

ing trees and soil. Consequently, all the potential uses of a cypress swamp must be carefully considered when management strategies are formulated. The recommendations we make are based on the information that we have summarized above. Considerably more research is necessary, however, into the full scope of implications that arise from management decisions.

## Silviculture

The major consideration in logging is regeneration. Although there is disagreement about the likelihood of natural regeneration after timber harvest, it is clear that a seed source must be left on or adjacent to a site, that severe fires following harvest can prevent regeneration, and that profound changes in hydroperiod, water levels, soil aeration, and understory vegetation can hinder seed germination and seedling survival. Given the precise sequence of water levels needed for seed soaking, seed germination, and seedling establishment, it is unlikely that regeneration from seeds deposited before harvesting will occur immediately after harvest.

Regeneration via coppice appears dependable, but it is not well understood. If sprouting is desired, trees should be cut so that the tops of the stumps are above the mean high water level, although sprouting appears to decrease if stumps are too high. Optimum tree age and season of cutting, vulnerability of trees grown from coppice to windthrow and disease (particularly peckiness), and the quality of timber produced by sprouts must be ascertained before dependence on coppice for cypress regeneration can be recommended for sustained-yield timber production. One advantage of successful reproduction by coppice may be early production of seeds from the sprouts.

Although an economic analysis of the profitability of planting cypress is beyond the scope of this paper, it seems safe to say that hastening (or ensuring) the establishment of a new cypress stand by planting might be advisable to derive the best returns from forest land. Seedlings should be tall enough to escape inundation after outplanting; 1-year-old seedlings may be adequate for smaller, shallower swamps. Cattle should be excluded from regenerating areas. Where nutria and rabbits are abundant, planting is risky, and trapping and/or application of repellents may be necessary.

Clearcutting is attractive because it requires less labor (selection of seed trees is not required) and only one cut is necessary during each rotation (no second cut is needed to remove seed trees). If an isolated swamp, such as a cypress dome, is to be harvested, then seed trees must be left or coppice production must be

dependable. If a larger swamp is to be cut, a viable alternative might be to harvest in small blocks to ensure good seed distribution from trees on the edges of the clearcuts.

The traditional seed-tree system, in which seed trees are left scattered throughout a large cutover area, risks damage to seed trees during the initial harvest and to the new stand when the seed trees are harvested. The latter risk can be eliminated if seed trees are not removed, making this technique a practical alternative. In mixed swamps where cypress regeneration is desired, cypress should not be selectively cut, because cypress seedlings and saplings are likely to be outcompeted by more shade-tolerant hardwoods. Cypress and many desirable shade-intolerant hardwoods are more likely to regenerate in such forests if small blocks are clearcut.

With a system of clearcutting small blocks (Fig. 10), the distinction between clearcutting and seed-tree cutting becomes blurred. Such a system will preserve a source of seed and maximize the amount of light reaching the floor of the swamp. Controlling the growth of understory vegetation may still be necessary to ensure cypress regeneration.

The question of thinning is difficult to address, because there has not been sufficient research to demonstrate its effectiveness. Thinning baldcypress stands increases the growth of remaining trees, but not significantly. Economic feasibility and potential for damaging the remaining trees during thinning operations are the major considerations in deciding whether thinning is advantageous.

In large stands of high-quality timber where it is economically feasible, the May Brothers' system of



Fig. 10. A north Florida swamp being cut gradually by harvesting only 16 hectares (40 acres) at a time.