



Pepperwood

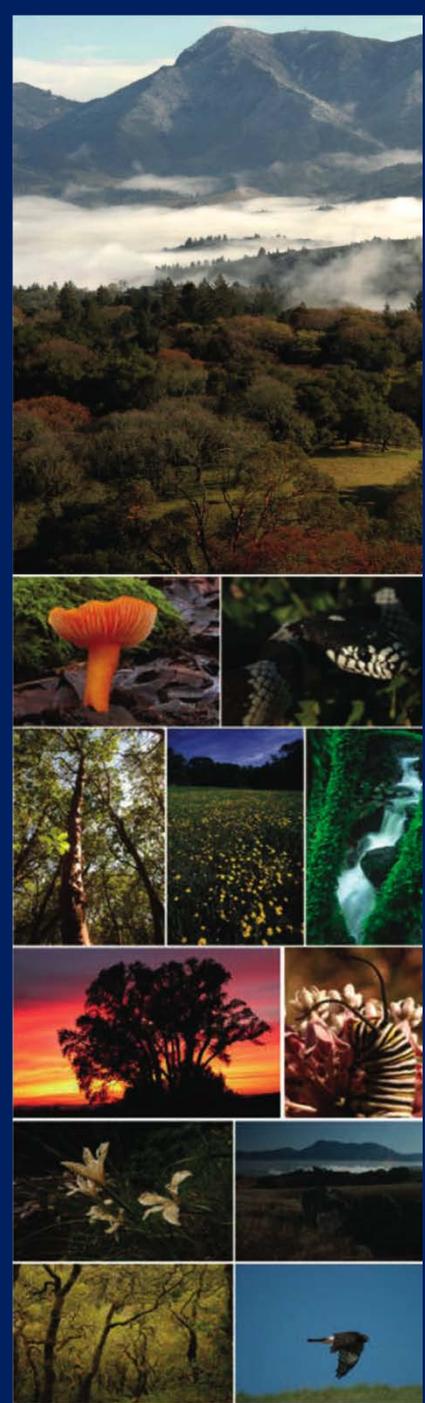
P R E S E R V E

Inspiring conservation through science

Ecosystem services, climate adaptation and the role of extreme events

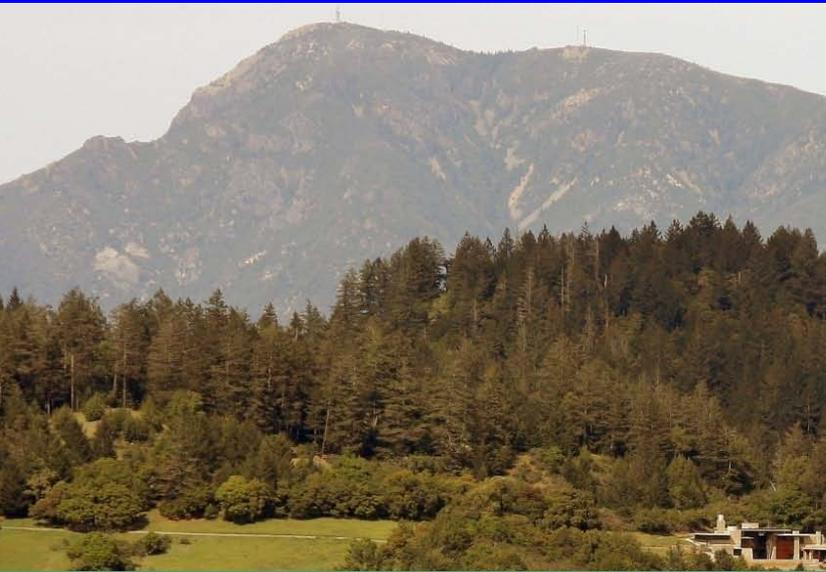
March 13, 2012

Lisa Micheli, PhD



Pepperwood Foundation

mission
to advance science-based conservation throughout
our region and beyond



The new Dwight Center for
Conservation Science



3200-acre reserve in eastern
Sonoma Co, originally gifted to CA
Academy of Sciences

