THE DEVELOPMENT OF A DECISION SUPPORT SYSTEM FOR PRIORITIZING FORESTED WETLAND RESTORATION AREAS IN THE LOWER YAZOO RIVER BASIN, MISSISSIPPI

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Abstract—The Eco-Assessor, a GIS-based decision-support system, has been developed for the lower part of the Yazoo River Basin, Mississippi, to help planners and managers determine the best locations for the restoration of wetlands based on defined ecological and geographic criteria and probability of success. To assess the functional characteristics of the potential restoration areas, the data layers are organized by hydrology, water quality, and habitat. The overall potential restorability, or the predicted physical ability of a tract of land to sustain a functional wetland, is also considered. Because an exact spatial representation of wetlands in the lower Yazoo River Basin does not exist, surrogate data layers are used to predict locations that might be restored to a functional wetland. The Eco-Assessor analyzes the following data layers by using a ranking system: geomorphology, soils, mature forest cover, farmed wetlands, flood frequency, topographic depressions, River Reach File Level 3 streams, wildlife management areas, conservation areas, primary roads, secondary roads, permanent water, and landscape factors. Various categories of each data layer are assigned a rank. A higher rank indicates that a particular geographic area has a higher probability of being restored to a functional wetland. Ranks for all the data layers are summed to result in a cumulative rank which can then be used to determine the areas that, overall, are the most likely to be successfully restored to a functional wetland. The ranking system method provides a means to analyze various restoration scenarios. A restoration scenario can be defined in a way that may focus equally on all functions, focus on one function, or focus on a particular geographic area.

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 of many Federal, State, and local agencies and organizations to restore forested wetlands have been successful. However, the lack of quantitative methods for prioritizing the selection of wetland restoration areas has meant that a less than optimum approach has been taken in the evaluation, selection, and restoration of forested wetlands.

In the past, selecting areas for wetland restoration was conducted based largely on identifying landowners willing to sell their land. This selection method, coupled with the lack of a quantitative approach for selecting and prioritizing potential restoration sites in past efforts, caused the process of forested wetland restoration to overlook how the restoration activity occurred on the landscape. Also, forested wetland "restoration" was often undertaken with little regard as to whether wetland functions were replaced. Until recently, the evaluation of alternate forested wetland restoration scenarios was a task that was impeded by the general unavailability of input data, the cost of developing digital data, the lack of sufficient tools for developing and comparing alternate scenarios, and the difficultly of integrating results into various types of independent analysis. Recent improvements in data availability, geographic information system (GIS) applications, computer technology, and general software technology have made possible the development and use of powerful decision-support systems (DSS) that integrate data, provide flexible analysis methods, and allow the easy interchange of data between various software analysis tools.

The DSS presented in this paper is the result of an interagency agreement between the U.S. Department of the Interior, Geological Survey, Water Resources Division, and the U.S. Environmental Protection Agency. The purpose of the agreement was to develop a DSS to facilitate the rapid generation and consideration of many alternate forested wetland restoration scenarios for the study unit located in the Yazoo River backwater area.

STUDY AREA

The study area examined was the Yazoo backwater area of the lower Yazoo River Basin, which included at least a portion of the following six counties in Mississippi: Warren, Issaquena, Sharkey, Yazoo, Humphreys, and Washington. The Yazoo backwater area is in the southern portion of the Yazoo River Basin, bounded by the Mississippi River levee on the west and the valley wall on the east and south. The southern tip of the Yazoo backwater area is just north of Vicksburg, MS. The area extends north about 100 km to a latitude near Belzoni, MS (fig. 1).

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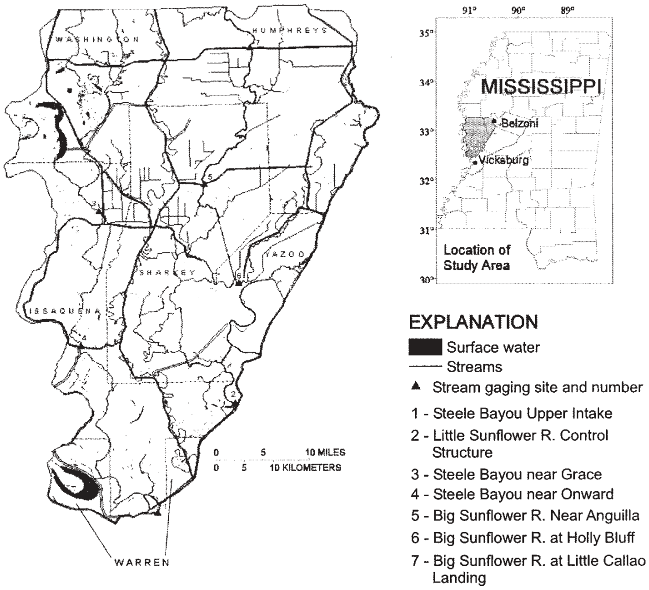

Figure 1—The boundaries of the study area located in the Lower Yazoo River Basin in Mississippi.

