

Climate and Conservation:

tools and data at the scale of land use decision-making

Karen Gaffney & Tom Robinson
Conservation Planning Program





Sonoma County Agricultural Preservation & Open Space District

- community vision: 1990
- re-authorized 2006 (76%)
- multi-objective: agriculture, open space, biodiversity, water, recreation, urban
- ¼ cent sales tax:
 - annual: \$16-22 million
 - through 2031: \$650-900 million
- to date: protection of 106,000 acres to date (easements/fee title)
- implications for climate change





Conservation Planning

- current state - internal capacity, data and analyses to support:
 - decision making: prioritization of land acquisition and stewardship
 - reporting and messaging: constituents & others
 - credible metrics and performance measurement
 - funding leverage
- local carbon applications:
 - land use decisions & GHG reduction goals = local
 - ancillary benefits: other partners, private sector
- state/federal applications:
 - tracking and aligning with state and federal objectives
 - AB32, SB 375: state climate legislation (regulatory, funding)
- NASA/University of Maryland data and products:
 - enhance/leverage local investment and credibility/accuracy



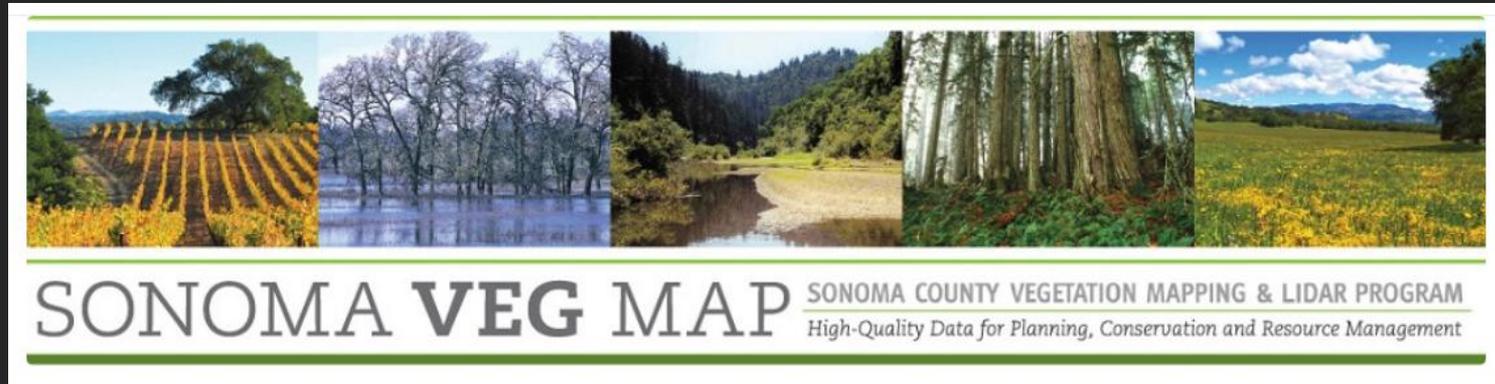
Key Initiatives

supported by NASA CMS/UMD products

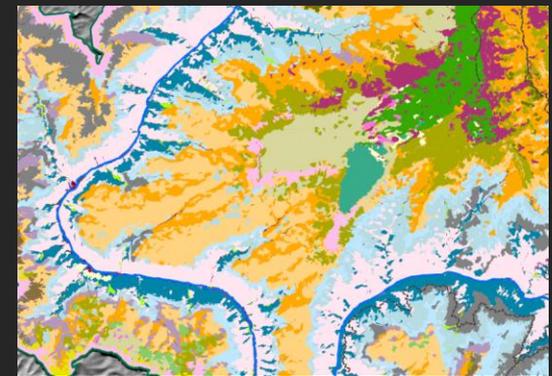
- Local Initiatives (next three years):
 - Sonoma County Vegetation Mapping and LiDAR Program
 - Climate Action Through Conservation
 - Healthy Lands & Healthy Economies
 - Groundwater & land conservation nexus
 - Riparian Corridor analyses
 - Ten Year Strategic Plan
 - Urban Footprint Scenario Planning
 - Climate Action 2020
- Regional Collaborations (ongoing):
 - North Coast Resource Partnership
 - Bay Area Integrated Regional Water Management
 - Bay Area Sustainable Communities Strategy “One Bay Area”



Vegetation Mapping and LiDAR Program



- Goal: current inventory of the natural landscape
 - vegetation structure
 - wide-spread habitats (e.g., oak woodlands)
 - small-area patches (e.g., vernal pools)
 - pervious/impervious surfaces
- High quality data for local planning, conservation, and resource management
 - conservation planning
 - public and private land/forest management
 - public policy development
 - messaging, funding development, etc.



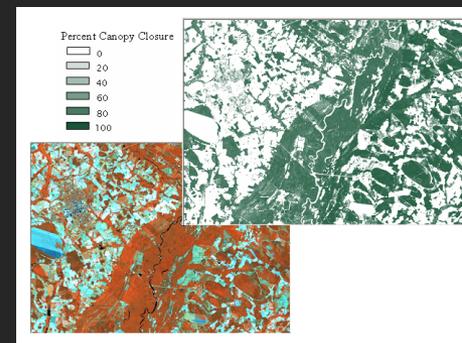
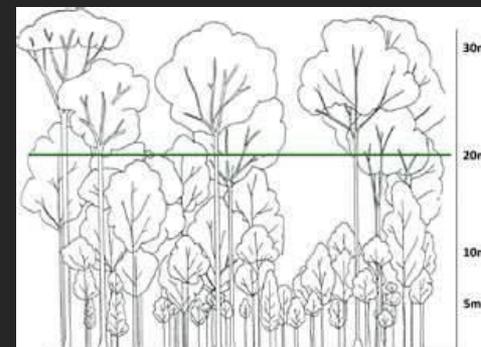
Vegetation Mapping and LiDAR Program

