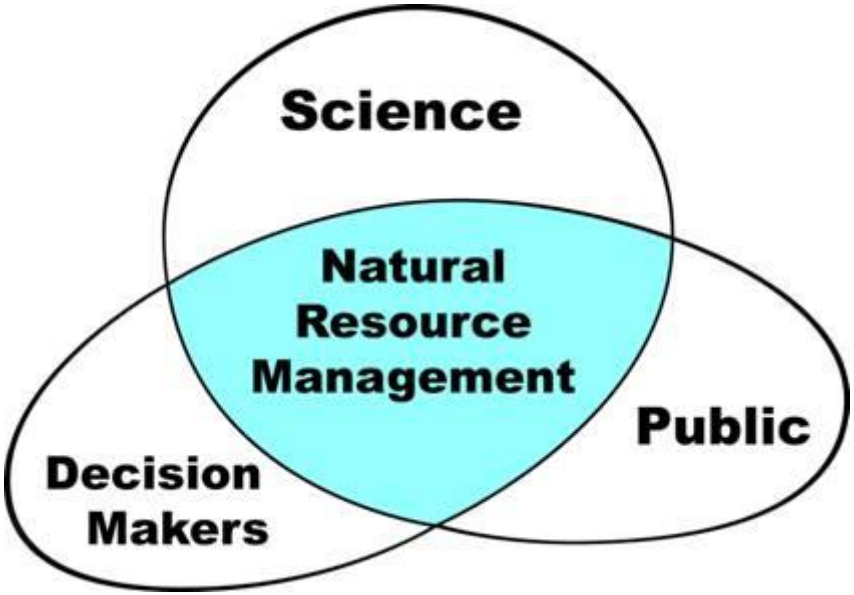
Development and Application of Automated Geospatial Watershed Assessment Tool (AGWA) for Rangelands.



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Brief History

- The AGWA-Rangeland project is based on years of previous research and application development.
- The AGWA Project is over 15 years old.
  - Watershed analysis and assessment of changing landscapes
  - In the EPA BASINS toolkit
  - Versions available in ArcView 3.x and ArcGIS 9.x &10.x
  - Google: AGWA Watershed - www.tucson.ars.ag.gov/agwa
- 2007 USDA-CSREES Rangeland Science Grant
  - Conversion of AGWA to AGWA-R to specifically address western rangeland conditions and management.
  - Joint project between the University of Arizona, University of Wyoming and USDA-ARS Southwest Watershed Research Center.
- 2008 USDA Grazing Lands CEAP Grant
  - Use of AGWA-R for conservation effects assessment for hot desert systems.

AGWA Goals: Design Criteria

- **Process-based tool to evaluate:**
  - Consequences of historical landscape change
  - Vulnerability related to current landscape conditions
  - Scenario/future alternatives assessments – BMPs
- **Operate with readily available GIS data**
  - USGS DEMs, LIDAR (ESRI GRID Format)
  - STATSGO, SSURGO, FAO soils
  - NALC, NLCD, GAP, land cover/use
- **Applicable across a range of geographies**

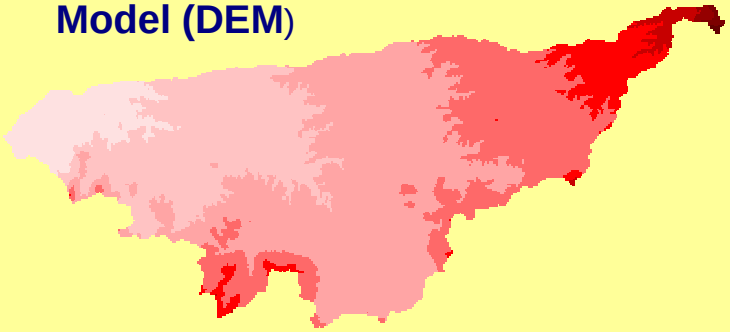
  AZ, OR, NV, NY, VA, WY, MT, Mexico, Kenya, Israel, S. Africa, Peru
- **Applicable to multiple spatial and temporal scales**
  - Hillslope, small watershed, large watershed
- **Both Stand-alone and Web application**
- **Target audience**
  - Researchers
  - Resource Managers and Decision Makers
  - Community-based Stakeholders

