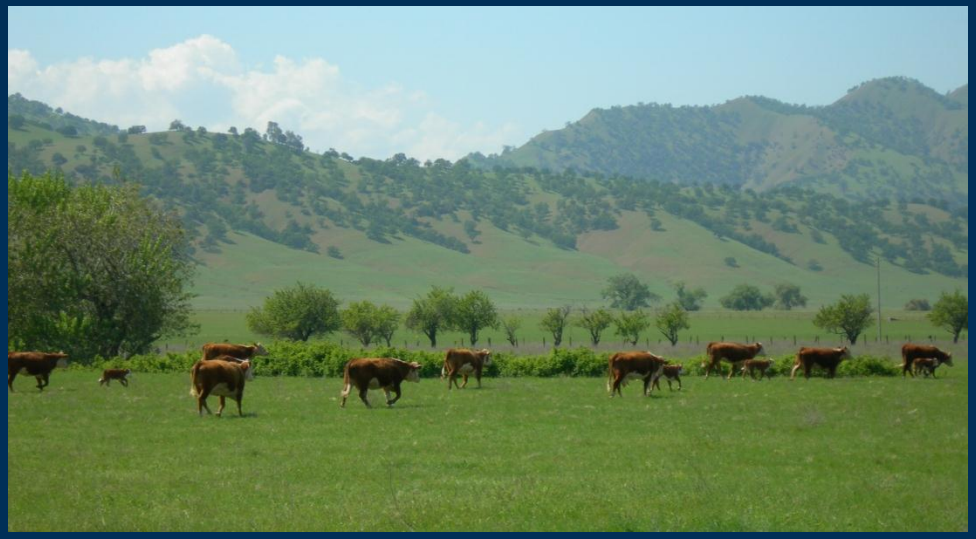
Climate change/land use change scenarios for assessing threats to ecosystem services on California rangelands

Pelayo Alvarez[4] ,Kristin Byrd[1], Chris Soulard[1], Lorraine Flint[2], Frank Casey[3],Ben Sleeter[1] and Terry Sohl[5]



[1]USGS Western Geographic Science Center, Menlo Park, CA,
[2]USGS California Water Science Center, Sacramento, CA ,
[3]USGS Science and Decisions Center, Reston, VA,
[4]Defenders of Wildlife, Sacramento, CA,
[5]USGS EROS Data Center, Sioux Falls, SD.