NASA CMS/Dubayah collaboration

- “Climate-smart” modeling capability from CMS biomass estimates:

Quantify GHG emissions of natural land conversion AND benefits of conservation (avoided emissions + sequestration)

- LiDAR adds **habitat modeling** capability through forest structure (size and canopy closure classes)



Vegetation Mapping and LiDAR Program

Other CMS added value

- Sparked a **consortium**: Brought many state and local partners to the table through LiDAR derivative products
- NASA ROSES grant brought six federal, state, and local partners to the table, **leveraging \$1.5M** of USGS, state, and local funds
- LiDAR derivative products (DEM, contours, building envelopes) are **useful for numerous natural resource objectives**



LiDAR-Derived Shaded Relief



Shaded Relief Derived from Existing 10-m USGS DEM

Timing

- Fall 2015 – Publish 27-class lifeform vegetation map using CMS LiDAR and derivatives in eCognition (Definiens)
- Summer 2015 – Evaluate and incorporate CMS biomass estimates
- Fall 2016 – Publish 45-class vegetation and habitat map using CMS canopy closure and vegetation height to crosswalk with California Wildlife Habitat Relationships classification
- Fall 2016 – Incorporate data findings into 10-year countywide conservation plan

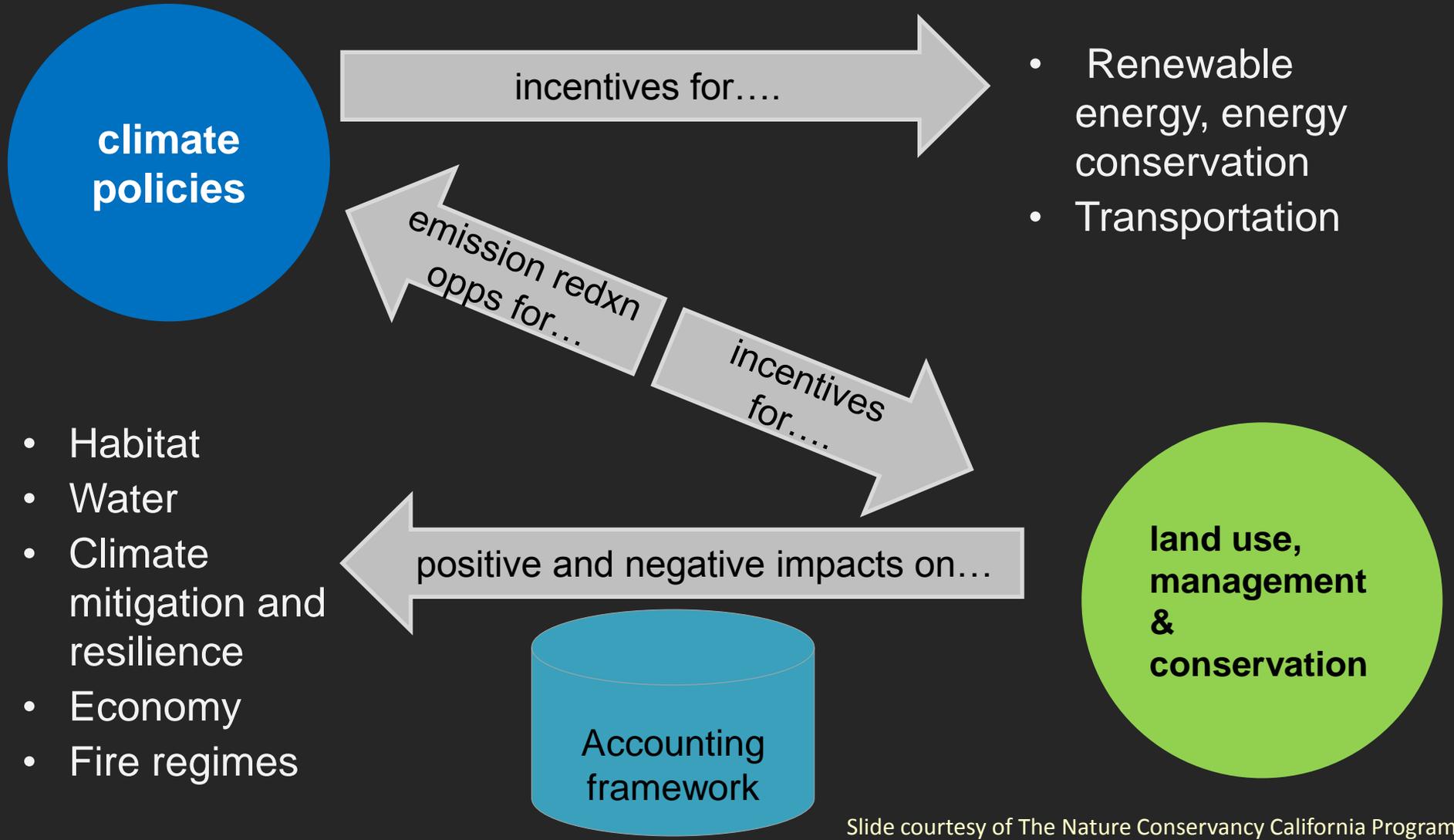


Climate Action Through Conservation

- Data, accounting framework, and incentives for counties to engage in climate change solutions through conservation and land use, using Sonoma County as pilot
- Method to calculate the GHG reduction co-benefits of natural resource conservation scenarios (e.g., acquisition + policy + management) over the next 20 years



Climate Action Through Conservation



Slide courtesy of The Nature Conservancy California Program



Climate Action Through Conservation

- Above-ground carbon Inventory

Goals: To provide spatially explicit estimates of the amount of carbon currently stored in forests and grasslands in the county. To provide a starting point for future projections, and a basis for monitoring GHG emissions and reductions over time.