AGWA-Rangeland – Basics

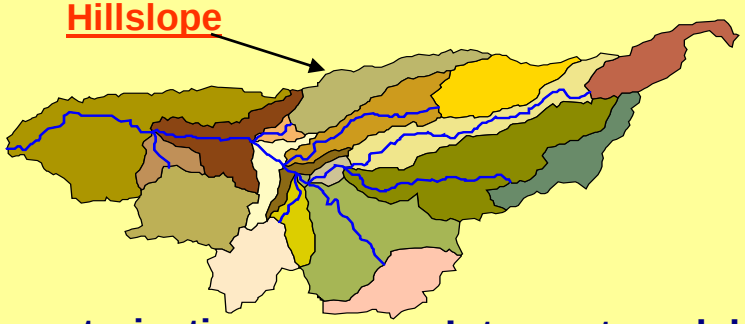
- Initial endpoints: runoff and sediment
- Simple, direct method for model parameterization
- Provide repeatable results for relative change assessments
- Different models to address multiple scales
  - SWAT for large basins, daily time steps
  - KINEROS for small basins, sub-hour time steps
  - RHEM for hillslope scale
  - Range Management Toolkit
  - Economic Assessment Toolkit
- Basic GIS functionality
  - watershed or hillslope delineation
  - watershed or hillslope characterization
  - simple, direct method for model parameterization
  - execute the models
  - visualize results spatially and difference results across multiple simulations

AGWA Conceptual Design: Inputs and Outputs

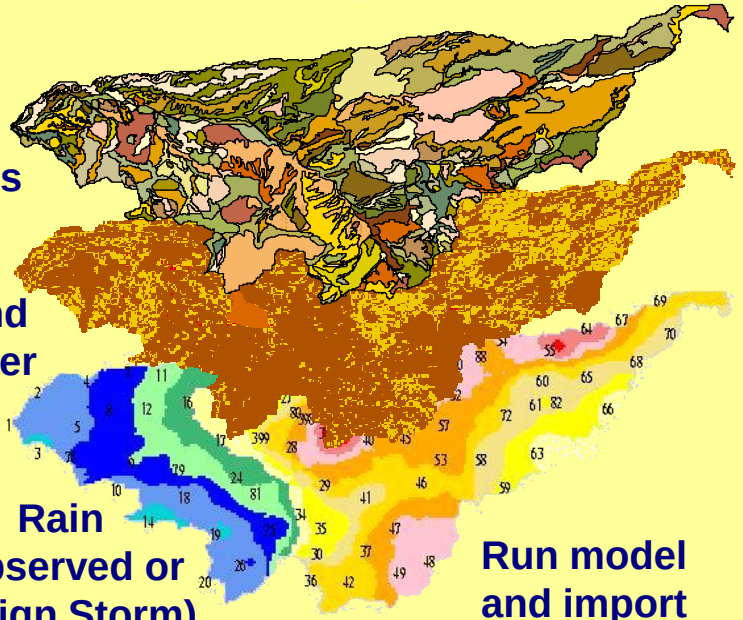
Watershed Delineation using Digital Elevation Model (DEM)



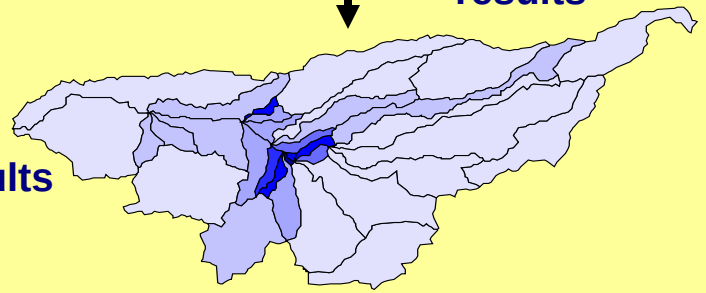
Watershed Characterization (model elements)



