An Integrated Resource Management System
(IRMS)

First Quarter Report

Prepared for
Missouri Department of Natural Resources
Missouri Department of Conservation

Submitted by
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1. Project Objectives and Tasks

The goal of this research project is to develop a user friendly Internet-based decision support system (DSS) that addresses total resource management by integrating ecological and economic models with a geographic information system (GIS). Specifically, research is proposed to develop and implement an integrated resource management system (IRMS). This DSS is designed to assist natural resource-based agencies in developing management plans.   For example, IRMS will be used by MDNR Soil and Water Conservation Program to prioritize Special Land Area Treatment (SALT) or EARTH projects.   IRMS will also be used as screening tool for identifying costs and benefits of potential SALT projects.

Specific objectives of the proposed project are as follows:

1. Develop an Internet-based Integrated Resource Management System (IRMS) that addresses changes in land use and/or its management practices by integrating economic and environmental simulation models.

2. Develop feedback loops with IRMS end users and conduct three workshops for selected agency field staff.

2. Research Approach

IRMS will have three components: an Internet-based geographic information system (GIS) building upon ArcView Internet Map Server, a graphical user interface (GUI), and a modeling system. The GUI includes the menus that allow a user to select parameters and evaluation criteria needed to run IRMS. It will be developed using Java, JavaScript, HTML Form components and ArcView Avenue programming languages. The interface enables the decision maker to manipulate land use/management practices, execute the models, and view results within the GIS.

The GIS layers to be incorporated in IRMS include: soils, land use, digital orthophoto quadrangles (DOQs), hypsography, and hydrography. Depending on the data needs of the models, other layers may also be digitized with IRMS. Digitization of these layers should require a modest effort given scanning technologies, object character recognition software and other software algorithms.   Although some of these layers do not currently exist statewide, the intent of this research is to have the appropriate tools in place before the layers do become available.

The modeling system includes the Cost and Return Estimator (CARE) model and four habitat models. CARE is a crop budget generator which can be used with individual stockholders in conservation planning or as a tool for economic evaluation in watershed planning. The first habitat model has been developed by Wes Burger, Mississippi State University (see Habitat Model to Predict Landscape Use of Northern Bobwhite in Missouri). Subsequent models will be incorporated onto the tool as they are developed by Burger and

others. The purpose of integrating the habitat models is to streamline and automate the process of constructing habitat suitability surfaces for large-scale habitat assessment.

3. Work Schedule

IRMS is a three-year project extending from October 1, 1998 to September 28, 2001. The actual starting date of the project was November 1, 1998 due to a short hold-up at MDNR for the funding to go through.

The table below lists the proposed timelines for IRMS:

Tasks	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Consult with agencies on assigning field staff to project and establish formal feedback loops	X											
Develop prototype IRMS by integrating CARE model	X	X	X	X	X							
Develop prototype of habitat models (CARE still under development)				X	X	X	X					
Complete integration of CARE model						X						
Complete integration of habitat models								X				
Activate feedback loops		X	X	X	X	X	X	X	X	X	X	
Conduct workshops								X		X		X
Prepare quarterly reports to funding agencies, collaborators and specified field staff	X	X	X	X	X	X	X	X	X	X	X	X
Meeting with funding agencies, collaborators, model developers and field staff regarding direction of project				X				X			X	
Prepare on-line users manual				X			X				X	
Prepare final report/distribute final version of IRMS												X

Task 1. Assign Field Staff to Project and Establish Formal Feedback Loops

IRMS is funded through Missouri Department of Natural Resources and Missouri Department of Conservation in collaboration with Natural Resources Conservation Service (NRCS) and Mississippi State University. The points-of-contact and collaborators from respective agencies are:

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Above collaborators were contacted for identifying field liaison in their respective agencies. The MDC field staff assigned to the project feedback loops are:

Scott Vance, Wildlife Biologist
Box 43, Williamsburg, MO 63388
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Shannon Zezula, Wildlife Conservationist
727 PCA Rd., Suite B, Warrensburg, MO 64093
Phone: (660) 747-8400 ext 120
Email: *not available yet*

In the follow-up contact with Scott and Shannon, both of them expressed a lot of enthusiasm and interest in working on the project.

Two soil scientists were suggested for the feedback loop by MDNR. The assignments are not finalized yet.