DEFENDERS OF WILDLIFE

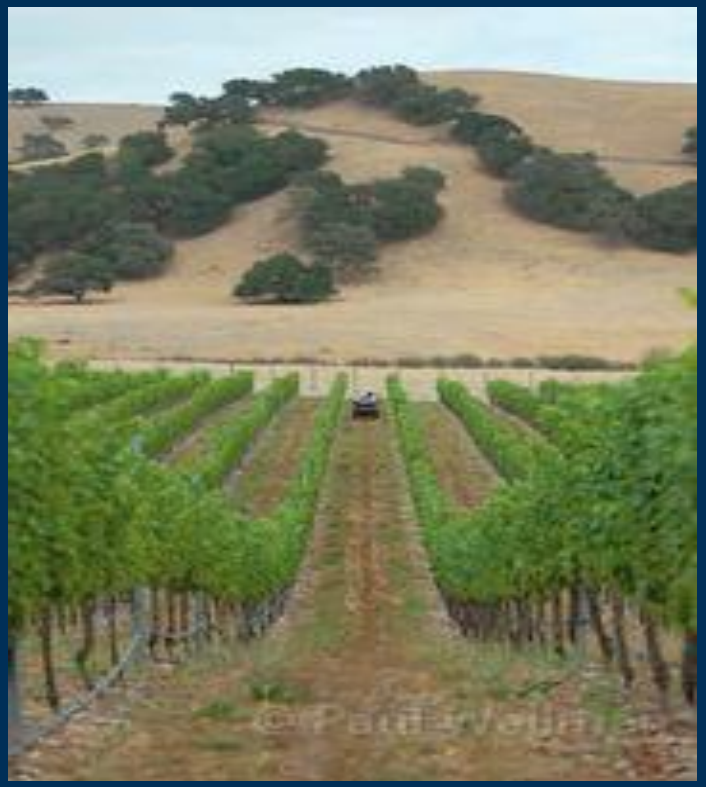
USGS science for a changing world

Ecosystem Services provided by Rangelands

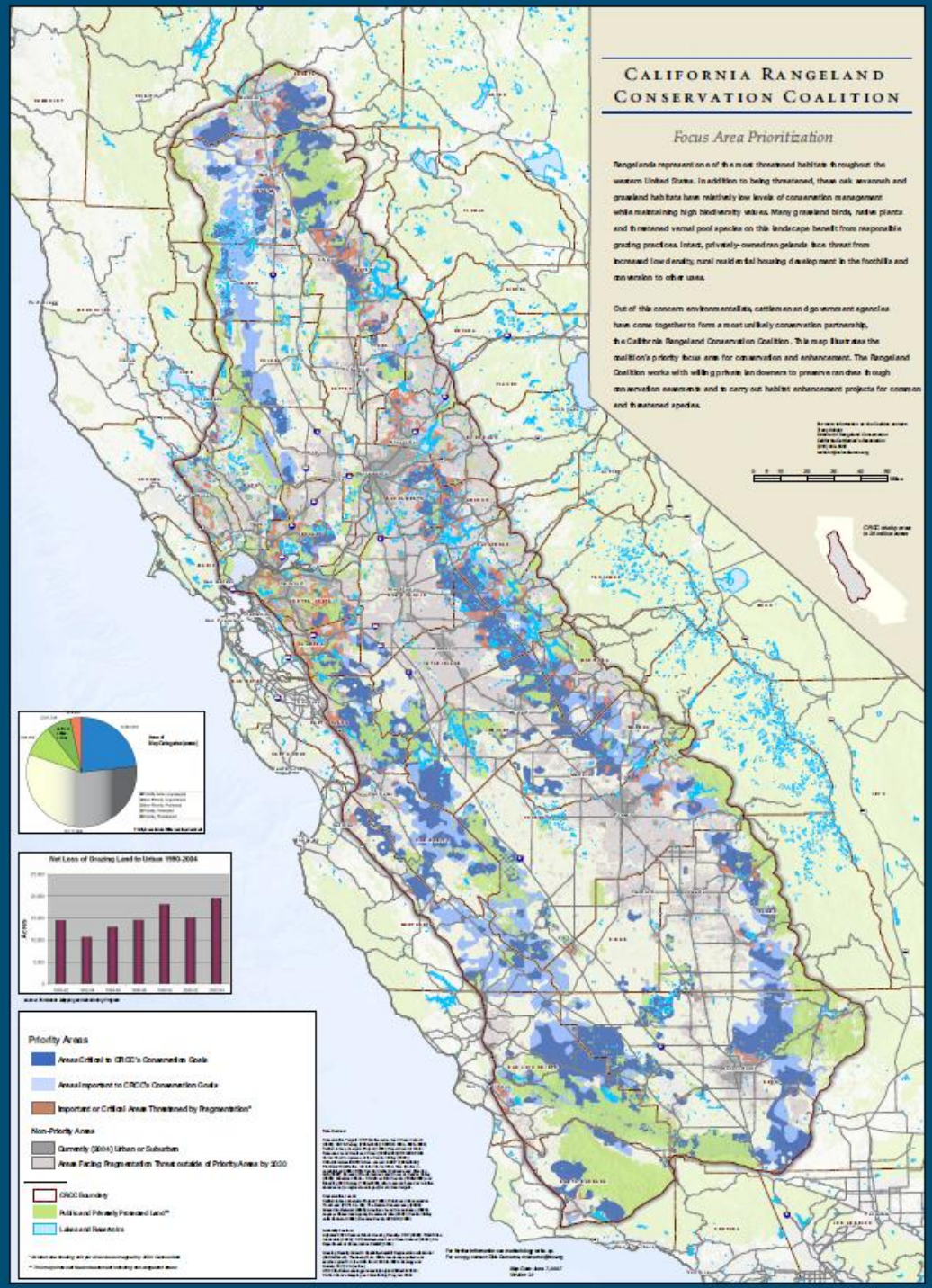
- Food, fiber and fuel
- Wildlife habitat
- Water
- Carbon sequestration
- Adaptation to climate change
- Open space, cultural values

Integrated Threats to Rangelands

- In California 20,000 acres of rangelands are lost every year
- Privately owned
- Cattle ranching: low profits
- Low levels of protection



Land conversion and climate change lead to loss of grazing land, water availability, and altered species distribution



Rangeland Coalition Focus Area Map (TNC, 2007)

http://www.carangeland.org/focusarea.html

Dark blue: Critical Conservation Areas

(Privately-owned rangelands that have high biodiversity value and require conservation action in the next 2-10 years.)