+ Intersect model elements with



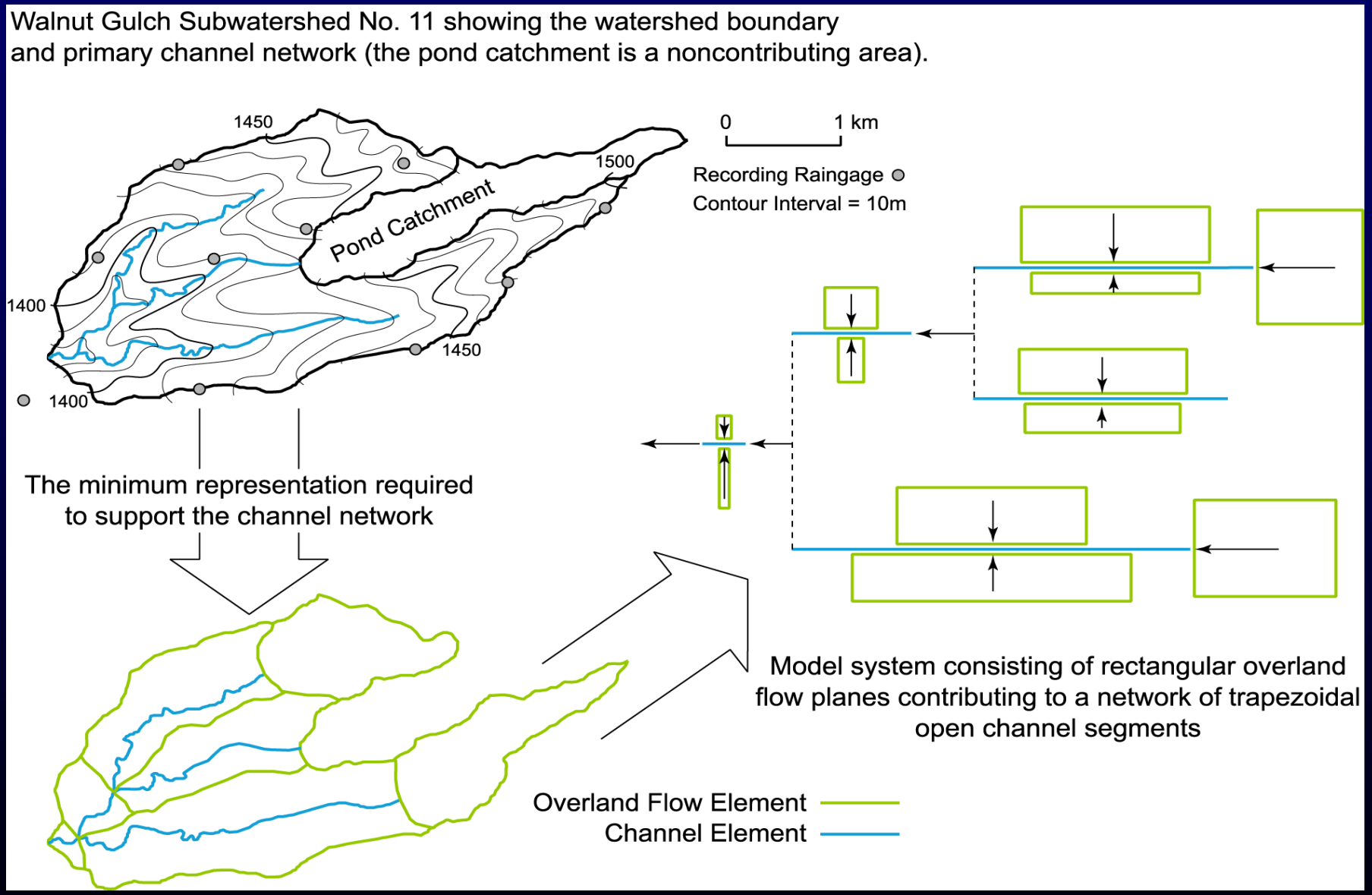
Run model and import results



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)

