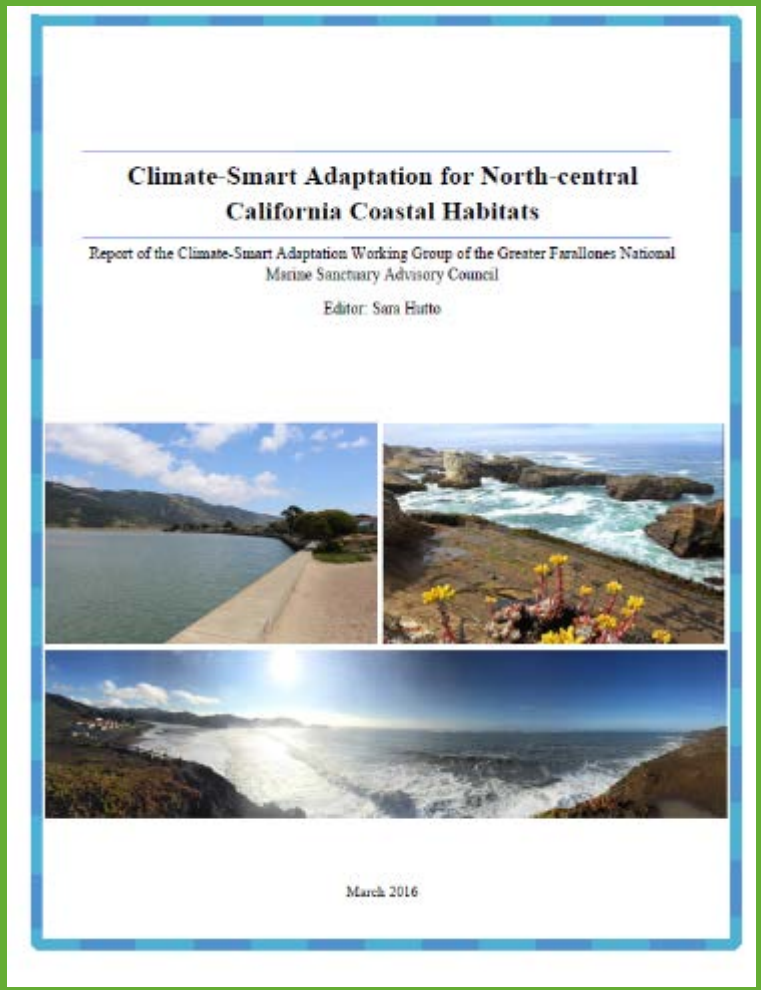
Climate-Smart Conservation: Nature-based, Multi-benefit Solutions for a Healthy Future

Point Blue
Conservation
Science

Ellie Cohen and Point Blue Staff
4th Ocean Climate Summit
NOAA Greater Farallones National Marine Sanctuary
May 17, 2016

Climate-Smart Adaptation



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Impending tipping point for the future of life on our planet

Exceeding 4 of 9 ‘planetary boundaries’

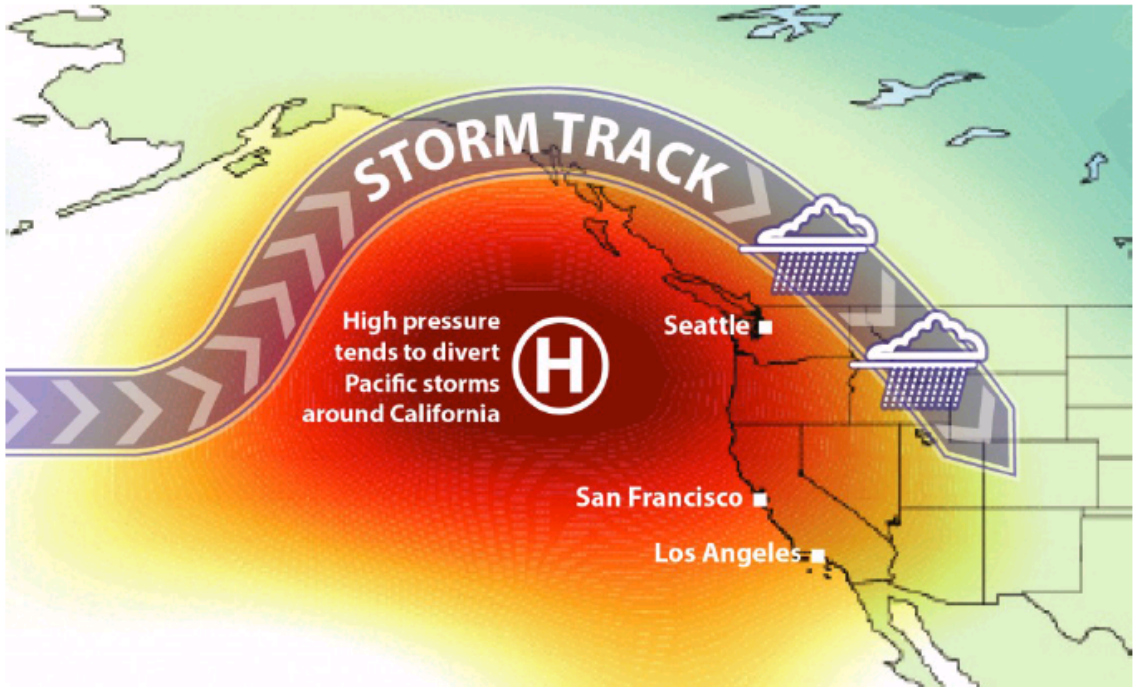
- Climate change
- Species extinction
- Habitat loss (land-use changes)
- Fertilizers (altered biogeochemical cycles)

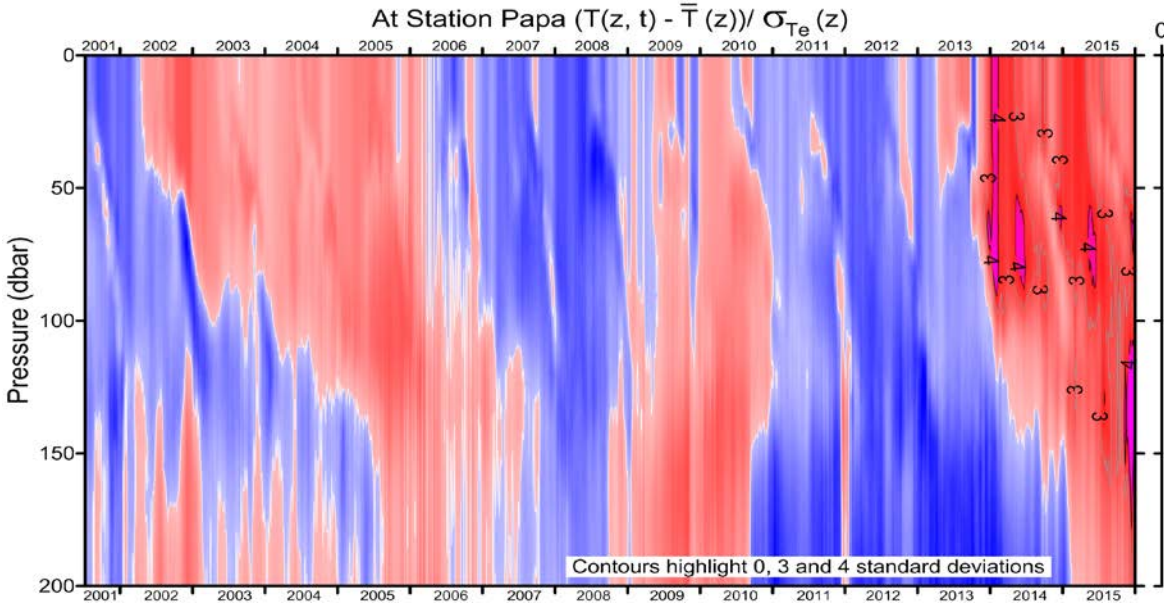
- Steffen et al, SCIENCE, Jan 2015, Planetary Boundaries
- Natl Acad. of Sci., Abrupt Climate Change Dec 2013
- Barnosky et al, NATURE June 2012

Image Cheng (Lily) Li.

Arctic heat and the Blob impacted El Niño

Uncertain future—
Heated waters go 200m deep





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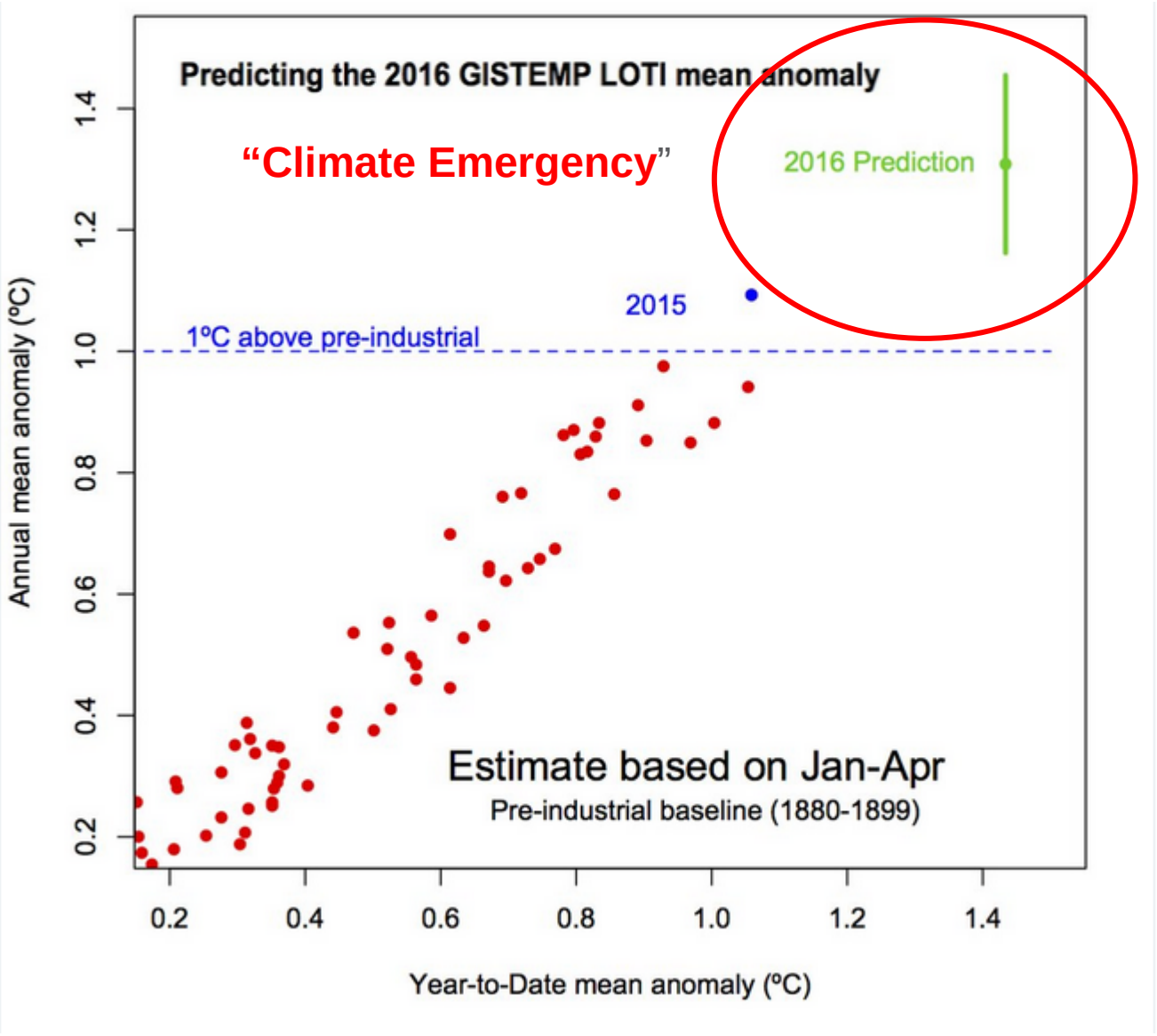
http://www.nanoos.org/resources/anomalies_workshop/workshop2.php

