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Integrating Ecosystem Services and Biodiversity Conservation

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framing questions

How do human economies impact ecosystem functioning?

How do human economies benefit from ecosystem functioning?

Who, where, and from what functions?

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millennium ecosystem assessment: main findings

- Humans have radically altered ecosystems in last 50 years
- Changes have brought gains but degradation of ecosystems is a barrier to achieving the MDGs
- Degradation can be reversed but requires new solutions- policies, institutions and practices.

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what's needed next?

"…landscape level quantification of economic values of entire bundles of ecosystem services under alternative management regimes"

- MA follow-up priorities (in Carpenter et al. Science 2006)

- Scales relevant to policy
- Spatially-explicit
- Integrated and interdisciplinary decisions
  - Ecology, economics, and policy

The Natural Capital Project: a new approach

Project Goals:

- Make conservation mainstream and economically attractive
- Incorporate multiple ecosystem services into natural resource decisions
- Change the way ecosystems are utilized by integrating environmental systems, economic benefits and human well-being
- Provide information, examples and tools to make that easy

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InVEST – Integrated Valuation of Ecosystem Services and Tradeoffs

- InVEST
  - Modular- analyze services independently or together
  - Tiered- Data, complexity, scale
  - Biophysical and Economic terms
  - Ultimately, decision support for policy decisions and management at regional scales

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InVEST: process flow

Stakeholder Engagement

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Scenarios

Change in Management, Climate, Population

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Biophysical Models → Maps, Tradeoff curves

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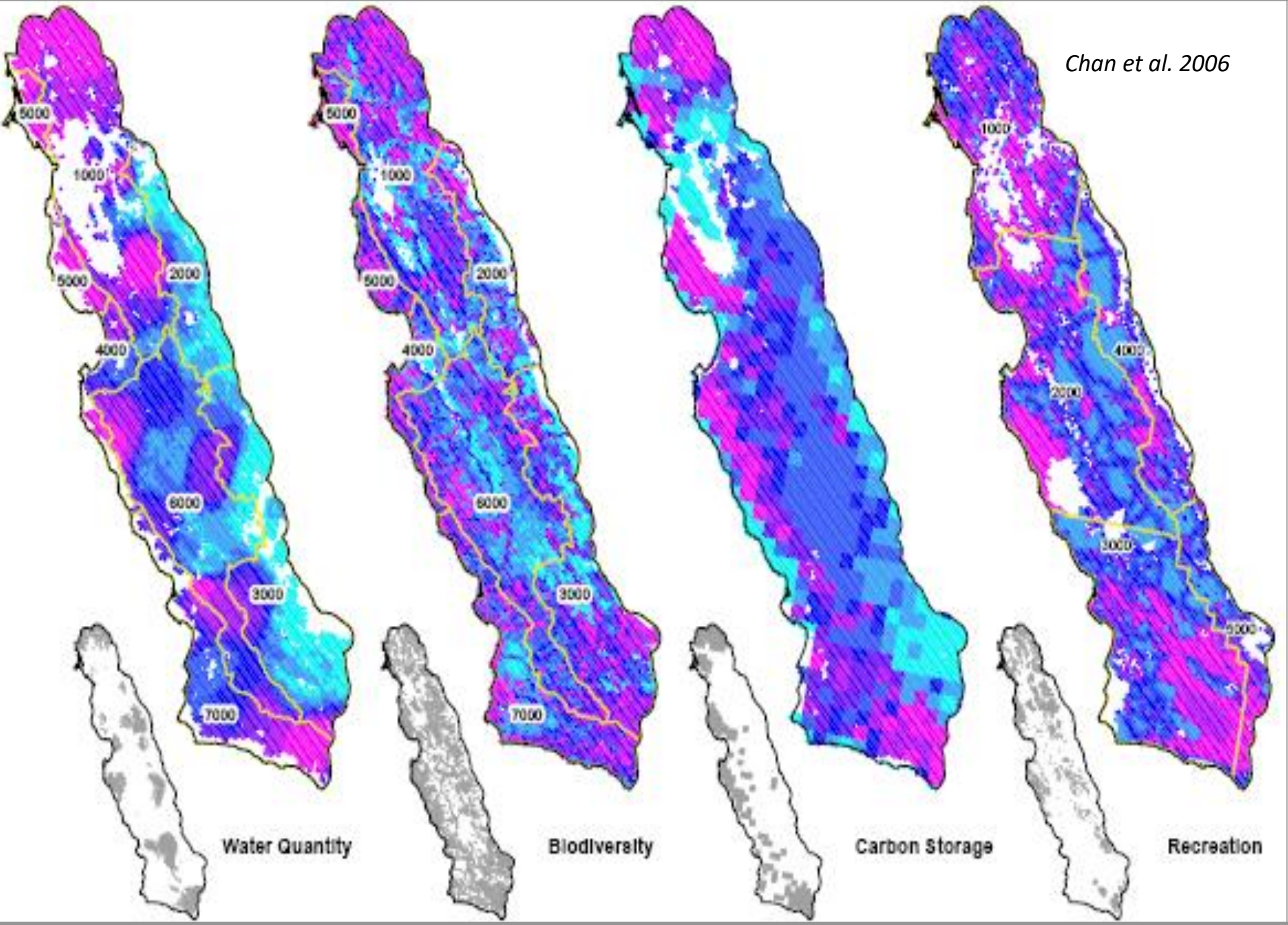
Economic Models → Balance sheets

