



*environmental Risk Assessment &  
Management System (eRAMS)*



# **A Web Technology for End-To-End Conservation Planning and Watershed Management**

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# Watershed Management

- Water Quantity
  - Flood control
  - Drought management
- Water Quality (Environmental) Criteria
  - Sediment
  - Nutrients
  - Pesticides
  - Metals
  - Pathogens
- Economic Criteria
  - Cost
  - Benefits
- Institutional Criteria

# Nonpoint Source Pollution Control

- Implementation of conservation practices / BMPs
  - Prevent or minimize pollution rather than retrospectively respond to it.
- Current Approaches
  - Cost-sharing
  - Targeting



Photo courtesy of NRCS

# Targeting Strategies

- Edge-of-field pollutant loadings (field-scale)
- Delivery to stream locations (watershed-scale)
  - Surface water transport pathways
    - Proximity to streams (stream order matters)
    - Overland and channel routing
  - Ground water transport pathways
- Stakeholder participation

# What is eRAMS

- A collaborative framework for management of land, water and energy resources
  - Web-based (one-stop)
  - Cloud computing infrastructure (similar to OMS3/CSIP)
  - Platform independent and can be deployed on any mobile system
  - Open source
  - Geospatial tools
    - No ESRI products
    - All components are free and open source

# eRAMS: Participatory Platform

- Facilitate collaboration and social networking
- Facilitate collecting, organizing and sharing data
- Integrate of data with modeling/analysis tools
- Turn information into insight

**Content  
management**



**Analytics**



**Information  
integration**



**Data  
management**



**Data warehousing**



**Information  
governance**

# eRAMS Watershed Management

- Establish **benchmark conditions** for a field/watershed
  - Provided by local experts
  - On-the-fly simulation of benchmark conditions
- **Assessment**: costs and environmental benefits of a given set of management alternatives
  - Provided by local experts
  - Dynamic, real-time scenario creation and assessment of alternatives
- **Planning**: scenario analysis and system optimization for developing sound resource management alternatives

# Data Collection and Sharing

- Identify problems
- Determine stakeholders' objectives, preferences and values
- Location and type of conservation practices
- Geospatial data
  - Extract from data warehouses: Climate, flow, WQ, soil, land cover, topography, hydrography, etc.
  - Upload user data
  - Digitize



# Modeling Components

- Modules
  - Soil and Water Assessment Tool (SWAT): general watershed processes
  - APEX: agroecosystem
  - MODFLOW: ground water
  - HEC-RAS: channel processes
  - OMS3/RUSLE2
- Plug-in applications for diverse set of problems
- “Decentralized” group of users
- Incorporation of local expert knowledge

# Technology Drivers

- No specific hardware or software requirements
  - Reduce training requirements
  - Eliminating the collection of duplicate data across agencies
  - Reduce long-term development and maintenance costs
  - Mobile system accessible, end-to-end, on the web
- Compatibility with existing databases/GIS technologies
  - Take advantage of readily available data

# Technology Drivers

- Benefit from Google, Bing, and NASA products and other commonly-used internet technologies
  - Common “look and feel” interface
  - High resolution aerial photos, etc.
- Compatibility with long-term vision of institutions involved with management of natural resources
- Working across scales: field to watershed


eRAMS - Environmental Risk Assessment & Management System - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.eramsinfo.com/erams\_beta/

Google

eRAMS - Environmental Risk Assess...

 **eRAMS**  
*share your geographic perspective...*

Username/Email:  Password:   
 or   
 Keep me logged in Forgot your password?

My Account Groups Map Resource Center Contact Us


### What is eRAMS?

a participatory web-based *Geographical Information System (GIS)* that facilitates:

- collection, organization and sharing location based information
- integration of data with complex modeling and decision support systems

### Why eRAMS?

The eRAMS technology provides an easy to use platform for participation between various stakeholders to manage land, water and energy resources. [Read More](#)





**Mazdak Arabi**  
Edit My Account



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All items

### Geographic Data

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All items

### Projects

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### Collaborators

Chat

- Collaborator 1
- Collaborator 2
- Collaborator 3

Location Documents owned by me > Folder xxx



Search by type



Sort by | Name

View by | List

+ Create new folder

The document collection is currently empty.

Folder 1

hover -> Total Size: 3.0 GB

click -> summary in the preview

double click -> open the page corresponding to the folder

Folder 2

File 1

Folder or document name

Owned by  
Last modified  
Last viewed  
Collaborators

List All

For folders

Share | Map | Add File

For files

Share | Map | Versions

Advertisement Location

Collaborator 1

Message

Collaborator 1: xxx

Mazdak: xxx

# Contacts and Collaborators

eRAMS - Environmental Risk Assessment & Management System - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.eramsinfo.com/erams\_beta/address\_book?reset=1

eRAMS - Environmental Risk Assess...

