DFG Climate College: Lecture #2

Ellie Cohen

PRBO Conservation Science

October 15, 1:30-2:30

Climate 101; understanding the basics of climate science and what we can do about it

DFG CLIMATE COLLEGE
California Department of Fish & Game

Course Logistics and Reminders

- All participants - DFG Climate College website
  - Course schedule
  - Reading materials

www.dfg.ca.gov/Climate_and_Energy/Climate_Change/Climate_College

Climate College website

www.dfg.ca.gov/Climate_and_Energy/Climate_Change/Climate_College

Climate College - California Department of Fish and Game - Windows Internet Explorer

http://www.dfg.ca.gov/Climate_and_Energy/Climate_Change/Climate_College/

Home | Recreation | Resource Management | Enforcement | Marine | Spills | Education | Science Institute | Data & Maps

Wildlife and Habitat Management

Climate Science Program

- Activities
- Resources
- DFG Climate College
- DFG Climate Stakeholders
- DFG Going Green
- Climate Change Case Studies
- Vulnerability Assessment Tools
- Western Association of Fish and Wildlife Agencies
- Director's Bulletins
- Legislation and Policy

Climate Science and Renewable Energy Branch
1416 9th Street
Sacramento, CA 95814
climatechange@dfg.ca.gov

Home » Climate and Energy » Climate Change » **Climate College**

DFG Climate College

In support of DFG's Science Institute initiative, the Fish and Wildlife Strategic Vision and the upcoming strategic vision process, the DFG Climate Science Program is proud to announce the first of its kind lecture series on climate change as it relates to the mission of DFG. The DFG Climate College is designed to cover the fundamentals of climate science and provide tools and resources necessary to empower participants to better incorporate climate change into their professional responsibilities. In the spirit of increasing climate literacy and partnership the course is **open to all partners and the public**. We encourage all who are interested to participate either in person or via WebEx.

Climate College overview video (6 minutes)

Registration*

- DFG STAFF REGISTRATION
- **ALL OTHER PARTICIPANTS**: If you are not a DFG staff member please register by sending an email to Registrar@dfg.ca.gov with your name, email address, organization, and whether or not you intend to participate in-person or via WebEx.

*Note: You must register for each individual lecture/class **at least two days** prior to the scheduled lecture. If you would like to register for ALL classes at once, please submit a request to Registrar@dfg.ca.gov indicating that you would like to register for every class in the course.

*Note: Expect a registration confirmation prior to the lecture. Check your junk mail/spam before contacting the registrar.

CLIMATE SCIENCE PROGRAM

Conservation Today for a Better Tomorrow
California Department of Fish and Game

presents

DFG Climate College

- Course Schedule and Materials
- Training Certification
- Partners

For more information contact climatechange@dfg.ca.gov

Climate College website: Schedule

www.dfg.ca.gov/Climate_and_Energy/Climate_Change/Climate_College

DFG Climate College Course Schedule and Materials - Windows Internet Explorer

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Home » Climate and Energy » Climate Change » Climate College » Course Schedule

Course Schedule and Materials

Below is a list of lectures and speakers for DFG's Climate College 2012-2013. Lectures are open to anyone who is interested in participating, and will be recorded and posted for those unable to join on the day of the event. Click on each lecture below for more information on the speaker(s), reading materials, companion webinars, and additional registration information.

September 18, 2012

California leading the way on climate action; where we go next is up to you! This lecture is a climate town hall with Director Bonham and representatives from the Governor's Office. Speakers:

- Chuck Bonham, Director, DFG
- Ken Alex, Senior Policy Advisor to Governor Jerry Brown, Director of the Office of Planning and Research
- Cliff Rechtschaffen, Senior Policy Advisor to Governor Jerry Brown
- Amber Pairis, Climate Change Advisor, DFG

Lecture 1 presentation (PDF)
Due to a technical difficulty there is no archived webinar for this lecture. Apologies for the inconvenience.

October 15, 2012

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Climate College website: Schedule

www.dfg.ca.gov/Climate_and_Energy/Climate_Change/Climate_College

DFG Climate College

Lecture #2

Title: Climate 101; understanding the basics of climate science and what we can do about it
Speaker: Ellie Cohen, President and CEO, PRBO Conservation Science
Date: October 15, 2012 (Monday)
Time: 1:30 – 2:30PM
Location: DFG headquarters in Sacramento, Natural Resources Agency building Auditorium
WebEx: Lecture also available to view via WebEx. We encourage DFG staff participating remotely to watch the lectures together by reserving a conference room with DSL. The powerpoint presentation will be posted in advance to minimize interruption for remote users due to WebEx or bandwidth complications. Because of a limit to the number of WebEx participants, we encourage those in the Sacramento area to attend in person.

Registration for Lecture #2
DFG STAFF CLICK HERE TO REGISTER
ALL OTHER PARTICIPANTS: If you are not a DFG staff member please email Registrar@DFG.ca.gov with your name, email address, organization, and whether or not you intend to participate in-person or via WebEx.
*Note: Please register at least two days prior to the lecture. If you would like to be registered for ALL classes at once, please submit a request to Registrar@DFG.ca.gov.

Suggested reading materials recommended by the speaker

- EPA : www.epa.gov/climatechange - excellent overview
- Skeptical Science: www.skepticalscience.com/ - rebuttals to common arguments with excellent information and citations
- Climate-Smart Adaptation Principles. National Wildlife Federation. www.nwf.org/Global-Warming/Climate-Smart-Conservation/Adaptation-Principles.aspx
- California Governor's Office of Planning and Research: Climate Change: Just the Facts

See additional resources in the "Climate Change, Ecosystems and Adaptation Resources List" provided below.

Speaker Biography
Ellie M. Cohen has served as President and CEO of PRBO Conservation Science

Course Logistics and Reminders

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- DFG Staff – there is an online discussion forum!

DFG Discussion Forum

Climate Roundtable - DFGIntranet - Windows Internet Explorer

http://dfgintranet/portal/ExploreDFG/Divisions/ECD/ClimateScienceandSustainability/TheClimateSustainabilityRoundtable/tabid/1696/forumid/40/scope/threads/Default.aspx

Roundtable

Join the Forum: DFG Bikes!

Review DFG Climate College Materials

LeftNav_BOTTOM

The Climate & Sustainability Roundtable

In order to enhance communication between the DFG climate team and DFG staff, this forum will provide a means for exchanging information related to climate change among DFG staff and foster internal communication regarding DFG climate change updates, news on recent research and publications, conference announcements, and more. Participation in this group will be a great way to learn how the DFG is integrating climate change into its daily functions and collaborative activities with stakeholders.

In order to participate in the forum, you will need to log in to this site with your Novell user name and password. To do so, simply click on the "Editor Login" link in the upper right-hand corner of this page. Then click on the "DFG" button, enter your Novell/GroupWise username and password, and click on the "Login" button. You will then be able to add to existing discussion threads or start a new thread within the forum. Questions or additional information please email climatechange@dfg.ca.gov.

Forum guidelines:
1. Maintain courteous and respectful discussions.

Settings

Climate & Sustainability Roundtable (you must log in to participate)

Climate Roundtable Forum ▸ Discussions ▸ Climate Roundtable

Show No Replies

New Thread

Threads	Replies	Views	Last Post
DFG Staff, tell us what you think about climate change! by WALBRIGHT@dfg.ca.gov	0	1	Today @ 2:42 PM by WALBRIGHT@dfg.ca.gov
Google street view-climate effects on reefs by APAIRIS@dfg.ca.gov	0	1	10/3/2012 10:53 AM by APAIRIS@dfg.ca.gov
Coastal Salt Marshes Will Sequester Carbon until Submerged by Sea			10/3/2012 10:51 AM

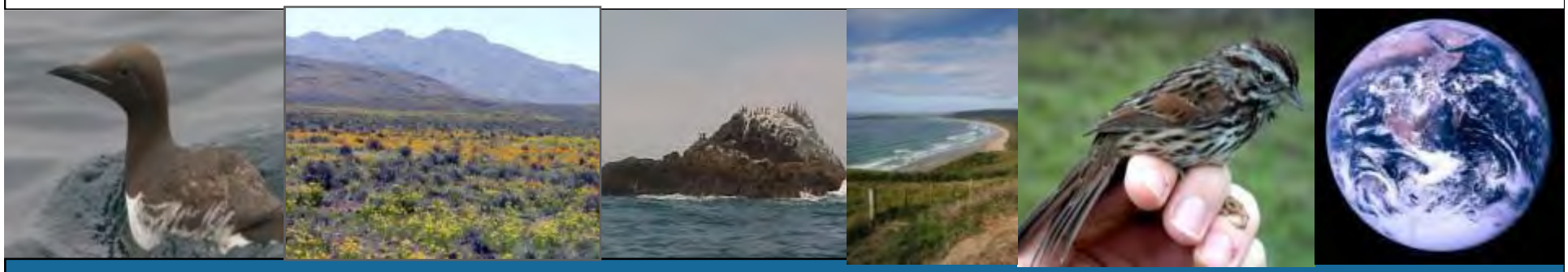
A Couple Reminders for Today

- Everyone will be muted for recording purposes

- On the phone – please submit questions via Chat to the Host (unanswered questions will be saved)

prbo

PRBO Conservation Science



Climate Smart Conservation: Climate change and nature-based solutions for wildlife and people

CA Dept. of Fish & Game Climate College
Ellie M. Cohen and PRBO Staff

October 15, 2012

PRBO Conservation Science

Improve conservation outcomes through ecosystem studies, restoration, outreach and partnerships

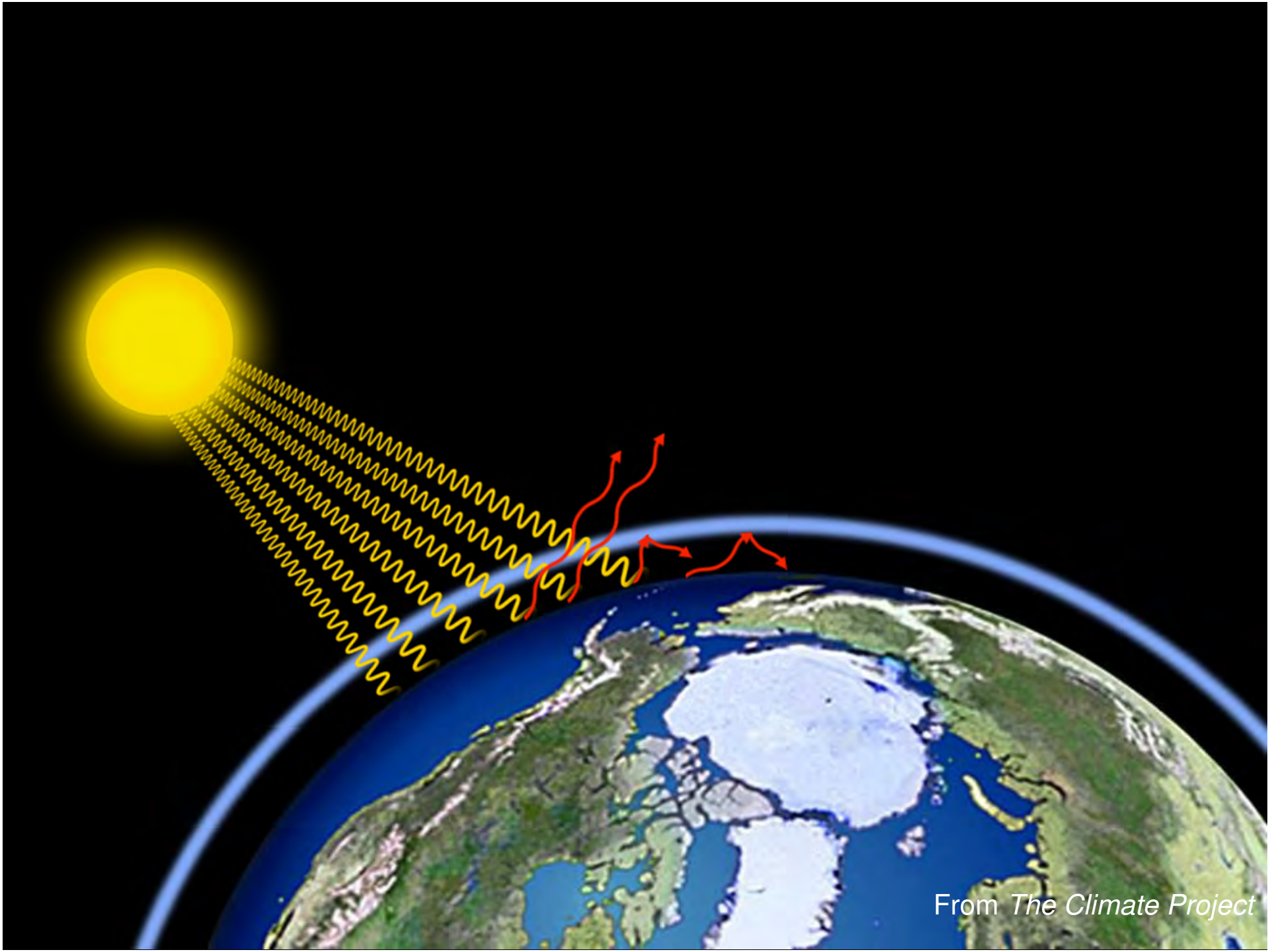
- Founded in 1965
- 140+ staff and seasonal biologists
- 2012 Budget: ~$10m

PRBO Conservation Science

PRIORITY: Reduce Impacts of Environmental Change on Ecosystems & Enhance Capacity to Adapt

Today's Presentation

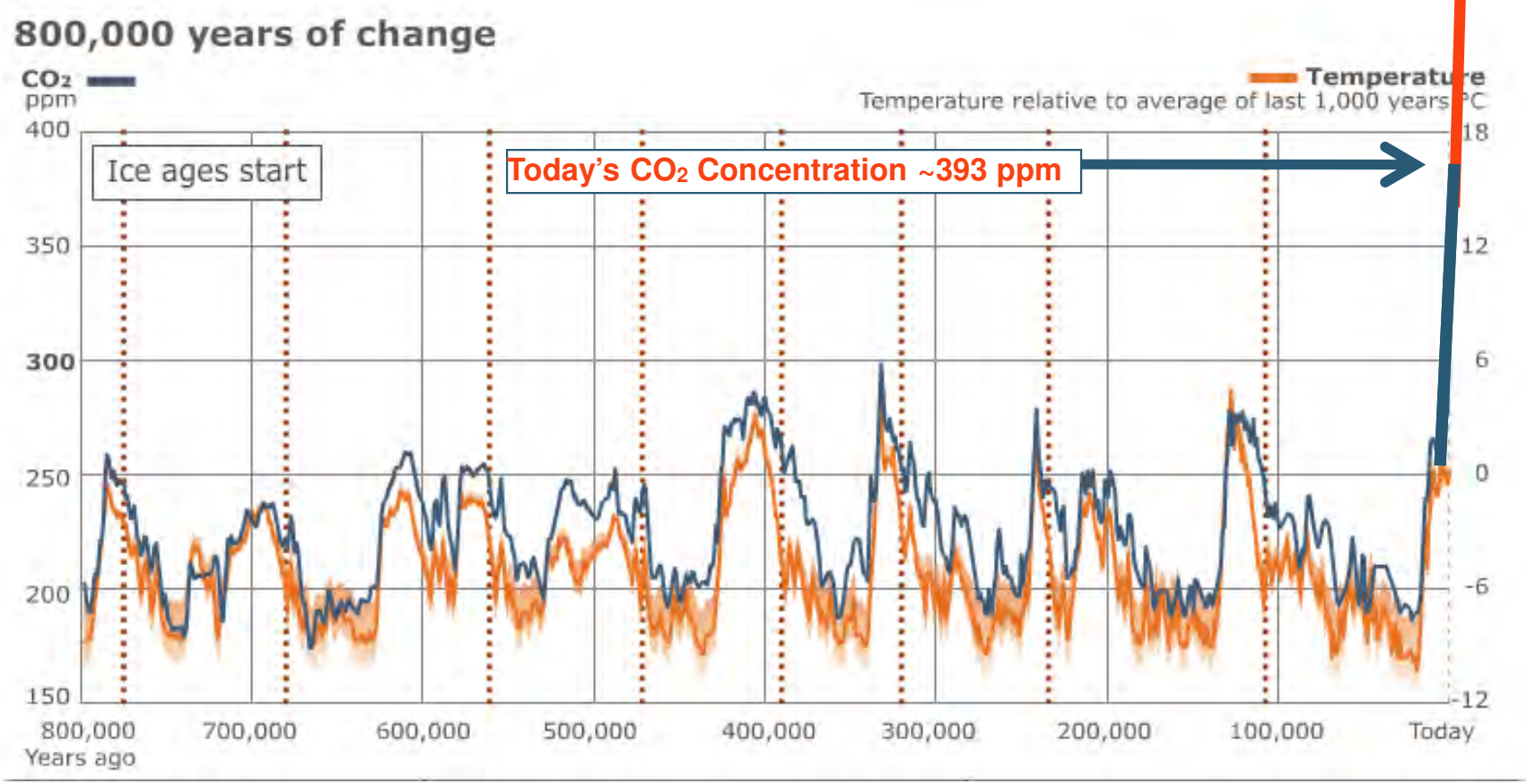
1. Climate Change
   - Overview
   - Latest findings globally, in California
2. Climate Smart Conservation
   - Key Principles
   - Examples
3. What we can do!


From *The Climate Project*

PRBO Conservation Science

CO2- higher than anytime in 800,000 years … or 15-20 million years?

