

# Estimating ecosystem service benefits from a western US Wilderness area

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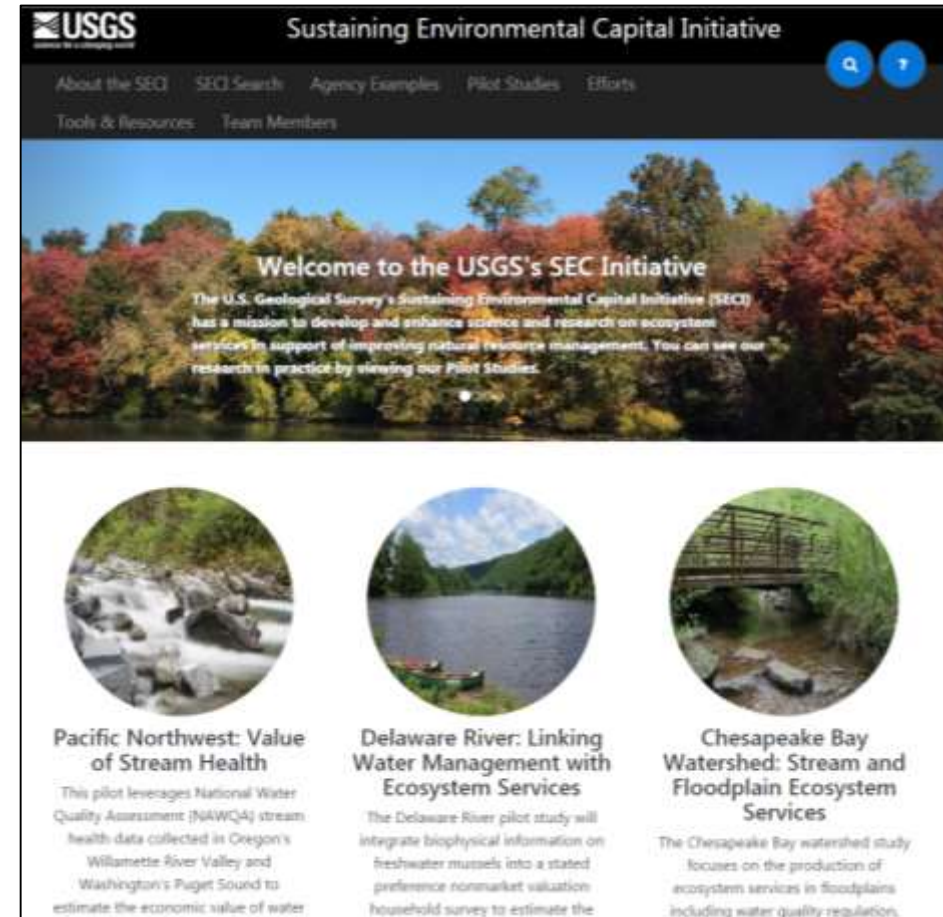
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# Sustaining Environmental Capital Initiative (SECI)

- USGS-led effort
  - To develop and enhance ecosystem service science in support of improving natural resource management
  - Leveraging USGS data, programs, and expertise for federal ecosystem services priorities
- Series of pilot studies



# National Wilderness Preservation System (NWPS) in America

## WILDERNESS ACT

Public Law 88-577 (16 U.S.C. 1131-1136)  
88<sup>th</sup> Congress, Second Session  
September 3, 1964

### AN ACT

To establish a National Wilderness Preservation System for the permanent good of the whole people, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled.

### Short Title

**Section 1.** This Act may be cited as the "Wilderness Act."

### WILDERNESS SYSTEM ESTABLISHED STATEMENT OF POLICY

**Section 2.(a)** In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness. For this purpose there is hereby established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as "wilderness areas", and these shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness; and no Federal lands shall be designated as "wilderness areas" except as provided for in this Act or by a subsequent Act.

**(b)** The inclusion of an area in the National Wilderness Preservation System notwithstanding, the area shall continue to be managed by the Department and agency having jurisdiction

## Wilderness areas

“for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness.”

