

Water Management

Cypress swamps play a complex role in regional water budgets. Like most freshwater wetlands, they are important in flood protection, although different kinds of swamps accomplish this in different ways. River swamps slow the velocity of water during flooding, damping the severity of flooding downstream and removing some of the silt from floodwaters. Isolated wetlands are more subtle in their effects, storing runoff before it reaches lakes and streams. During dry periods, slow evapotranspiration from pondcypress swamps allows more infiltration of surface water into groundwater (Heimburg, 1984). This pattern of storage during times of water abundance and release during times of water shortage alleviates the effects of uneven distribution of rainfall over the year in areas with abundant wetlands (Littlejohn, 1977).

The Green Swamp is a 223,400-hectare (550,000-acre) region in west-central Florida where wetlands occupy roughly 30% of the surface area. About two-thirds of the wetlands, or 45,500 hectares (112,000 acres), are cypress domes and strands. A regional water budget showed that the infiltration rate of water from wetlands to the surface aquifer was roughly three times the rate of infiltration from upland areas (Brown, 1984). Simulating drainage of wetlands showed that the level of the surface aquifer progressively declined as the proportion of drained wetlands increased; draining 80% of the area's wetlands caused a 45% reduction in the amount of water available to the area.

Cypress strands and domes have also been used for disposal of wastewater that has undergone secondary treatment (Fig. 9). Such systems can remove more than 90% of the organic matter, nutrients, and minerals



Fig. 9. A north Florida cypress pond being used for advanced wastewater treatment.

from wastewaters before they reach groundwater (Dierberg and Brezonik, 1984). Major changes observed in swamps receiving treated effluent are the development and persistence of a continuous cover of duckweed (*Lemna* spp., *Spirodela* spp., and *Azolla carolinensis*) (Ewel, 1984), development of anoxia in the water (Dierberg and Brezonik, 1984), and an increase in passerine bird populations together with elimination of amphibian reproduction (Harris and Vickers, 1984).

Significant increases in growth rates have been measured in pondcypress trees growing in swamps receiving treated effluent. The basal area increment (bai) per tree of pondcypress in a north Florida strand that had been receiving wastewater for 41 years was twice the bai of trees in a nearby dome that did not receive effluent (Nessel et al., 1982). Similar results were obtained in two north Florida pondcypress domes, one that had received secondary effluent for a short time and one that had received runoff from fertilized farmlands and feed pens (Brown, 1981). However, addition of raw sewage and primary wastewater depressed pondcypress growth rates in parts of another north Florida strand, apparently due to the development of severe reducing conditions (Lemlich and Ewel, 1984).

Although regeneration in such swamps may occur during a scheduled drydown or even during a summer drought, planting seedlings is probably necessary for long-term ecosystem maintenance. Pondcypress seedlings planted in a cypress dome receiving secondary wastewater grew faster than those in a control dome, but mortality rates were higher; baldcypress seedlings in the sewage dome grew more slowly and had a higher mortality rate than those in the control, possibly because baldcypress is not as well adapted to low oxygen concentrations (Deghi, 1984).

Management of Cypress Swamps

It is clear that cypress swamps play a variety of roles in meeting society's needs. Without any explicit management, they provide habitat for wildlife and reduce flood peaks and groundwater fluctuations. At the same time, they can be used to treat wastewater and to provide a variety of wood products. The fact that cypress swamps still represent a large proportion of wetlands in the southeastern United States suggests that early logging activities were not entirely destructive and that cypress swamps can recover from at least some degree of logging.

Demands for all the services that swamps can supply are increasing, and the greater facility of modern logging vehicles for maneuvering in swamps has increased the potential for damage to both remain-