Estimating Conservation Benefits on Western Rangelands

The CEAP TEAM

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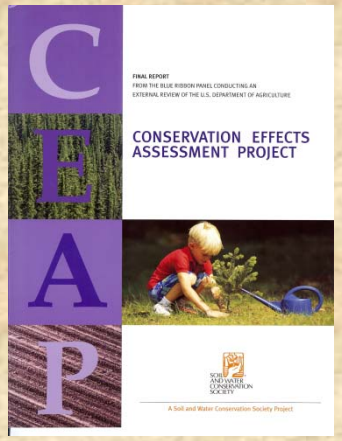
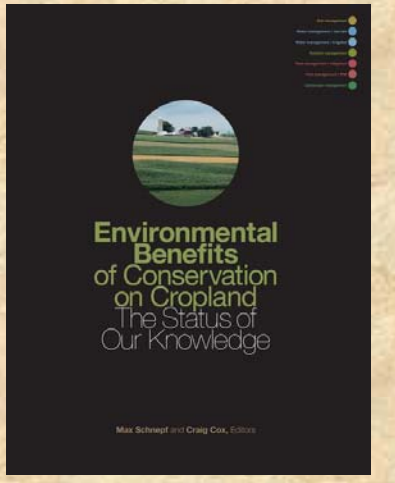
Science-based Technology

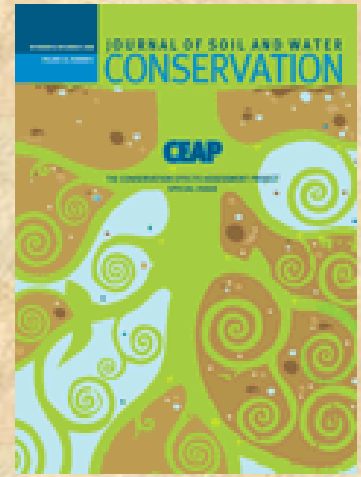
Conservation Effects Assessment Project

CEAP should be built to answer the question: What should we do next year (ecosystem forecasting).

CEAP should define and test the science-bases for adaptive management for conservation programs and practices.