## eRAMS

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mazdak\_demos

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Projects

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Collaborators

### Contacts

Search:

Email:

New Contact Properties Delete New Map Layer Upload Download

Name	Email	Organization	Phone	Website	
Bruell, Harry		Southwest Conservation C			Map
Bryson, Phil		Brainstorm Enterprises			Map
Burns, Mike		Alpine Bank			Map
Calderwood, Cathy		Mountaintop Leadership C			Map
Capdevielle, Scott		Syndicom Inc.			Map
Capron, Bryce	bc_signs@hotmail.com	Dolores County Developm		www.dolorescounty.org	Map
Coulehan, Mary Jo	Director@pagosachamber	Pagosa Chamber of Comr	(w) 970-264-2360	www.pagosaspringscham	Map
Cummings, Marcy		Cortez Chamber			Map
Dignum, Kirk		Mercy Medical Center			Map
Dove Creek Chamber of C		Dove Creek Chamber of C		dovecrcham@yahoo.com	Map
Fernandes, Aaron		ACF Enterprises, LLC			Map
Goodwin, Don		Archuleta County Educati			Map
Griffith, Marianne	Chamber@mancosvalley.c	Mancos Valley Chamber	(w) 970-533-7070	www.mancoscolorado.com	Map
Guttridge, Dana	cortezchamber@cityofcort	Montezuma Community Fr	(w) 970-565-3414	www.cortezchamber.com	Map

Done

Start eRAMS - Environment... Microsoft PowerPoint - [...]

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# Contacts and Collaborators

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eRAMS - Environmental Risk Assess...

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mazdak\_demos  
Modify Account  
Add Photo

**Contacts**

New

Name

- Bruell, Ha
- Bryson, P
- Burns, Mi
- Calderwo
- Capdevie
- Capron, B
- Coulehan
- Cumming
- Dignum,
- Dove Cre
- Fernande
- Goodwin,
- Griffith, Ma
- Guttridge

**Documents**  
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All items

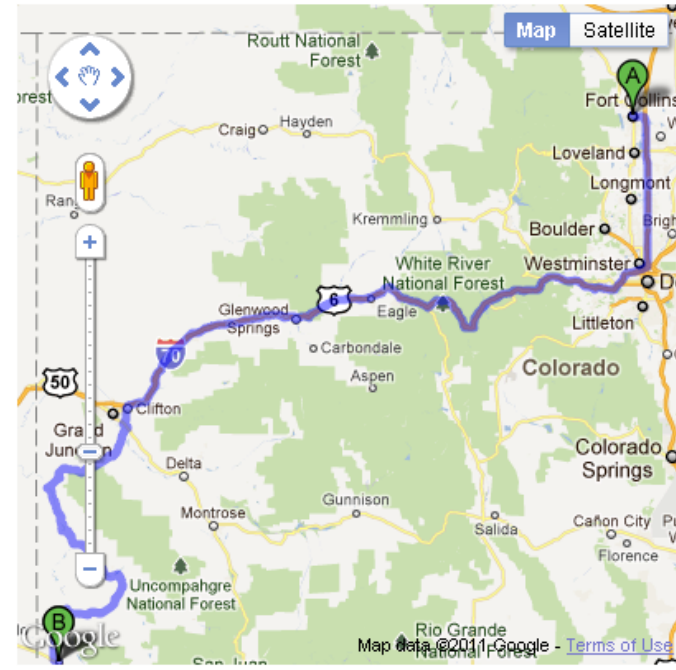
**Geographic Data**  
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**Projects**  
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All items

**Collaborators**

**Google Map** Search: Em

Directions from:  Route Print



1. Head **south** on **S Sherwood St** toward **W Olive St**

2. Take the 1st **left** onto **W Olive St**

3. Turn **right** onto **S College Ave**

4. Turn **left** onto **E Mulberry St**

5. Merge onto **I-25 S** via the **Driving Directions** **over**

6. Take exit **216B** to merge onto **I-76 W** toward **Grand Jct**

7. Merge onto **I-70 W**

8. Take exit **37** to merge onto **I-70 BUS W/US-6 W/Interstate 70 Business Loop W** toward **Clifton/Grand Jct**

9. Turn **left** onto **CO-141 S/32 Rd**

10. Turn **left** onto **CO-141 S/US-50 E/Alt Route Route State Hwy 141**

11. Turn **right** onto **CO-141 S**

12. Turn **right** to stay on **CO-141 S**

13. Turn **left** onto **US-491 S**

14. Turn **left** onto **Main St**

Done

Start eRAMS - Environment... Microsoft PowerPoint - [...]

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# Projects

eRAMS - Environmental Risk Assessment & Management System - Mozilla Firefox

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Geographic Data  
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All items

**Projects**  
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Collaborators

Projects

Search:

Excel PDF Print

**New Project** Properties Delete Set Current

Name	Type	Creation Date
* Colorado Biomass		
D_27Oct2011		
default		
Maquoketa		
OCT27_pm		
Poudre		
Raccoon		
RUSLE2 Test		
sterling		
test222		
test_OCT24		
WD_Test		

**New Project** Type Creation Date

Project Type:

Project Name:

Project Template:

Okay Cancel

Done

Start eRAMS - Environment... Microsoft PowerPoint - [...]

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# Map Canvas

eRAMS - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.eramsinfo.com/erams\_beta/map/

eRAMS

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Map LUI Scenarios Assessment Planning

Zoom to Address:  Go

Settings

Base Layers

Google  
 None  Physical  Streets  Hybrid  Satellite

Bing  
 Shaded  Hybrid  Aerial

World Layers

User Layers

Project Layers

Editing Layer

Choose Map Tool Pan Zoom Clear Map Query Print

United States

2000 km 1000 mi

Transferring data from ecn.t0.tiles.virtualearth.net...