Funded by California Landscape Conservation Cooperative

DEFENDERS OF WILDLIFE

USGS science for a changing world

Project Goals

- Six spatially-explicit climate change/land use change scenarios from years 2000 – 2100 consistent with three IPCC emission scenarios and two climate models –

A2, B1, and A1B and

PCM (warm, wet future), GFDL (hot, dry future)

- Assess potential threats to rangeland ecosystem services
    1. wildlife habitat,
    2. water availability, (runoff/recharge) (Lorraine Flint and Alan Flint, USGS)
    3. carbon sequestration

DEFENDERS OF WILDLIFE

USGS science for a changing world

Project Goals, continued

3. An economic analysis of scenarios to quantify economic costs and benefits and identify where ecosystem services can be optimized (Frank Casey, USGS)

4. A web-based visualization tool for resource managers to view and compare scenarios in a map format, and

5. An outreach program that will target the Rangeland Coalition network to communicate how results can be applied to conservation and land management decisions. (Pelayo Alvarez, Defenders of Wildlife)

DEFENDERS OF WILDLIFE

USGS science for a changing world

Driving Force Assumptions for the United States based on IPCC Emission Scenarios

(table adapted from Ben Sleeter, USGS)

	A1B	A2	B1
DEMOGRAPHICS	Medium growth, sprawl	High growth, sprawl	Medium growth, densification
ECONOMICS	Very High Income	Medium Income	High Income
TECHNOLOGY	Very High rate of innovation	Low rate of innovation	High rate of innovation
ENERGY	Balanced between several sources	Fossil fuel intensive	Rapid diffusion of “green” energy resources
CLIMATE	HOT temperature range: 2.8 °C; 1.7 – 4.4 °C	VERY HOT temperature ange: 3.4 °C; 2.0 – 5.4°C	WARM temperature range: 1.8 °C; 1.1 – 2.9°C
ENVIRONMENTAL PROTECTION	Mixed-use based conservation	Conservation lower priority	Conservation high priority

Scenario Narratives for CA Rangelands

Rancher's Focus Group, January 2012, Davis CA

<u>Key Concerns about ranching future:</u>

- Limited availability of grazing land for lease
- Fragmentation of grazing land
- Forage quality and quantity
- High start-up investment

DEFENDERS OF WILDLIFE

USGS science for a changing world

Scenario Narratives for CA Rangelands

– Alternative conservation plans

A1B	Development – low density Agriculture – high value perennial crops	Conservation – mixed-use emphasis	500,000 acres protected by 2100, near urban centers
A2	Development – low density Agriculture – intensive, less innovation	Conservation – low priority	No active conservation planning
B1	Development – high density Agriculture – moderate	Conservation – biodiversity high priority	1,000,000 acres protected by 2100, in high biodiversity areas

Case Study of Two Watersheds:

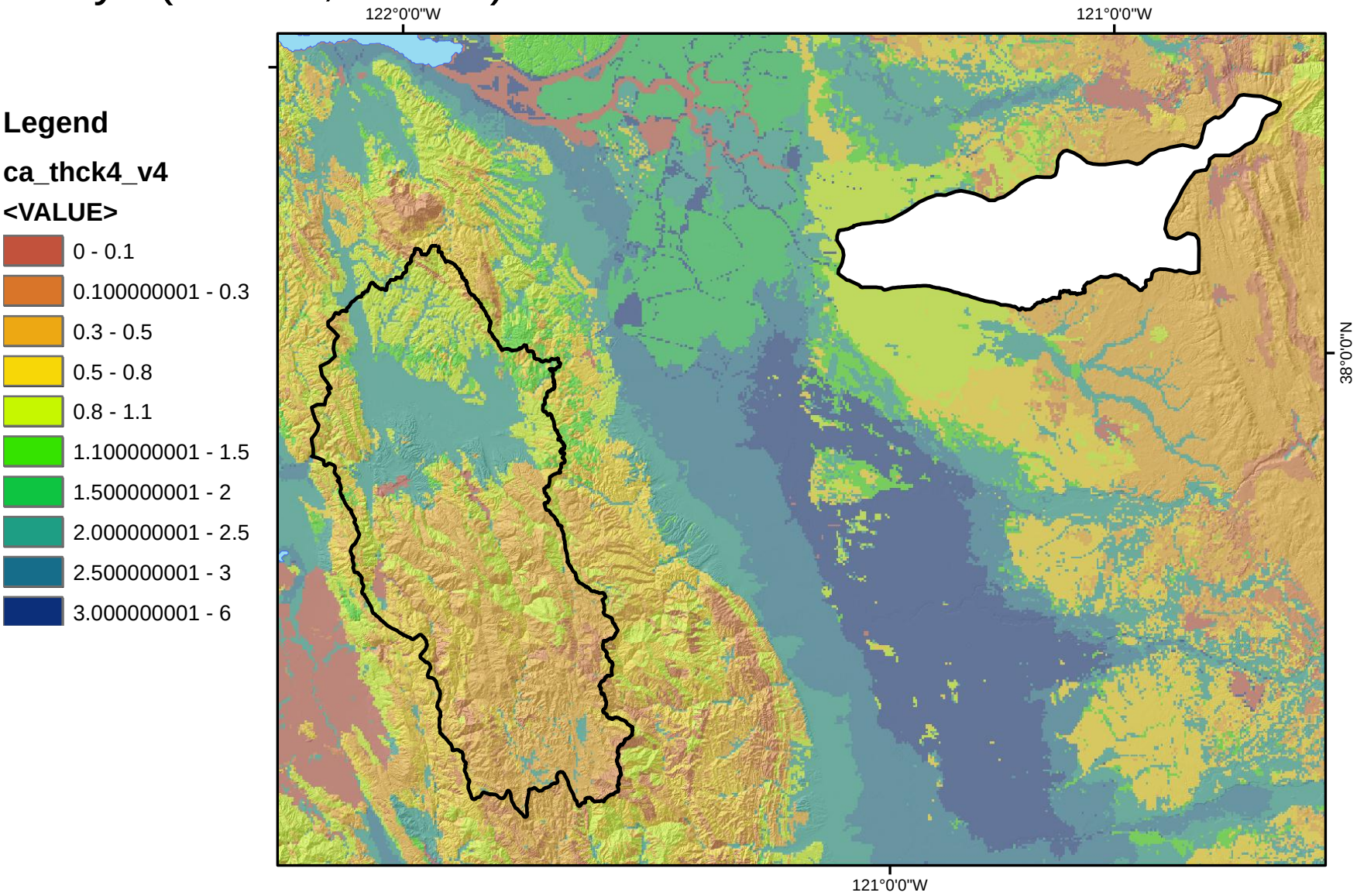
SF Bay-Alameda Creek
Calaveras-Mormon Slough

