EMDS

Model Uses   EMDS is an application framework for knowledge-based decision support of ecological assessments at any geographic scale.   The system integrates GIS and knowledge-based reasoning and decision modeling technologies to provide decision support for a substantial portion of the adaptive management process of ecosystem management.

Major Categories	Decision Support	<u>**Subject Knowledge Level**</u> Intermediate
Minor Categories	Desired Future Conditions	<u>**Technical Difficulty Level**</u> Intermediate
Model Type	Other – Modeling System	<u>**Geographic in Nature?**</u> Yes

Abstract

The EMDS program is an extension to ArcGIS 8 that utilizes 6 sub programs to assist with the overall process of landscape evaluation and planning: NetWeaver logic engine; Hotlink Browser; Data Acquisition Manager; Priority Analyst; EMDS Project Environment

NetWeaver Logic Engine

The NetWeaver logic engine evaluates data against a knowledge base that provides a formal specification for the interpretation of data. A knowledge base can be thought of as a type of meta database. EMDS application developers use the NetWeaver Developer System (Rules of Thumb, Inc.) to design the knowledge bases used in EMDS. The logic engine allows partial evaluations of ecosystem states and processes based on available information, making it ideal for use in landscape evaluation where data are often incomplete. The NetWeaver engine was selected as the core logic processor of EMDS because its associated development system readily supports design of logic specifications for the types of large, complex, and abstract problems typically posed by ecosystem management.

A second key feature provided by the logic engine is the ability to evaluate the influence of missing information on the logical completeness of an assessment. The engine, in conjunction with the EMDS Project Environment and the Data Acquisition Manager, provides powerful diagnostic tools for determining which missing data are most valuable given currently available data and for determining how much priority to give to missing data given other logistical information.

Hotlink Browser

Sophisticated geographic analyses often produce impressive looking maps. However, if the analytical system that produces a map cannot also explain the derivation of analysis results being portrayed in a relatively simple and straightforward way, then the system appears to observers as a black box. With the high level of public interest in natural resource management in these times, black box solutions are a political liability. The Hotlink Browser displays the evaluated state of a knowledge base. Users can navigate the networks of analysis topics to trace the logic of evaluations in an intuitive interface.   More importantly, the presentation of results in this graphic format is sufficiently intuitive that users of the system can use the Hotlink Browser as a powerful communication tool that effectively explains the basis of evaluation results to broad audiences.

Data Acquisition Manager (DAM)

Data gaps are common, particularly in the early stages of landscape evaluation. It turns out that, from a logic perspective, the influence of missing information is very dynamic. The Data Acquisition Manager (DAM), in conjunction with the NetWeaver logic engine and the EMDS Project Environment, summarizes the influence of that missing information, given the information that is currently available, and assists the user with establishing priorities for obtaining the missing data to improve the logical completeness of an assessment in the most efficient way. To assist the priority setting process, a variety of maps, tables, and graphs provide information about what data are missing, the influence of data, and how it is distributed in the landscape.

Priority Analyst

The Priority Analyst (PA) is a planning component that assists with setting priorities for management activities in landscape elements of the assessment area given results of a landscape evaluation performed by the NetWeaver logic engine. Whereas the logic engine addresses questions about the current state of the assessment area, PA addresses

questions about where to direct management for best effect. For most applications of evaluation and planning, maintaining this distinction is important because the landscape elements in poorest condition are not necessarily also the best candidates for management activities such as restoration for example.

PA is a Multi-Criteria Decision Analysis (MCDA) component that assists resource managers in ranking landscape elements based on how well each rates against a set of decision criteria. Using output from a landscape evaluation and a decision model designed in Criterium DecisionPlus (InfoHarvest, Inc.), PA rates the landscape elements not only with respect to their condition, but also with respect to factors related to the feasibility and efficacy of management. PA implements two decision models: the Analytic Hierarchy Process (AHP) and the Simple Multi-Attribute Rating Technique (SMART).

EMDS Project Environment
The EMDS extension to ArcMap consists of the six components described in this section. For practical purposes, the EMDS Project Environment can be thought of as a supervisory component of the extension that manages the activities and interactions of the other components (see EMDS System Components) within the ArcMap environment. The EMDS Project Environment also is the primary component of the extension with which a user interacts to set up assessments, analyses, and scenarios, all of which are organized within a tree view of project structure.

ArcMap itself provides the resource manager with a powerful GIS environment in which to visualize, create, process, and display spatial information. It is in ArcMap where a user assembles all the necessary data layers to be processed by the NetWeaver logic engine, and ArcMap handles all EMDS spatial displays. More generally, however, because EMDS is implemented as an ArcMap extension, all the spatial processing power inherent to ArcMap, and any of its other available extensions, is available to the EMDS user.

Future Developments
Unknown

Model Limitations
The output is only as good as the GIS data and the knowledge base used. Although this modeling approach is fairly transparent, and can combine a variety of interests, it can still be seen as a bit of a "black box".

Model Features
- NetWeaver logic engine
- Hotlink Browser
- Data Acquisition Manager
- Priority Analyst
- EMDS Project Environment

Required Data Types
Expert information about the ecosystem required for knowledge base construction.

GIS data required for data analysis.

Model Outputs
GIS maps and tables of landscape evaluation for different management scenarios.

Source
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Source (URL)
http://www.fsl.orst.edu/emds/

Hardware Requirements
Those required for ArcGIS 8.x

Supported Platforms

DOS	☐	**UNIX**	☐
Windows	☒	**Macintosh**	☐

Software Requirements
On Windows 2000 and XP, the minimum ArcGIs version is 8.1. build 642.
On Windows NT, the minimum ArcGIS version is 8.1.2, build 671.
In ArcMap, go to Help-About on the menu bar to check the build prior to installing EMDS.

Cost, Licensing and Availability
Extension is free, but must already have ArcGIS 8 (see software requirements).