Provides for:

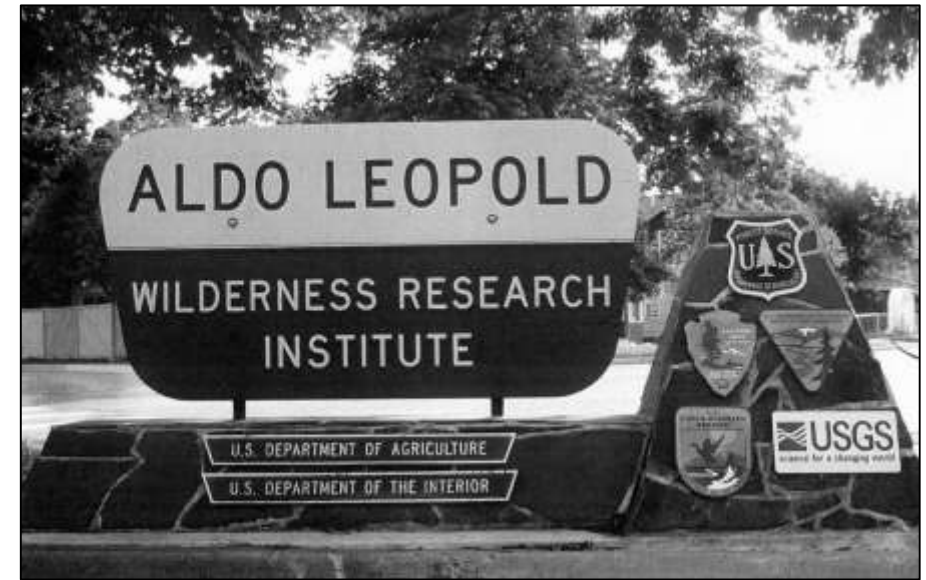
- protection of these areas
- preservation of their wilderness character
- gathering and dissemination of information regarding their use and enjoyment as wilderness

# 2020 Vision for the NWPS

## 2020 Vision

*Draft Implementation Plan*

**DRAFT** interagency actions for stewardship of America's National Wilderness Preservation System



## Report on the Values and Benefits of Wilderness in the United States

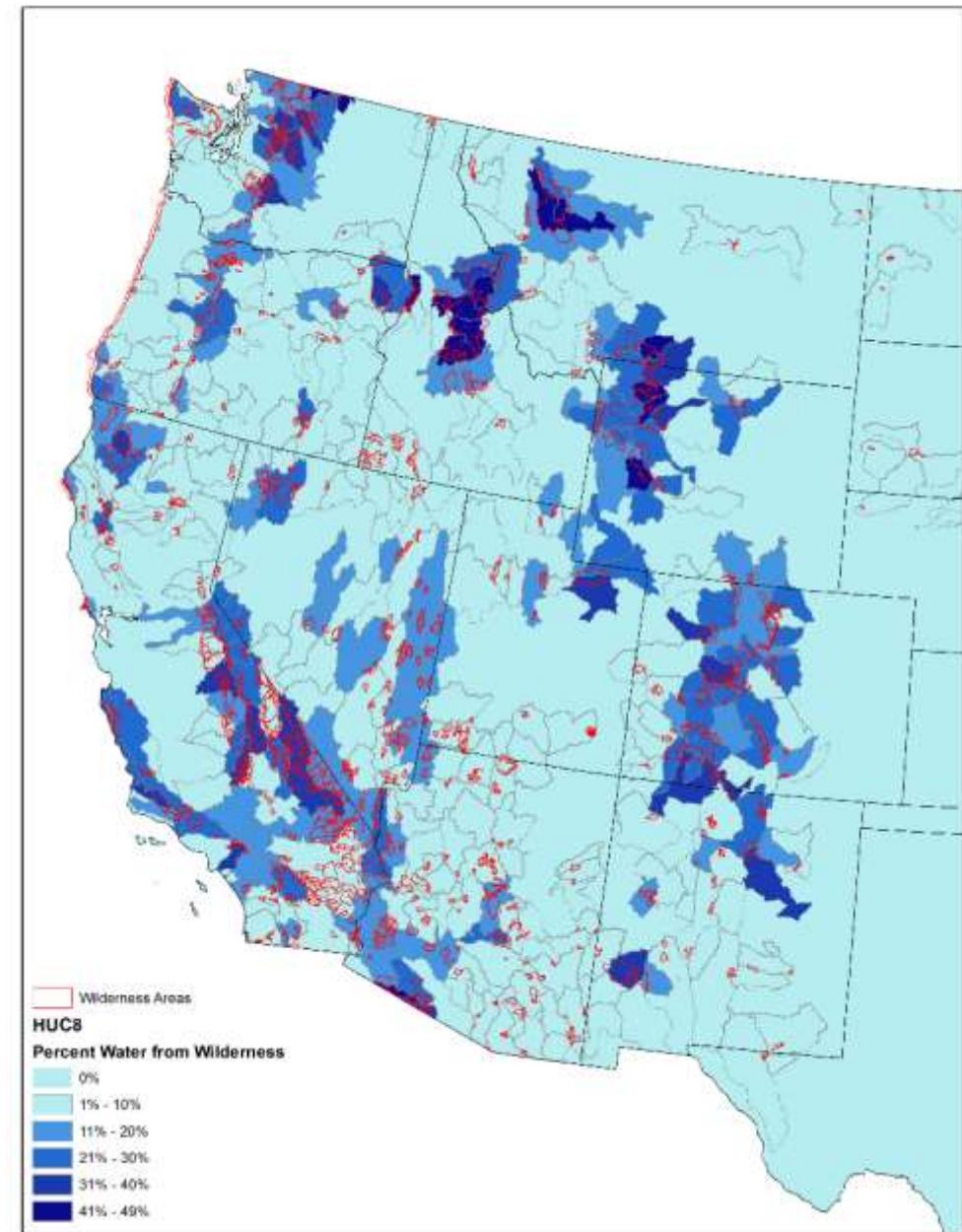
- What are economic/social values and benefits of Wilderness?
- How will a changing society find relevance in Wilderness?