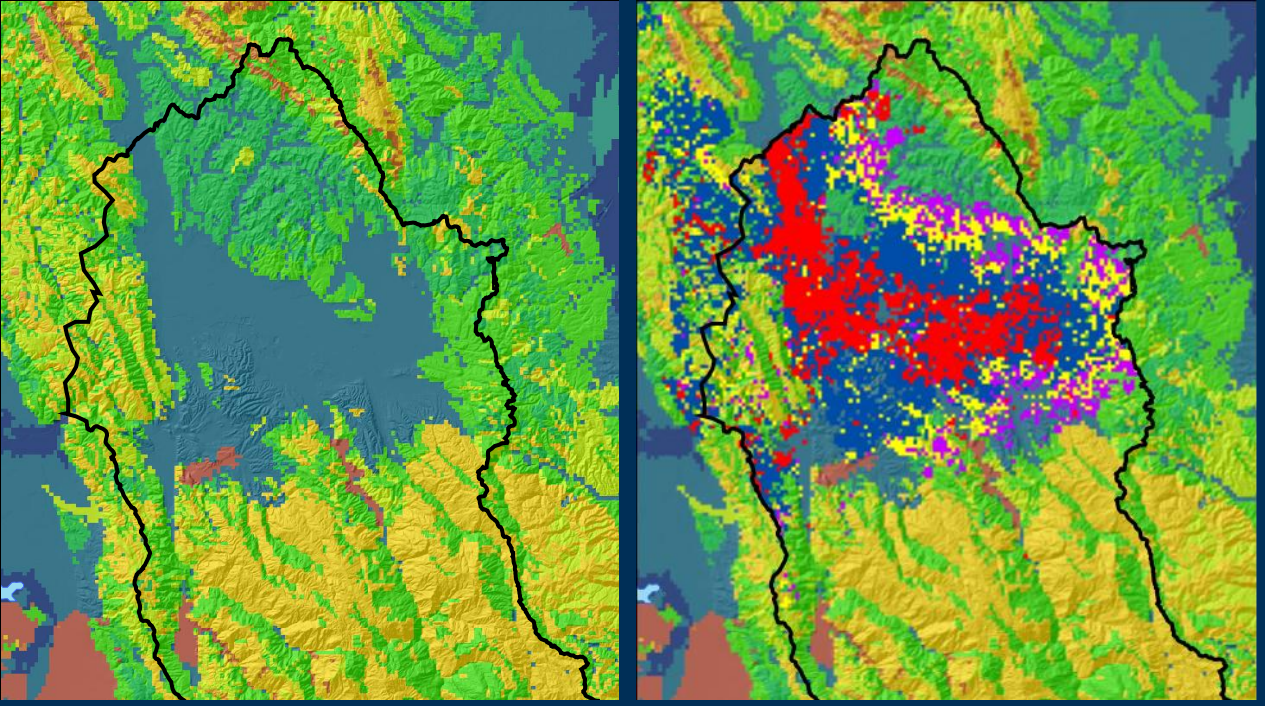
Habitat, Water, and Carbon

DEFENDERS OF WILDLIFE

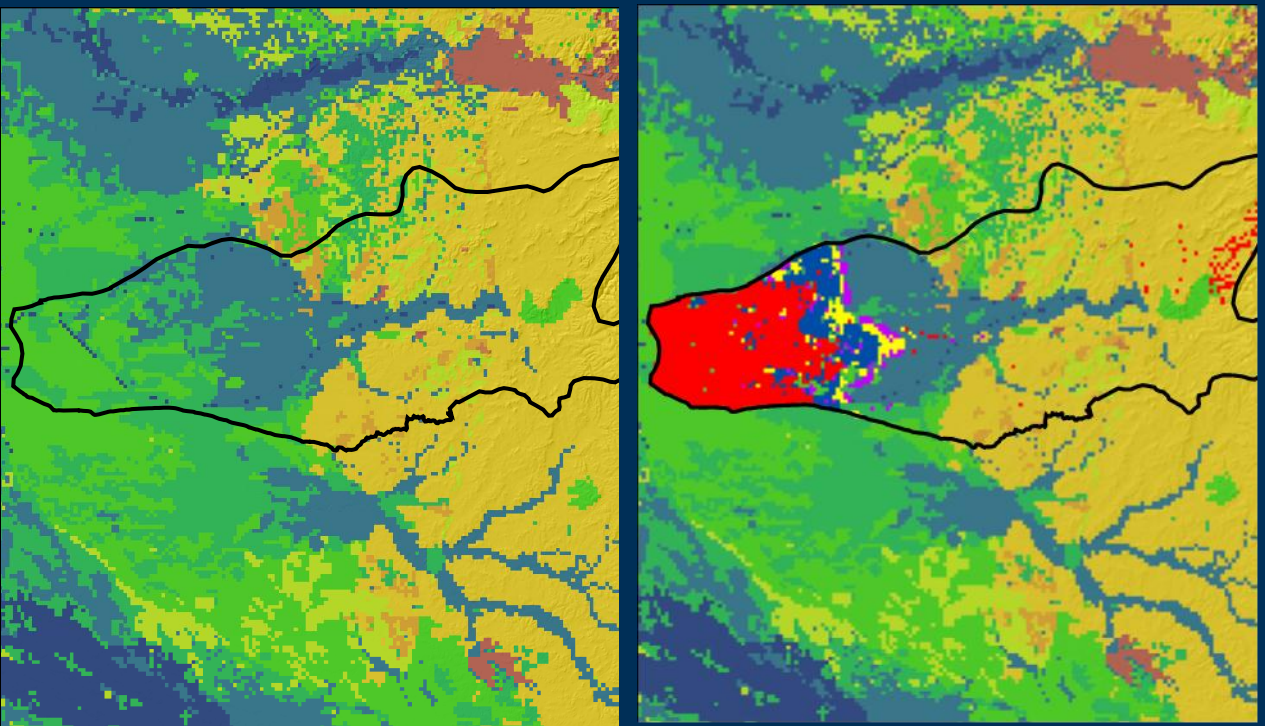
USGS
science for a changing world

Soil water storage affected by porosity and depth – New soil thickness dataset – SSURGO county-level soil surveys (L. Flint, USGS)



