ECONOMIC ANALYSES OF WETLANDS MITIGATION PROJECTS IN THE SOUTHEASTERN U.S.

Bart Baca and Steve Florey
Coastal Science Associates, Inc.
328 Second Avenue North
Jacksonville Beach, Florida 32250

Dennis King and Curtis Bohlen
Maryland International Institute for Ecological Economics
1 Williams Street
Solomons, Maryland 20688

ABSTRACT

Economic analyses were conducted of numerous wetlands mitigation projects to determine the real costs of successful projects. The work was part of a study conducted by the Maryland International Institute for Ecological Economics. Private consultants were contacted who provided itemized cost data on their projects in spreadsheets or hard copy. The present paper is an analysis of the data relating to various wetlands within the U.S., emphasizing the southeastern U.S. Analyses included preconstruction, construction, and postconstruction costs.

As expected, there was much variation between project costs in the U.S., with a range of between $77,900 per acre and $18,000 per acre (Mean $38,275; S.D. $13,456). Freshwater wetlands were generally much more costly than saltwater wetlands, and construction costs far exceeded pre- and postconstruction costs. Complex or mixed wetlands also showed generally higher costs.

Southeastern wetland types analyzed were predominantly freshwater, but they provide accurate guidelines for the region. In the southeastern U.S., the average wetland cost $23,874 (S.D. $11,410) to construct and succeed. Land costs doubled the mitigation costs. For longer term, successful projects, the cost of maintenance was the major component of postconstruction costs.

INTRODUCTION

Thousands of wetlands mitigation projects have been constructed in the U.S. since wetlands regulations came into effect. Originally the costs of these projects was not given adequate attention during the permitting process, the applicant often agreeing to provide whatever mitigation was necessary to obtain a permit, without realizing the potential for high costs associated with the work. As a result, mitigation projects were often not begun or completed. Agencies began requiring proof of sufficient financial resources for projects, including project budgets and dedicated funding. Budgets for mitigation projects are now necessary in many states, and mitigation costs have been itemized and standardized. The analysis of these itemized budgets was the primary goal of the present research. To determine itemized costs, budgets were obtained for "successful" projects throughout the U.S., successful meaning that they had met the permitting criteria and had been in compliance for over two years. This paper contains a summary of project costs, with itemizations, for the entire U.S., and with emphasis on the southeastern states of Florida, Georgia, and South Carolina.

METHODS

A number of data bases were used to derive mitigation costs. The University of Maryland Center for Environmental and Estuarine Studies collected data in 1993 for approximately 1,000 projects; the itemized data for 90 projects were collected directly by the Center (the primary data base) and the remainder were collected by other sources. Coastal Science Associates, Inc. (CSAi) collected itemized data from about thirty projects they were responsible for in the southeastern U.S., adding those to the regional list. Projects were itemized within the categories preconstruction, construction, and postconstruction, and dollar amounts were separated into the categories labor, materials, equipment, and other. Preconstruction costs were design and permitting; construction costs were land (omitted), earthwork, and planting; and postconstruction costs were maintenance and monitoring. Cover sheets and blank budget sheets were submitted to various firms and agencies for completion of the primary data base. Databases were entered onto spreadsheets software for analysis.

Databases for eight categories of created/restored wetlands were generated, as follows:

(1) Aquatic Bed Projects, tidal or nontidal submerged plants;
(2) Complex Projects, three or more wetland types in a project;
(3) Freshwater Mixed Projects, nontidal projects with both forested and

emergent vegetation;

(4) Freshwater Forested Projects, woody vegetation (forest or shrub);
(5) Freshwater Emergent Projects, emergent (herbaceous) vegetation;
(6) Freshwater Tidal Wetlands Projects, tidally influenced, often mixed emergent/woody vegetation;
(7) Saltmarsh Projects, dominated by marine emergent vegetation; and
(8) Mangrove Projects, mangrove dominated wetlands.

Table 1. Summary of various mitigation costs and cost components for the southeastern states of Florida, Georgia and South Carolina (N=30; S.D. shown for larger date sets).