Maps, Tradeoff curves, Balance sheets → Stakeholder Engagement


Chan et al. 2006
Water Quantity
Biodiversity
Carbon Storage
Recreation

Sierra Nevada site: Primary objectives

1. Map and value the Sierra Nevada's natural capital (what is there, who is benefiting from it, and what is it worth?)

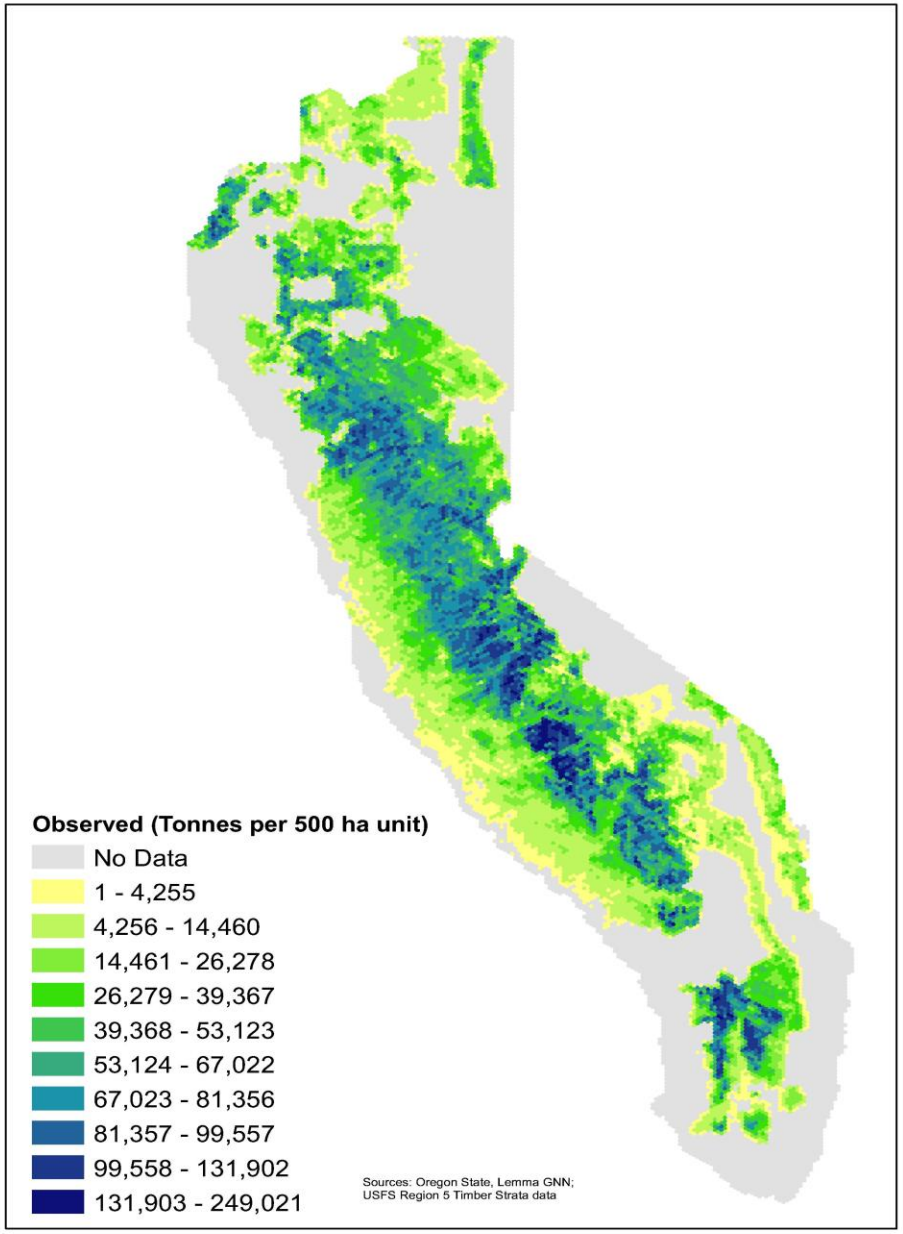
- Understand policy and market options at broad scales
- Characterize the flows of services at regional scale
- Develop applied, local demonstration project

