Ducks Unlimited
Forested Wetland Restoration Suitability Model

The Ducks Unlimited (DU) Forested Wetland Restoration Suitability Model ranks (high, medium-high, medium-low, and low) the restoration potential of forested wetlands on flood-prone land throughout the Mississippi Alluvial Valley. The rankings are derived using Knowledge Engineer decision trees, which are used to assess areas across the landscape for factors related to the three major criteria for wetland delineation: hydrology (e.g., natural flood probability), soils (e.g., using soil moisture index as a proxy), and flora (e.g., temporal aspects of forest change). In addition, several exclusion layers were applied to remove from consideration all areas in which restoration would be impossible, impractical, or unnecessary (e.g., protected areas, such as forested federal and state lands, DU conservation easements). This model may be applicable to any geographic area engaged in active floodplain planning.

OVERVIEW:

Lead developers: Ducks Unlimited Southern Regional Office.[2]

Date developed: Finished in 2004.[1]

Geographic area: Mississippi Alluvial Valley (MAV) (Fig. 1).[2]

Resource types: Forested bottomland hardwood wetlands.[3]

Restoration/conservation: Identifies priorities for restoration (reestablishment of forest cover and/or hydrology), restoration (rehabilitation), and enhancement.[3]

Current status: DU is currently using the restoration priority tool to help determine where to pursue forested wetland restoration conservation delivery programs. The tool is currently used as guidance in selection of mitigation sites for DU's in-lieu fee program and to help target bird habitat restoration activities.[3]

Figure 1. DU's Forested Wetland Restoration Suitability Model is applied within the Mississippi Alluvial Valley. Used with permission from Ducks Unlimited.

PRIORITIZATION ANALYSIS:

Input data QA/QC: DU conducted ground verification to verify the accuracy of input variables for two counties in the MAV. In doing so, they confirmed that areas classified as Soil Moisture Index (SMI) classes 1 and 2 contained ground indicators of high surface soil moisture. In addition, DU completed a map agreement analysis in which they confirmed that Soil Survey

Geographic Database (SSURGO) hydric soils data for five counties corresponded strongly with SMI classes 1 and 2.[2]

Landscape prioritization tools:

Forested wetland restoration suitability model: The forested wetland restoration suitability model evaluates site suitability for wetland restoration using Knowledge Engineer in ERDAS Imagine. The first step in Knowledge Engineer involves classifying each of five primary datasets (natural flood probability (NFP), soil moisture (SMI), depressional sinks, stream buffers, and forest change) in either a binary fashion (high/low) or a non-binary fashion. The datasets classified in a non-binary fashion are NFP and SMI, with NFP separated into four classes and SMI into three. In the second step, a decision tree developed in Knowledge Engineer sorts particular pixels based on the combination of classifications for each individual dataset at that pixel's location. Another unique characteristic of Knowledge Engineer is that, based on the particular combination of classifications that result in a particular priority ranking for a parcel, confidence values are assigned for each pixel's categorization. In the final output all pixels in the MAV study area are classified into one of the four priority classes (high, medium-high, medium-low, and low) and assigned a confidence value.[2]

Prioritization objectives assessed:[1]

- Feasibility of restoration

Table 1. The prioritization model evaluates the suitability of areas within the MAV for the effectiveness of restoration of forested bottomland wetland habitat.[2,4]

Factor used in analysis	Data source(s)
Suitability factors	
Natural flood probability (NFP) maps	Period of record stream gauge data (US Army Corps of Engineers, Vicksburg District); Landsat TM imagery (after 1982)
Soil moisture index (SMI)	Landsat 7 ETM+ satellite imagery (acquired winter 1999)
Depressional sinks	USGS National Elevation Dataset
Forest change (1940's to 2001)	Landsat Multispectral Scanner (MSS) imagery; Landsat TM imagery; Landsat ETM+ imagery
Stream buffers	USGS National Hydrography Dataset
Exclusion factors	
2001 forest cover	Landsat Multispectral Scanner (MSS) imagery; Landsat TM imagery; Landsat ETM+ imagery
Permanent water bodies	Generated internally using summer imagery and low river levels
Roads	ESRI dataset

Urban areas	ESRI dataset
Wildlife management areas	Data acquired from individual state agencies
National Wildlife Refuges	USFWS National Cadestral Database
National forests	Forest Service GeoData Clearinghouse
Farm and home administration lands	Data provided by either NRCS or FWS
Wetland Reserve Program project sites	NRCS geospatial database
DU conservation easements	DU conservation easement geospatial database
DU private landowner projects	DU private lands geospatial database
Private landowner conservation projects of other conservation partners	Vector data acquired from conservation partners