Will 2016 set new record of 1.5°C above pre-industrial?



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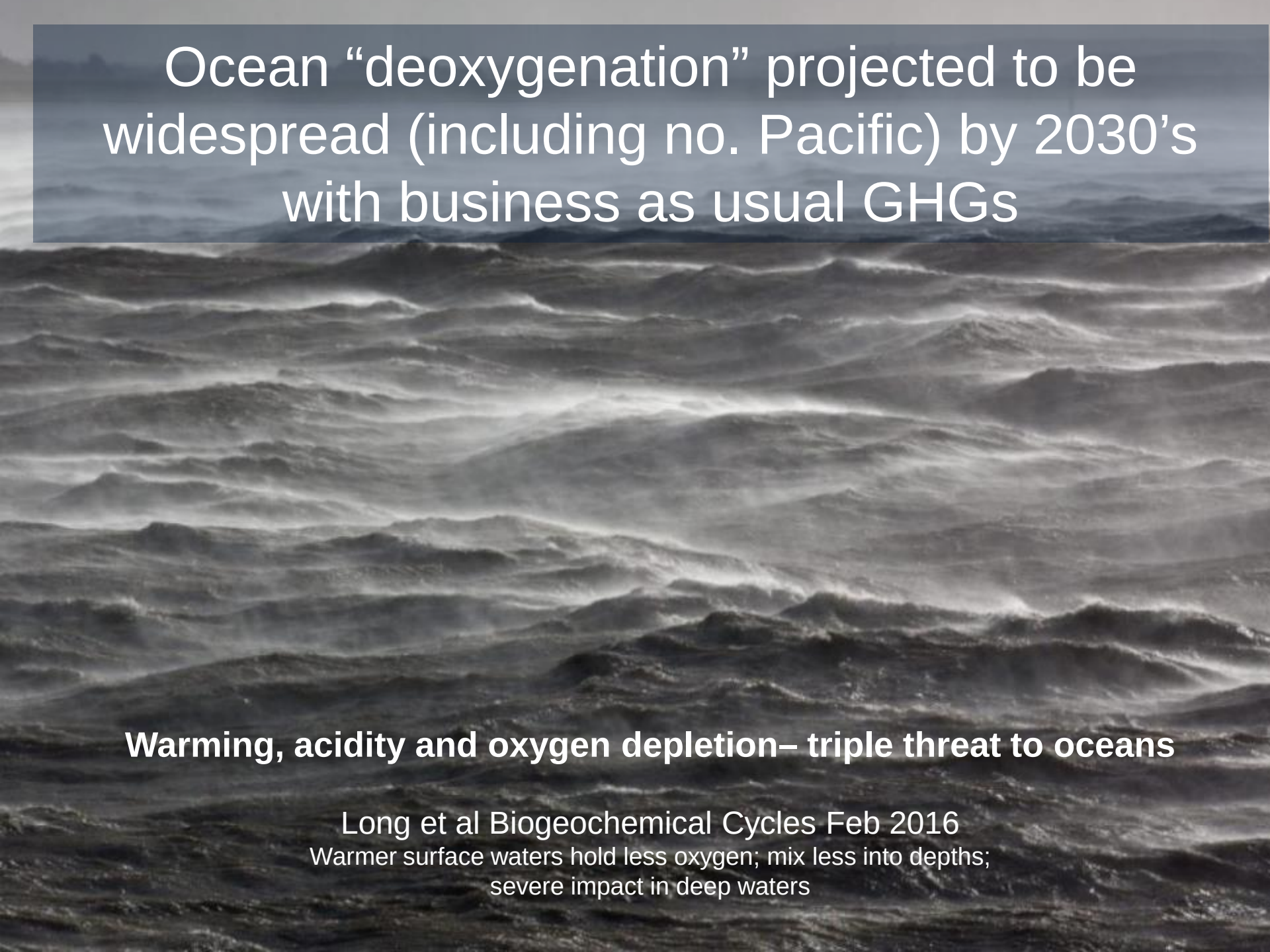
Gavin Schmidt, Climatologist, NASA Goddard Institute for Space Studies, May 14 2016
http://www.theguardian.com/environment/2016/may/16/april-third-month-in-row-to-break-global-temperature-records

Ocean “deoxygenation” projected to be widespread (including no. Pacific) by 2030’s with business as usual GHGs



Warming, acidity and oxygen depletion– triple threat to oceans

Long et al Biogeochemical Cycles Feb 2016

Warmer surface waters hold less oxygen; mix less into depths;
severe impact in deep waters

We are totally reliant on nature

Ecosystem Services or Nature's Benefits

- Freshwater, clean air
- Food, fisheries
- Wood, fiber, fuel

- Climate
- Flood
- Disease
- Water quality

- Recreational
- Educational
- Spiritual

Est value= 2x global GNP or $72 trillion in 2012

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www.millenniumassessment.org/en/index.aspx

databank.worldbank.org

Paris Climate Agreement - Dec. 2015

Goal: hold increase in global avg. temp. well below 2°C; includes nature-based solutions

…**importance of ensuring integrity of all ecosystems, including oceans….**

…take action to conserve sinks of greenhouse gases…

…support **reducing emissions from deforestation**…and **conservation**

…Build resilience through **sustainable management of natural resources**.

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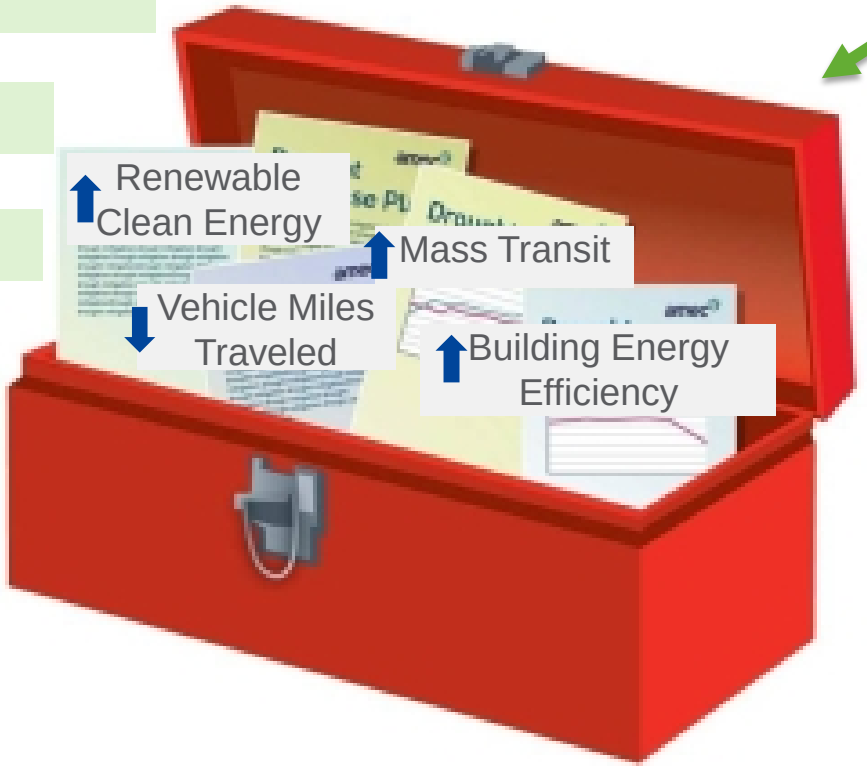
United Nations Framework Convention on Climate Change
http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf
www.pointblue.org/parisagreementecosystems

Climate change tool box…
…must include nature-based solutions

Mitigation: GHG emissions reductions

Adaptation

Sequestration



Nature-based solutions "*climate-smart conservation*"

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Tara G. Martin, James E. M. Watson. **Intact ecosystems provide best defence against climate change**. *Nature Climate Change*, 2016; 6 (2): 122 DOI: 10.1038/nclimate2918

Climate-Smart Conservation Key Principles

1. **Focus on future** conditions, not past; plan ahead to reduce risks
2. Design actions in **watershed/ecosystem/biosphere context** across multiple scales in time and space
3. Employ **flexible, adaptive approaches** for timely response to continual change
4. **Prioritize actions for multiple benefits across range of scenarios** to nature *and* people
5. **Collaborate & communicate across sectors** for timely, long term solutions
6. Practice the TEN% Rule: **Test and Experiment Now**!