Carbon Storage

How much carbon is currently being held in the forest? What is the carbon sequestration potential?

Method 1: "Fake Age" Estimated biomass based on stand size class for forest cover based on USFS (Smith et al. 2005) estimates for other pools (standing dead wood, understory, dead and down wood, forest floor, soil) (data: USFS Calveg using WHR classification)

Method 2: "Observed" based on stand survey and interpolation and same estimates for other pools (data: USFS R5 Strata Grid, LEMMA program Oregon State Univ.)



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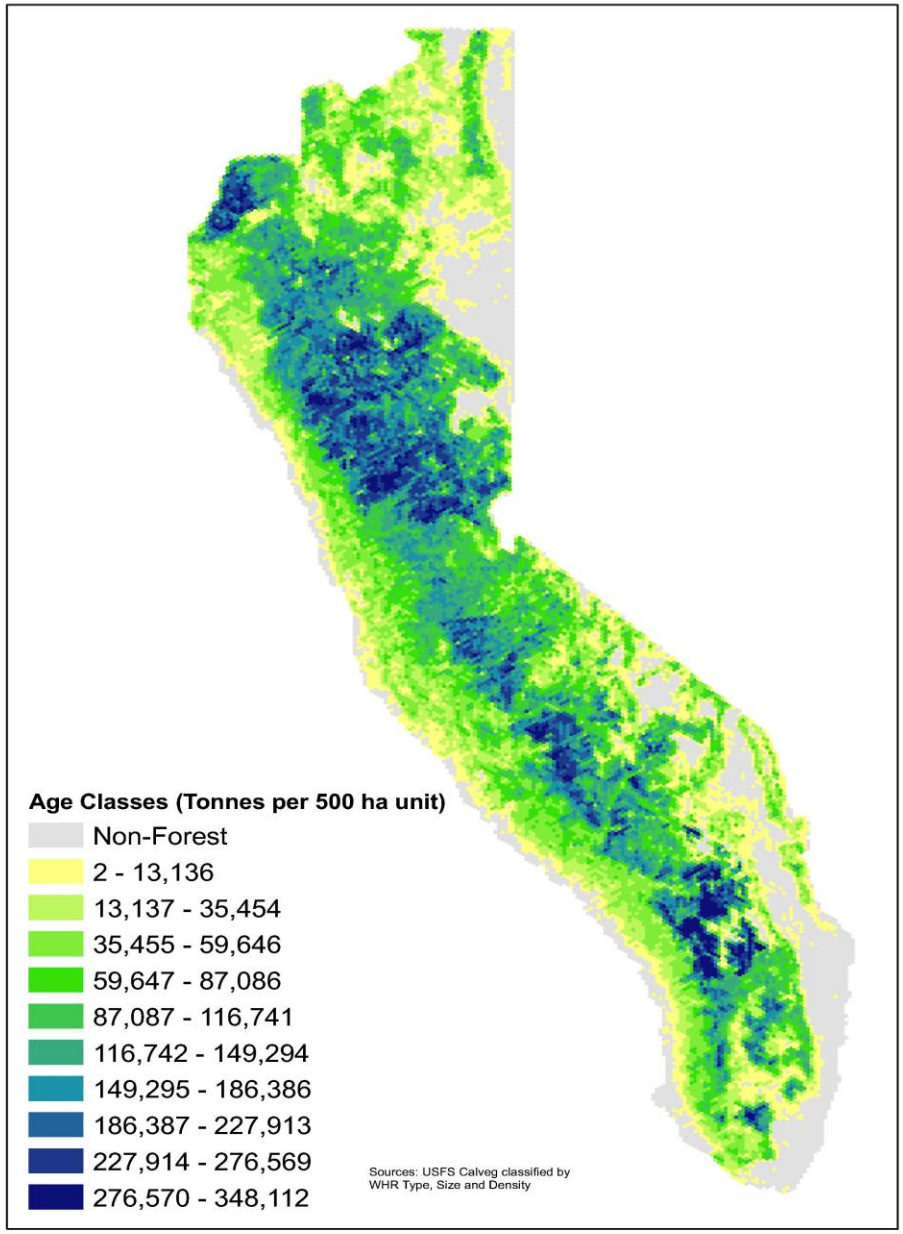


