



Kristine Uhlman, RG

NEMO* in Arizona

***Nonpoint
Education for
Municipal
Officials ...**

and other Land Use Decision Makers





Avanyu

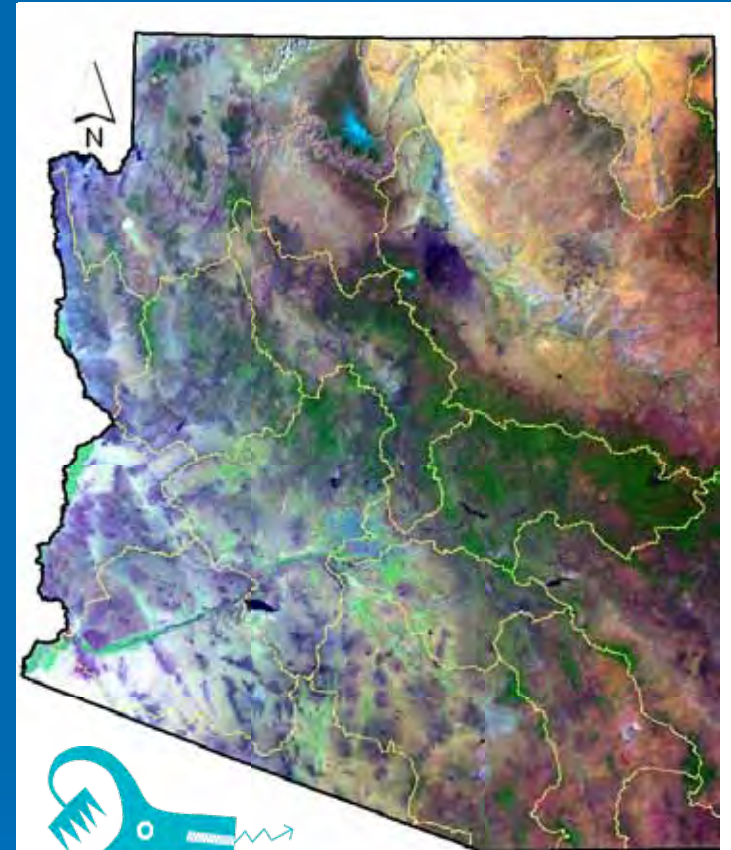
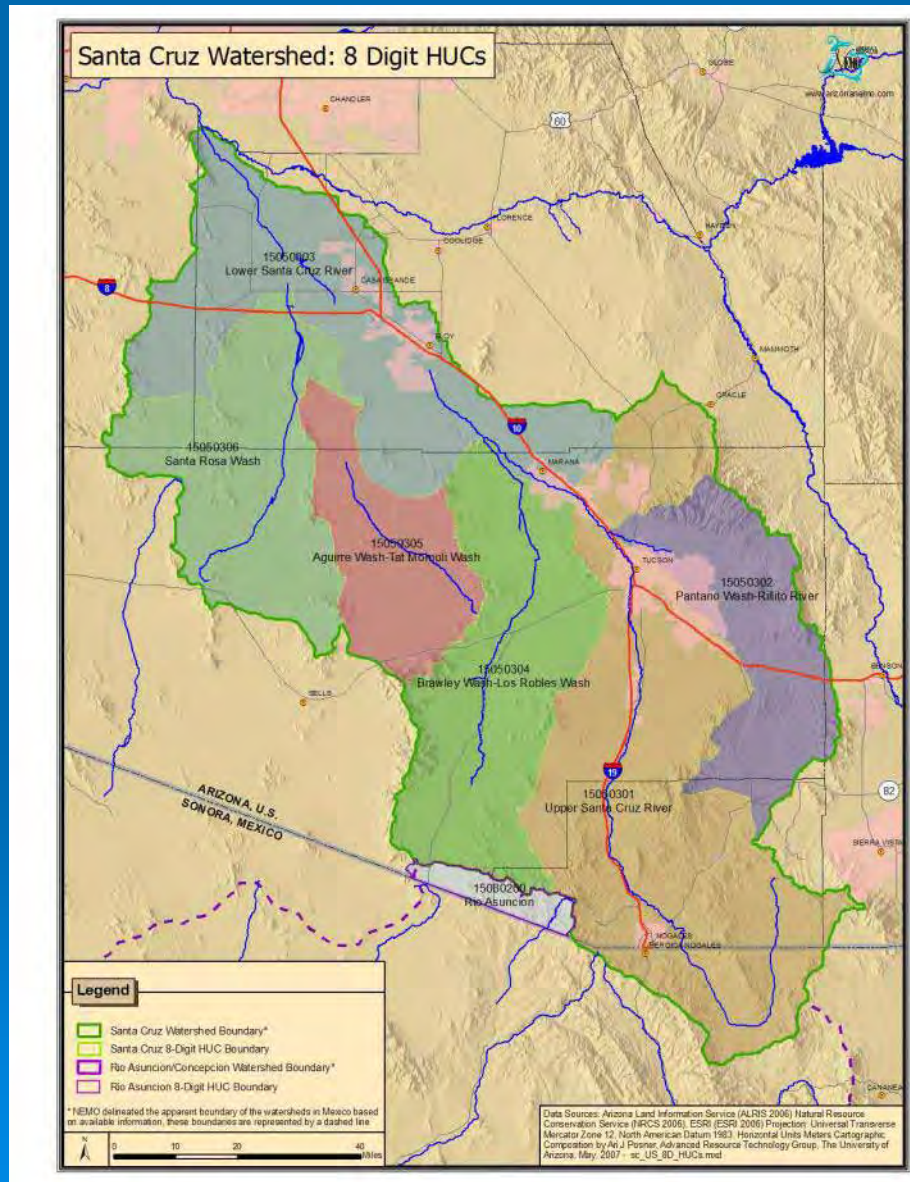
*The mythical
serpent that is the guardian
of the springs among the
pueblo cultures of the
Southwest*

*A rain and lightning deity
who is believed to have given birth
to the waterways, and whose voice
is thunder*



*“one who lives
in the water below the earth”*

Mapping, Project support, Decision tools -





	NEMO Overview
	NEMO Watershed Based Plans
	Best Management Practices Manual
	Community Watershed Groups
	Southwest Strategy Water Projects
	Funding Sources
	Introduction to water quality management
	County and Small Watershed Maps
	
	Arizona NEMO materials
	Calendar of events
	Links
	NEMO Contacts

NEMO WATERSHED-BASED PLANS

Please note: NEMO Watershed-Based Plans and maps for the following watersheds are currently being revised and should be considered DRAFT versions only.

Maps may be downloaded by either right clicking on the name or on the image itself.

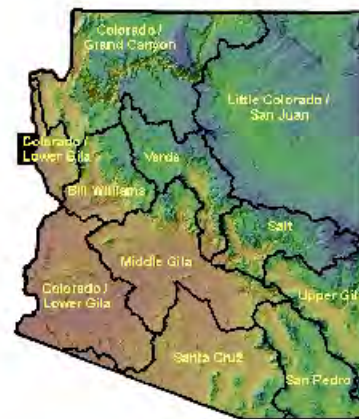
Sources for NEMO GIS data can be found at the bottom of this page. To obtain specific GIS data from Arizona NEMO, download the [Request Form](#) here.

Watersheds

- Bill Williams
- Upper Gila
- Verde
- Little Colorado River
- Middle Gila
- Upper Agua Fria
- San Pedro River

Acronyms and Glossary

- Acronyms
- Glossary



BILL WILLIAMS

• Watershed Based Plan Documents

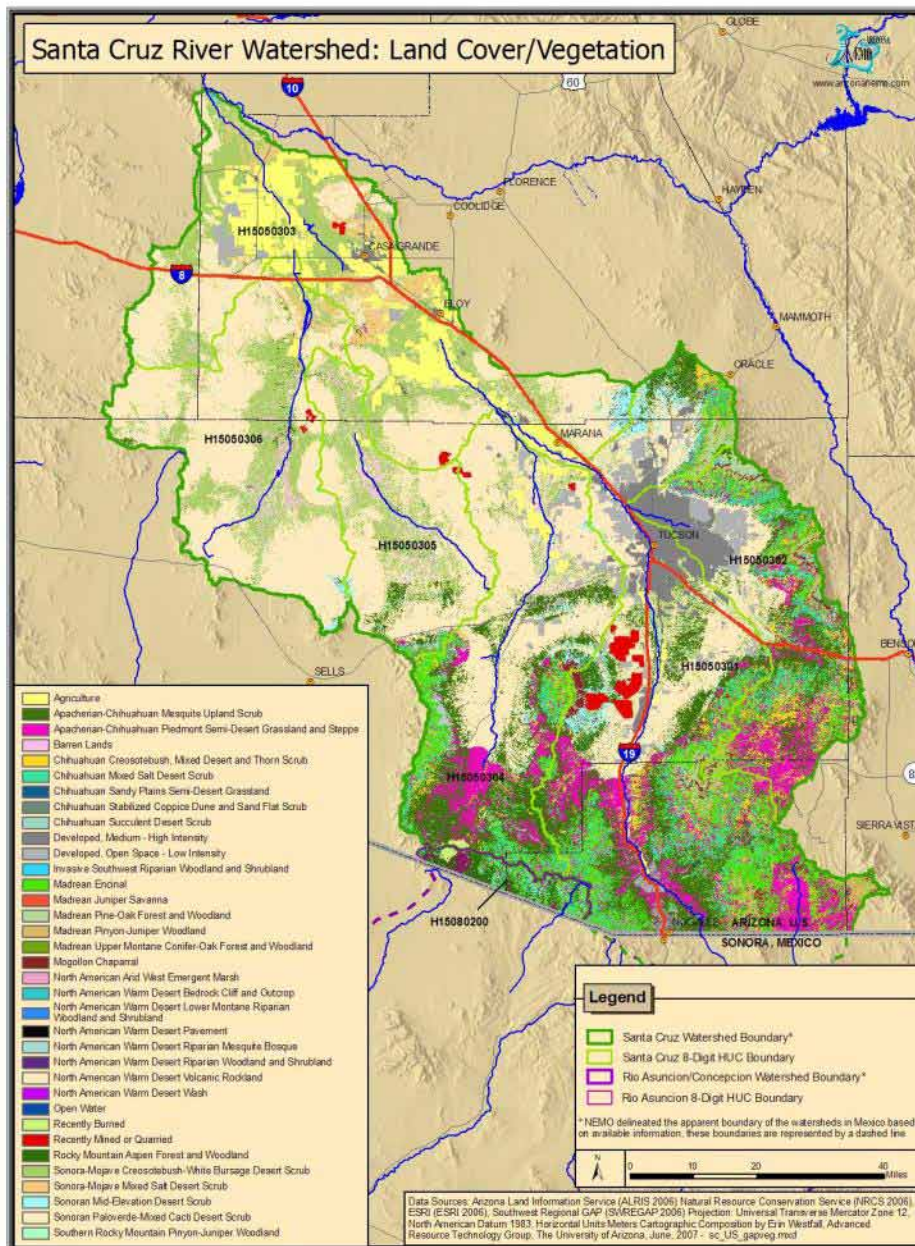
- Title Page, Acknowledgements, Table of Contents
- Executive Summary
- Section 1 Introduction
- Section 2 Physical Features
- Section 3 Biological Resources
- Section 4 Social/Economic
- Section 5 Important Resources
- Section 6 Watershed Classification
- Section 7 Watershed Management
- Section 8 Watershed Planning
- Appendix A
- Appendix B
- Appendix C
- Appendix D