By 2050 with "business as usual" -CO2 at 600 ppm"



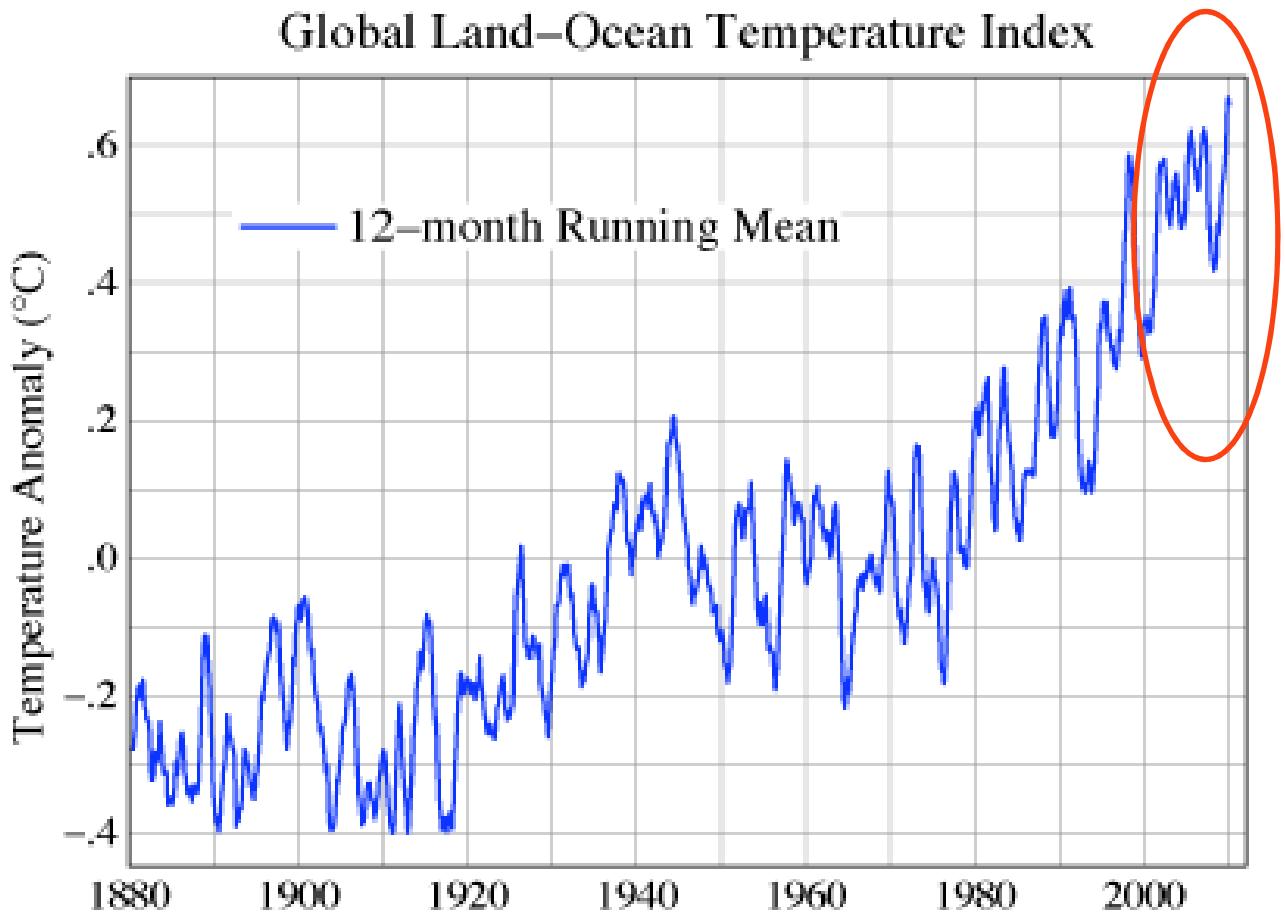
British Antarctic Survey; *BBC News, December 3, 2009*

Last time sustained CO2 levels this high --15-20 m years ago, SL 25-40 m higher, 3-6C warmer– Tripati et al, Science, Dec 2009

used ratios of boron to calcium in foraminifera - marine algae ; **atmospheric CO2 was stable at about 280 ppm for almost 10,000 years until 1750

2000-2009 Warmest Decade on Record (1990-1999 was warmest before that)

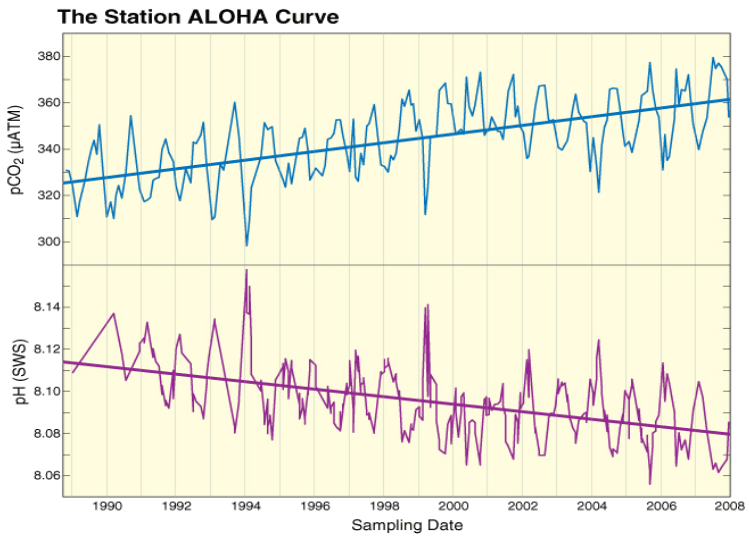
- Jan-Sept 2012 warmest, most extreme in contiguous US on record
- July 2012- warmest month ever recorded



NASA's Goddard Institute for Space Studies http://data.giss.nasa.gov/gistemp/
NOAA National Climatic Data Center- http://www.ncdc.noaa.gov/sotc/global/
http://www.ncdc.noaa.gov/sotc/national/2012/9

PRBO Conservation Science

Ocean Acidification (OA)- *Fastest rate in 300m yrs; alters ocean chemistry, breaks down shells*

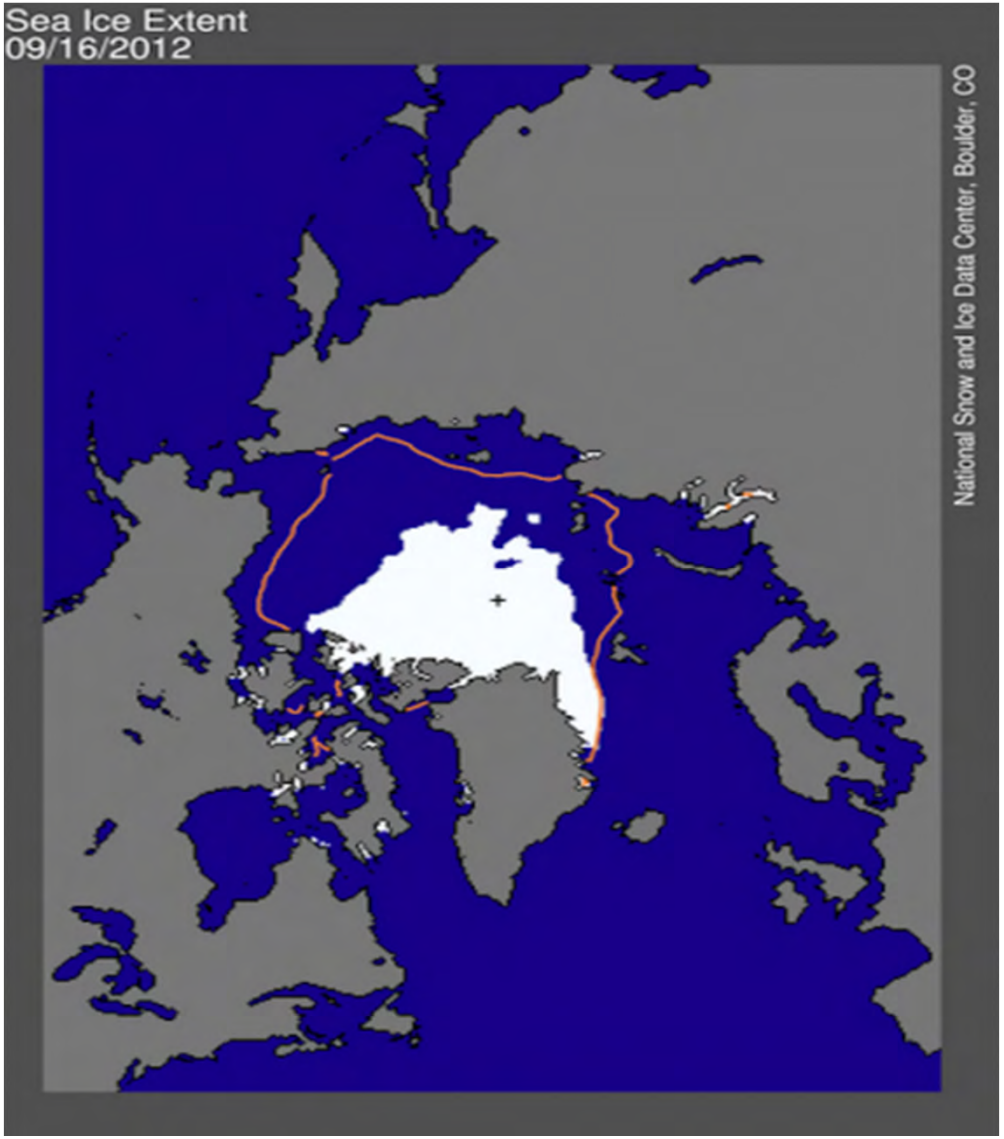


More CO2 (blue) = more acidic ocean/lower pH (purple)
8.1 pH current globally, 7.8 pH projected by 2100 *(IPCC "business as usual" scenario);*
7.7 pH in Puget Sound, spring 2010, impacts young oysters

Hönisch et al **The Geological Record of Ocean Acidification**. *Science*, March 2, 2012; *Ridgwell & Schmidt Feb 14 2010 Nature Geoscience* lower ph in past =mass extinctions; tipping point pH of 7.8- calcified organisms begin to disappear; jelly-dominated future?

Arctic sea ice extent lowest on record, Sept. 16, 2012

Half 1980 size; entirely gone by Sept. 2016?

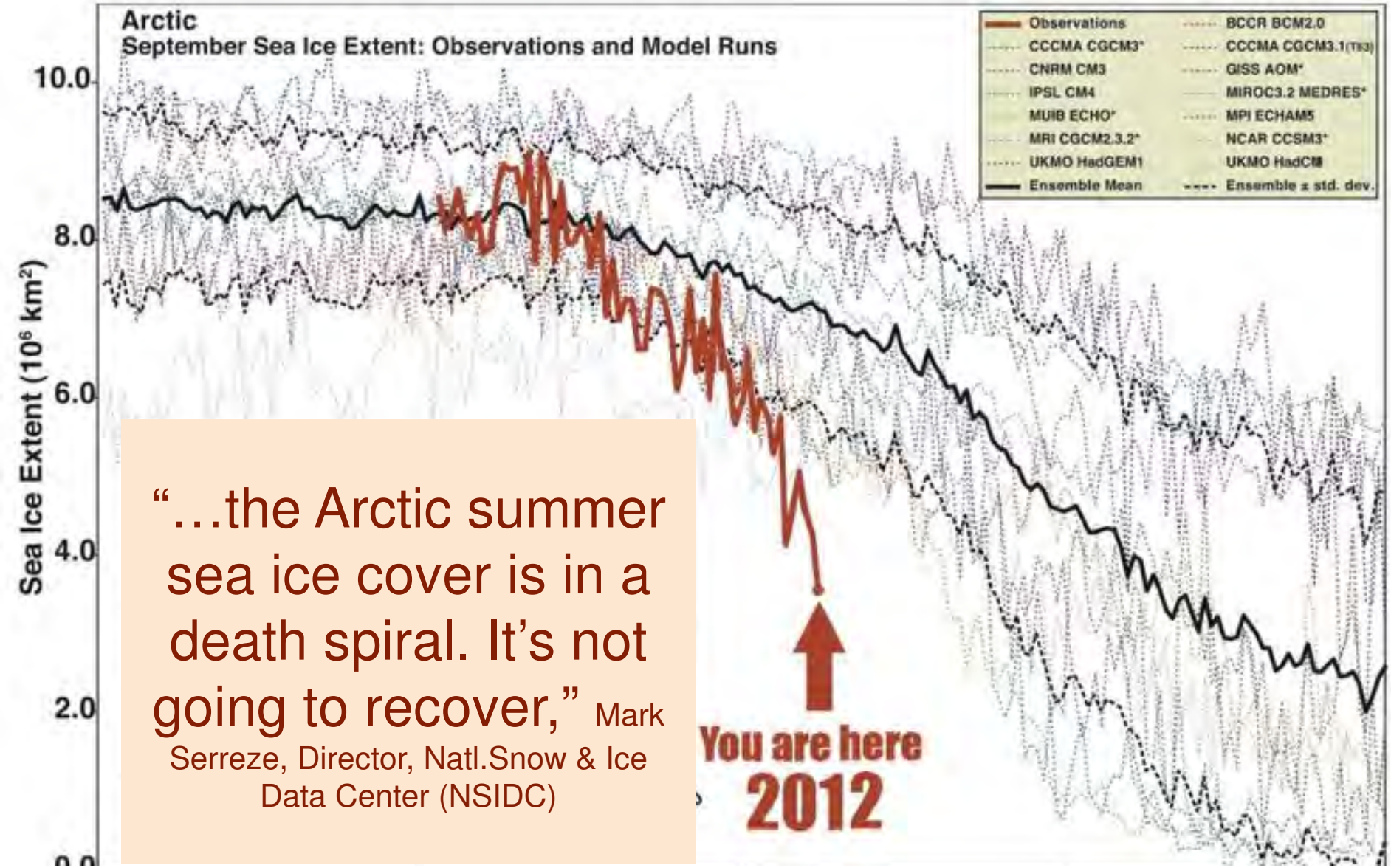


- White: 2012 minimum sea ice extent
- Orange: median ice extent from 1979-2000
- Blue: ocean

National Snow and Ice Data Center

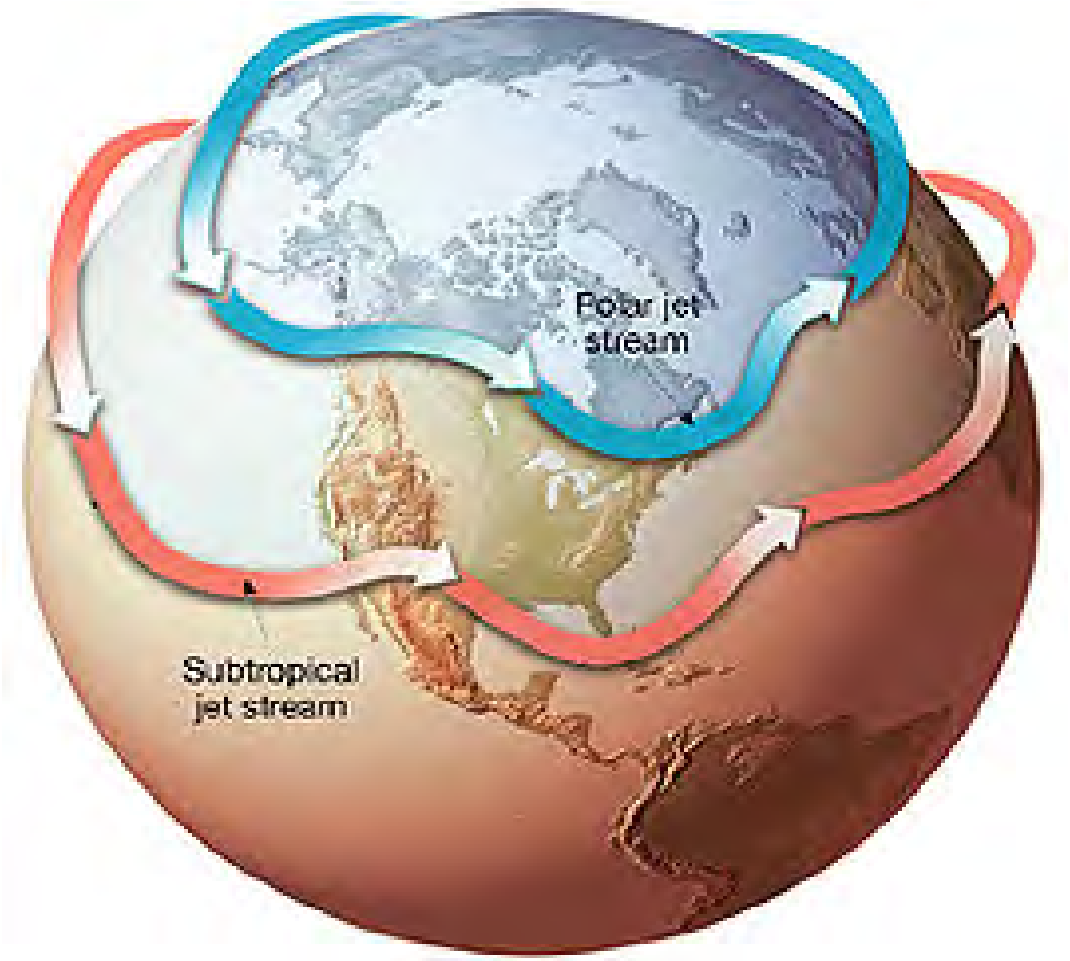
Arctic expert predicts final collapse of sea ice within four years, "global disaster" unfolding--Peter Wadhams, global ice expert, Univ. Cambridge, Guardian UK Sept 17 2012

Arctic sea ice melting much faster than projected



"…the Arctic summer sea ice cover is in a death spiral. It's not going to recover," Mark Serreze, Director, Natl.Snow & Ice Data Center (NSIDC)

A warming Arctic – destabilizes jet stream, which affects mid-latitude weather.



NOAA graphic; Arctic sea ice shatters previous low recordshttp://nsidc.org/news/press/20121002_MinimumPR.ht
Overland et al GEOPHYSICAL RESEARCH LETTERS, VOL. 39, L19804, 6 PP., Oct 10 2012

PRBO Conservation Science

Arctic permafrost melting: “positive” feedback- up to1.5° F additional warming by 2100

Scientific American– *Once frozen solid, permafrost near the Arctic is melting, creating conditions for decomposition of organic matter and the release of carbon as CO2 and methane. Image -NASA; MacDougall et al* **Significant contribution to climate warming from the permafrost carbon feedback** *Nature Geoscience* **Sept 9 2012**

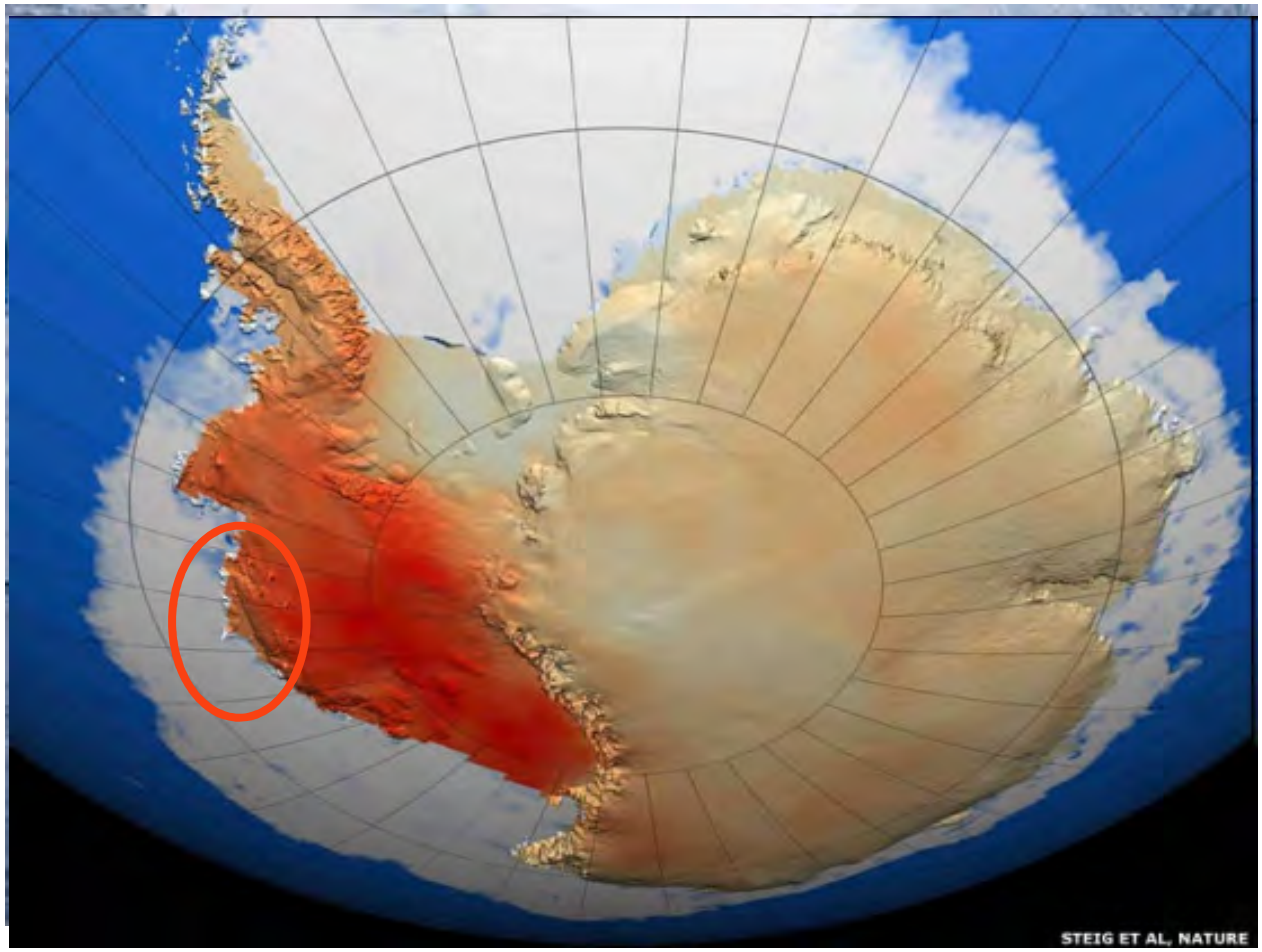
Ice Sheets Melting Faster– *both polar regions*

Pine Island Glacier (bigger than NYC):