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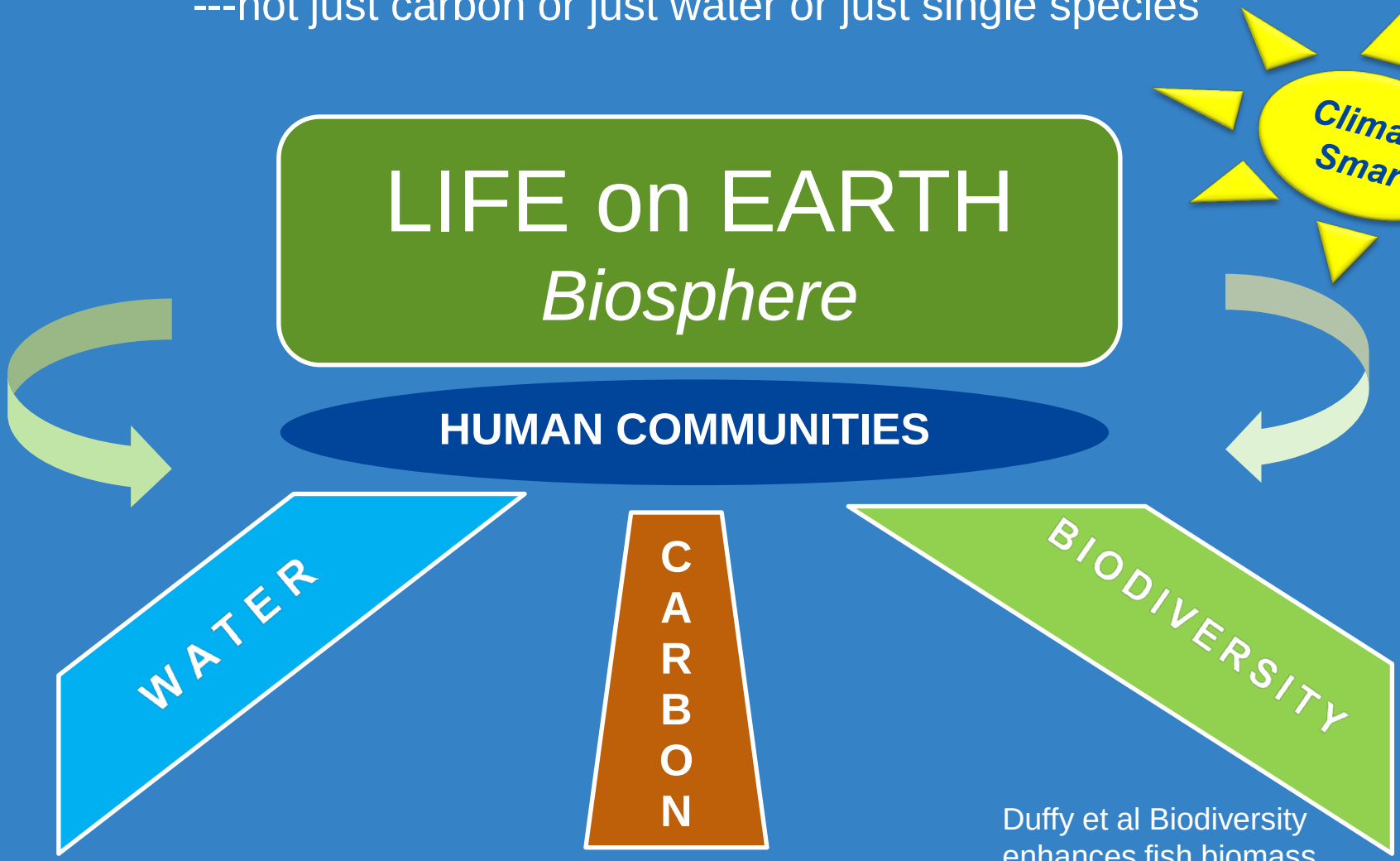
Adapted from: NWF Climate Smart Conservation Adaptation Principles 2011; Draft Principles for CA Resources Agency Adaptation Update 2012; CSIRO's Climate change impacts on Australia's biodiversity conservation & protected areas, Sept 2012 Update

Prioritize actions for multiple benefits

---not just carbon or just water or just single species



Duffy et al Biodiversity enhances fish biomass and resistance to climate change PNAS May 2016

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ecohen@pointblue.org

Restore healthy rangelands = 40%+ of CA

- Multi-benefit: clean water, carbon, biodiversity, bottom lines

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NRCS

40 m acres @ avg. 1MT CO2e/acre = offset ~10% of CA emissions/year == residential/commercial emissions

CARBON FARM PLANNING in Marin

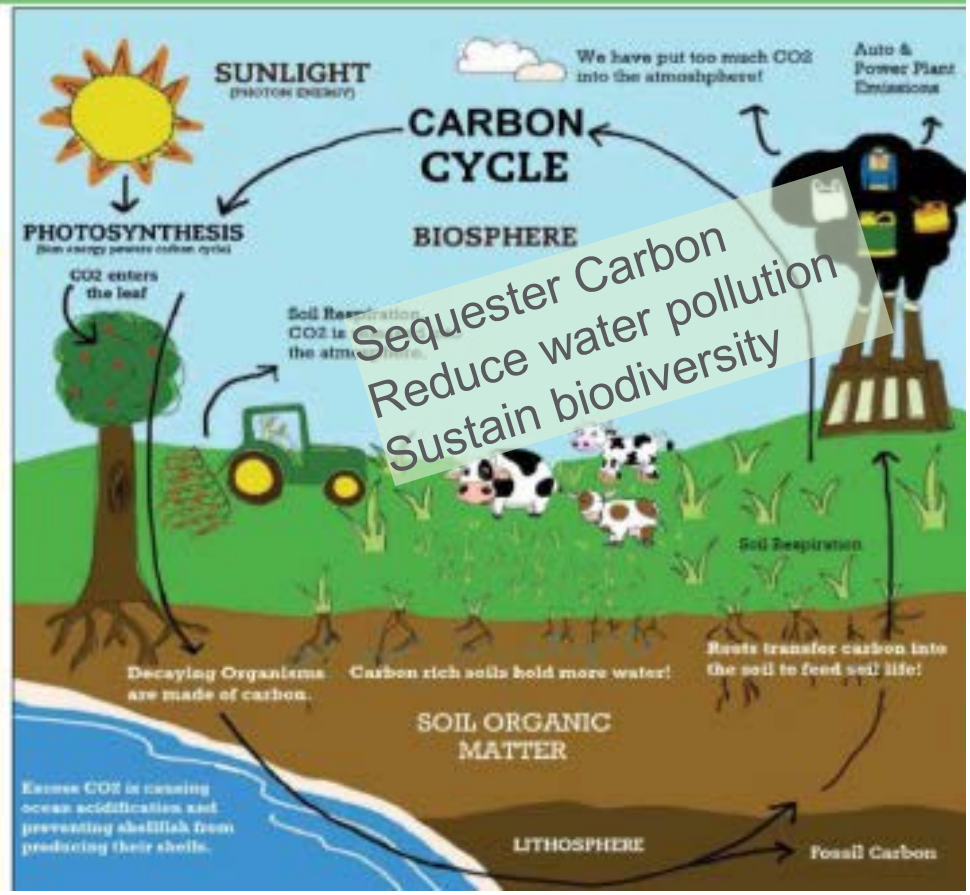
Assistance is available for farmers and ranchers!

Plan for carbon sequestration and climate adaptation conservation practices with Marin RCD!

Potential List of Conservation Practice(s)* in a Carbon Farm Plan:

- Compost Application • Anaerobic Digester
- Silvopasture/ Shrub & Tree Establishment
- Windbreak/ Shelterbelt/ Hedgerow
- Riparian and Wetland Restoration
- Filter Strips • Grassed Waterways
- Forage & Biomass Planting
- Rangeland Management
- Prescribed Grazing and Range Planting
- Nutrient Management
- Residue & Tillage Management, No-Till
- Cover Crops

*NRCS Standard Conservation Practices



MARIN RESOURCE CONSERVATION DISTRICT

MARIN CARBON PROJECT

Carbon Cycle Institute

Restore Riparian: 90% lost in CA-- enormous potential for benefits

Climate Smart Restoration

Planting more species that:

- Withstand extremes
- Provide food year-round for disrupted phenologies

- **Climate-smart Restoration Tool Kit:** http://www.pointblue.org/
- Seavy et al., **Why climate change makes riparian restoration more important than ever**. *2009. Ecological Restoration* Ecol. Rest. v27

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http://www.rivers.gov/california.php
http://www.pointblue.org

Riparian restoration

Filters out pollutants, reduces erosion and promotes groundwater recharge (Tabacchi et al. 2000, Mander and Hayakawa. 2005)

Captures carbon and prepares ecosystems for change (Lewis et al. 2015, Matzek et al. 2015, Seavy et al. 2009)

Provides habitat for birds, fish and wildlife
(Knopf and Samson 1994, Pusey and Arthrington 2003, Gardali et al. 2006, Golet et al. 2008)

Protects soil and supports pollinators – food security (Power et al. 2010)

Increases property values and provides recreational opportunities
(Colby and Smith-Incer. 2005, Bark et al. 2008)

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Restore tidal wetlands: natural infrastructure

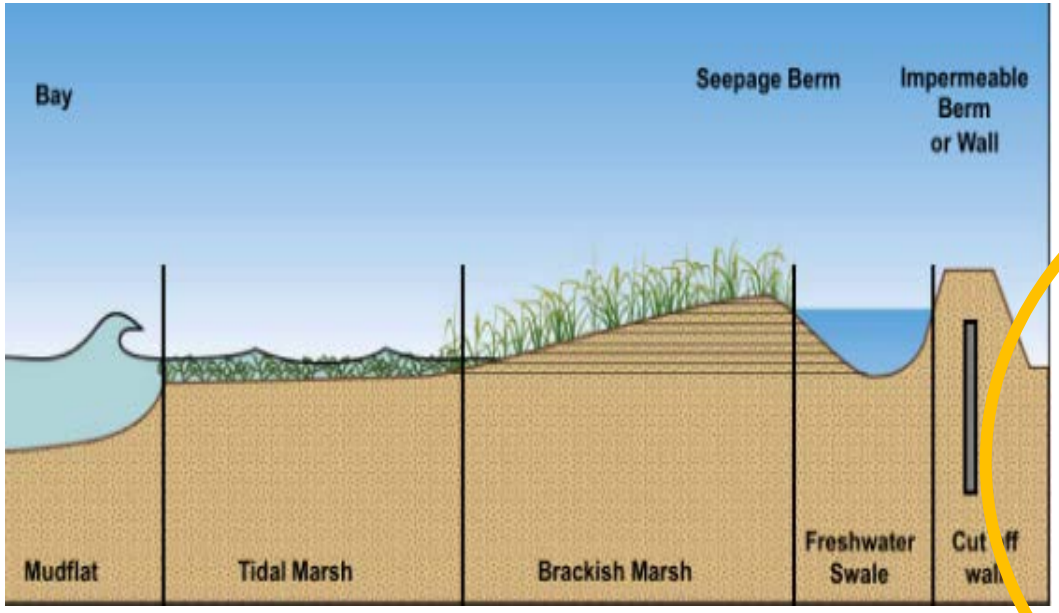
Protect remaining undeveloped shoreline and upland transition zone