Current Carbon Storage DRAFT Tier 2: Estimated Forest Carbon and Associated Pools

Sierra Nevada Demonstration Site

Water Yield

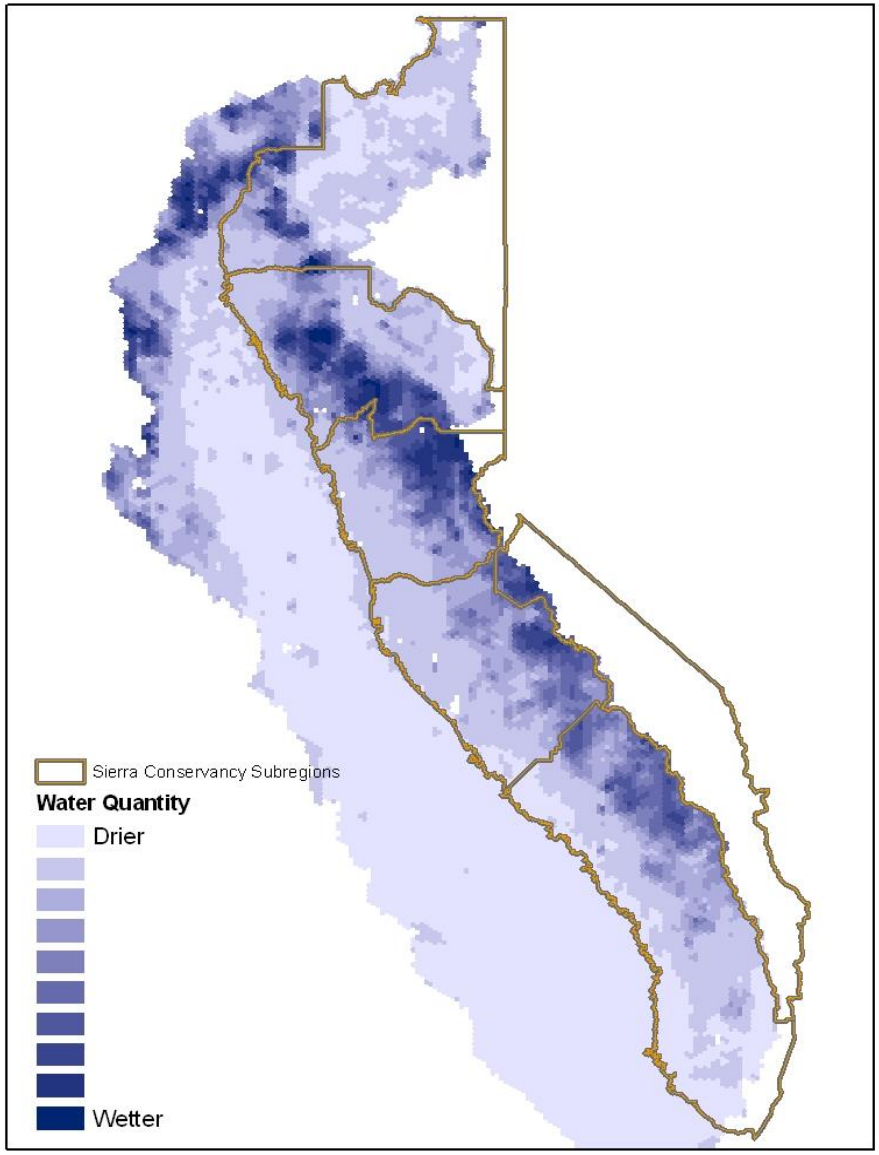
Accounting for ecosystem processes , how much water will be available as runoff or recharge for groundwater?

(data: PRISM data for precipitation, monthly temperature, Root depth and LAI look-up tables- various sources, STATSGO soil depth and available water content)

Water Quality

What areas will saturate first and potentially contribute to degraded water quality?