Parameter	Mean/S.D. Cost $/acre
States	
Florida	24,899/10,919
Georgia	23,200/11,467
South Carolina	20,247/12,409
Wetland Type	
Aquatic Bed	20,140
Freshwater Mixed	20,540
Freshwater Emergent	31,793
Freshwater Forested	20,696
Salt Marsh	34,145
Mangrove	16,652
Construction Phase	
Preconstruction	3,109/1,280
Construction	15,954/4,354
Postconstruction	4,932/1,608
Maintenance, by Type	
F.W. Emergent	4,654
F.W. Forested	3,021
Mixed	4,740
Plant Source Costs	
Nursery	32,857
Forestry Department	3,070
Wild Stock	28,688

Figure 1. Mitigation costs - nationwide.
(1993 data; sans land; n=90)

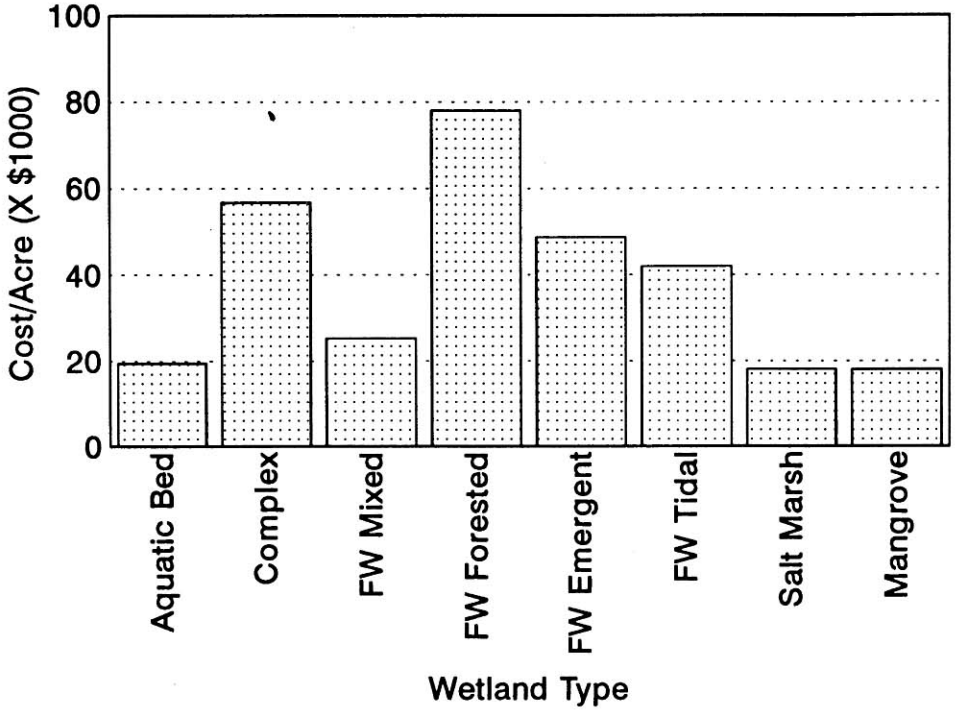
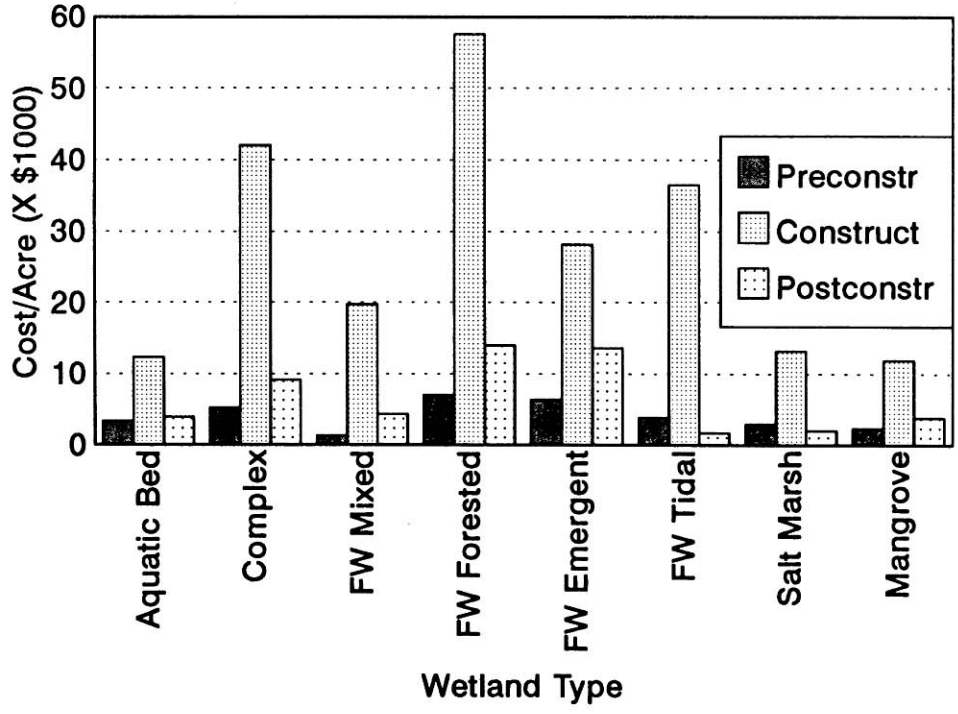