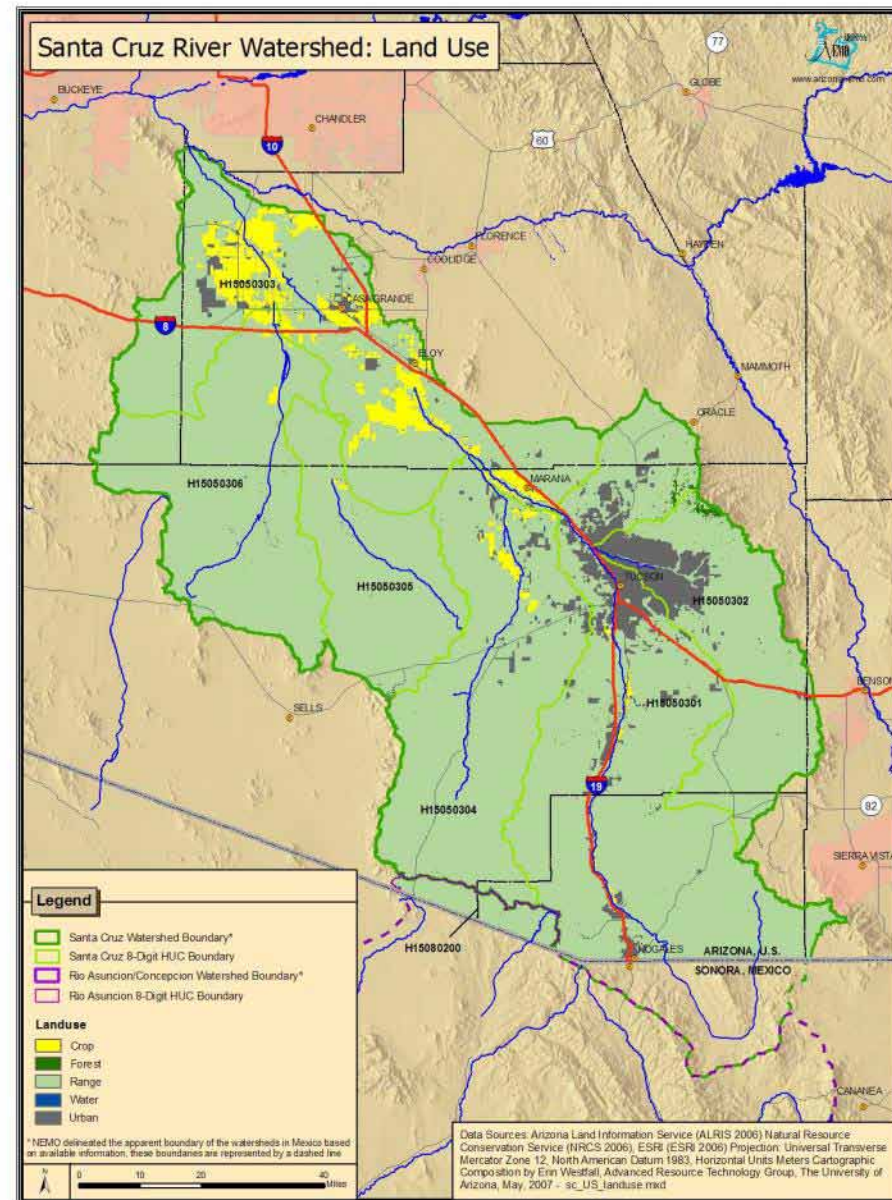
• Maps

- Viewable web image
- 8.5 x 11 printable PDF document
- Watershed map

Santa Cruz River Watershed: Land Cover/Vegetation



Santa Cruz River Watershed: Land Use

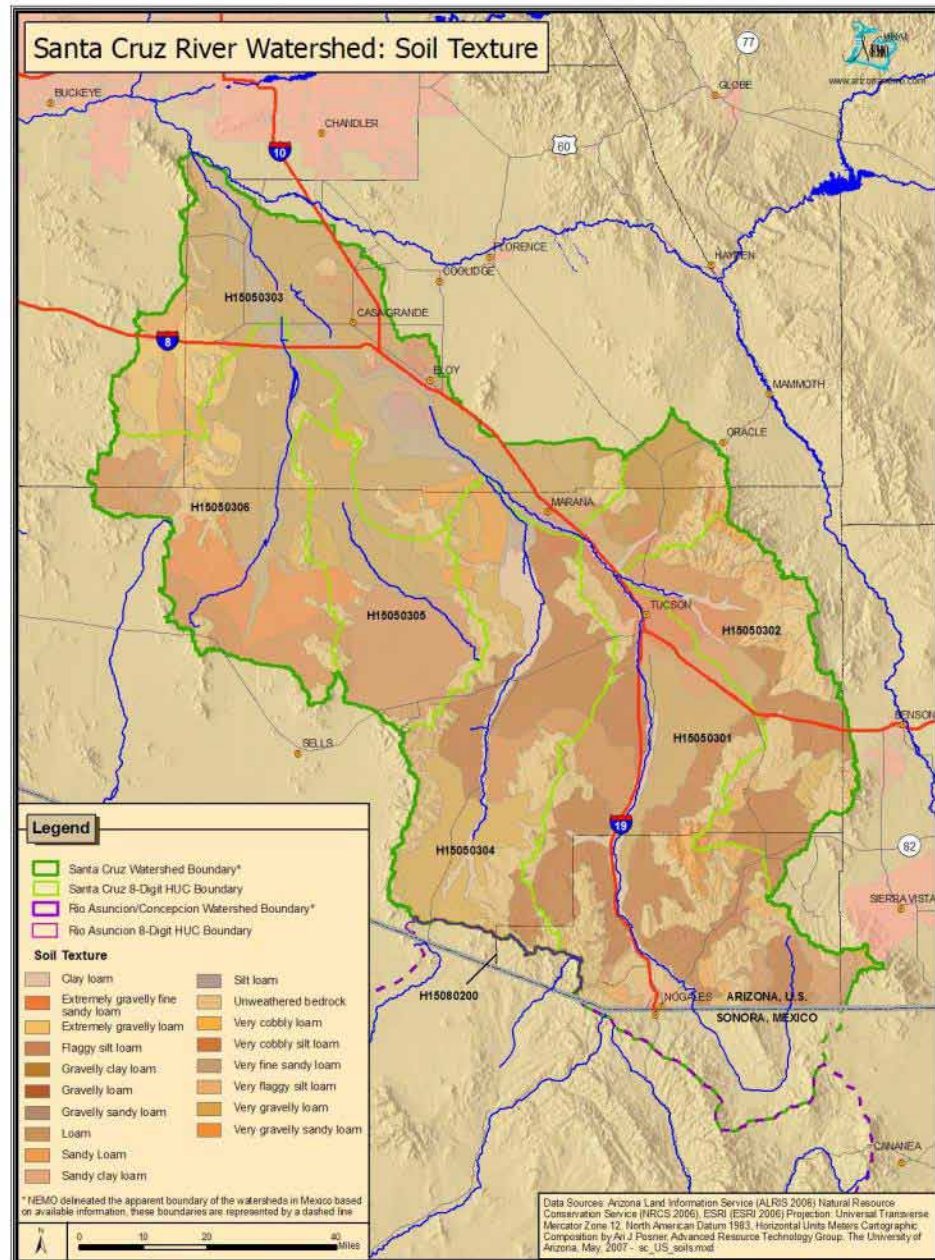
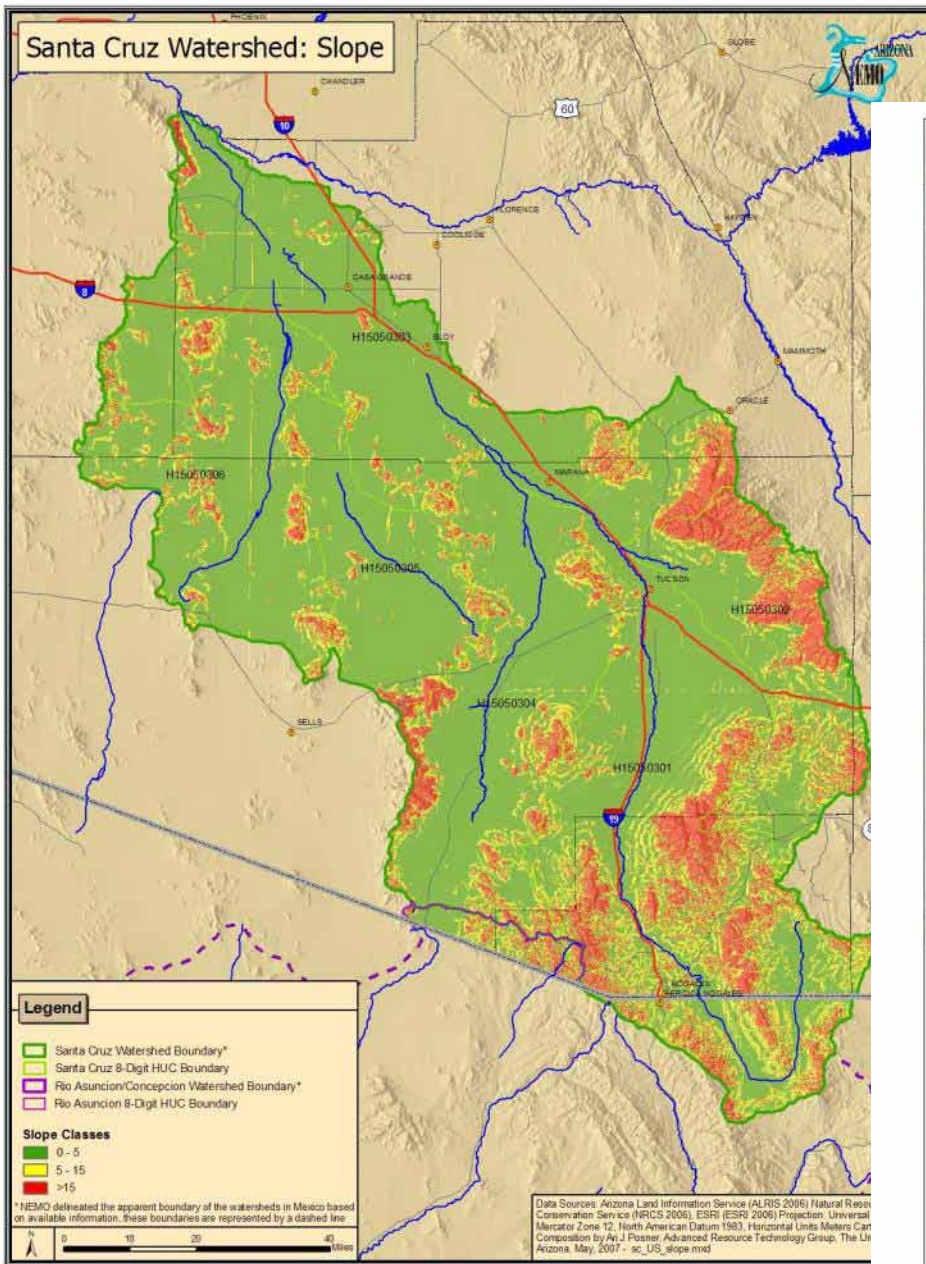


