TAB A

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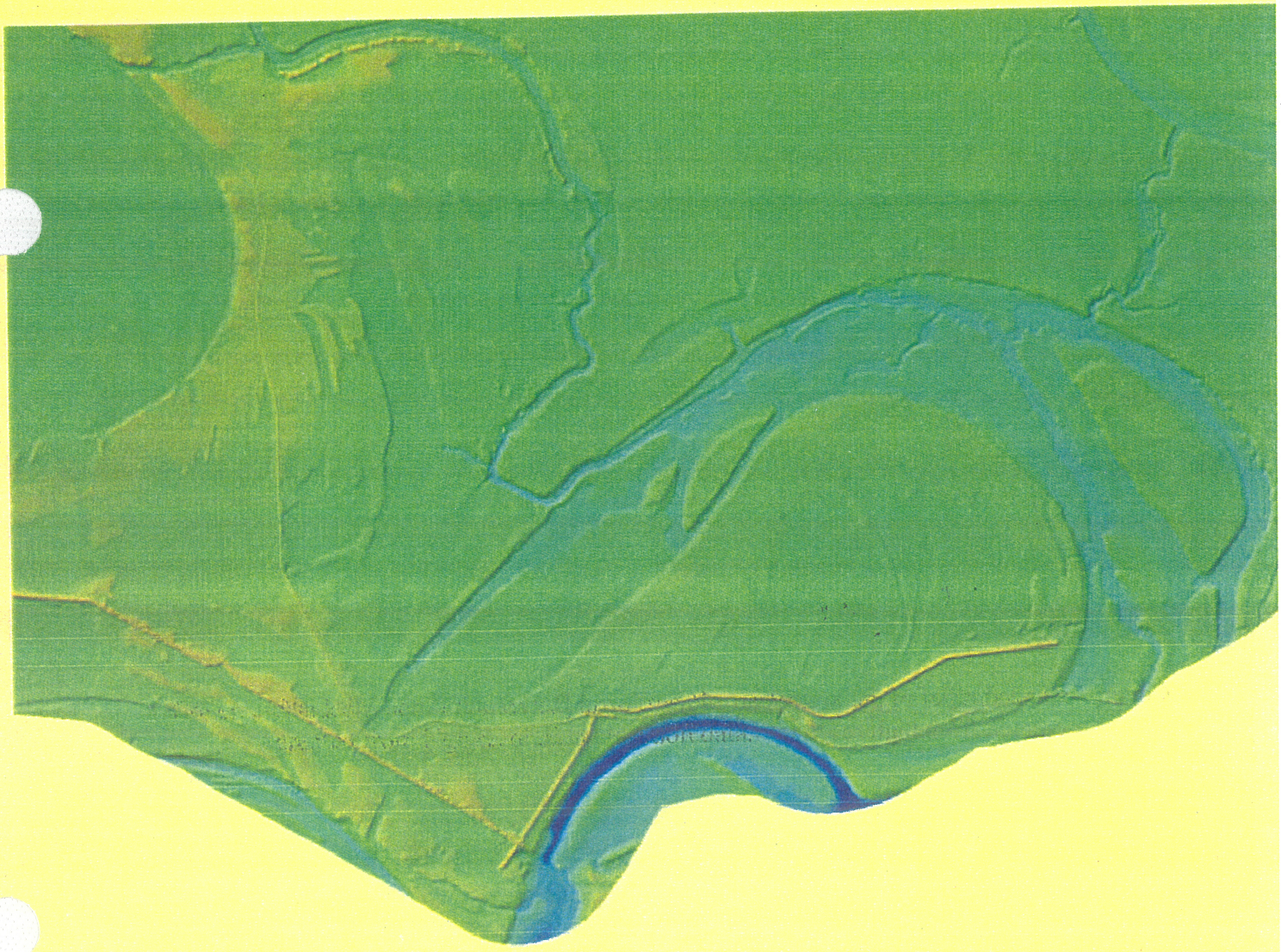
A DECISION SUPPORT SYSTEM FOR PRIORITIZING FORESTED WETLAND RESTORATION IN THE YAZO BACKWATER AREA, MISSISSIPPI



U.S. Department of the Interior
U.S. Geological Survey
Water-Resources Investigations Report 00-4199

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2000

U.S DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
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TABLES

CONVERSION FACTORS

Multiply	By	To obtain
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
acre	0.4047	hectare

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ABSTRACT

A working prototype decision support system (DSS) was developed for the Yazoo Backwater Area, Mississippi, to help planners and managers prioritize, plan, conduct, and optimize forested wetland restoration activities. The DSS comprises geographic information system (GIS) spatial data themes, application programs that provide a cumulative analysis of the relative ability of sites to function as wetlands, and output data that are specific to a given restoration analysis scenario. The DSS input includes GIS data themes such as geomorphology, soils, land use, elevation, farmed wetlands, flood frequency, topographic depressions, streams, public lands, roads, and permanent water bodies, which can be used as spatial templates to define areal hydrologic settings. These GIS data themes can then be ranked and combined to estimate the relative suitability of a potential wetland restoration site, thereby, determining relative wetland equivalence on the landscape.