(data: USGS National elevation dataset- derived slope and drainage area, STATSGO soil depth)



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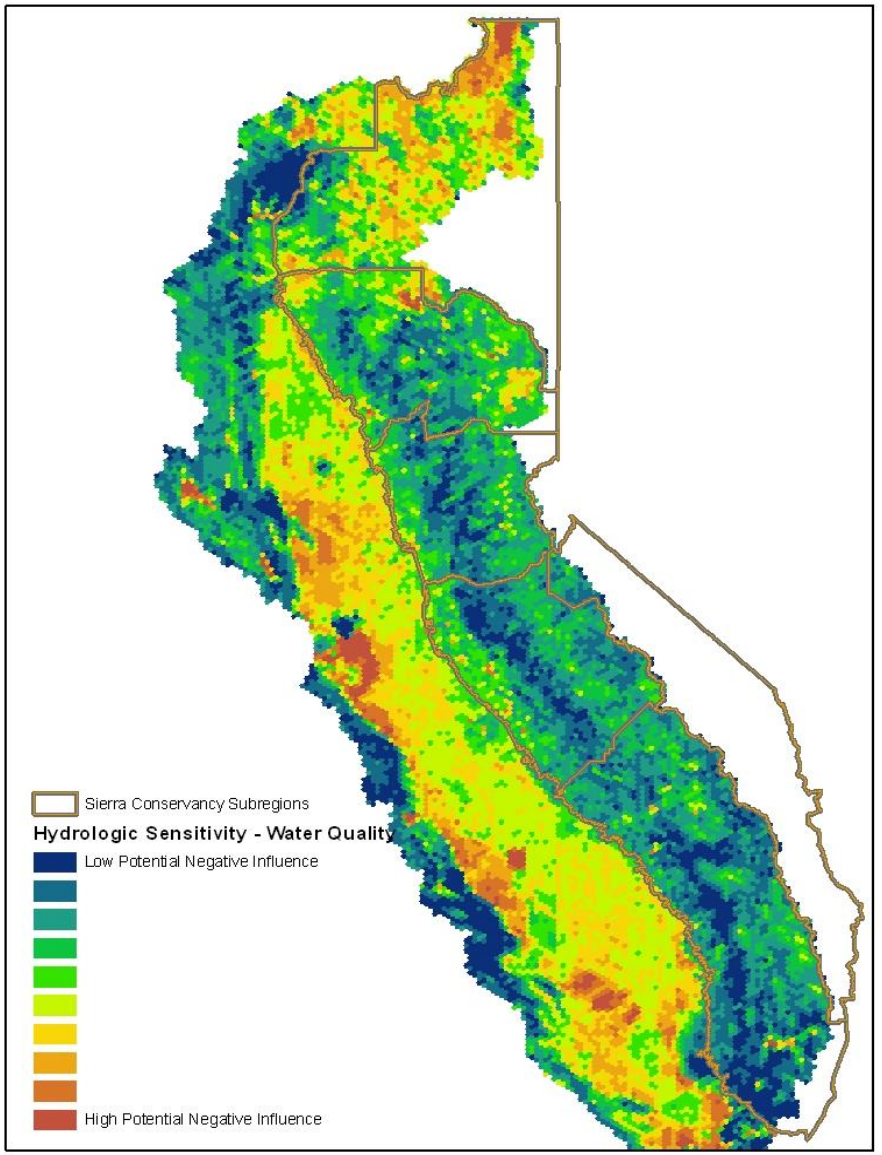