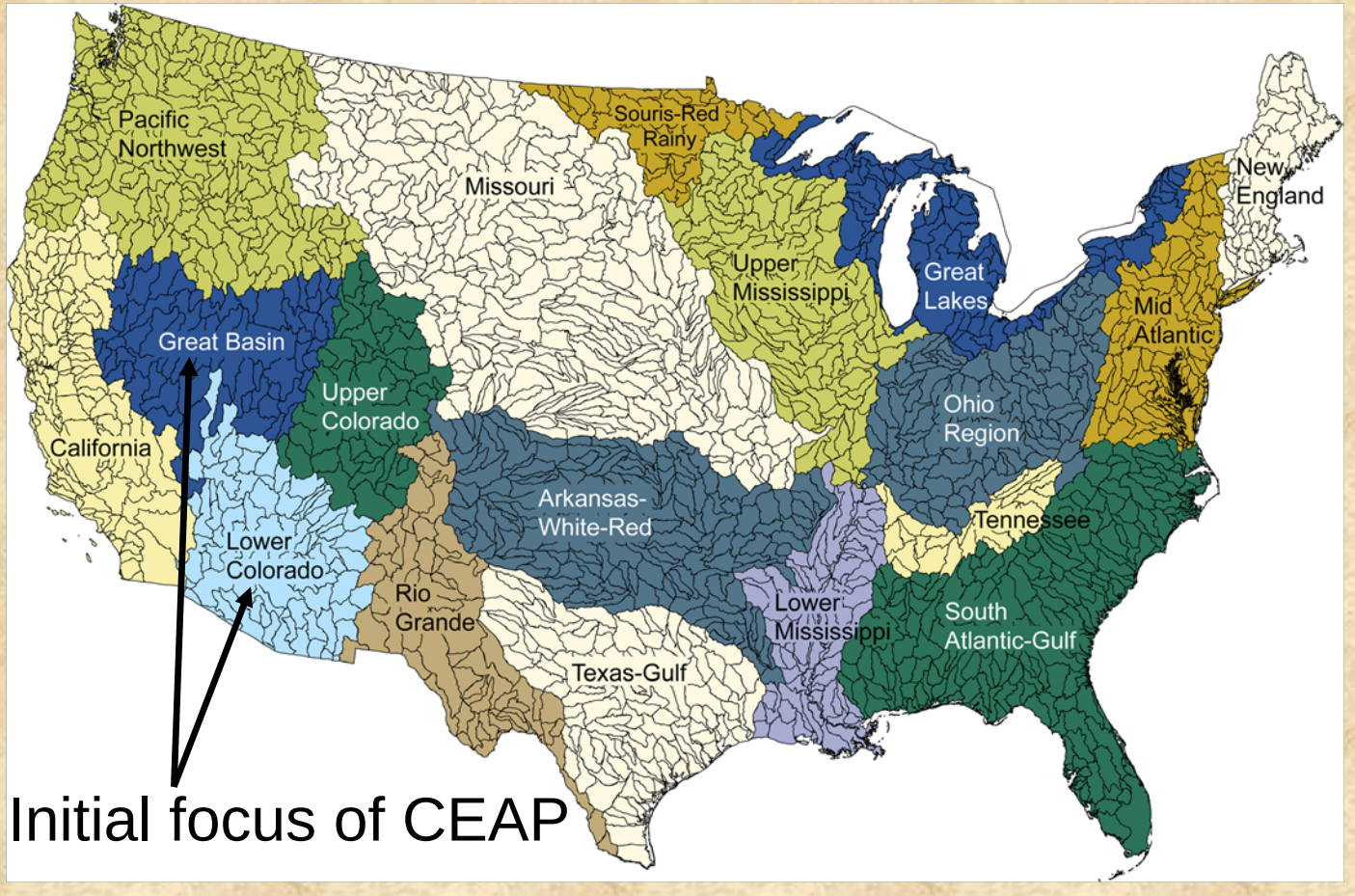




Categories of Management Practices to be Emphasized

- Prescribed grazing
- Pest management
- Fire management
- Brush management
- Riparian management
- Range Seeding
- Upland Habitat Management

Conservation Effects Assessment Project



for Rangelands

Site Assessment for NRI

NRI Site Data

- Plant community
- Cover
- Biomass
- Plant Height
- Soil Series
- Slope
- Management Practices

RHEM Requirements

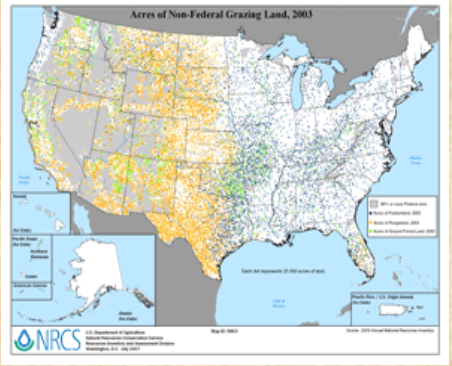
- Plant community
- Soil Series
- Slope
- Climate
- Cover

Output

- Runoff
- Soil loss

Individual Site

or



Aggregate Sites
Regional/National Scale

Phase I Risk Assessment:

2, 5, 10, 25, 50, 100 return period storms

Rangeland Hydrology Erosion Model

SCENARIO INPUTS

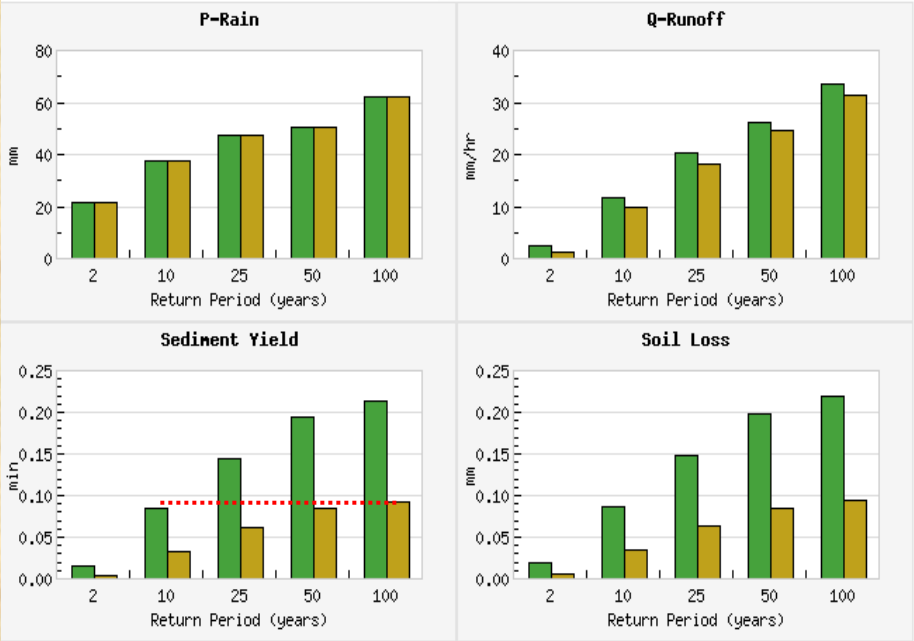
Download report as CSV

	MARK1	MARK2
State ID	NM	NM
Climate Station	ALBUQUERQUE WB AP	ALBUQUERQUE WB AP
Soil Texture	Sandy Clay Loam	Sandy Clay Loam
Moisture Content	0.25	0.25
Slope Length (meters)	30	30
Slope Shape	S-Shaped	S-Shaped
Slope Steepness	10	10
Vegetation Community	Bunch Grass	Bunch Grass
Canopy Cover %	50	80
Basal Cover %	5	8
Cryptogams Cover %	5	8
Rock Cover %	0	0
Litter Cover %	50	80
Total Ground Cover %	60	96