Criteria: Replicable, accurate, sensitive to carbon stock changes, cost-effective.

Tool currently uses FIA forest inventory and LandFire vegetation data (historic datasets, high likelihood of continuance)



**Total C stock (1990):
214 Tg CO₂e**

**Total Inventoried Carbon Stock (CO₂)
Tonnes/Ac - 1990**



Climate Action Through Conservation

- Baseline emissions projections

To establish baseline trend, a historic inventory was created by “re-vegetating” areas converted between 1990 and the earliest LandFire dataset (2001) by using other land cover datasets (LandSat TM, CA Department of Conservation data)

CMS LiDAR-derived carbon/biomass data could be used to create a predictive model that can yield more accurate and precise estimates of carbon at greater spatial resolution



**Total C stock change:
15 Tg CO₂e
750,000 Mg CO₂e annually**

**Forest
Growth**

Fire

Conversion

Change in stock (2010 - 1990)

Tonnes/ac CO₂

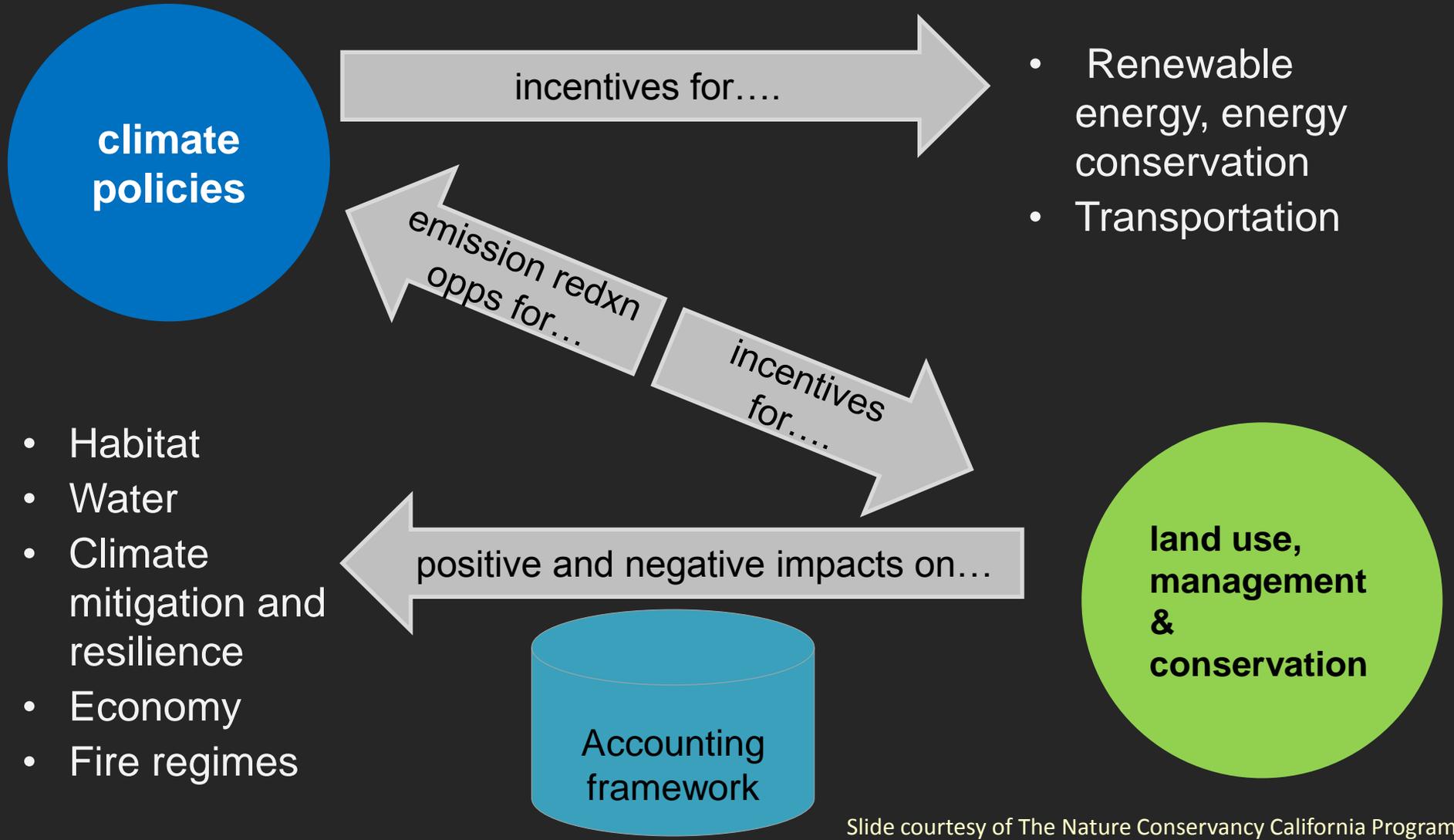


The Nature Conservancy 


SONOMA COUNTY
AGRICULTURAL PRESERVATION
AND OPEN SPACE DISTRICT

National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, IPC

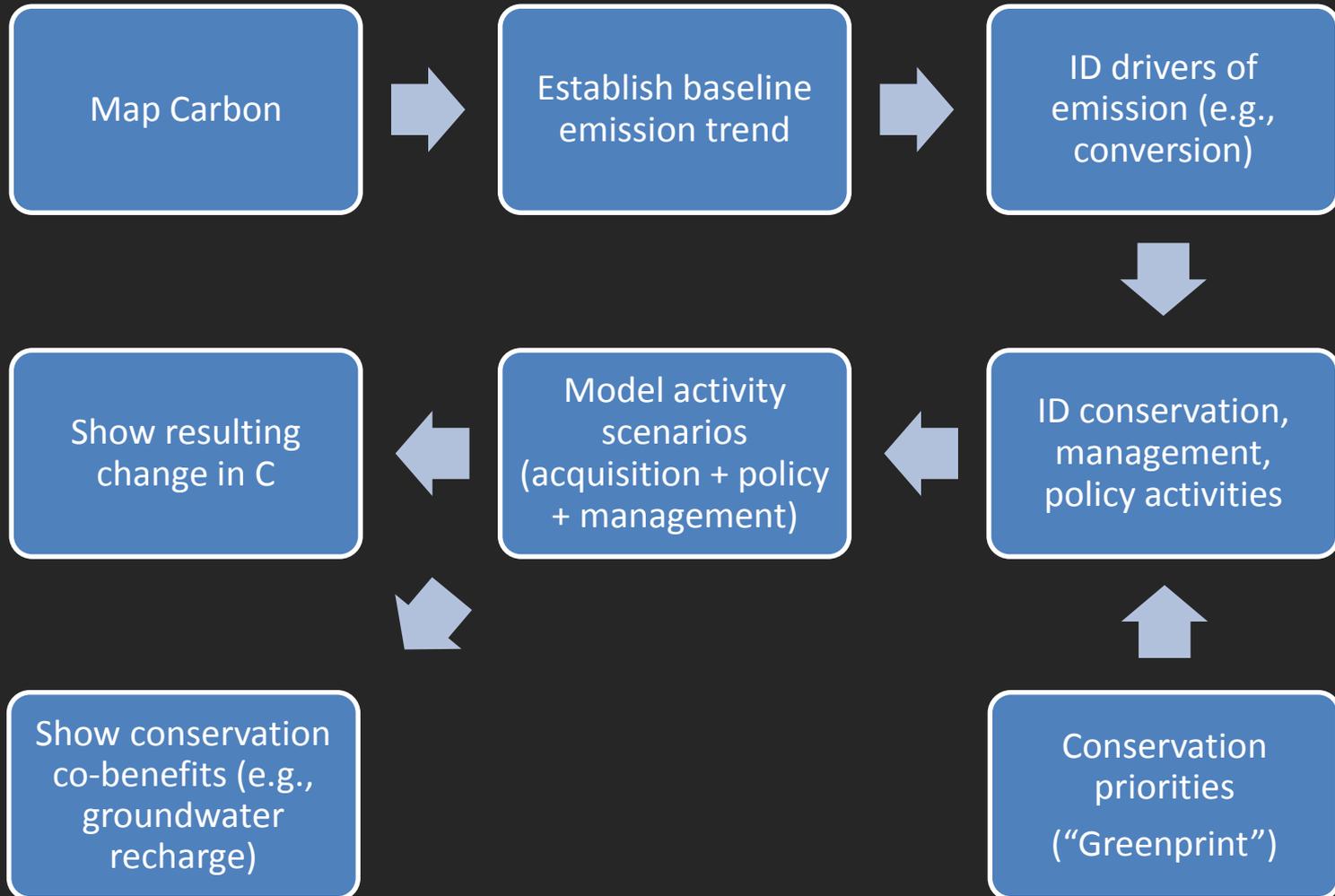
Climate Action Through Conservation



Slide courtesy of The Nature Conservancy California Program



Accounting Framework



Key Component: Modeled Activities

- What potential conservation/ restoration actions need to be accounted for?
 - Avoided conversion (what could have happened?)
 - Reforestation
 - Improved forest management
 - Urban forest management



Riparian Forest Restoration



© 2014 Google

Google earth

Imagery Date: 4/20/2013 38°36'42.18" N 122°46'30.58" W elev 137 ft eye alt 795 ft

Riparian Forest Restoration



179 ft

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Imagery Date: 4/20/2013 38°36'42.18" N 122°46'30.58" W elev 137 ft eye alt 795 ft