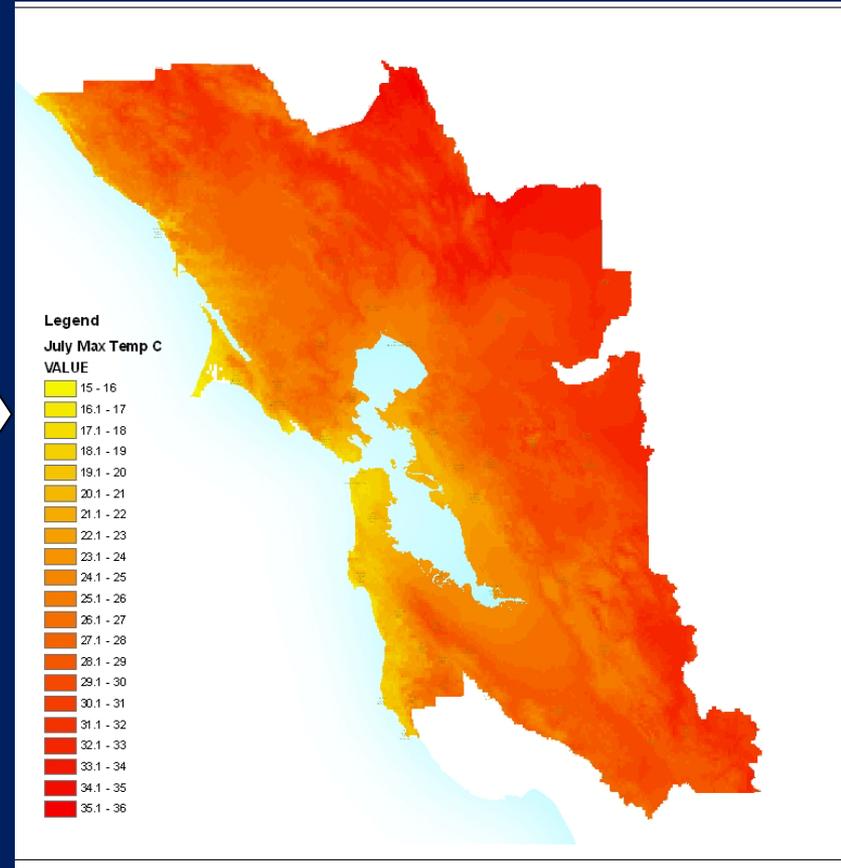


Pepperwood
PRESERV

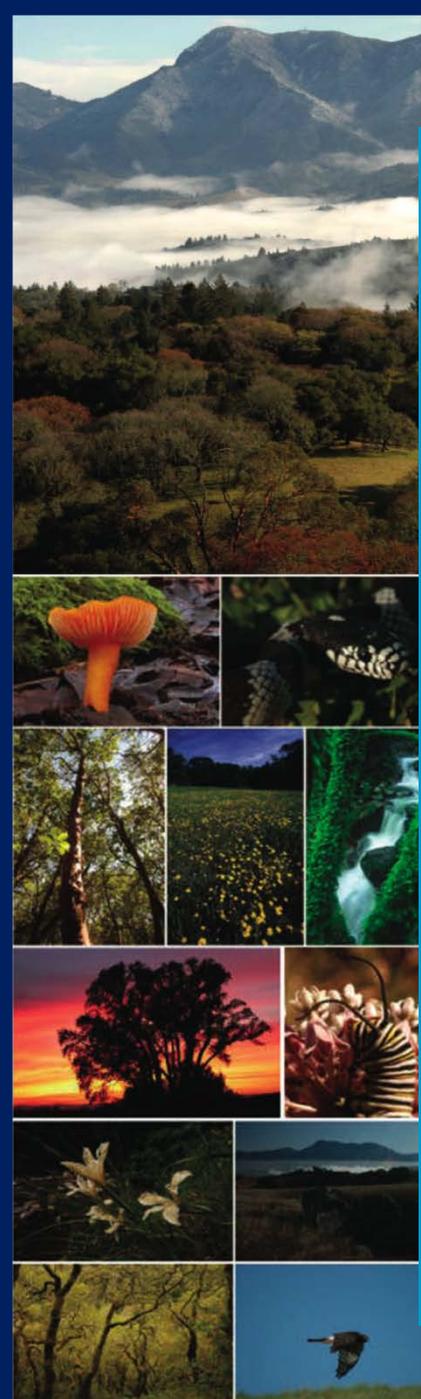
Inspiring conservation through science



the structure and function of biodiversity



making the global local to learn how to cope
with climate change



Relationship of extreme events to
ecosystem services
Bay Area-wide Initiatives: TBC3 and
BAECCC
North Bay Climate Adaptation
Initiative
Russian River ecosystem services
Implications for conservation lands
watershed management

outline



Pepperwood
P R E S E R V E

Inspiring conservation through science



Ecosystem Services

Extreme weather—flood, drought (fire)—disturbances that can stress and/or renew systems, force transitions or extirpations

Our emergency response measures impact ecosystems

Ecosystems services include buffering human communities against climate change

Healthy ecosystems provide free “services” to human communities, including: water filtration, groundwater recharging, stormwater control, air purification, nutrient recycling, crop pollination, and soil enrichment.