Risk Assessment Framework

Total Ground Cover %	60	96

RETURN PERIOD GRAPHS



2 YEAR RETURN PERIOD RESULTS

	MARK1	MARK2
Rain (mm)	21.80	21.80
Runoff (mm)	2.31	1.10
Sediment Yield (ton/ha)	0.02	0.00
Soil Loss (ton/ha)	0.02	0.00

10 YEAR RETURN PERIOD RESULT

Watershed Assessment with AGWA

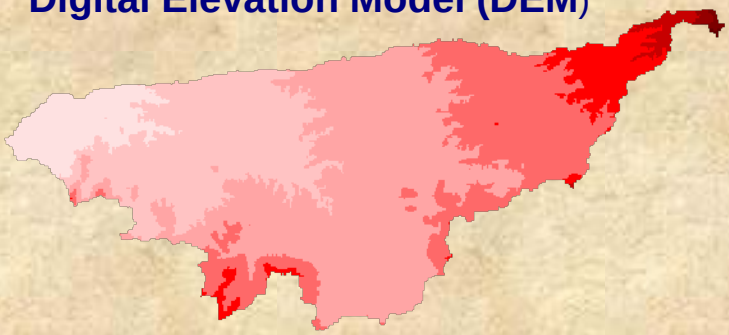
- **PC-based GIS tool for watershed modeling**
  - **Can handle multiple hydrological models (*modular: SWAT, KINEROS, RHEM, Cont. KINEROS)***
  - **Ease of use - widely applicable with attainable data**
  - **Simple, direct method for model parameterization**
- **Investigate the impacts of land cover change, and management practices, on runoff, erosion, water quality**
- **Provide accurate, repeatable results (tracks relative trends and change unless validation data is available)**

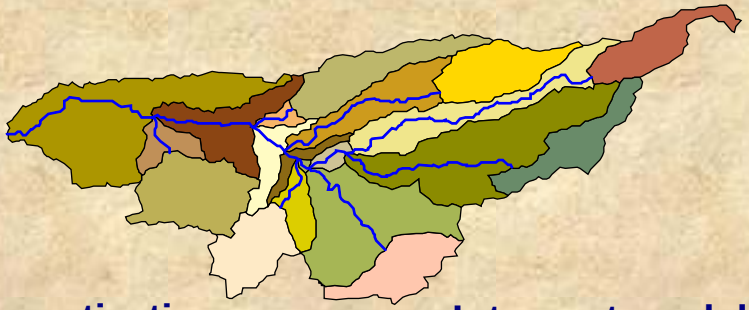
Several Existing Features

- **"Area of Interest" simultaneous multiple watershed analysis**
- **Stream buffer strip tool**
- **Land-cover modification tools**
- **Cons. Practices modification using NRCS state / transition models**
- **Post-fire watershed assessment**

AGWA Conceptual Design: Inputs and Outputs

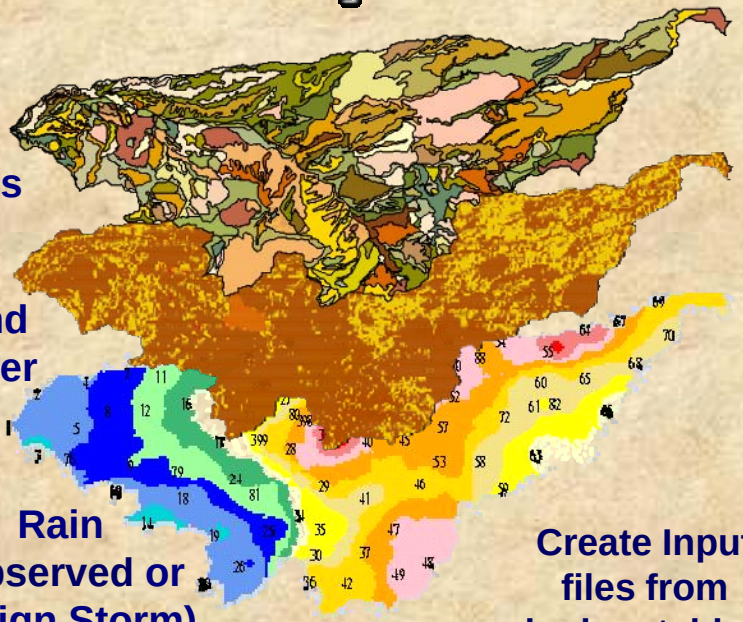
Watershed Delineation using Digital Elevation Model (DEM)





Watershed Discretization (model elements)

Intersect model elements with

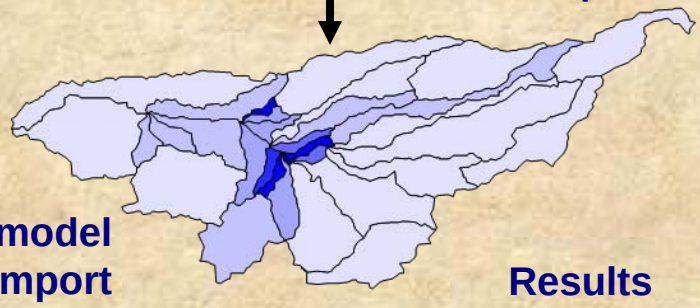


Soils

Land Cover

Rain (Observed or Design Storm)