PROCEDURES

Ecological Rule Development

Wetland functions are often used as comparative evaluation criteria for the ecological merit of wetlands. Hydrogeomorphic Assessment (HGM) uses wetland functions to evaluate existing wetlands at a site-specific level (Brinson 1993). The Eco-Assessor DSS uses similar principles to HGM, but spatial data at a landscape level is grouped by wetland functions to evaluate whether or not a sustainable wetland could exist at a location where there currently is not one. In this study, common wetland functions have been grouped into four categories: restorability, hydrology, water quality, and habitat functions. For the purposes of the initial model generation, the hydrology, water quality, and habitat function categories were given approximately the same weight in the overall analysis, whereas restorability has a weight of approximately half that of the other three. However, the model is adaptable, using check boxes and pull-down menus, which allow the model to be run with any preferred subset of functional categories emphasized, and it also allows the input of new ranking values for any of the functions. This kind of customization can address particular resource needs or test hypotheses about the impact of ranking decisions and weights. Also in some cases, a particular function appears in more than one functional category. In these cases, the function is considered critical enough that the redundancy is justified.

Restorability—This functional category is defined as the physical ability of a parcel of land to sustain a functional wetland. The wetland restorability section of the Eco-Assessor DSS provides for the evaluation of geomorphology, soils, regeneration distance, and farmed wetlands spatial data layers. A summary of the ranks assigned to functions within this group is presented in table 1.

Geomorphology, as derived by Saucier (1994), consists of abandoned channels, backswamps, and pointbar/valley trains. Abandoned channels are considered the lowest land formations in terms of elevation, become inundated most frequently, and are given the highest rank. Backswamps are

Table 1—Summary of the ecological rules used in the Eco-Assessor decision-support system for the wetland restorability function

Wetland function	Spatial data layer	Data variables	Functional restoration ranking
Wetland restorability	Environment of deposition	Abandoned channel	5
		Backswamp	3
		Pointbar	1
	Soils	Hydric	10
		Nonhydric	1
	Regeneration distance	Within 60 m of mature forest	5
		Between 60 and 120 m	3
		Greater than 120 m	1
	NCRS farmed wetlands	Farmed wetland	5
		Other	0

NCRS = Natural Resource Conservation Service.

Table 2—Summary of the ecological rules used in the Eco-Assessor decision-support system for the wetland hydrology function

Wetland function	Spatial data layer	Data variables	Functional restoration ranking
Hydrology	Flood frequency	Within the 0.5-year flood	20
		Within the 2-year flood	10
		Beyond the 2-year flood	5
	Topographic depressions	Topographic depressions	20
		Other	1

slightly higher in elevation than abandoned channels but are still low enough to be frequently inundated. Pointbar/valley trains are slight ridges on the land's surface, are the least wet, and are given the lowest rank.

Hydric soils are defined by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), and modified for the Yazoo River Basin by using the U.S. Army Corps of Engineers report "Delineation of Wetlands of the Yazoo River Basin in Northwestern Mississippi," Misc. Paper EL–92–2 (Kirchner and others 1992). The presence of hydric soils is important to the sustainability of wetlands.

Restoration areas that are near existing mature forest tend to have much higher species diversity than areas that are far from an existing stand of mature forest (Allen 1990). The rapid natural regeneration of forest will occur out to a distance of 60 m from existing forest (Allen 1997), and areas within 60 m of existing forest are given the highest ranking in this model.

The criterion for NRCS "farmed wetlands" is for areas (excluding pothole, playa, and pocosin) that have a 50-percent chance of being flooded or ponded for at least 15 consecutive days during the growing season (U.S. Department of Agriculture 1996). Areas classified as NRCS "farmed wetlands" indicate places on the landscape that are inundated for a significant duration and are, therefore, very likely to maintain sustainable wetlands and are given a high rank.

Hydrology—The hydrology function is a representation of the hydrologic regime of a given cell within the landscape. Both the frequency and duration of flooding are considered. The hydrology section includes and provides for the evaluation of flood frequency and topographic sinks spatial data layers. A summary of the ranks assigned to functions within this group is presented in table 2.

Those areas indicated as flooded by a 0.5-year flood are the most frequently inundated and, therefore, most likely to sustain a wetland. The areas within the 2-year flood are not inundated as often but are still viable sites for a wetland. Those areas beyond the 2-year but within the 100-year flood are the least likely to be inundated on a regular basis and are the least likely areas for a sustainable wetland. The flood frequency data were created by compositing the nominal flood image data for the 0.5-, 2-, and 100-year nominal flood images into a composite nominal flood frequency image (fig. 2).