Start eRAMS - Mozilla Firefox Microsoft PowerPoint - [...] My Documents 3:06 AM



# Map Canvas

eRAMS - Mozilla Firefox

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http://www.eramsinfo.com/erams\_beta/map/

eRAMS

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Map LUI Scenarios Assessment Planning

Zoom to Address:  Go

Settings

Base Layers

Google  
 None  Physical  Streets  Hybrid  Satellite

Bing  
 Shaded  Hybrid  Aerial

World Layers

User Layers

Project Layers

Editing Layer



Choose Map Tool Pan Zoom Clear Map Query Print


Map showing the United States with state labels: WASHINGTON, MONTANA, NORTH DAKOTA, MINNESOTA, OREGON, IDAHO, WYOMING, SOUTH DAKOTA, WISCONSIN, MICHIGAN, ILLINOIS, INDIANA, OHIO, PENNSYLVANIA, NEBRASKA, IOWA, NEBRASKA, MISSOURI, KENTUCKY, VIRGINIA, CALIFORNIA, NEVADA, UTAH, COLORADO, KANSAS, MISSOURI, W. VA., NORTH CAROLINA, ARIZONA, NEW MEXICO, OKLAHOMA, ARKANSAS, TENNESSEE, TEXAS, LOUISIANA, MISS. ALA. GA. S.C. FLA. The map also shows parts of Canada (ONTARIO, N.B., P.E.I., N.S., Vt., MAINE, N.H.) and Mexico (Gulf of California, Gulf of Mexico, The Bahamas, Havana). A scale bar indicates 2000 km and 1000 mi. The Bing logo is visible in the bottom left corner of the map area.


Transferring data from ecn.t0.tiles.virtualearth.net...

# Watershed Management Tools

mazdak\_demos | [Offline](#) | [Help](#) | [Sign Out](#)

[Print](#)  



**Watershed Tools** 

- Watershed Delineation
- Data Extraction
- Clip Layers To Watershed
- Distance To Feature
- Intersection With Feature
- Zonal Stats
- Extract Model Output
- OMS3/RUSLE2
- Multi-Criteria Decision Analysis

# Uploading Geospatial Layers

The screenshot displays the eRAMS web application interface. The browser window title is "eRAMS - Mozilla Firefox" and the address bar shows "http://www.eramsinfo.com/erams\_beta/map/#". The application header includes navigation links: Home, My Account, Groups, Map, Resource Center, and user information: mazdak\_demos | Offline | Help | Sign Out.

The left sidebar contains a "Project Layers" section with the following items:

- Spatial Layers
  - TX\_Demo
  - Raccoon
  - Watershed
- Subbasins
- Streams
  - Streams
- Outlets
  - Outlets

The main map area shows a map of the United States with a red watershed area highlighted in Iowa. The map includes a scale bar (2000 km, 1000 mi) and a Bing logo. The map controls include "Choose Map Tool", "Pan", "Zoom", "Clear Map", "Query", and "Print".

Transferring data from erams9.engr.colostate.edu...

# Symbology and Cartography

eRAMS - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.eramsinfo.com/erams\_beta/map/#

eRAMS

Home My Account Groups Map Resource Center mazdak\_demos | Offline | Help | Sign Out

World Layers

User Layers

Project Layers

Spatial Layers

- TX\_Demo
- Raccoon**
- Watershed
- Outlets
  - Outlets
- Streams
  - Streams
- Subbasins

Tables

Editing Layer

Choose Map Tool Pan Zoom Clear Map Query Print

Legend:

- 244.61 - 315.73
- 315.73 - 347.82
- 347.82 - 366.25
- 366.25 - 383.48
- 383.48 - 429.62

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Start eRAMS - Mozilla Firefox Microsoft PowerPoint - [...

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# Geospatial Capacities

eRAMS - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.erasinfo.com/eras\_beta/map/#

eRAMS

Home My Account Groups Map Resource Center mazdak\_demos | Offline | Help | Sign Out

Map LUI Scenarios Assessment Planning

Zoom to Address:  Go

- Settings
- Base Layers
- World Layers
- User Layers
- Project Layers
  - Spatial Layers
    - TX\_Demo
      - Temperature Gages
      - Rain Gages
      - Outlets
      - Streams
      - Subbasins
      - HRUs
      - Raccoon
    - Tables
  - Editing Layer

Choose Map Tool Pan Zoom Clear Map Query Print

Map showing a watershed area in green, with numbered points 1 through 6. The map includes roads like I-30, US Highway 69, and Texas Highway 154. A scale bar indicates 20 km and 10 mi.

Transferring data from erams9.engr.colostate.edu...

Start eRAMS - Mozilla Firefox Microsoft PowerPoint - [...]