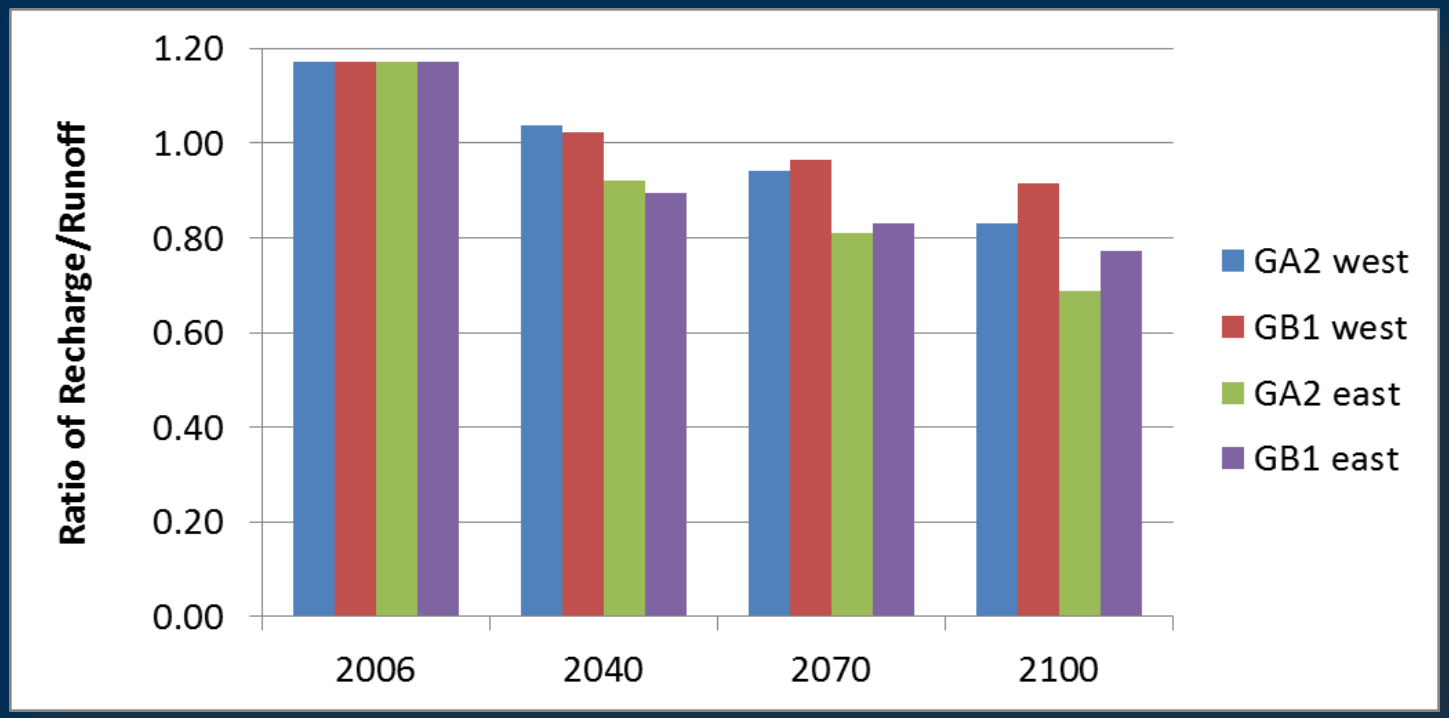


Alameda Creek: Development moves from deep to shallow soils 2006 - 2100



Calaveras: Development moves from shallow to deep soils 2006 - 2100

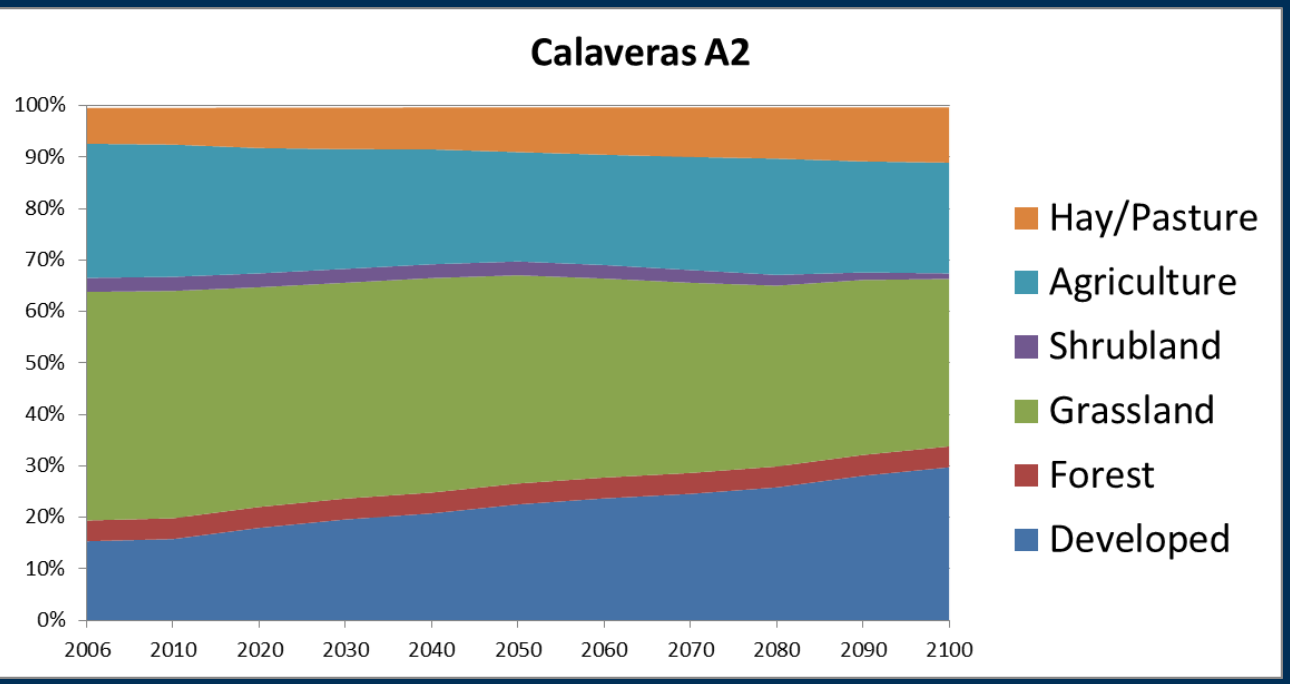
Ratio of Recharge to Runoff – More runoff in A2 Scenario, Calaveras Watershed

