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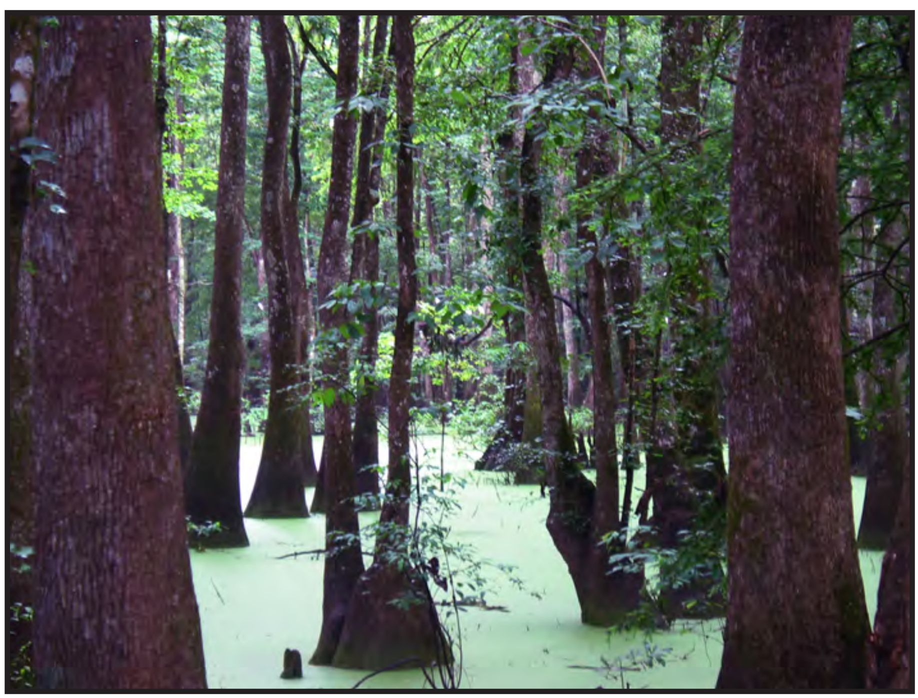
# An Evaluation of Amphibians and Fish Associated with Wetland Microtopography Projects within the White River Watershed



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Information for this publication was adapted from graduate research conducted by **Sergio Pierluissi** and **Kent Hersey** under the supervision of **Dr. Sammy King** (U.S. Geological Survey and Louisiana State University AgCenter) and **Mark Leao** under the supervision of **Dr. Ed Buckner** (University of Arkansas Pine Bluff). Funding was provided by the Natural Resources Conservation Service, Agricultural Wildlife Conservation Center (AWCC, formerly Wildlife Habitat Management Institute). AWCC Project #68-7482-2-17.

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# An Evaluation of Amphibians and Fish Associated with Wetland Microtopography Projects within the White River Watershed

## Introduction

Bottomland hardwood (BLH) forests are distributed along rivers and streams throughout the central and southern United States, with the greatest concentration in the Mississippi River Alluvial Valley (MAV). Oxbows, sloughs, and other wetlands embedded within these forests are important habitat components for a variety of fish and wildlife species. Due primarily to agriculture and flood control activities, only about 25 percent of the original 25 million acres of BLH forests in the MAV still remain. Many of the sloughs, oxbows, and other wetland features have been drained. Furthermore, much of the remaining forests are highly fragmented and hydrologically altered, thus further reducing their value as fish and wildlife habitat.

In the 1980s, fish and wildlife agencies began attempts to restore some of the wildlife habitats that were lost in the MAV (fig. 1). Initially, these efforts were local in scale, but from the 1990s to date, restoration efforts have increased dramatically as a result of the Wetlands Reserve Program (WRP). Arkansas, Louisiana, and Mississippi lead the nation in land enrolled in WRP, with the greatest concentration in the MAV. In Arkansas alone, more than 190,000 acres were enrolled in the program by the end of FY2005.

Early WRP efforts consisted of simply reforesting fields with little attention to hydrologic restoration (fig. 2); however, more recent efforts have emphasized restoring or creating microtopographic (<6 in) or macrotopographic (>6 in) features on restoration sites. These activities have resulted in the restoration and creation of oxbows, sloughs, managed moist-soil units, and other wetland features.

## University of Arkansas Pine Bluff, U.S. Geological Survey, and Louisiana State University AgCenter researchers conduct initial evaluations of new technique

Two groups of organisms that can provide an effective evaluation of the development of microtopography and macrotopography features are amphibians and fish. In this initial work, researchers specifically wanted to determine whether micro and macrotopography were effective habitat restoration strategies and, if so, what characteristics these sites should have to support diverse frog and fish communities.

Researchers sampled more than 30 wetlands in the White River Basin of Arkansas to determine the major factors related to breeding frog use of WRP restored wetlands, as well as frog use on National Wildlife Refuges and state Wildlife Management Areas. In addition, researchers sampled fish communities on five WRP tracts and one state wildlife management area, specifically, to determine whether micro- and macrotopography were effective habitat restoration strategies and, if so, what characteristics these sites should have to support diverse frog and fish communities.