Riparian Forest Restoration



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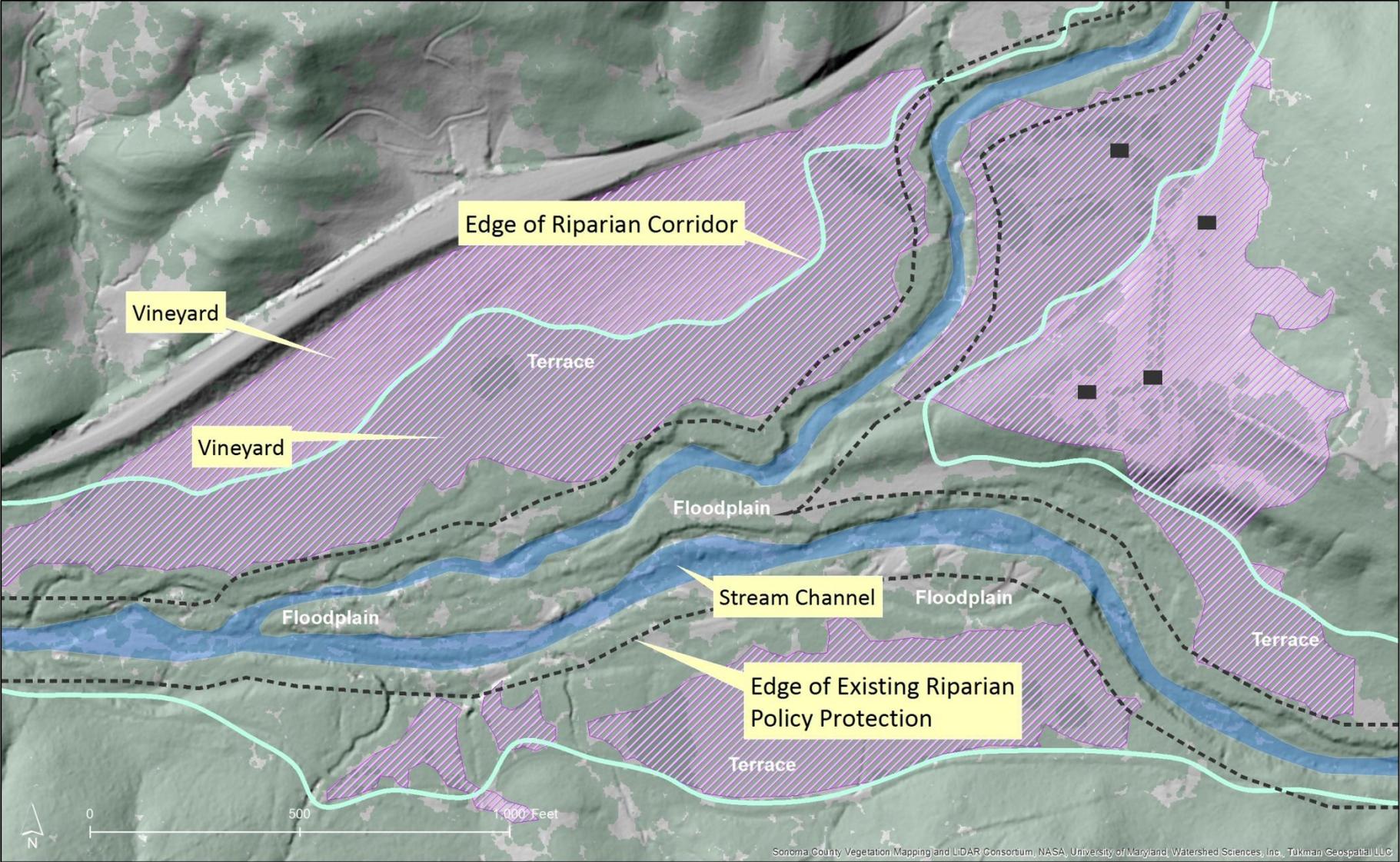
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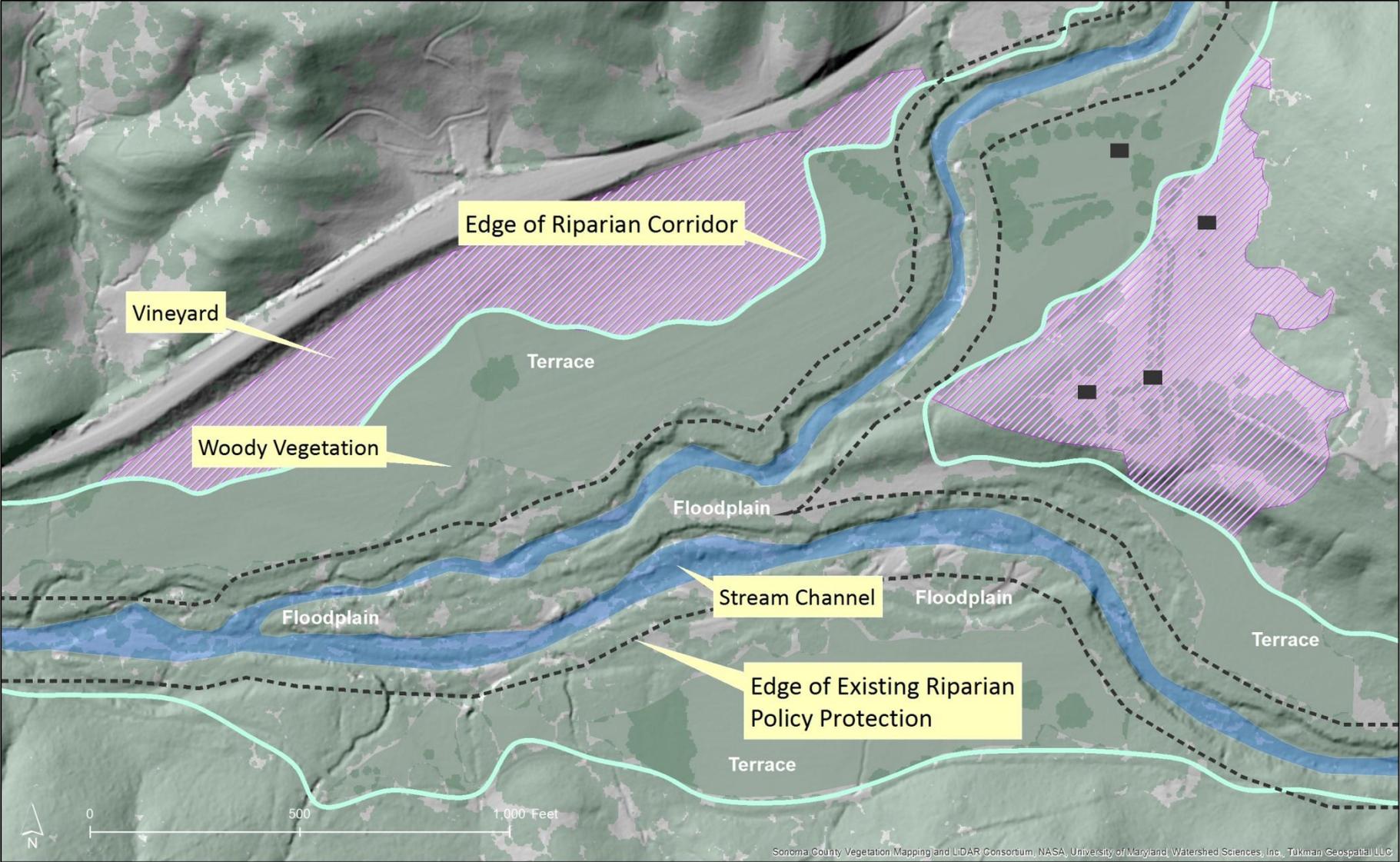
1993

