Assessment of Goods and Valuation of Ecosystem Services (AGAVES) San Pedro River basin, Arizona and Mexico

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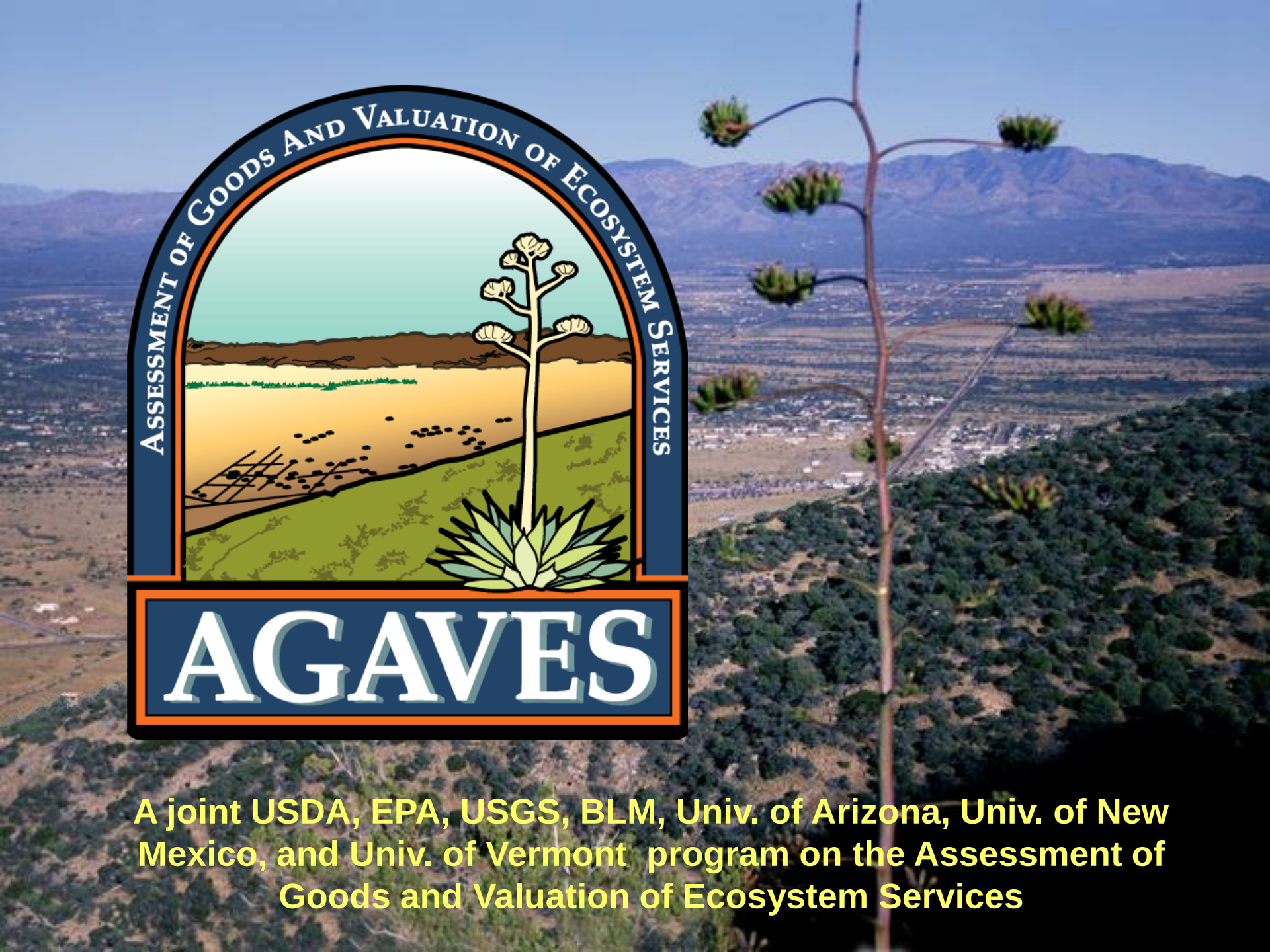


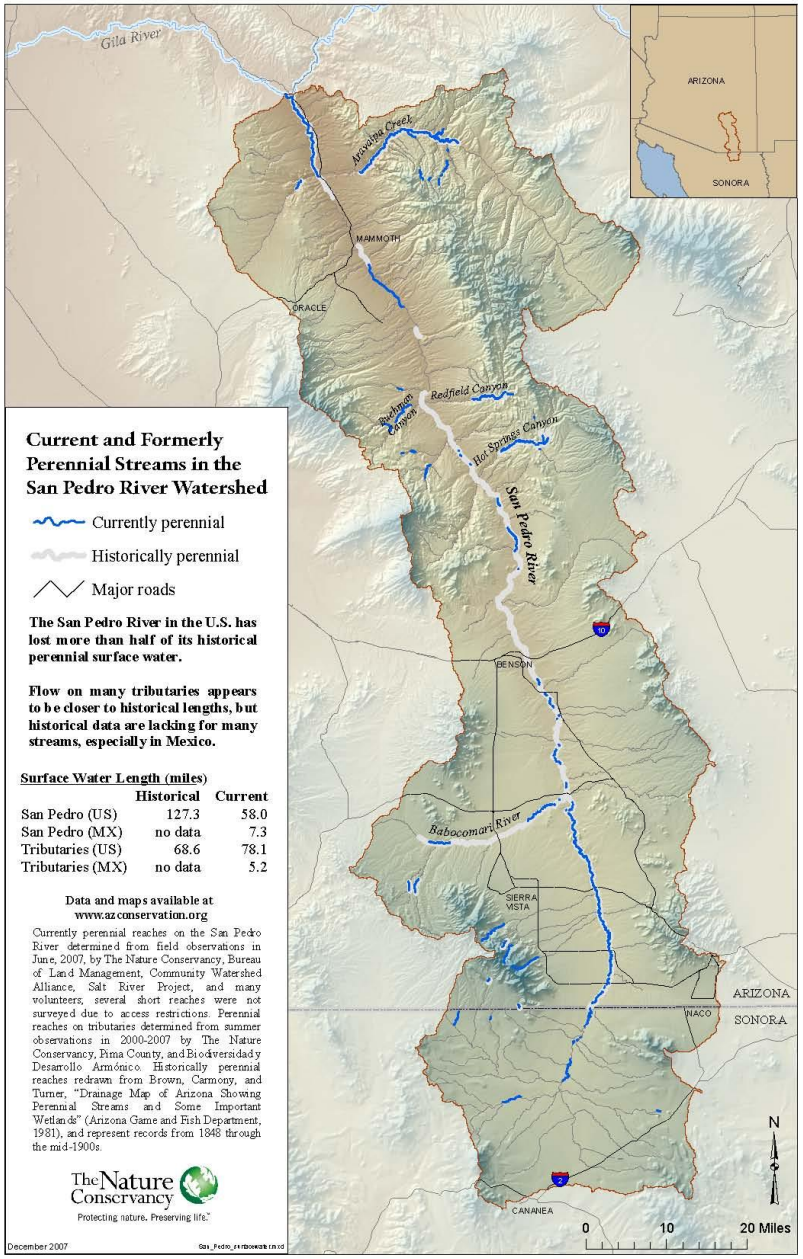
A joint USDA, EPA, USGS, BLM, Univ. of Arizona, Univ. of New Mexico, and Univ. of Vermont program on the Assessment of Goods and Valuation of Ecosystem Services