Santa Cruz River Watershed: Assessed Streams and Lakes

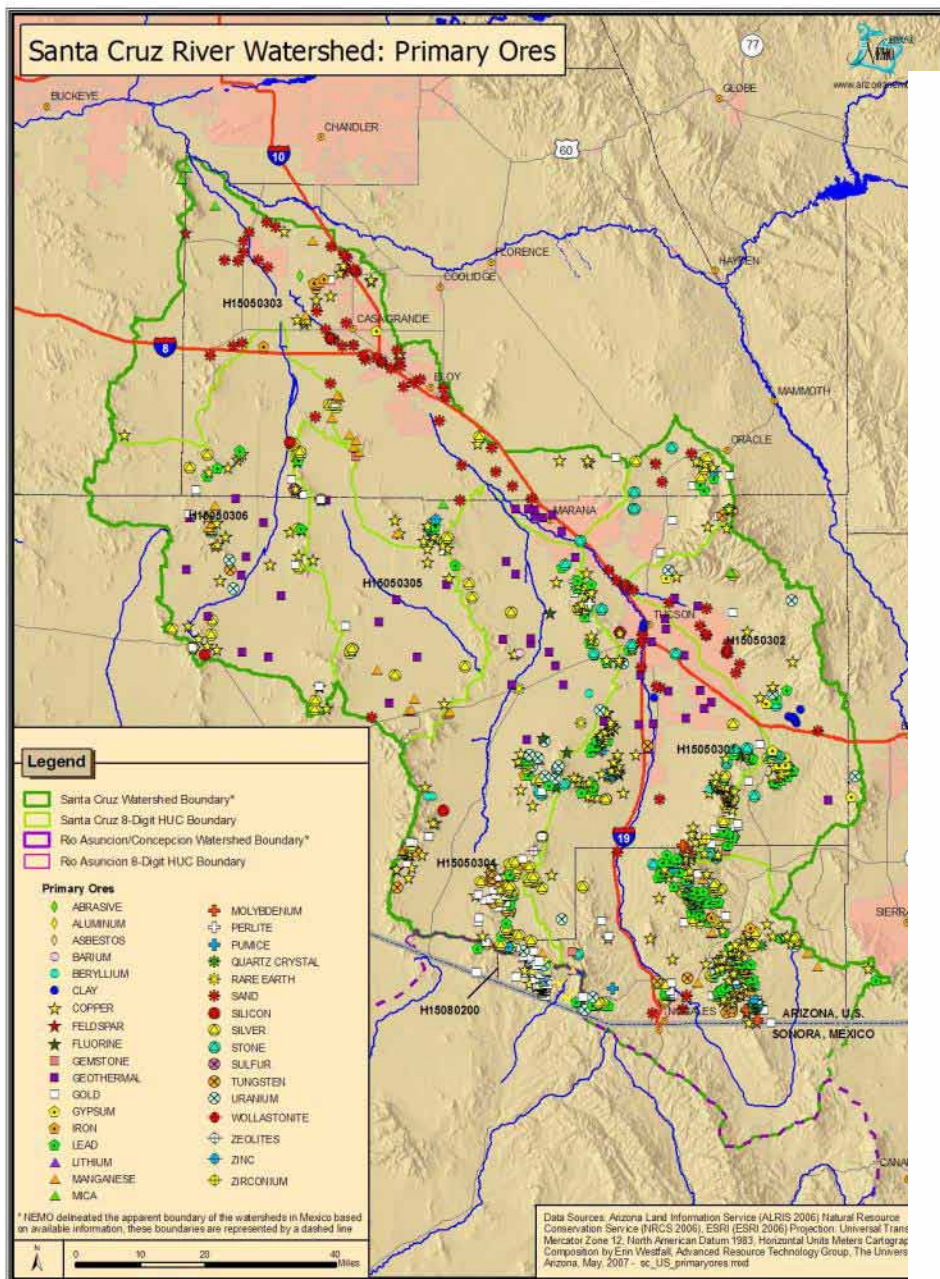


Santa Cruz River Watershed: Stream Types

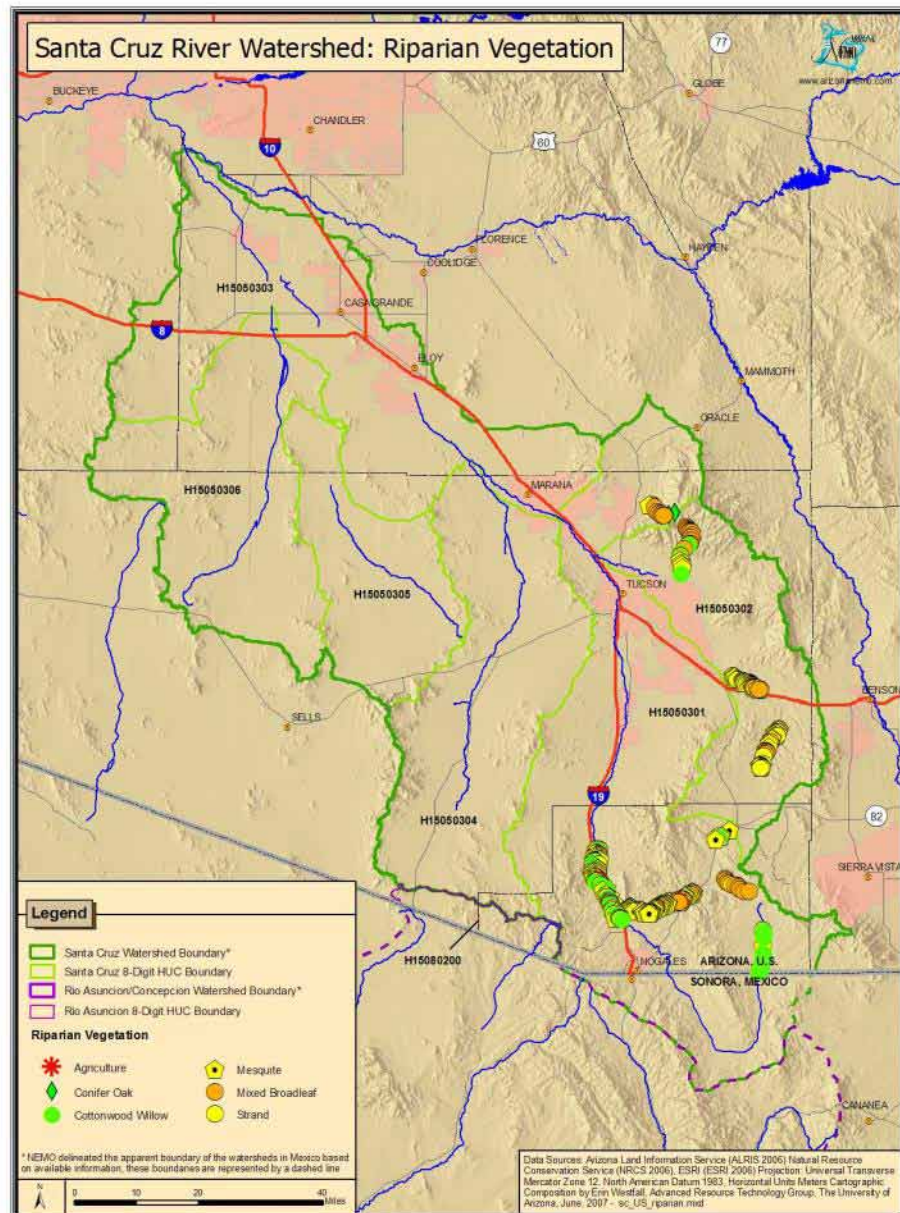




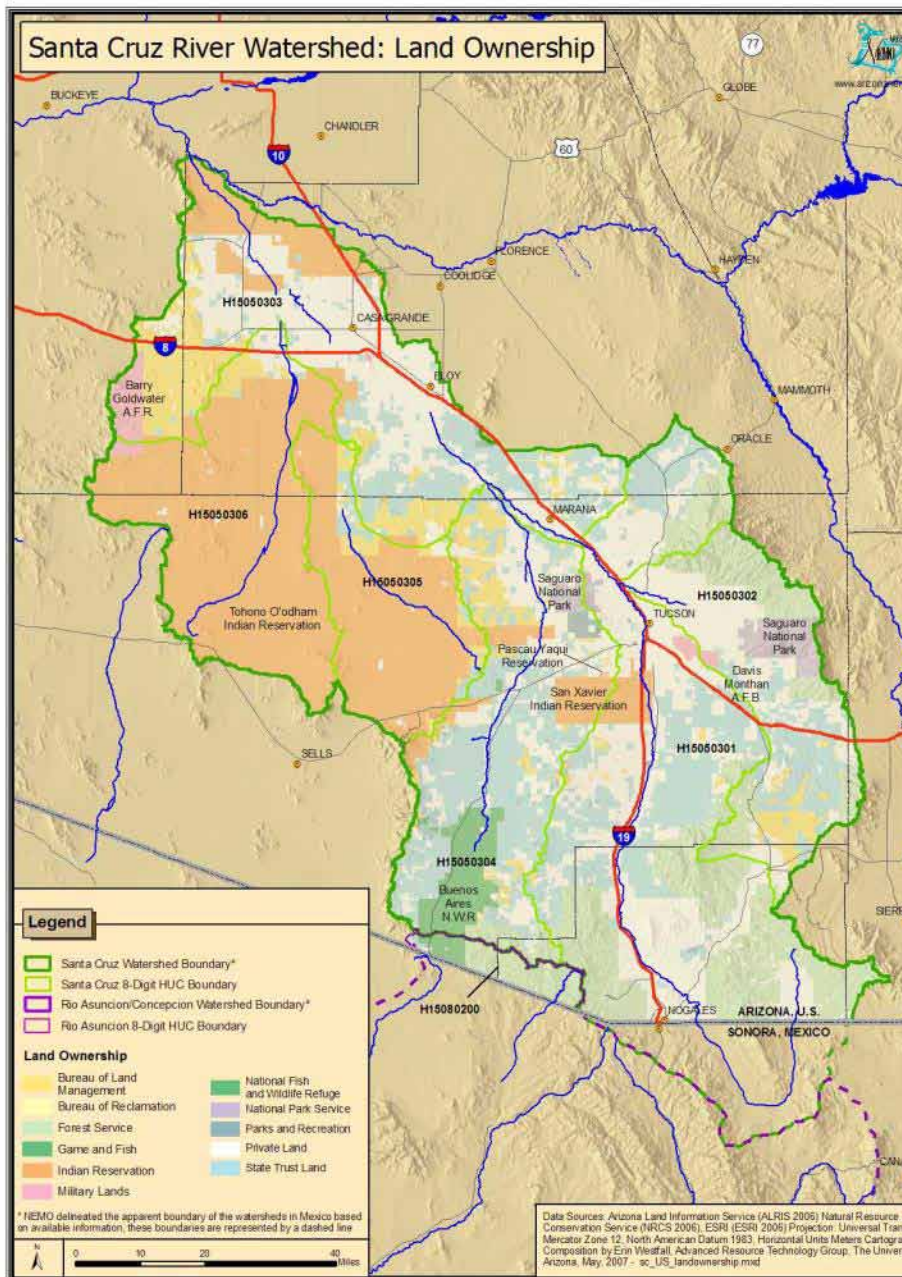
Santa Cruz River Watershed: Primary Ores



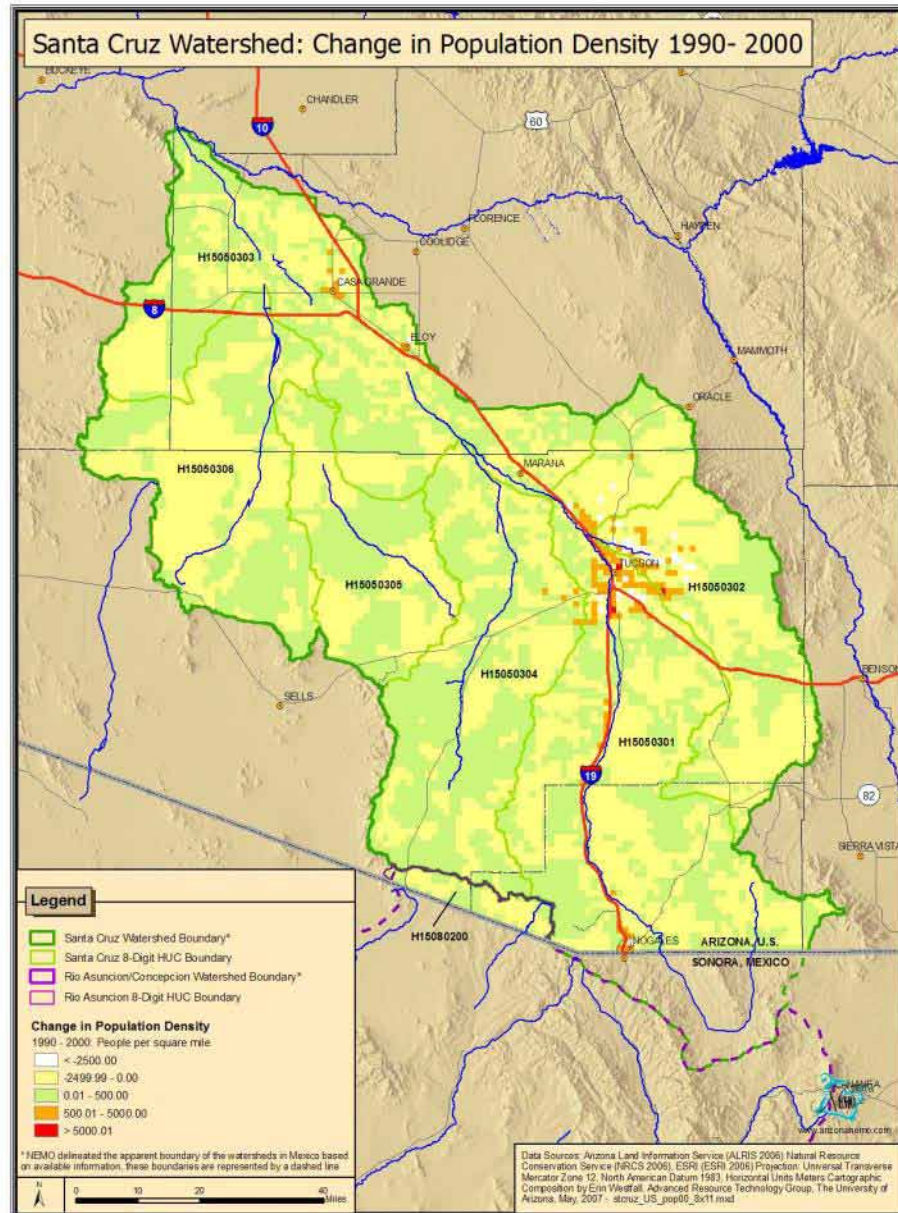
Santa Cruz River Watershed: Riparian Vegetation



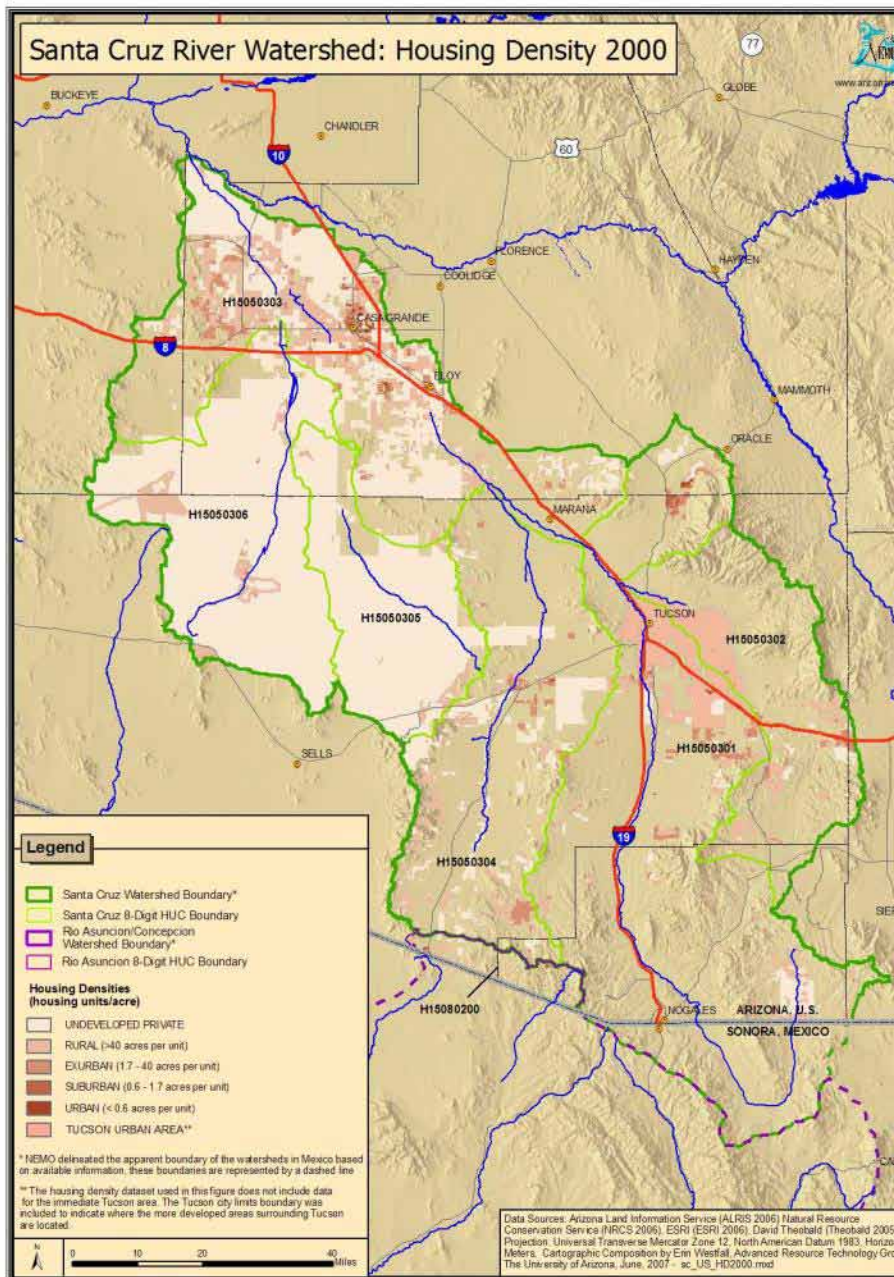
Santa Cruz River Watershed: Land Ownership



