Importance of Water

Hydroperiod is the length of time that water stands at or above the surface of the ground. It is very important in determining the diversity and productivity of a swamp. When water stands for a long time, oxygen disappears from the soil, forms of manganese, iron, and sulfur that are toxic to many plants accumulate, and much of the available nitrogen escapes to the atmosphere. Fewer and fewer plants are able to exist as flooding persists. Therefore, plant diversity serves as a rough index to hydroperiod. Cypress swamps have hydroperiods of 6 to 9 months. Cypress trees are among the most flood-tolerant of all swamp trees. Once established, they can withstand year-long hydroperiods indefinitely, although depth of flooding may limit survival. However, because germination will not occur if water is standing, the trees cannot regenerate in permanently flooded areas.

Moving water, on the other hand, brings in oxygen and nutrients, increasing both productivity and diversity (Fig. 2). River swamps that flood for only a short time once or twice a year thus have a very diverse flora, whereas backswamps and sloughs, where trapped water remains for weeks or months after floodwaters subside, are often characterized by pure stands of cypress.

Pondcypress trees lose relatively little water through evapotranspiration, which is the loss of water in transpiration from the leaves plus evaporation from the water or soil surface. Both pondcypress and baldcypress trees are deciduous, so there is no transpiration during the winter. Evaporation from cypress ponds is very low at this time of year (Mitsch, 1984). From April through October, when cypress trees are in leaf, evapotranspiration rates in pondcypress domes are 60% to 80% of pan evaporation rates, which estimate maximum water loss due to evaporation and transpiration (Heimburg, 1984) and 77% of estimated evapotranspiration from slash pine plantations (Ewel, 1984). Evapotranspiration from baldcypress trees is probably not as low (Brown, 1981).

Fire

Fire frequency appears to differ significantly between pondcypress and baldcypress swamps. Pondcypress swamps occasionally burn during droughts. When protected from fire, they tend to develop into mixed-hardwood swamps or bayheads (Monk, 1968; Duever et al., 1986; Gunderson, 1984; Hamilton, 1984). Fires reduce the number of species and the relative importance of broadleaf species, thereby maintaining cypress dominance in these swamps (Ewel and Mitsch, 1978; Schlesinger, 1978). The thicker, shaggier bark of

Fig. 2. Cypress tree growing along the Apalachicola River. Note the silt-laden water, which brings nutrients to the swamp during flooding, and the cypress knees at the water's edge.

pondcypress trees may represent an adaptation to a greater frequency of fire than occurs in baldcypress swamps.

Fire seldom kills mature cypress trees, although severe fires may reduce tree vigor for several decades (Duever et al., 1986). A fire in a pondcypress dome in north central Florida killed more than 95% of the pines and hardwoods but only 18% of the cypress (Fig. 3) (Ewel and Mitsch, 1978). Even if a fire kills the aboveground portion of the tree, the root system may survive if the fire does not penetrate the peat layer, and the tree may grow back from sprouts. Much of the pondcypress regrowth after major fires in 1954 and 1955 in the Okefenokee Swamp was probably from stump sprouts (Cypert, 1972). Duever and Riopelle (1984) found that fires in the Okefenokee Swamp are often followed by the development of even-aged cypress stands.

The natural frequency of fires in unaltered cypress swamps is probably inversely related to hydroperiod