Create Input files from lookup tables



Run model and import results

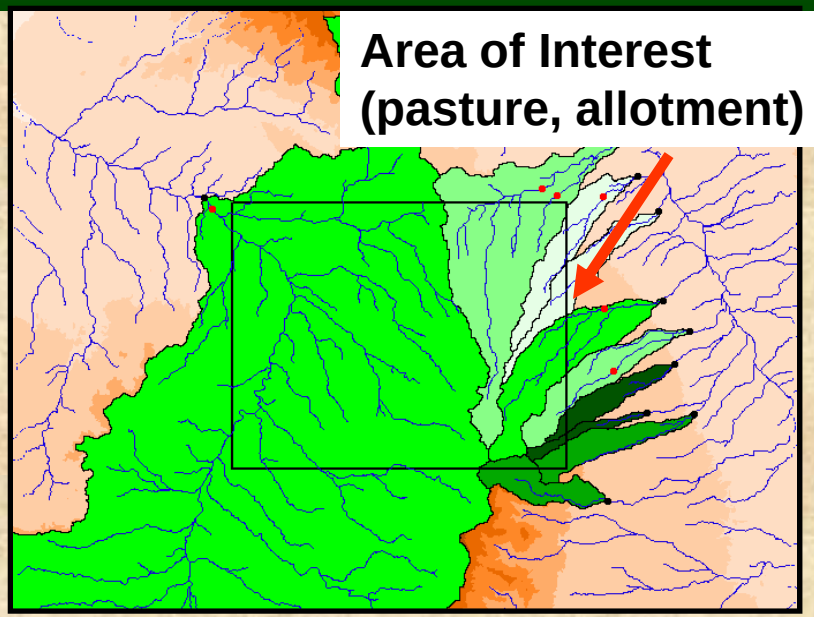
Results

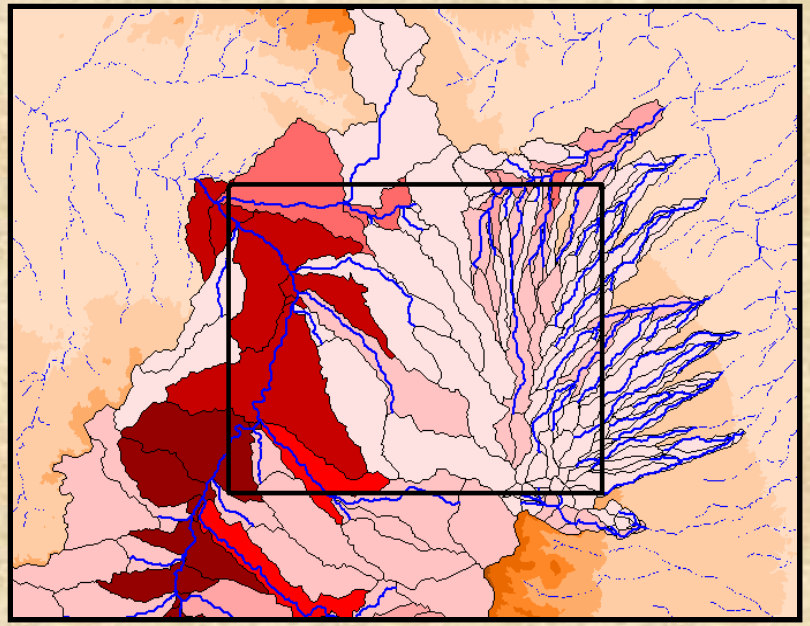
Output results that can be displayed in AGWA

KINEROS Outputs	*SWAT Outputs*
Channel Infiltration (m^3/km)	Precipitation (mm)
Plane Infiltration (mm)	ET (mm)
Runoff (mm or m^3)	Percolation (mm)
Sediment yield (kg)	Channel Disch. (m^3/day)
Peak flow (m^3/s or mm/hr)	Transmission loss (mm)
Channel Scour (mm)	Water yield (mm)
Sediment discharge (kg/s)	Sediment yield (t/ha)
	Nitrogen (kg)
	Phosphorus (kg)