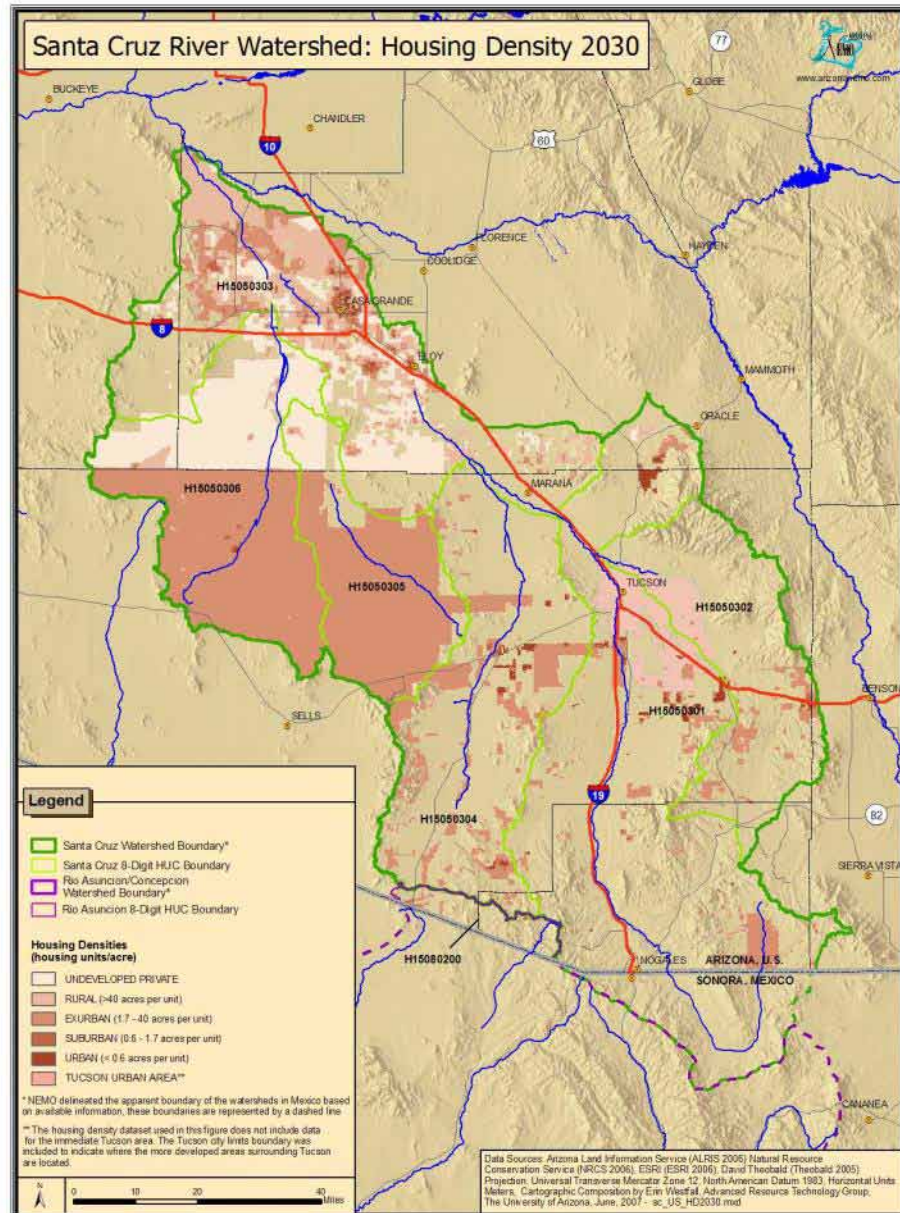
Santa Cruz Watershed: Change in Population Density 1990-2000



Santa Cruz River Watershed: Housing Density 2000



Santa Cruz River Watershed: Housing Density 2030



Complexity of Landscape Processes in the West

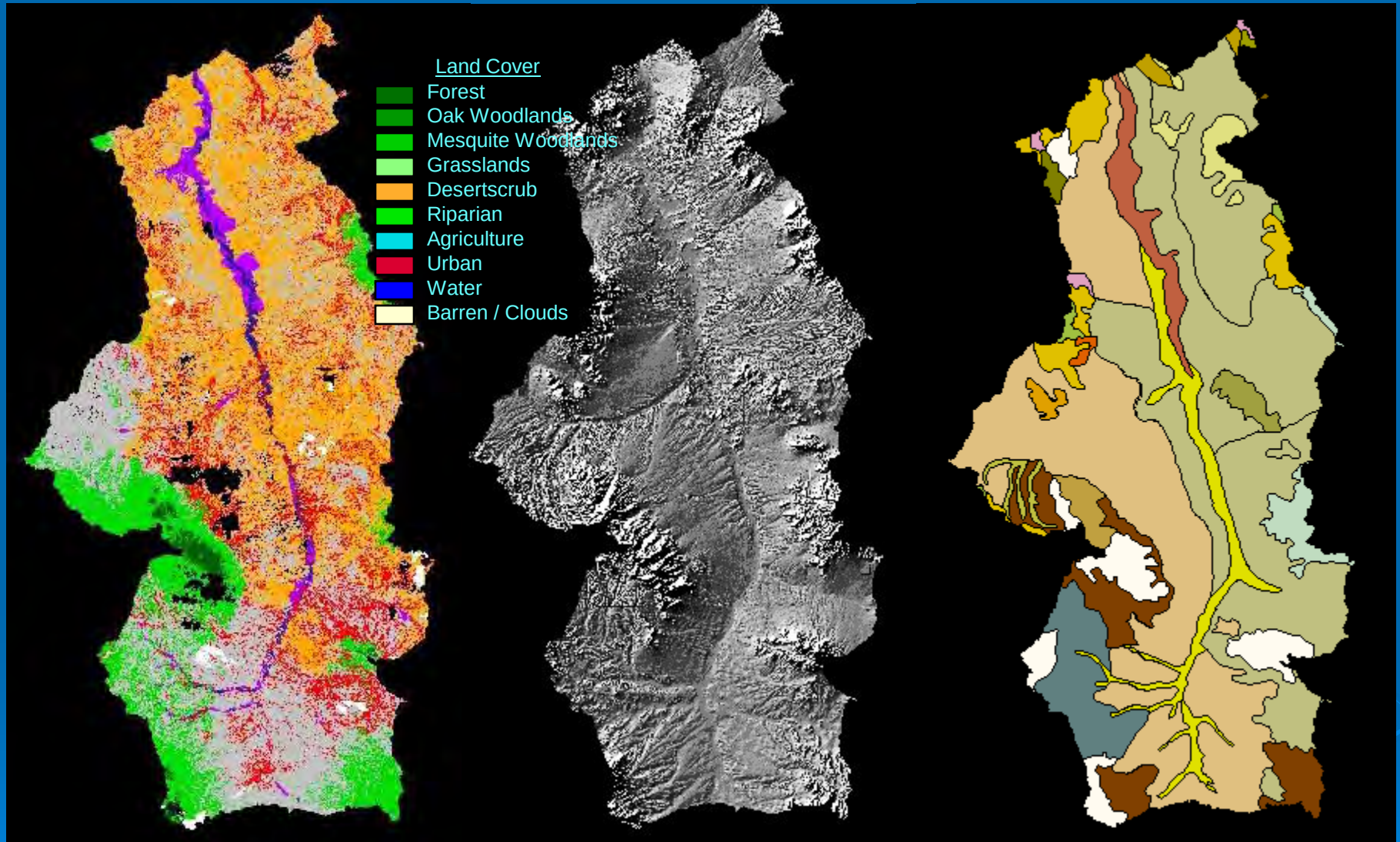


Watershed-Based Plans

- GIS-based hydrologic watershed modeling
- Automated Geospatial Watershed Assessment – AGWA – hydrologic model parameterization and results visualization
- Fuzzy Logic knowledge-based decision support tools



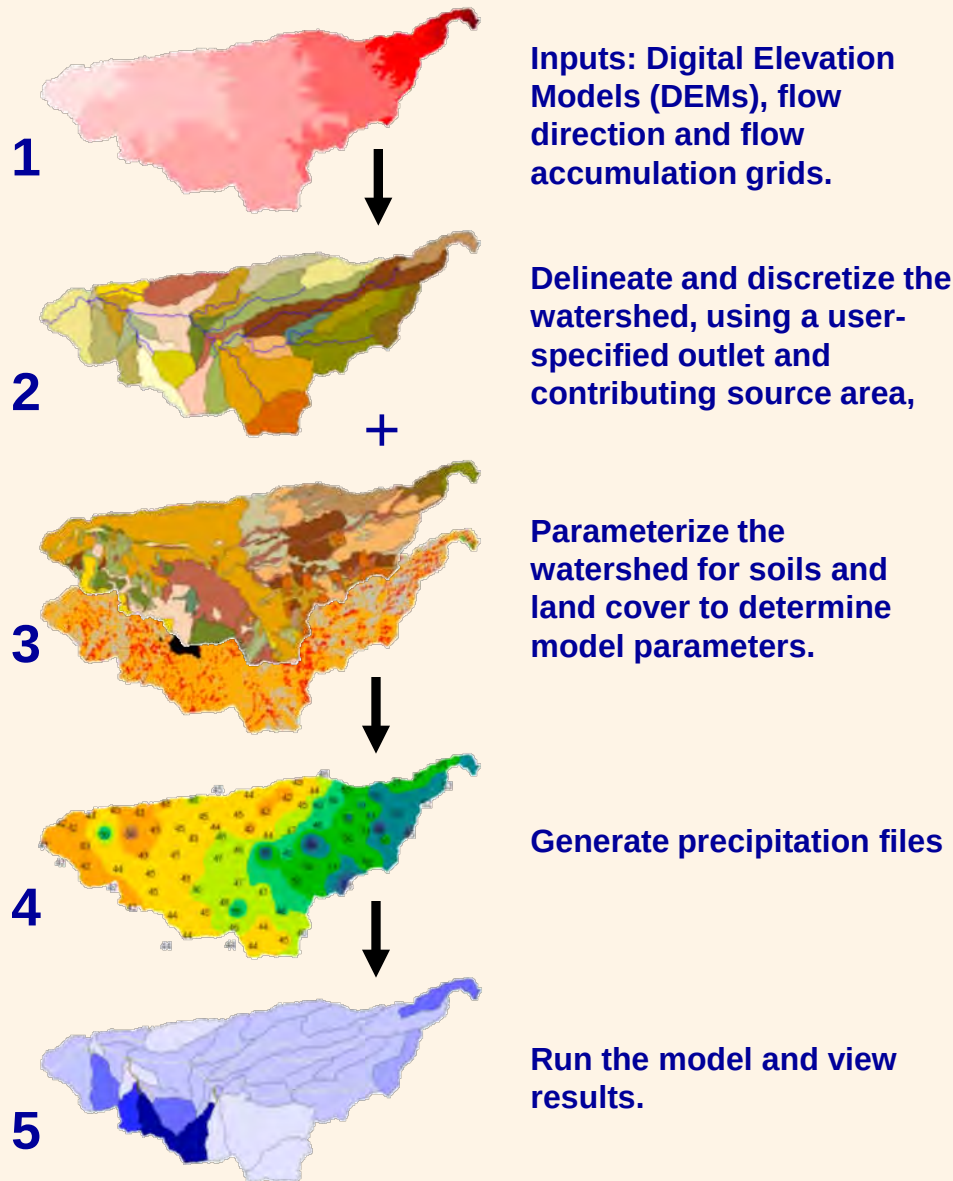
Automated Geospatial Watershed Assessment - AGWA