Figure 2. Project costs by phases - nationwide.
(1993 data; sans land; n=90)



RESULTS

In database evaluation, some weaknesses were seen in the inability to separate costs into categories, the differing intended functions of the created wetlands, and the use of volunteers in various projects which complicated costing. The cost of land was another complicating factor because it was lacking or inconsistent. Agricultural conversion (or reversion back to wetland), common in the midwestern U.S. but rare in the southeast, was used only to a limited extent in the nationwide analysis.

Using the primary nationwide database, without land costs, gave consistent costs for various categories (refer to King and Bohlen, 1994a, for original data). A summary of cost per acre by wetland type is depicted in Figure 1 and shows freshwater forested wetlands were most expensive, averaging approximately $77,900 per acre. Mangrove and salt marsh projects were least expensive, averaging approximately $18,000 per acre. Obvious differences exist between costs for freshwater vs saltwater projects using nationwide statistics gives an average of $48,475 per acre for freshwater and $18,050 per acre for saltwater; however, the variability of the data precluded meaningful statistical analyses. A breakdown of these costs is given for each project type in Figure 2. As shown, the majority of costs are associated with construction, with postconstruction costs appearing to be higher in freshwater projects. To further analyze these costs, a breakdown of construction vs postconstruction costs is given in Figure 3. As shown, freshwater emergent (marsh) types have the closest totals, with construction costs comprising 58 percent, and postconstruction costs comprising 28 percent, of the total. The highest disparity, an 83 percent difference between construction and postconstruction costs, was seen with freshwater tidal wetlands. The complex and mixed wetlands showed slightly larger disparities than other categories.

The 1993 data for 30 southeastern U.S. projects provide similar comparisons, and more details were collected by the authors which allowed further analyses. Overall mitigation costs for three southeastern states are given in Figure 4. Without land costs, cost-per-acre averages of $24,899 (S.D. $10,919), $23,200 (S.D. $11,467), and $20,247 S.D. ($12,409) were obtained for Florida, Georgia, and South Carolina, respectively (overall mean $23,874; S.D. $11,410). These averages were derived by the number of projects. This method factored in the cost-per-acre differences between large and small projects. If total project costs are divided by total acreage, the overall mean is much lower, $14, 869 per acre. Land costs, computed solely for Florida, but based on only seven projects, added $26,179 to the mitigation cost (per acre), doubling the average cost.

Figure 3. Construction vs postconstruction costs - U.S.
(1993 data; sans land; n=90)