Climate Smart

- Reduce flooding
- Slow sea level rise
- Filter out pollutants
- Provide fish and wildlife habitat
- Sequester C ~3T/acre or ~300,000 MT CO2e/yr per 100,000 acres when keeping pace with SLR
- Recreation

- **baylandsgoals.org/science-update-2015/**
- **mavensnotebook.com/2015/07/29/tidal-marshes-and-climate-change/ Callaway, 2015**

Tidal marshes combined with earthen levees can reduce construction and maintenance costs by almost 50%



The Horizontal Levees

Climate Smart

Ecological Engineering

- Disaster risk reduction
- Hard/soft engineering
- Ecosystem-based adaptation

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Cheong et al ***Coastal Adaptation with Ecological Engineering*** Nature Climate Change Aug 2013
The Horizontal Levees Feb 2013 http://www.bay.org/publications/the-horizontal-levee

Coastal habitats –natural infrastructure- reduce risk to people & property by 50%

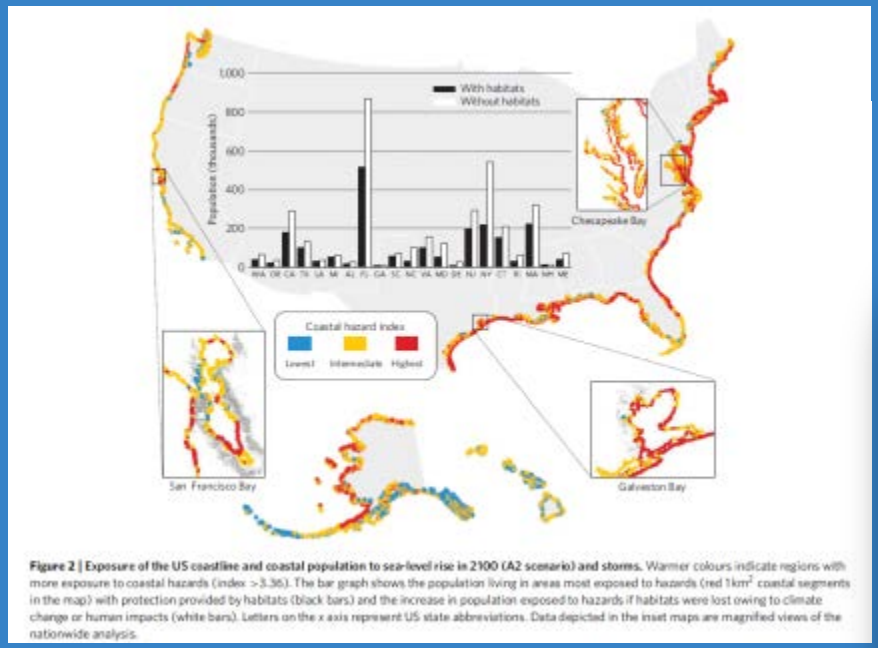
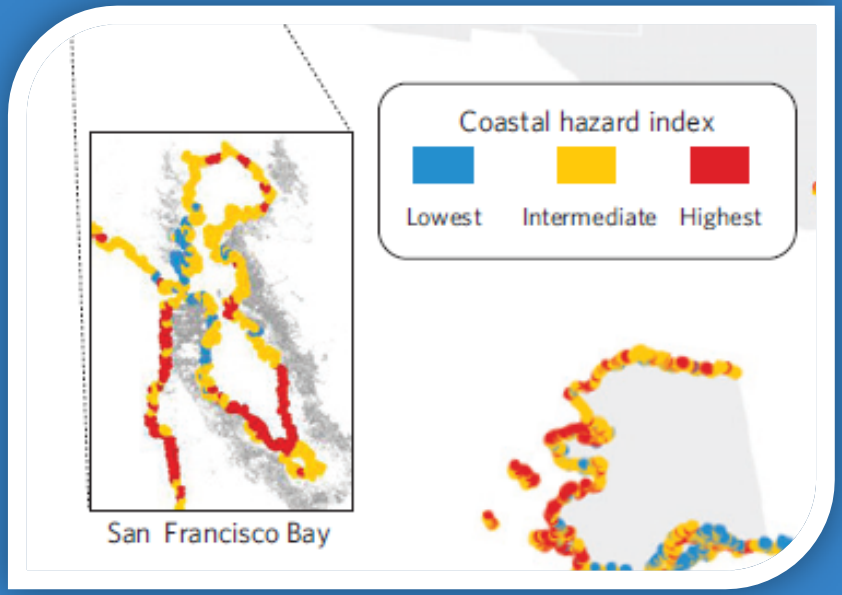


Figure 2 | Exposure of the US coastline and coastal population to sea-level rise in 2100 (A2 scenario) and storms. Warmer colours indicate regions with more exposure to coastal hazards (index >3.36). The bar graph shows the population living in areas most exposed to hazards (red 1km² coastal segments in the map) with protection provided by habitats (black bars) and the increase in population exposed to hazards if habitats were lost owing to climate change or human impacts (white bars). Letters on the x axis represent US state abbreviations. Data depicted in the inset maps are magnified views of the nationwide analysis.



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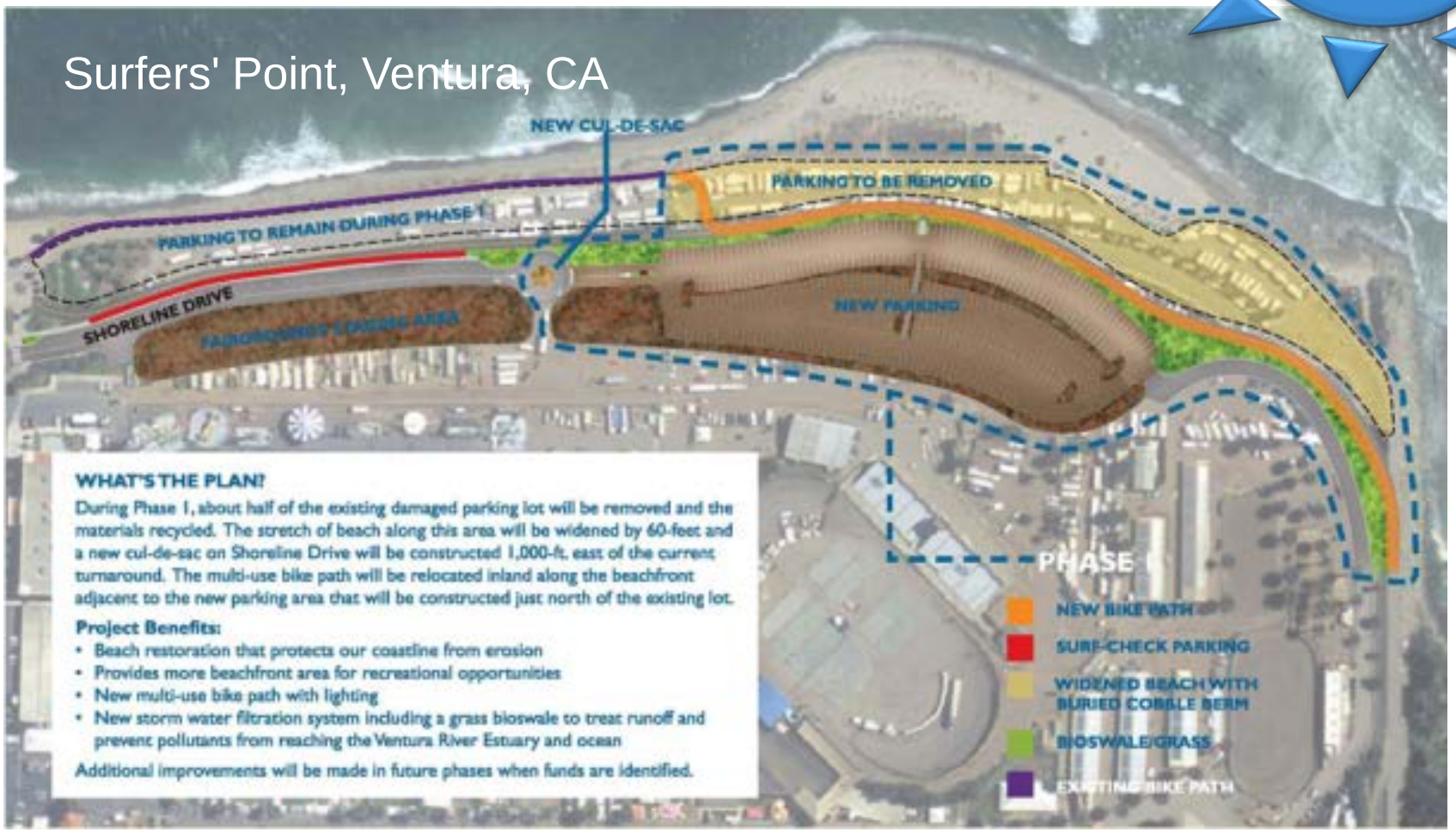
Arkema et al **Coastal habitats shield people and property from sea-level rise and storms** Nature Climate Change July 2013