Area of Interest – Multiple Watershed Analysis

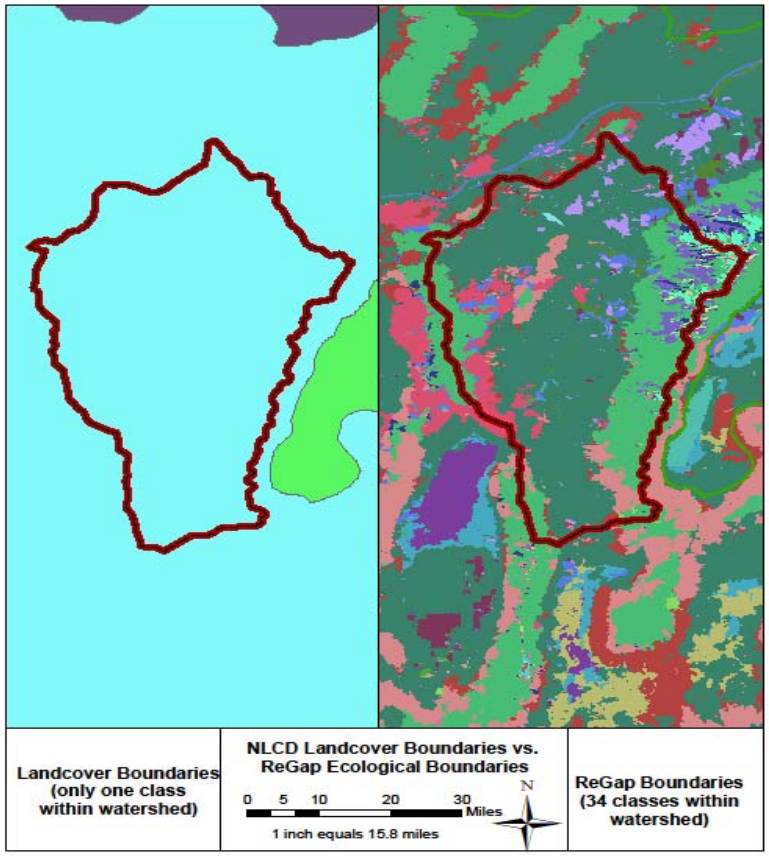
- **Interactively locates multiple watershed outlets**
- **Uses the stream network & boundary polygons to cover the area with the fewest, and smallest, watersheds necessary**
- **Discretized watersheds form a watershed group that is parameterized and simulated as one unit**



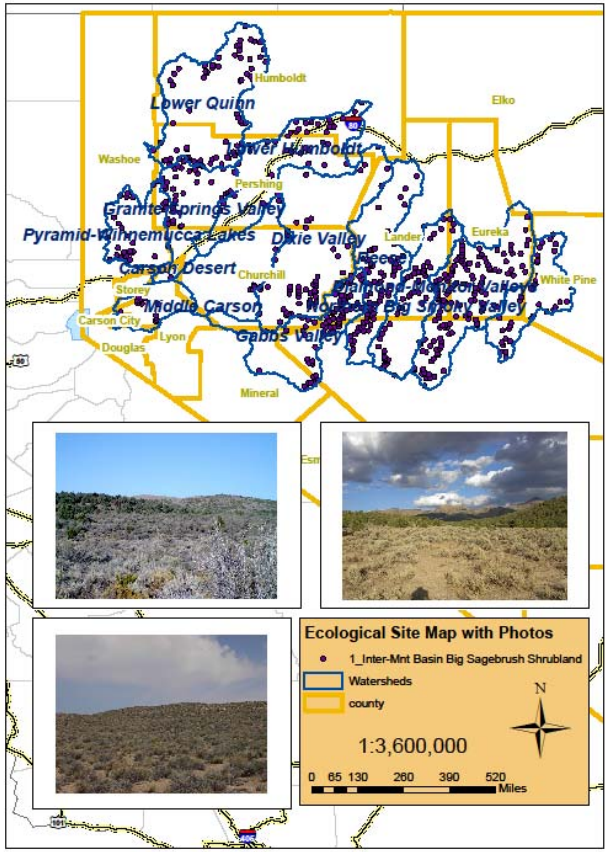


Representative Land Cover

Preference is to use Ecological Sites if available. Alternative is to use plant community level data from REGAP or LANDFIRE and update with MODIS data.



