United States Geologic Survey
Forest Breeding Bird Decision Support Model

The Mississippi Alluvial Valley (MAV) Forest Breeding Bird Decision Support Model is an ArcGIS-based raster assessment that rates areas throughout the MAV for their ability to benefit forest-breeding birds through restoration of bottomland hardwood forest habitat. The tool scores potential restoration areas (pixels) based on their proximity to forest core areas, with proximity scores weighted based on core area size. The contribution of restored area to landscape factors, such as percentage of surrounding habitat that is "non-hostile," are also taken into account, and extra consideration is given for sites located at high elevations within the floodplain – these being less vulnerable to flood damage. The Forest Breeding Bird Decision Support Model is readily transferable to other regions of the country containing large floodplain areas that are interested in prioritizing for habitat connectivity and wildlife values.

OVERVIEW

Lead developers: U.S. Geological Survey (USGS) Patuxent Wildlife Research Center, U.S. Fish and Wildlife Service (FWS) Lower Mississippi Valley Joint Venture Office.[1]
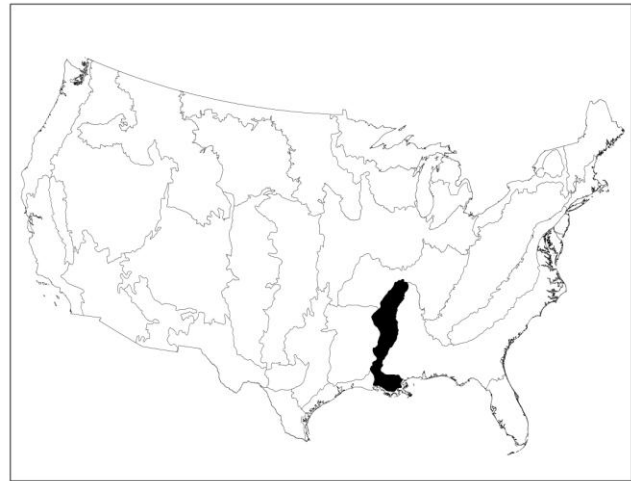
Year developed: 2004.[2]

Geographic area: Mississippi Alluvial Valley (MAV) (Fig. 1).[1]

Resource types: Bottomland hardwood forest wetlands.[1]

Restoration/conservation: Restoration (reestablishment), preservation/protection, and acquisition without preservation/protection.[2]

Figure 1. The Forest Breeding Bird Decision Support Model prioritizes forest bird habitat for the Mississippi Alluvial Valley (shaded above). Map from Twedt et al. (2006).

Stakeholders: The Lower Mississippi Joint Venture, which seeks to reforest 800,000 ha of bottomland hardwood forest in the MAV.[1]

Current status: The tool is complete and prioritization results are being used for a variety of purposes including Section 404 compensatory mitigation, endangered species mitigation, forest restoration and acquisition, and the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Wetland Reserve Program (WRP). The Lower Mississippi Valley Joint Venture is currently working to establish a similar reforestation prioritization model for the bird conservation region adjacent and to the west of the MAV—the West Gulf Coastal Plain Bird Conservation Region.[2]

PRIORITIZATION ANALYSIS

Landscape prioritization tool(s):

Forest breeding bird decision-support model: The Forest Breeding Bird Decision Support Model is an ArcGIS-based assessment that rates 30m^2 raster cells throughout the Mississippi Alluvial Valley for their ability to benefit forest-breeding birds through restoration of bottomland hardwood forest habitat. The tool scored potential restoration areas based on their proximity to forest core areas, with proximity scores weighted based on core area size. The contribution of restored area to landscape factors, such as percentage of surrounding habitat that is "non-hostile," was also taken into account. Extra consideration was given to sites located at high elevations within the floodplain, which were considered less vulnerable to flood damage.[1]

Throughout the process of developing the tool, all member agencies and organizations in the Lower Mississippi Alluvial Valley Joint Venture Forest Bird Working Group were given the opportunity to review the tool methods and outputs.[2]

The results of this scoring process were visualized as maps depicting the priority ratings of all 30m^2 pixels comprising the MAV (Fig. 2). Factors and data sources applied by the model are detailed in Table 1.