-melting into sea at rate of 2.5 miles per year or 35 ft per day

Greenland 2012-

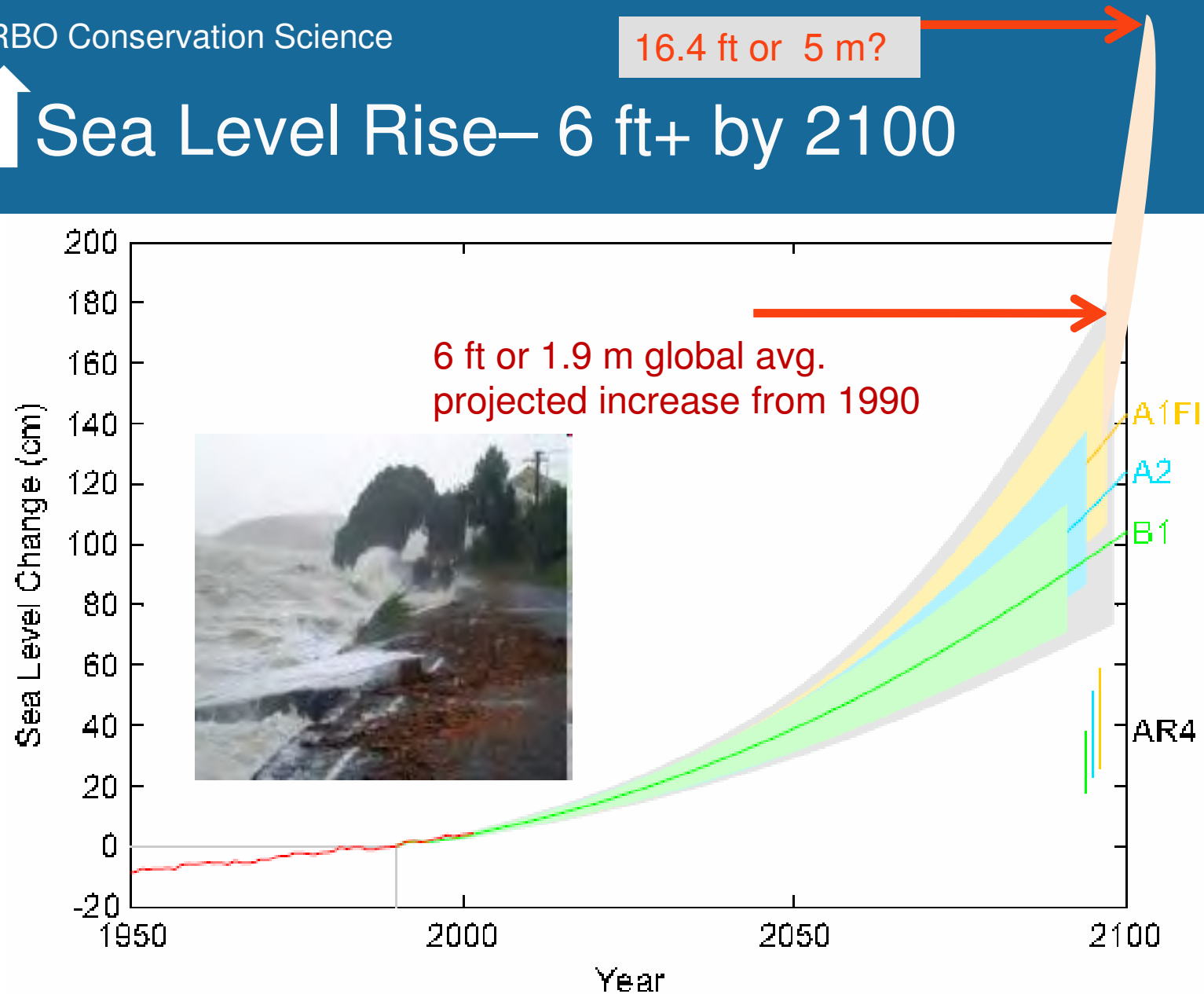
unprecedented surface ice melt in 2012



Steig, et al, *Nature* 457, 459-462 Jan 22 2009 "State of Polar Research" Feb 25, 2009
Observations beneath Pine Island Glacier in West Antarctica and implications for its retreat
Nature Geoscience June 6 2011
N. R. Golledge, et al *Proceedings of the National Academy of Sciences*, 2012

PRBO Conservation Science

Sea Level Rise– 6 ft+ by 2100



Vermeer, M., Rahmstorf, S. PNAS, December 2009; Hansen, Sato:/ NASA: July 2011. http://arxiv.org/abs/1105.0968v3 ice sheet disintegration is nonlinear - *doubling ice loss every decade = meters SLR by 2100; Also see:* National Academy of Sciences West Coast Sea Level Rise Report (June 2012) up to 1 ft by 2030, 2 ft by 2050, 5.5 ft by 2100

PRBO Conservation Science

SLR + high tides + storm surges = catastrophic coastal flooding

- *3 ft. SLR*
- *4 ft.+ high tide*
- *10 ft. wave surges*

= 17 ft. of flooding

•1 in100 yr extreme floods every year by ~2100 with projected SLR

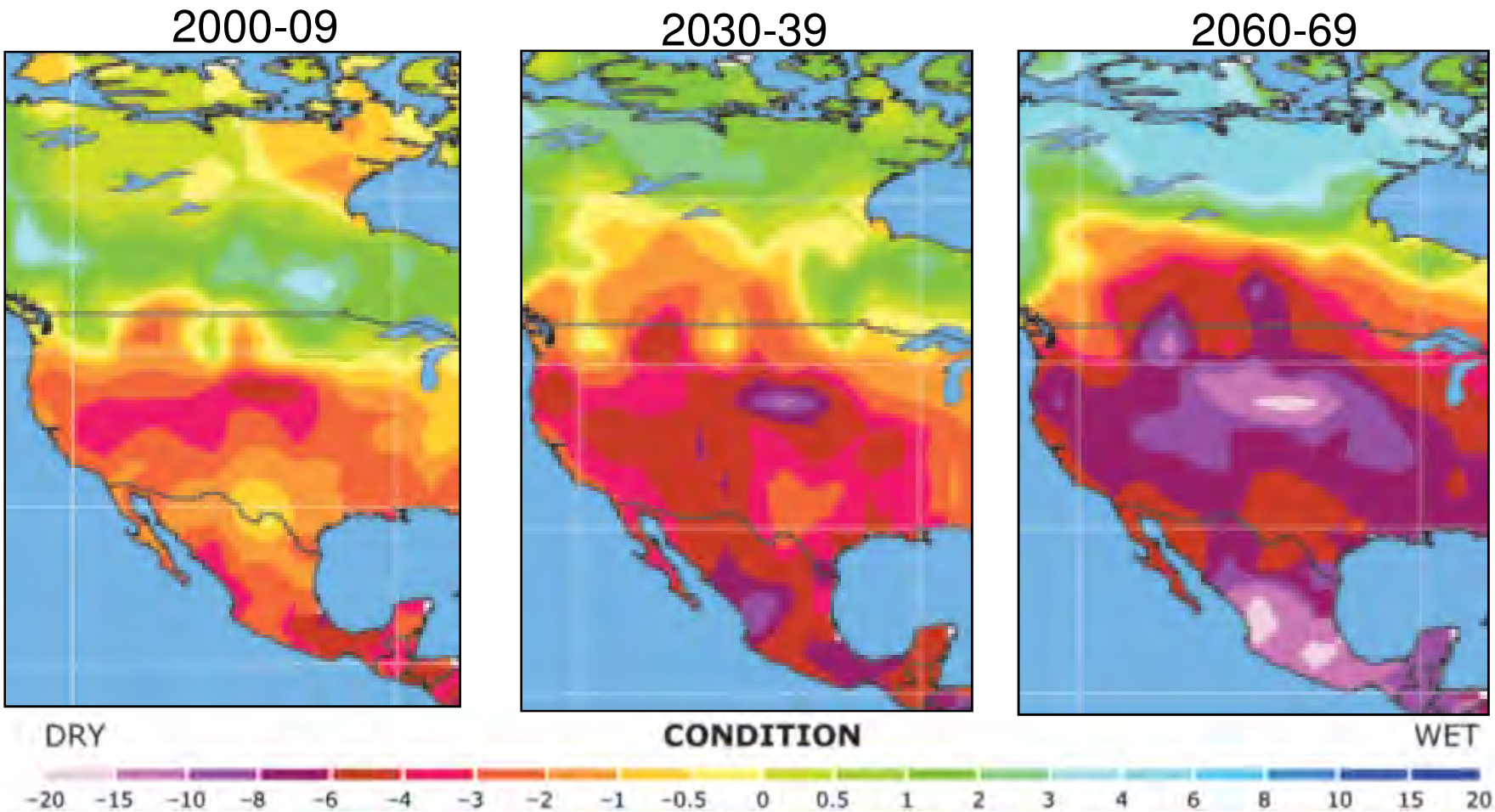
Bromirski et al Coastal Flooding Potential Projections: 2000–2100. Scripps CA Coastal Flooding Projections July 2012; www.climatechange.ca.gov

San Diego coastline

Rising sea levels send ripples through real estate industry
UNION-TRIBUNE June 24, 2007

PRBO Conservation Science

Extreme Drought: permanent Dust Bowls expected over decades ahead



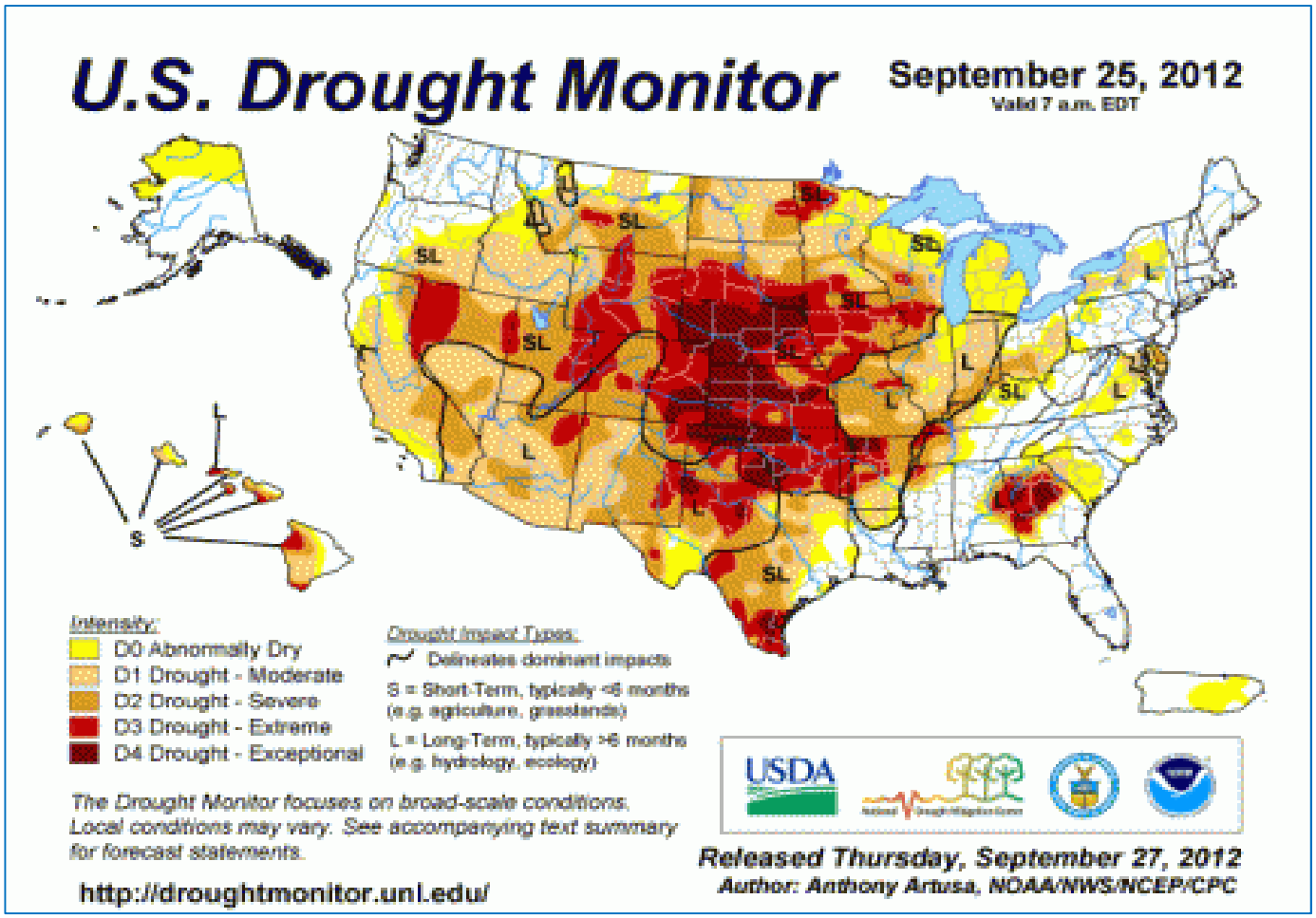
Palmer Drought Severity Index of -4 or lower considered extreme drought; UCAR graphics; not forecasts

Aiguo Dai, ***Drought under global warming: a review***, National Center for Atmospheric Research, 19 Oct 2010

Aiguo Dai, ***Increasing drought under global warming observations***, Nature Climate Change August 2012

PRBO Conservation Science

2012 epic drought- 2/3 of country: *Worst since 1930s Dust Bowl and 1950s*



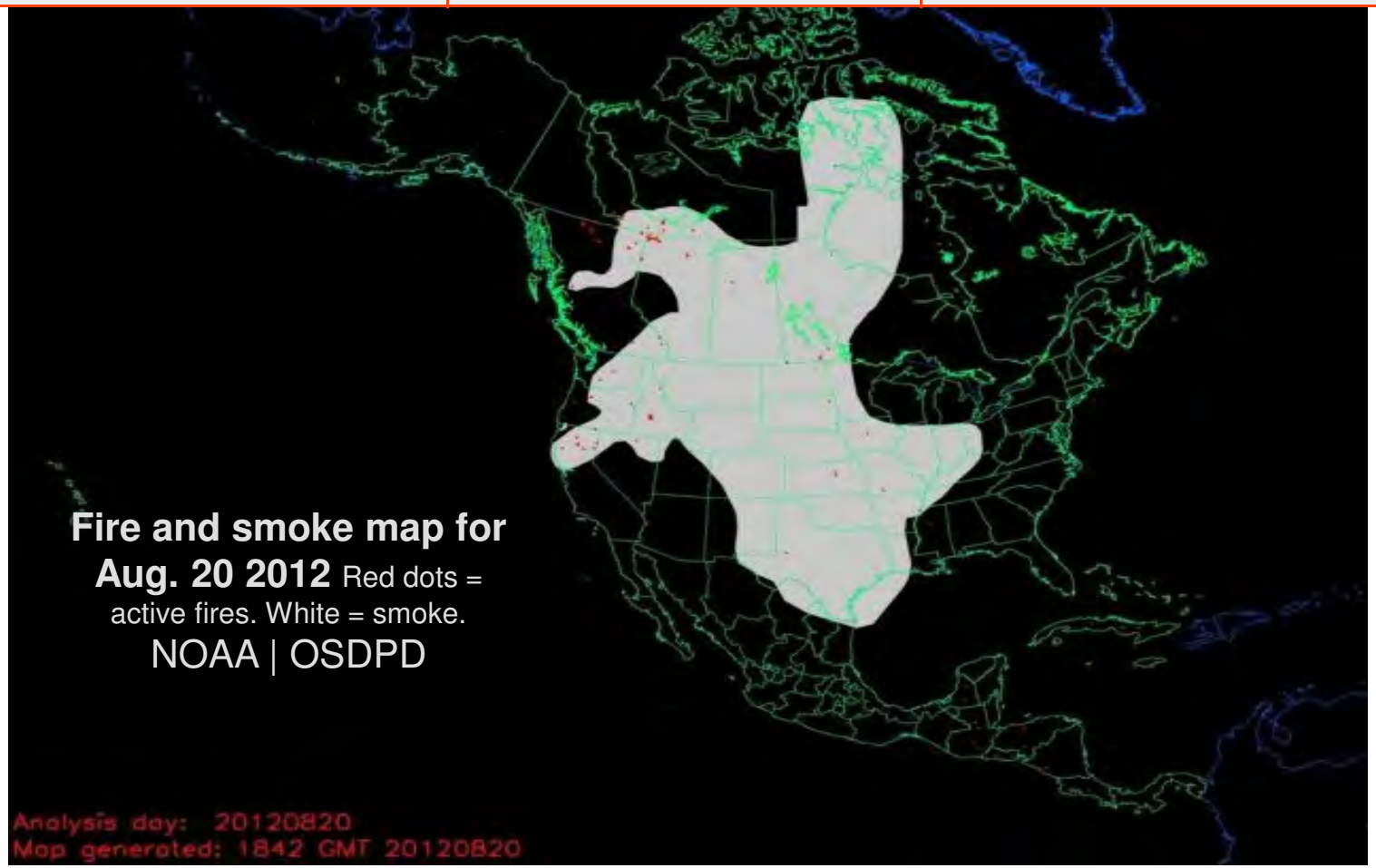
http://www.ncdc.noaa.gov/news/us-drought-monitor-update-september-25-2012
www.climatecentral.org *Epic Dust Bowl of 2012 Expands Again Sep 30 2012*

PRBO Conservation Science

2012 record wildfire season; "*Forest Services runs out of $ for fire fighting, takes from other programs" Oct 2012*

2012 (1/1/12 - 10/10/12)	Fires: 49,682	Acres: 8,862,861

National Interagency Fire Center



Fire and smoke map for Aug. 20 2012 Red dots = active fires. White = smoke.
NOAA | OSDPD

Wildfire crews face tight funds, longer season San Francisco Chronicle October 8, 2012; Climate Central: Age of Western Wildfires – Report Sept. 2012; Climate Change Increases Threat of Fire to US West June 2011; Marlon et al. **PNAS: wildfires in the western USA**. PNAS 2012

PRBO Conservation Science

2012 on track to break 2011 record of extreme, deadly events & $55 billion in damages

"It's not the right question to ask if this storm or that storm is due to global warming, or is it natural variability. Nowadays, there's always an element of both."
- Kevin Trenberth, National Center for Atmospheric Research, Aug 15, 2010

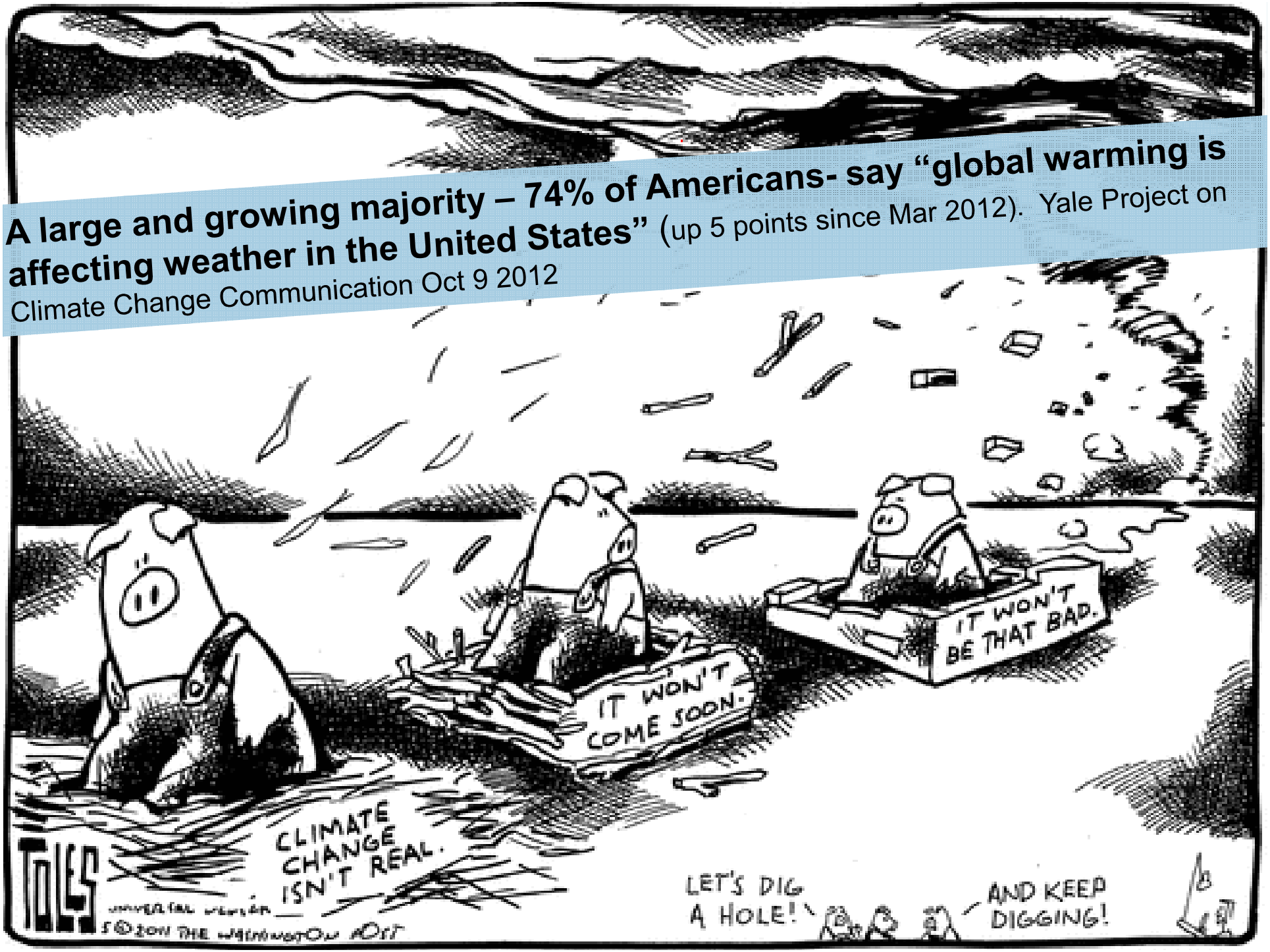
2012 natural disasters- $22 b in insured losses so far with 220 deaths (not including wildfire, drought); 15,000 warm temp records broken March 2012; (warmest US March ever; NOAA); 80 tornadoes March 2, 2012 in one day