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Riparian Forest Restoration



Riparian Forest Restoration



Conservation Values Assessment: Draft Framework for Avoided Conversion

Themes

Food Production

Water Ecosystem Services

Terrestrial Habitat

IN DEVELOPMENT

Components

Irrigated cropland and rangelands

Headwater stream quality

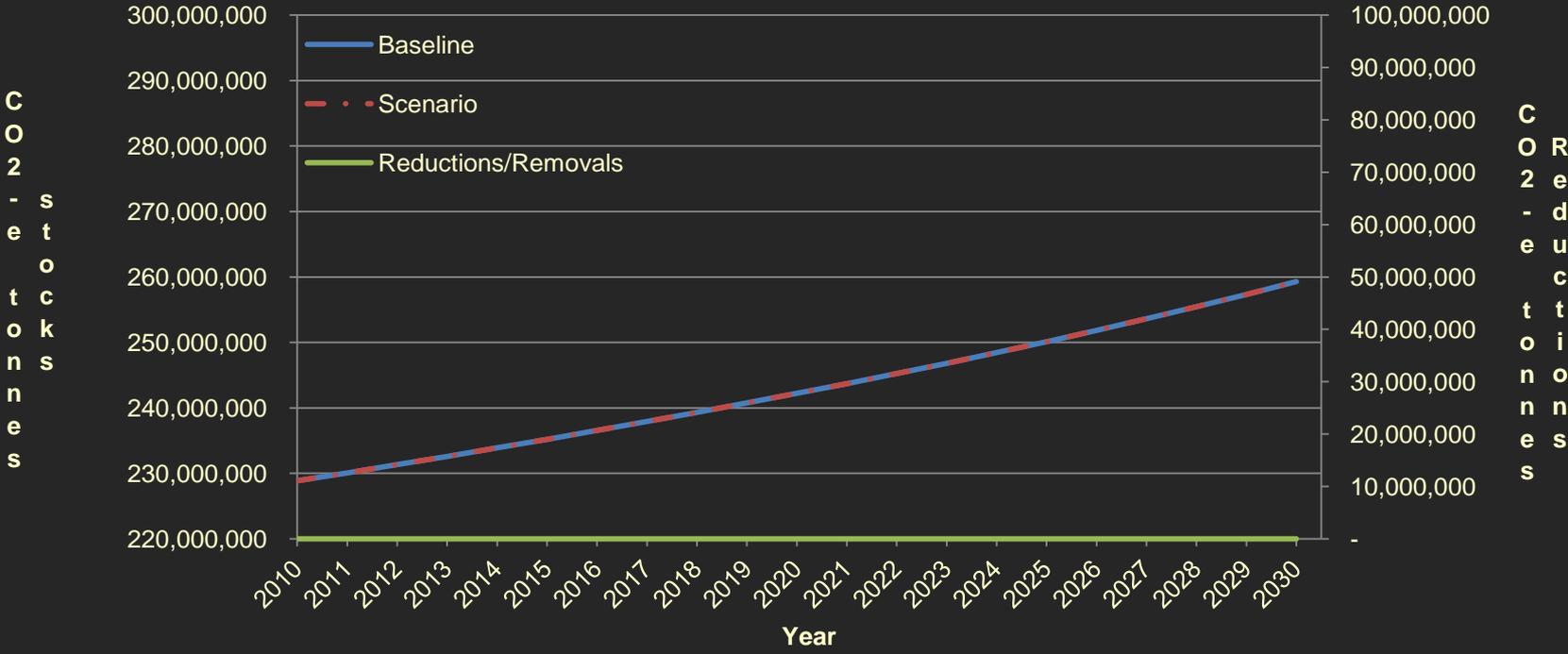
Groundwater recharge

Human disturbance, rare habitats, and wildlife linkages



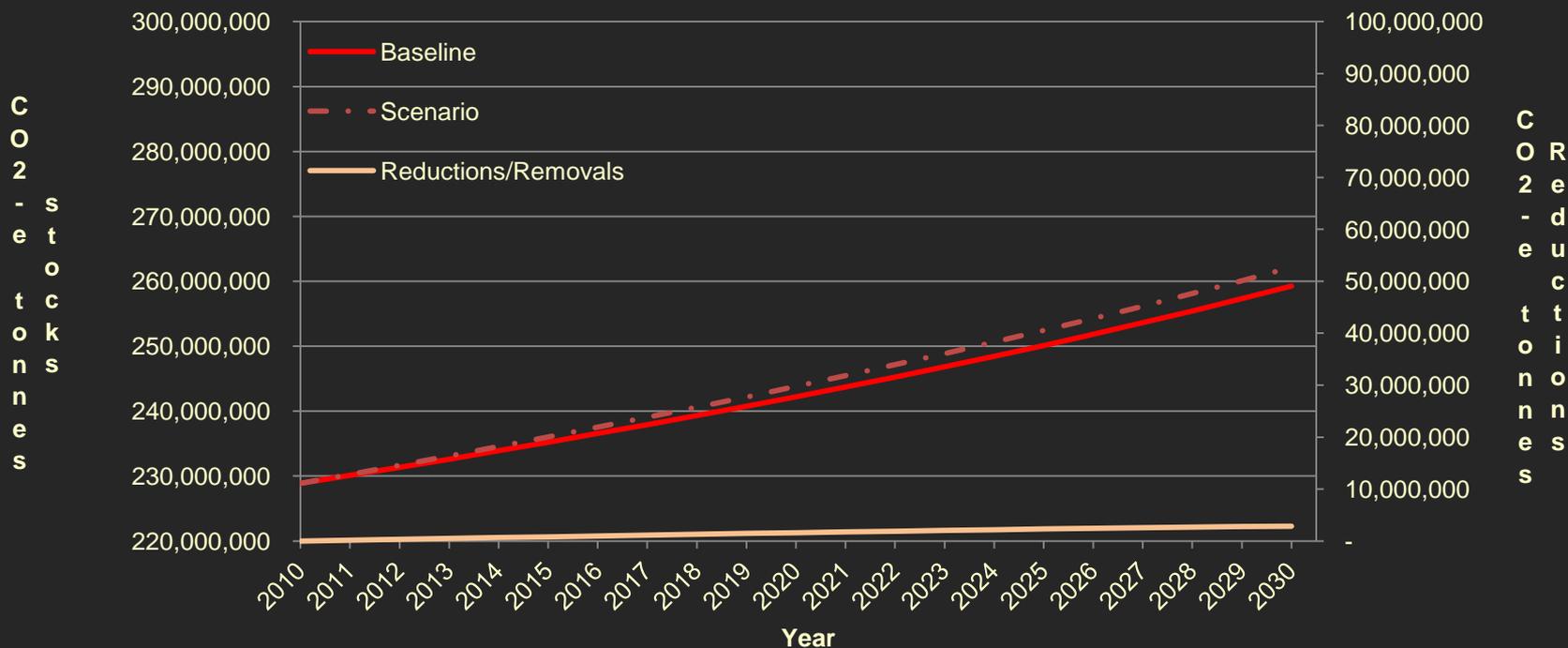
Example of GHG Baseline and Reduction Scenarios