Modifications to Kineros and AGWA

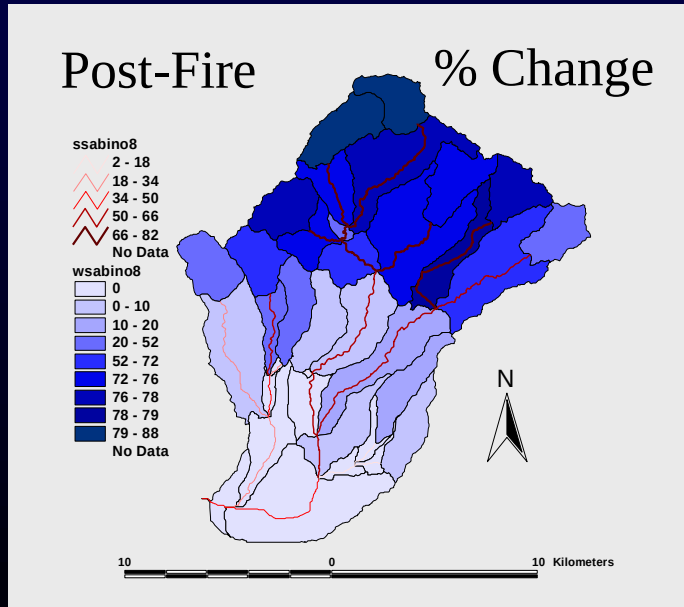


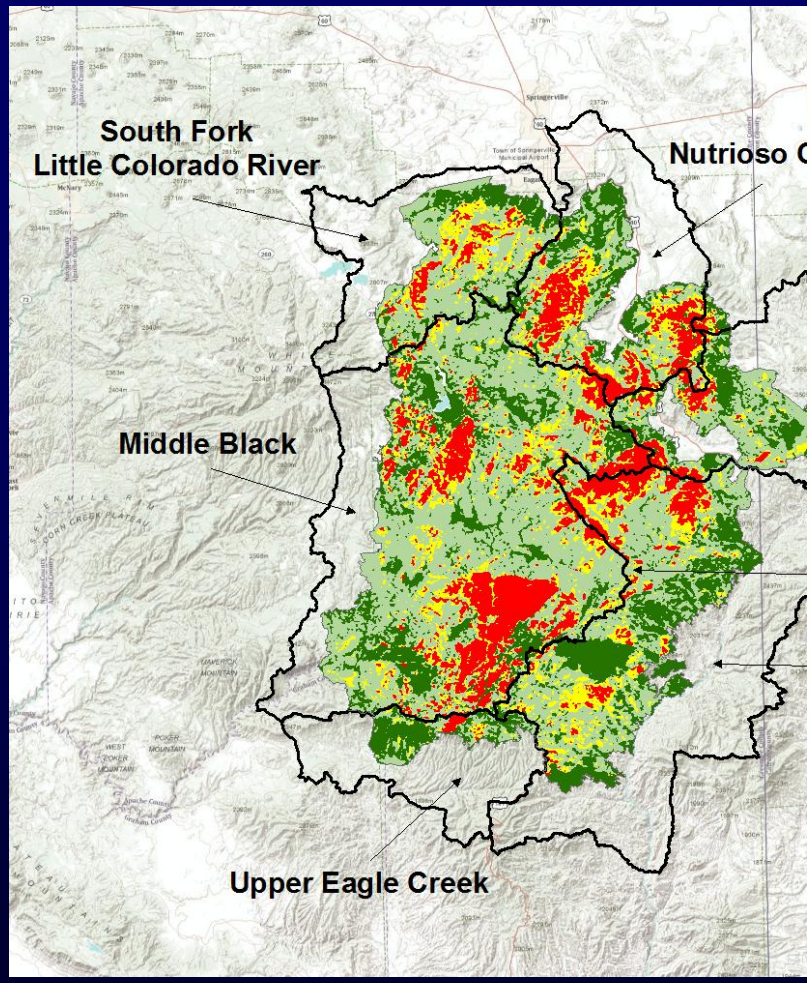
Range Management Toolkit

- **Use of vegetation data for model parameterization**
  - **Vegetation Monitoring Data**
  - **Rangeland Health Data**
  - **NRCS Ecological Site Descriptions**
  - **Data sets from both WY and AZ**