Topographic depressions indicate places on the landscape where water is likely to pond because they are points of low elevation surrounded by points of higher elevation. Once water enters a depression, there is no outlet through which the water is able to drain. The lack of an outlet causes the

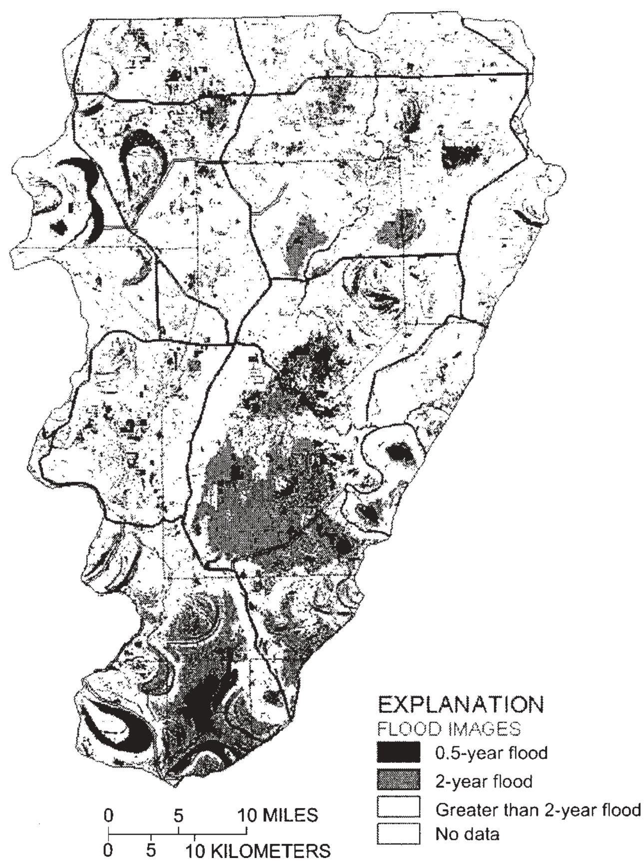

Figure 2—The spatial extent of the 0.5- and 2.0-year floods in the Lower Yazoo River Basin, as determined from satellite imagery

water to remain in the sink until evaporation or seepage or both occur, resulting in floodwater storage and possible interaction with ground-water resources.

Water quality—The water-quality function gives weight to areas on the landscape that would filter, trap, or degrade chemical components such as nitrogen and phosphorous commonly found in the water. The water-quality section includes and provides for the analysis of spatial data layers such as stream buffers, flood frequency, and topographic sinks. A summary of the ranks assigned to functions within this group is presented in table 3.

Flood frequency is a factor in both the wetland hydrology function as well as the wetland water-quality function. In the water-quality function grouping, those areas indicated as flooded by a 0.5-year flood are the most frequently inundated. Therefore, the areas within the 0.5-year flood are the most likely to sustain a wetland. The areas within the 2-year flood are not inundated as often but are still viable sites for a wetland. Those areas beyond the 2-year but within the 100-year flood are the least likely to be inundated on a regular basis and are the least likely areas for a sustainable wetland.

Stream buffers are assigned by stream level beginning with a 10-m buffer because no less than a 10-m stream buffer is a minimum necessary to filter nitrogen and phosphorous (Dillaha and others 1989, Howard and Allen 1988). Stream buffers have been shown to control the flow of nitrate, phosphorous, sediment, and sediment-borne chemicals in surface runoff and shallow ground water (Lowrance and others 1997).

Topographic depressions allow water to pond in areas with no outlet through which water can drain. If water remains trapped in a topographic depression for extended periods of time, sediments fall out and anaerobic processes begin. The amount of sediment that will be deposited in depressional areas is higher than in nondepressional areas because longer hydroperiods allow for longer settling time (Hupp and Morris 1990, Kleiss 1996). Both the trapping of the sediments and the degradation of chemicals through anaerobic processes improve overall water quality (Mitsch and Gosselink 1993).

Habitat—The habitat function gives weight to areas of the landscape in which wildlife may easily persist. The habitat section considers proximity factors, such as distance to wildlife management areas and conservation areas, distance away from primary and secondary roads, proximity to permanent water bodies, and landscape factors such as forest block size and core area. A summary of the ranks assigned to functions within this group is presented in table 4.