Water Quantity and Hydrologic Sensitivity : DRAFT

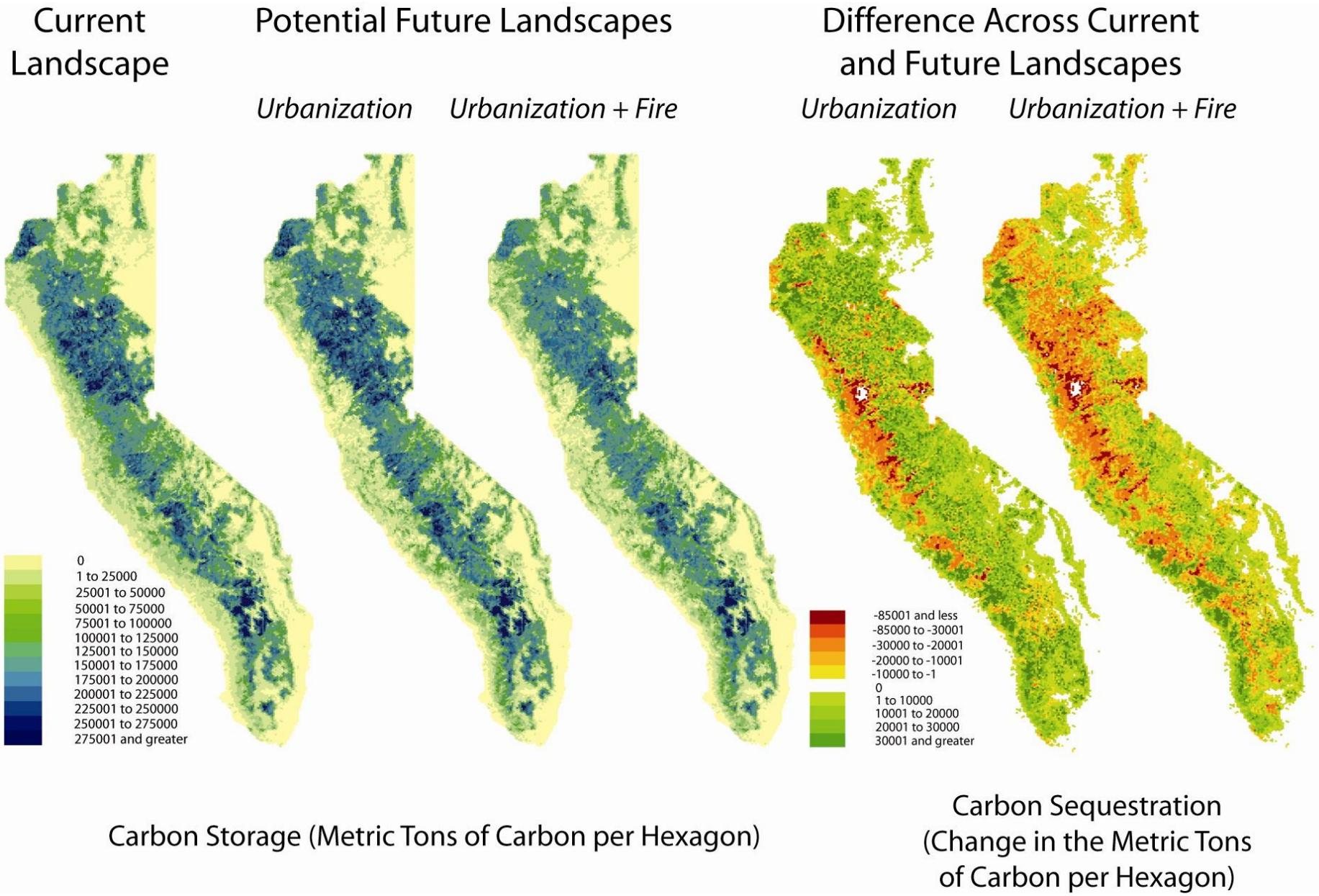
Sierra Nevada Demonstration Site

Are there opportunities to "bundle" services? Do certain areas meet goals for multiple services?

Correlation coefficients (r) of biophysical production

	Carbon Storage	Water Quality	Rarity	Intactness	Water Quantity
Carbon Storage	1.00				
Water Quality	0.29	1.00			
Rarity	-0.09	0.13	1.00		
Intactness	0.64	0.25	-0.23	1.00	
Water Quantity	0.38	0.20	-0.07	0.40	1.00

Legend
-0.25 - 0
0 - .1
-0.1 - 0.2
.2 -.4
>.4


Current Landscape
Potential Future Landscapes
Urbanization
Urbanization + Fire
Difference Across Current and Future Landscapes
Urbanization
Urbanization + Fire
0
1 to 25000
25001 to 50000
50001 to 75000
75001 to 100000
100001 to 125000
125001 to 150000
150001 to 175000
175001 to 200000
200001 to 225000
225001 to 250000
250001 to 275000
275001 and greater
-85001 and less
-85000 to -30001
-30000 to -20001
-20000 to -10001
-10000 to -1
0
1 to 10000
10001 to 20000
20001 to 30000
30001 and greater
Carbon Storage (Metric Tons of Carbon per Hexagon)
Carbon Sequestration (Change in the Metric Tons of Carbon per Hexagon)