Climate Change and Designed Landscapes: No Longer Your Grandmother’s Watershed

Mt. Tam Watershed Symposium, MMWD
Ellie M. Cohen and PRBO staff

April 11, 2008
1. Climate Change - happening now & accelerating
2. Birds - good indicators of ecosystem function, fisheries health
3. “Designed landscapes” - key mitigation & adaptation strategy
4. Monitoring - critical to assessing & improving ecosystem resiliency during rapid change
5. Mt. Tam Watershed - central to region’s biodiversity and ecological function
Climate Change Happening Now

Greenland
Greatest surface ice melt on record

Antarctica
Wilkin’s Ice Shelf Breaking Up
March 25, 2008

Unquiet Ice Speaks Volumes on Global Warming.
Robin Bell, Scientific American, February, 2008

Konrad Steffen, Russell Huff, CIRES, University of Colorado, Boulder, 12-11-07

National Snow and Ice Data Center/NASA
CO2 into atmosphere – 3x faster
Arctic melting – 3x faster, 30 years earlier
Greenland melting – 3x faster
Antarctica melting -- faster
Sea level rise – 2x faster

than IPCC 2007 predictions (www.climateinstitute.org.au)

American West temperatures – 2x faster

than rest of world (Rocky Mtn. Climate Organization/NRDC)
Climate Change Exacerbates other “Change”

- Habitat loss
- Biodiversity loss
- Invasive species
- Over-exploitation of resources
- Fresh water diversions
- Pollution

Tuna
-- ~1.4 degree F increase past 100 years
-- ~3-12 degree F projected for next 100 years
-- Already seeing impacts of warming including greater variability in wind, ocean currents, more extreme weather events
Seabird Breeding Failure

Farallon National Wildlife Refuge

Cassin’s Auklet

www.prbo.org
Many Other Animals Also Depend on Krill!
Total backscatter (Sv)

2004
May
Jul
Sep
Oct
Feb
Apr
May
Jun
Jul
Oct
May
Jun
Jul
Oct

2005
July
Oct
May
Jun
Jul
Oct

2006
May
Jun
Jul
Oct

Gelatinous zooplankton in Tucker samples

Cells identified as krill
Mean biomass (g/m²)

Fish and Seabirds - similar diet, impacts

Cassin’s auklets
Mean productivity = 0.67

Chinook salmon
Mean Index = 0.72

Auklets Predict Salmon - a year ahead

“Salmon season called off in bid to save chinook”
April 11, 2008
San Francisco Chronicle
Sea Level Rise, Storm Surges, Salinity
Catastrophic Flooding, Drought, Fire,

San Anselmo, CA Jan. 1, 2006

See: CA Climate Change Center
~20–30% species face extinction with 2.7 F increase

~40–70% with 6.3 F increase

IPCC 4th Assessment Final Report Nov. 2007
Key Part of Solution: CONSERVATION

Enhance ecosystem resistance, resilience, & response to rapid climate change

Mitigate and adapt

Seavy et al, PRBO unpublished; Millar et al. (2007)
How to maintain biodiversity and ecosystem function during rapid change?

ESA--Endangered Species Act--powerful tool of 20th century

Under rapid change in 21st Century, new ESA?

Ecosystem Services Act
Employ Adaptive Conservation Strategies

Monitor key biological measures—e.g., focal bird species

Understand ecological mechanisms

Inform mitigation and adaptation actions

http://www.prbo.org/cms/docs/consplans/ACSGUIDEweb.pdf
Develop Climate Change Conservation Plans

See [www.prbo.org/calpif/](http://www.prbo.org/calpif/)
Create “Designed Landscapes” to:

- enhance biodiversity and ecosystem services
- forestall or soften ecological transitions
- establish habitat refugia, buffer zones, corridors
- facilitate shifts in species distribution

Wiens, J., September, 2007, [www.prbo.org/climatechange](http://www.prbo.org/climatechange)
San Pablo Bay: ~50,000 acres total

Ecosystem “services”:
• Sequester carbon
• Reduce flood impacts
• Reduce sea level rise impacts
• Sustain fish and birds
• Filter out pollutants

Napa Sonoma Marsh Restoration, Ponds 2, 2a, 3, Larry Wyckoff, CDFG
Monitoring: Not all designs created equally!

Restoration Assessment Models
Bull Island, Napa River

Stralberg, D., et al, PRBO

\[ Y = m_1 x_1 + m_2 x_2 + m_3 x_3 + m_4 x_4 + b \]

- \( Y \): Common Yellowthroat density
- \( x_1 \): Distance to nearest channel
- \( x_2 \): Proportion of \( Typha \)
- \( x_3 \): Proportion of \( Scirpus \)
- \( x_4 \): Vegetative diversity

R: PRBO Conservation Science
Protect Future Wetlands- barriers?

Assumptions:
- 1 m sea level rise
- Increased salinity

Northern SF Bay Delta
Assumptions:
1 m sea level rise, increased salinity

Stralberg, D., et al, PRBO
Mt. Tam Watershed Implications?
Where will birds occur?

Oak Woodland changes—create and manage for refugia to soften transition?

Future Acorn Woodpecker Distribution

Stralberg, D., et al., PRBO Conservation Science
Invasives = Biodiversity, Resilience
Riparian = Water, Biodiversity

Ecosystem “Services”:

• Reduce flood damage
• Provide wildlife corridors
• Sustain fish and birds
• Replenish ground water
• Store water
• Nourish upland habitat

Yellow Warbler
Cosumnes Preserve

Grosholz, T., et al, UC Davis
Mt. Tam Designed Landscapes: Benefit Adjacent Public and Private Lands
Result: links corridors, biodiversity
In Summary

• Expand biological monitoring, long term data sets
• Use bird ecology studies - early warning indicators
• Employ adaptive conservation- feedback cycle, real time conditions
• Identify and protect current and future refugia
• Link corridors, facilitate species movement
• Recognize change is occurring, rate of change is increasing, losses will occur
• Prioritize investments and act now!

For more, see: www.prbo.org/climatechange
Increasing rate of climate change...

It’s no longer our grandmothers’ watershed. Think globally, act locally!  MMWD photo
• “The longer action is delayed, the more it will cost.”
  (IPCC, Nov 2007)

• Kick our carbon habit and prioritize adaptive conservation now
THANK YOU, MMWD and….

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- Bureau of Land Management
- California Coastal Conservancy
- California Department of Fish and Game
- California Bay Delta Authority
- California Audubon
- California Seagrant
- Central Valley Joint Venture
- Cornell Lab of Ornithology
- DMARLOU Foundation
- Richard Grand Foundation
- Marin Municipal Water District
- Giles Mead Foundation
- Moore Family Foundation/Gordon & Betty Moore Foundation
- David and Lucile Packard Foundation
- National Fish and Wildlife Foundation
- National Park Service
- National Science Foundation
- NOAA Fisheries, Marine Sanctuaries
- Natural Resource Conservation Service
- Resources Law Group/Resources Legacy Fund Foundation
- Riparian Habitat Joint Venture
- San Francisco Bay Joint Venture
- The Climate Project/Al Gore
- The Nature Conservancy
- U.S. Fish and Wildlife Service
- USDA Forest Service