My Documents 3:49 AM

# Heads-Up Digitizing

The screenshot displays the eRAMS web application interface within a Mozilla Firefox browser window. The browser's address bar shows the URL [http://www.eramsinfo.com/erams\\_beta/map/#](http://www.eramsinfo.com/erams_beta/map/#). The application interface includes a top navigation bar with tabs for **Map**, **LUI**, **Scenarios**, **Assessment**, and **Planning**. On the left side, there is a sidebar menu with options: **Zoom to Address:** (with a text input field and a **Go** button), **Settings**, **Base Layers**, **World Layers**, **User Layers**, **Project Layers**, and **Editing Layer** (which is expanded to show an **Edit layer:** dropdown menu currently set to **Collection1**). The main map area features a toolbar with buttons for **Choose Map Tool**, **Pan**, **Zoom**, **Clear Map**, **Query**, and **Print**. A dropdown menu is open under **Choose Map Tool**, listing digitizing options: **Add Polygon**, **Add Circle**, **Add Line**, **Add Point**, **Identify Area**, **Edit Features**, and **Select Features**. The map itself shows an aerial view of a rural landscape with fields and trees. At the bottom of the browser window, the taskbar shows the **Start** button, open applications including **eRAMS - Mozilla Firefox** and **Microsoft PowerPoint - [...]**, and the system tray with the date **My Documents**, system icons, and the time **3:53 AM**.



# Heads-Up Digitizing

The screenshot displays the eRAMS web application interface within a Mozilla Firefox browser window. The browser's address bar shows the URL [http://www.eramsinfo.com/erams\\_beta/map/#](http://www.eramsinfo.com/erams_beta/map/#). The application interface includes a top navigation bar with buttons for 'Add Polygon', 'Pan', 'Zoom', 'Clear Map', 'Query', and 'Print'. On the left side, there is a sidebar with a 'Map' tab selected, and a 'Zoom to Address:' field with a 'Go' button. Below this, there are expandable sections for 'Settings', 'Base Layers', 'World Layers', 'User Layers', and 'Project Layers'. The 'Project Layers' section is expanded to show 'Spatial Layers', which includes a tree view with 'TX\_Demo' and 'Conservation' layers. Under 'Conservation', there is a 'Collection1' layer with a red polygon labeled 'Field1'. Other layers listed include 'Temperature Gages', 'Rain Gages', 'Outlets', 'Streams', 'Subbasins', 'HRUs', and 'Raccoon'. The main map area shows an aerial view with a large red polygon overlaid on a field. The bottom status bar of the browser shows the Windows taskbar with the Start button, eRAMS - Mozilla Firefox, and Microsoft PowerPoint - [...] open, along with the system tray showing 'My Documents' and the time '3:56 AM'.

# Conservation Practices

eRAMS - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.eramsinfo.com/erams\_beta/map/#

eRAMS

Map LUI Scenarios Assessment Planning

Select fields with name:

- Bank Stabilization
- Contouring
- Crop Rotation
- Fertilizer Management
- Field Borders
- Filter Strips
- Grade Stabilization Structure
- Grassed Waterway
- Grazing
- Irrigation
- Land Use
- Pesticide Management
- Ponds
- Riparian Strips
- Sediment Detention Basin

Add Polygon

Grassed Waterway

Activate Grassed Waterway Calculation

Activate Grassed Waterway Calculation

Starting Day:

Starting Year:

Manning's n:

Sediment Linear Parameter:

Depth:

Width:

Length (km):

Average Slope (m/m):

Unit Cost (\$/unit):




Photo courtesy of NRCS

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Start eRAMS - Mozilla Firefox Microsoft PowerPoint - [...] My Documents 3:58 AM

# NRCS Handbook

Waterway.pdf (application/pdf Object) - Mozilla Firefox

http://www.eramsinfo.com/media\_erams\_beta/eRAMS Practices/NRCS Standards/Waterway.pdf

1 / 3 51.8%

Find

412 - 1

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**GRASSED WATERWAY**  
(Ac.)  
CODE 412

**DEFINITION**  
A shaped or graded channel that is established with suitable vegetation to carry surface water at a non-erosive velocity to a stable outlet.

**PURPOSE**

- To convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding.
- To reduce gully erosion.
- To protect/improve water quality.

**CONDITIONS WHERE PRACTICE APPLIES**  
In areas where added water conveyance capacity and vegetative protection are needed to control erosion resulting from concentrated runoff.

**CRITERIA**

General Criteria Applicable to All Purposes  
Plan, design, and construct grassed waterways to comply with all Federal, State, and local laws and regulations.

Capacity  
The minimum capacity shall convey the peak runoff expected from the 10-year frequency, 24-hour duration storm. Capacity shall be increased as needed to account for potential volume of sediment expected to accumulate in the waterway between planned maintenance activities. When the waterway slope is less than 1 percent, out-of-bank flow may be permitted if such flow will not cause excessive erosion. At a minimum, the design capacity shall remove the water before crops are damaged.

Stability  
Determine the minimum depth and width requirements for stability of the grassed waterway using the procedures in the NRCS National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 7, Grassed Waterways; Agricultural Research Service (ARS) Agriculture Handbook 667, Stability Design of Grass-Lined Open Channels; or other equivalent method.

Width  
Keep the bottom width of trapezoidal waterways less than 100 feet unless multiple or divided waterways or other means are provided to control meandering of low flows.

Side slopes  
Keep the side slopes flatter than a ratio of two horizontal to one vertical. Accommodate the equipment anticipated to be used for maintenance and tillage/harvesting equipment that will cross the waterway in the designed width.

Depth  
The capacity of the waterway must be large enough so that the water surface of the waterway is below the water surface of the tributary channel, terrace, or diversion that flows into the waterway at design flow.

Provide freeboard above the designed depth when flow must be contained to prevent damage. Provide freeboard above the designed depth when the vegetation has the maximum expected retardance.