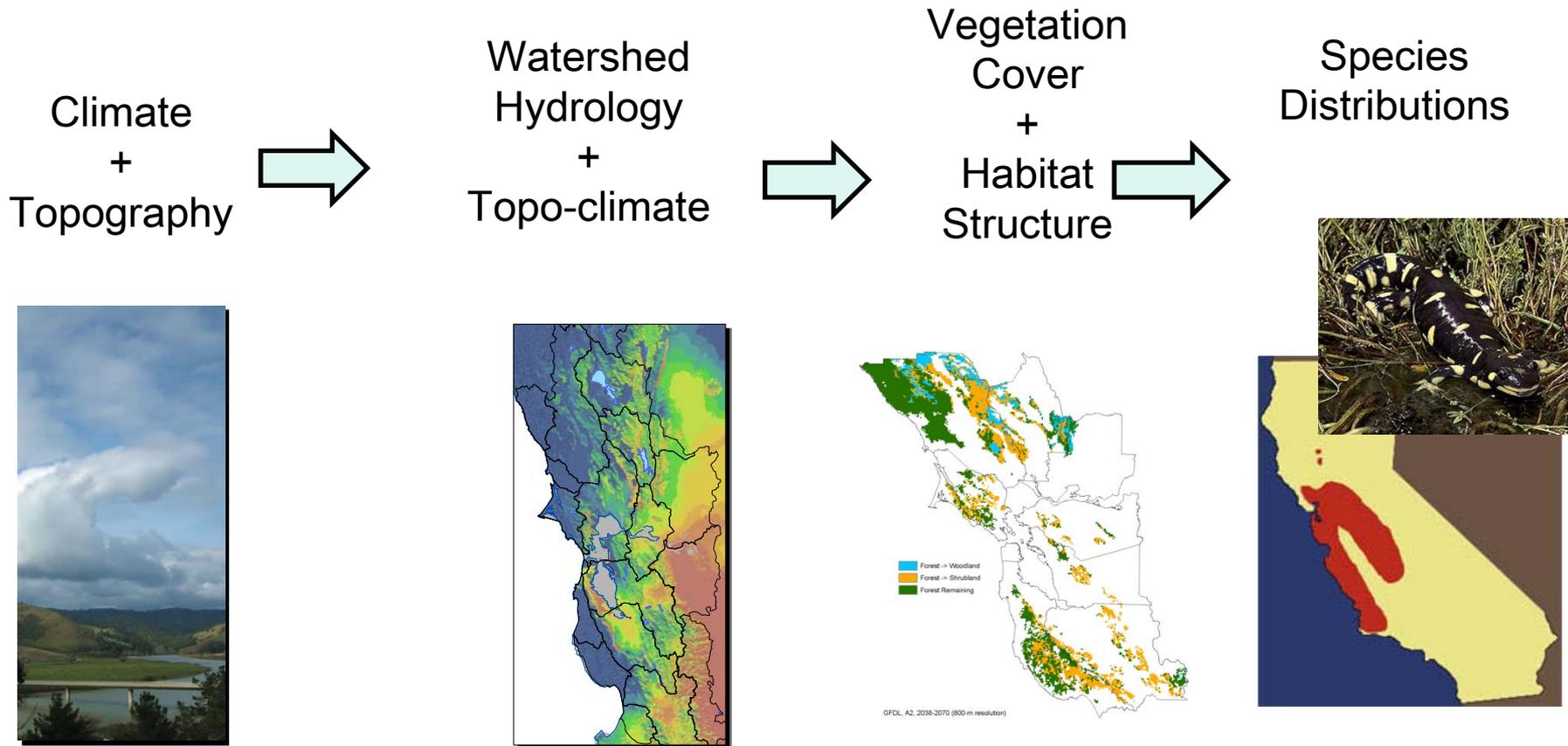


Bay Area Protected Areas and Climate Change Workshop: Pepperwood Meeting July 19-21 2010

Left to right: Miguel Fernandez, Jim Thorne, Mary Lee Hannibal, Alicia Torregrosa, Stu Weiss, Mike Hamilton, Meg Krawchuk, Will Cornwell, Nicole Heller, Al Flint, David Ackerly, Lorrie Flint, Ryan Branciforte, Scott Loarie, Dave Conklin, Jason Kreitler, Sam Veloz, Lisa Micheli, Healy Hamilton, Max Moritz, Morgan Kennedy, Beth Sabo, Jim Johnstone **Missing:** Kirk Klausmeyer, Lee Hannah, Diana Stalberg, Phil Duffy, Karen Gaffney, Adina Merenlender

Terrestrial Biodiversity Climate Change Collaborative (TBC3)