# Chapter 6: Water Resources

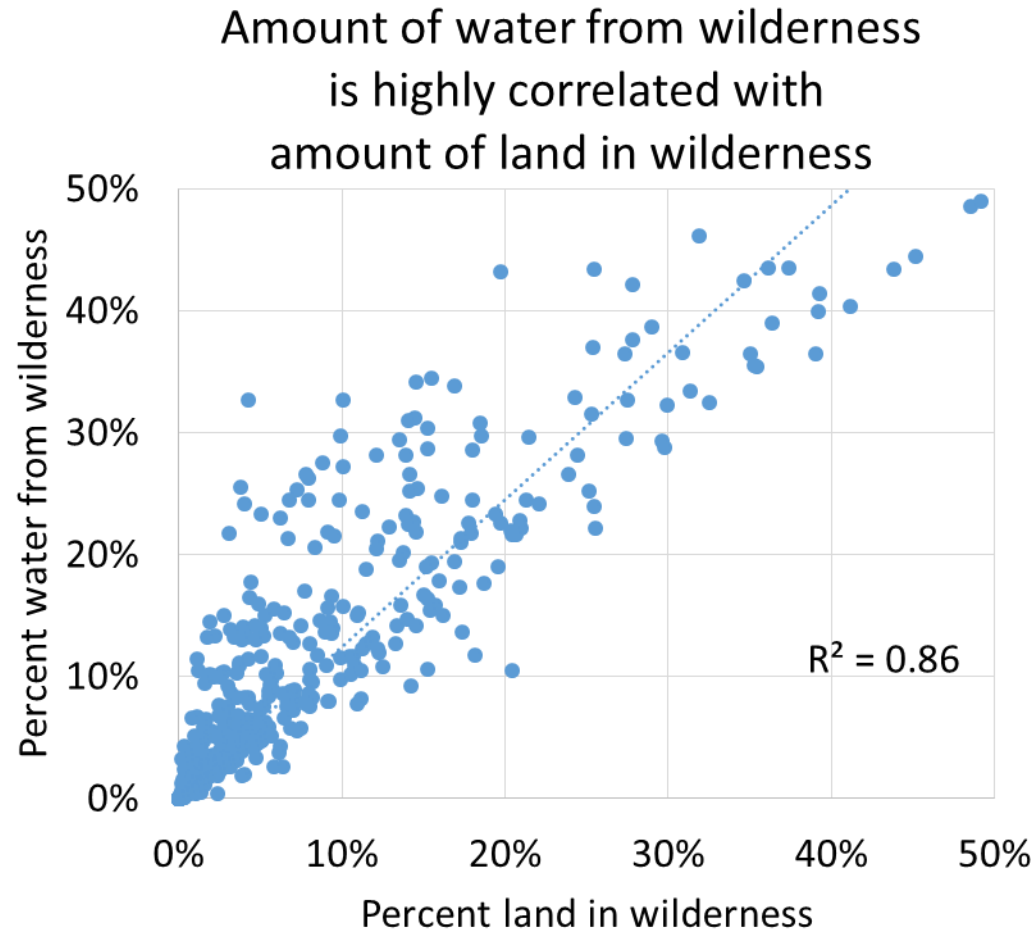
Importance of wilderness to  
water-related ecosystem services?