SAN PEDRO STUDY AREA

- 2,800 sq mi headwater of Lower Colorado River Basin
  - Undammed
  - Perennial flow
- Substantial body of previous research
- Ecologically important
- Service-dependent local economy
- Active & organized stakeholders
- Pressing environmental concerns
- History of ecosystem-based management decisions

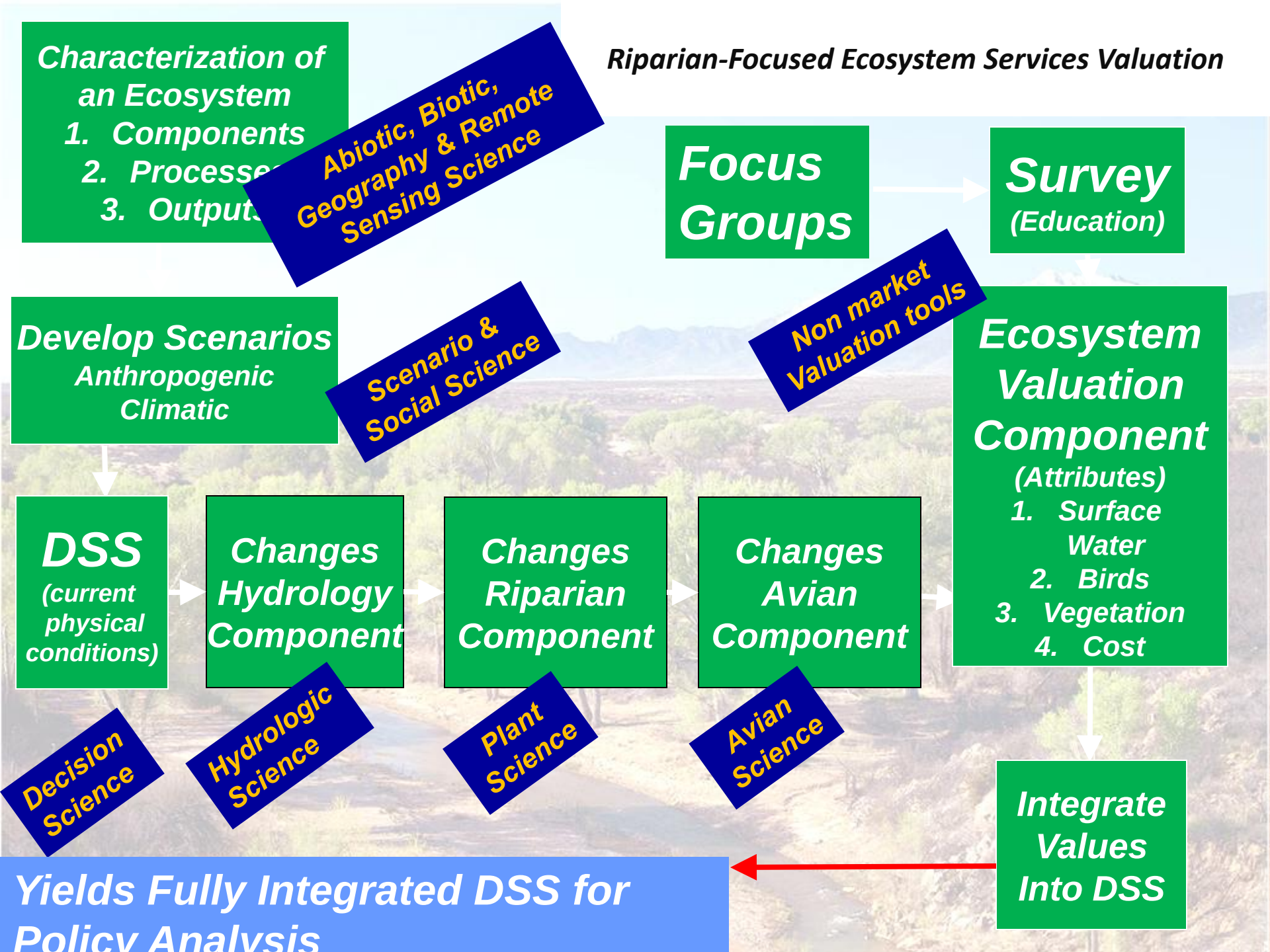
PROBLEM

- GW use is transforming river from perennial to ephemeral



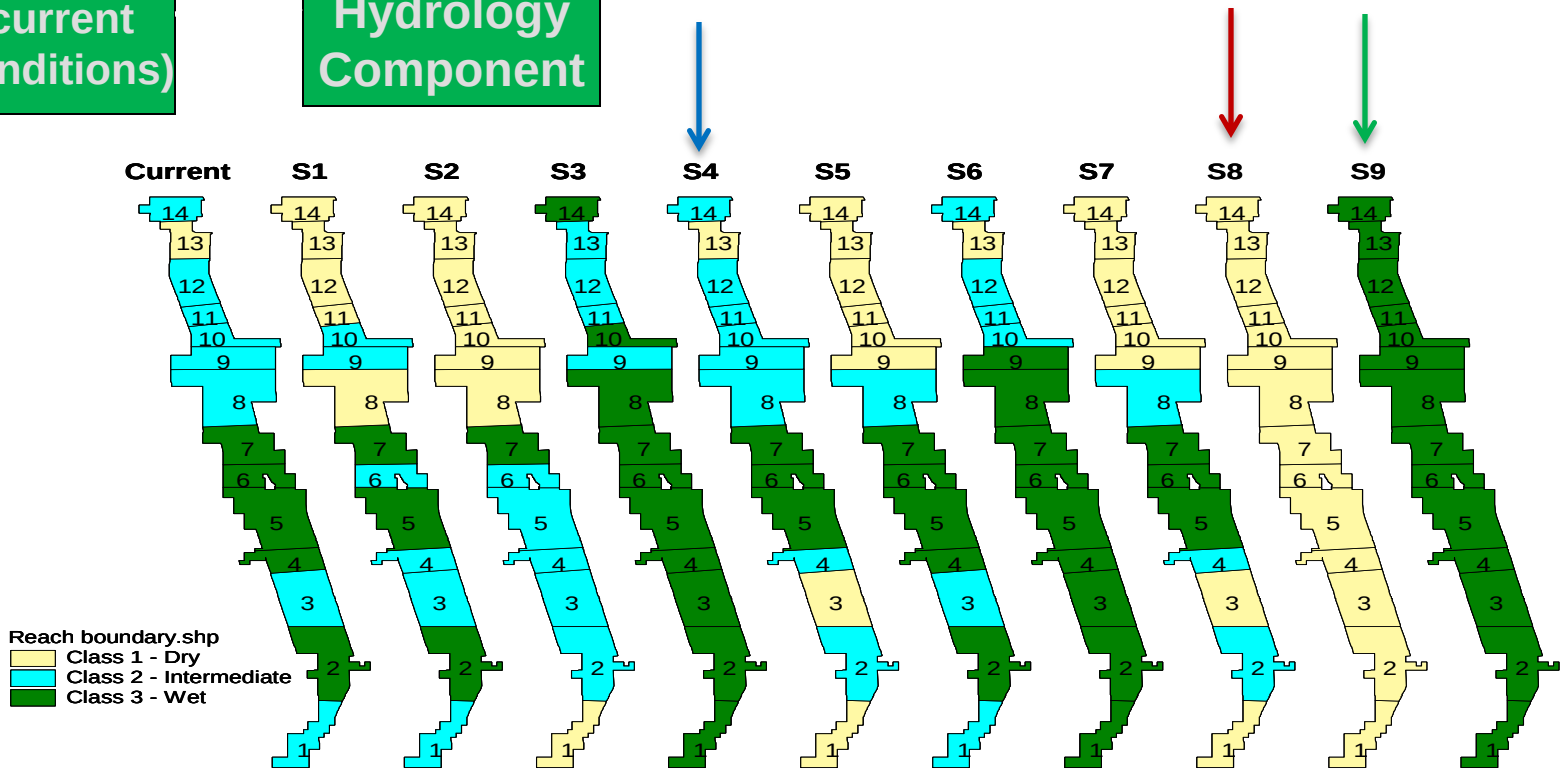
Overview

- Fine-scale, riparian-focused research
  - Biophysical
  - Economic
  - Decision support
- Basin-scale research
  - Biodiversity metrics
  - Climate, land-use, and hydrologic scenarios
- USGS-BLM Pilot Study on ES Valuation
  - Phase 1 - tools comparison


Riparian-Focused Ecosystem Services Valuation
Characterization of an Ecosystem
1. Components
2. Processes
3. Outputs
Abiotic, Biotic, Geography & Remote Sensing Science
Focus Groups
Survey
(Education)
Develop Scenarios
Anthropogenic
Climatic
Scenario & Social Science
Non market Valuation tools
Ecosystem Valuation Component
(Attributes)
1. Surface Water
2. Birds
3. Vegetation
4. Cost
DSS
(current physical conditions)
Changes Hydrology Component
Changes Riparian Component
Changes Avian Component
Decision Science
Hydrologic Science
Plant Science
Avian Science
Integrate Values Into DSS
Yields Fully Integrated DSS for Policy Analysis

3. DSS (current conditions)

4. Changes Hydrology Component



S4: Continued and increased agricultural pumping near Palominas; new developments in unincorporated areas of Palominas and Hereford near SPRNCA