Proximity Functions

The public lands are divided into two categories. The first category contains the managed wildlife areas, National Wildlife Refuge And State Wildlife Management Areas. The second category contains general conservation lands, Public Land Restoration, Delta National Forest, Farmer’s Home Administration, and Wetland Reserve Program lands. Expanding existing public lands, when managed appropriately, greatly benefits wildlife by increasing the interior space available for habitat. Also, any connections that can be made between two patches of land add valuable corridors for the movement of wildlife (Allen and Kennedy

Table 3—Summary of the ecological rules used in the Eco-Assessor decision-support system for the wetland water-quality function

Wetland function	Spatial data layer	Data variables	Functional restoration ranking
Water quality	Flood frequency	Within the 0.5-year flood	15
		Within the 2-year flood	10
		Beyond the 2-year flood	5
	Stream buffers	Stream level 1: within 90 m	15
		Stream level 2: within 80 m	15
		Stream level 3: within 70 m	15
		Stream level 4: within 60 m	15
		Stream level 5: within 50 m	15
		Stream level 6: within 40 m	15
		Stream level 7: within 30 m	15
		Stream level 8: within 20 m	15
		Stream level 9: within 10 m	15
		Stream level 0: within 5 m	15
		Other	0
	Topographic depressions	Topographic depressions	15
		Other	0

Table 4—Summary of the ecological rules used in the Eco-Assessor decision-support system for the wetland habitat function

Wetland function	Spatial data layer	Data variables	Functional restoration ranking
Habitat	Wildlife management areas	Within 250 m of wildlife management areas	10
		Between 250 and 500 m	5
		Between 500 and 1000 m	1
		Beyond 1000 m	0
	Conservation areas	Within 60 m of conservation areas	5
		Between 60 and 120 m	3
		Between 120 and 500 m	1
		Beyond 500 m	0
	Primary roads	Within 50 m of primary road	0
		Between 50 and 500 m	1
		Beyond 500 m	3
	Secondary roads	Within 50 m of secondary road	1
		Between 50 and 500 m	2
		Beyond 500 m	3
	Permanent water	Within 150 m of permanent water	5
		Between 150 and 1000 m	1
		Beyond 1,000 m	0
	Forest block size	Between 1 and 10 acres	1
		Between 10 and 320 acres	5
		> 320 acres	10
	Core area ratio	Ratio of core area to total area of patch > 0.66	10
		Between 0.33 and 0.66	5
		< 0.33	1

1989). The expansion of existing wildlife management areas has an added benefit because the management of wildlife is already the top priority in this area.

Distances away from primary and secondary roads were adapted from a Louisiana Department of Natural Resources study by Kinler (1994). The study ranked human disturbances by distance and type of disturbance. For the purposes of the Eco-Assessor, primary roads are considered a constant disturbance and secondary roads are considered only a frequent disturbance.

Being near permanent water bodies is beneficial to wildlife because water is a requirement for basic living needs. In a study conducted in the same general geographic area (Wakeley and Marchi 1992), six species were chosen for a habitat evaluation of the Upper Steele Bayou area in Mississippi. The six species, which are common to bottomland hardwood forest, include the barred owl (Strix varia Barton), gray squirrel (Sciurus carolinensis Gmelin), Carolina chickadee (Parus carolinensis Audubon), pileated woodpecker (Dryocopus pileatus Linnaeus), wood duck (Aix sponsa Linnaeus), and mink (Mustela vison Schreber) (Wakely and Marchi 1992). Of these six species, the pileated woodpecker has the most quantitatively specific habitat requirements according to the U.S. Fish and Wildlife Service Habitat Suitability Index Model (HSI). Minimum distance requirements to and from permanent water bodies, as well as minimum forest block size, are given in the HSI. The HSI for the pileated woodpecker indicates that nesting habitat generally is not observed greater than 150 m from water bodies (Schroeder 1982). The habitat requirements for the pileated woodpecker are often used as a representation of the habitat requirements for other cavity nesting birds by natural resource agencies (Renken and Wiggers 1993).

Landscape Factors

The landscape can be assessed using such landscape factors as patch size, core area, and patch shape. A patch of forested land < 1 ac does not provide sufficient habitat for wildlife (Wakely and Marchi 1992); therefore, any patch < 1 ac is dissolved. The larger the patch size the more that habitat is benefited. There are two categories of wildlife species: generalists and specialists. Generalists can live in patches of many shapes and sizes because their populations are larger and they are highly mobile. It is the specialists that require the greatest conservation efforts. Specialists require large patches of forest with greater interior area and less edge (Kinler 1994). It is important to provide for the needs of the specialists by giving weight to larger patches of land.

The ratio between core area and total patch area is used to give more weight to patches of land that have a greater portion of interior area. Core area is defined by the Fragstats manual as "the area within a patch beyond some specified edge distance or buffer width" (McGarigal 1995). Any land that is in the interior of a patch more than 100 m from the edge is considered core area. For a given patch of land, the number of cells considered core area divided by the number of cells in the entire patch, results in a ratio of core area to patch shape. A long thin patch of land would receive a lower ratio, whereas a long wide patch of land would receive a higher ratio. A patch of land with a high ratio would provide wildlife habitat with fewer edge effects and more interior space. More interior space available in a given patch gives rise to the number of interior species and species diversity (Ohman and Eriksson 1998).

GIS Data Layers

The scope of this project did not include the collection of new data to develop new data layers; therefore, the data layers are the best information currently available from agencies working within the State of Mississippi. In some cases, data layers are numerically derived from existing layers. All data layers were resampled to generate a grid of 25-m cell size.