Representative Plant Communities



Inter-mountain Basin Big Sagebrush Shrubland

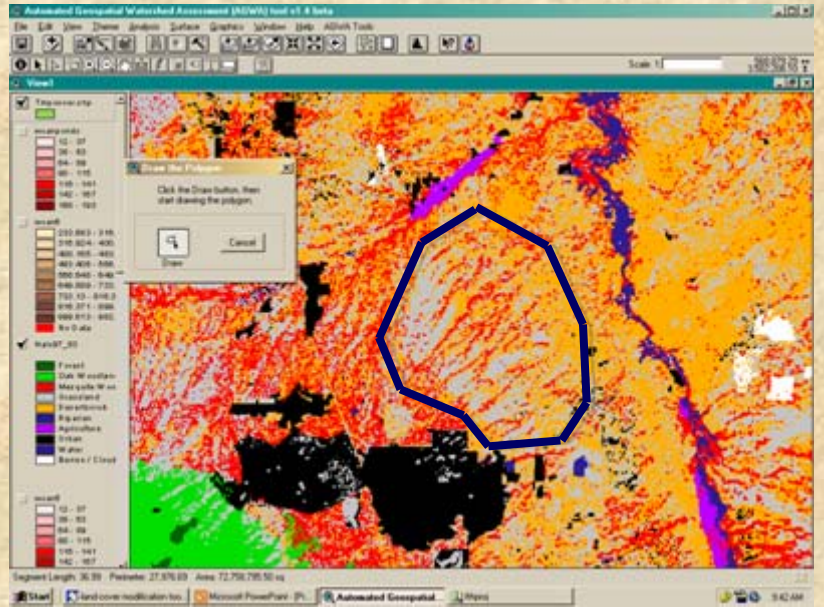
JUOS	Juniperus osteosperma	Utah juniper	Tree
PIMO	Pinus monophylla	singleleaf pinyon	Tree
ARTRW8	Artemisia tridentata	Wyoming big sagebrush	Shrub
ARTRT	Artemisia tridentata	Basin big sagebrush	Shrub
ERNA10	Ericameria nauseosa	Rabbit brush	Shrub
BRTE	Bromus tectorum	Cheatgrass	Grass
POSE	Poa secunda	Big bluegrass	Grass
PHHO	Phlox hoodii	Spiny phlox	Forb
SAKA	Salsola kali	Russian thistle	Forb

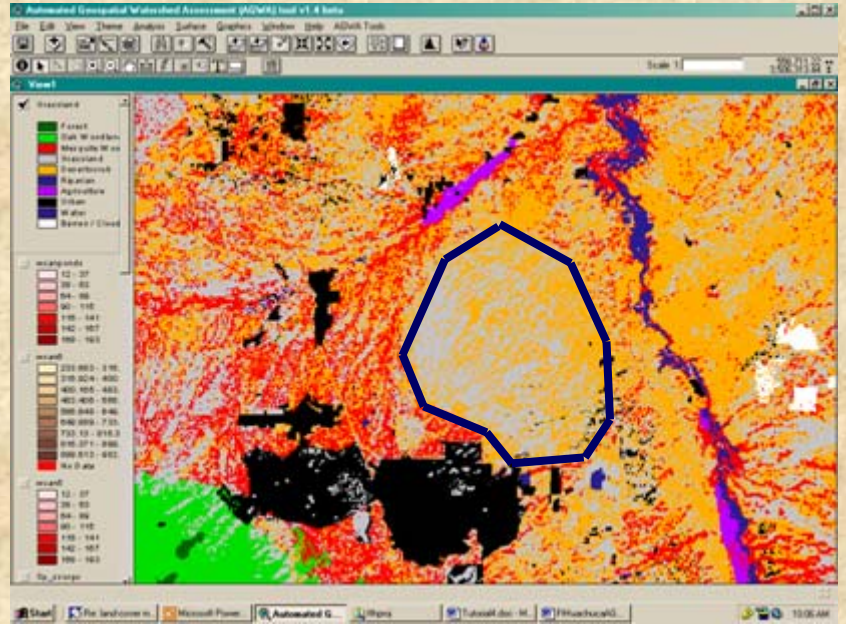
Land-Cover Modification Tool

Allows user to specify type and location of land-cover alterations by either drawing a polygon on the display, or specifying a polygon map

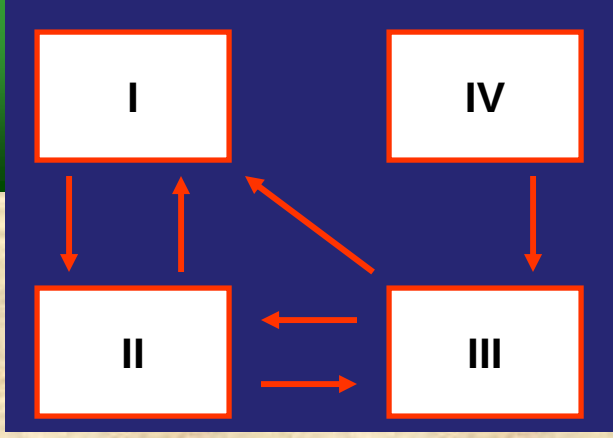
Types of Land-Cover Changes:

- **Change entire user-defined area to new land cover class**
- **Change one land-cover type to another in user-defined area**
- **Change land-cover type within user-supplied polygon map**
- **Create a random or fractal clustered land-cover pattern**
  - **e.g. to simulate burn pattern, change to 64% barren, 31% desert scrub, and 5% mesquite woodland**