S8: Low extreme-river essentially dries up

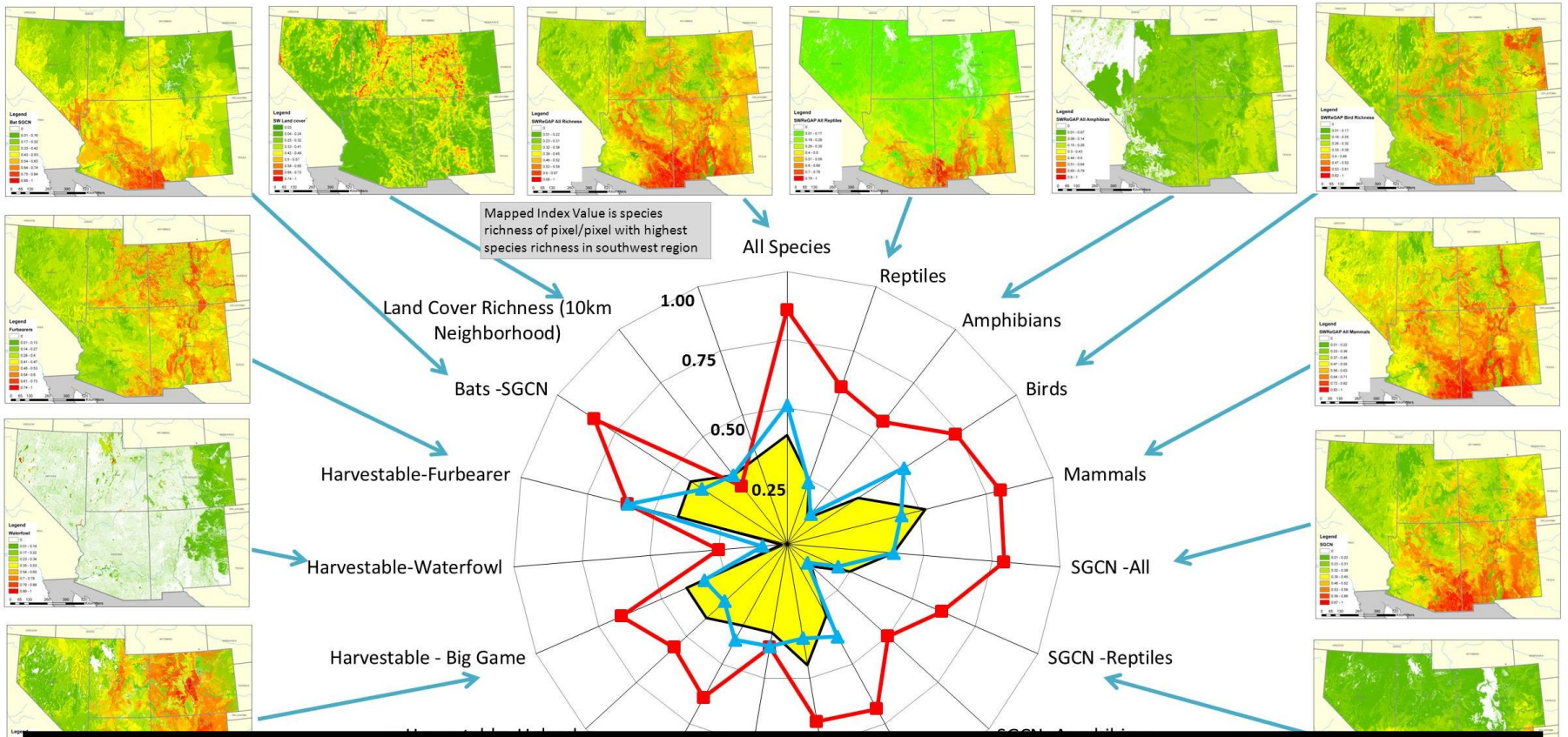
S9: High extreme-river essentially has surface flows throughout SPRNCA

Choice Modeling

Attributes	Riparian Vegetation	% Time SW Is Present	Bird Type/Pop. Attributes	
Current Condition		< 60%		Bundle #1
Alternate Condition - 1		> 60% < 95%		Bundle #2
Alternate Condition - 2		> 95%		Bundle #3

- Attributes across bundles are NOT independent
- Need science (⟺) to describe dependence of attributes in a bundle

Biodiversity Metrics – Regional Scale



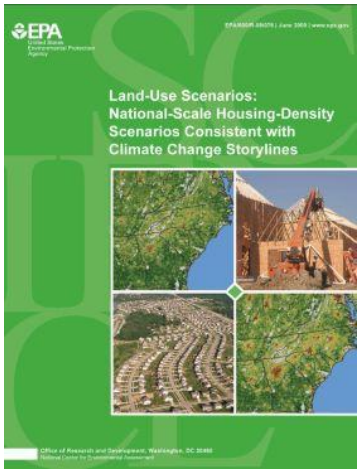
Habitat is used as a surrogate measure of biodiversity, an important societal value. Species richness can be an important indicator of ecosystem condition and it's ability to sustain numerous ecosystem services.

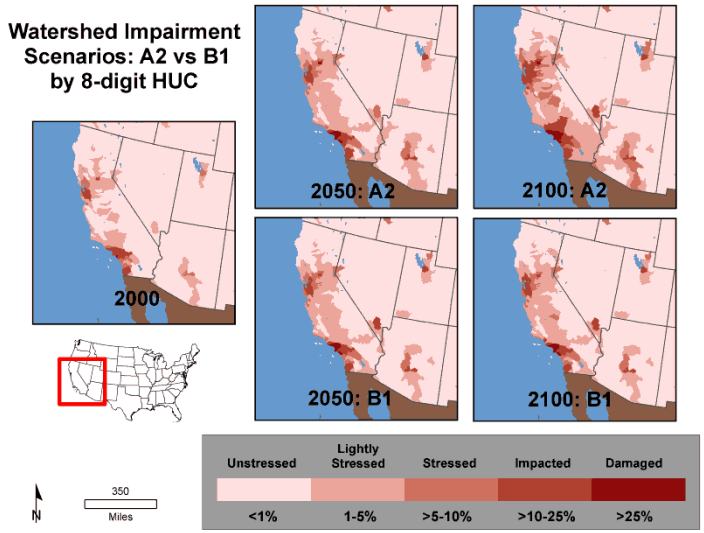
Relating land cover/use to habitat as a measure of biodiversity permits the evaluation of alternative future scenarios.