TBC3 conceptual research framework



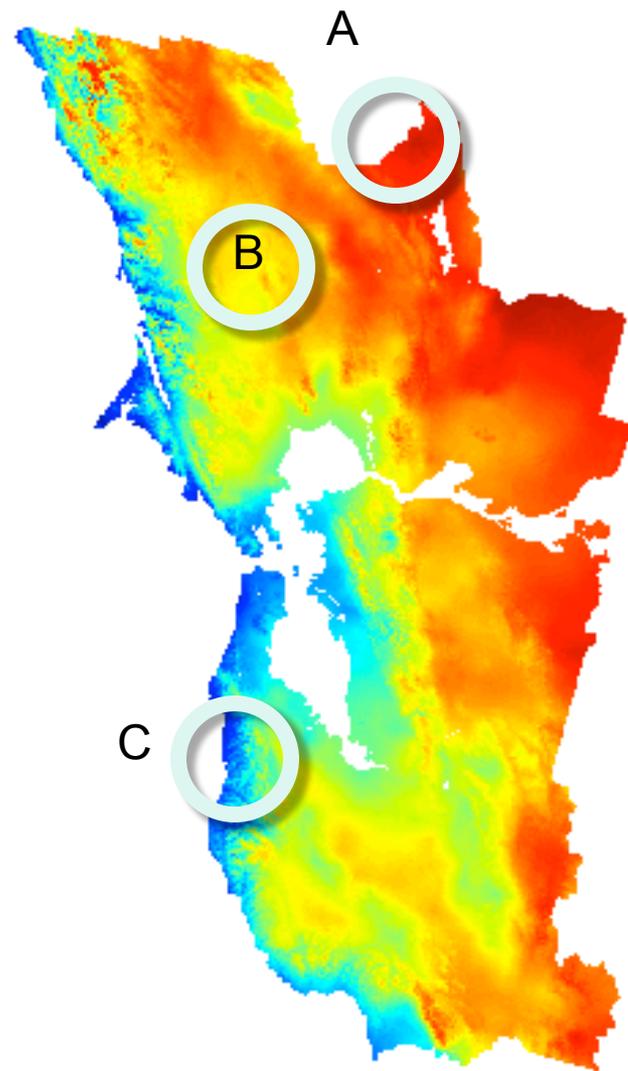
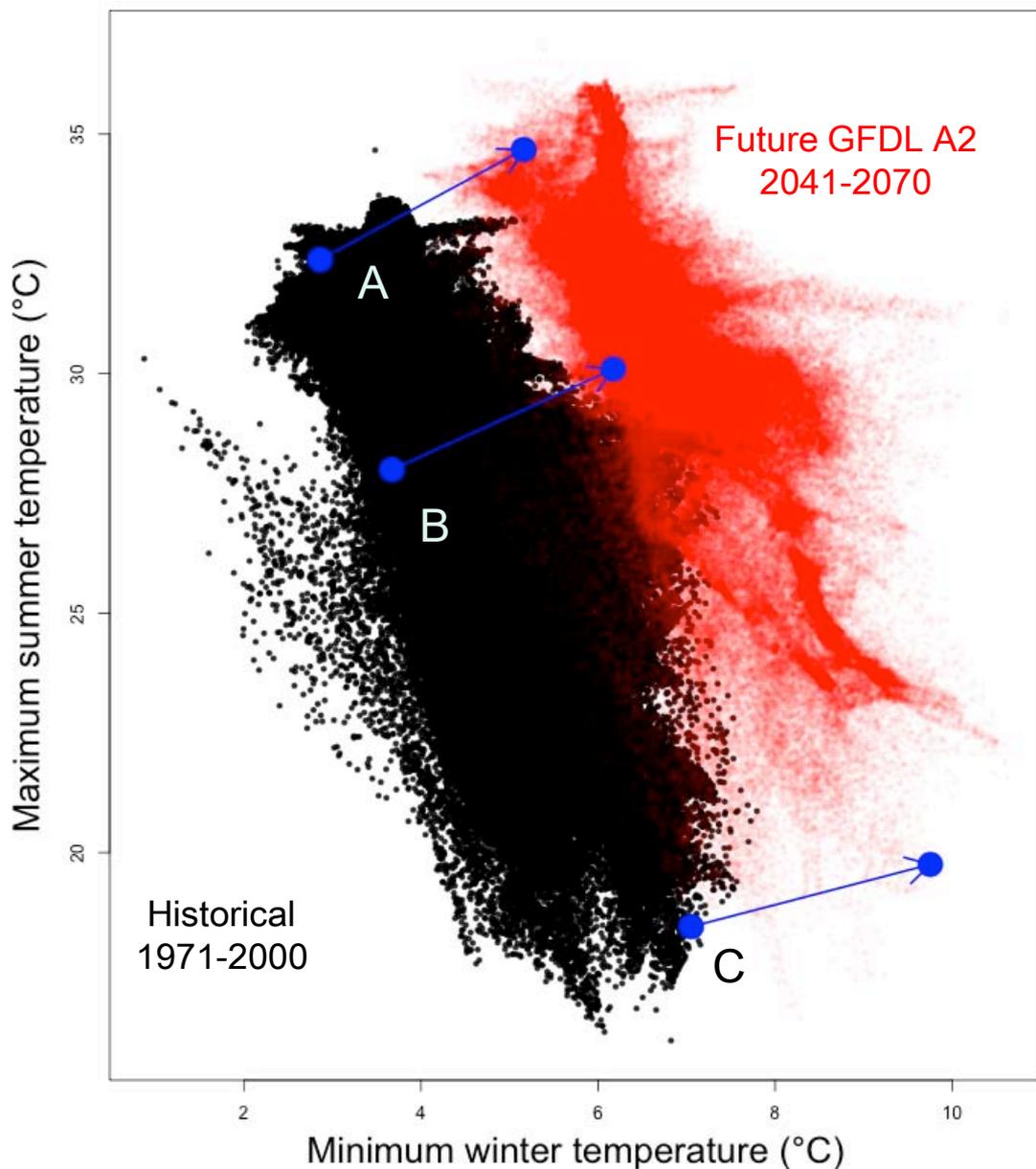
TBC3 Research Agenda

- Create Bay-Area fine-scaled (270m) ensemble (13 models) for temp and precip
- Compare and contrast outputs via statistical analysis
- Create guidance for watershed managers regarding model selection and appropriate applications
- Compile and standardize Bay Area empirical fog data sets for analysis

Leads: Stu Weiss (BAOSC)
Healy Hamilton (California Academy of Sciences)
Alicia Torregrosa (USGS)



Due to the coastal-inland pattern, rising temperatures create novel climates in the Bay Area—will this result in novel ecosystems?



Courtesy Dave Ackerly, UCB

Pacific Coastal Fog: TBC3 Output 1.2

- GIS fog datasets for ecological modeling derived through data fusion and data assimilation techniques
- FOG TEAM of meteorological remote sensing specialists, atmospheric scientists, climatologists, oceanographers, ecohydrologists, statisticians, modelers, plant physiologists, and representative fog data users