Wilderness in western US:

- 29% of water supply
- 20% of lands



# Interpreting ‘water from wilderness’



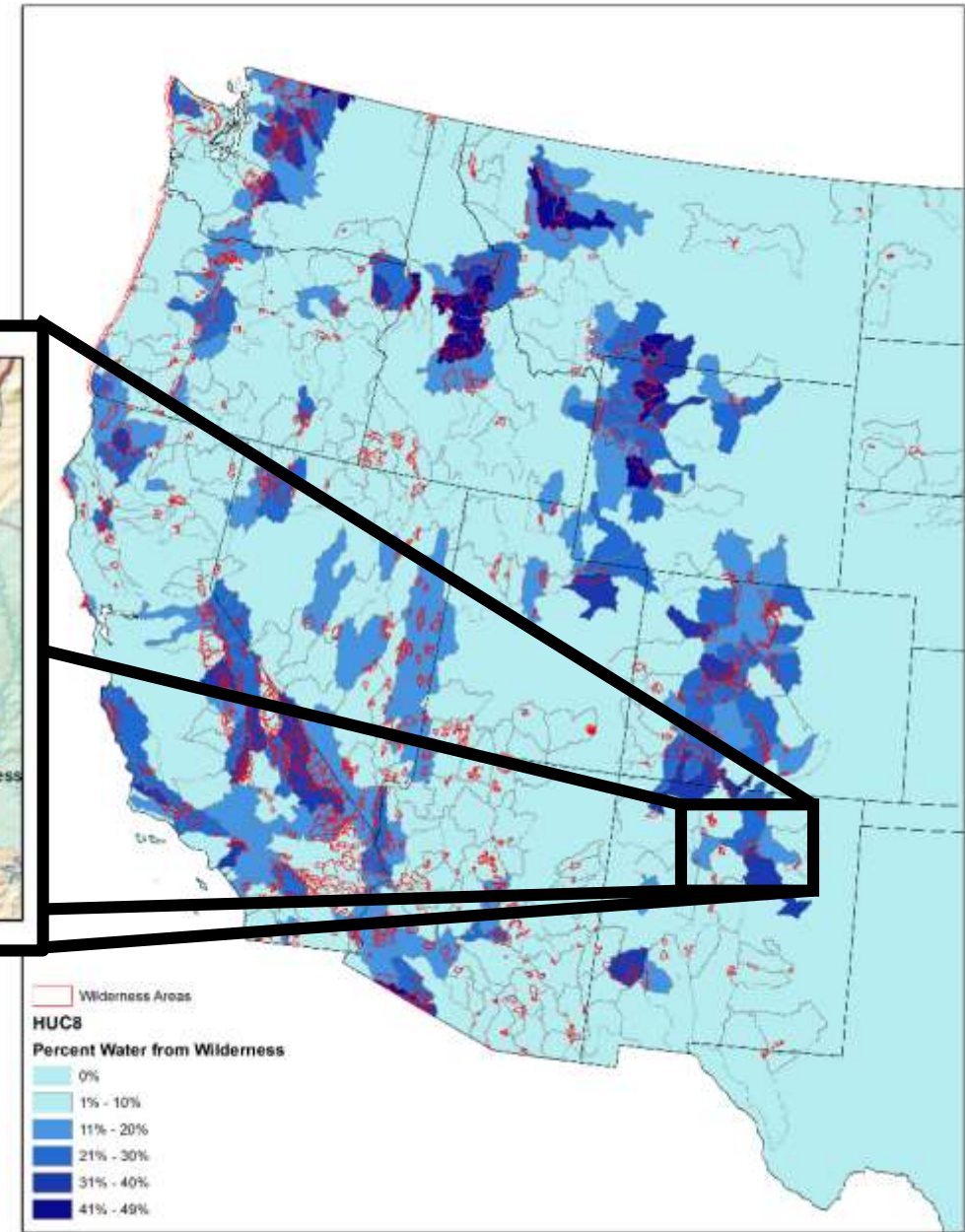
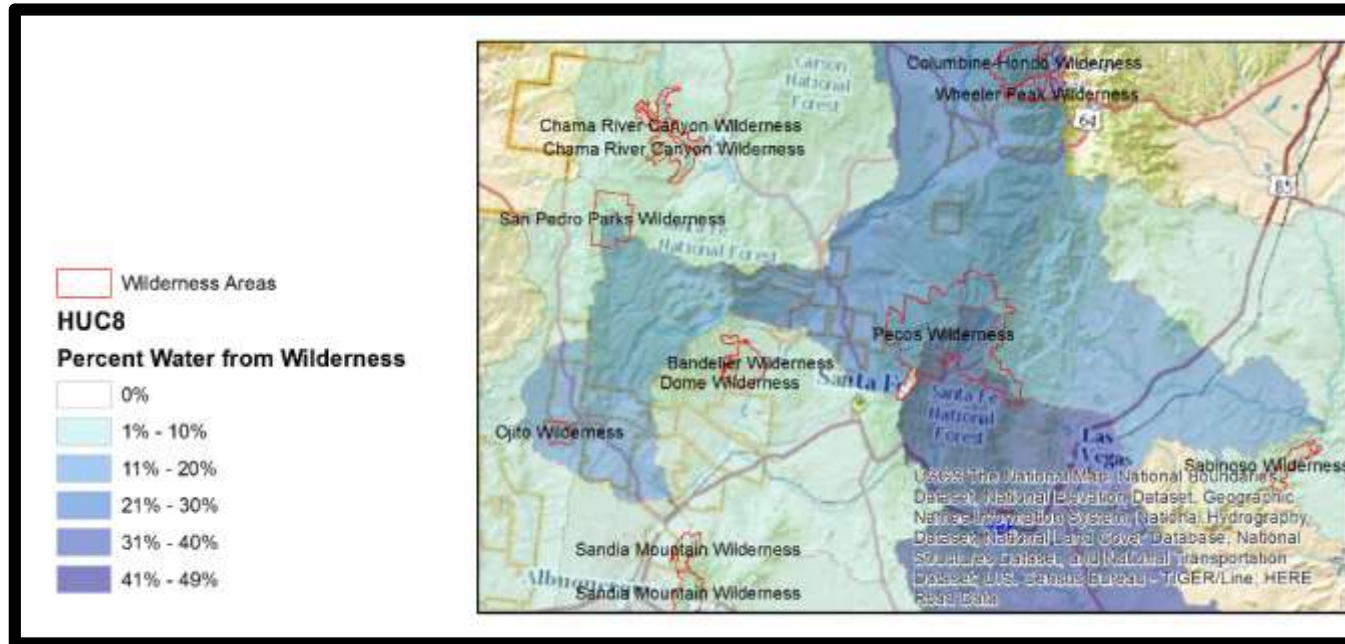
What does “water from wilderness” tell us?

Does wilderness add to the value of water?

- What is the value of water in and from the wilderness?
- What’s the counterfactual?