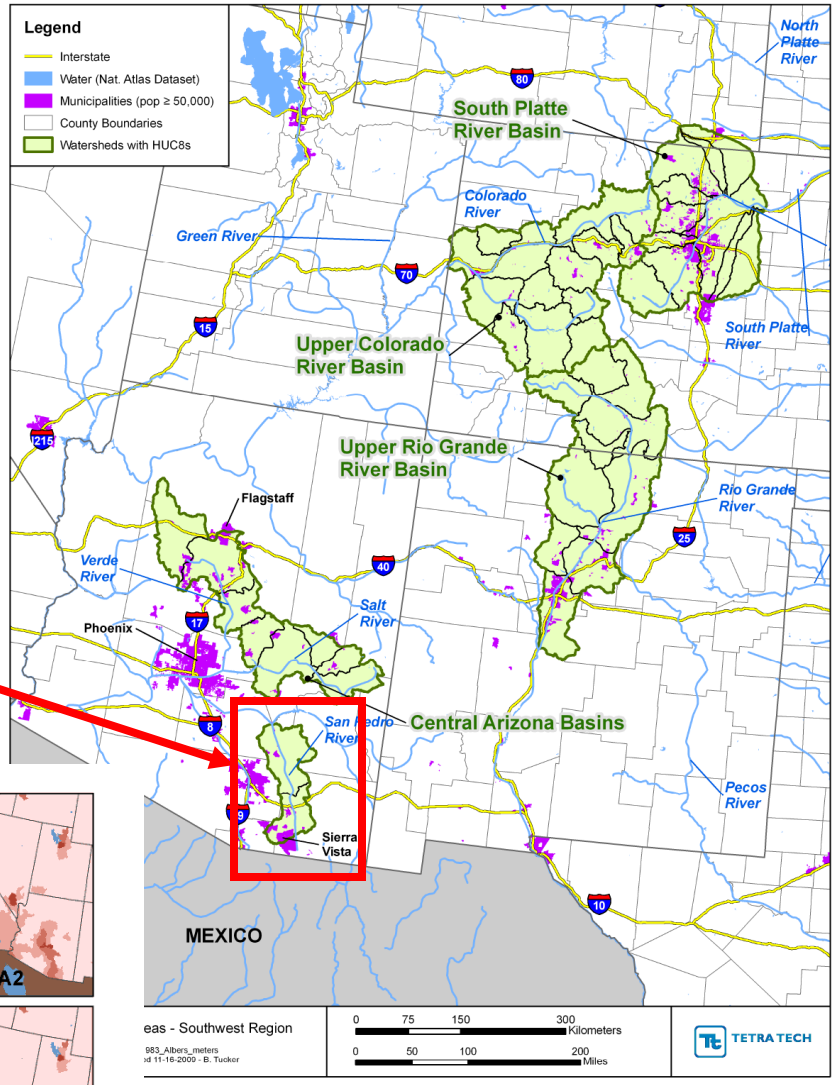
Basin Scale - Development of Climate, Land-Use, and Hydrology Scenarios

EPA ORD/NCEA

Global Change Research Program







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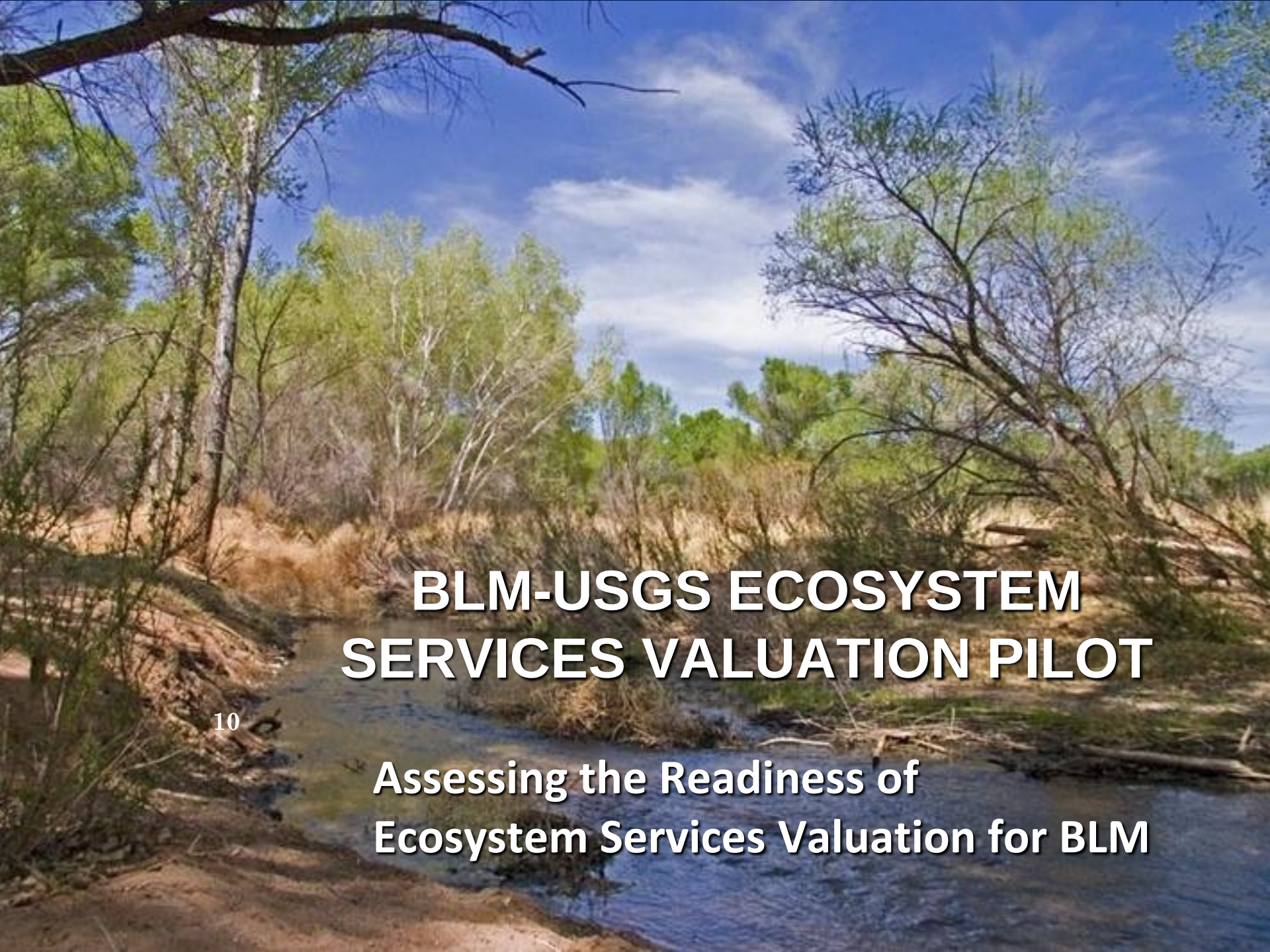
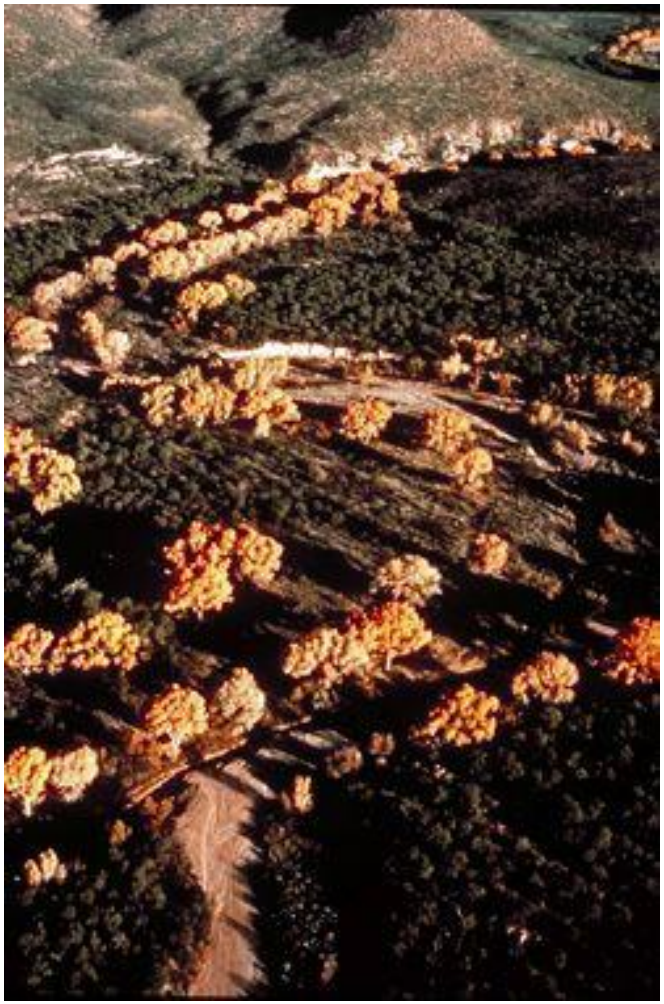