Drainage  
When needed to help or keep vegetation established on sites having prolonged flows, high water tables, or seepage problems, include Subsurface Drains (606), Underground Outlets (620), stone center waterways or other suitable measures in waterway designs.

NRCS NHCP

Bank Stabilization  
Contouring  
Crop Rotation  
Fertilizer Management  
Field Borders  
Filter Strips  
Grade Stabilization Structures  
Grassed Waterways  
Grazing  
Irrigation  
Land Use  
Pesticide Management  
Ponds  
Riparian Strips  
Sediment Detention

Select fields with name: Field 1

Photo courtesy of NRCS

m  
m  
km  
ha

Standards SWAT Conservation Practice Sheets

Transferring data from www.eramsinfo.com... Done

Start eRAMS - Mozilla Firefox Waterway.pdf (applic... Microsoft PowerPoint - [...]

My Documents 3:59 AM

# Scenario Builder

eRAMS - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.eramsinfo.com/erams\_beta/map/#

eRAMS

Map LUI Scenarios Assessment Planning

Select GIS layers

Design Scenario

Choose Scenario: Scenario1 Create Delete

Scenario: Scenario1

<b>Model inputs have been specified for this scenario. To change the inputs, either upload new zipped model input files or copy them from another scenario.</b>

Add Model Input Or base scenario on: Baseline Copy

Location and Type of Conservation Practices for Scenario1

Add Polygon Pan Zoom Clear Map Query Print

Transferring data from dev.virtualearth.net...

Start eRAMS - Mozilla Firefox Microsoft PowerPoint - [...]

My Documents 4:07 AM

# Locations to Implement Changes

The screenshot displays the eRAMS web application interface. At the top, there are navigation tabs: Map, LUI, Scenarios (selected), Assessment, and Planning. Below the tabs, there are several interactive elements:

- A dropdown menu labeled "Select GIS layers".
- A dropdown menu labeled "Design Scenario".
- A section titled "Location and Type of Conservation Practices for Scenario1" with a dropdown menu set to "Q1" and buttons for "Create" and "Delete".
- Underneath, there are several options for conservation practices, each in a button-like box:
  - Select By Attribute
  - Select By Spatial Location
  - Assign Conservation Practices (expanded list):
    - Bank Stabilization
    - Contouring
    - Crop Rotation
    - Fertilizer Management
    - Field Borders
    - Filter Strips
    - Grade Stabilization Structure
    - Grassed Waterway (highlighted with a blue border)
    - Grazing

On the right side, there is a map view showing a satellite image of a rural area. A vertical toolbar is overlaid on the map, featuring a compass, a plus sign, and several minus signs. The map includes labels for "Highway", "ville", "S US-69", "Dix", "E FM-1564", "Fm 2101", and "West Ta". The Bing logo is visible in the bottom right corner of the map area.

At the bottom of the application window, there is a footer that reads: "Read [www.eramsinfo.com](http://www.eramsinfo.com)".

# Dynamic Assessment of Scenarios

The screenshot displays the eRAMS software interface. The top navigation bar includes tabs for Map, LUI, Scenarios, Assessment (selected), and Planning. A button labeled 'Add Poly' is visible on the right. The main content area is divided into two sections: 'General Analysis Settings' and 'Visualization Settings'. The 'General Analysis Settings' section includes dropdown menus for 'Scenarios' (set to 'Scenario'), 'Time step' (set to 'Monthly'), and input fields for 'start date' (01/01/1977) and 'end date' (12/31/1978), with a 'Run' button below. The 'Visualization Settings' section includes a 'Choose Scenarios' dropdown (set to 'Scenario1') and a 'Units' dropdown (set to 'English'). Below these are input fields for 'Period to Display' with 'start date' (01/01/1977) and 'end date' (12/31/1978). A list of visualization options is shown with expandable arrows: 'Field', 'Outlet', 'Watershed', and 'Cost'. A terminal window is overlaid on the right side of the interface, displaying the following text:

```
SWAT2009
Rev. 477
=====
Integrated Inputs in HRU/SUB Levels
=====
Modified by Haw Yen
2011/09/29
Colorado State University
=====
Soil & Water Assessment Tool
LINUX Version
Program reading from file.cio . . .
executing

Executing year 1
Executing year 2
```

# Visualization

Map LUI Scenarios **Assessment** Planning

## General Analysis Settings

Scenarios: **Scenario**

Time step: **Monthly**

start date: **01/01/1977**

end date: **12/31/1978**

**Run**

## Visualization Settings

Choose Scenarios: Units:

**Baseline** **Scenario1** **SI**

Period to Display:

start date: **01/01/1977**

end date: **12/31/1978**

Field

Outlet

Outlet #: **6**

Output: **Sediment (ton/ha)** **Go**

**Choose Map Tool**

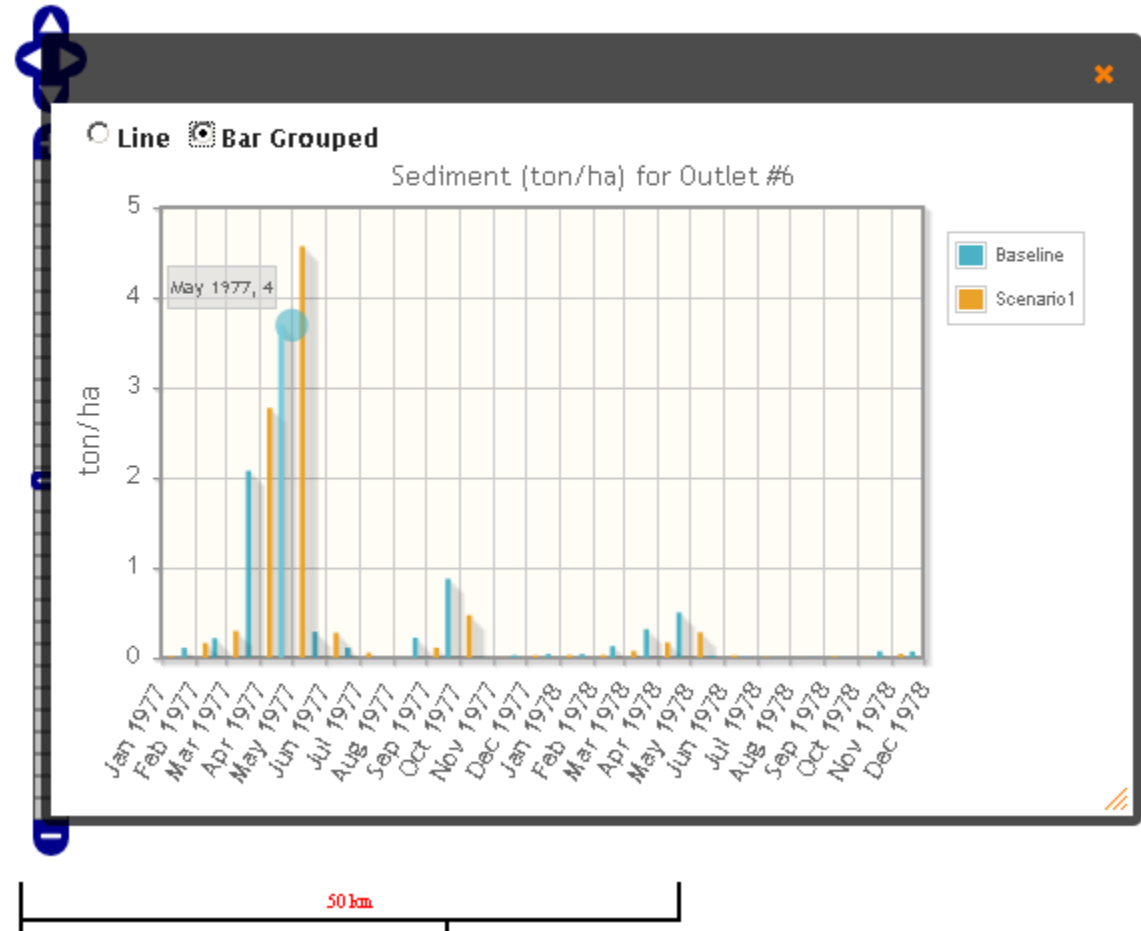
**Pan**

**Zoom**

**Clear Map**

**Query**

**Print**



# Cost Comparison

## Visualization Settings

Choose Scenarios: Units:

**Baseline Scenario 1**

SI

Period to Display:

start date:

01/01/1977

end date:

12/31/1978

▶ **Field**

▶ **Outlet**

▶ **Watershed**

▼ **Cost**

Total Watershed Cost

Go

**Total Watershed Cost**

**Cost Itemized Based on Practices**

**Cost Summary for Subbasins**

**Cost Summary for HRUs**



# Optimization-Based Targeting

Map LUI Scenarios Assessment **Planning**

**Objective Function**

- Minimize Cost
- Minimize Pollutant Loads
- Minimize Cost/Benefit Ratio
- Minimize Cost-Benefit