2011 $55 billion with a record 14 disasters of $1 billion or more in damages &….loss of human lives

http://democrats.naturalresources.house.gov/sites/democrats.naturalresources.house.gov/files/documents/2012-09-25_ExtremeWeather_.pdf

NOAA; http://www.torontosun.com/2012/03/05/scientists-see-rise-in-tornado-creating-conditions;

A large and growing majority – 74% of Americans- say "global warming is affecting weather in the United States" (up 5 points since Mar 2012). Yale Project on Climate Change Communication Oct 9 2012



PRBO Conservation Science

Biological diversity enhances ecosystem function but ~25% or more of spp could be extinct by 2050…

- Thomas et al Nature 2004; **Current forecasts probably underestimate climate change impacts on biodiversity -competition and dispersal differences. M. C. Urban et al** ***Proceedings of the Royal Society B: Biological Sciences*****, 2012**
- **Ecosystems with greater biodiversity cope better with stress;** Steudel, B, et al. *Ecology Letters*, Sept. 2012
- **Species richness enhances ecosystem function in world's drylands** Maestre, F., et al , *Science*, Jan 2012

PRBO Conservation Science

Alpine species have nowhere to go- *9 out of 25 Pika populations gone*

Pika or rock rabbit- United States Geological Survey

Lowest elevation 7500 100 yrs ago (Grinnell),now lowest 9500 ft at Yosemite; Beever et al. 2010; Moritz et al. 2008; Natl Park Service ***Pikas in Peril***

PRBO Conservation Science

Changes in phenology already widespread

Black-headed Grosbeak among >50% of songbirds arriving earlier to central CA breeding grounds MacMynowski et al., 2007 PRBO/Stanford

- Migratory bird arrivals
- Animal emergence
- Timing of Breeding
- Ecological mismatches

Edith's Bay Checkerspot
Jasper Ridge, CA population extinct; mismatch in timing between emergence of plantain, caterpillar combined with other stressors- nitrogen/invasives/fragmented habitat

Common murres, Farallon Natl Wildlife Refuge, breeding 20 days earlier since 1972. www.prbo.org /USFWS

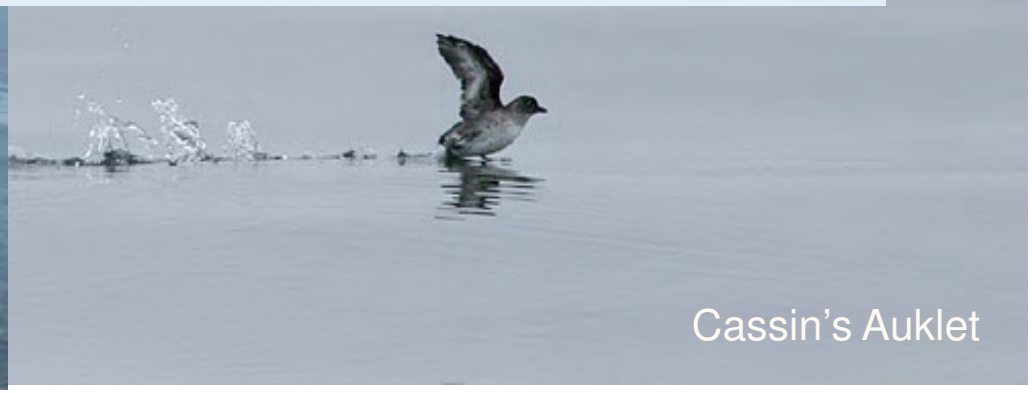
See more at: http://www.usanpn.org National Phenology Network

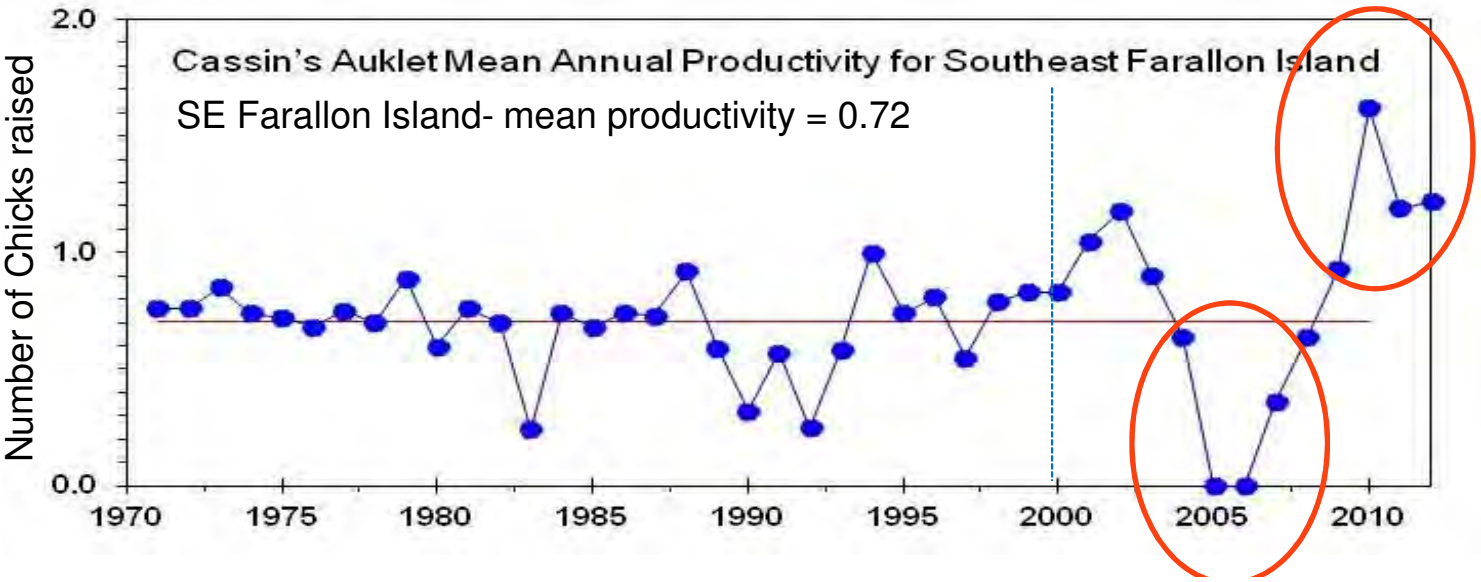
PRBO Conservation Science

Ocean Extremes – *foodweb and wildlife impacts*

Cassin's auklets projected to decline by >62% over next 20 yrs if 2005-2006 anomaly repeats.

Farallon National Wildlife Refuge- USFWS


Cassin's Auklet

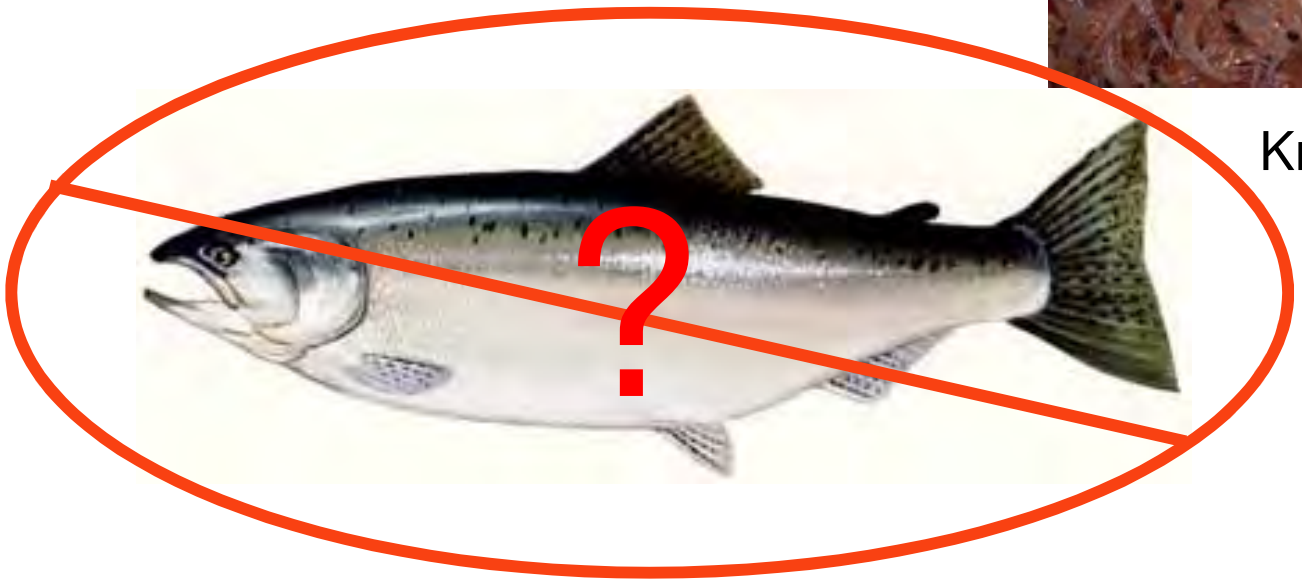


www.prbo.org

PRBO Conservation Science

As go the auklets- go the salmon?

Krill



“Salmon make comeback in Northern California”

Klamath River, Oct 9, 2012 NBC Nightly News

“Salmon season called off in bid to save chinook” April 11, 2008
“Smallest fall run of chinook salmon reported” February 19, 2009
“Feds: Calif. returning chinook salmon a record low” February 11, 2010

San Francisco Chronicle

Extreme Heat Events… *Nest Abandonment, Chick Mortality on Alcatraz (NPS), Farallon Refuge (USFWS)*

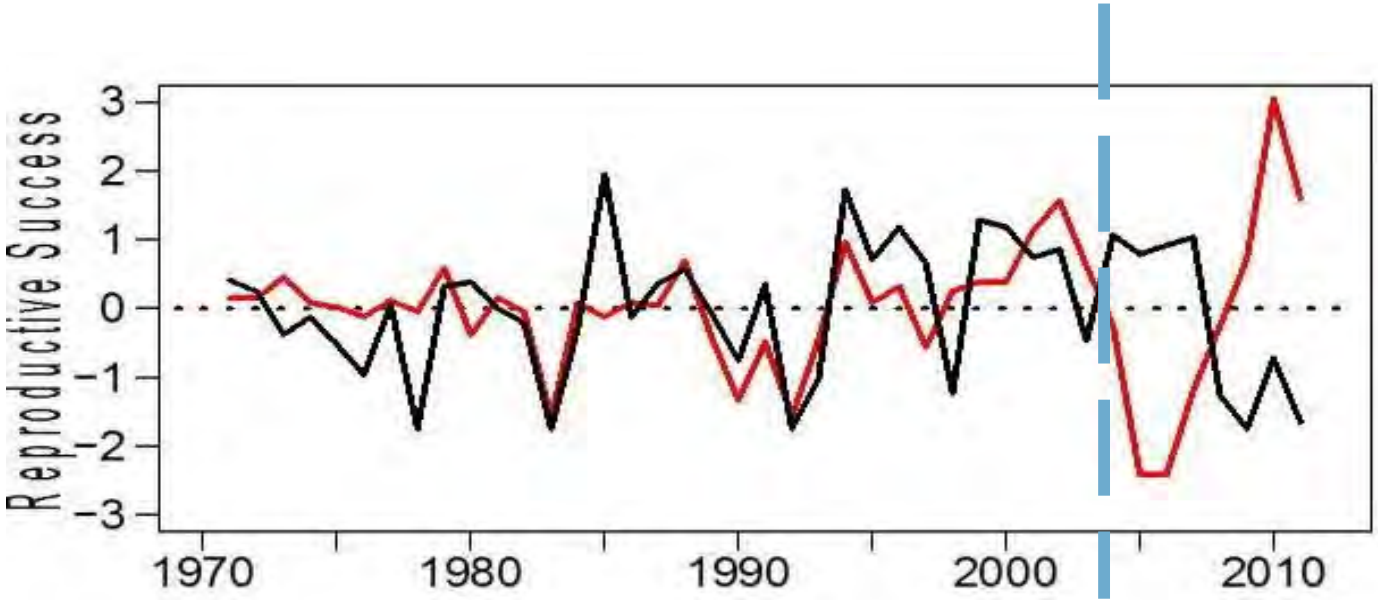
Record Heat in SF Bay Area- May 15-16, 2008

PRBO Conservation Science

Central CA pelagic ecosystem erratic since 2005: *new ecosystem state emerging?*

Cassin's Auklet

Brandt's Cormorant



Reproductive success of 2 seabirds trended parallel until 2004- then diverged; Anchovies gone but why?

40% of major ecological community types expected to switch to different state by 2100-- "forced migration" with changing conditions ---Bergengren, et al **Ecol. sensitivity: a biospheric view of climate change.** Climatic Change 22 July 2011

www.prbo.org

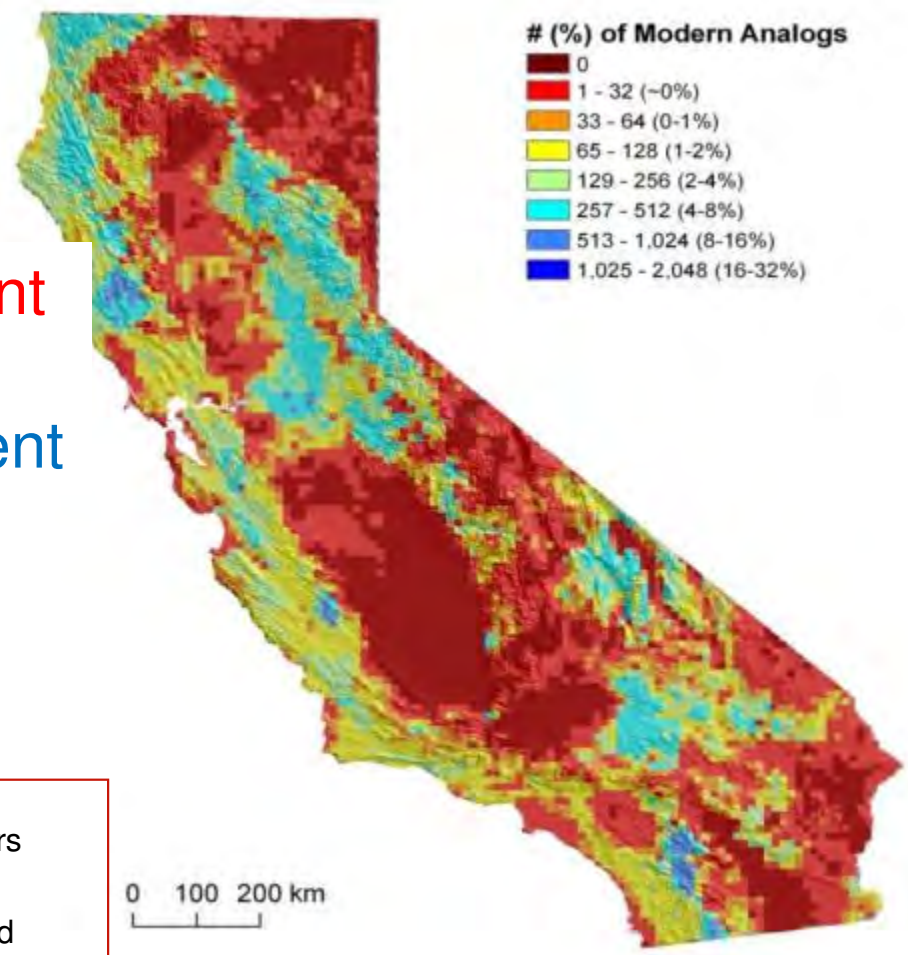
PRBO Conservation Science

By 2070: Over 50% of CA with very different "no-analog" bird communities

Red= Very Different

Blue= Less Different

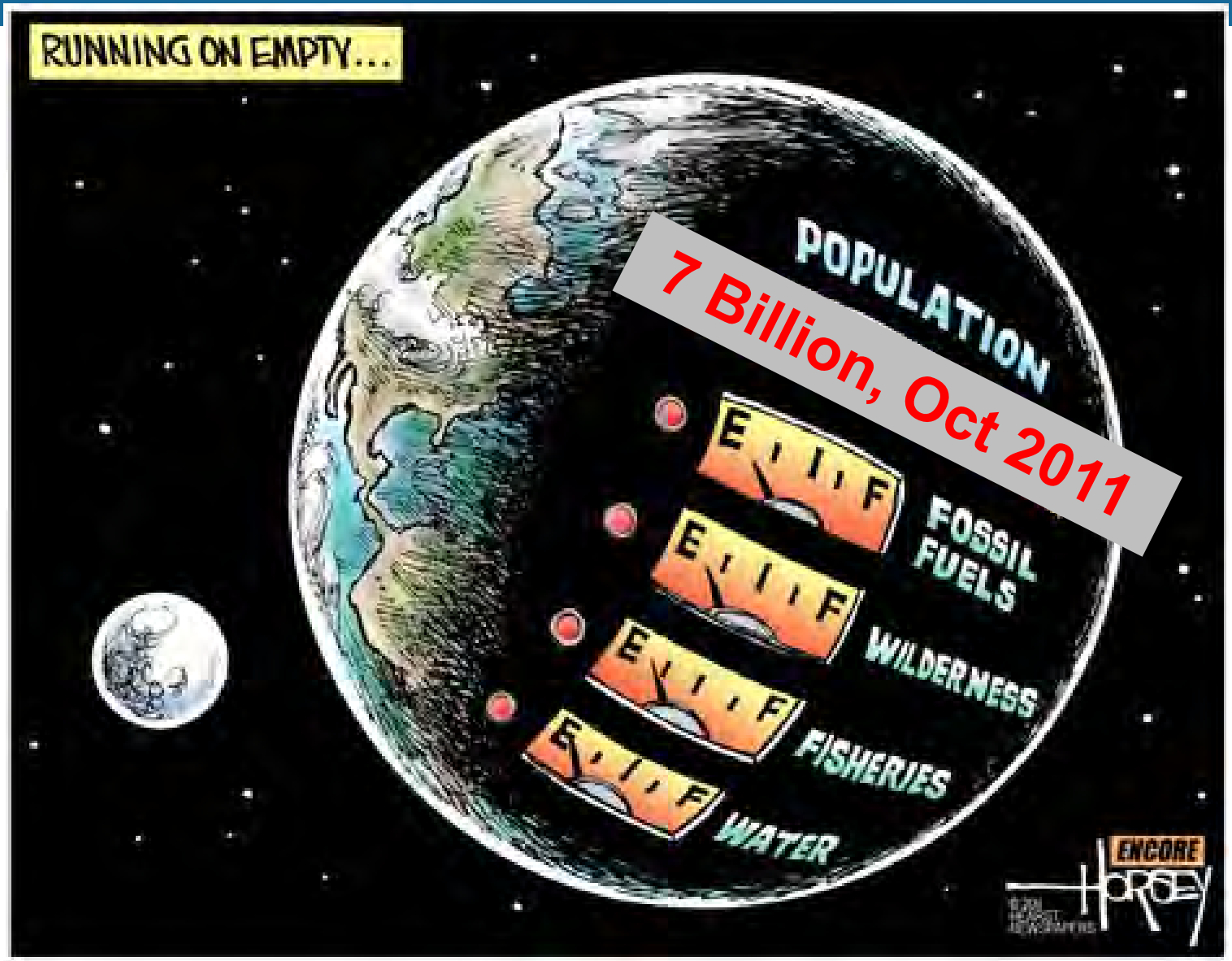
www.prbo.org/data



- Data from 199 land bird focal species; from multiple partners including KBO, CDFG, others
- Assumes all exist 60 years from now
- Combined with temperature, precipitation and vegetation variables
- From IPCC moderate climate scenarios A1B, A2

Source: PRBO, Stralberg et al., PLoS One, 2009

Business as Usual



Humans Rely on Healthy Ecosystems!