Action	
Baseline Trend	Normal anticipated trajectory of CO2e in biological stocks



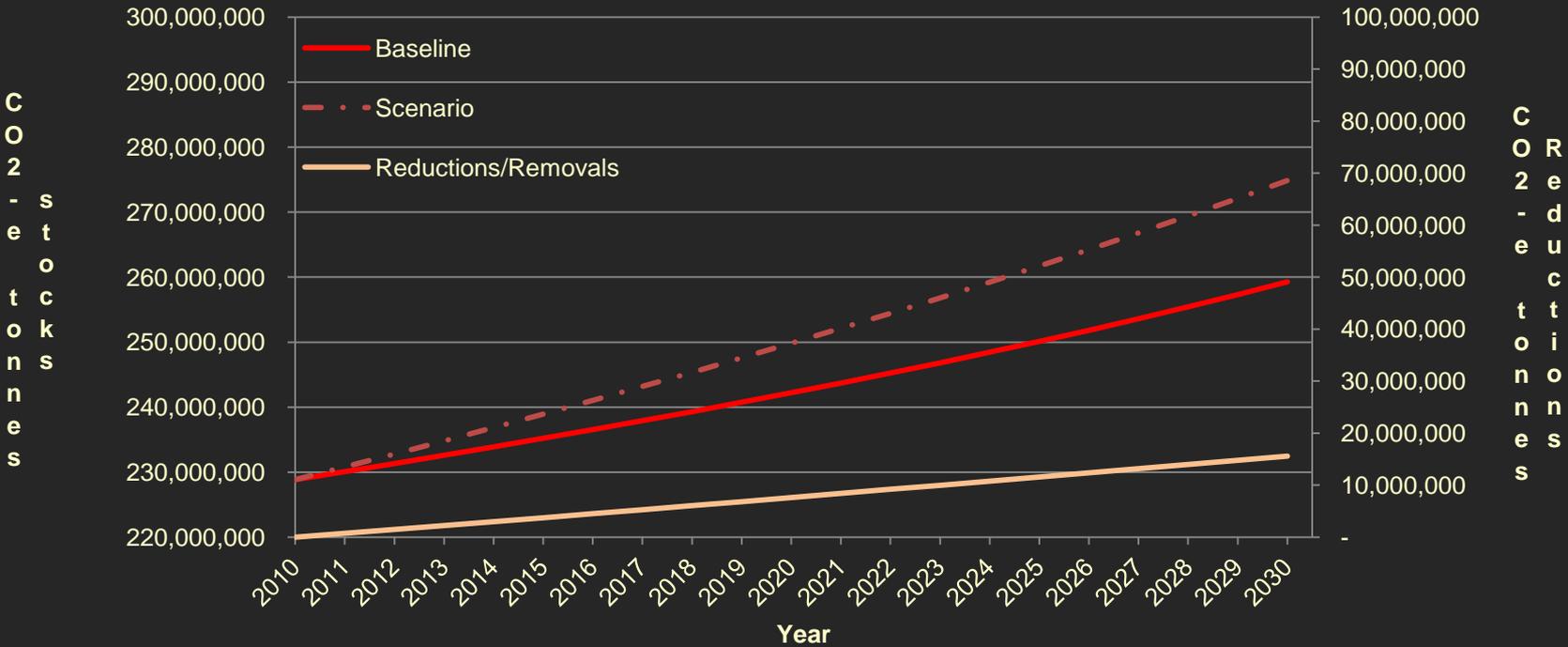
Example of GHG Baseline and Reduction Scenarios

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Baseline Trend	Normal anticipated trajectory of CO2e in biological stocks
Scenario I	Stop conversion of grasslands and shrublands into agriculture



Example of GHG Baseline and Reduction Scenarios

Action	
Baseline Trend	Normal anticipated trajectory of CO2e in biological stocks
Scenario I	Stop conversion of grasslands and shrublands into agriculture
Scenario II	Thin redwood/Douglas-fir forests from below instead of removing dominant trees



Timing

Spring/Summer 2015:

- Complete project report, documentation and tool v.1
- Verify inventory assumptions
- Assess uncertainty of inventory and projections

