation in certain soil and stand characteristics within a 40.5 hectare (100 acre) swamp. Sixty, 405 square-meter (one tenth acre) plots were used to sample soil and stand parameters. Particle size distribution, pH, oxidizable matter, total N, and extractable P, K, Ca, Mg, Mn, Fe, Zn, and Cu were sampled at two soil levels, 0 to 15 cm and 61 to 122 cm. A soil profile was made on each plot to a depth of 122 cm. Carbon dioxide content of soil water was sampled within the 0 to 15 cm soil depth and water table level was measured on each plot on six separate occasions during the growing season. Stand characteristics sampled were basal area, mean annual growth, cubic foot volume, board foot volume, site index, and height of dominant and codominant trees. Tests for interrelationships among soil and stand parameters were made by multiple regression analyses.

Soil profiles from each plot showed that two distinct soil groups could be delineated within the swamp, based on the color of the soil in the 61 to 122 cm depth. Analyses for oxidizable matter revealed that one group of soils had less than 9 percent oxidizable matter as compared to more than 22 percent oxidizable matter for the other group.

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The soils were strongly acid, varying from pH 3.8 to 5.0. Based on nutrient analyses of both soil horizons, the level of major elements was lower and minor elements higher than expected. The range in ppm was wide for all elements; P, 4-68; K, 13-110; Ca, 67-850; Mg, 34-314; Mn, 4-148; Zn, 2-35; Fe, 73-1110; and Cu, trace. Total nitrogen ranged from 0.00 percent to 1.27 percent. The water table averaged 14 cm above soil surface and ranged from 0 cm to 24.3 cm. Carbon dioxide concentration in the soil ranged from 2 percent to 21 percent of the partial pressure.

Ranges for stand variables were: Height of dominant and co-dominant trees, 16.4-28.3 meters (54-93 feet); site index, 17.3-27.2 meters (57-89 feet) for 50 years; basal area, 6.5-28.8 sq. meters (70-310 square feet); mean annual growth, 0.08-0.35 cu. meters (2.9-12.5 cubic feet); cubic meter volume above 12.7 cm dbh, 5.2-34.7 (cubic foot volume above 5" dbh, 184-1,222); merchantable cubic meter volume above 30 cm dbh, 0-9.9 (board foot volume above 12" dbh, 0-4,211).

Regression analysis by soil group, i.e., difference in oxidizable matter in the 61 to 122 cm soil depth, as compared to nongrouping of the soils resulted in shifting the emphasis from chemical properties to a combination of chemical and physical properties and water table conditions.

Most of the variation in stand conditions within the swamp was accounted for by reciprocal of age and stand density. Interrelationships between stand characteristics varied widely, depending on the stand variable used; that is, interrelationships between stand and site characteristics were not constant from one dependent variable to another. This points out the fallacy of using a single stand variable to evaluate site characteristics.

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SILVICULTURE have considered established types, yet in many cases synonymous.

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R. Zahner
University of Michigan