BLM-USGS ECOSYSTEM SERVICES VALUATION PILOT

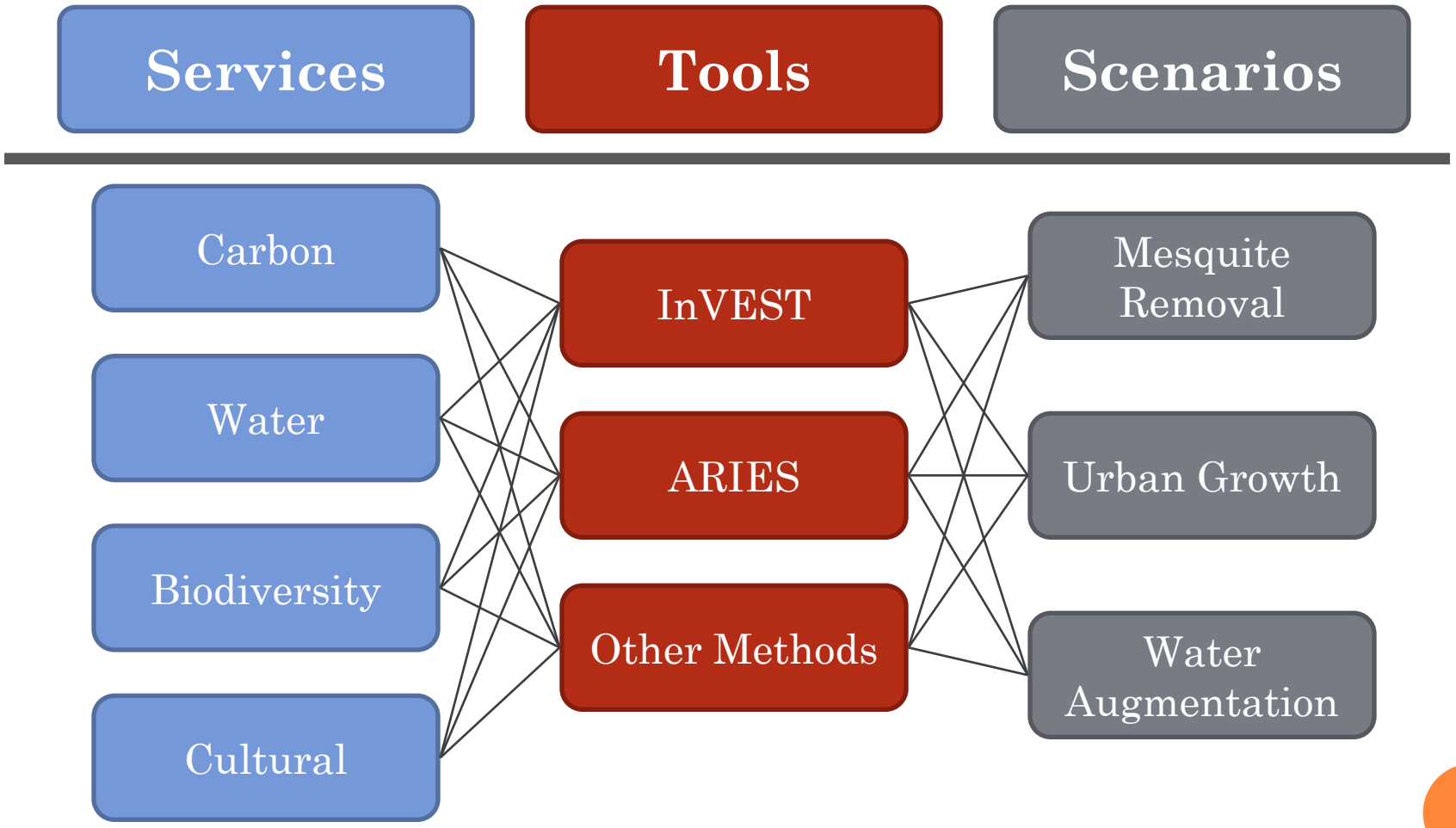
Assessing the Readiness of Ecosystem Services Valuation for BLM