Ongoing – Continue outreach for additional county and regional pilots



Multiple Benefits of Conservation

- conservation = unique tool for addressing climate change
- integration of multiple objectives/benefits
 - cost effective in achieving multiple goals
 - carbon sequestration, emissions avoidance, climate adaptation, biodiversity, human health, food security, water quality and supply
 - biophysical data with socio-economic data: quality of life
 - Impact/relevance, “lands” with decision makers, funders and the public
 - helps us leverage local investment
- NASA/UM collaboration, products, high resolution data:
 - enhance the accuracy of these multi-benefit analyses
 - foundational to their credibility & success





HEALTHY LANDS HEALTHY ECONOMIES



DEMONSTRATING THE ECONOMIC VALUE OF
NATURAL AREAS AND WORKING LANDSCAPES



- Three county coalition – monetizing the multiple benefits of conservation
- CMS data and products are foundational to this initiative
- Providing decision support locally and statewide
- Influential in California policy & legislation
 - Water bond
 - AB 32 implementation
 - Local county measures – Measure Q in Santa Clara (Silicone Valley)



CARBON PLUS

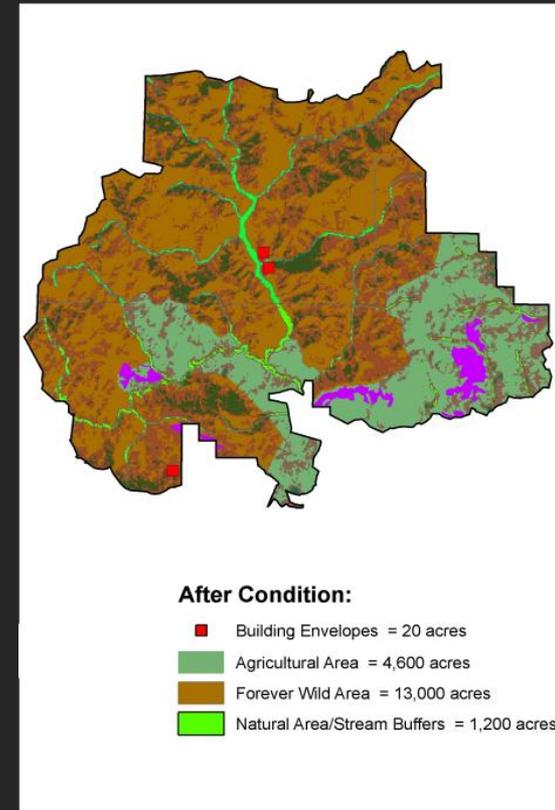
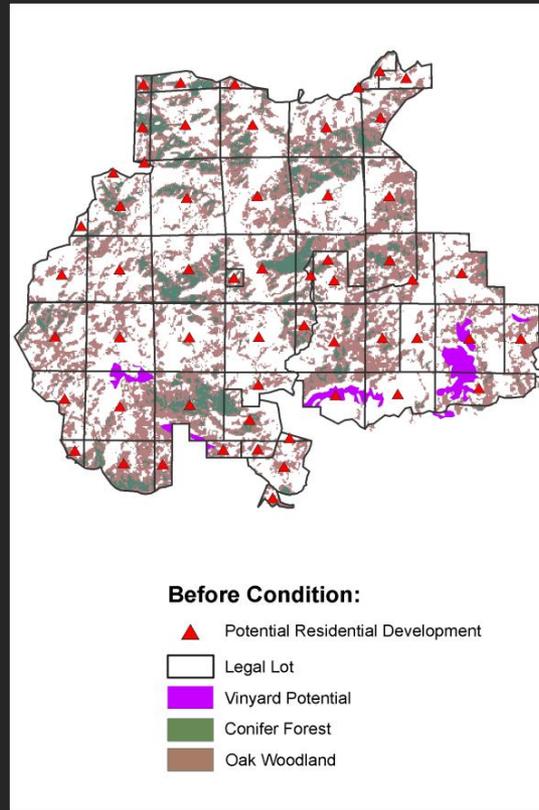


Cooley Ranch Conservation Easement

¼ of Lake Sonoma watershed

Conservation Co-benefits

- Avoid fragmentation maintain wildlife habitat connectivity
- Avoid impervious surfaces over groundwater recharge areas
- Recreation and public health
- Protect and restore riparian zones for biodiversity and ecosystem services
- Benefits to green infrastructure (e.g., reduced fire hazards, reduced sediment loading, pollutant buffering)



Multiple Benefits: C + Coastal Resilience

- forest based carbon in coastal areas
- use of LiDAR/CMS products to investigate “green infrastructure” alternatives for coastal resilience to sea level rise/storm surge/flooding
- partnership with county planning, NOAA, USGS, Coastal Conservancy, Ocean Protection Council, Stanford University, local communities
- recreation, terrestrial/marine habitats, tourism



Integration of Multiple Sectors

- CMS products as a “convening tool” with multiple, evolving applications
- public sector (examples)
 - CalFire
 - quantifying carbon for grant evaluations
 - fire/fuel load modeling and emissions implications
 - Sonoma County Water Agency
 - catastrophic wildfire (emissions and C impacts on water intakes)
 - emissions and C reporting in stream maintenance program, infrastructure
 - co-benefits of groundwater recharge and use for hydro-modeling
- private sector applications (benefits of providing via public agency)
 - farmers and ranchers: carbon projects under AB 32
 - engineering firms, restoration ecologists and habitat restoration groups
 - landowners
- integration: Urban Footprint scenario modeling tool/EEMS
 - decision support using CMS data with all sectors
 - local capacity building with long term benefits



Thank You

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Sonoma County Water Agency
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City of Petaluma
The Nature Conservancy, California
Save the Redwoods League

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Visit <http://www.sonomavegmap.org>
Follow @SonomaVegMap

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⁴ East West Forestry Associates

⁵ Tukman Geospatial

⁶ EnvisionGeo

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