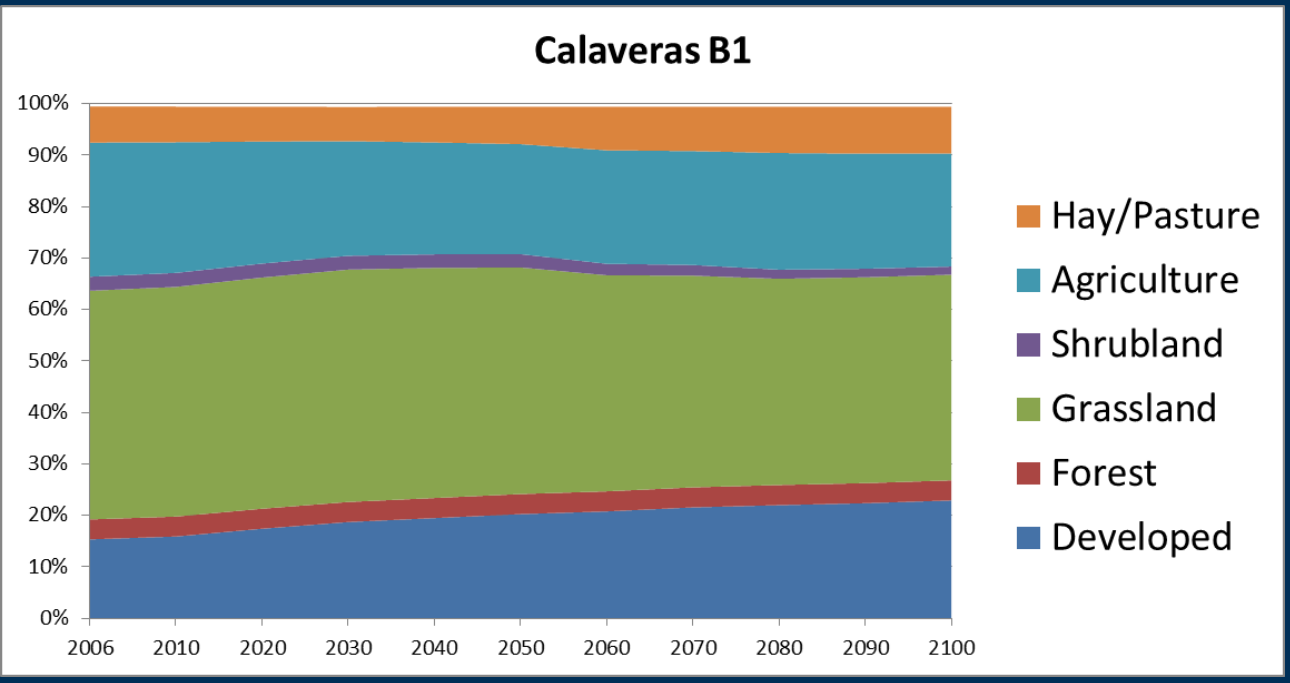


		Ratio (recharge/runoff)			
Basin	Scenario	2006	2040	2070	2100
West	GA2	1.17	1.04	0.94	0.83
	GB1	1.17	1.02	0.97	0.92
East	GA2	1.17	0.92	0.81	0.69
	GB1	1.17	0.89	0.83	0.77

DEFENDERS OF WILDLIFE

USGS science for a changing world





Calaveras Habitat Change

More grassland/shrub land conversion to agriculture in A2

DEFENDERS OF WILDLIFE

USGS science for a changing world

Calaveras - Carbon

- Social value of carbon : avoided marginal damages from carbon emissions to a society as a whole, that is, of the avoided damage done by an additional ton of carbon released into the atmosphere. In our particular case, if that carbon were released as a result of land conversion” (Kroeger, 2012)

DEFENDERS OF WILDLIFE

USGS science for a changing world

Carbon (preliminary)

- Over the estimated 5,200 of grassland lost in the Calaveras-Mormon Slough watershed during the 2006-2040 time period, the total social value of soil carbon is estimated to be about $13.2 million.