Land use image data—In 1988, the U.S. Army Corps of Engineers, Vicksburg District (USACE), collected satellite image data for the purpose of generating a land use classification data set. Land use in the study area was based on these data and was provided by the USACE in the Universal Transverse Mercator (UTM) projection, North American Datum (NAD) 27. The satellite image data were divided into the following land use categories: cotton, soybeans, corn, rice, herb1, herb2, pasture (grass), bottomland hardwood, swamp, river, lake, and pond. In areas within the satellite images where the land use was obscured by cloud cover or where the spectral response is similar to that provided by sandbars, selected pixels are classified as sandbar/clouds. For areas not classified, null data values indicate the spatial extent of the study unit.

After generating land use data, the USACE adjusted the land use. The adjusted land use data differ from the original land use classifications where it is known the land has been put into habitat or land use management programs such as wildlife management areas, wetland reserve program lands, national wildlife refuges, and conservation reserve program lands.

Flood image data—The USACE collected satellite imagery of flood scenes to accomplish several specific tasks. The primary tasks included compiling areas inundated by floods of a known stage to develop a stage-area relation and spatially characterizing areas inundated by a flood of a given frequency.

A relation between flood stage and inundated area is developed in the form of a stage-area curve by selecting images for flood scenes of various stages and determining areas inundated. The stage-area curve is useful in estimating flood extent. Dates and stages for flood scenes used by the USACE in generating a stage-area relation for the lower Yazoo River Basin are listed in table 5. By comparing those dates and times with satellite image data availability, it was possible to select images that corresponded to specific flood events for areas in the vicinity of specific gages within the study area. Image data for each gaged area for flood events of specific frequency were composited into a mosaic of images. The nominal flood image data generated from composited images provided a view of a simulated flood in which all areas are at the stage for the specific flood considered. The 2-year nominal flood image scene is shown in figure 2.

Hydric soils data—The soils data mapped and provided by the USACE show the extent of hydric, nonhydric, and riverbottom soils throughout the study area (fig. 3). The presence of hydric soils in a location provides one of the physical indicators that the location might support wetland function. Hydric soils, as defined by the NRCS were for the Yazoo River Basin in northwestern Mississippi (Kirchner and others 1992).

Geomorphology data—The base source for hydrogeomorphology GIS data compiled at 1:250,000 scale was the report "Geomorphology and Quaternary Geologic History of the Lower Mississippi Valley" (Saucier 1994). This data layer provides an indication of the fluvial environment that gave rise to specific landforms and divides the landscape into areas that are characterized as abandoned channels, backswamps, and pointbar/valley trains.

Public lands data—The public lands data were obtained from the U.S. Department of the Interior, Fish and Wildlife Service (USFWS). The data contain six public land types, including Public Land Restoration, Delta National Forest, Farmer's Home Administration, Wetland Reserve Program, National Wildlife Refuge, and State Wildlife Management Area lands.

Roads and transportation data—Data for primary and secondary roads and railroads were obtained from the Mississippi Automated Resources Information System (MARIS). The sources for MARIS transportation data layers are U.S. Department of the Interior, Geological Survey, digital line graph (DLG), and the Mississippi Department of Transportation. The 1:100,000-scale primary roads data include interstates, U.S. highways, and 1- and 2-digit State highways; for example, Mississippi Highway 3 and Highway 25. The secondary roads layer includes 3-digit highways; for example, Mississippi Highway 471 and the Natchez Trace Parkway.

Water bodies data—Permanent water bodies were adapted from MARIS permanent water data. This data layer was

Table 5—Stage measurements for seven stream gauging sites in the Yazoo backwater area[a]

Date of image	Steele Bayou at Grace	Steele Bayou at Onward	Steele Bayou at Upper Intake	Big Sunflower River at Little Callao Landing	Big Sunflower River at Anguilla	Big Sunflower River at Holly Bluff	Little Sunflower River at Upper Intake
03/12/73	93.3	85.5	77.2	97.1	94.1	89.5	82.2
03/31/73	98.2	92.5	89.3	102.8	99.3	96.5	95.4[b]
05/05/73	100.4	100.6	100.2	101.9	100.7	100.4	100.3
01/30/74	98.3	92.9	90.6	101.2	98.1	96.0	93.4
01/13/83	94.6	93.1[b]	91.9	100.8	98.1	95.5	93.1
02/17/84	92.6	85.8	76.1	99.4	94.3	90.5	81.4
03/05/87	91	84.9	79.5	98.7	94.7	90.0	82.4
12/02/87	86.9	73.7	66.2	87.0	83.0	79.1	70.8
03/10/89	89.7	89.7[b]	89.7	90.1	89.0	91.5	90.0
04/01/91	87.5	N/A	83.3	89.4	87.7	86.0	83.8
04/30/91	98.1	93.9	90.4	103.0	98.5	95.4	91.7
06/04/91	86.9	85.2	84.8	95.0	93.8	92.4	89.1
02/01/93	86.3	83.4	83.0	84.7	83.8	83.6	83.2

All measurements are in feet above mean sea level.
N/A = not available.
[a] Stage values are from U.S. Army Corps of Engineers published data except where indicated.
[b] Dave Johnson, U.S. Army Corps of Engineers, written communication, November 2, 1998.