Ecosystem Services

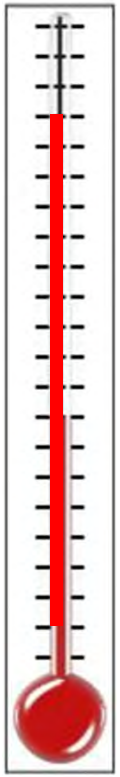
- Food
- Freshwater
- Wood and Fiber
- Fuel

- Climate
- Flood
- Disease
- Water quality

- Recreational
- Educational
- Spiritual

www.millenniumassessment.org/en/index.aspx

GOOD NEWS: We can reduce impacts and provide more time for wildlife and people to adapt



PRBO Conservation Science

To Prevent Total Climate Chaos-

Must engage in mitigation *and* adaptation simultaneously

- **Mitigation**: reduce greenhouse gas emissions (GHG) and enhance carbon sinks

- **Adaptation**: actions to reduce the risks of, and to adapt to, climate change impacts on the human and **natural environment**

'Mitadaption'…. or….

Climate Smart

Climate Smart Conservation

Definition:

Conservation strategies and actions that:

Specifically address impacts of climate change in concert with existing threats

Promote nature-based solutions to:

- Reduce GHG emissions, enhance carbon sinks,
- Reduce climate change impacts on wildlife and people, enhance ability to adapt
- Sustain vibrant, diverse ecosystems

Adapted from National Wildlife Federation's Climate Smart Conservation Adaptation Principles 2011

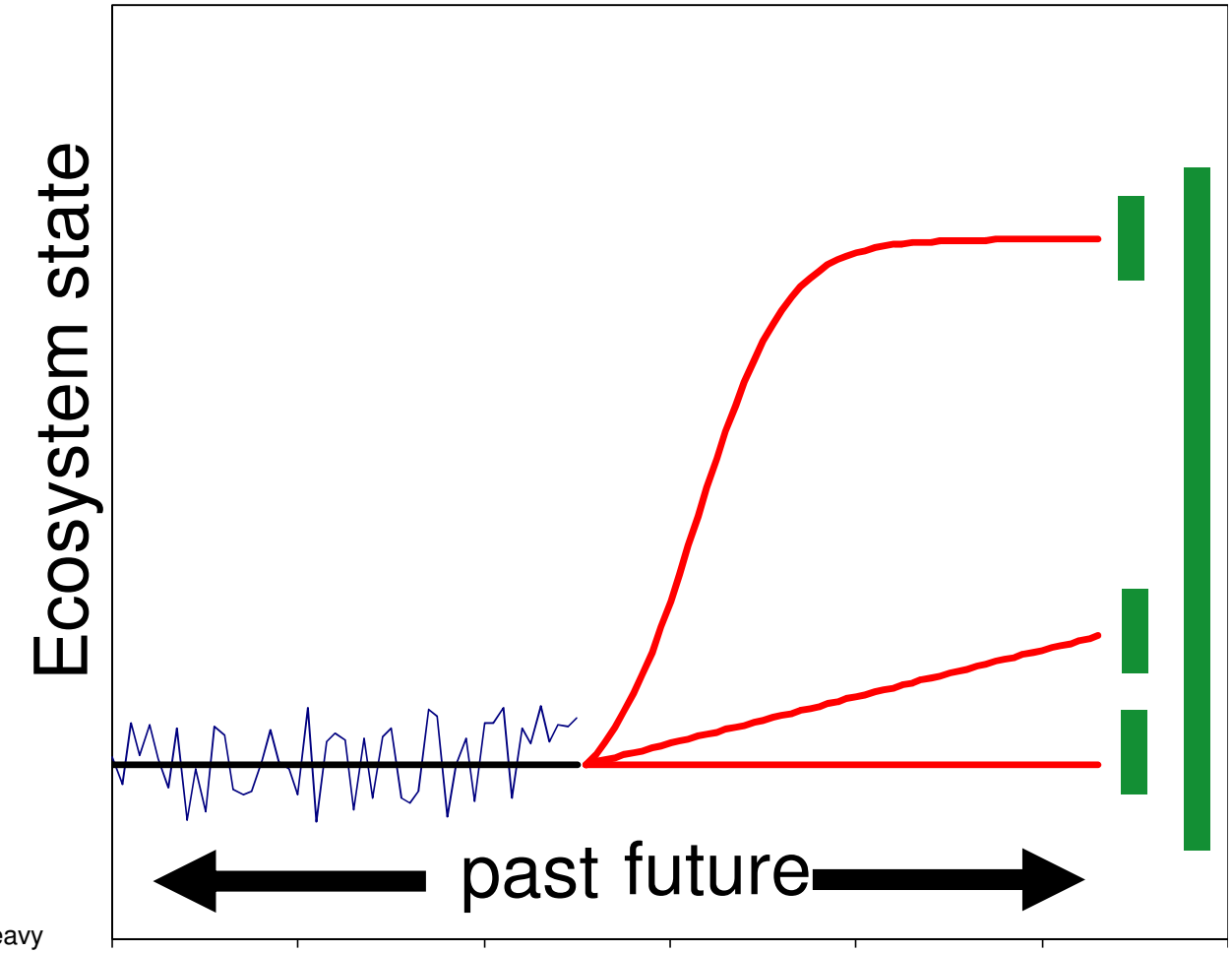
Climate Smart Conservation
Key Principles & Examples

1. Focus on future
2. Ecosystem context
3. Adaptive, flexible management
4. Prioritize
5. Collaborate & communicate

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

PRBO Conservation Science

1. FOCUS ON FUTURE CONDITIONS- including extremes, not past



-- Design restorations to succeed under multiple scenarios:

- 1000 yr flood
- Decades+ drought
- Increased coastal salinity…

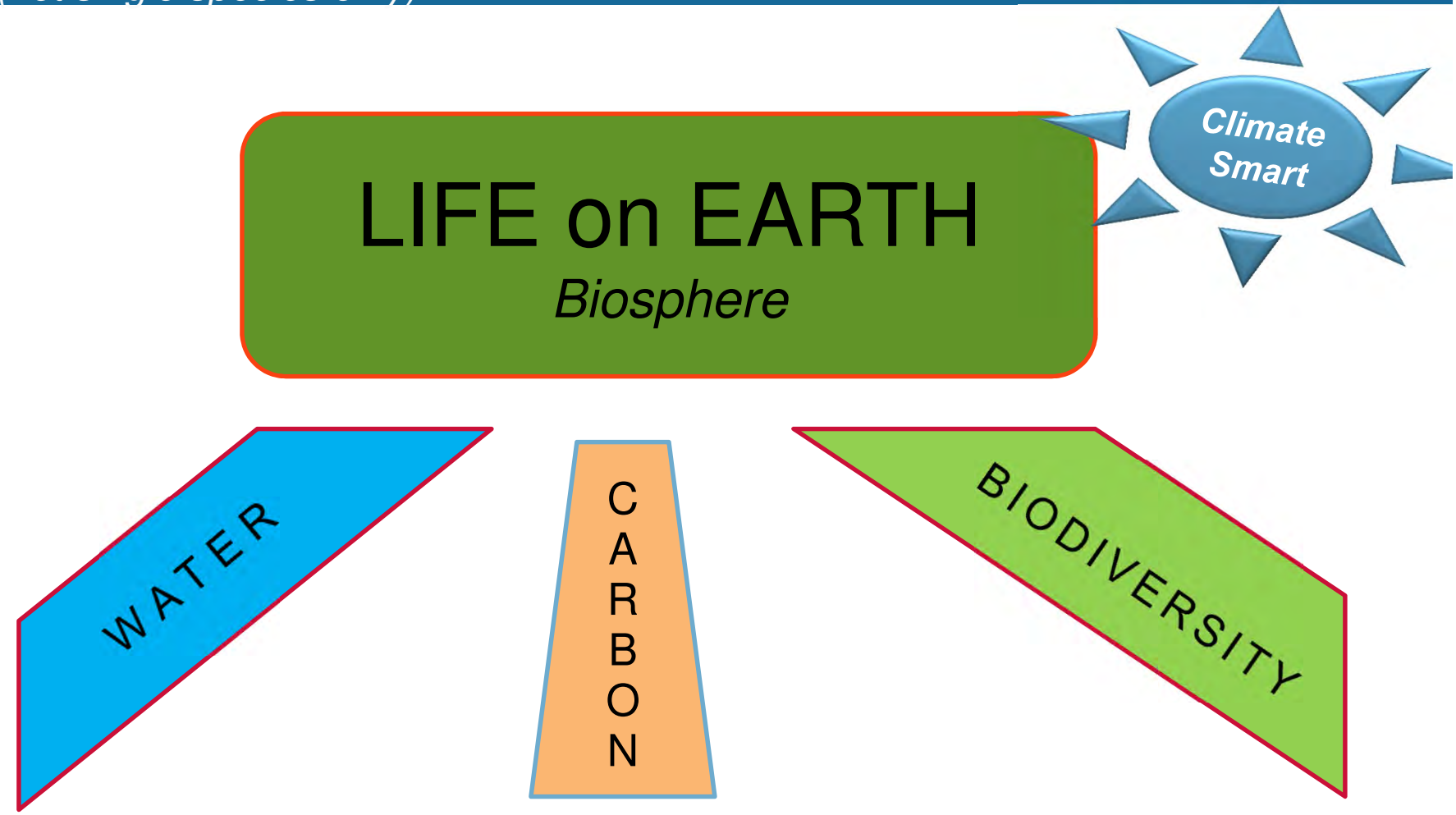
-- Manage for habitat, species and 'climate space' diversity to buffer against extremes

Nat Seavy

www.prbo.org

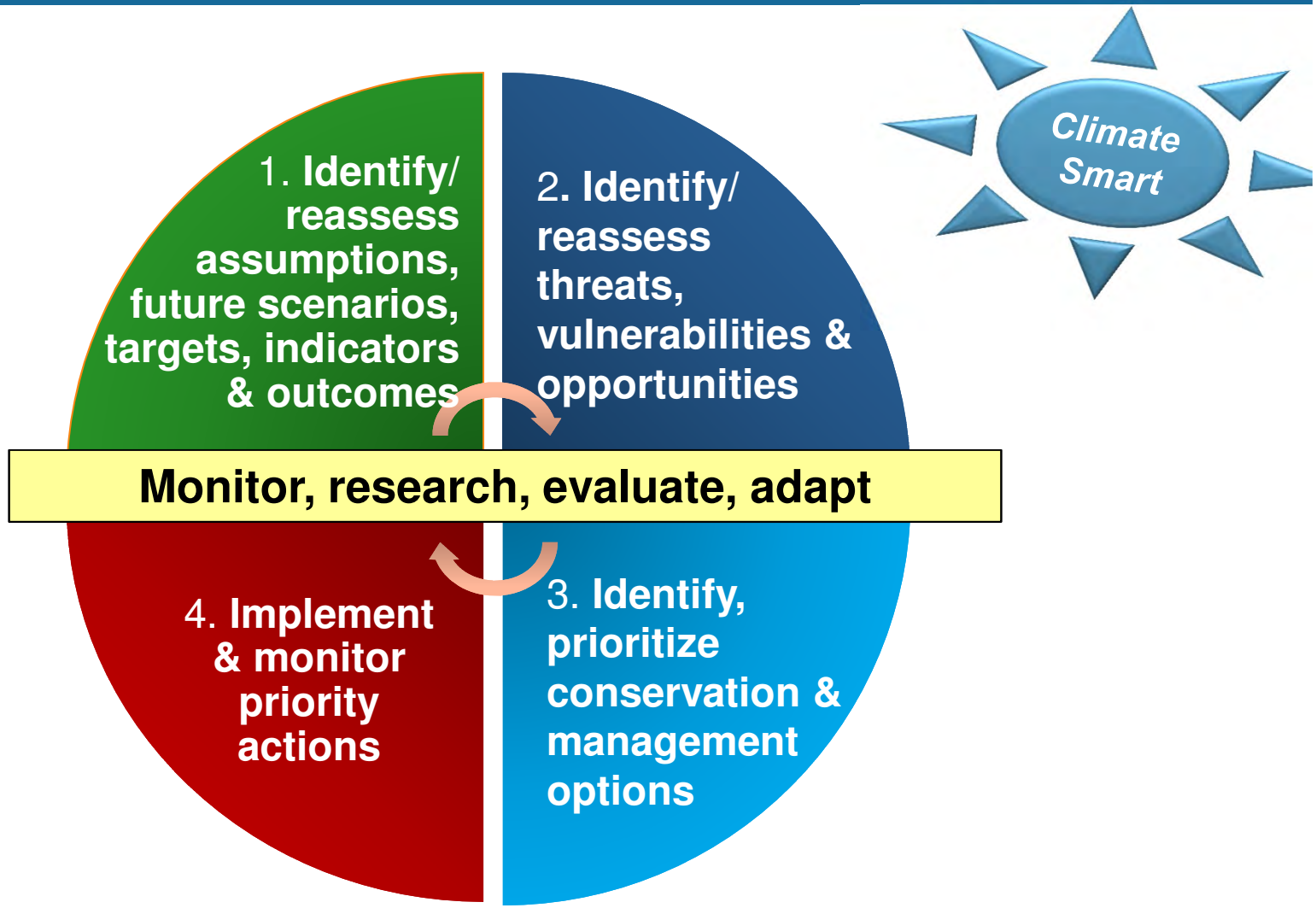
PRBO Conservation Science

2. DESIGN ACTIONS IN ECOSYSTEM CONTEXT- *think and link beyond protected areas; plan for multiple species and benefits (not single species only)*



PRBO Conservation Science

3. EMPLOY ADAPTIVE, FLEXIBLE MANAGEMENT *to address continually changing conditions*



PRBO Conservation Science

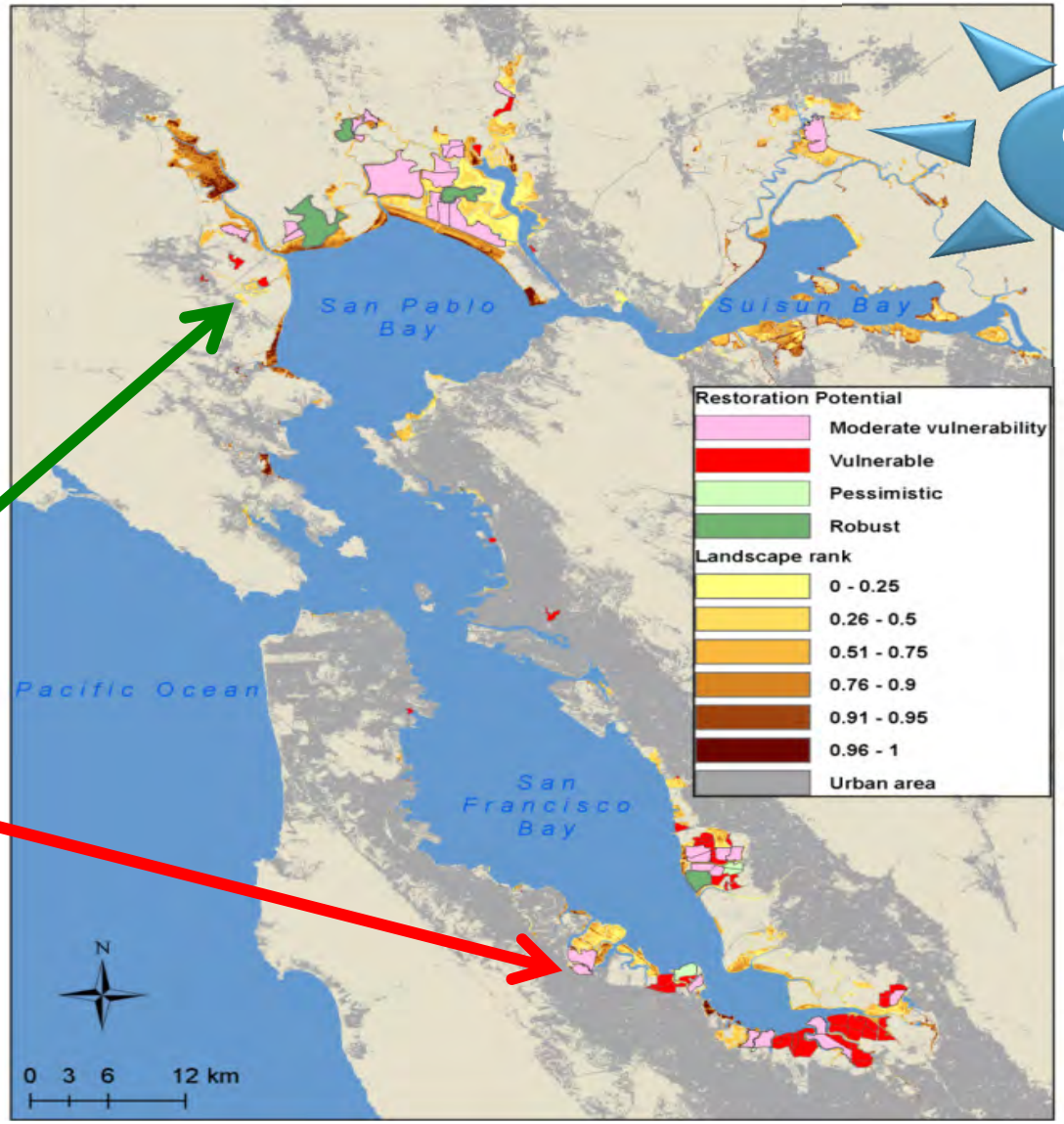
4. PRIORITIZE ACTIONS – *e.g. for best outcomes, reduced vulnerability built and natural environment, multiple benefits*

Tidal Marsh & SLR
Restoration ranked across multiple scenarios (high/low SLR; high/low sediment; multiple timeframes (2010, -30, -50, -70, 90, 2110)

Green: Highest quality bird tidal marsh habitat; low adaptation management needs

---

Red: Lowest quality across all scenarios; significant adaptation management needs



Climate Smart

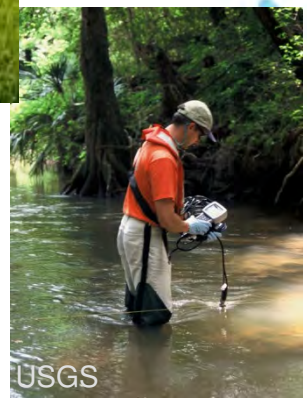
PRBO Conservation Science

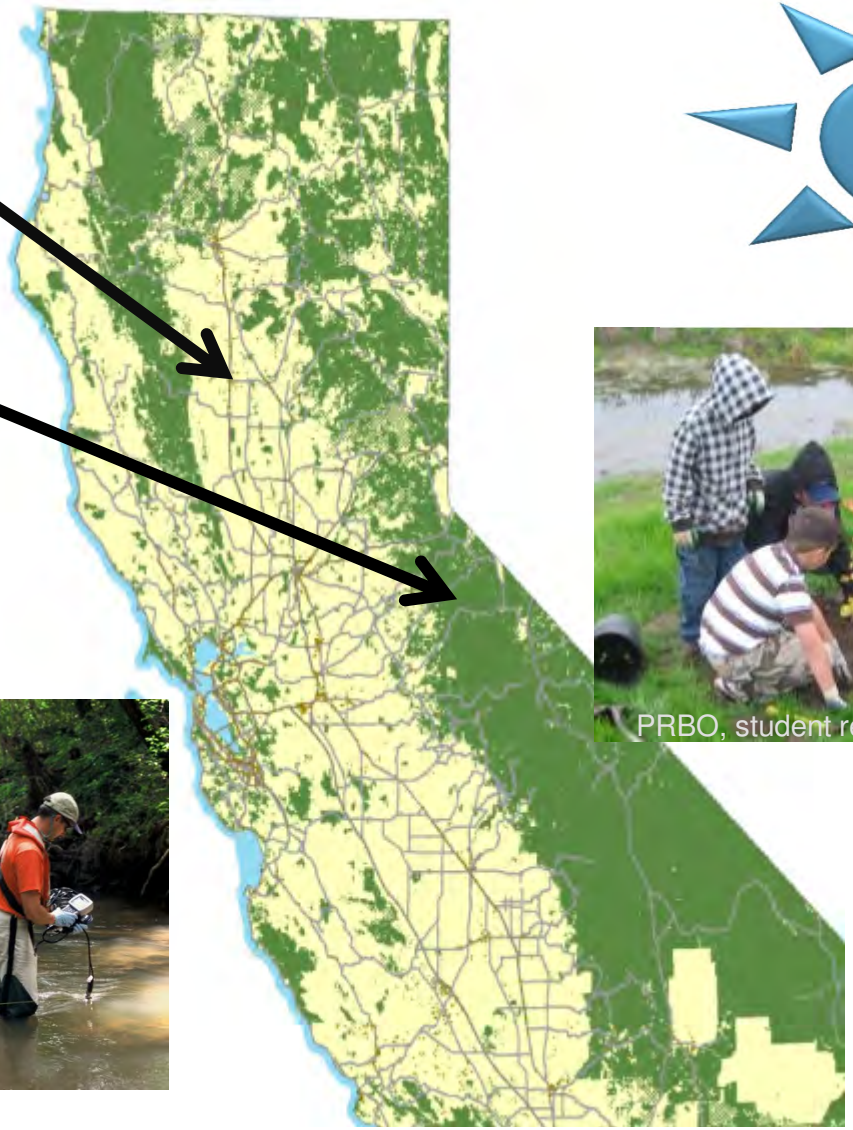
5. COLLABORATE & COMMUNICATE ACROSS SECTORS – *actions on multiple scales, timely, long term*