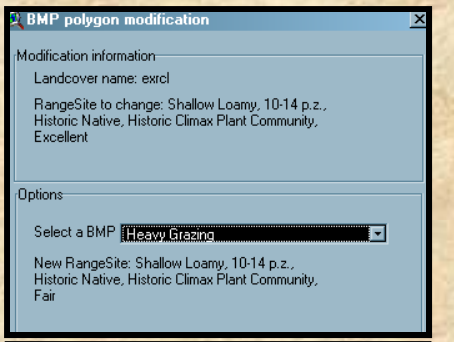


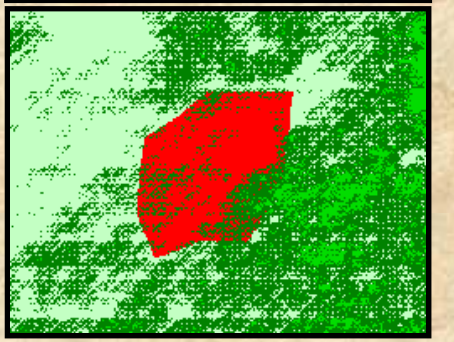


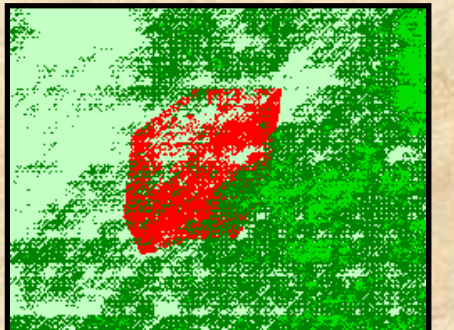
CP Modification Tool



- **Can use NRCS Ecological Sites with state and transition diagrams**
- **Transitions from one state to another are assumed to occur via specified Conservation Practices (CP)**
- **Current Conservation Practices include:**
  - **Prescribed fires**
  - **Grazing regimes**
  - **Invasive species control**
- **Users can also select the success rate of a Conservation Practices, creating a randomly distributed patchy surface of the original state and the new state**

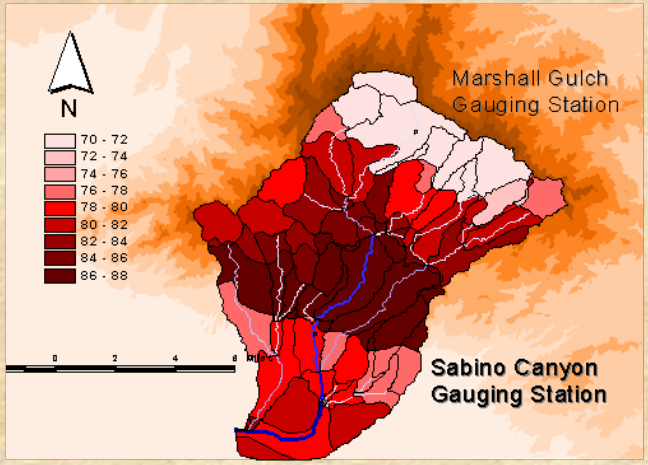




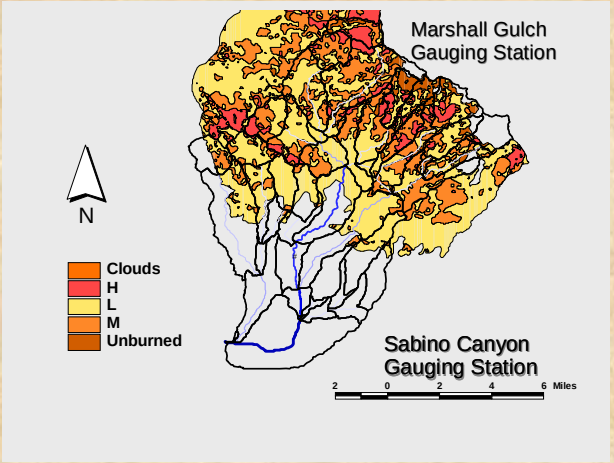


Post Fire Assessment

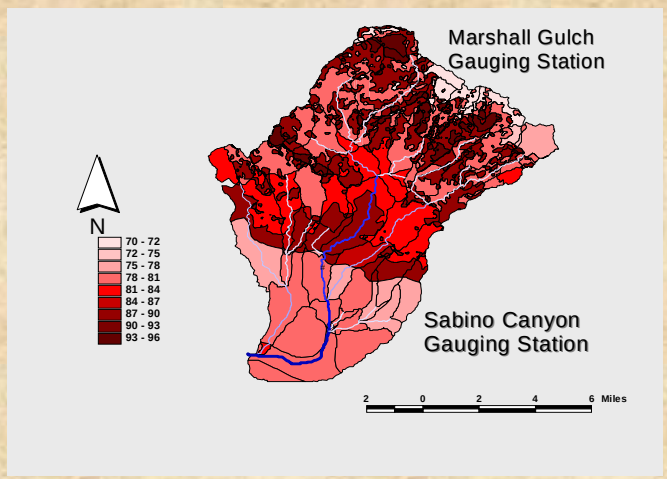
Pre-fire Est. Curve Numbers f(Hydro. Soils Group, Cover Type)