Project Goals

- Determine usefulness of ecosystem service valuation for the BLM
- Determine the feasibility of valuation tools and methods given BLM's capabilities
- Provide relevant information for plans and projects in the Gila District

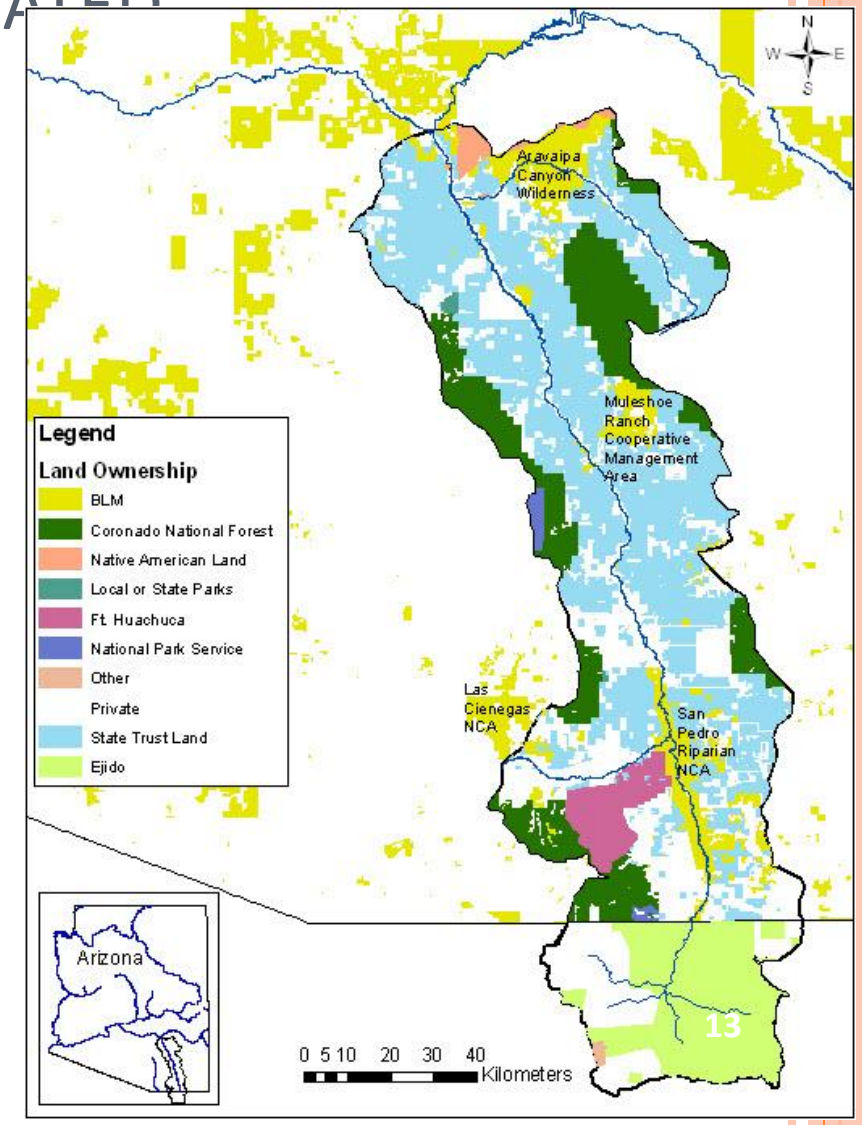


Project Design



Ecosystem Services Evaluated

- Water
  - Ground water for drinking and irrigation
  - Surface water for recreation and aesthetics
- Biodiversity
  - Biodiversity for birding
  - Biodiversity for hunting
- Carbon sequestration and storage
- Cultural services
  - Recreation
  - Aesthetic



Criteria for Evaluating tools/methods

1. Does it measure ecosystem services or ecological processes?
2. Time requirements?
3. Open source: requirements for hiring consultants vs. using trained staff internally?
4. Current level of development?
5. Scalability & generalizability?
6. Ability to incorporate multiple cultural & valuation perspectives (i.e., monetary & nonmonetary, Native American/tribal values)?
7. Responsiveness to scenarios of possible change

RESULTS: ARIES & INVEST MODELS

InVEST

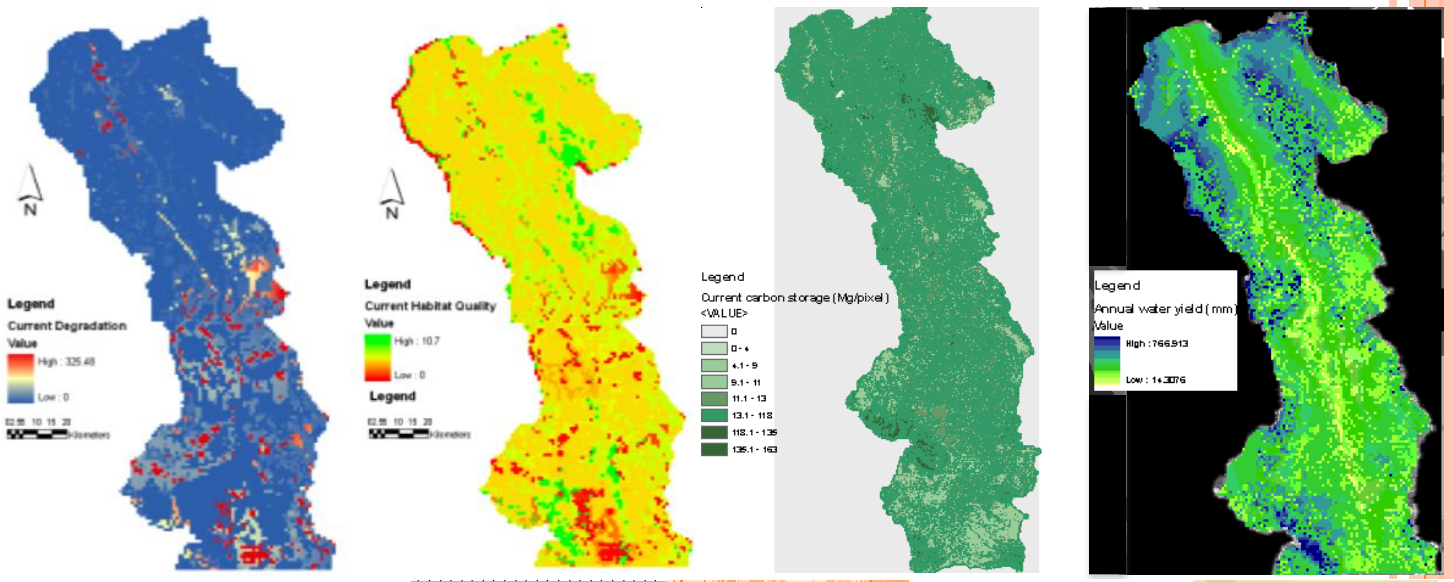
- Carbon storage (tons)
- Combined surface and groundwater
- Biodiversity
- No uncertainty measure