Private Land
50% of CA

Public Land
50%

PRBO, rice grower


USGS



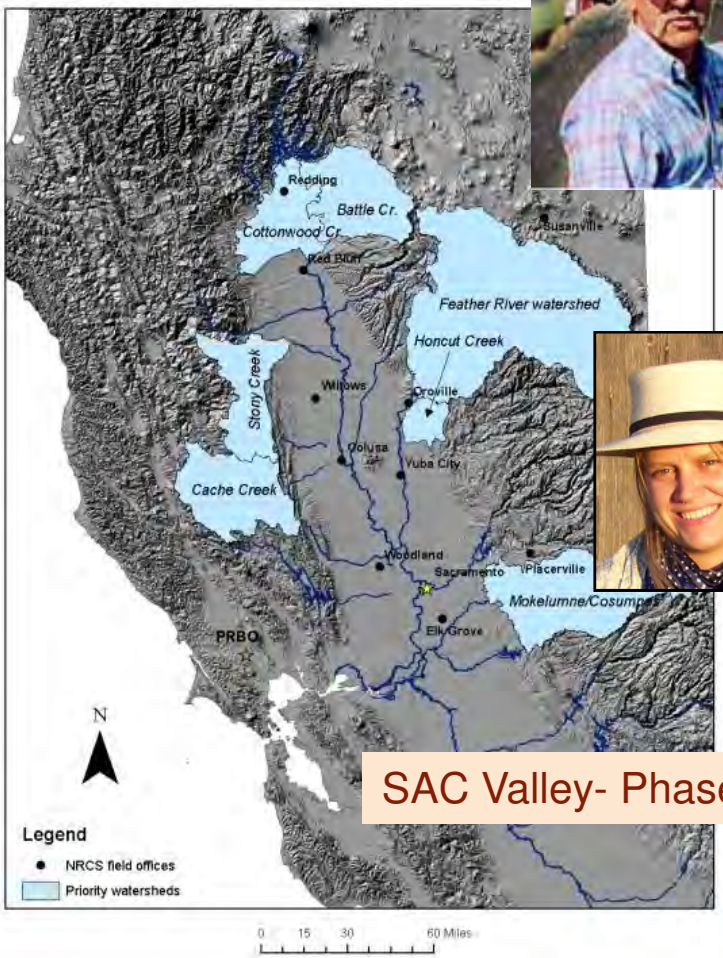
PRBO, student restoration

EXAMPLE: Climate Smart Rangeland Management

Goal: "Re-water" foothill rangeland watersheds

through prescriptive grazing, other eco-friendly management practices

- Enhance 1.1 million acres on CA foothill grazing lands next 5 yrs.
- Restore water storage & flow = 2x Hetch-Hetchy capacity
- Sequester 1 million+ tons soil carbon, and other benefits
- Hiring, training 21 Partner Biologists
  - Based in NRCS local offices working hand – in- hand with ranchers, community
  - Leveraging Farm Bill conservation funds for CA rangeland watersheds



SAC Valley- Phase I

It works: Upper Stony Creek “re-watered” through prescriptive grazing, other eco-friendly practices

Perennial grasses returned

PRBO Conservation Science

Biodiversity – and bottom lines- enhanced

EXAMPLE: Climate Smart Riparian Restoration

Riparian restoration key strategy to address climate change:

- Reduces drought and flood impacts
- Recharges groundwater
- Provides habitat connectivity
- Creates thermal refugia for wildlife
- Supports fish, birds, other wildlife

www.PRBO.org Seavy et al., **Why climate change makes riparian restoration more important than ever**. *2009. Ecological Restoration* Ecol. Rest. v27

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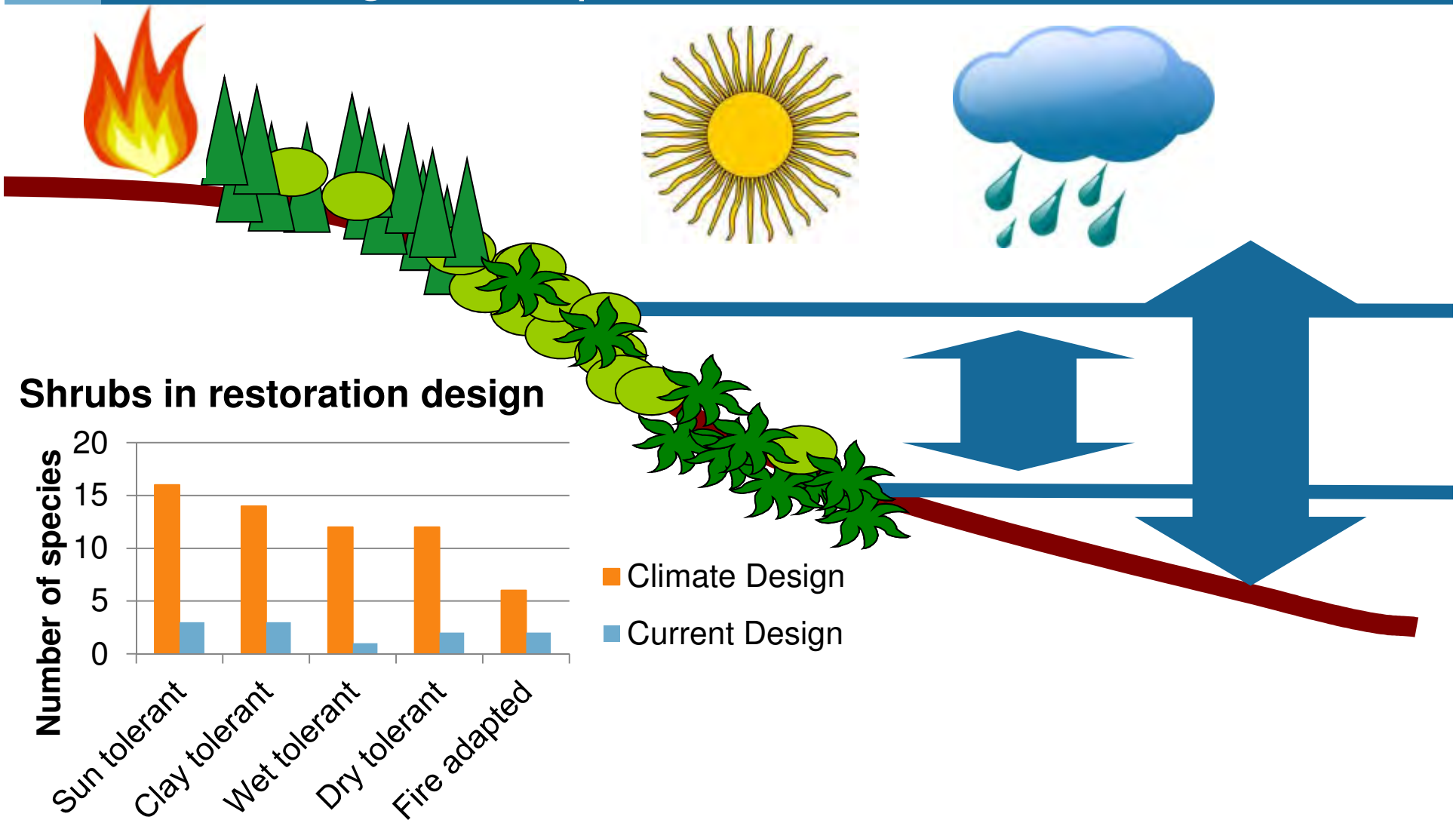
Testing new restoration designs:

Planting more species tolerant of extremes



Source: Tom Gardali, Nat Seavy www.prbo.org

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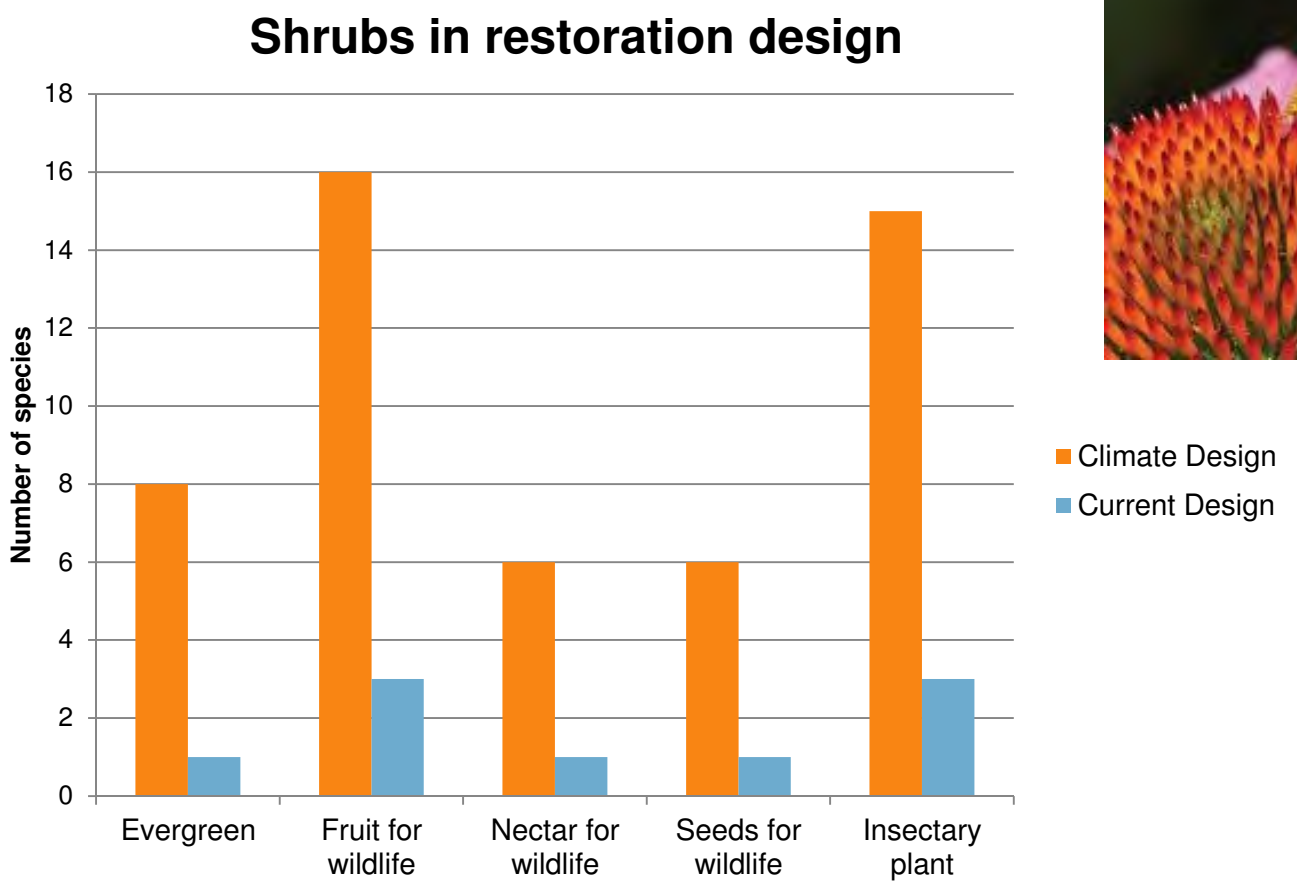
Providing more food resources over longer period for disrupted phenologies



Source: Tom Gardali, Nat Seavy www.prbo.org

PRBO Conservation Science

TEST AND EXPERIMENT– You can do it building on what you already know:

Common Name	Tolerates full or partial sun	Tolerates clay soil	Tolerates wet conditions	Tolerates dry conditions	Evergreen	Fire Adapted	Wildlife fruit source	Wildlife Nectar source	Wildlife Seed Source	Insectary Plant
Sticky manzanita	1		0	1	1	1	1	1		1
common manzanita	1	1	0	1	1	1	1	1		1
Bearberry	1	1	0	1	1	1	1	1		1
Marin manzanita	1		0	1	1	1	1	1		1
CA Sagebrush	1	1	0							
Salt Marsh Baccharis	1	1	1							
coyote brush	1	1	1							
spice bush	1	1	1							
Ceanothus	1									
blue blossom	1		0							
Mountain Mahogany	1	1	0							
Creek dogwood	1	1	1							
hazelnut	1	1	1							
Hawthorne	1	1	1							
Western leatherwood	1	1	1							
fremontia/ flannelbush	1	1	0							
Toyon	1	1	0							
Creambush	1	1	1							
Pitcher Sage	1		0							
twinberry	1	1	1							
coffeeberry	1	1	1							
reberry buckthorn	1		0							
Gooseberry	1	1	1							
Straggly Gooseberry		1	1							
pink current	1	1	1							
CA Rose	1	1	1							
wood rose	0	1								
ground rose	1		0							
thimbleberry	0	1	1							
CA blackberry	1	1	1							
blue elderberry	1	1	1							
snowberry	1	1	1							
Poison Oak	1	1	1							
CA grape	1	1	1							

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sticky manzanita	1	1	1	1								
common manzanita	1		1	1	1						1	1
Bearberry			1	1	1	1						
Marin manzanita												
CA Sagebrush								1	1	1	1	1
Salt Marsh Baccharis							1	1	1	1		
coyote brush	1							1	1	1	1	1
spice bush				1	1	1	1	1				
Ceanothus			1	1	1							
blue blossom			1	1	1	1	1	1	1	1		
Mountain Mahogany			1	1	1							
Creek dogwood					1	1	1					
hazelnut	1	1	1	1				1	1	1		
Hawthorne				1	1							
Western leatherwood	1	1	1									
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Toyon						1	1			1	1	1
Creambush					1	1	1	1		1	1	
Pitcher Sage												
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CA blackberry			1	1	1	1	1					
blue elderberry					1	1	1	1				
snowberry					1	1	1		1	1		
Poison Oak												
CA grape												

EXAMPLE: Climate Smart Planning

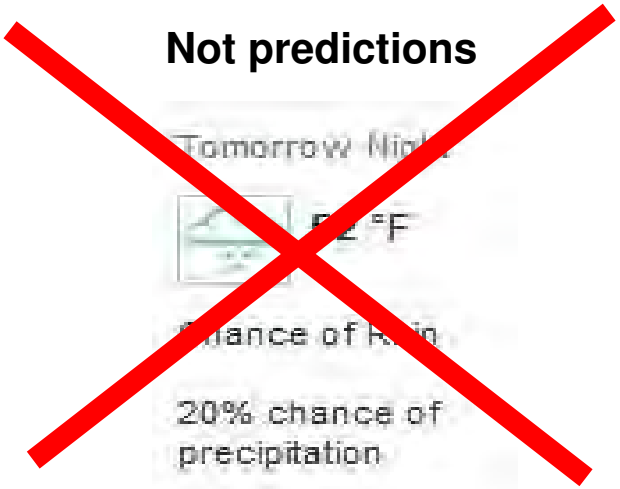
Scenario planning:

a collaborative planning tool for addressing climate change in an uncertain future

Adapted from: http://www.jiscinfonet.ac.uk/tools/scenario-planning/index_html

Scenario Planning

Not predictions



- Assumes future will be very different
- Encourages collaborative “out-of-the-box” thinking amongst diverse stakeholders
- Develops a range of plausible futures (worst to best case)
- Gets past paralysis from not having certainty in projections
- Guides what we need to do now to address the range of future scenarios

From Sara S. Moore, *Getting from Climate Projections to Decisions: a Marin Case Study* April 1,2011 NBWA; and http://www.jiscinfonet.ac.uk/tools/scenario-planning/index_html

PRBO Conservation Science

DELTA 2050: internal strategic planning

Scenario Planning Process:

1. Scoping
2. Trend analysis
3. **Build Scenarios**
4. **Generate Options**
5. Test Options
6. Action Plan

Fewer levees: Managed habitat retreat, restoration

Pickleweed Pastures

Less fresh water in Delta

More fresh water in Delta

Peripheral Realities

Go with the Flow

More levees: Fortify levees to hold back the sea

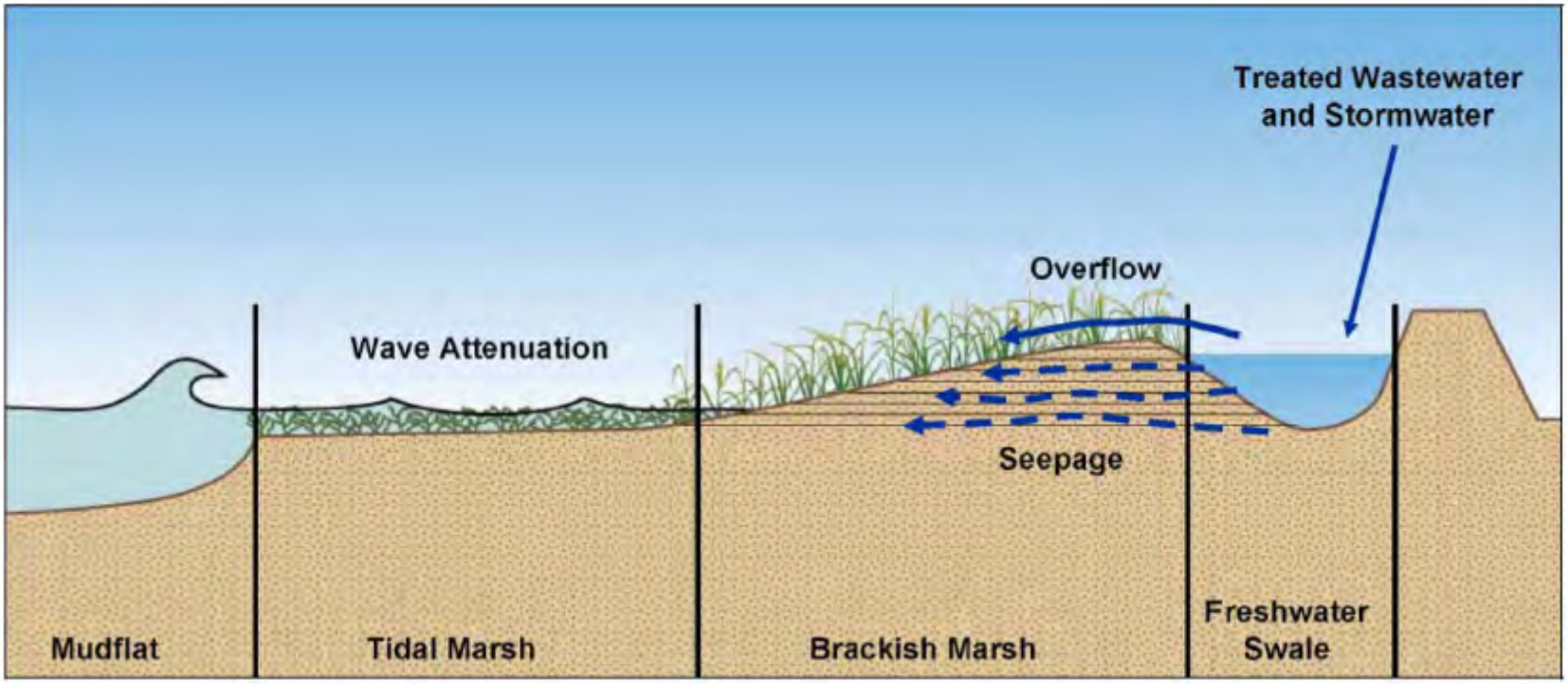
OPTIONS (sampling):