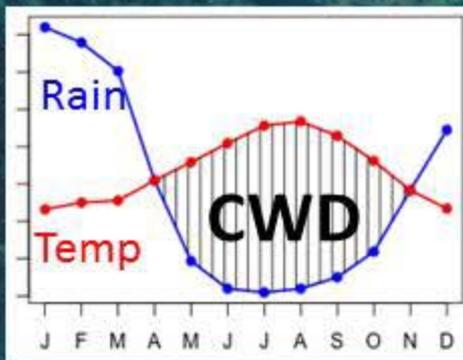


SCRIPPS INSTITUTION OF OCEANOGRAPHY

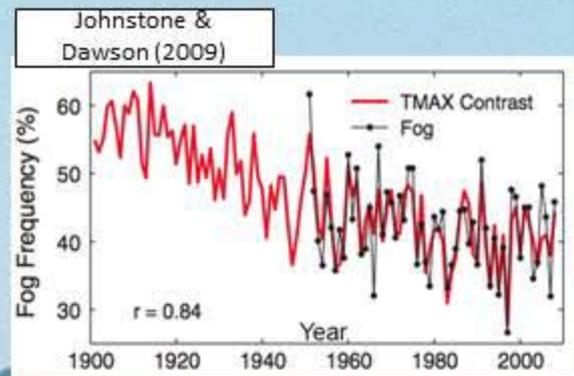


Photograph by James A. Sugar

Science Questions



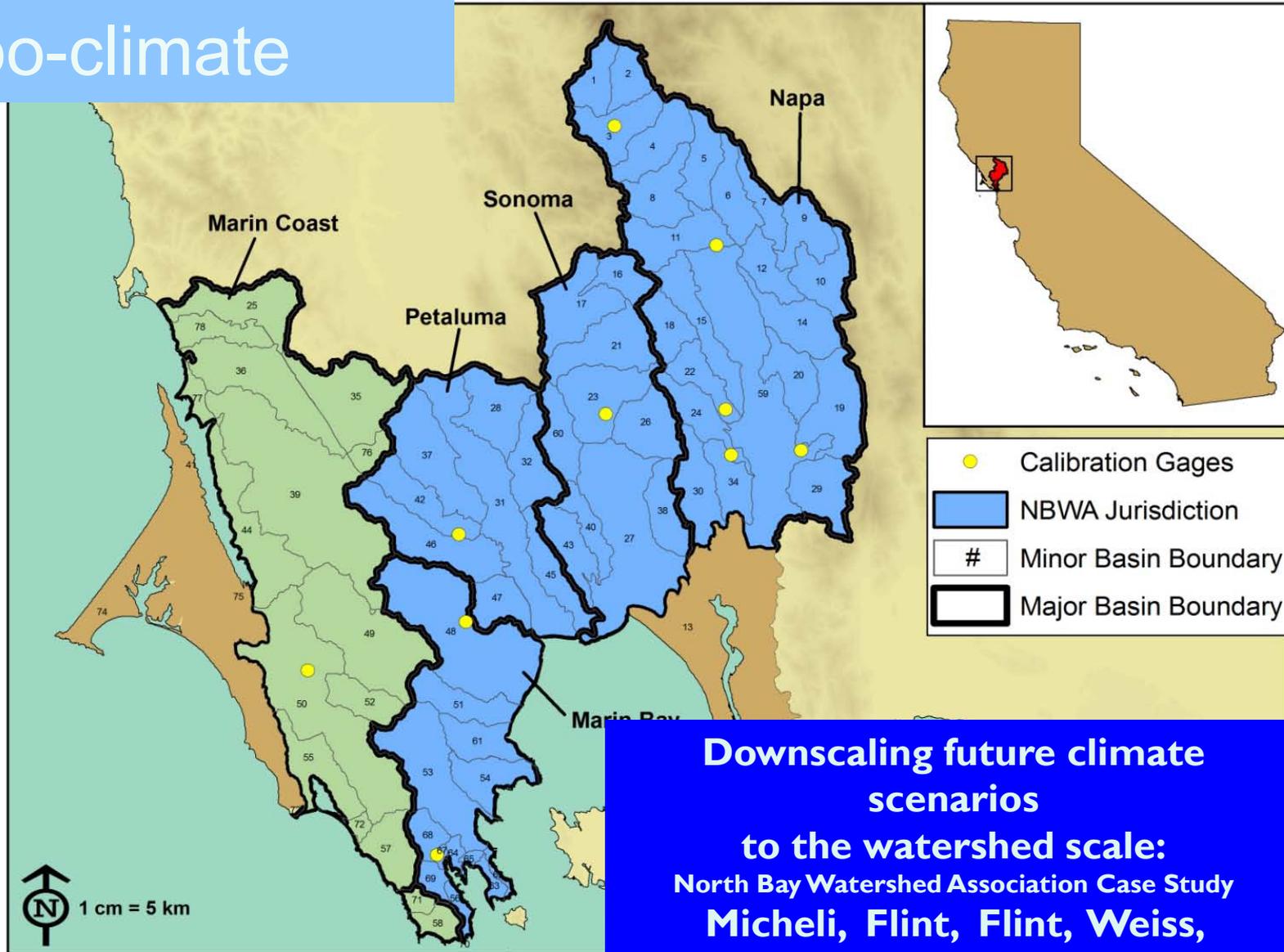
Maps of future climatic water deficit scenarios for CA suggest increasing late summer aridity under all scenarios, will fog mitigate this effect, if so, how much and where?



Data suggest Pacific coastal fog is in decline. Is this related to climate change? How will it affect coastal species and habitats?