Advanced Resource Technology – ART Lab – GIS Watershed Modeling

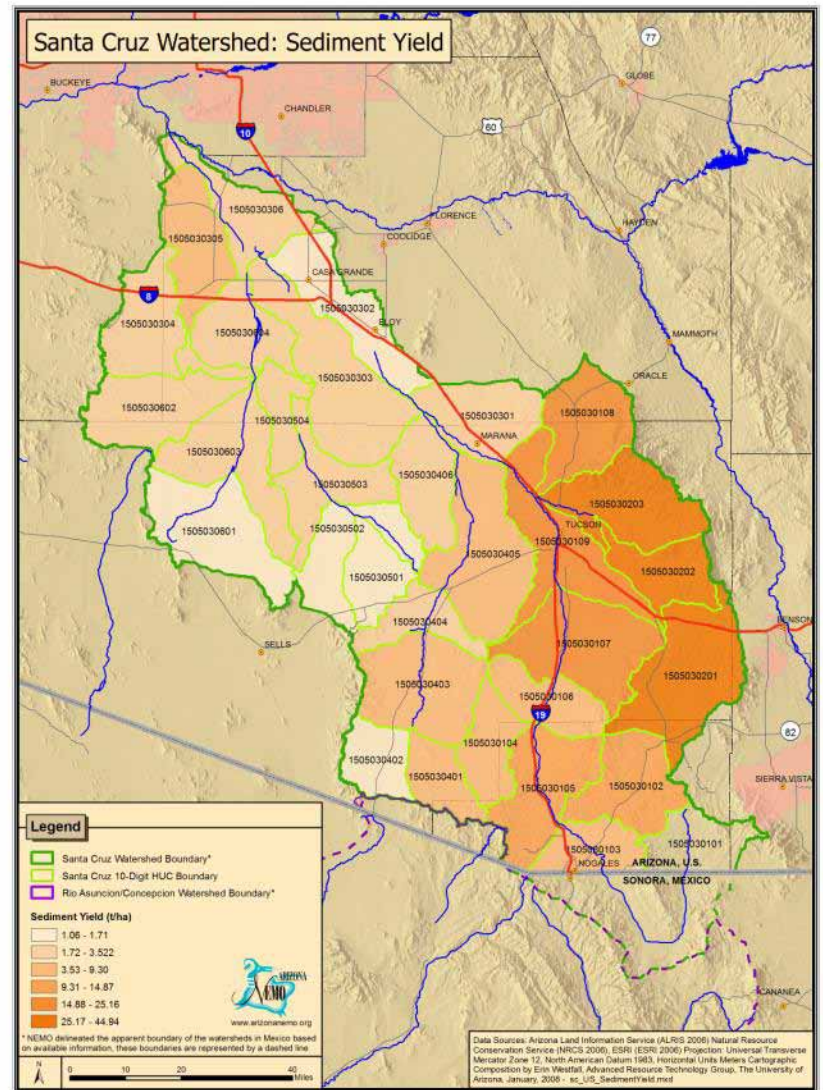
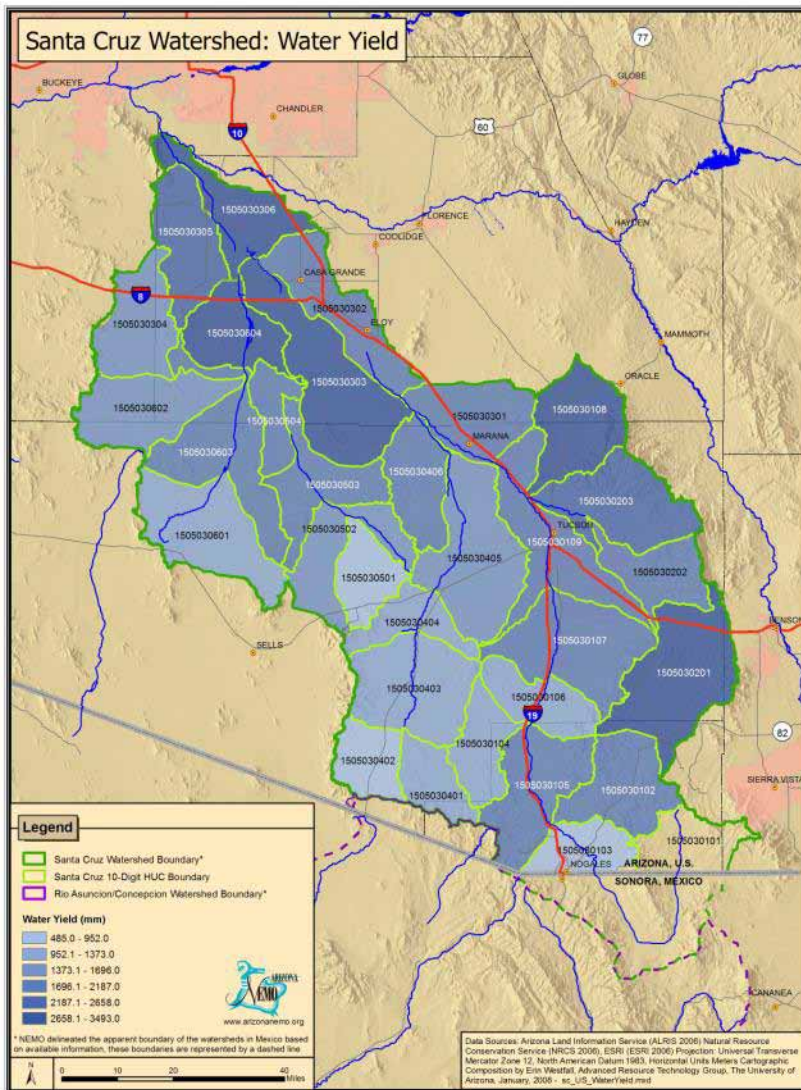
Automated Geospatial Watershed Assessment Tool (AGWA)

- Extension for ArcView 3.x
- Runs two runoff/erosion models: KINEROS2 & SWAT
- Model simulations identify subwatershed areas vulnerable to increased sedimentation and erosion due to soil and slope conditions as well as land use practices across the watershed.

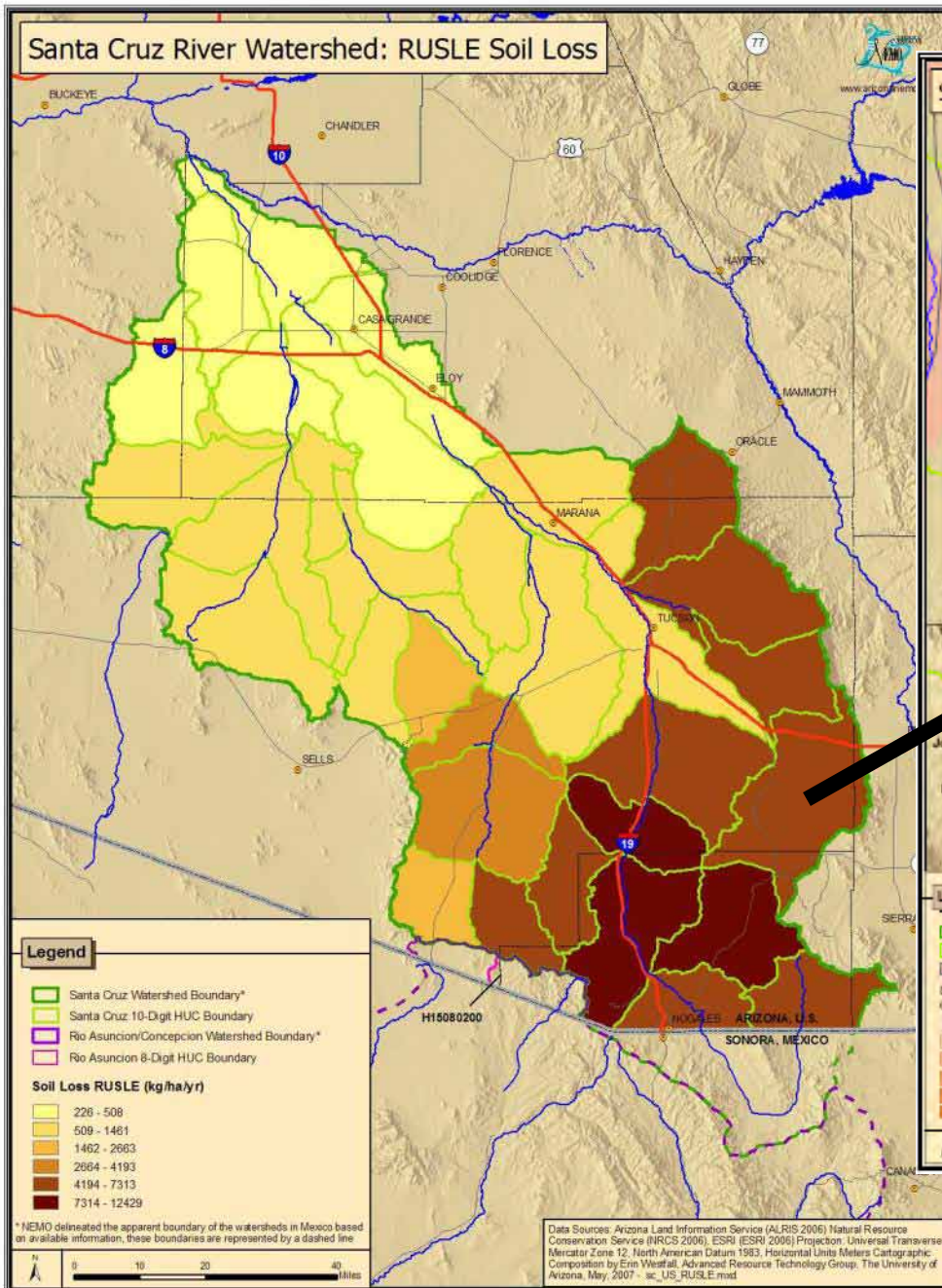


www.tucson.ars.ag.gov/agwa





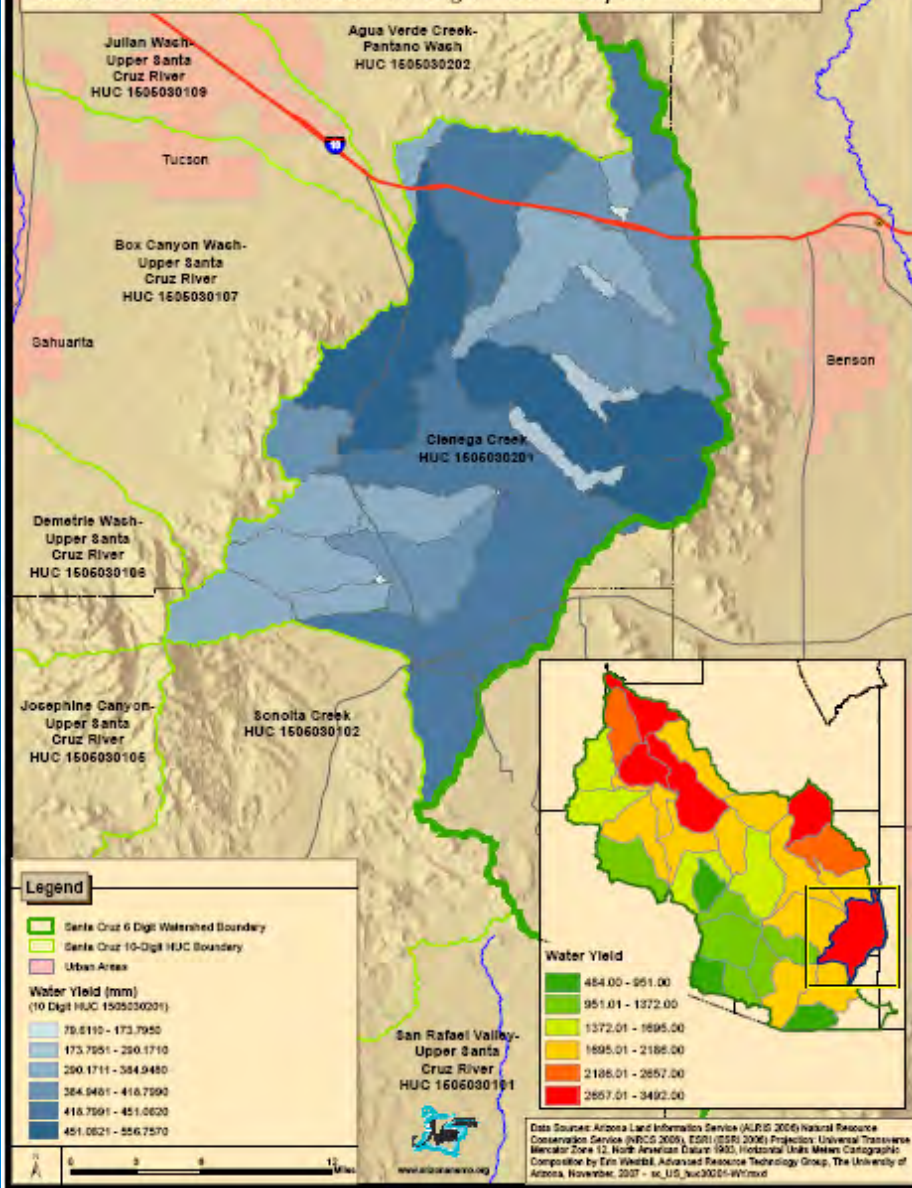
Santa Cruz River Watershed: RUSLE Soil Loss



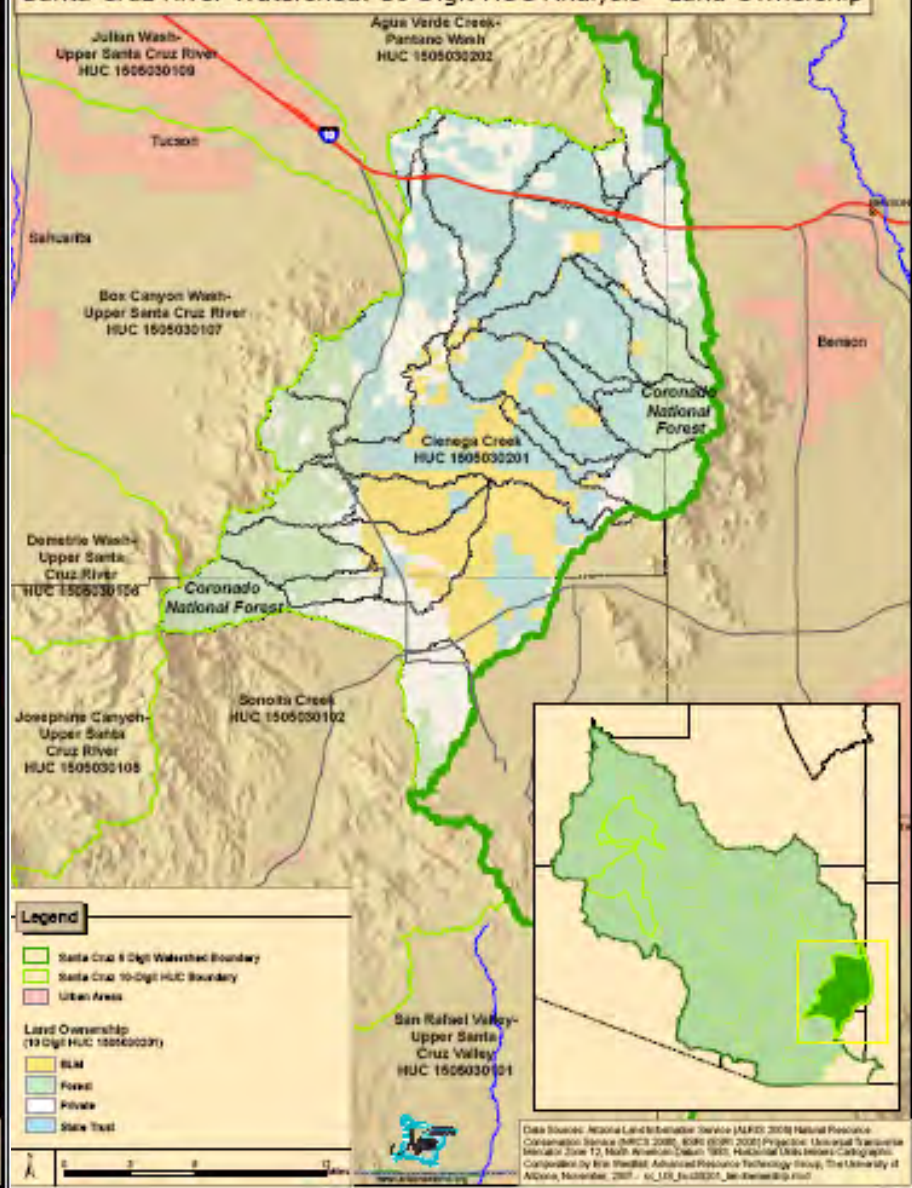
Santa Cruz River Watershed: 10 Digit HUC Analysis - Sediment Yield