- **Optimization modeling for multiple benefits – biodiversity, water, fisheries, agriculture**
- **Restoration innovations – how best to breach levees to maximize benefits**
- **Levee innovations– how maintain and promote ecosystem function**
- **Improve water use efficiency – flooded fields for agriculture, birds**

Adapted from: Sara Moore, Preparing for Climate Change with Case Studies: Futures of Wild Marin; and http://www.jiscinfonet.ac.uk/tools/scenario-planning/index_html

Other Climate Smart Conservation Examples: Design and build tidal marsh/levee system

To reduce sea level rise & storm surge impacts on infrastructure *and* create new wildlife habitat at Bay's hard edges (little or no habitat left)



ESA PWA tidal marsh restoration design

Hayward Area Shoreline Planning Agency, Hayward, CA (SF Bay)

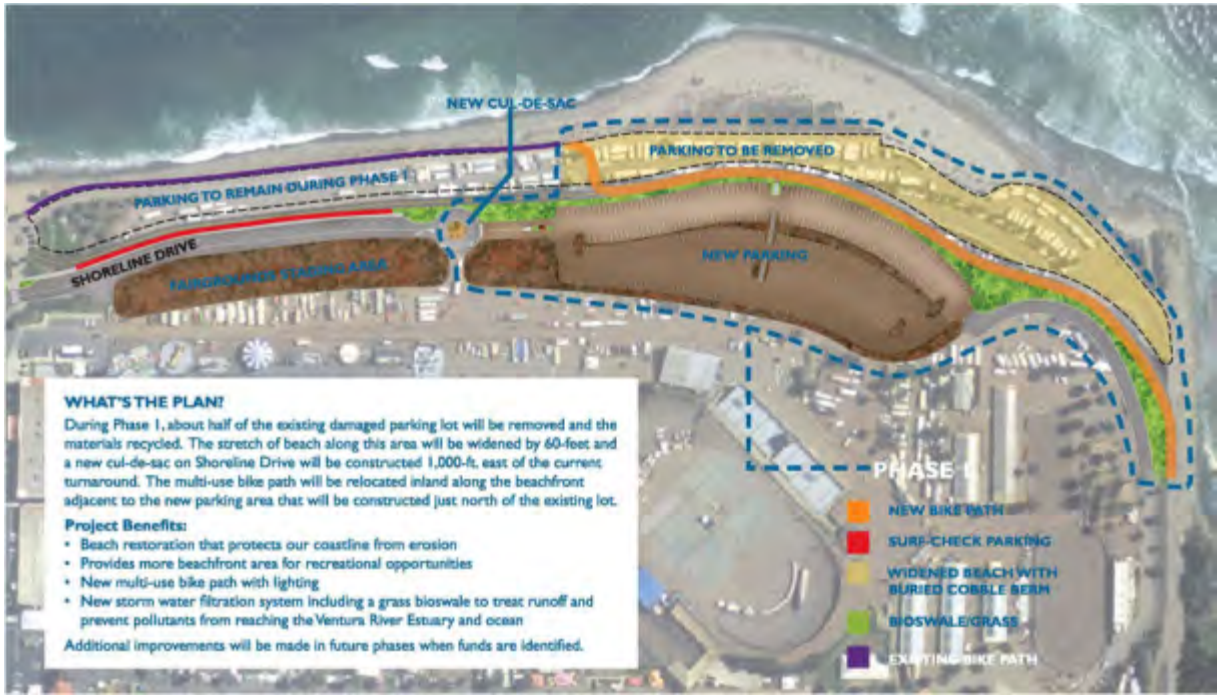
http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/haspa_executive_summary.pdf

Climate Smart: Implement Managed Retreat

Surfers' Point, Ventura, CA

Phase I:

- Existing damaged parking lot removed; materials recycled
- Beach widened by 60 ft
- Multi-use bike path relocated inland
- New parking area built north



Partners include: City of Ventura, Ventura County Fairgrounds (Seaside Park), California Coastal Conservancy, California State parks, the State Coastal Commission and the Surfrider Foundation

http://www.surferspoint.org/

PRBO Conservation Science

Climate Smart: Innovate tidal marsh restoration –to capture more sediment, grow faster to meet rising tides

Sonoma Baylands, San Pablo Bay

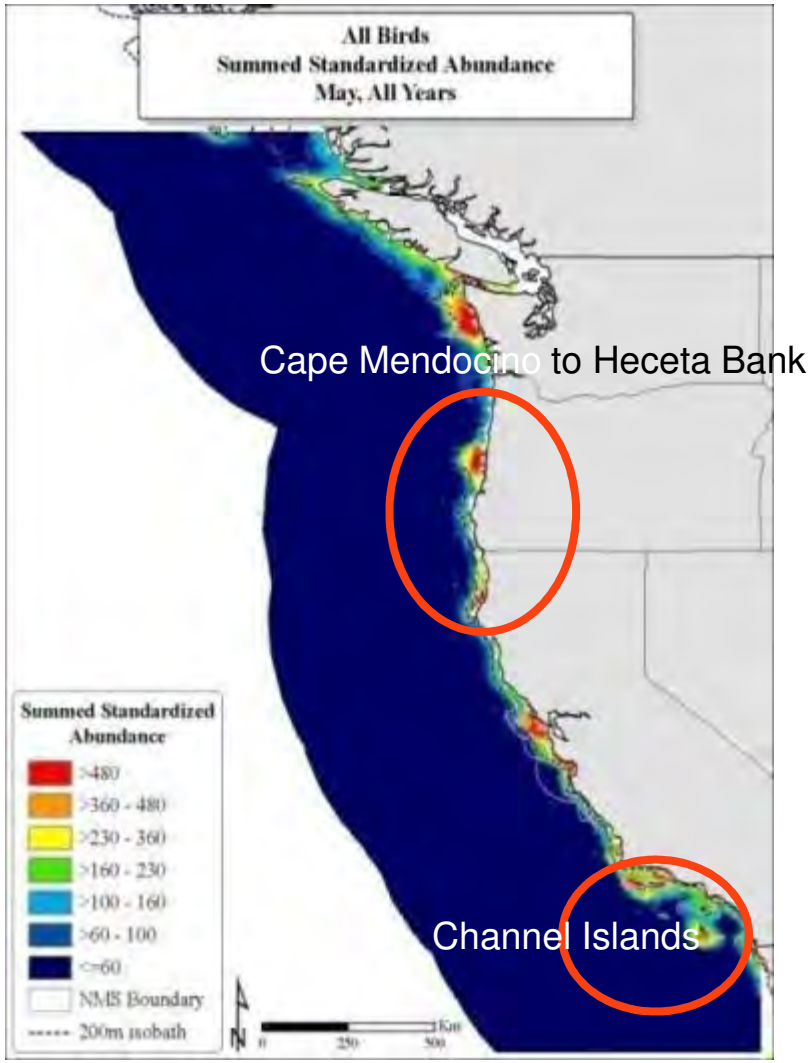
- **Constructing hundreds of small islands to address major limiting factor- *lack of sediment*:**
  - **create wind breaks**
  - **filter out sediment from the incoming**

http://www.sonomalandtrust.org./ ; *John Burgess / Santa Rosa Press Democrat:* Sears Point Ranch Restoration Site
http://www.pressdemocrat.com/article/20120216/ARTICLES/120219645/1042/opinion?p=2&tc=pg&tc=ar

PRBO Conservation Science

Climate Smart: Protect marine food web hotspots to buffer wildlife, fisheries from extremes

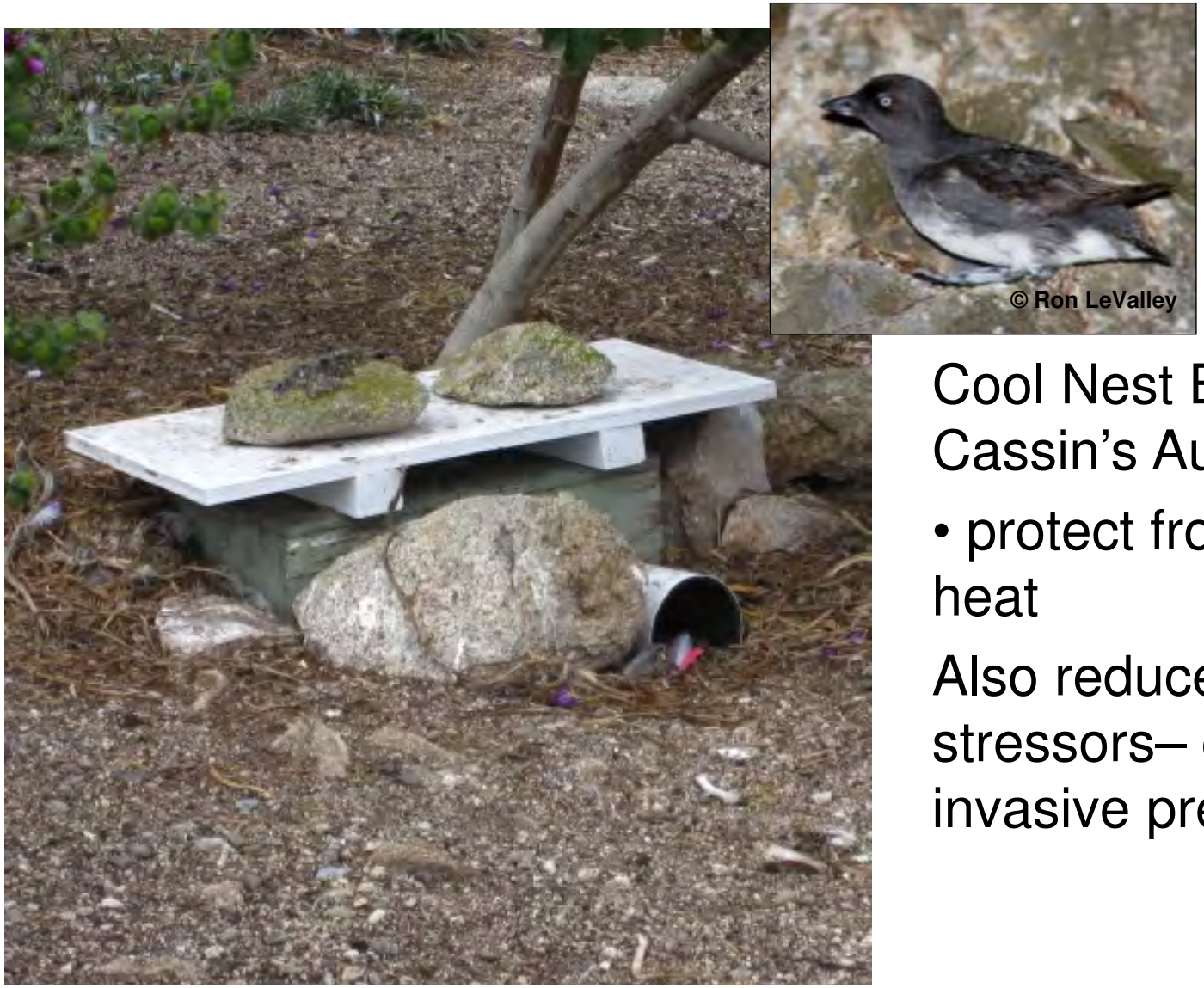
- Identified areas of high food web productivity "hotspots" in the California Current under "good" and "bad" ocean conditions
- Identified gaps in protection
- Guiding where to establish and/or expand marine protected zones
  - types of protection, when



Where the wild things are: predicting hotspots of seabird aggregations in the California Current System.
Nur et al Ecological Applications 2011 www.prbo.org

PRBO Conservation Science

Climate Smart : Give More Time to Sensitive Species to Adapt



Cool Nest Boxes for Cassin's Auklets:

- protect from extreme heat

Also reduce other stressors– e.g., control invasive predators

Climate Smart: Collaborate across traditional barriers

Example: Bay Area Ecosystems Climate Change Consortium

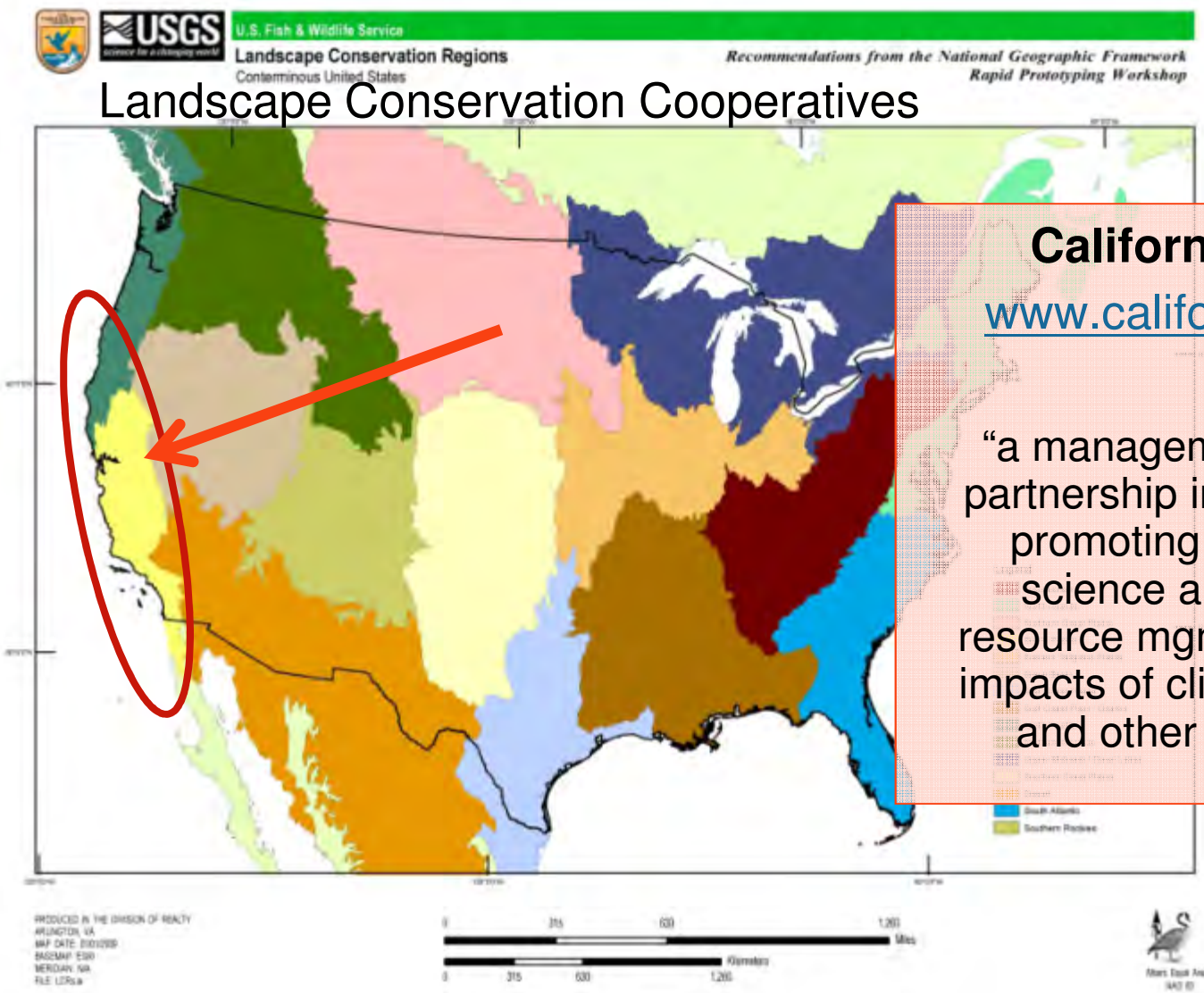
or BAECCC www.baeccc.org

Bringing together scientists, natural resource managers and planners to sustain nature's benefits in the face of accelerating climate change

- NOAA Gulf of the Farallones and Cordell Bank National Marine Sanctuaries
- NOAA Coastal Services Center
- US Fish & Wildlife Service
- PRBO Conservation Science
- US Geological Survey
- CA Coastal Conservancy
- CA Dept of Fish and Game
- National Park Service
- Bay Conservation and Development Commission
- SF Bay Joint Venture
- SF Estuary Partnership
- Upland Goals Project
- Bay Area Open Space Council

PRBO Conservation Science

Climate Smart: Collaborate across traditional barriers



Landscape Conservation Cooperatives

California LCC

www.californialcc.org

"a management-science partnership informing and promoting integrated science and natural resource mgmt to address impacts of climate change and other stressors"

PRBO Conservation Science

Climate Smart: Engage youth & community in local, hands-on restoration efforts!

PRBO STRAW Project- Students & Teachers Restoring a Watershed www.prbo.org/straw

How address the challenges of accelerating climate change on top of other stressors?

Apply the 10% Rule Every Day

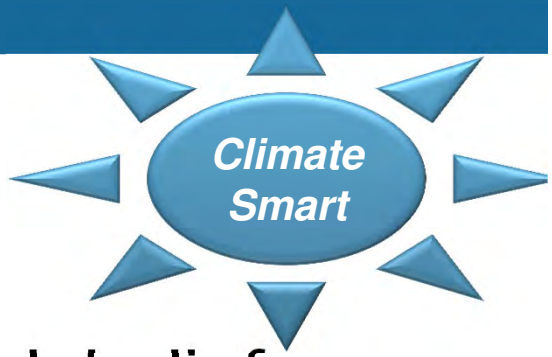
Climate Smart

T = Test &

E = Experiment

N = Now

Communicate the science AND inspire hope



- **Inspire:** I think I can, I think I can
- **Solution oriented:** confident, hopeful, belief in human ingenuity – people more likely to accept the science than if focus is only on dire consequences, inevitable, catastrophic
- **We have CHOICES --**talk about choices we have!

Susan Joy Hassol- AGU talk- December 2011
http://www.climatechangecommunication.org/index.cfm

PRBO Conservation Science

Climate Smart: Communicate science terms in ways that have appropriate meaning to public

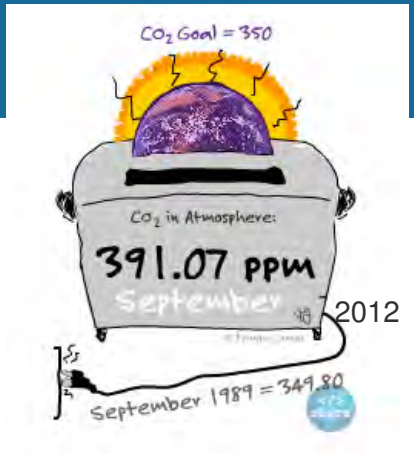
Terms that have different meanings for scientists and the public		
Scientific term	**Public meaning**	**Better choice**
enhance	improve	intensify, increase
aerosol	spray can	tiny atmospheric particle
positive trend	good trend	upward trend
positive feedback	good response, praise	vicious cycle, self-reinforcing cycle
theory	hunch, speculation	scientific understanding
uncertainty	ignorance	range
error	mistake, wrong, incorrect	difference from exact true number
bias	distortion, political motive	offset from an observation
sign	indication, astrological sign	plus or minus sign
values	ethics, monetary value	numbers, quantity
manipulation	illicit tampering	scientific data processing
scheme	devious plot	systematic plan
anomaly	abnormal occurrence	change from long-term average

From Somerville, Richard C.J. & Hassel, Susan. ***Communicating the science of climate change*** Physics Today, October 2011.

No More "Business as Usual"

CLIMATE SMART:
Reverse greenhouse gas emissions, enhance ability to adapt and make ecosystem conservation an equal priority *now*

CO2 Target:



< 350 ppm

"To preserve creation, the planet on which civilization developed" – *James Hansen, PhD*

Director, NASA Goddard Institute for Space Studies
Human-made Climate Change: A Moral, Political and Legal Issue, Blue Planet Lecture, Tokyo, Japan, October 2010

Ppm = parts per million of CO2 in the atmosphere

We can secure our future using nature-based solutions in concert with other policies:

1. Phase out Coal by 2030

All coal emissions halted in 20 years; no unconventional fossil fuels- tar sands, oil shale, methane hydrates

2. Price Carbon Immediately: Fee and Dividend

3. Invest in Energy Efficiency & Eco-friendly Renewable Energy

4. Secure Nature's Benefits- Eco-friendly Land & Ocean Management

From: Jim Hansen, *Human-made Climate Change: A Moral, Political and Legal Issue*, Blue Planet Lecture, Tokyo, Japan, October 2010 and Worldwatch Report #179: *Mitigating Climate Change Through Food and Land Use*

Coming up next on

FUTUREFLIX

THE MOVIES OF TOMORROW, TODAY!