Watershed Hydrology + Topo-climate

TBC3 Research Agenda

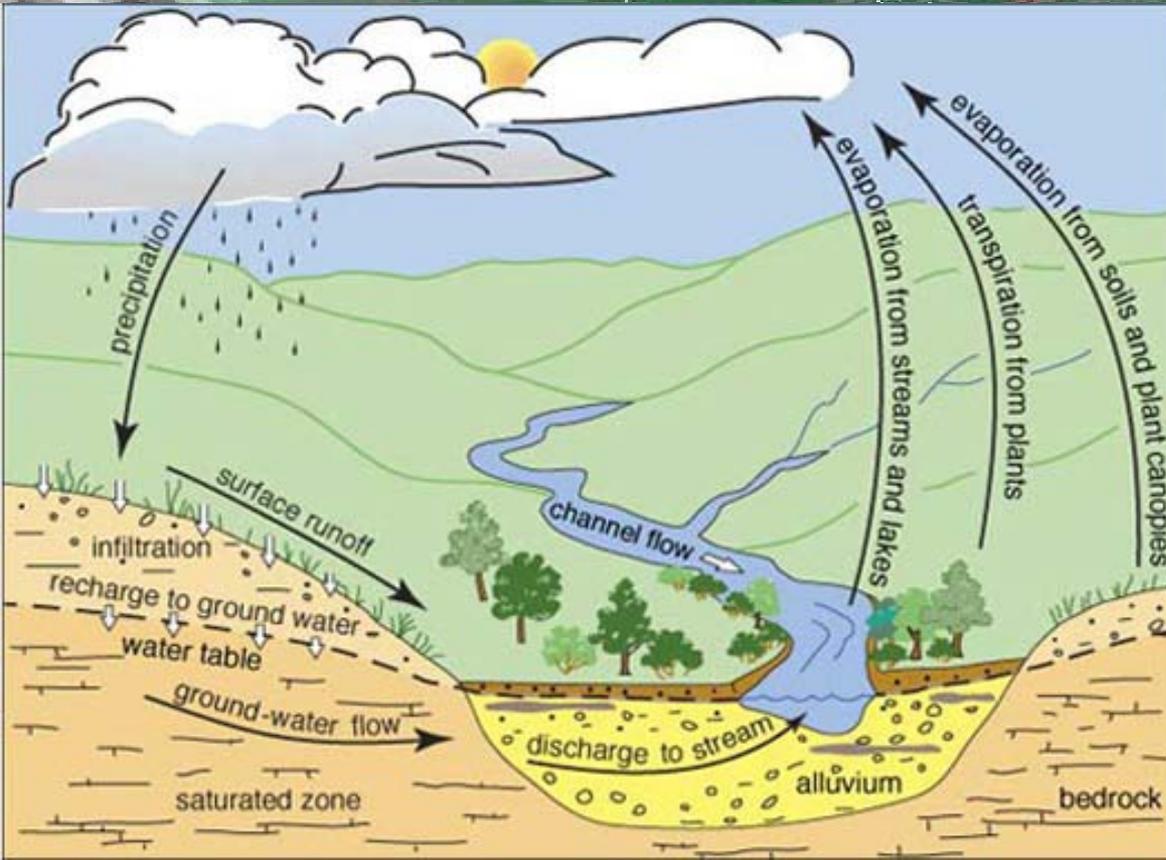
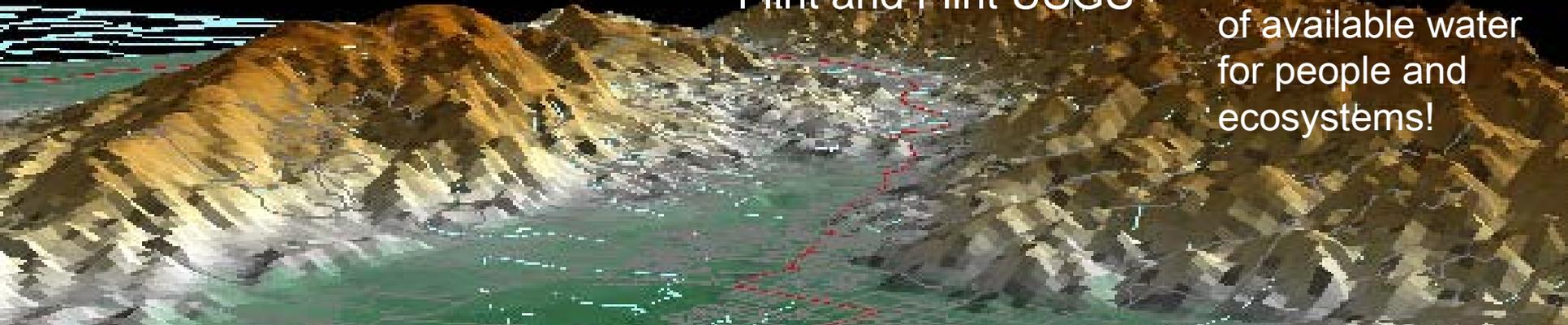


**Downscaling future climate scenarios
to the watershed scale:
North Bay Watershed Association Case Study
Micheli, Flint, Flint, Weiss,
Kennedy 2011**

Basin Characterization Model

Flint and Flint USGS

To get at important issue of available water for people and ecosystems!



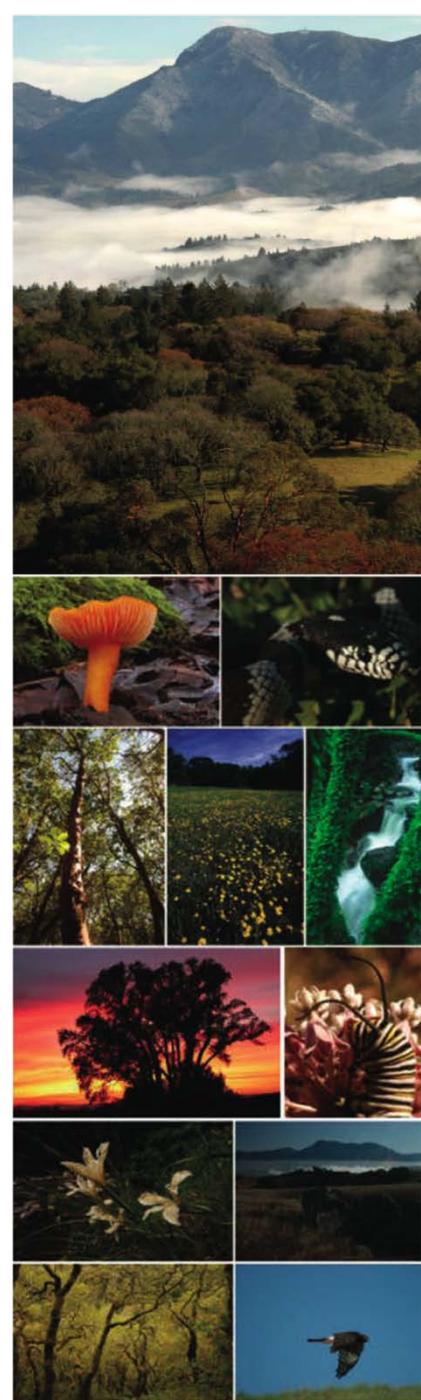
Solves the physical water and energy balance based on topography, soils, rainfall, and temp for every pixel in domain—to estimate flows, recharge and soil moisture