Santa Cruz River Watershed: 10 Digit HUC Analysis - Water Yield



Santa Cruz River Watershed: 10 Digit HUC Analysis - Land Ownership

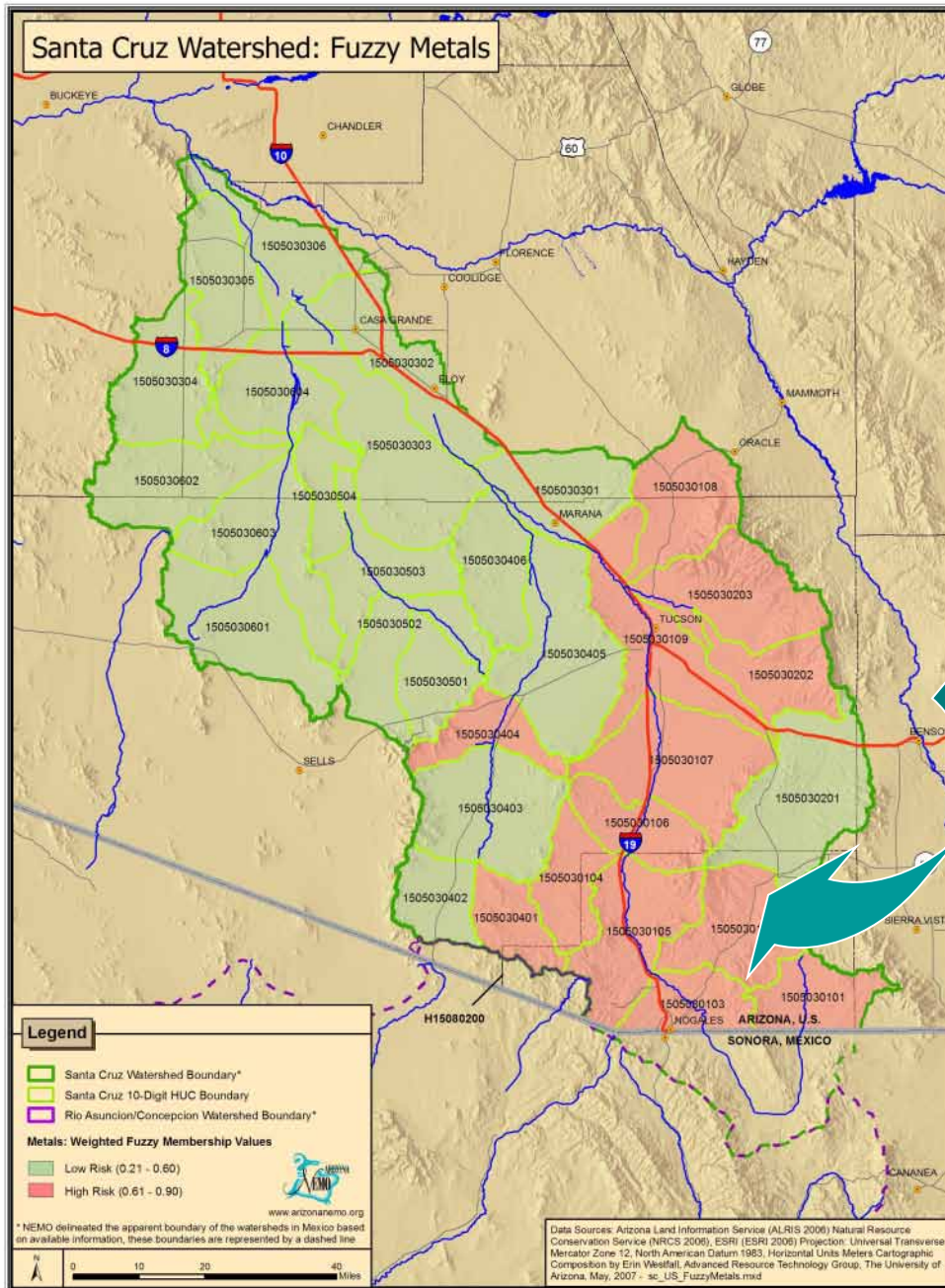


Metals

- Assume sediment from abandoned mine sites contains elevated levels of heavy metals
- Calculate & Classify Sediment Yield
 - RUSLE / SEDMOD
 - ArcInfo Workstation
- ADEQ Water Quality Data
- GIS analysis to rank subwatershed based on number of mines in subwatershed & near streams
- Final ranking using Weighted Combination method of Fuzzy Logic for each subwatershed



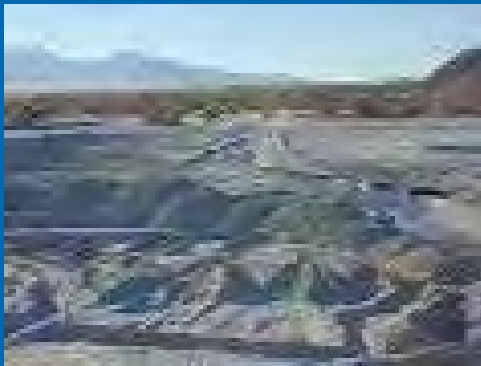
Subwatershed	WQA ¹	#Mines/ Subwatershed	#Mines/ Riparian	Erosion Category	FMV Weighted
Railroad Wash-Upper Gila River	0.6	1.000	1.000	0.200	0.640
Apache Creek-Upper Gila River	0.8	1.000	1.000	0.200	0.700
Animas Valley	0.5	0.000	0.000	0.000	0.150
Centerfire Creek-San Francisco River	0.5	0.000	0.000	0.200	0.210
Upper Blue River	0.6	0.250	0.400	0.200	0.385
Pueblo Creek-San Francisco River	0.5	0.000	0.000	0.000	0.150
Lower Blue River	0.6	0.500	0.400	0.200	0.410



Metals

Sonoita Creek Subwatershed, for metals pollution – assumed to be due to abandoned mine sites and highly mineralized soils.





Tailings restoration
and riparian buffers

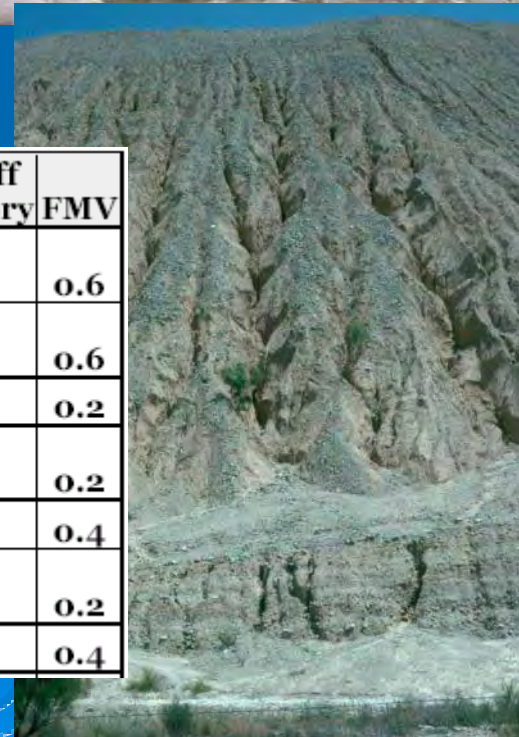


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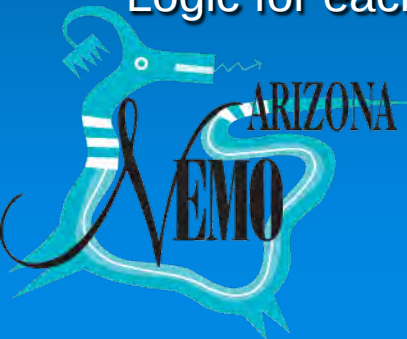


Sediment

- ADEQ Sediment or Turbidity data
- GIS analysis for human use
 - Subws and near riparian
- GIS analysis of Land ownership
 - FMV = 0 if (% State + private <= 10)
 - FMV = (% State + private - 10) / 15
 - FMV = 1 if (% State + private >= 25)
- Calc & Classify Runoff & Erosion
 - AGWA / SWAT
- Final ranking using Weighted Combination method of Fuzzy Logic for each subwatershed

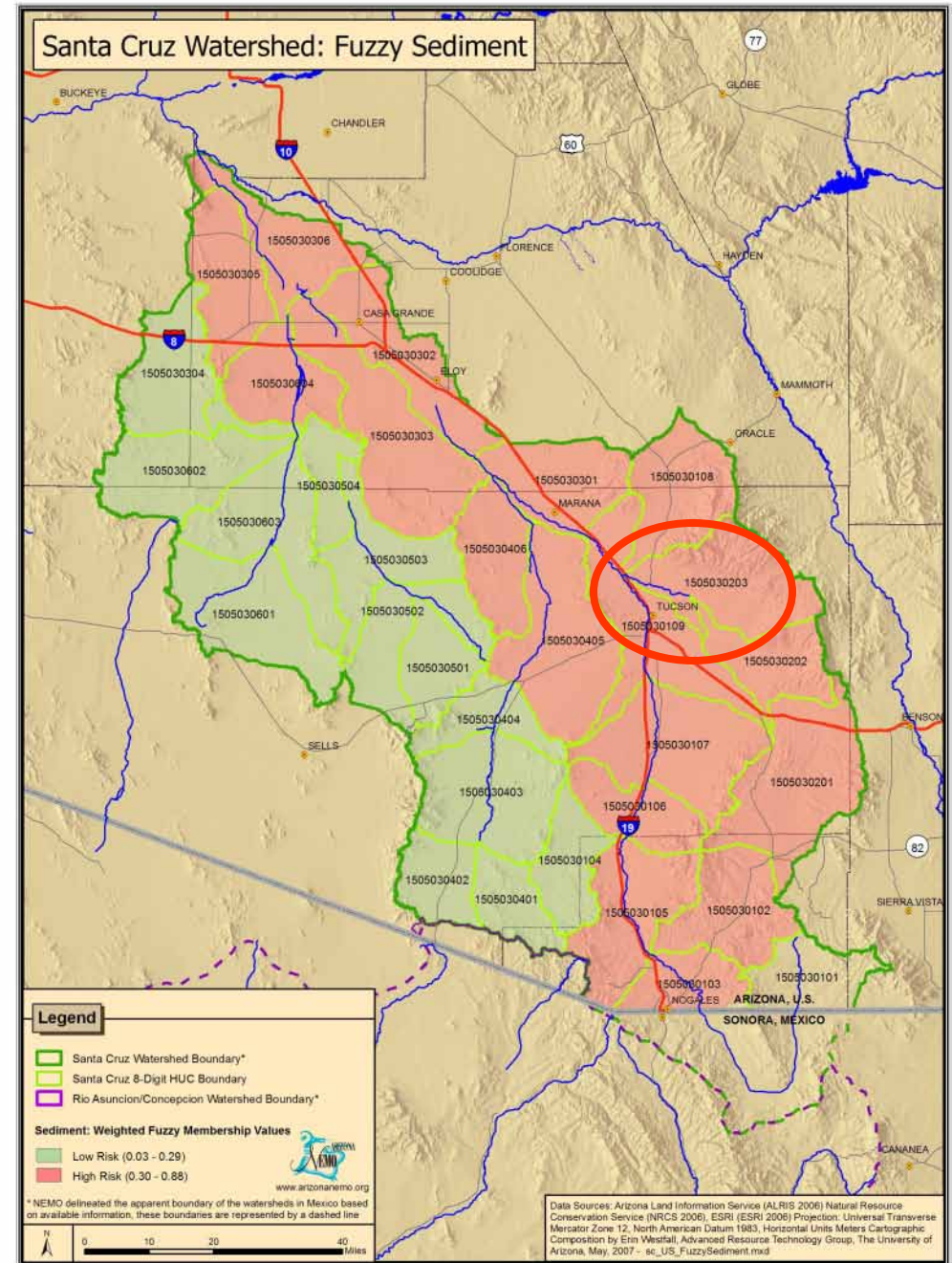


Subwatershed	Runoff Category	FMV
Railroad Wash-Upper Gila River	3	0.6
Apache Creek-Upper Gila River	3	0.6
Animas Valley	1	0.2
Centerfire Creek-San Francisco River	1	0.2
Upper Blue River	2	0.4
Pueblo Creek-San Francisco River	1	0.2
Lower Blue River	2	0.4