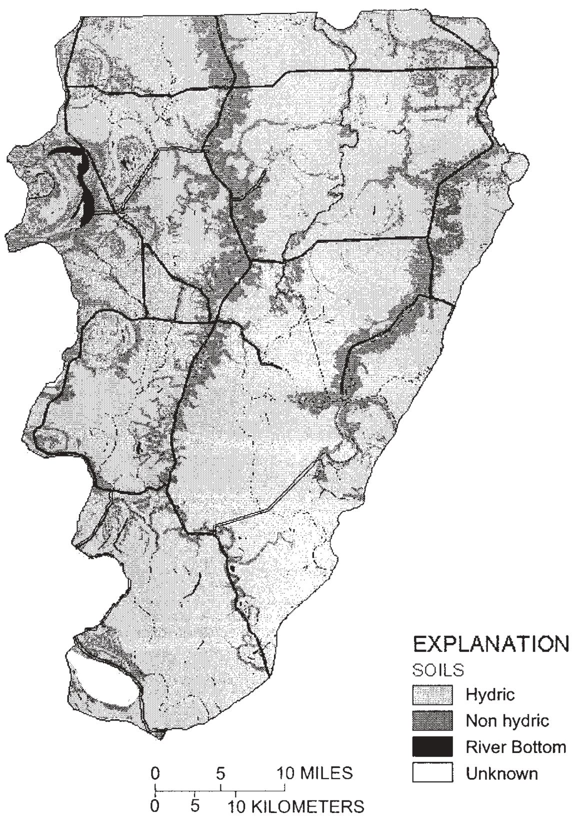

Figure 3—The spatial extent of hydric and nonhydric soil in the study area.

modified by removing areas designated as catfish ponds, for the specific needs of this effort.

Elevation contour data—Hypsographic contours were made available through MARIS as compiled from 1:24,000-scale U.S. Department of the Interior, Geological Survey, base material.

Hydrologic network data—The EPA River Reach File Level 3 (RF3) was selected to represent the hydrologic network for the area. Stream buffers were created from the RF3 streams network coverage by using stream level. Stream level ranges from 0 to 9. A level 1 stream flows to the ocean. A level 9 stream would be the size of a small creek or a ditch. A level of 0 indicates that the actual stream level is unknown in the RF3 dataset.

NRCS "farmed wetlands"—The NRCS created the "farmed wetlands" data set such that the criteria for "farmed wetlands" was for areas (not pothole, playa, or pocosin) that have a 50-percent chance of being flooded or ponded for at least 15 consecutive days during the growing season. Areas classified as NRCS "farmed wetlands," indicate places on the landscape that are inundated for a significant duration and are, therefore, very likely to maintain sustainable wetlands. The NRCS "farmed wetlands" are defined for regulatory purposes and are not indicative of farmed areas that may be considered wetlands under alternate wetland definitions.

Digital elevation data—High-resolution hypsographic data were obtained from a collaborative effort with MARIS. High-resolution, drainage-reinforced digital elevation model (DEM) data were developed by using the high-resolution hypsographic data and the ArcInfo routine TOPOGRID, which uses line information to create customized elevation grids. The hypsography data layers were combined, and a seamless elevation grid was created at a 10-m posting interval (raster cell spacing) for the entire lower Yazoo River Basin. A filled DEM layer and other hydrologic derivatives were produced to allow the analysis of hydrology within the study area. The filling of a DEM involves an automated process wherein localized depressions (which in nature fill and overflow) are digitally filled to provide a continuous hydrologic surface.

The difference between the filled and the unfilled high-resolution DEM was used to create a topographic depressions data set (fig. 4). This layer provides an analytical tool for assessing the size, distribution, and nature of areas that can be considered as topographic depressions and likely sites for water storage and functional wetlands restoration.

Topographic base data—To provide a continuous topographic base for the study area, USGS digital raster graphics (DRG) of the 1:24,000-scale quadrangle maps were collar-clipped (the white map collar or border was clipped out), edge-matched, and placed into seamless image catalogs for the study area. This topographic base layer was used to provide quality assurance for all GIS data layers used in the study.