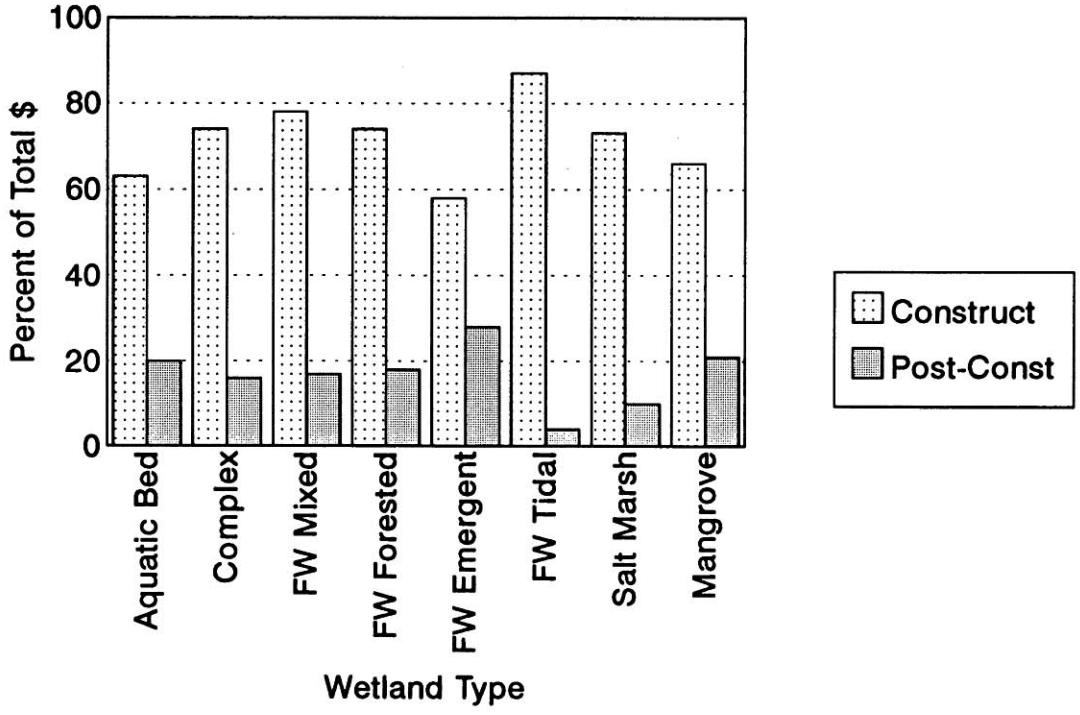


Figure 4. Cost comparison between three states.
(1993 data; sans land; n=30)

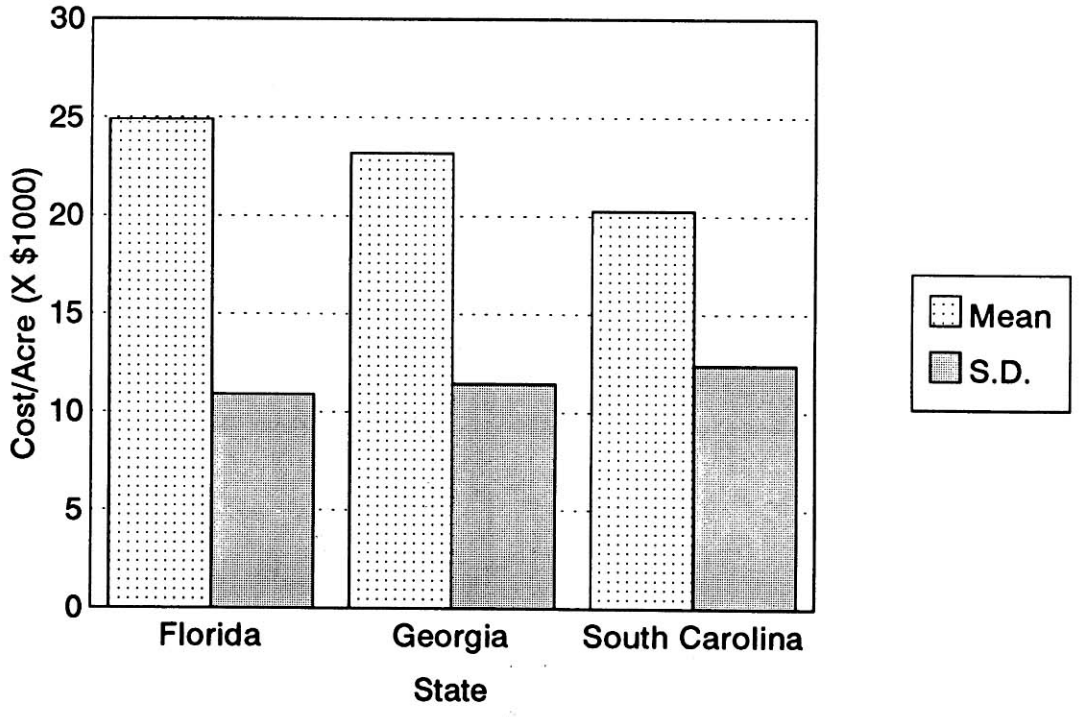


Figure 5. Mitigation costs - nationwide vs southeast.
(1993 data; sans land; n=90)

