PHOSPHATE LAND RECLAIMED

by David J. Robertson

Approximately 6000 acres of phosphate mineralized land are mined annually in Florida, all of which must be reclaimed. In addition, the state's Non-Mandatory Land Reclamation Trust Fund is making funds available to reclaim the nearly 90,000 acres of land that were mined before July 1, 1975, the date reclamation was required by law. Since its creation in 1978, the Florida Institute of Phosphate Research (FIPR) reclamation research program has been working to enhance the economic and productive value of reclaimed land, to encourage the reestablishment of diverse natural ecosystems, and to integrate the functions of both wherever feasible. The majority of the reclamation research currently supported by FIPR is directed toward redeveloping native plant communities on mined land.

Most phosphate-mined land that was voluntarily reclaimed before 1975 was rehabilitated for commercial purposes. Mined land reclaimed with overburden and sand tailings is very stable, and the presence of numerous small lakes increases its value. Many of the older mines are now the sites of prime commercial and residential developments in Polk County.

However, unlike the relatively standard and straightforward earth-moving and recontouring that must be done to prepare mined land for construction, the reclamation of natural communities is still in its developmental stages. Reclamation professionals historically have emphasized techniques for enhancing the survival of plants in wetlands and upland forests, and most of the reclamation research sponsored by FIPR has likewise been concentrated on refining technology currently in practice. Within the past year, though, there has been increasing interest in integrating the knowledge and experience gained during the last ten years or so to begin to redevelop complete, functional ecosystems composed of the variety of plant communities that occupied the area prior to mining.

WETLANDS

The Rules of the Florida Department of Natural Resources dealing with phosphate mine reclamation (Chapter 16C-16) state that "wetlands which are affected by mining operations shall be restored to at least premining surface areas." In other words, wetlands must be replaced on an acre-for-acre basis. Approximately 15% of the phosphate resources in the Bone Valley district of Polk and eastern Hillsborough and Manatee counties are overlain by wetlands, and the percentage increases on reserve lands that will be mined in the future in the Southern Extension, an area encompassing Hardee and northern Desoto counties. In order to responsibly extract the phosphate resources, demonstrations of successful wetland reclamation are critically important.

Among the first wetland reclamation projects to receive FIPR support was a study recently completed by Dr. Howard T. Odum, Dr. G. Ronnie Best, and several graduate researchers at the University of Florida's Center for Wetlands. The study took several approaches to investigating "Interactions Between the Phosphate Industry and Wetlands." Graduate researcher Michael Miller compared the organization of floodplain forests on relatively undisturbed water bodies with those in areas that have been influenced by the phosphate industry through modified surface and groundwater regimes, phosphatic clay ("slimes") spills, channelization, and alterations in water chemistry. He compared the growth rate of cypress, *Taxodium distichum* and *T. ascendens*, growing on streambanks and lakeshores with that of trees growing on the floodplain at 16 sites in central and north Florida. Miller found that growth on the sites influenced by mining generally was similar to that on undisturbed sites of similar type. However, the study did detect differences that warrant additional research. When Miller expanded his research to examine the age structure of all of the tree species making up the floodplain communities, the data revealed that the dominant native tree species are all approximately of the same age, with very little recruitment of young individuals of any species. Whether such an "even-aged" mode of growth is the natural one for Florida wetlands or whether the present wetlands are even-aged because of past episodes of lumbering or fire is not yet evident. However, forested wetlands established on reclaimed land with all trees planted at the same time will be remarkably similar to undisturbed wetlands with regard to the even-age distribution of the dominant trees.

Studies of case histories of natural succession on clay settling areas ("slime" ponds) by Betty Rushton, a second graduate researcher, identified a few sites in which forested wetland development was proceeding at a pace comparable to that which occurs on disturbed areas that have not been mined. In some settling areas with long hydroperiods, natural succession proceeded very rapidly to a stage dominated by willow, *Salix caroliniana*, but any further succession toward a mature diverse swamp has been arrested, apparently due to a lack of adequate seeding of cypress, gum, and other species adapted to the long flooding regimes. It's interesting to note, though, that in a few cases where the accidental distribution of dikes, spoils, and clays left after mining has created sites with shorter hydroperiods adjacent to tracts of undisturbed wetland vegetation, succession has advanced beyond the willow stage and typical wetland hardwoods have become established in only 30 years.