Implement Managed Retreat

Climate Smart



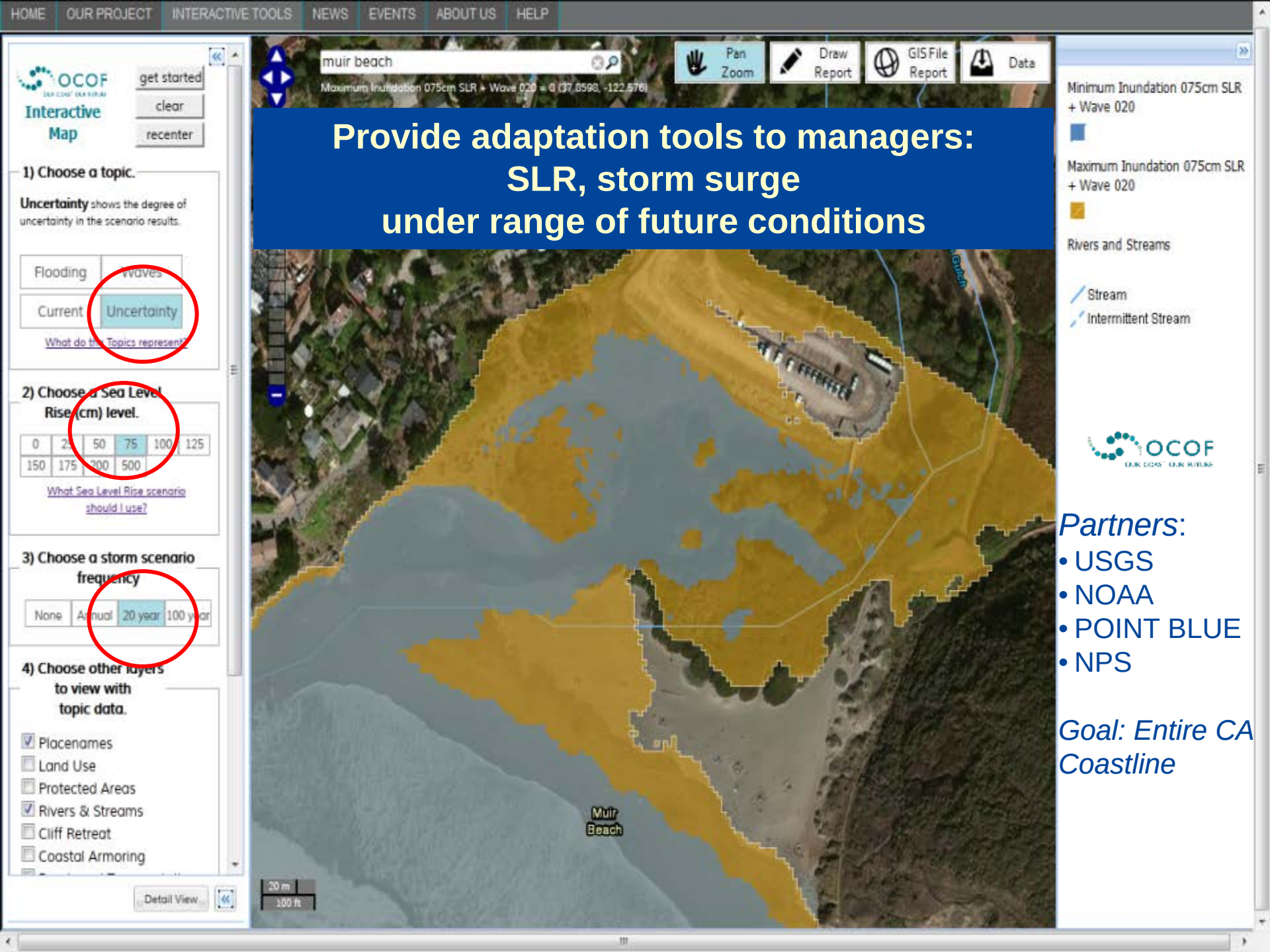
CITY OF VENTURA

STATE OF CALIFORNIA Coastal Conservancy

CALIFORNIA STATE PARKS

SURFRIDER FOUNDATION

http://www.surferspoint.org/


HOME
OUR PROJECT
INTERACTIVE TOOLS
NEWS
EVENTS
ABOUT US
HELP
OCOF
Interactive Map
get started
clear
recenter
1) Choose a topic.
Uncertainty shows the degree of uncertainty in the scenario results.
Flooding
Waves
Current
Uncertainty
What do the Topics represent?
2) Choose a Sea Level Rise (cm) level.
0
25
50
75
100
125
150
175
200
500
What Sea Level Rise scenario should I use?
3) Choose a storm scenario frequency
None
Annual
20 year
100 year
4) Choose other layers to view with topic data.
Placenames
Land Use
Protected Areas
Rivers & Streams
Cliff Retreat
Coastal Armoring
Detail View
muir beach
Maximum Inundation 075cm SLR + Wave 020 = 0 (37.8598, -122.576)
Pan Zoom
Draw Report
GIS File Report
Data
Provide adaptation tools to managers:
SLR, storm surge
under range of future conditions
Muir Beach
20 m
100 ft
Minimum Inundation 075cm SLR + Wave 020
Maximum Inundation 075cm SLR + Wave 020
Rivers and Streams
Stream
Intermittent Stream
OCOF
Partners:
• USGS
• NOAA
• POINT BLUE
• NPS
Goal: Entire CA Coastline

How is OCOF being used? www.ourcoastourfuture.org

NOAA Fisheries & Sonoma County Water Agency

Fisheries Management

(Russian River NOAA Habitat Blueprint)

CalTrans

Infrastructure Vulnerability

Sonoma County

LCP Update

Marin County

SLR Vulnerability Assessment

- C-SMART (outer coast)
- BayWAVE (inner bay)

UC Berkeley

SF Bay Adaptation

Alameda City Council

San Mateo County

SLR Vulnerability Assessment

City of Half Moon Bay

SLR Vulnerability Assessment

General Plan and LCP Update

Santa Clara County

Silicon Valley 2.0

USGS science for a changing world

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What to do in the ocean?

- Reduce human impacts and give species more time to adapt
- Sequester more carbon and reduce OA impacts

MONITORING

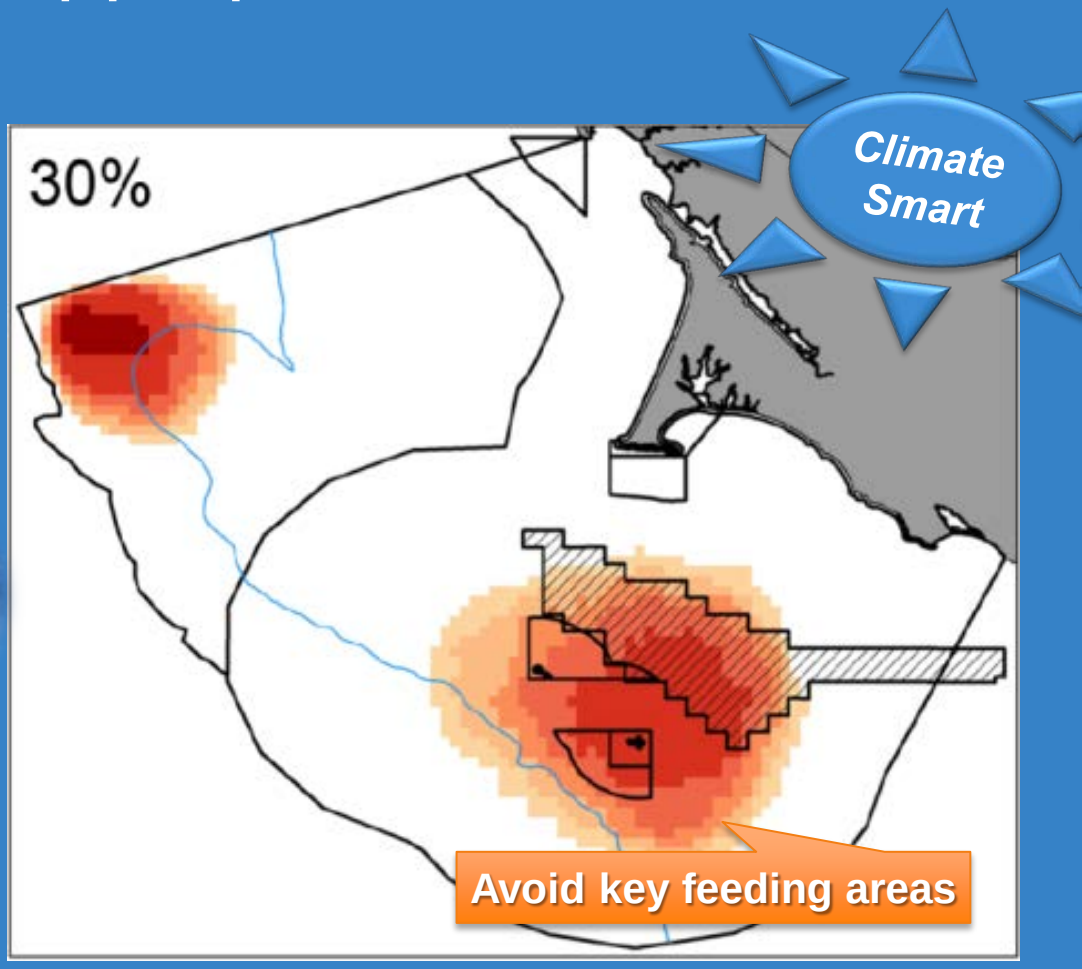
Climate Smart

Conserve Ocean Predators: key role in carbon cycle- cascading impacts saltmarsh, seagrass, mangroves

Atwood, et al. **Predators help protect carbon stocks in blue carbon ecosystems**. *Nature Climate Change*, 2015

Ballard, et al. Biological Conservation 2012

Implement ocean zoning: protect food web hotspots & support appropriate human uses



McGowan, J. 2012. Point Blue/SFSU

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GULF OF THE FARALLONES
National Marine Sanctuary