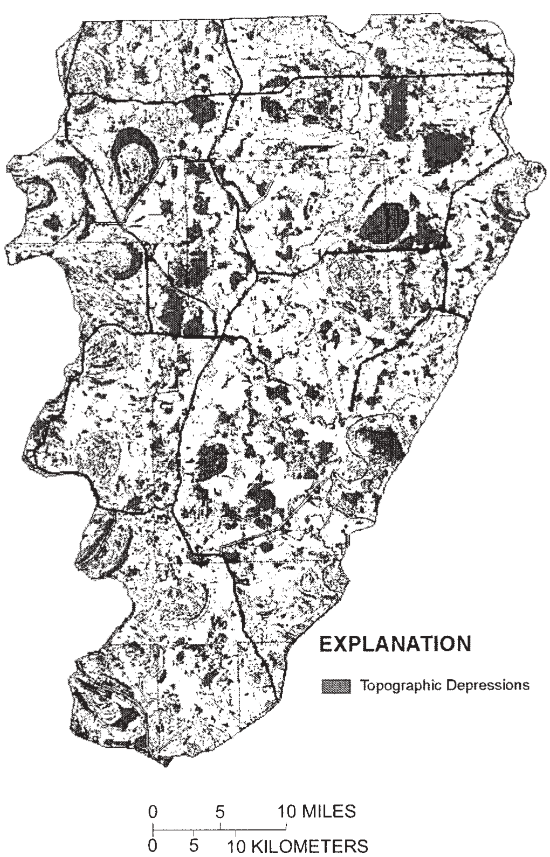

Figure 4—The spatial extent of topographic depressions in the study area.

Model Development

The Eco-Assessor program was written using Arc Macro Language programming and runs using ArcInfo in a Windows NT environment. Clickable menus are provided in order to give the user the ability to turn on and off each data layer as well as change the ranks assigned to each data layer.

RESULTS AND DISCUSSION

Generation of "Functional Restoration" Maximum

Once the Eco-Assessor has analyzed each data layer, the ranks for all data layers are summed. The summation results in a functional restoration (FR) rank for each cell of eligible land. The functional restoration rank is used as the indicator of which areas on the landscape are the most suitable for wetland restoration and would perform wetland functions well.

Functional restoration maximum is the grid generated by the Eco-Assessor that contains the total FR value for each eligible cell in the study area. The FR maximum assumes that every eligible cell within the study unit is selected for reforestation. The total FR value is the sum of the assigned rank for each data layer of a given cell. The resultant FR maximum spatial data layer has cells that have cumulative ranks that range from 15 to 140. The highest ranked areas are those that would be the most suitable for wetland restoration and would be most likely to perform wetland functions. This is depicted in figure 5.

Scenario Generation and Evaluation

Reforesting all eligible areas within the study area is an unrealistic goal; therefore, specific subsets of the study area are recommended for reforestation. These subsets of the study area or scenarios are selected by using the GIS and establishing spatial criteria. The justification for the spatial criteria may be based on a number of reasons. A scenario may be based upon targeting a particular wetland function, a certain geographic area, a certain feature on the landscape, or any other set of criteria that can be spatially determined.

The use of the FR rank becomes particularly important when considering scenarios. The FR rank allows for the comparison of scenarios on an ecological basis. The total FR rank for a given scenario provides an indicator of the ecological benefits to be gained by reforesting the area specified by the scenario. The total FR rank for a scenario is divided by the total number of acres for that scenario. This calculation results in a FR per-acre score for that scenario. The FR per-acre score can then be used to compare the ecological merits of various scenarios (fig. 6).

In the hydrology scenario, the eligible areas inundated in the USACE nominal 2-year flood scene are selected for reforestation (fig. 7).

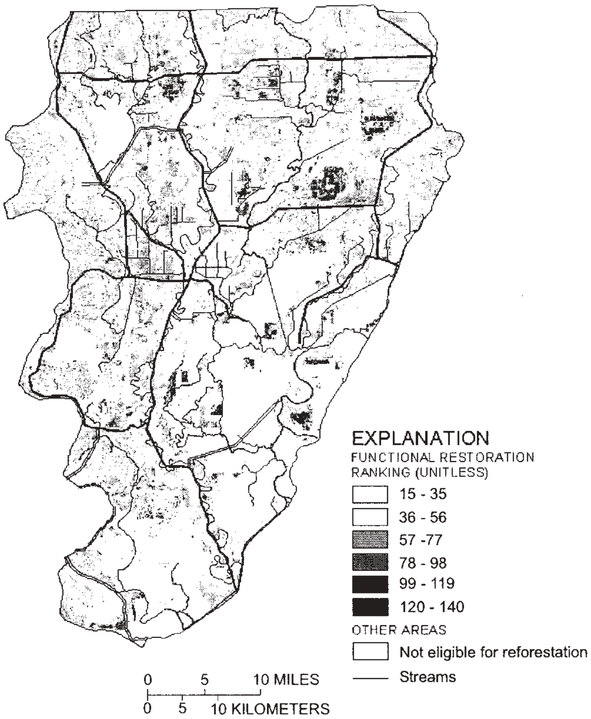

Figure 5—Functional Restoration Maximum—the data layer generated by summing the assigned ranks for all data layers for each 25-m cell in the study area. Darker areas represent areas that have a higher probability of being restored back to a functional wetland.