YOU ORDERED

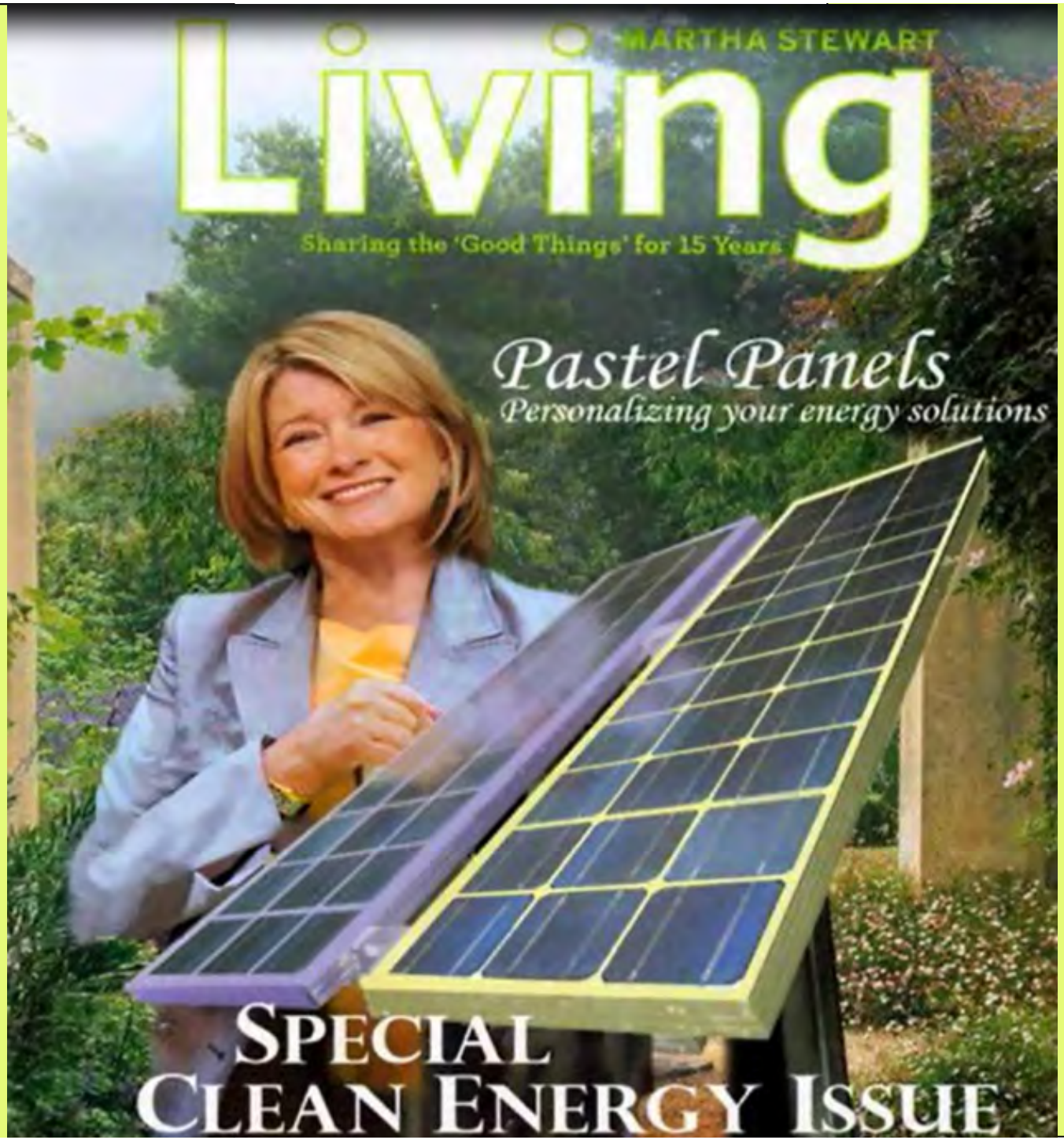
Title: **Climate: A Crisis Averted ©2055**

Synopsis: A riveting documentary on how human beings overcame the greatest challenge the species ever faced.

Director: Ken Burns III | USA | Running Time: 4min 04 sec

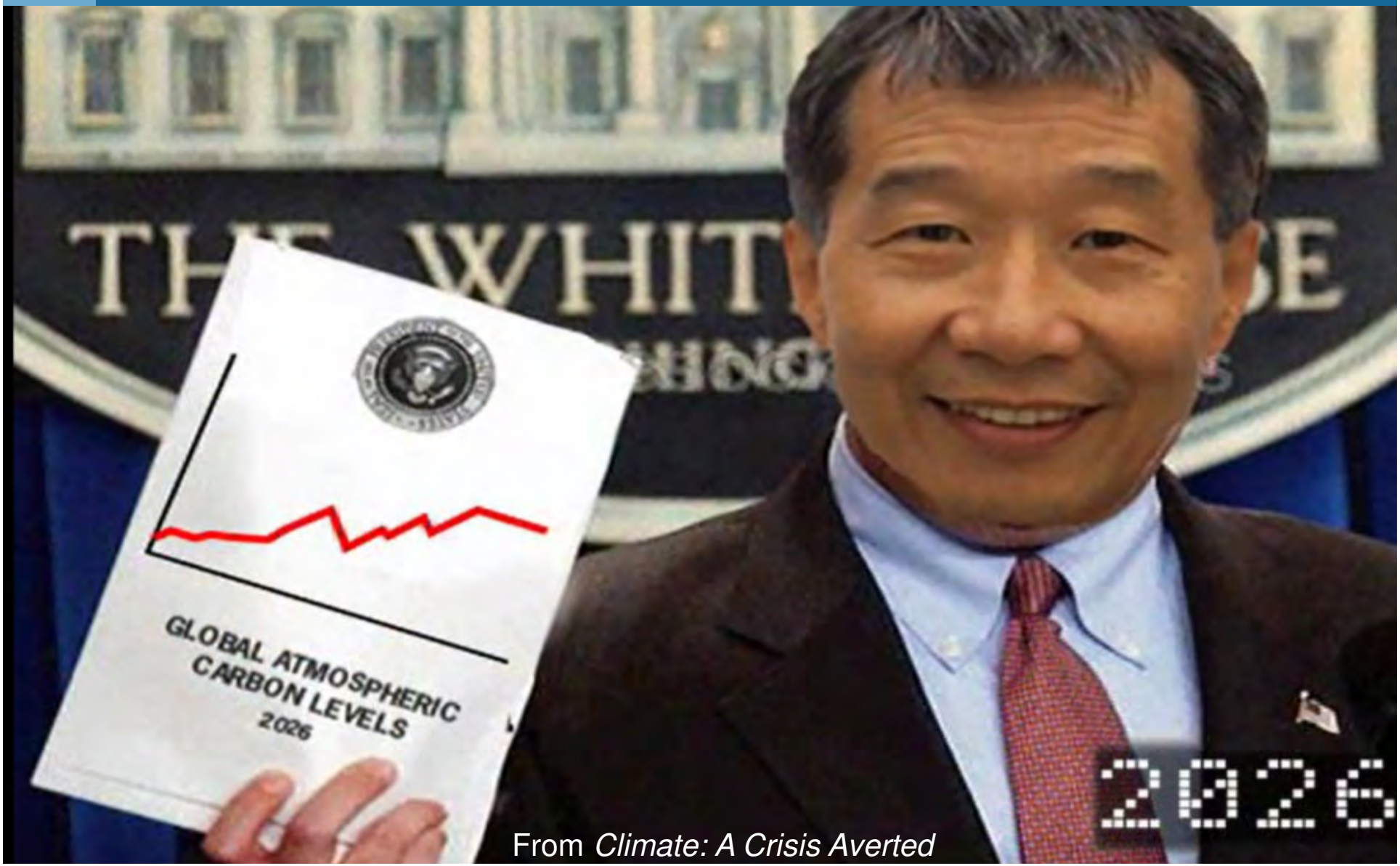
00:01

From *Climate: A Crisis Averted*



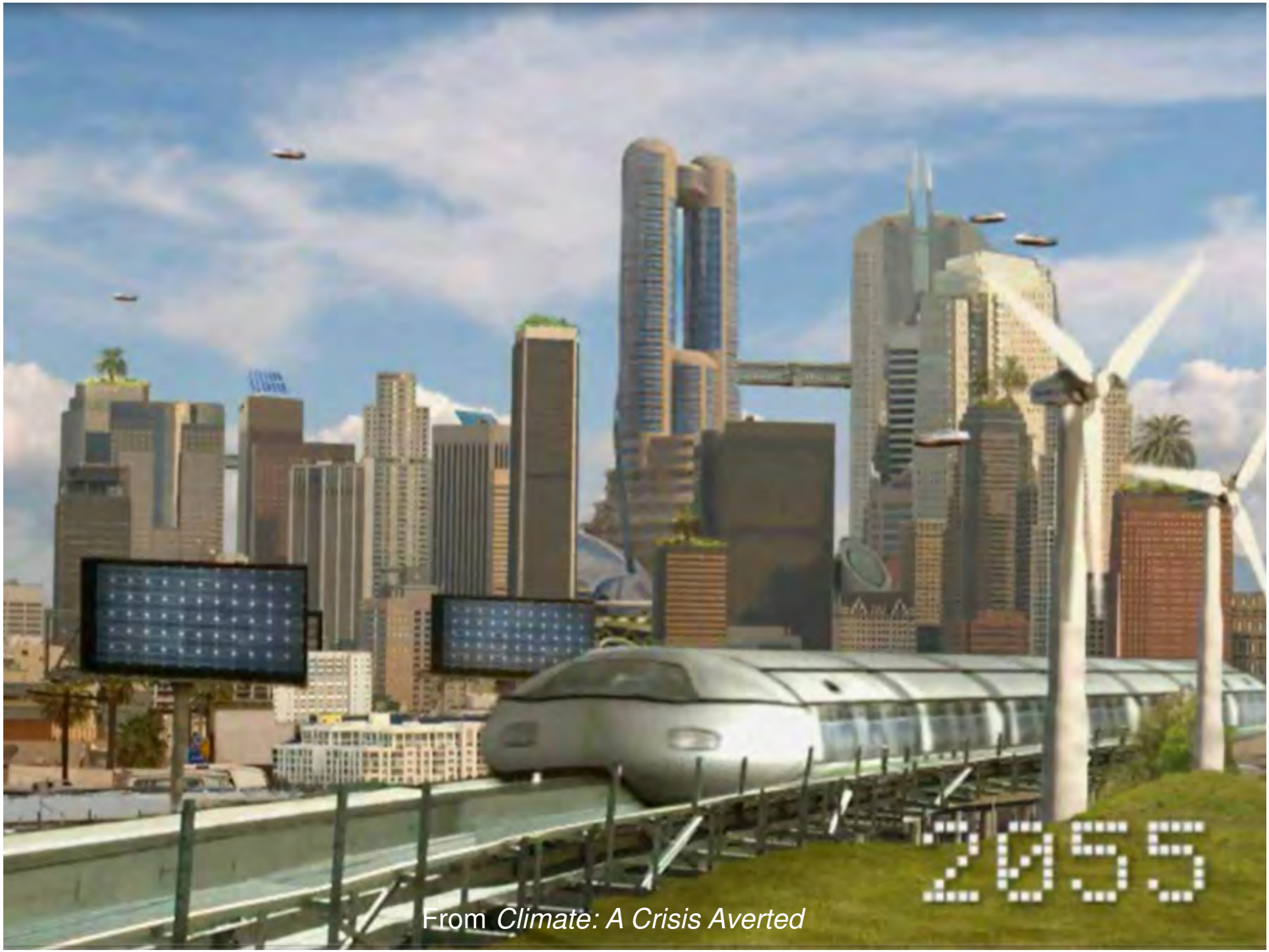
From *Climate: A Crisis Averted*

US Climate Secretary, 2026 - *CO2 levels off!*



From *Climate: A Crisis Averted*

Major investments in nature-based solutions pay off!
Water flows despite drought and snow-pack loss
August, 2050



From *Climate: A Crisis Averted*

IN SUMMARY:

Climate change is happening now and accelerating

Practice Climate Smart Conservation daily:

to reduce/reverse climate change impacts, promote adaptation, and sustain ecosystem benefits for wildlife and people

Key Principles:

1. **Focus actions on future conditions, not past**
2. **Design actions in ecosystem/watershed context**
3. **Employ adaptive, flexible management to timely response to continual change**
4. **Prioritize 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!**

Because of our climate smart actions today, we will have healthy ecosystems sustaining wildlife & our communities for our children and children's children….

Each of us can make a difference!

San Diego Airport
Southwest Airlines
Terminal Feb 2012

Additional Resources

- Climate Change: Lines of Evidence National Research Council and the National Academy of Sciences videos
- Cooler Smarter: Practical Steps for Low-Carbon Living. Union of Concerned Scientists
- www.skepticalscience.com Explaining climate change science & rebutting global warming misinformation
- www.realclimate.org Climate science from climate scientists
- www.climatechangecommunication.org Center for Climate Communication
- www.merchantsofdoubt.org/ how handful of scientists obscured truth from tobacco smoke to global warming
- http://blogs.kqed.org/climatewatch/ climate-related science and policy issues, with a specific focus on California
- www.californialcc.org and www.baeccc.org list serve- receive webinar announcements, weekly biodiversity and climate change news updates, and more

THANK YOU!

NASA Blue Marble HD 2011

PRBO Conservation Science

Acknowledgements

Anonymous (2)
Audubon California
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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
Central Valley Joint Venture
Faucett Family 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 Foundation
San Francisco Bay Joint Venture
The Nature Conservancy
U.S. Fish and Wildlife Service
USDA Forest Service
USDA Natural Resources Conservation Service
US Geological Survey
and PRBO Board, Members and Staff

Climate Smart Conservation Principles

1. **FOCUS GOALS ON FUTURE CONDITIONS** not past ('stop trying to prevent ecological change'); incorporate extremes using plausible scenarios w/ modeled projections to address uncertainty in near- & long-term time frames.

2. **DESIGN ACTIONS IN ECOSYSTEM CONTEXT** including ecosystem function & ecological diversity, with multiple species benefits in broader geographic scope (e.g., watersheds); think & link beyond current protected areas including private lands.

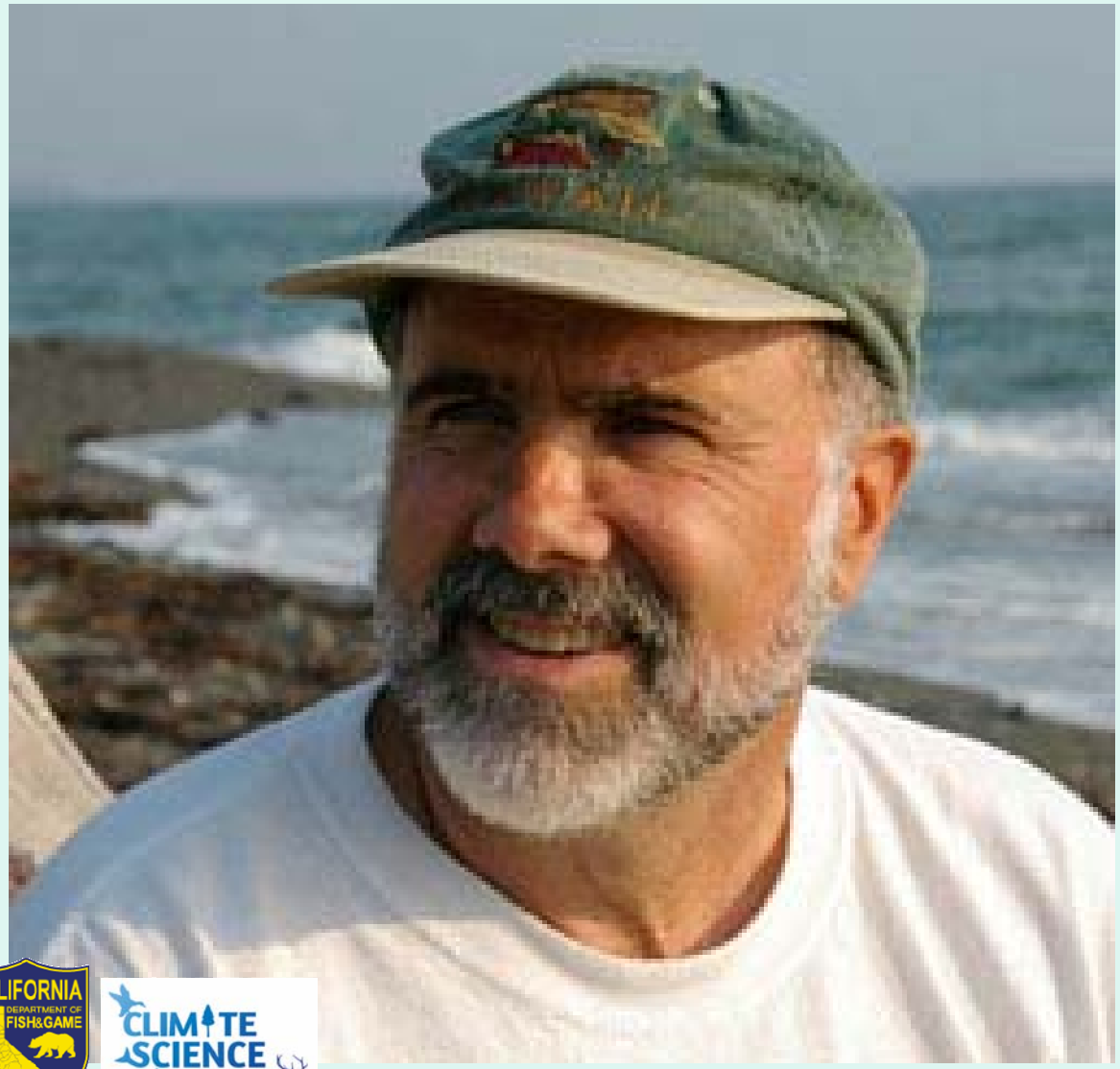
3. **EMPLOY ADAPTIVE & FLEXIBLE MANAGEMENT** for most timely, effective responses to continual change in climate, ecology and economics.

4. **PRIORITIZE ACTIONS** based on best available science and across multiple plausible scenarios for greatest benefits to wildlife & people.

5. **COLLABORATE & ENGAGE ACROSS SECTORS**- establish/ expand non-traditional alliances to accelerate effective problem solving (*e.g., between/among public & private resource managers, scientists, decision-makers);* share knowledge openly & actively; regularly communicate to the public the science and the hope; engage local communities, esp. youth, instilling conservation ethic for long term success!

Adapted from: Draft Principles for CA Adaptation Update 2012; NWF Climate Smart Conservation- Adaptation Principles 2011 and CSIRO- Climate change and Australia's biodiversity conservation, protected areas 2012

DFG Climate College: Lecture #3



Tom Suchanek
USGS

November 5, 1:00-2:00

What's happening? Projected climate change impacts to California and the San Francisco Bay region: 2C or not 2C, that is the Challenge

California Landscape Conservation Cooperative Symposium

November 5th - 1:00pm – 4:15pm

Modoc Hall, Willow Room

1:00 ****What's happening? Projected climate change impacts to California and the San Francisco Bay region: 2C or not 2C, that is the Challenge.** Tom Suchanek, Lead Scientist and Climate Change Coordinator, USGS Western Ecological Research Center

2:00 **A climate change vulnerability assessment for Sierra Nevada birds.** Rodney Siegel, Ph.D., Executive Director, The Institute for Bird Populations

2:45 **Setting Regional Strategies for Invasive Plant Management Using CalWeedMapper.** Doug Johnson, Executive Director, California Invasive Plant Council

3:30 **A Vulnerability Assessment and Adaptation Strategies for Focal Resources of the Sierra Nevada.** Jessi Kershner, EcoAdapt

** This talk is part of the DFG Climate College Webinar Series