ACCESS
www.accessoceans.org

Reduce ship strikes on whales: new lanes; near real time

Whale Alert- West Coast citizen science app

Point Blue Conservation Science

NOAA

UCSF

United States Coast Guard
U.S. Department of Homeland Security

Reduce Whale Entanglements

Find Win-Win Approaches to Fishing Gear

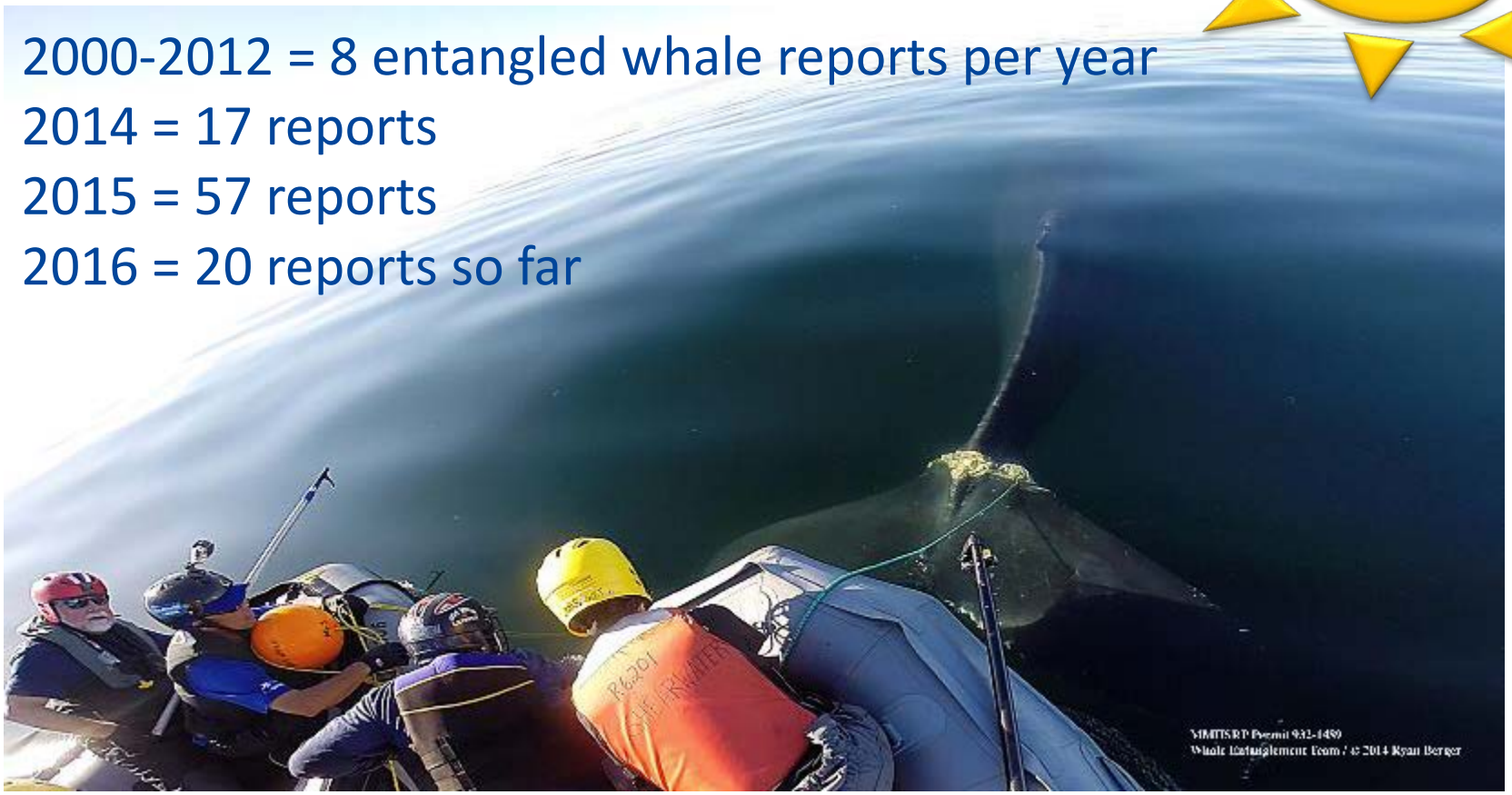
Climate Smart

2000-2012 = 8 entangled whale reports per year

2014 = 17 reports

2015 = 57 reports

2016 = 20 reports so far



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Build Cool Nest Boxes

Temperature at Farallon NWR increased by 4°C (~7°F)

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Install Floating Nest Platforms

Apply the 10% Rule – must also test ways to increase C sequestration in ocean

T = Test &

E = Experiment

N = Now

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Restore seagrass- sequester C, reduce OA impacts, increase habitat, slow wave action

http://www.habitat.noaa.gov/coastalcarbonsequestration.html

http://baynature.org/article/subtleties-of-the-subtidal/

Hejnowicz et al Frontiers in Marine Science 2015
Travathan-Tackett et al Ecology 2015
First National Report on Living Shorelines Institutional Barriers Released 2015 www.estuaries.org

State of California Coastal Conservancy

Restore Kelp Forests: Ocean Macroalgal Afforestation

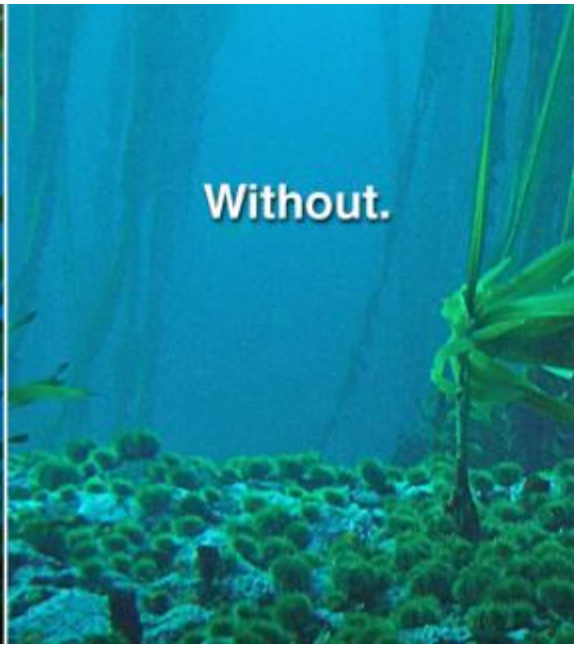
"most exciting, if least understood, option" Tim Flannery

If seaweed farms covered 9% of the ocean they could remove 53 gigatonnes of CO_2 (=~ all current human emissions) and produce enough biomethane to replace all of today's needs in fossil fuel energy ….

N'Yeurt, A. et al., Process Safety and Environmental Protection 2012
Photo: GFNMS, Jared Figurski, UCSC

Recolonize Sea Otters: Key to kelp recovery, sequester C, reduce OA impacts, other benefits

Prey on sea urchins



Hughes et al PNAS 2013
Wilmers et al Frontiers in Ecology and the Environment 2012

No more ‘business as usual’

- Reverse greenhouse gas emissions,
- Transition to clean, efficient and equitable energy and water-use economy, and,
- Prioritize nature-based solutions-- *required for success.*

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Coastal Adaptation- We have choices!

Additional

4-5 feet

Point Blue

Redwood City shoreline

What will each of us start doing differently today?

Be bold, innovate and optimize the power of nature-based climate solutions!

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Whale Populations Stable Despite Warming Ocean

Climate-smart conservation zones protect wildlife, food web & local fishing economy

March 2025

Photo: Frederic Larson, SF Chronicle

Major Investments in Nature-based Solutions Pay Off!

Nutrient pollution halted, carbon captured and wildlife increased despite drought and snow-pack loss

August, 2030

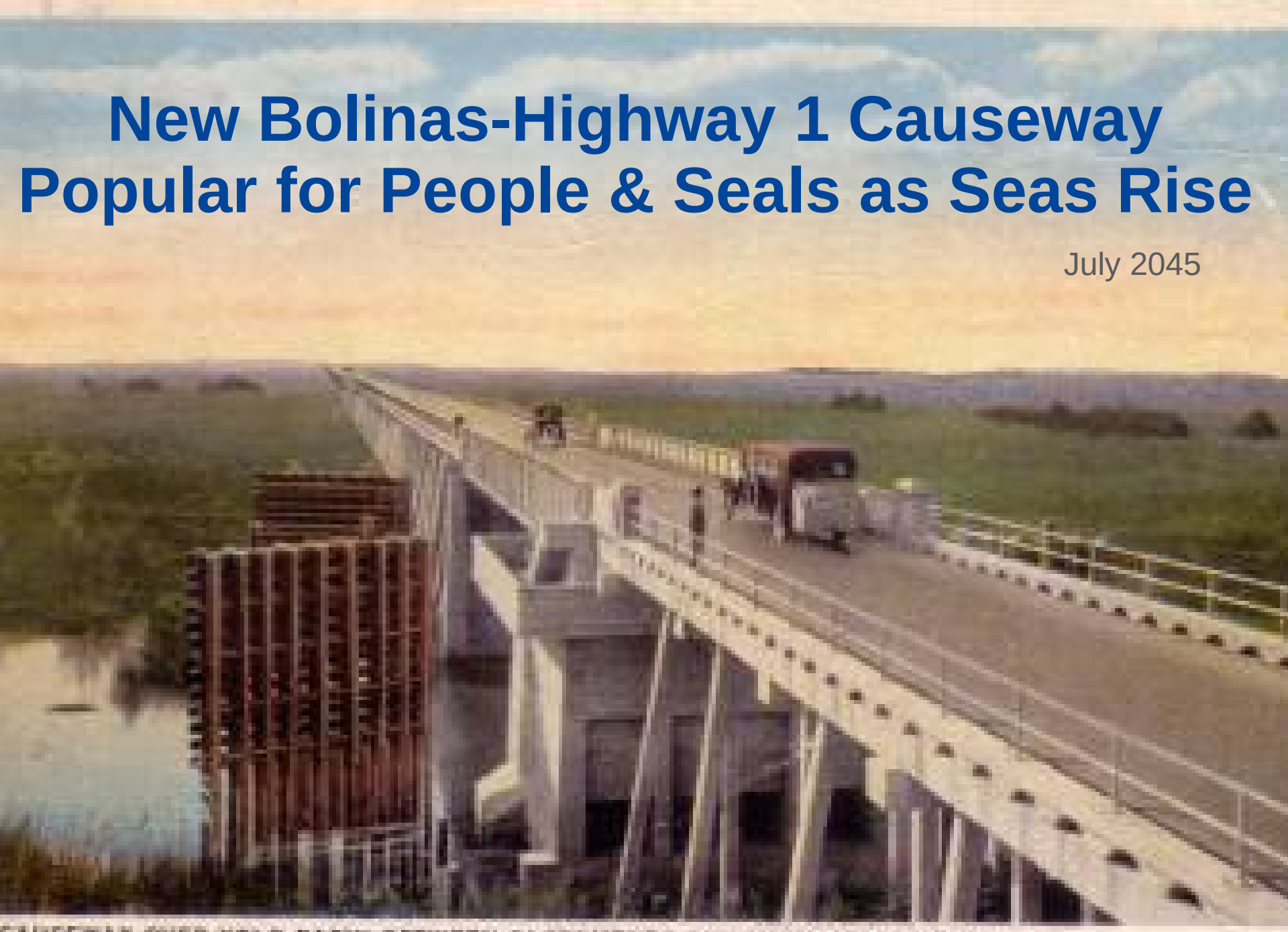
Sea Otters Thriving and Kelp Forests Return

More wildlife, more carbon stored, healthier ocean

March 20

New Bolinas-Highway 1 Causeway Popular for People & Seals as Seas Rise

July 2045



CAUSEWAY OVER YOLO BASIN BETWEEN SACRAMENTO AND DAVIS, CALIFORNIA.