Author David Robertson measuring the girth of trees at the Sink Branch site.

A preliminary analysis of data on seed disposal and germination by Tim McClanahan, a third graduate

continued on page 10

RECLAIMED _____ **from page 7**

researcher, showed that the large contiguous expanses of disturbed land created by current mining procedures form a barrier to seed dispersal that retards natural revegetation and succession. Formerly, when mined areas were smaller and dispersed within vegetated areas, natural seeding was better. Preliminary experiments transplanting living soil blocks from areas in stages of advanced succession to areas of early wetland succession appear to have accelerated the recovery process.

The final report on this project is currently being published and will be available for distribution in late spring. Like most good research, it helped Center for Wetlands personnel organize a second project in which concepts developed during the initial study will be tested in carefully structured field trials. The second project, "Interactions of Wetlands with Phosphate Mining," maintains the integrity of the original research group and will continue to concentrate on riparian hardwood forests, succession in clay settling areas, and seed dispersal.

The Institute of Phosphate Research has been actively involved in actual swamp and floodplain forest restoration. In 1983, FIPR awarded a grant to Dr. Mark Brown, also of the Center for Wetlands at the University of Florida, to test the efficacy of spreading organic wetland topsoil for hardwood swamp reclamation. The application of a layer of peaty "mulch" has proved to be extremely effective in introducing herbaceous aquatic vegetation into newly recontoured wetland basins in numerous marsh reclamation projects throughout the phosphate industry, but it had never been tested as an amendment for encouraging the development of hardwood swamp. Dr. Brown's proposal, "Studies of a Method of Wetland Reconstruction after Phosphate Mining," involved spreading mulch in two different configurations along the edge of a reclaimed lake at Occidental Chemical Company's Suwannee River Mine in north Florida. Unfortunately, vagaries in the weather and in water requirements for Occidental's ore processing system disrupted Dr. Brown's research and limited the amount of practical information that the project will provide. Nonetheless, such full-scale wetland reclamation research is among the Institute's highest priorities. FIPR is committed to improving the success of wetland reclamation by sponsoring a diverse array of innovative demonstration projects.

The largest forested wetland reclamation project undertaken by FIPR to date involves a co-operative agreement between the Institute and several federal Interior Department agencies. FIPR has been working with the U.S. Bureau of Mines, the U.S. Geological Survey, and the U.S. Fish and Wildlife Service on a model riparian forest reclamation project at AMAX Phosphate's Big Four Mine in Hillsborough County. The "Wetlands Reclamation Research Project," actually a combination of three separately-funded studies, is unique in that a small stream, its associated floodplain forest, and the area's subsurface hydrology were all monitored and evaluated before mining began on the 16-acre tributary to Lake Branch of the South Prong Alafia River. The U.S. Geological Survey began monitoring water levels in the surficial and artesian aquifers in 1982 in order to insure that a full year's record of groundwater data was available prior to mining. The U.S.G.S. team also installed a weir in the stream to allow them to measure discharge from the small watershed. The U.S. Bureau of Mines, working with AMAX engineers, prepared a mining and recontouring plan that will provide guidance for restructuring the subsurface strata in such a way that the infiltration and runoff characteristics of the reclaimed area will be conducive to wetland redevelopment. The U.S. Fish and Wildlife Service updated a biological survey of the site that had been conducted several years ago by AMAX, and worked with AMAX reclamation personnel to draw up a detailed experimental revegetation scheme that includes extensive trials of new reclamation techniques. The pre-disturbance data, collected before mining began in January 1984, will provide a basis for comparison when reclamation is completed in 1985.

(The remainder of this article, covering stream diversion and reclamation of uplands, will appear in the next issue of **The Palmetto**.)