Prioritization objectives assessed:[2]
- Habitat quality

Table 1. Factors and associated data sources used to identify priority restoration sites in the USGS Forest Breeding Bird Decision Support Model.[1]

Factors used in analysis		Data source(s)
Proximity to forest core (area >1000m from hostile habitat)		2001 NLCD (land cover classes: deciduous, evergreen, mixed, and transitional forests, orchards, and woody wetlands); Classification of forest cover from 1992 Landsat TM imagery, updated based on 1999 TM imagery (J. Holden, unpublished data);
Proximity to forest sub-core area (area >500m from hostile habitat)		
Proximity to forest non-core area		
Forest core size: 1000-2000 ha; 2000-5000 ha; 100-1000 ha; <100 ha; >5000 ha		
Percentage nonhostile habitat	Reforested areas	Public lands reforestation database maintained by the Lower Mississippi Valley Joint Venture Office; office also works with partners to maintain data on private lands enrolled in WRP and CREP
	Shrublands	NLCD 2001 (shrubland class)
	Emergent wetlands	NLCD 2001 (emergent herbaceous wetlands class)
	Natural water bodies	NLCD 2001 (open water class), USGS Digital Line Graph Hydrography Data (lakes and rivers; NHD)

Updated: 2/24/2012

Distribution of ridges and benches	Soil moisture index for non-forested habitats	winter TM satellite imagery (J. Holden, unpublished data)
	Estimated locations of local ridges and slopes	Identified from 30-m USGS DEMs (Caruso 1987)
	Percent hydric soils land cover	Derived from soil associations defined in USDA STATSGO data (USDA 1995)
	Crop type land cover data	Classified from TM imagery (Bellow and Graham 1992) that characterized the propensity for flooding throughout the MAV (e.g., cotton being least likely to flood and soybean the most likely to flood)
	Location of natural flood storage basins	Multiple classified TM images (J. Holden, unpublished data

NLCD = United States Geological Survey National Land Cover Dataset; CREP = Conservation Reserve Enhancement Program; DEM = Digital Elevation Model; STATSGO = State Soil Geographic (dataset); TM = Thematic Mapper

Validation of the landscape prioritization tool(s): Over the last five years, agency personnel from the FWS, USGS, and state conservation agencies have conducted intensive time- and distance-based avian point count field assessments to validate the MAV model results. These field assessments identify presence/absence and bird densities for particular bird species within different forest blocks.[2]

Prioritization products: Static maps and raster-based GIS data outputs from the MAV Forest Bird Restoration Habitat Model are available for download from the Lower Mississippi Valley Joint Venture website (see: http://www.lmvjv.org/FBB_Decision_Support_Model.htm). Outputs from the model prioritizing areas for addition of restored forest area to different sizes of forest core area, for addition of "non-hostile" area, and for combining all prioritization scores are shown in Figure 2.
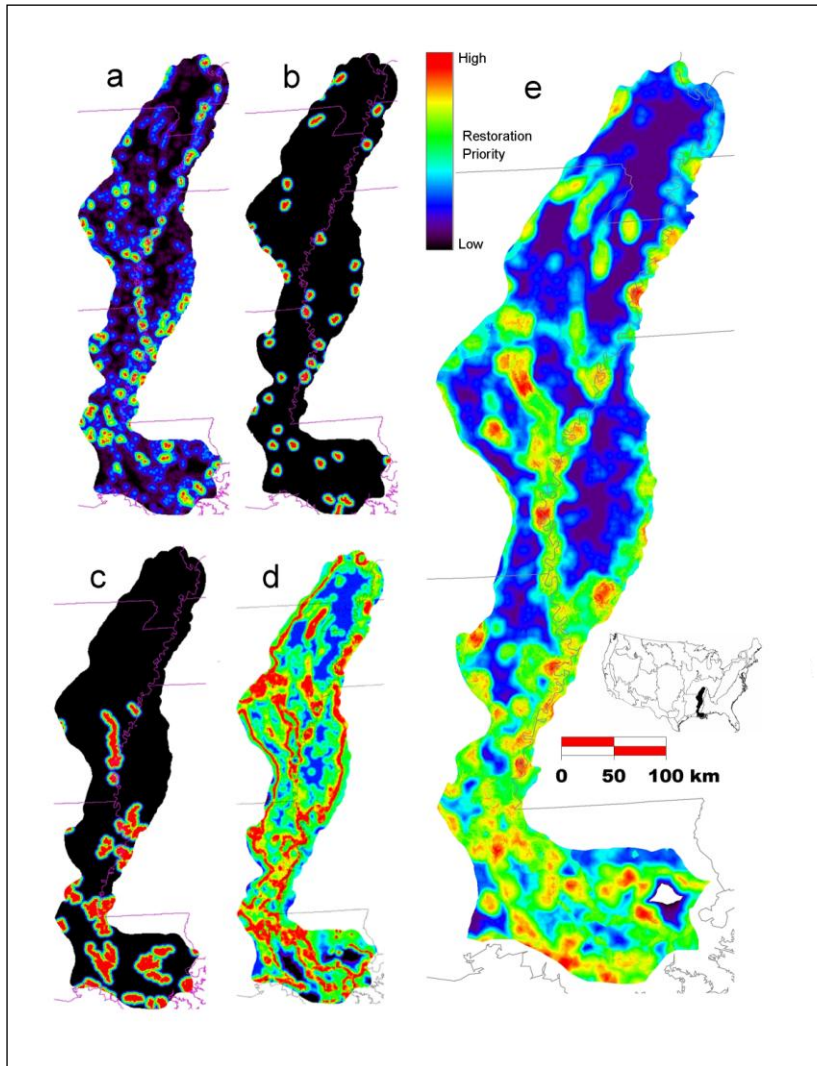
Figure 2. The prioritization outputs of the Forest Breeding Bird Decision Support Model rate areas throughout the MAV for their ability to benefit forest birds as restoration sites. These include: (a) creating forest patches with >2000 ha core area, (b) creating forest patches with > 5000 ha core area, (c) adding to forest core areas already >5000 ha, (d) increasing percentage forest cover in local landscapes to >60%, and (e) combining scores for all of these criteria and emphasizing higher-elevation sites. Figure from Twedt et al.