DEFENDERS OF WILDLIFE

USGS
science for a changing world

Potential Applications/Users

A) Decision-making tool for:

- Agencies: Prioritization,
- Non-profits: RCDs, land trusts Prioritization, restoration, easements
- Others: Planners, legislators

B) Research

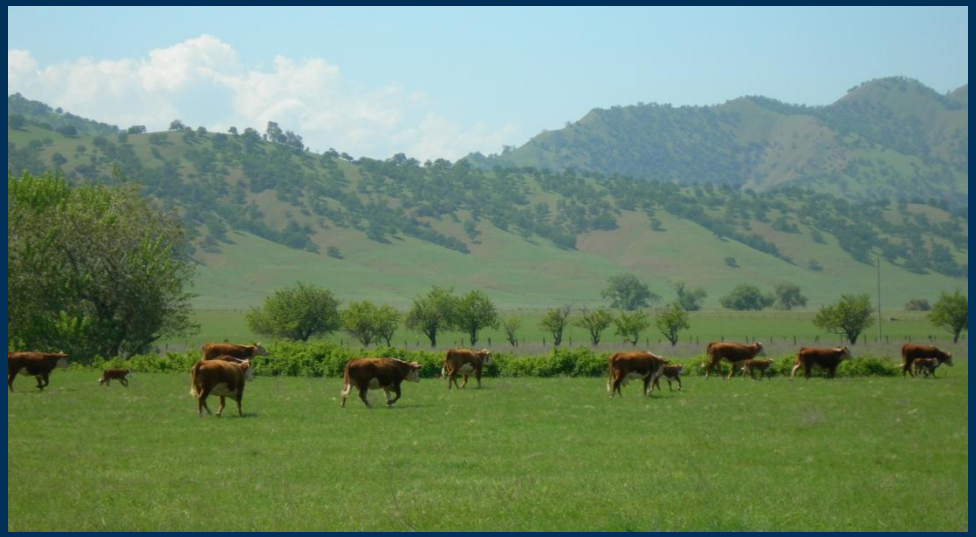
C) Outreach

DEFENDERS OF WILDLIFE

USGS science for a changing world

Thank You!

Pelayo Alvarez[4] ,Kristin Byrd[1], Chris Soulard[1], Lorraine Flint[2], Frank Casey[3], Ben Sleeter[1] and Terry Sohl[5]



[1]USGS Western Geographic Science Center, Menlo Park, CA,
[2]USGS California Water Science Center, Sacramento, CA ,
[3]USGS Science and Decisions Center, Reston, VA,
[4]Defenders of Wildlife, Sacramento, CA,
[5]USGS EROS Data Center, Sioux Falls, SD.

DEFENDERS OF WILDLIFE

USGS science for a changing world