Motivates case study approach

# Identifying a case study



# Key local concerns

Water availability and restoring ecological processes – fire and hydrologic cycles – under a changing climate





# Existing, landscape-scale efforts

- Santa Fe Watershed
- Rio Grande Water Fund
- Collaborative Forest Landscape Restoration Projects
- East Jemez Landscape Futures
- Santa Fe Fireshed
- Wilderness additions



# Goal: link numerous efforts

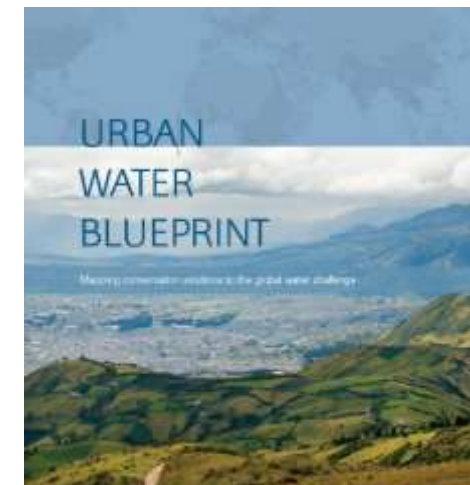
- WEWG: benefits of water from wilderness
- SECI: develop and apply ES science to improve natural resource management
- Local landscape-scale forest restoration, conservation, and adaptation efforts
- Contribute information on ES values and benefits of public lands (including wilderness)
- Two main efforts:
  - Nonmarket valuation of forest restoration
  - Synthesis of cultural and economic valuations

# Santa Fe poll supports forest restoration


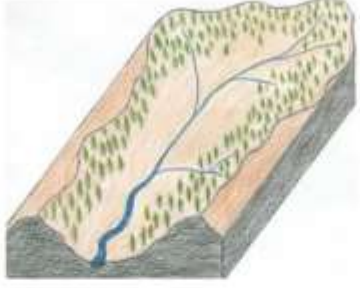



- 82% of ratepayers willing to pay \$0.65 per month (\$7.80/year) for prescribed burns in Santa Fe Watershed
  - (including portion of Pecos Wilderness)
- actual average costs: \$0.54 per month

Establishes public support, but didn't estimate nonmarket benefits of restoration



# Insight from contingent valuation (CV) in Flagstaff, AZ

Current Watershed Condition	Restored Watershed Condition	Watershed Condition Following Wildfire
		
<ul style="list-style-type: none"> <li>• Limited water yield</li> <li>• Reduced groundwater recharge</li> <li>• Reduced water quality</li> <li>• High risk of catastrophic wildfire</li> <li>• Present day flows</li> <li>• Low flood risk in unburned areas</li> </ul>	<ul style="list-style-type: none"> <li>• Enhanced water yield</li> <li>• Enhanced groundwater recharge</li> <li>• Enhanced water quality</li> <li>• Reduced risk of catastrophic wildfire</li> <li>• Improved spring snowmelt flows</li> <li>• Reduced flood risk</li> </ul>	<ul style="list-style-type: none"> <li>• Irregular water yield</li> <li>• Restricted groundwater recharge</li> <li>• Highly reduced water quality</li> <li>• Increased sedimentation</li> <li>• Potential loss of Lake Mary as a water source</li> <li>• Potential of unprecedented flood events in Flagstaff</li> </ul>

Mean annual willingness to pay for restoration of 2.4 million acre watershed

- \$59 per hh for residential users
- \$184 per hh for irrigators

Plan: Develop new choice experiment expanding this study to include focus on wilderness and cultural values

Mueller (2013). Estimating the value of watershed services following forest restoration. *Water Resources Research* (49): 1-9.

Mueller (2014). Estimating willingness to pay for watershed restoration in Flagstaff, AZ using dichotomous choice CV. *Forestry* (87): 327-333.

# Join existing efforts to catalog and organize cultural values for ES

**TABLE 4** | Possible Existence of Cultural Ecosystem Services Provided by Acequia Landscapes in the Upper Rio Grande Bioregion