**Water Quality Targets**

Sediment:  % (Reduction) ▾

Total Phosphorous:  kg/ha ▾

Total Nitrogen:  mg/L ▾

Total Pesticide:  % (Reduction) ▾

**Budget Constraints**

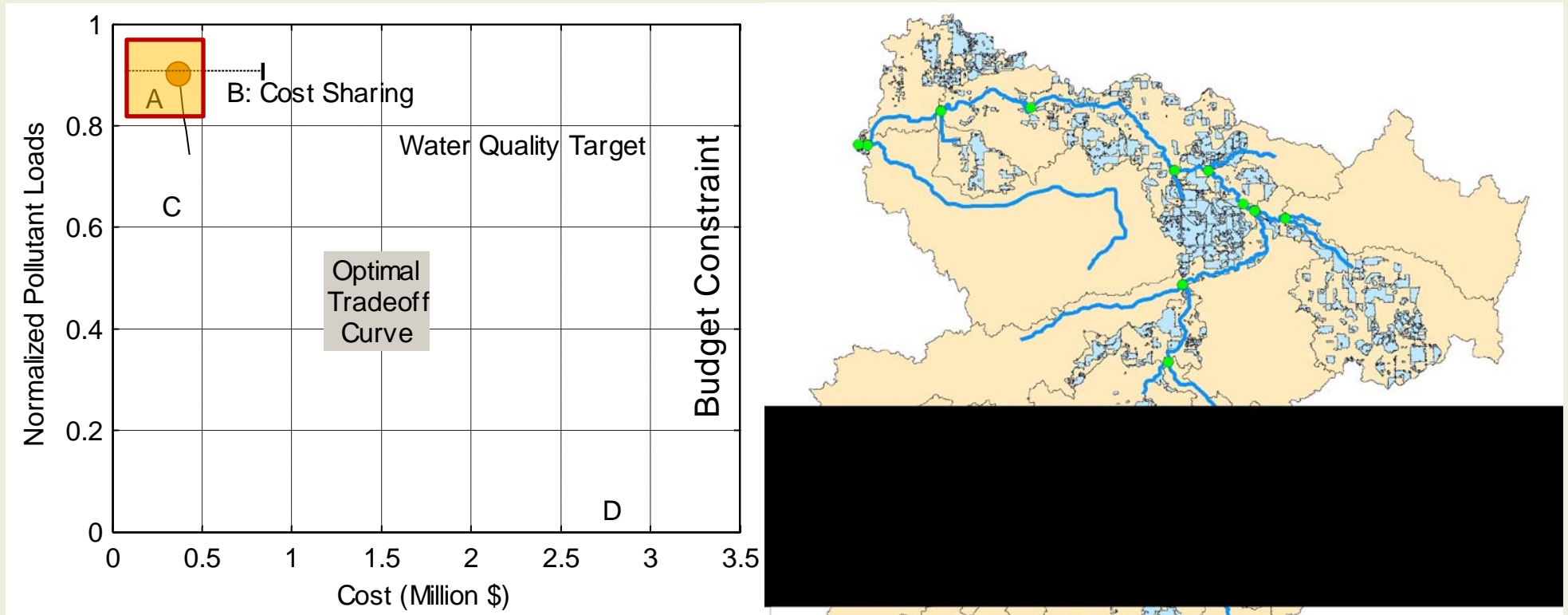
Total Watershed Cost (\$):

Include cost of removing land from production.

Include loss of productivity due to reduced fertilizer applications.

**Run Optimization**

# Optimization Module



# Multi-Criteria Decision Analysis

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http://www.eramsinfo.com/erams\_beta/map/

eRAMS

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Choose Map Tool Pan Zoom Clear Map Query Print

Multi-Criteria Decision Analysis

Field layer: Subbasins

Select MCDA option: Promethee II

Search:

Criteria	Weight	Subcriteria	Min/Max	Relative Indifference Weights (%)
<input checked="" type="checkbox"/> WQ	0.8	<input checked="" type="checkbox"/> ptnon2_h <input checked="" type="checkbox"/> slo1	Min	1 0
<input checked="" type="checkbox"/> Cost	0.2	<input checked="" type="checkbox"/> sll <input checked="" type="checkbox"/> csl	Min	1 0

Showing 1 to 2 of 2 entries

Save Revert Calculate Close

Done

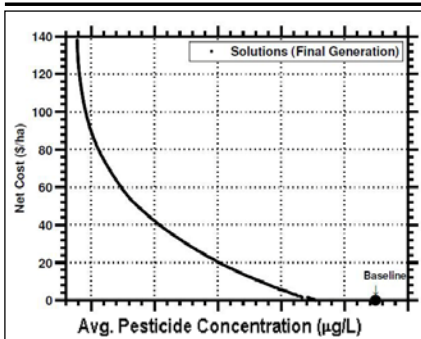
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# Efficient Communication