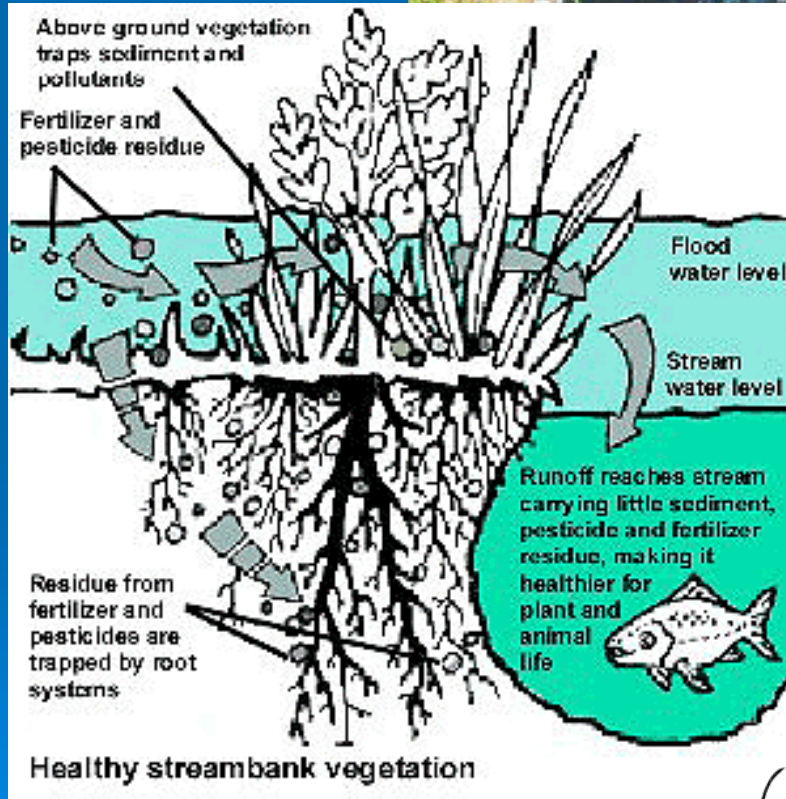


Sediments

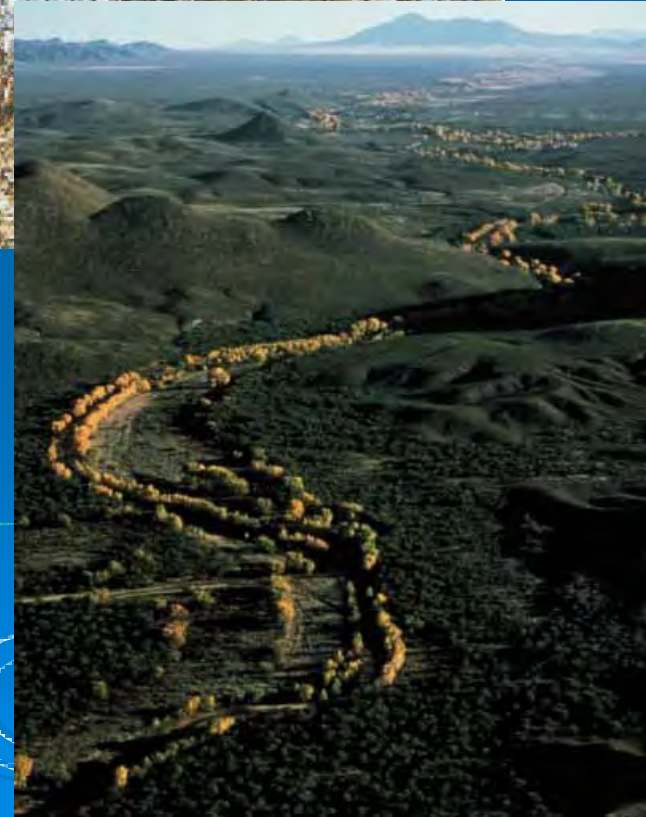
Tanque Verde Creek – Rillito River, in the Tucson area, for sediment pollution derived from land use – increased urbanization



Engineered erosion control

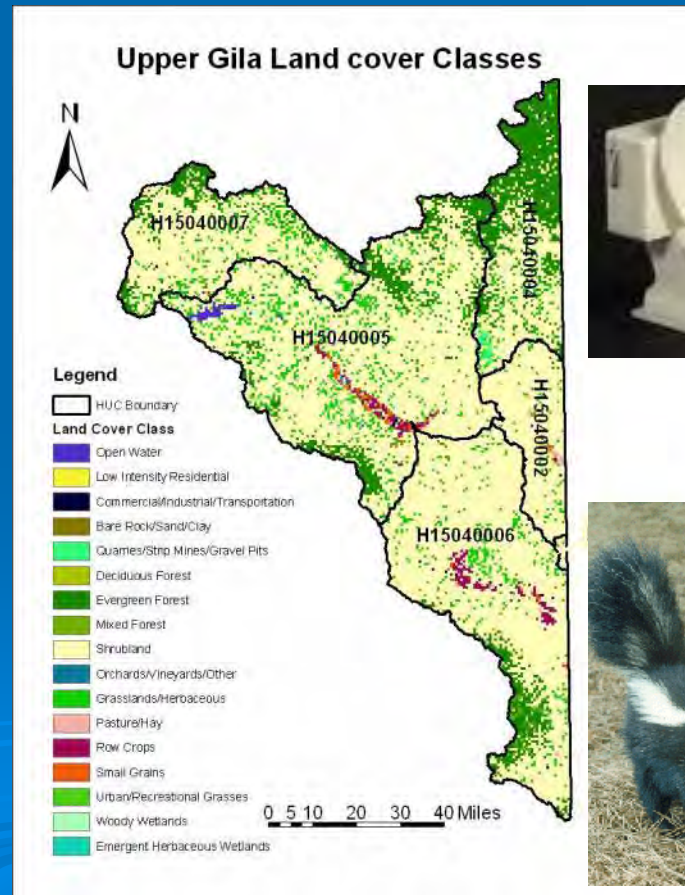
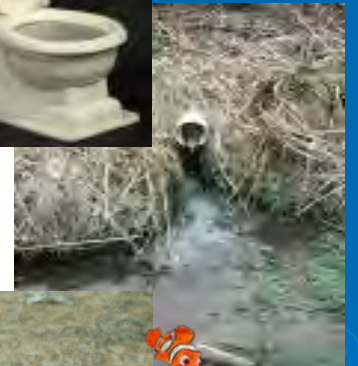


Riparian restoration



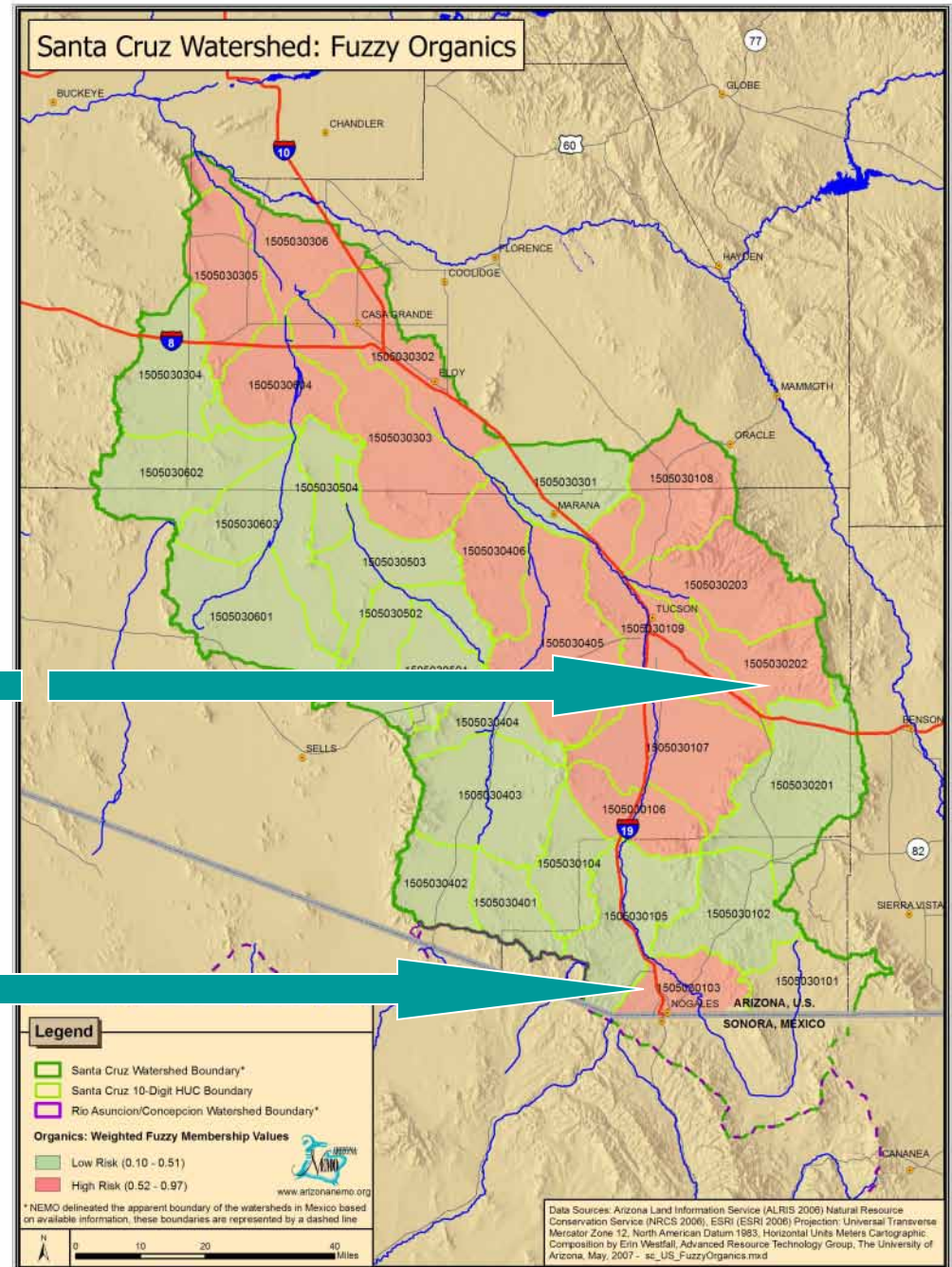
Organics

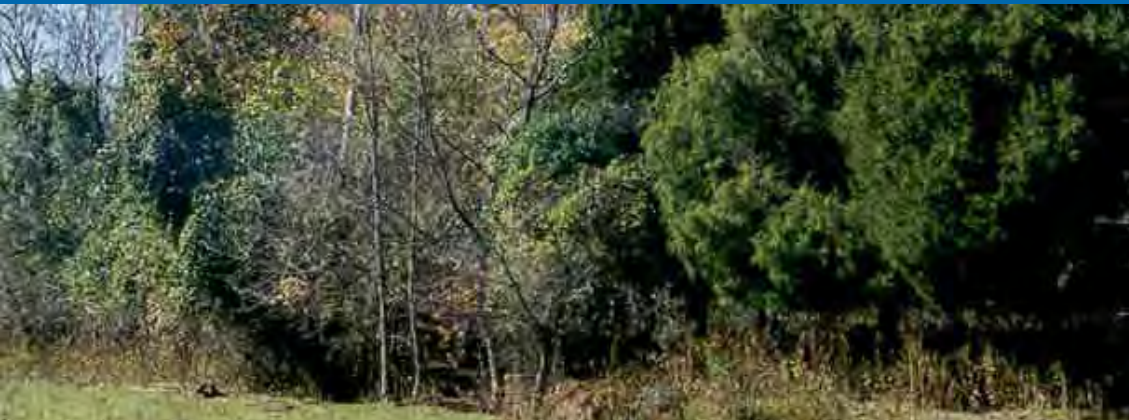
- ADEQ Water Quality Data for Nitrogen, pH, *E. coli*, DO
- GIS Analysis of Land Use
 - Grazing
- GIS Analysis of Human Use
 - Subws and near riparian
- Final ranking using Weighted Combination method of Fuzzy Logic for each subwatershed



Organics, and Nutrients!

Potrero Creek Subwatershed and also Agua Verde Creek / Pantano Wash, for organics pollution due to discharge of wastewater and livestock grazing.