Validation of the landscape prioritization tool(s): Although DU has not yet completed any groundtruthing, it would like to validate the model within the next few years. However, changes in the landscape since the last model run could be problematic unless a revision to the model, which is under consideration, is completed as well.[4]

Prioritization products: An output dataset of forested wetland restoration priorities, produced for the MAV in ArcGIS. A subset image of the model output is shown in Figure 2.[2]

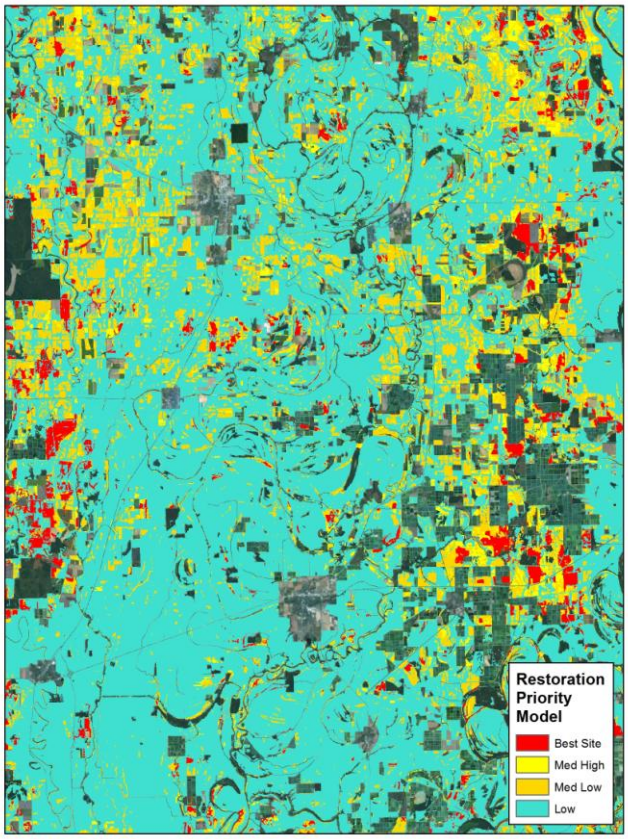

Figure 2. Output map from the DU model. Used with permission from Ducks Unlimited.

IMPLEMENTATION:

Regulatory/non-regulatory programs:

- Section 404 compensatory wetland mitigation: The model is being applied to aid DU in the identification of potential compensatory mitigation sites used for DU's Mississippi Delta in-lieu fee program.[1]
- Lower Mississippi Valley Joint Venture, which operates a conservation delivery network, is using the model in combination with several other models to target bird habitat restoration.[1]
- DU would like to see increased non-regulatory incentives for use of prioritization maps, including increased Wetland Reserve Program (WRP) points for restoration of prioritized sites.[1]

Transferability:

- DU's model could be used as a surrogate for active floodplain planning.[1]

Data gaps:[1]

- Data for additional exclusion layers

Barriers:

Updated: 5/11/2012

- DU has not been capable of maintaining the technical staff capacity needed to update and keep current its forested wetland restoration prioritization tool; however the GIS and remote sensing capacity needed to complete this task is currently being added with anticipation of a model update within 2-3 years.[3]
- Increased time and funding for the program would help results and data inputs to remain up-to-date.[1]
- Training on using the prioritization results would help to expand use of the tool.[1]

Future goals:

- Incorporate the tool into Farm Bill-related wetland delivery projects. Obstacles to achieving this goal would include:
  - Staff capacity, time, and funding to update and maintain the prioritization tool, as well as data to keep the tool up-to-date.[1]
  - WRP often attempts to distribute funding throughout states so that farmers feel that this funding is equitable, thus creating barriers to targeting large amounts of WRP funding in specific regions.[1]

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[1] Interview on 8/2/2011 with Dale James, Manager of Conservation Planning, Ducks Unlimited.
[2] Shankle, S, Brown, D, Holden, J. Site suitability modeling for the restoration of forested wetland in the Mississippi Alluvial Valley.
[3] Feedback received on 5/10/2012 from Dale James, Manager of Conservation Planning, Ducks Unlimited.
[4] Feedback received on 1/24/2012 from Dale James, Manager of Conservation Planning, Ducks Unlimited.