## Economic Conservation Practice Placement to Reduce Atrazine Concentration Levels in the Wildcat Creek Watershed

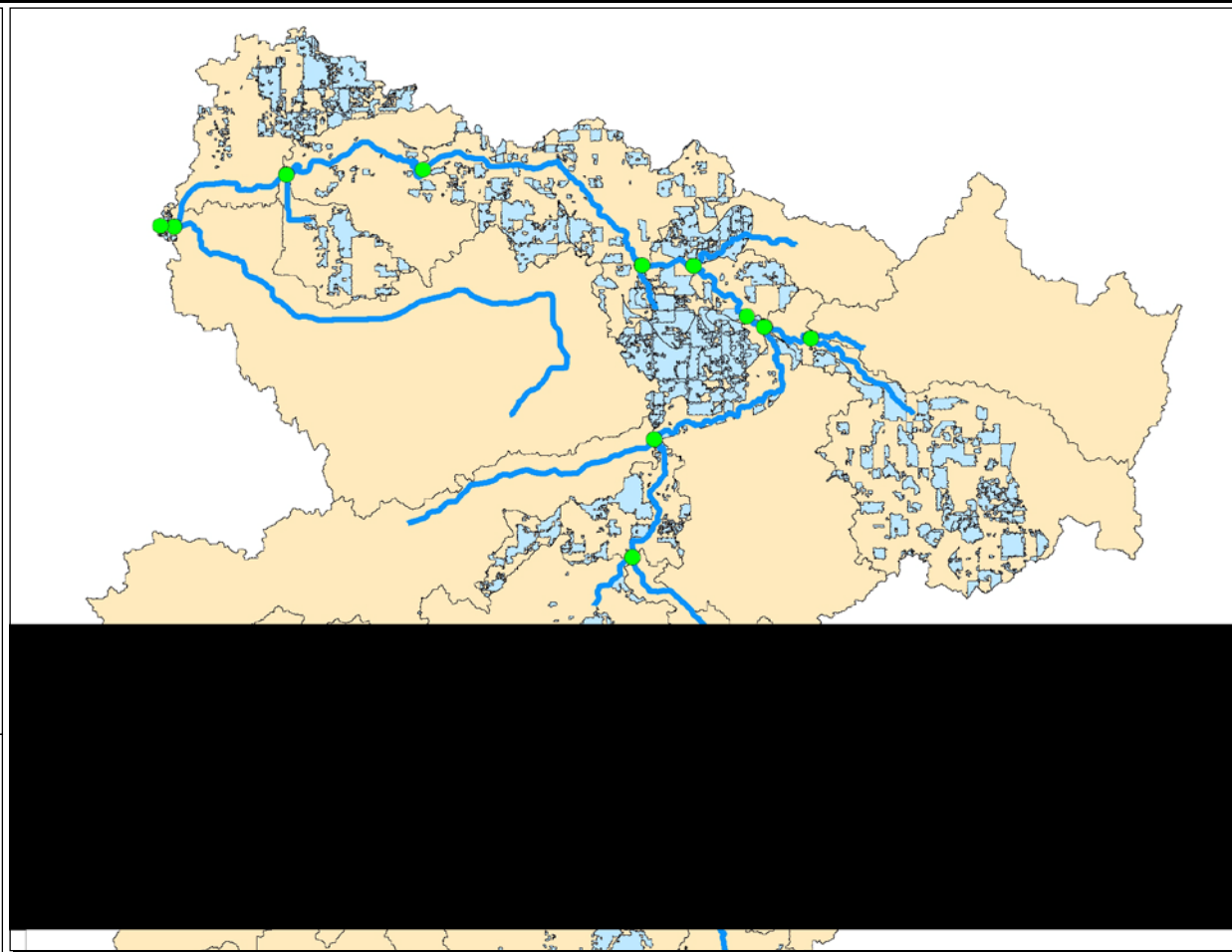
*Wildcat Creek Watershed Objective:* reduction of atrazine loads into the Kokomo reservoir by 10% (Concentration reduction target from average 3.31 µg/L to 3.0 µg/L, EPA MCL).



Finding a balance between cost and environmental improvements. This recommendation on where to target conservation implementation (provided in the map to the right) is based on the above cost / benefit placement. As demonstrated by the curve, reducing pesticide concentration generally requires the increased cost of conservation practices installation. Choosing how to address water quality concerns is a unique decision for each community, and can be affected by a water quality improvement goal, or the budgetary resources available.

### Cost Breakdown of Recommendation

Practice	Cost (\$)
Pesticide Management	
Filter Strips	
Residue Management	
Tillage- No Till	
<b>TOTAL COST (\$)</b>	<b>\$ xxxx.xx</b>



### Atrazine Concentrations and Targets

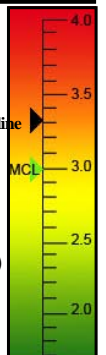
**Source of Pollutant in Drinking Water**  
Runoff from herbicide used on row crops

**Maximum Contaminant Level (MCL)**  
0.003 milligrams per Liter (mg/L) or 3 parts per billion (ppb)

**Maximum Contaminant Level Goal (MCLG)**  
0.003 mg/L or 3 ppb

**Health Effects**  
Some people who drink water containing atrazine in excess of the MCL over many years could experience problems with their cardiovascular system or reproductive difficulties.

**More information**  
<http://epa.gov/ogwdw/contaminants/basicinformation/atrazine.html#one>



### Targeted Conservation Practice Influences on Water Quality

Practice	Influence	Estimated Benefit(s) Across Watershed
Pesticide Management	Reduces application rates, etc.	xxx ug/L
Filter Strips	Filters surface	xxx ug/L
Residue Management/No Till	Reduces erosion	xxx ug/L

# Biomass Energy

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Map Renewable Energy

**Biomass**

Selection Input Results

Total Number of Species = 4989461  
Poultry = 3920100  
Sheep = 247000  
Horse = 0  
Beef = 626100  
Dairy = 196261  
Swine = 0

Total Energy = 98324 KWh

Species	Total Number of Species	Total Energy (KWh)
Poultry	3920100	~3500000
Sheep	247000	~250000
Beef	626100	~600000
Dairy	196261	~200000
Swine	0	0

Line Chart Pie Chart

Add Polygon Pan Zoom Clear Map Query Print

Transferring data from chart.apis.google.com...

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# eRAMS Applications

- Iowa NRCS
  - Watersheds
    - Raccoon River Watershed
    - Maquoketa River Watershed
    - Boone River Watershed
  - Analysis
    - Wide-area assessment
      - High-cut analysis
      - Rapid watershed assessment
      - Multi-criteria decision analysis
    - Design components
      - e.g., ponds

# eRAMS Applications

- Arkansas NRCS
  - Watersheds
    - Three priority HUC8 watersheds within the MRBI
  - Analysis
    - Benefits of existing practices
    - Identifying suites of cost-effective practices
- California Fish and Wildlife Coop.
  - Three HUC8 Oregon watersheds
  - Benefits of wetlands
  - Priority areas for wetland restoration



# Funding Agencies

USDA NRCS

USDA NIFA

USDA AES

US EPA

NSF

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