ARIES

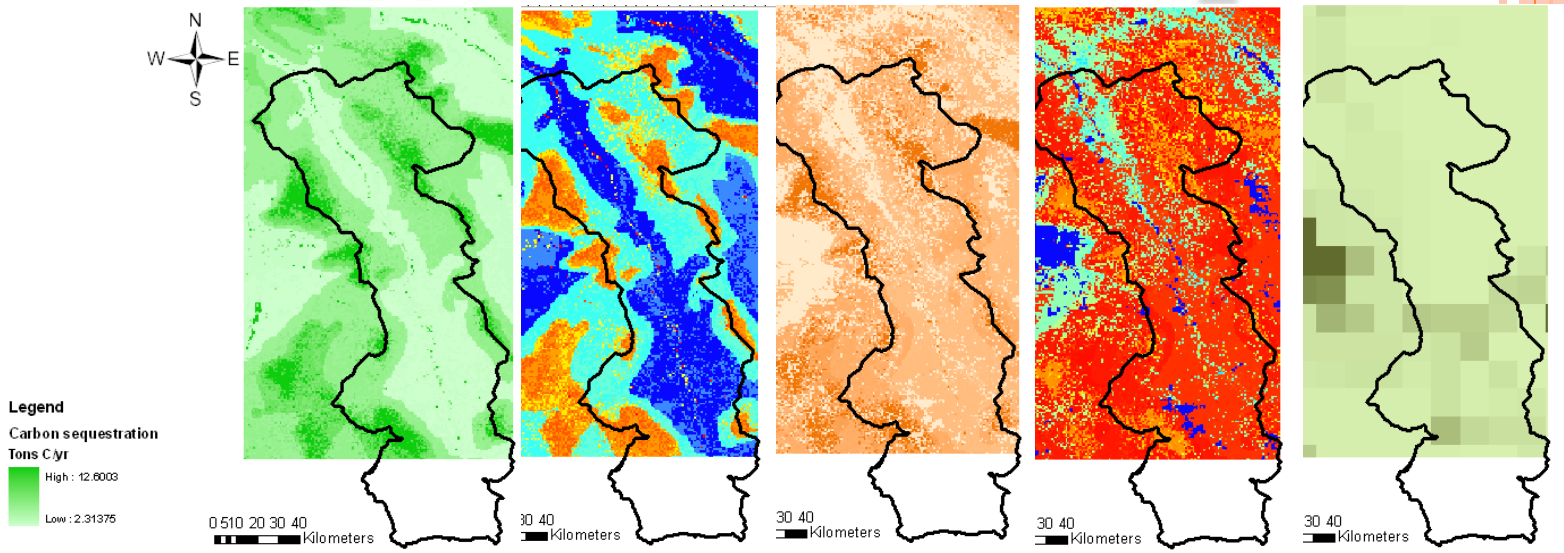
- Carbon storage ($)
- Surface water only
- No biodiversity model
- Includes uncertainty measures

RESULTS: ARIES & INVEST MODELS

InVEST
- Biodiversity
- Carbon
- Water yield results



ARIES
- Carbon results, incl. uncertainty maps



Key variable: Time requirements vs. added information

Method/ Tool	Est. hours, pilot study	Est. hours with high-quality data	Relative amt. of information provided	Comments
Synthesis of past primary valuation	60	20	Moderate	Time needed for review and synthesis of the literature; could be greater in areas where more studies have been completed (for example, Pacific Northwest).
Value transfer	10	10	Low	Estimate for the Wildlife Habitat Benefits Estimation Toolkit. Time requirements would be substantially greater to build new transfer functions, particularly if using a Bayesian approach.
Ecosystem Services Review	10	10	Low	Can be completed quite quickly but does not provide quantitative results; time to completion could be several times greater if a large number of stakeholders are involved.
InVEST (3 ecosystem services	250	40	High	Time to complete could be drastically reduced with system for sharing data and underlying model assumptions.
ARIES (4 ecosystem services)	800	40	Highest	Included time to customize and extensively debug models, which will not be necessary for future applications. Spatial data management system reduces data input needs in future applications.

No tool performs perfectly against all 7 evaluative criteria; suggests a time and place for different tools.

BLM-WIDE OUTCOMES

Feasible for immediate agency-wide use	• Ecosystem Services Review, Wildlife Habitat Benefits Estimation Toolkit
Feasible for agency-wide use given development of supporting databases	• Primary Valuation, Point Transfer, Function Transfer, InVEST
Feasible for agency-wide use given pending development of global models or expanded underlying datasets	• ARIES, EcoServ, SolVES
Proprietary tools, feasible for use in high-profile cases where contracting with consultants is possible	• EcoAIM, EcoMetrix, ESValue, NAIS
Place-specific tools that require extensive developer support	• Ecosystem Portfolio Model, Envision, MEASURES, MIMES