The GIS applications used in this DSS perform the following three functions: assess the ecology (the Eco-Assessor); reclassify land-use in areas selected for restoration (the Tree-Translator); and generate output data to compare restoration scenarios (the Parameter-Generator). Areas selected for reforestation are translated (in the GIS) into "forested" land use, and the tree species that are "planted" on the landscape (in the DSS) either compose an ecologically optimal or an economically optimal community of tree species. Output from the DSS can be compared and analyzed by using economic, statistical, graphical, and tabular methods. Output data for seven selected scenarios were generated for the Yazoo Backwater Area and are presented as examples to illustrate the flexibility of the DSS to identify areas that meet restoration objectives.

INTRODUCTION

Forested wetlands, once the predominant land cover on the Mississippi River Alluvial Plain (Creaseman and others, 1992), provide habitat for wildlife, water-quality benefits, flood storage, and many other ecological and environmental benefits. Ongoing efforts by Federal, State, and local agencies and organizations to restore forested wetlands have been somewhat successful. Although landscape methods to prioritize potential restoration sites and to model restoration activities in selected areas offer an improved approach to evaluate, select, and restore forested wetlands, further improvements in tools and methods are needed.

In the past, selecting areas for wetland restoration was based largely on identifying landowners willing to sell their land. Coupled with the lack of a quantitative approach for prioritizing and selecting potential restoration sites, scientists tended to overlook how restoration activities were to be implemented on the landscape.

Wetland restoration requires extensive site-specific fieldwork by wetland experts, biologists, and ecologists. Preliminary fieldwork is not practical, however, where large areas of land are to be considered for restoration over a broad regional extent. The task of visiting all potential areas and conducting site evaluations prior to screening, prioritizing, and selecting suitable sites becomes physically impossible. Planning large-scale restoration efforts having a broad regional extent can best be accommodated by using a decision support system (DSS) based on a geographic information system (GIS). A DSS makes it possible to evaluate different restoration scenarios; to select from among these scenarios those areas for restoration that best meet current wetland restoration program goals; and to plan activities to optimize the economic and/or ecologic benefits of the restoration.

Until recently, development and use of a DSS to select sites and evaluate restoration scenarios was impeded by the lack of input data, the cost of developing digital data, the lack of tools to develop and compare alternate scenarios, and the difficulty of integrating output data results into various types of independent analysis programs. Recent improvements in data availability, GIS applications, and computer technology have made possible the development of systems that can be used to integrate data, provide flexible analysis methods, and allow interchange of data between various analysis tools.

This report presents a working prototype GIS-based DSS developed to support analyses and decisions related to forested wetland restoration efforts in the Yazoo River Basin in Mississippi. The documented DSS used available data, the most conservative of which were used when more than one source was available for a given data layer or theme. Descriptions of the DSS and the input data themes, details of how the data are used in the DSS, and a discussion of selected example output scenarios are provided. The reader should note that the maps are intended to help illustrate the concept and methods used to develop the DSS, and are not intended to convey site-specific data.

This report is the result of an interagency agreement between the U.S. Geological Survey (USGS) and the U.S. Environmental Protection Agency (EPA). The purpose of the agreement was to develop a DSS to facilitate evaluating alternate forested wetland restoration scenarios for areas subject to backwater flooding in the lower part of the Yazoo River Basin in Mississippi (hereafter referred to as the Yazoo Backwater Area or the study area). Concurrent with the DSS work, an economic

evaluation of the costs and benefits of reforestation scenarios (Shabman and Zepp, 2000) was performed by researchers at Virginia Polytechnic Institute and State University (Virginia Tech).

The Yazoo Backwater Area includes all or parts of six counties in central western Mississippi including Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo (fig. 1). The Yazoo Backwater Area is bounded by the Mississippi River levee on the west and by levees and the valley wall of the bluff hills on the east and south. The southern extent of the Yazoo Backwater Area is just north of Vicksburg, Mississippi. The Yazoo Backwater Area extends north about 100 kilometers to just north of Belzoni, Mississippi.

THE DECISION SUPPORT SYSTEM

A user-friendly, modular, broad-based prototype DSS was developed as a new approach to identify, prioritize, and select sites (or scenarios) for wetland restoration activities, and specifically to optimize these activities in the Yazoo Backwater Area. This prototype wetland restoration DSS addresses these objectives by providing a set of applications that perform functions, which have been grouped into the following modules:

Module 1 -- Ecological Assessment: The Eco-Assessor

- Identify areas eligible for reforestation.
- Identify areas most likely to sustain a functional wetland.
- Select areas that maximize the wetland functions performed.

Module 2 – Land-Use Conversion: The Tree-Translator

- Select tree species for locations where the likelihood of survival is high.
- Optimize the benefits of reforestation based upon predefined ecologic and/or economic criteria.

Module 3 -- Output Data File Preparation: The Parameter-Generator

- Prepare output data files that report functional restorability, acreages, flood ranges, soil types, and other factors that can be used to evaluate the scenario.