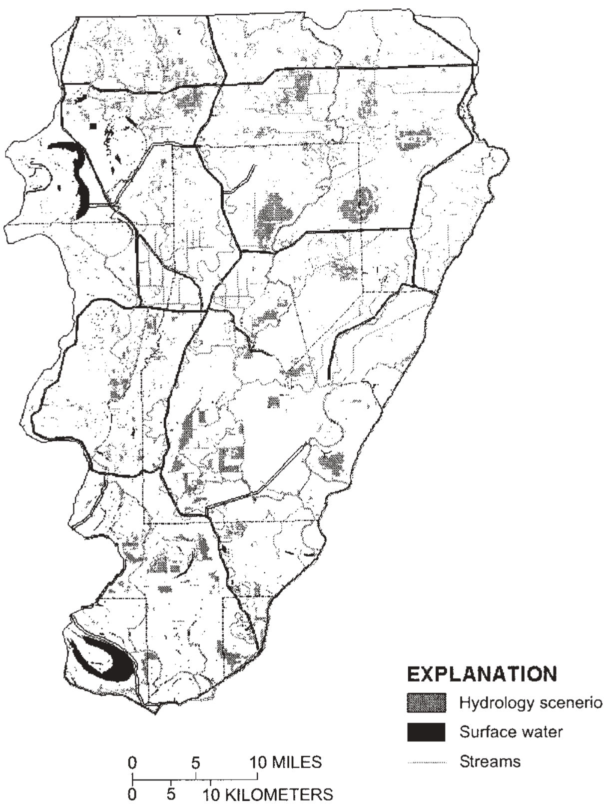

Figure 6—Various restoration scenarios can be compared by comparing their sum of functional restoration values (A) and by dividing the functional restoration value by the area to get a functional restoration value per land area estimate (B).

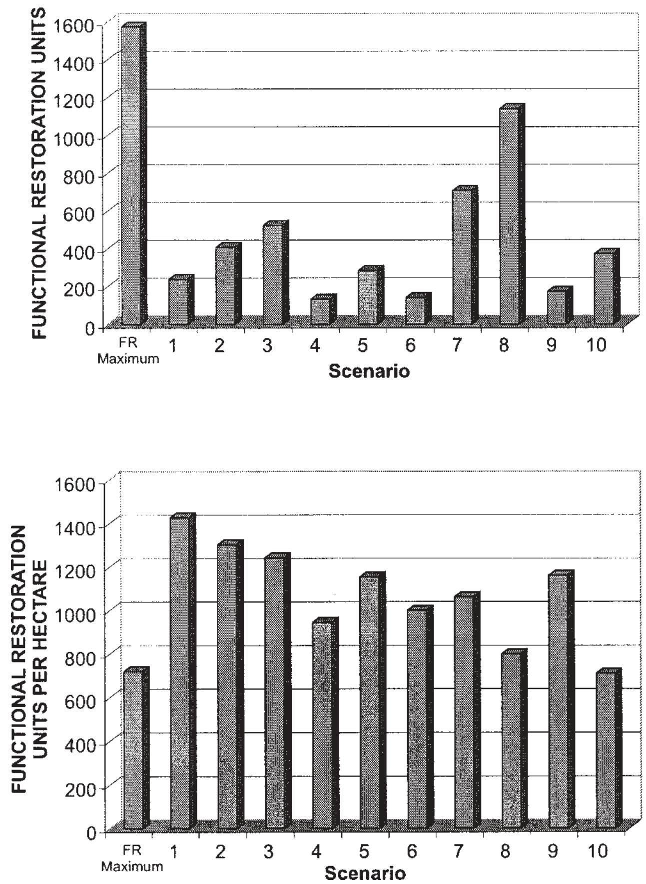

Figure 7—An example of a restoration scenario derived from the Functional Restoration Maximum layer in which all cells within the 2-year flood are selected.

SUMMARY

The Eco-Assessor DDS provides a valuable tool to prioritize the restoration of forested wetlands in the lower Yazoo River basin. The data compiled, and the tools that are included in the DSS, facilitate the rapid generation and consideration of alternate restoration scenarios. The DSS can be used to help develop reforestation plans that place wetland forest communities in locations in the landscape where each wetland has a high probability of developing into a functional wetland system. Reforestation efforts can be targeted to areas that would provide the highest ecological benefit for a given economic investment. The DSS also provides a method for systematically altering the buffer distances and ranks assigned to each data layer through the use of the interactive menus, which make up the Eco-Assessor framework. The ability to change the ecological rules and rank values allows the user to obtain the most appropriate ranking for a given wetland system.

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