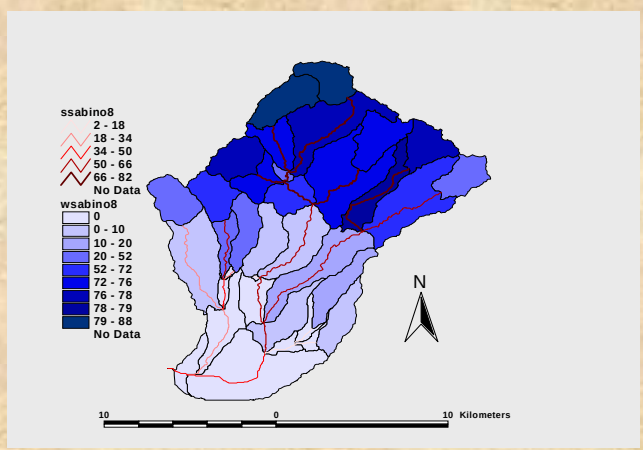
Overlay Burn Severity Map



Post-Fire Curve Number Map f(Hydro. Soils Group, Cover, Burn Severity)

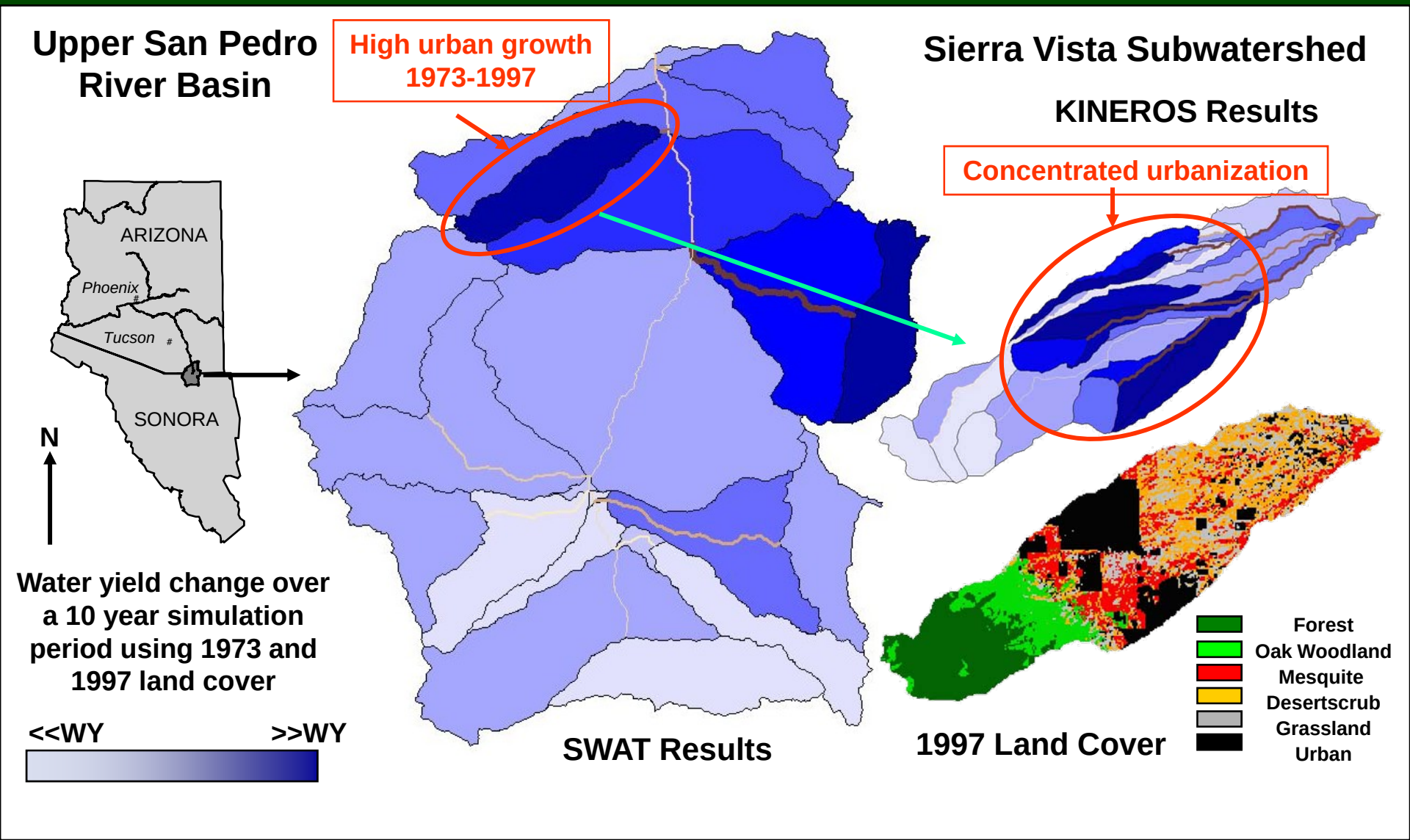


Estimated Percent Change in Water Yield in First Year Following Aspen Fire



Multi-Scale Application

- Using SWAT and KINEROS for integrated watershed assessment
- Land cover change analysis and impact on hydrologic response



We appreciate and welcome partners in developing technology to quantify and assess the environmental and economic benefits of conservation on the Nation's Grazing Lands