Vegetation + Habitat Structure

TBC3 Research Agenda

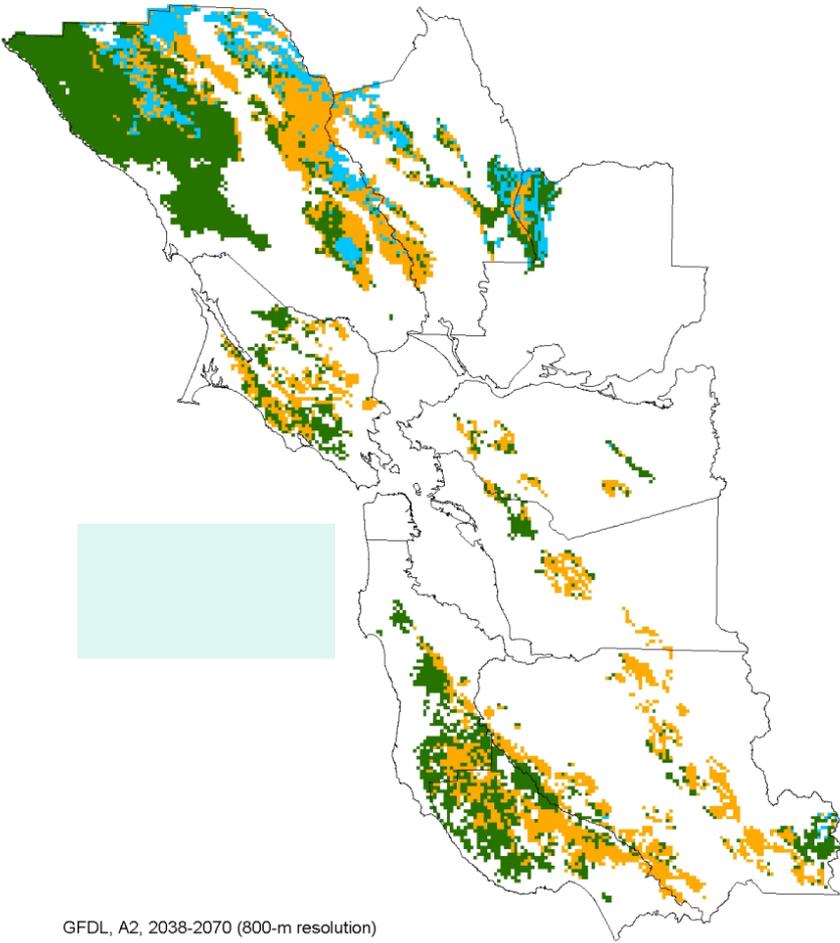
- Develop and implement field-based protocol for synchronized monitoring of topo-climate and vegetation at Pepperwood
- Design and implement protocol for detecting vegetation in transition
- Explore ways of “scaling up” to multiple reserves across Bay Area to detect regional change

Leads: David Ackerly (UCB)
Stu Weiss (Bay Area Open Space Council)
Jim Thorne (UCD)
Alan and Lorraine Flint (USGS)



Future climates favor shrub and grassland at the expense of forest in the Bay Area

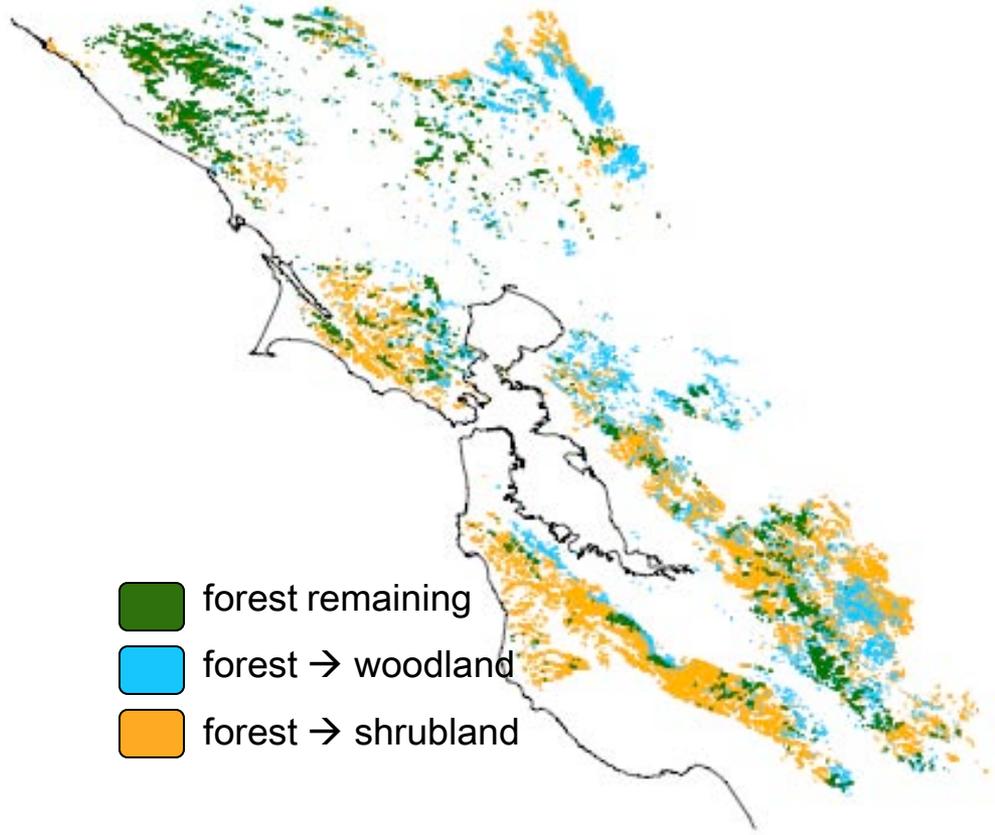
'Random forest' model of CalVeg types
800 m resolution, UCSC regional climate model