Task 2. Develop Prototype IRMS By Integrating CARE Model

The Cost and Return Estimator (CARE) is the originally proposed economic model for the project. Several new economic models relevant to conservation decision making have been developed and used by NRCS since the research proposal was submitted. These models were reviewed for appropriateness and applicability for this project. The model developers were contacted for insights and comments.

CARE. The CARE is a farm budget generator, developed by USDA Soil Conservation Servies (SCS) from 1985 to 1994, and primarily used as a field office or farm PC tool. CARE relies upon a set of databases that store information on the farming activity such as ownership, usage patterns, and machinery complement. The model output includes a budget listing gross receipts from production, production activities, inputs and outputs to the land, costs, gross returns, and net returns. Specifically, CARE serves three distinct functions: (1) provide a database for storing the basic components of a farm budget such as data on machinery, land, inputs, outputs, prices, etc.; (2) provide an environment that allows users to easily combine the machinery, inputs, land, etc., into a set of operations that specify a budget to be analyzed; and (3) generate reports from the analysis of the budget data.

The original interface of CARE model is a hybrid of several DOS-based software programs including Lotus, dBase III and Clipper. Specifically, the menu system utilizes a "bounce bar" style of interface. As you press the left and right arrow keys, the highlight bar will move left and right. Pressing the <Enter> key will activate the option currently highlighted.

Cost Builder. The Cost Builder is a simple Windows-based conservation cost estimating tool that was released in April, 1997. The user selects a conservation practice (e.g. Filter Strip) from a list for cost schedule reporting. The data required from user includes Year Installed, Present Value of Installation Value, Annual Payment and Annual Operating Cost. The tool calculates the Total Annual Cost for the selected practice.

Cost Effectiveness Analysis I - IWR-Plan. This beta software program determines the cost effectiveness of conservation systems or practices. The tool was developed by the Institute for Water Resources, Army Corps of Engineers, in cooperating with NRCS, and released in January 1998. IWR-Plan has been used by the Army Corps of Engineers for cost effectiveness analysis. The program currently does not support spatial data.

Cost Effectiveness Analysis II – LandTrt. This spreadsheet model determines the cost effectiveness of watershed or area wide conservation projects. Cost effectiveness is defined here as: "maximizing environmental benefits per dollar spent", or "achieving the highest resource improvements at lowest cost". The tool was released in February 1997. LandTrt provides decision support in dealing with a watershed or area consisting of various land uses with distinct resource concerns. The tool selects the most cost effective combinations of land uses, resource concerns or pollutant loadings, and conservation practices or systems. It also specifies the quantity of an area to treat.

LandTrt contributes to one specific criteria used in the evaluation of resource conservation projects: cost effectiveness or efficiency. A series of Microsoft Excel spreadsheet tables need to be built to set up a LandTrt model.

Profits and Costs (ProCosts). ProCosts is a profit (i.e. farm budget) and cost analysis program that handles crop budgeting, livestock budgeting, and conservation practices. The targeted audiences include: (1) economists, analysts, engineers and consultants who supply profit and cost estimation services to private sector businesses and public sector planners; (2) planners, farmers, ranchers and analysts who use information about profits and costs to plan and make decisions.

ProCosts is developed to phase out CARE. An Alpha Version was released on November 20, 1998. Alpha testing is planned for three months till mid-February. The beta testing and version 1.0 release will follow after the Alpha testing. The targeted computer platform is a Web or client server.

David Buland provides technical support at NRCS for the CARE model. He currently joins Kevin Boyle (NRCS) as the key developers of ProCosts. When asked for recommendations on model inclusion for IRMS, they both recommended ProCosts over CARE or other models and gave assurances that ProCosts will be working with a database in time for the IRMS project. David and Kevin also expressed interest in receiving updates on the IRMS project and contributing to the Web site.

Based on model review and comments from David Buland and Kevin Boyle, ProCosts is selected for economic model integration with IRMS. The program will be downloaded after the Alpha testing is completed.

The IRMS Web site is currently under construction and will be constantly improving. The URL address for the site is: **http://www.cares.missouri.edu/irms**. The site will not only host the interactive decision support system, GIS databases and information on models, but will also provide all project-related information and links. Furthermore, the Internet technology is intended to be the primary mechanism for communication and feedback among the project collaborators and participants.