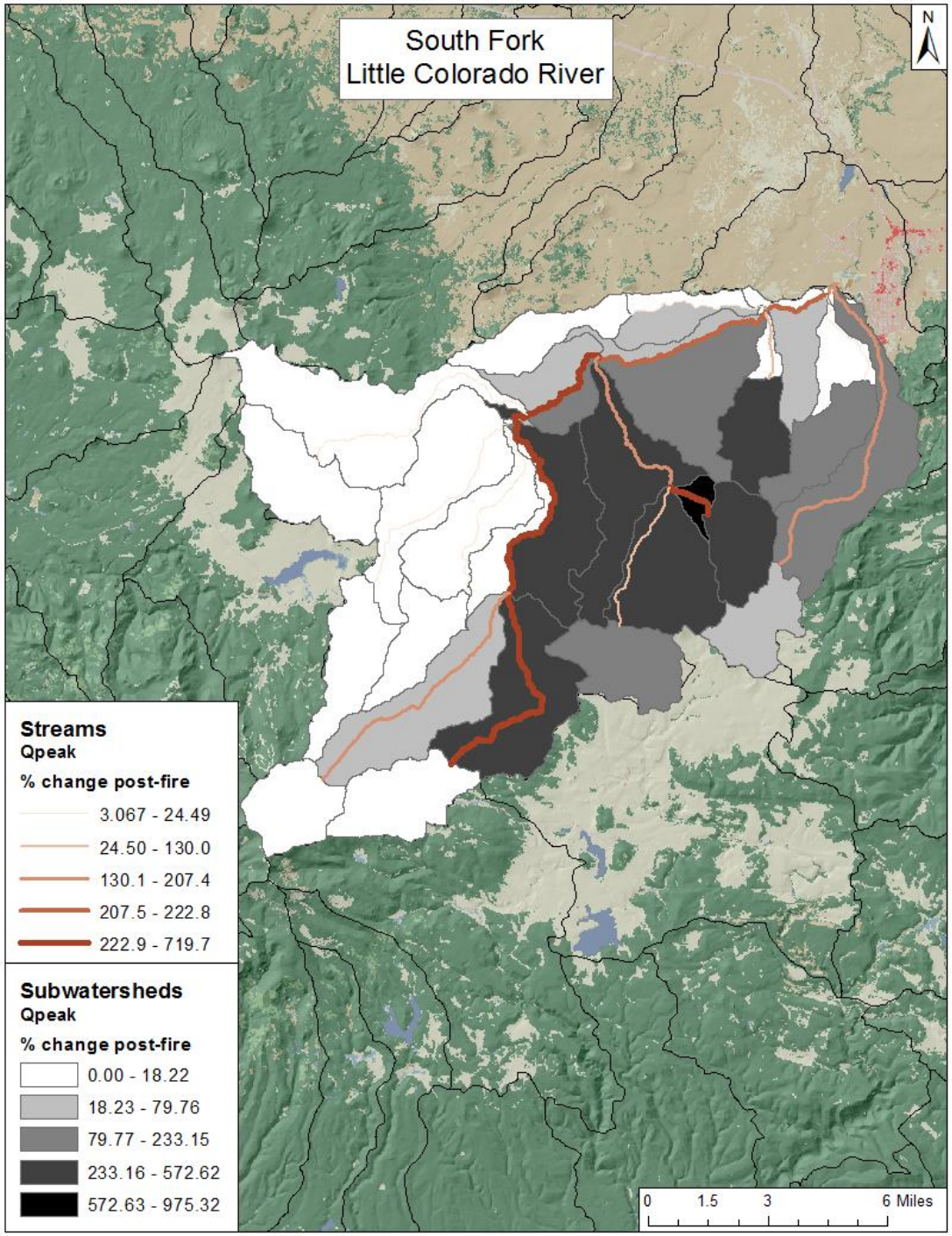
} Or a Combination

- **Land cover modification**
  - **Use to incorporate rangeland improvements**
- **Animal distribution (fencing, water)**
- **Stock ponds/ reservoirs**
- **Buffer strips (KINEROS)**
- **Post-fire effects**
- **Multi-watershed analysis**





Fire Severity Map



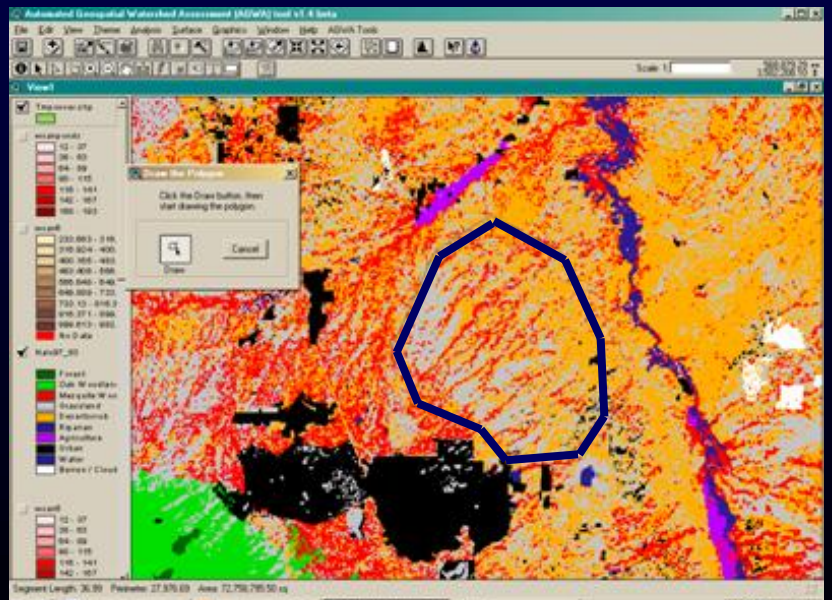
Land-Cover Modification Tool

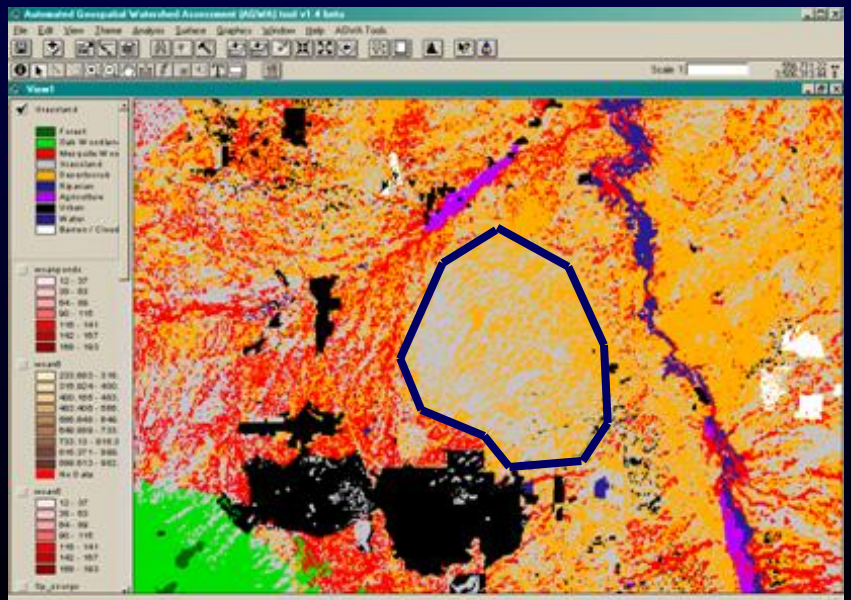
Allows user to specify type and location of land-cover alterations by either drawing a polygon on the display, or specifying selected features from a polygon map (i.e. a pasture).