IMPLEMENTATION

Regulatory/non-regulatory program applications:
- Ducks Unlimited Mississippi Delta In-Lieu Fee Program: Priorities identified by the tool are used as part of the process for selecting sites at which to undertake compensatory wetland mitigation projects.[2]
- Endangered species compensatory mitigation (e.g., ivory-billed woodpecker).[2]
- Forest restoration and acquisition by the Mississippi Valley Joint Venture, Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative, and state wildlife management programs.[2]

Updated: 2/24/2012

- Selection of sites to fund for wetland restoration and conservation WRP, though different states use the tool differently as part of their WRP site-ranking process.[2] In some states, the WRP provides incentives for using prioritized bottomland hardwood restoration sites from the MAV model. This reforestation prioritization model is used in some instances as a criterion in the enrollment process for determining the number of "points" a particular wetland restoration project receives, though the formula and inclusion of the MAV model varies by state.[2]
- The tool may be used to determine how changing management practices on existing lands could affect birds – e.g., determine the effects of changing an area from simple row crop agriculture to a different crop type. Land managers could use the tool to better consider forest bird habitat in decisions.[2]
- USFWS could provide incentives for land protection and refuge augmentation through the Partners for Fish and Wildlife program.[2]
- Other incentives for investing in reforestation and wetland restoration include biomass energy incentives and carbon sequestration offset credits.[2]

Transferability:
- The model is readily transferable to other regions of the country that contain large floodplains and are interested in prioritizing for habitat connectivity and wildlife values.[2]

Data gaps:
- A lack of high resolution digital elevation model (DEM) data. Current DEM data are unable to resolve small differences in local elevation within the floodplain.[2]
- A lack of data on the location of historic high-elevation bottomland forest.[2]
- Soil associations within STATSGO soils data include multiple soil types. As a result, these soils data serve as poor predictors of soil characteristics.[2]
- Soil moisture and crop type data that are inadequate for predicting forest types.[2]
- Natural flooding maps are limited in coverage, with information particularly limited in Missouri, and do not distinguish flood duration.[2]
- Better assessment of restoration potential may now be possible using recently developed hydrogeomorphologically derived maps depicting potential natural vegetation.[3]
- During the development of the MAV forest restoration prioritization model, property rights concerns related to identification of NRCS Conservation Reserve Program (CRP) sites were problematic, with the result being that model developers were unable to access a database containing specific CRP lands.[2]

Future goals:
- The tool's developers would like to see the reforestation prioritization maps continue to be used. Potential barriers to this include:
  - Insufficient financial incentives for non-regulatory restoration, such as in the WRP or Partners for Fish and Wildlife program.
  - Preferences among some state programs (e.g., WRP) against focusing restoration funding in specific priority areas for reforestation (e.g., the MAV) in favor of spreading funding across large areas.

[1] Twedt DJ, Uihlein WB, Elliot AB. 2005. A spatially explicit decision support model for restoration of forest bird habitat. Conservation Biology 20(1) 100-110.

[2] Interview on 8/1/2011 with Daniel Twedt, Wildlife Biologist, United States Geological Survey.

[3] Feedback received on 2/24/2011from Daniel Twedt, Wildlife Biologist, United States Geological Survey.