Green Infrastructure Protects NYC from Latest Superstorm

following Bay Area's lead

October, 2050

Architecture Research Office and dlandstudio
NY Times Nov 2012






Because of our collaborative climate-smart conservation actions today, healthy ecosystems will sustain thriving wildlife & human communities well into the future…





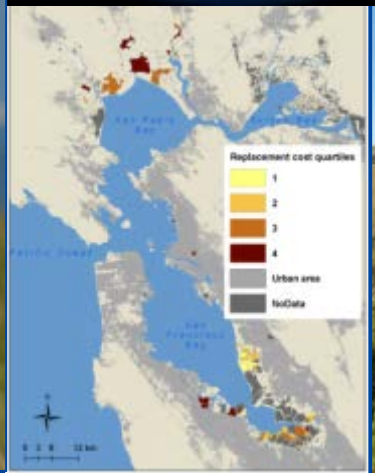




Point Blue
Conservation science
for a healthy planet.






Replacement cost quartiles
1
2
3
4
Urban area
NoData



Thank You!

Anonymous (2)
11th Hour Fund
Audubon California
Bay Area Ecosystems Climate Change Consortium
S.D. Bechtel, Jr. Foundation
Bernice Barbour Foundation
Bureau of Reclamation
Bureau of Land Management
California Coastal Conservancy
California Department of Fish and Game
California Department of Water Resources
California Bay Delta Authority
California Landscape Conservation Cooperative
California State Parks
Central Valley Joint Venture
Faucett Catalyst Foundation
Richard Grand Foundation
Marin Community Foundation
Giles Mead Foundation
Moore Family Foundation
David and Lucile Packard Foundation
National Park Service
National Science Foundation
NOAA National Marine Sanctuaries
Natural Resource Conservation Service
Resources Legacy Fund Foundation
San Francisco Bay Joint Venture
The Nature Conservancy
U.S. Fish and Wildlife Service
USDA Forest Service
US Geological Survey
USDA Natural Resources Conservation Service
and Point Blue Board, Members and Staff

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NMS: Watershed Context

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http://ww2.kqed.org/science/2014/02/03/helping-to-heal-the-san-francisco-bay-delta-watershed-through-art/
https://www.columbus.gov/Templates/Detail.aspx?id=41532

Restore mountain meadows: 30k acres by 2030

Climate Smart

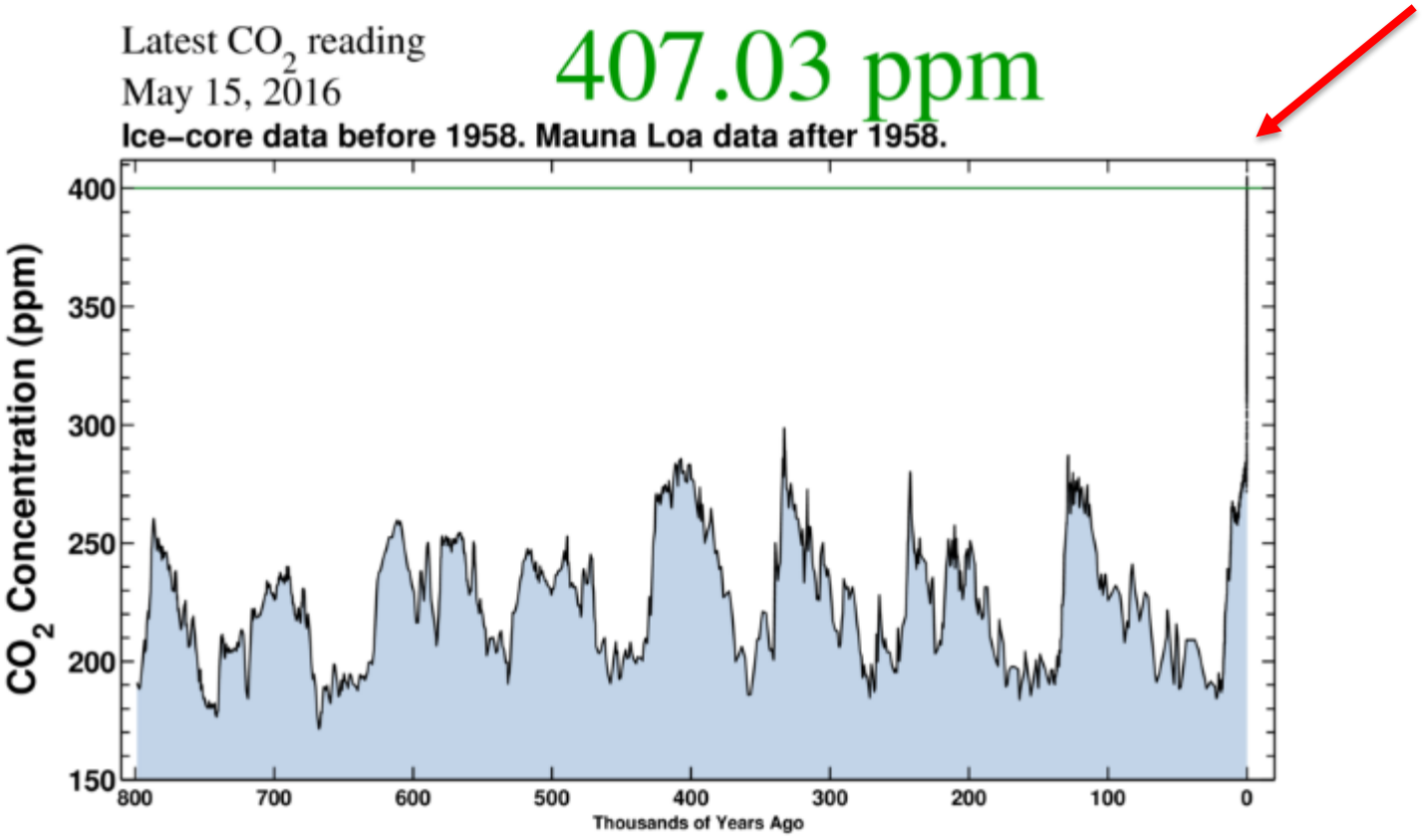
Sierra Meadow Partnership:

- Cal Trout
- Stillwater Sciences
- Point Blue Conservation Science
- TNC
- USFS
- UC Davis Watershed Sciences
- American Rivers
- Trout Unlimited
- Institute for Bird Populations

Healthy meadows sequester more carbon, recharge aquifers, sustain more birds, and provide other benefits

Norton et al. 2011
Point Blue - unpublished

CO2 – exceeded 409 ppm in HI and 400 ppm in Australia for first time in April



https://scripps.ucsd.edu/programs/keelingcurve/
http://www.theguardian.com/environment/2016/may/11/worlds-carbon-dioxide-concentration-teetering-on-the-point-of-no-return

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Ocean acidification

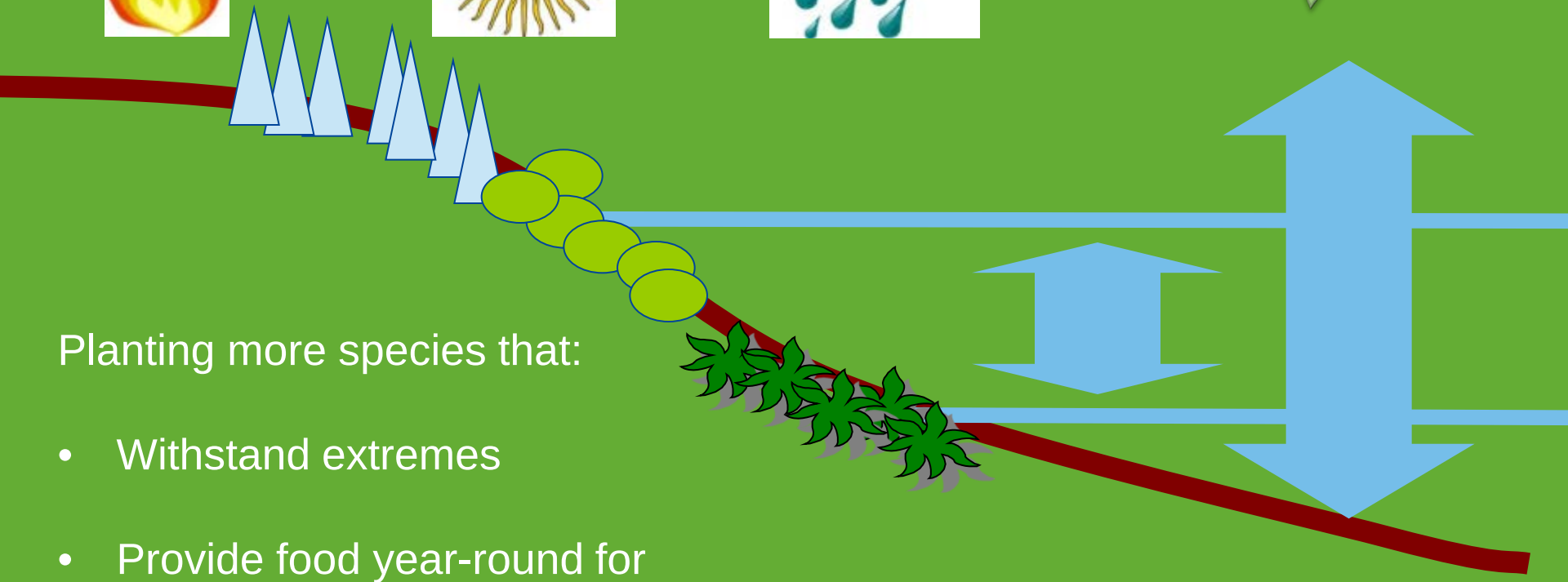
- Mussels grew fastest in more acidic conditions with abundant food supply;
- Manage locally for multiple envir. drivers

R. Feely, PMEL

Coral bleaching near Heron Island, Australia, Feb 2016; www.slate.com

Kroeker, et al Ecology Letters, 2016

Climate-Smart Ecological Restoration



Planting more species that:

- Withstand extremes
- Provide food year-round for disrupted phenologies

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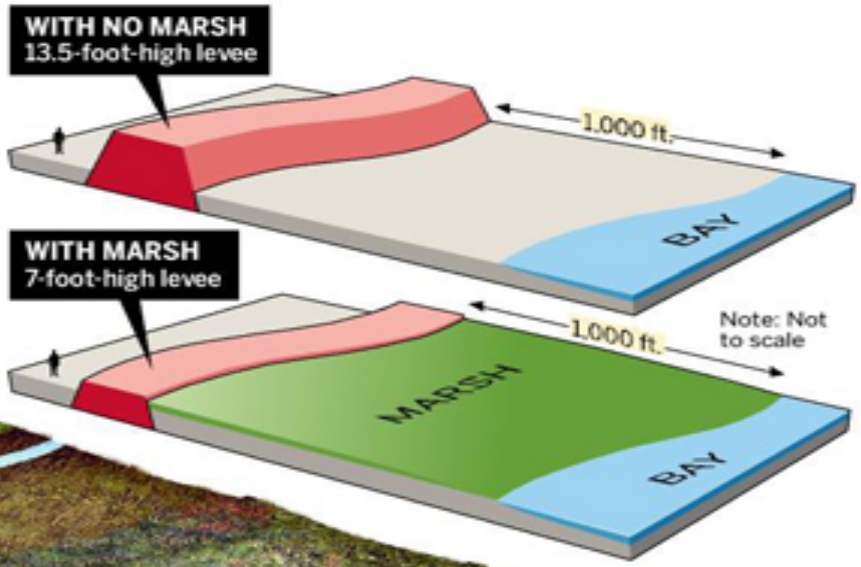
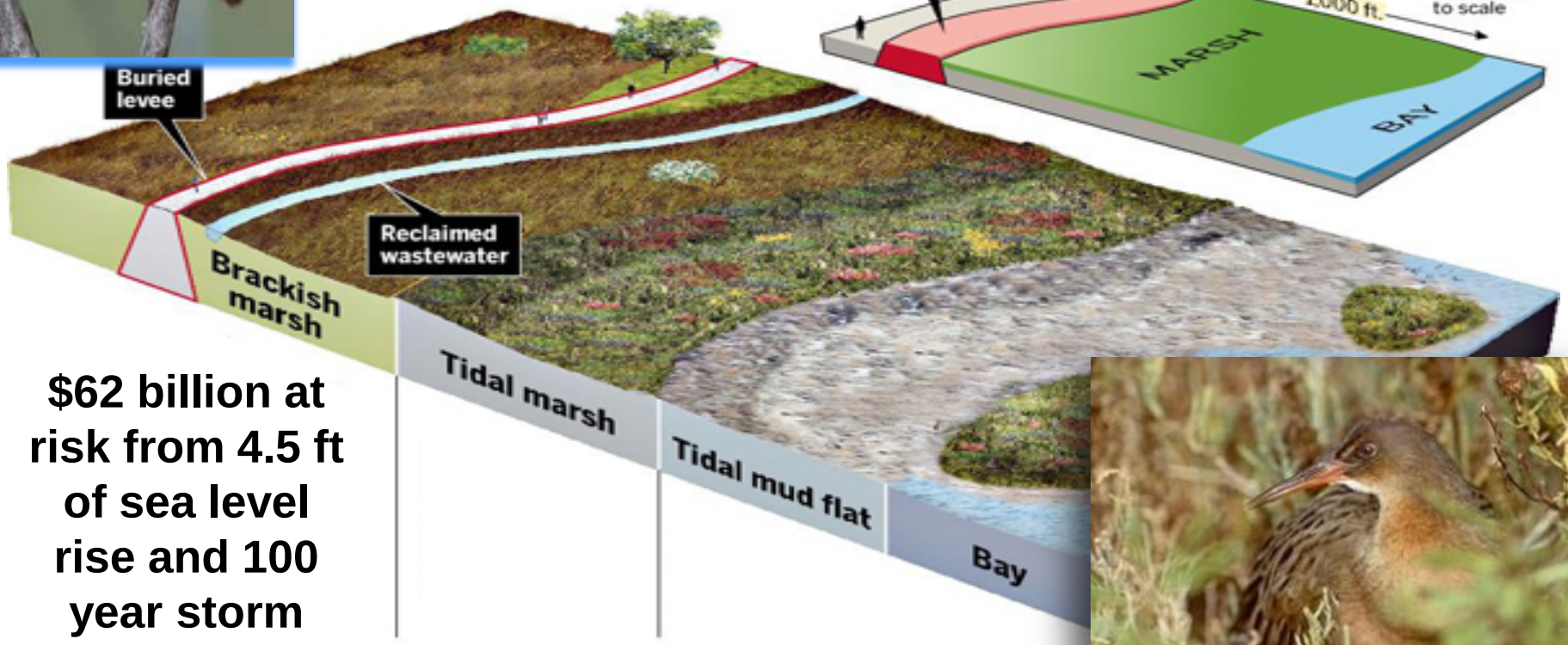
- **Climate-smart Restoration Tool Kit:** http://www.pointblue.org/our-science-and-services/conservation-science/habitat-restoration/climate-smart-restorationtoolkit/
- Seavy et al., **Why climate change makes riparian restoration more important than ever**. *2009. Ecological Restoration* Ecol. Rest. v27

Nature- Based Solutions for Sea Level Rise





$62 billion at risk from 4.5 ft of sea level rise and 100 year storm

The Bay Institute, 2013

Nature-based Solutions- New Policies

President Obama Policy Guidance Oct 7, 2015: **directs all federal agencies to incorporate natural infrastructure and ecosystem services into planning and decision making.**

Governor Brown 2015

- **Exec Order B-30-15:** Includes requiring state agencies to **prioritize natural infrastructure solutions** & prioritize actions that both address build preparedness and reduce GHGs
- **Healthy Soils Initiative:** for ag practices that sequester carbon, reduce GHGs and support biodiversity

CA--AB 1482 (Gordon): Requires all state agencies to use the climate **adaptation strategy to inform planning decisions --includes natural infrastructure.**

CA--SB 379 (Jackson): Requires cities and counties to **include climate adaptation in their general plans –including natural infrastructure** actions.

TRADE - OFFS

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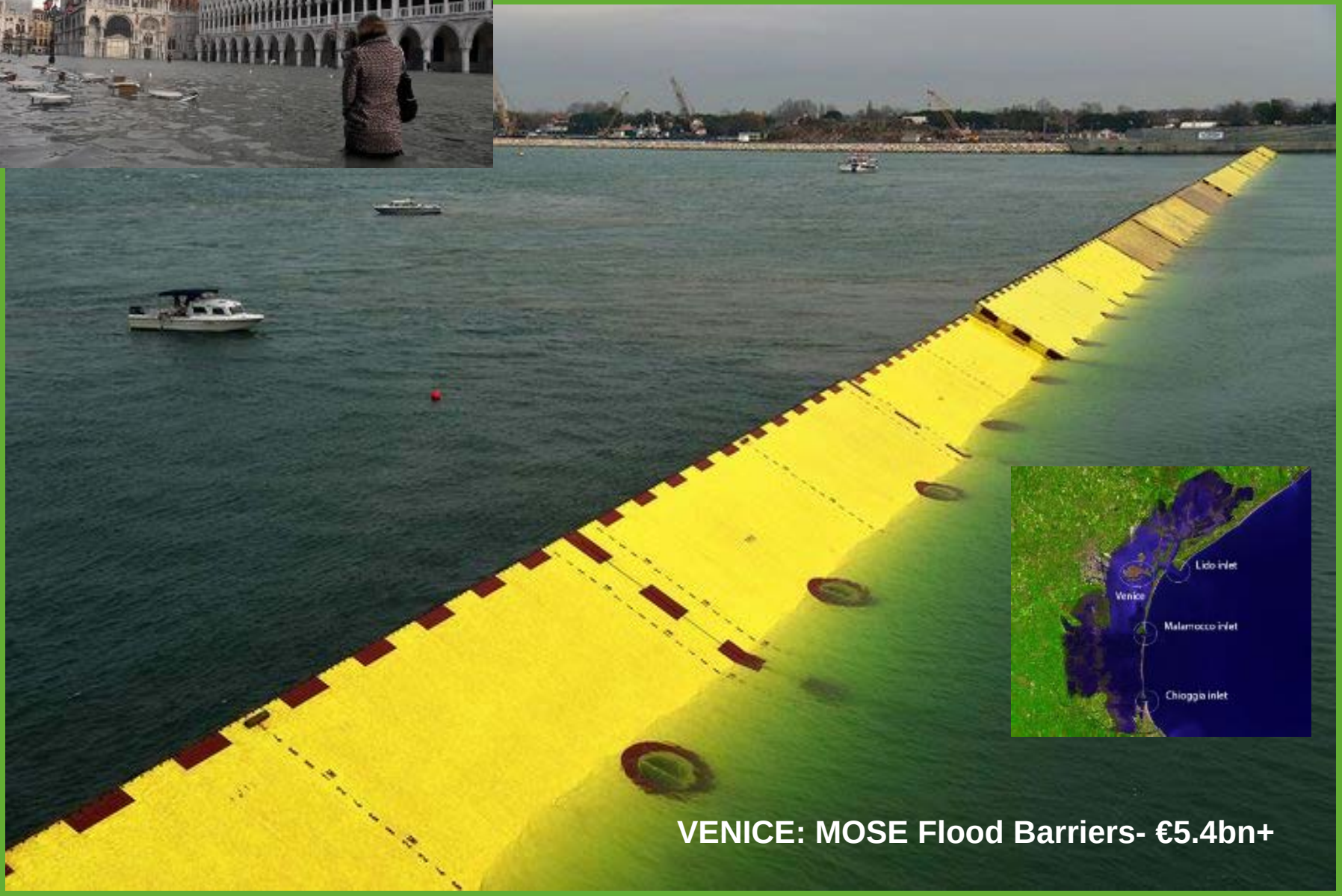
We have choices….

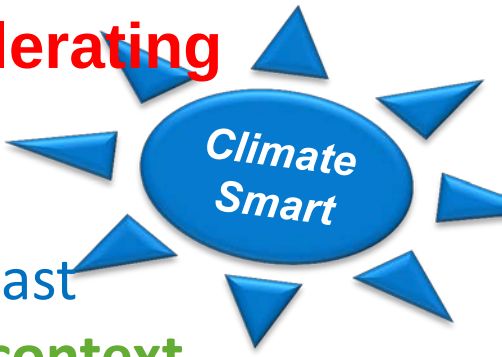


VENICE: MOSE Flood Barriers- €5.4bn+

IN SUMMARY– Climate Smart

Climate change is happening now and accelerating

We must engage in Climate Smart actions daily:



1. **Focus actions on future** conditions, not past
2. Design actions in **ecosystem/watershed context**
3. Employ **flexible, adaptive approaches** for timely response to continual change
4. **Prioritize actions** across multiple scenarios for greatest benefits to wildlife and people
5. **Collaborate & communicate across sectors** for timely, long term solutions; convey science *and* hope!
6. **Follow the TEN% Rule**: Test and Experiment Now!