Types of Land-Cover Changes:

- **Change entire user-defined area to new land cover**
- **Change one land-cover type to another in user-defined area**
- **Change land-cover type within user-supplied polygon map**
- **Create a random land-cover pattern based on fractals**

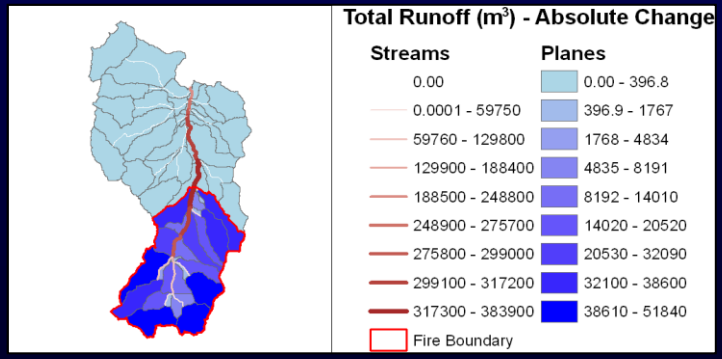
  e.g. Shrub management, remove shrubs from hillslopes

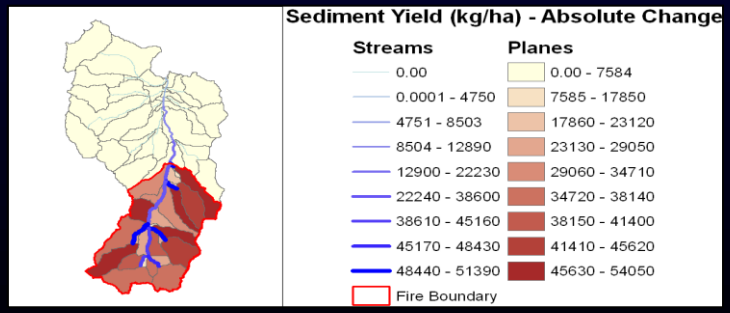


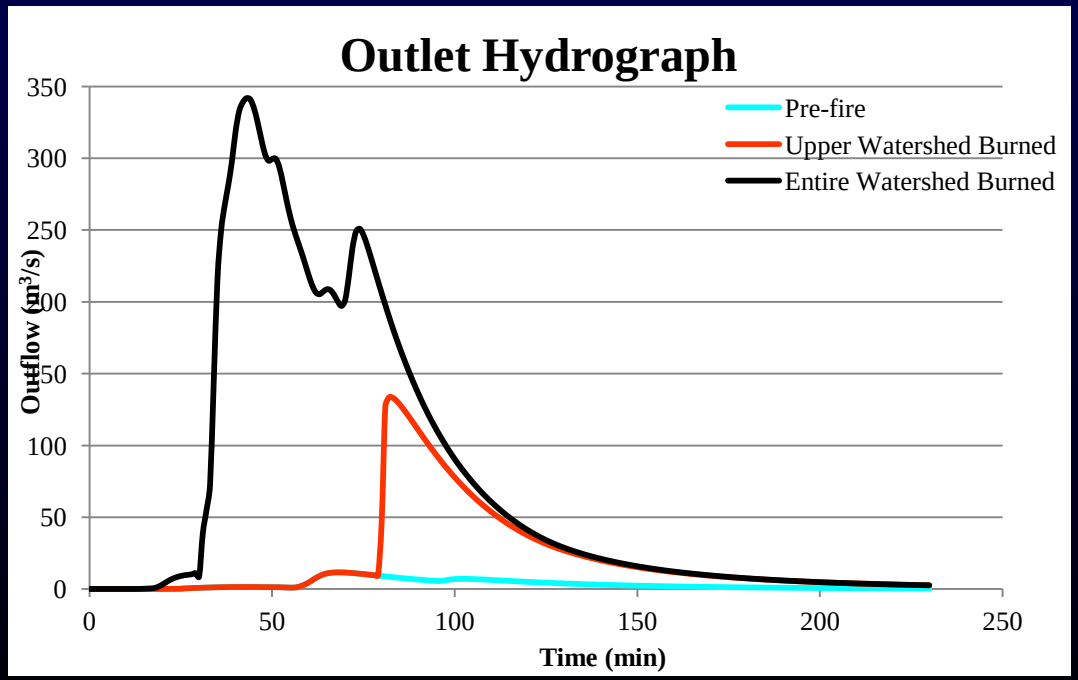


Example: Fire Effects

- Fire effects on the Reynolds Creek Watershed, Idado
- Watershed size: 238 km^2
- Two fire scenarios: 35.4% and 100% burn; 5 year 30 minute design storm
- Fire reduced saturated hydraulic conductivity to 2.0 mm/hr and the Manning's N to 0.011.