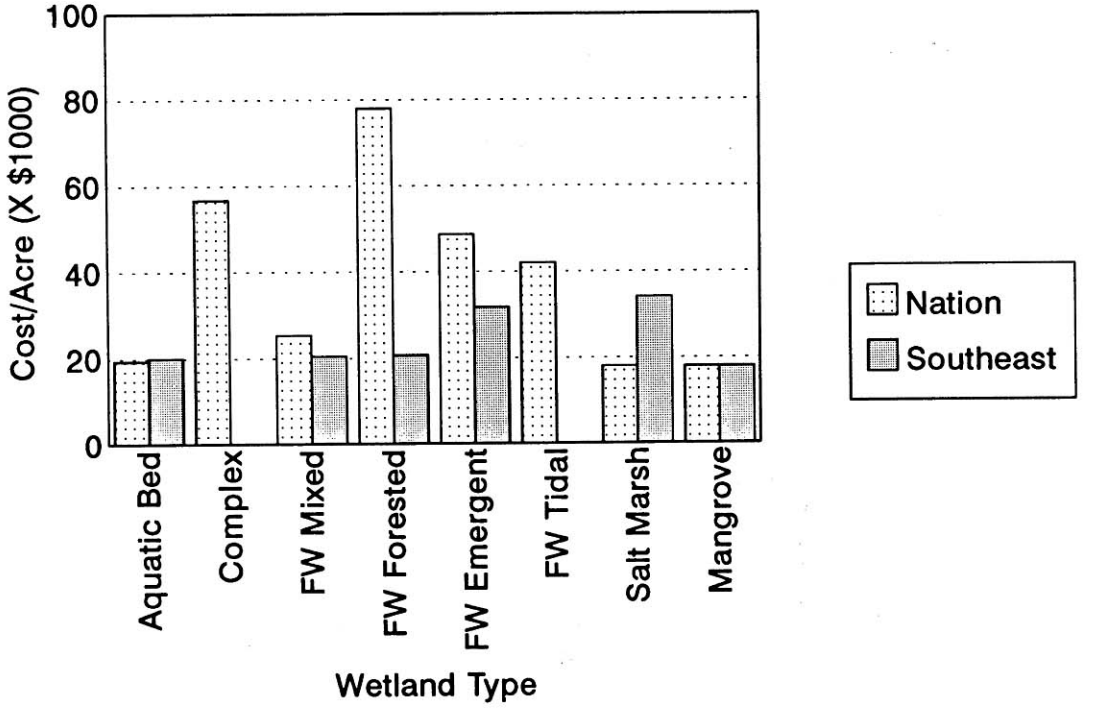
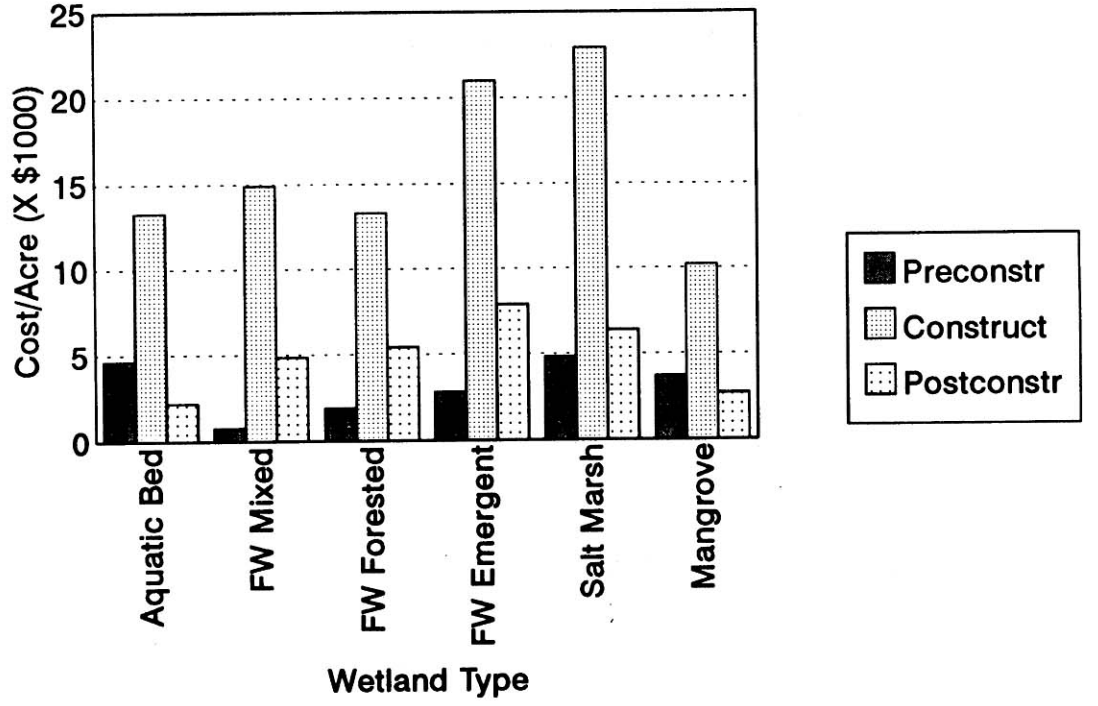