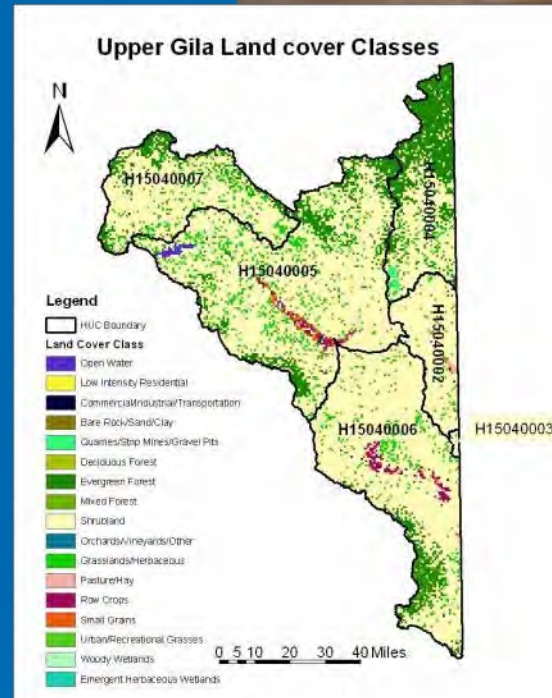


Livestock exclusion fencing, riparian buffers,
repair of failing septic systems



Selenium

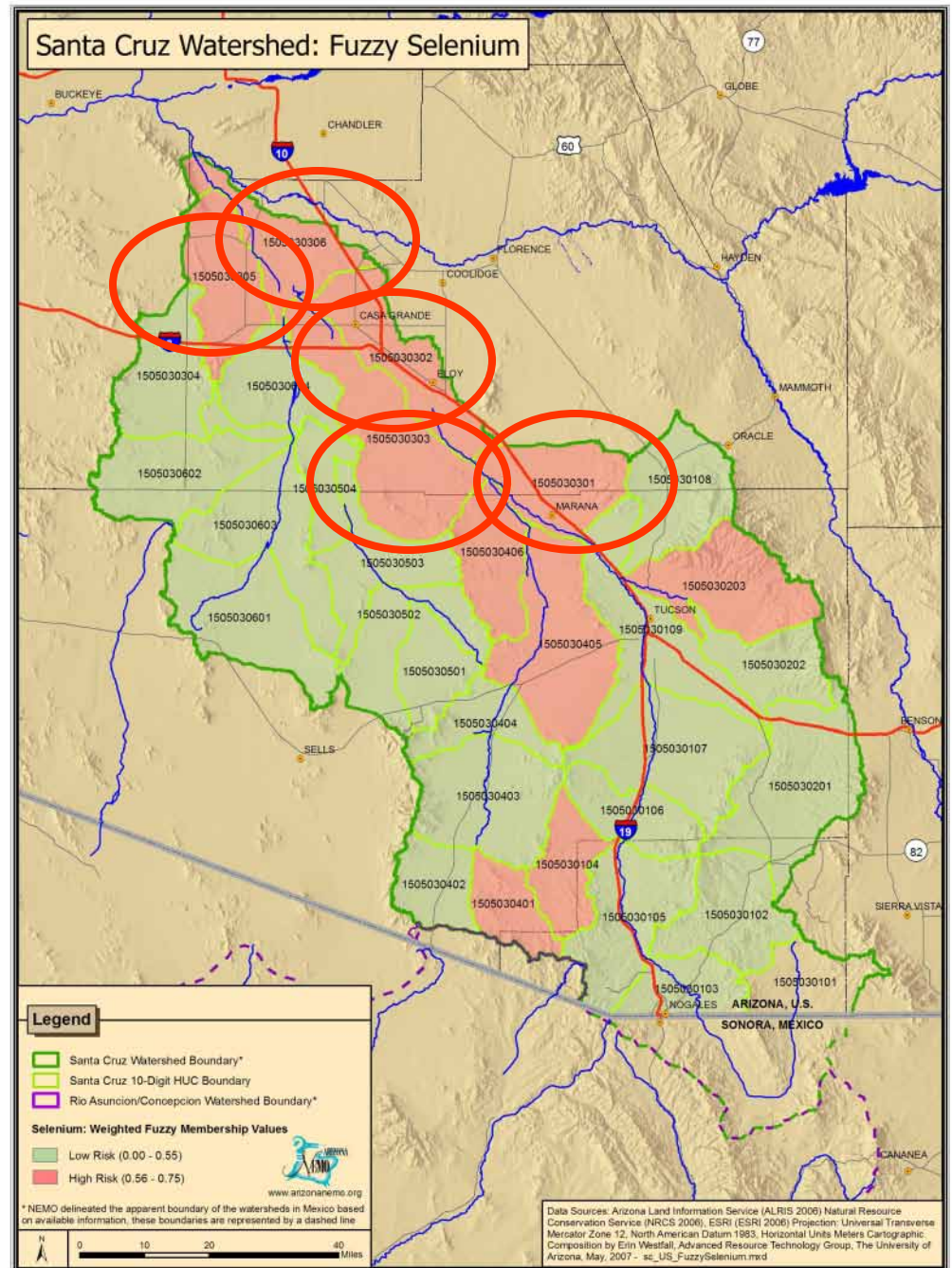
- ADEQ Water Quality Data
- GIS Analysis of Land Use
 - Agriculture
- Final ranking using Weighted Combination method of Fuzzy Logic for each subwatershed



Subwatershed Name	WQA ¹	FMV for Agricultural Lands	FMV Weighted
Railroad Wash-Upper Gila River	1.0	0.354	0.677
Apache Creek-Upper Gila River	1.0	0.059	0.530
Animas Valley	0.5	0.000	0.250
Centerfire Creek-San Francisco River	0.5	0.186	0.343
Upper Blue River	0.5	0.001	0.250
Pueblo Creek-San Francisco River	0.5	0.000	0.250
Lower Blue River	0.3	0.000	0.150

Selenium

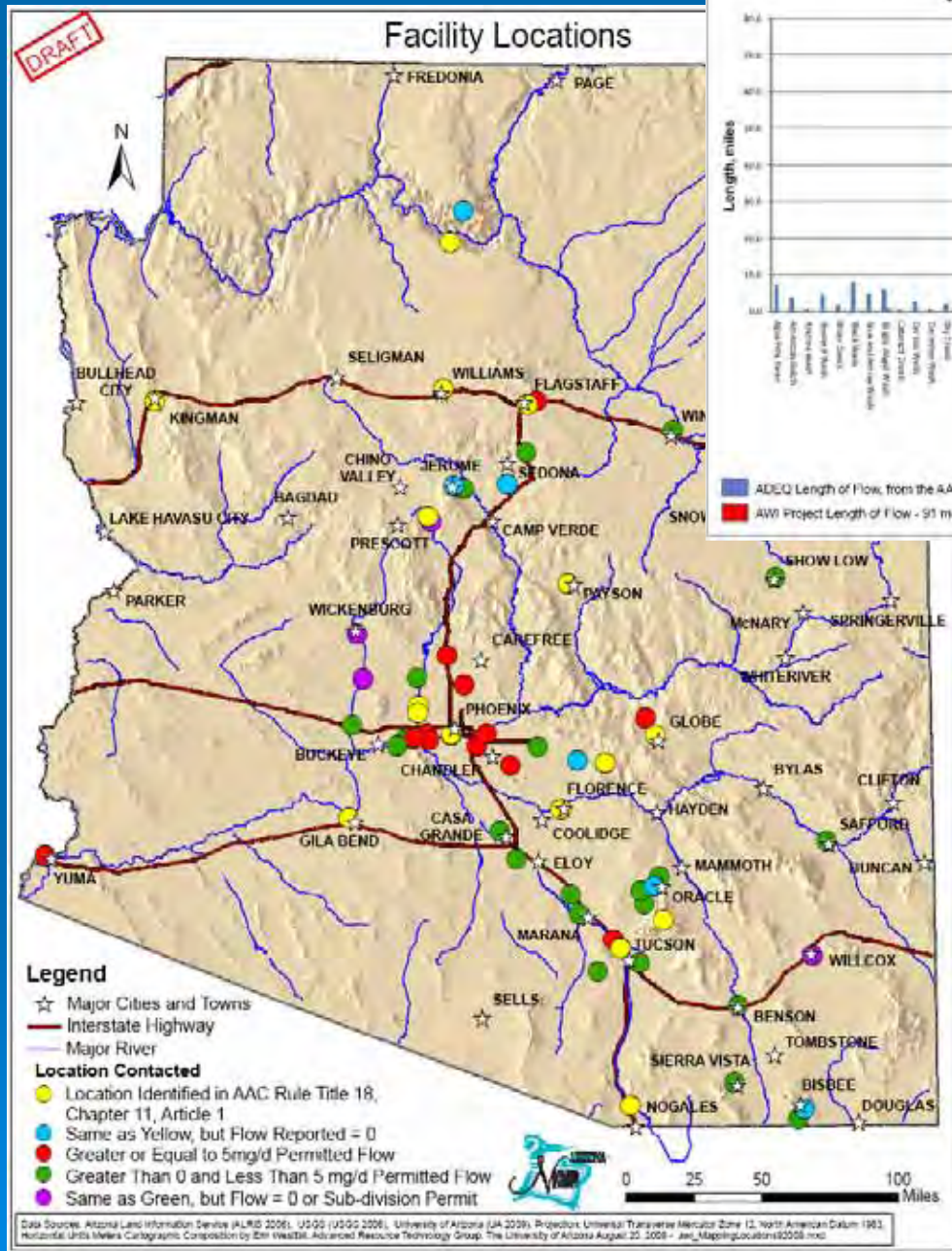
Selenium due to elevated naturally occurring selenium and agricultural practices.



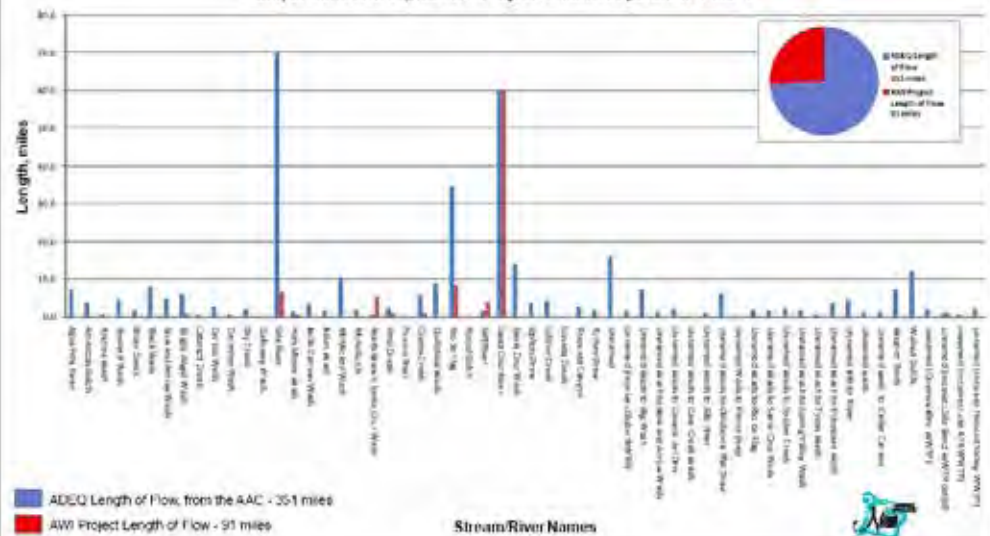


Mechanized irrigation





Comparison of ADEQ and AWI Project Effluent Dependent Waters

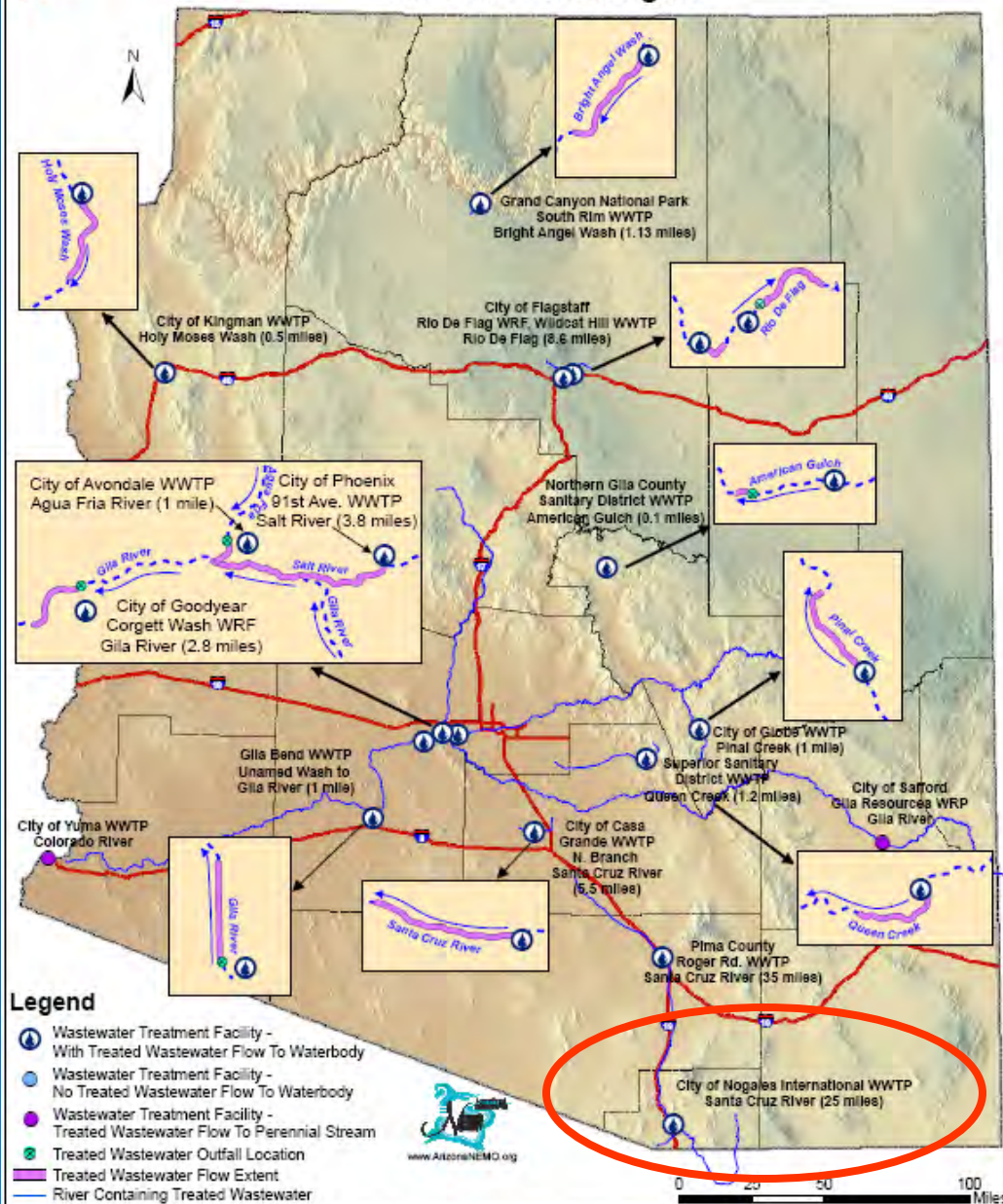


351 miles assumed
by ADEQ

91 miles mapped over
the study period.

DRAFT

Treated Wastewater Stream Discharge Locations and Stream Lengths



Arizona Water Institute
AWI

Treated Wastewater
Stream Discharge
Locations and Stream
Lengths

25 miles of flow
downstream from the
City of Nogales International
Wastewater Treatment
Plant

Thank You!

Yes, I have
a question



www.ArizonaNEMO.org