The DSS comprises GIS spatial data themes, applications that provide a cumulative analysis of the relative ability of sites to function as a wetland, and output data specific to a given restoration analysis scenario. The combination of input data, application programs, and output data make it possible to select the most eligible areas that best fit the restoration objectives. A DSS lacking input and output data is simply an analysis tool; however, a DSS containing output data can be used in the decision-making process.

All GIS data themes used in this DSS are in the Arc/INFO grid-data format, and are in the Universal Transverse Mercator, Zone 15 (UTM 15) projection, North American Datum of 1927 (NAD 27). Data that were needed, but not grid-based were converted to the Arc/INFO grid-data format. All image data were provided with a 25-meter cell size, and all other data layers were provided or developed at a 25-meter cell size resolution except for elevation data, which were generated at a 10-meter cell size. To facilitate analysis, all data layers were aligned, and in most cases, resampled and realigned prior to analysis.

No new GIS data themes were generated for this DSS. Some spatial data layers used in the DSS are dated, and many of the analysis layers are the result of modifying or manipulating existing data. Uncertainties were involved in using dated information in the DSS, especially since the system

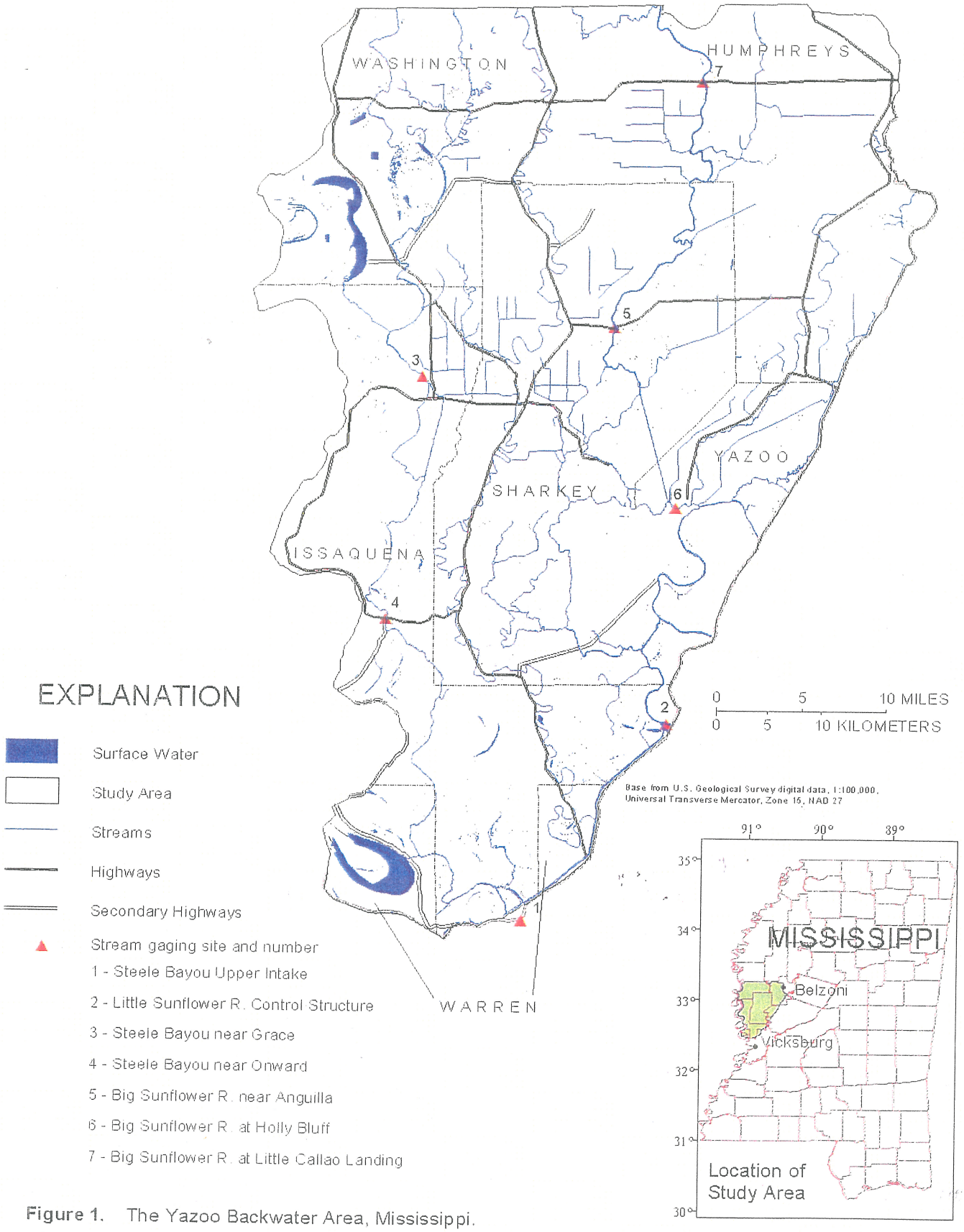

Figure 1. The Yazoo Backwater Area, Mississippi.