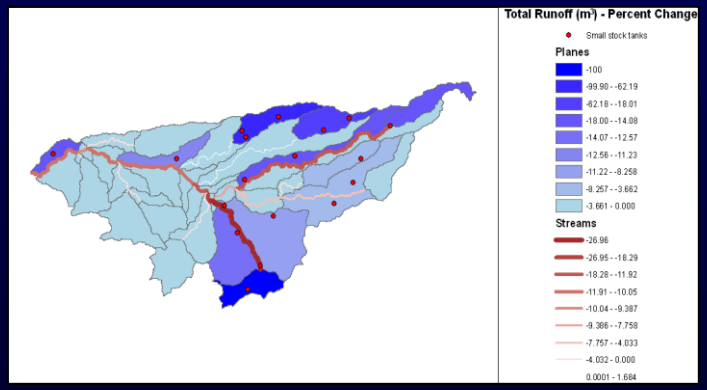


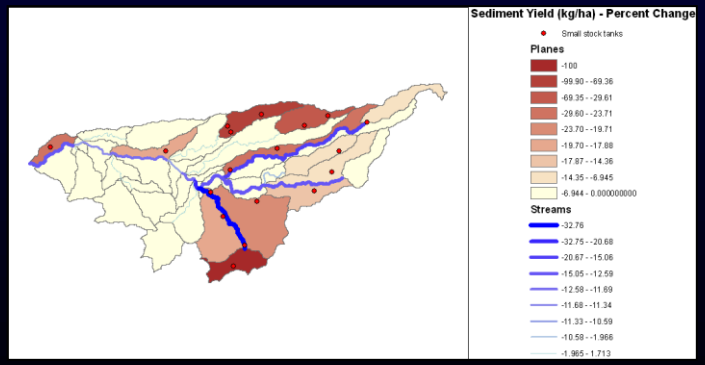


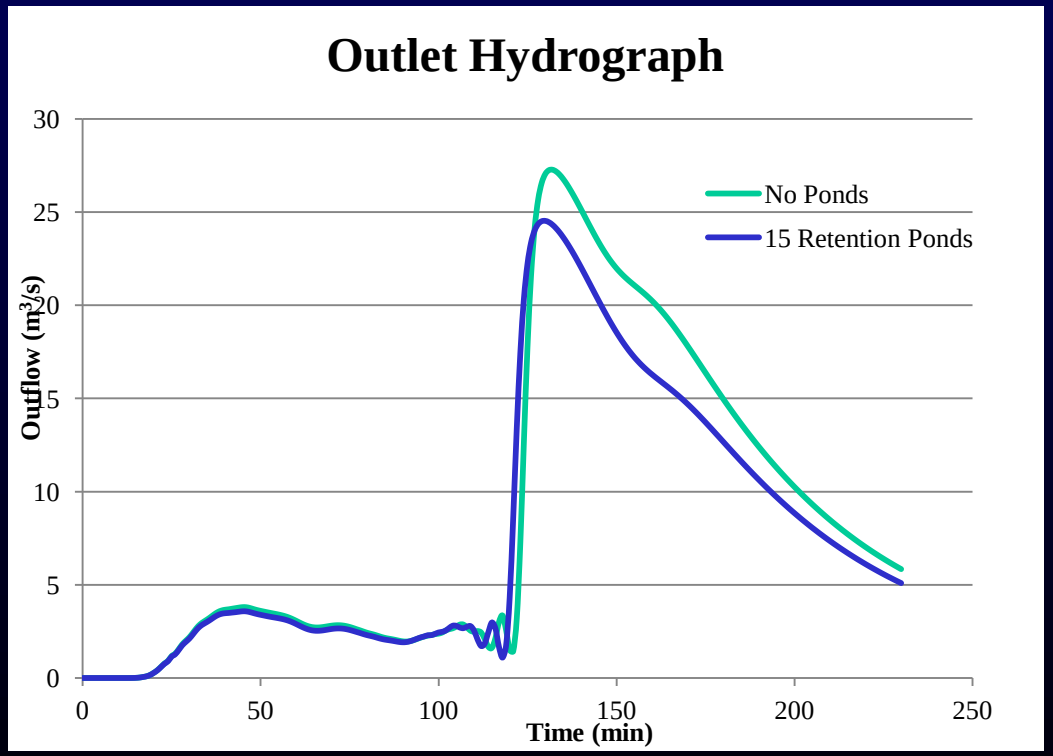


Example: Stock Ponds

- Impact of stock ponds on Walnut Gulch Watershed, AZ
- Watershed size: 150 km^2
- 15 existing hillslope retention structures; 5 year 30 minute design storm
- 100% storm flow retention assumed