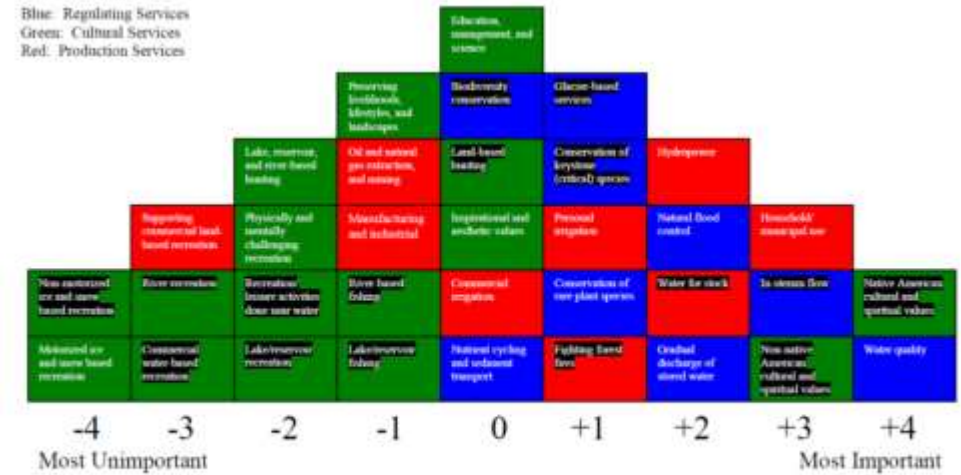
Cultural	Sierra	Monte	Dehesa	Solar	Acequia	Altito	Jolla	Vega	Ciénega	Bosque	Río
Cultural diversity				A							
Spiritual and religious values		(cs9)		(cs1,3,4,5,6,7,8,9,11)	(cs1,2,3,10)					(cs10)	(cs1,11)
Knowledge systems		(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)
Educational values		(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)
Inspiration	A	A	A	A	A	A	A	A	A	A	A
Esthetic values		(ca2,3)	(ca2,3)	(ca1,2,3)	(ca1,2,3)	(ca2,3)	(ca2,3)	(ca2,3)	(ca2,3)	(ca2,3)	(ca2,3)
Recreation and ecotourism	(cr1,2,4,7)	(cr1,2,3)	(cr1,4)	(cr1,8)	(cr1,3,8)	(cr1)	(cr1)	(cr1)	(cr1)	(cr1,2,6)	(cr1,3,5)
Culturally important species <sup>1</sup>	A	A	A	A	A	A	A	A	A	A	A

If the cell is unmarked, no values were designated for that cell. If marked with an A, values are not divided further. If notated other than A, please read explanations as follows: **spiritual and religious** (cs): cs1—Matachines, cs2—La Llorona, cs3—feast days, cs4—Penitentes, cs5—Moradas, cs6—Christmas services, cs7—Easter/Semana Santa, cs8—fiestas, cs9—Bultos/Santos, cs10—blessing of the waters; **knowledge systems** (ck): ck1—indigenous agricultural knowledge, ck2—flexible resource management, ck3—transmissible knowledge; **educational values** (ce): ce1—ecosystem science, ce2—experiential learning; **esthetic values** (ca): ca1—social relations, ca2—querencia, ca3—place based environmental ethic, ca4—cultural heritage values; **recreational values** (cr): cr1—birdwatching, cr2—hunting, cr3—fishing, cr4—running/biking, cr5—rafting, cr6—horseback riding, cr7—rock climbing, cr8—cultural tourism.

<sup>1</sup>Culturally important species; yet to be determined.

*Raheem et al. (2015). A framework for assessing ecosystem services in acequia irrigation communities of the Upper Rio Grande watershed. WIREs Water. doi: 10.1002/wat2.1091*

**The Native American Viewpoint**



Note: Those statements highlighted in black are statistically distinguishable

Native American viewpoint explains 10 percent of study variance and is defined by 8 participants. All 8 are enrolled members in the Crow, Eastern Shoshone or Northern Arapaho Tribe. 7 participants work for tribal governments in natural resource management or municipal water.

*Armatas et al. (2014). Applying Q-methodology to select and define attributes for non-market valuation... Ecological Economics 107, 447-456.*

Synthesize multiple other efforts to catalog and organize cultural values

# Wrap-up

## **Linking numerous efforts**

- WEWG: benefits of water from wilderness
- SECI: develop and apply ES science to improve natural resource management
- Local landscape-scale forest restoration, conservation, and adaptation efforts

## **Questions**

- How do shared boundaries, existing efforts, affect approach?
- How do we pull together efforts on social and economic values?
- Deeper conceptual questions:  
restoration -> resilience -> adaptation
  - What does “adapting ecosystems to changing climate” mean for ES benefits?
  - Can we “inject ES values” into adaptation conversation? Use them as targets?