Figure 6. Project costs by phases - southeast.
(1993 data; sans land; n=30)



Southeast breakdowns of costs by wetland type were similar in some cases to the nationwide costs given above, but there were distinct differences. As shown in Figure 5, and as compared to Figure 1, costs in the southeast were much smaller for freshwater forested wetlands and freshwater emergent wetlands, and much larger for salt marsh. However, the relatively small number of project for each type precluded statistical comparisons. King and Bohlen (1994b) found that total cost differences between nationwide and southeastern projects were significant, using Analysis of Covariance (ANCOVA). Southeast project costs, by construction phases, are given in Figure 6, and these are also similar to nationwide costs previously shown in Figure 2. Differences, such as with freshwater forested types, indicate that construction costs were the main variable.

A summary of various other cost comparisons for the region is given in Table 1. Construction phase costs indicated the same trend as nationwide, with actual construction costs being approximately twice the total of pre- and postconstruction. A large component of postconstruction costs was maintenance, which involves weed control, hydrology maintenance, and replanting. As shown, forested wetlands required the least maintenance, presumably because of less competition by weedy vegetation relating to the larger starting tree size. Herbaceous wetlands develop emergent weeds such as cattails which are difficult and costly to control, and starter plants are usually bareroot and/or small in size. Mixed wetlands are costly by virtue of the different methods needed for the variety of species and wetlands created.

Plant source costs provide insight into this important cost component. Nursery stock costs are Freight On Board from various Florida producers. Their larger size and better root structure aided in survival. However, they were not used in enough projects to increase the average overall project cost of $24,849. Forestry Department refers to state tree suppliers. Trees are bareroot and 3-4 feet tall. Since these trees were used often in southeastern projects, they kept project costs low. However, they required more maintenance and replanting (recent plans require larger and/or potted plants). Wild stock were removed from the wetland to be impacted, or from adjacent or area wetlands. Plants were "heeled in," potted, or planted directly into the mitigation site. Although these plants are "free," the costs of digging, heeling/potting, and installation are considerable, making these plants nearly as costly as nursery stock.

CONCLUSIONS

Analyzing a large and selective data base has provided an indication of mitigation costs in the U.S. and southeastern region. Caution is advised in applying and using this information, however. Data were collected in 1993 for projects constructed in, or before, 1990. In addition, new practices such as wetland banking were not taken into account, and refinements in wetland techniques have occurred since these projects were constructed. The size of the database, as well as that of the statistical analyses of the data, precluded their inclusion. The reader is referred to King and Bohlen (1994a,b) for such detailed information.

REFERENCES

King, D.M. and C.C. Bohlen. 1994a. A Technical Summary of Wetland Restoration Costs in the Continental United States. Univ. Md. CEES Tech. Rep. UMCEES-CBL-94-048. 24pp.

King, D.M. and C.C. Bohlen. 1994b. Wetland Compensation Costs in EPA Region IV-the Southeast. Univ. Md. CEES Tech. Rep. UMCEES-CBL-94---049. 12pp.