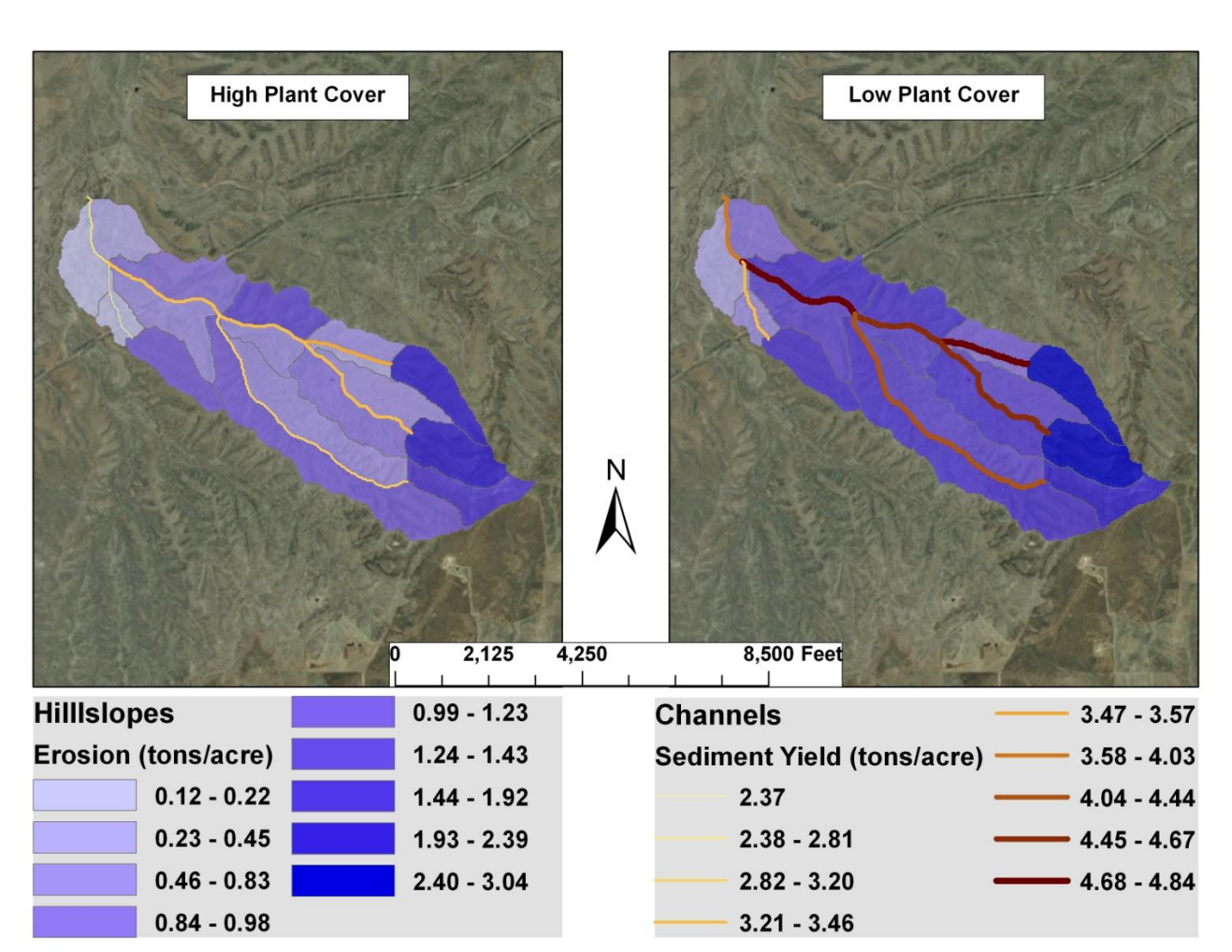
Example: Vegetation Change

- **Loamy Upland Ecological Site, Arizona**
  - **Historic native plant community (CC = 78%; GC = 72%)**
  - **Mesquite-Native plant community (cc = 25%; GC = 40%)**
- **783 acre watershed with uniform vegetation**
- **One-hour rainfall events; 2-yr to 100 yr return periods**

	High Plant Cover			Low Plant Cover		
One-hour event occurring every-	Erosion (tons/acre)	Runoff (ac-ft)	Infiltration (ac-ft)	Erosion (tons/acre)	Runoff (ac-ft)	Infiltration (ac-ft)
2 years	0.53	38.27	44.08	0.94	57.82	24.68
5 years	0.84	60.81	47.24	1.36	82.46	25.69
10 years	1.06	76.90	49.12	1.67	99.92	26.21
25 years	1.34	98.20	50.91	2.08	122.49	26.74
50 years	1.57	115.08	52.08	2.40	140.16	27.06
100 years	1.82	134.57	53.01	2.79	160.43	27.39

Example: Vegetation Change

- One hour – 10 year return period event



Future Efforts and Issues

- Will be used in the USDA-NRCS Grazinglands Conservation Effects Assessment Project
  - Case study in southeastern Arizona
- Need to develop vegetation parameters for ecological sites and management treatments
  - Effect of prescribed grazing
  - Spatial utilization patterns
  - Temporal changes
  - Create realistic management scenarios
- How do we address the high spatial and temporal variability of precipitation
- Need to incorporate “disturbed” rangeland conditions into RHEM


Input?