**Figure 1** The goal of restoration is adding to the remaining wetlands in the Mississippi Alluvial Valley

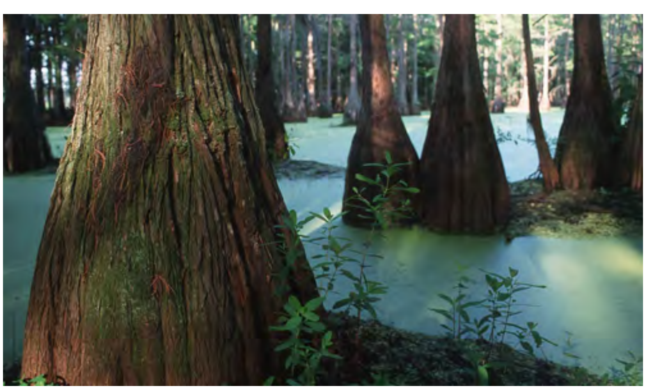

**Figure 2** Forest restoration with little attention to hydrologic restoration

## Effects of micro/macrotopography

### Amphibians

During spring, wetlands that had temporarily flooded and had greater wetland depths tended to support a higher number of species (species richness). During summer, species richness was greater for wetlands with a large amount of vegetation cover, whereas younger wetlands and wetlands with sparse vegetation cover around the wetland had lower species richness (fig. 3).

No single wetland type provided habitat for all species. For example, several species were positively associated with the more upland sites that did not receive overbank flooding, whereas another species showed a positive relationship with deeper wetlands that were temporarily or semi-permanently flooded. Results also indicate that frog species composition will likely change as these wetlands age. Some species were more common at younger wetlands, whereas others were more common at wetlands with mature forests.

### Fish

Similar to the frog data, results indicate that the species of fish present will likely change as these wetlands and their associated plant communities mature. In this study, when changes over time are examined separately by habitat type, pool habitats appeared to exhibit successional changes in species composition, whereas canal habitat fish communities remained relatively unchanged despite differences in wetland age. Canals were defined as linear, steep-sided water bodies that generally followed levees or bordered pools. Pools were defined as nonlinear in nature with a larger surface area to volume ratio. Both borrow pits and oxbows were considered pools for this study.

Findings suggested that fish communities in pool habitats of WRP-created wetlands with micro/macrotopography rapidly became rich and diverse, but fish species composition changed as wetlands aged. Fish species found to occur most commonly in the most mature wetland pools were longnose gar, cypress minnow, bigmouth buffalo, channel catfish, warmouth, and orangespotted sunfish. Canal habitats populated rapidly through time, but fish species composition remained relatively stable as evidenced by the lack of differences in fish species composition between old and new canal habitats. Fish species that were typical of canals included carp, gizzard shad, black bullhead, spotted gar, and shortnose gar.

### Waterfowl

The development of microtopography and macrotopography features has been criticized by some as being too costly and of lower value to waterfowl than moist soil impoundments because of the relative lack of control in producing annual plants. While initial costs may or may not be more expensive (site characteristics are important as to which is more expensive), over the long term, costs will actually be lower than moist soil because of the passive nature of management. Instead, micro and macrotopography, with and without water-control structures, are developed on sites to allow for both active and passive management on the vast majority of all the easements. Although micro and macrotopography sites may support fewer waterfowl per unit area, as they mature, these sites will provide habitats for many species of amphibians, secretive marsh birds, and other fish and wildlife species whose life-history requirements are not met by the early-succession habitat conditions obtained through current management practices of moist soil units (fig. 4).

**Figure 3** Creation of micro/macrotopography to benefit fish and amphibians

**Figure 4** Micro and macrotopography produce moist soil zones and habitat for secretive marsh birds, amphibians, and fish

## Recommendations

- The results of this study indicate that micro and macrotopography can be rapidly utilized by flood plain fish and amphibians.
- Management strategies designed to benefit flood plain fish and chorusing frogs can be mutually exclusive. Several species of amphibians are susceptible to fish predation, thus supporting high fish densities may exclude some species of frogs from successful reproduction.
- If amphibian diversity is the objective, a complex of wetlands of various sizes, depths, and flood lengths that support diverse wetland plant communities and are surrounded by forests or appropriate habitats should be considered. In our study, certain types of wetlands supported higher richness of frogs, but no single wetland type was good for all species. To encourage wetland vegetation development, wetlands should include shallow littoral zones with gentle slopes. For sites that are subject to manual drawdowns, the timing of drawdown should consider the timing and length of the breeding and larval period (and habitat requirements) for affected species.
- From a fisheries perspective, connectivity to the river is an important prerequisite to improve flood plain fish communities. The inclusion of deeper areas in future wetland designs will provide refuge during harsh conditions, such as extended drought periods and extreme temperatures, that lead to excessively high water temperatures and potentially lethal dissolved oxygen levels.
- The habitat potential of canals used for water manipulation can be enhanced by incorporating bank structure that follows the contour of the land, has a less extreme slope, and includes narrow riparian buffer strips along and adjacent to the bank.
- Finally, water-level management is necessary in actively managed wetlands to create soil and water conditions that are suitable for the germination and growth of desired plant species, control problem vegetation, stimulate invertebrate production, and make resources available for target species. Water-control structures should be placed where water circulation will be maximized, facilitating nutrient cycling and helping to reduce the risk of disease outbreaks.  Also, if water control structures are constructed in floodplain wetlands, an outlet to facilitate fish passage out of seasonal wetlands are warranted.