GFDL, A2, 2038-2070 (800-m resolution)

Diana Stalberg et al. 2010 PLoS ONE (PRBO)

Predictive vegetation modeling of Bay Area vegetation
270 m downscaled climate, GFDL mid-century future



- forest remaining
- forest → woodland
- forest → shrubland

Will Cornwell et al. in prep. (UC Berkeley)

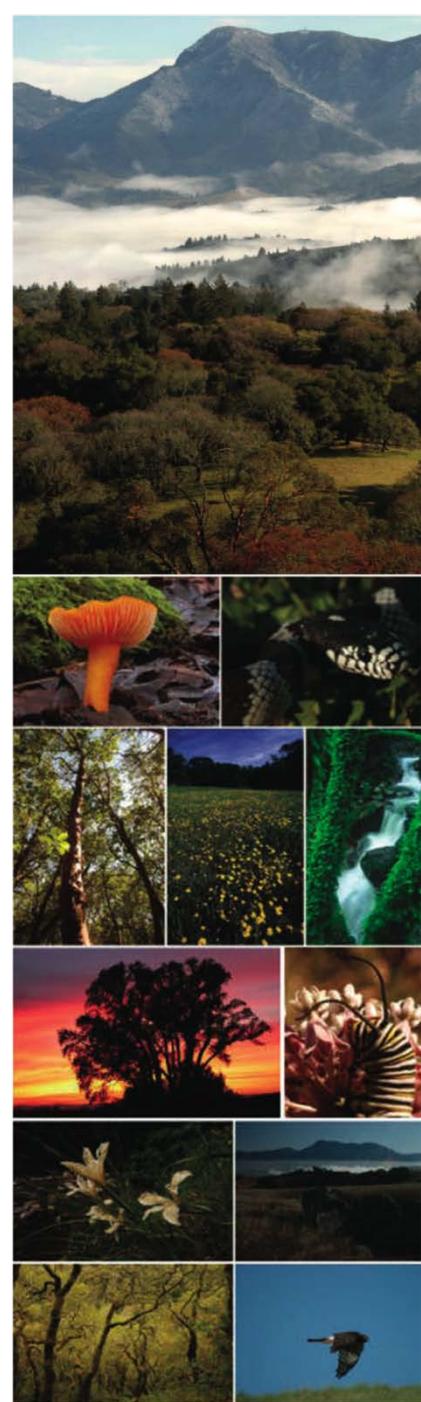
- Persistence: Can we forecast where various species will persist into the future?
- Movement: Can we project how species future distributions will shift under alternative climate change scenarios?
- Extreme Events: Presently using projections in monthly time steps-how to move forward to evaluate impacts of extreme events?



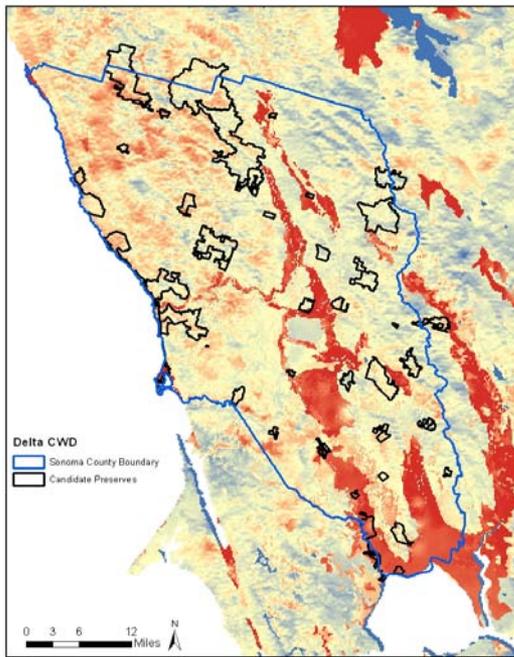
TBC3 Integration with Bay Area Ecosystem Climate Change Consortium (BAECCC)



- TBC3 serves as terrestrial technical team
- Define meaningful interface with estuarine and coastal teams—key to next science steps
- Assist with regional integrated monitoring strategy (Sonoma County pilot, SFBJV)
- Help develop long-term research strategy with BAECCC and CA LCC
- Rely on BAECCC in concert with BAOSC to help reach natural resources managers
- Work on collaborative commons framework(s) for data and knowledge sharing



North Bay Climate Adaptation Initiative **NBCAI**



Goal The goal of NBCAI is to foster an open conversation between technical experts, land and water managers and policymakers in support of effective local scale climate adaptation strategies that preserve natural resources, biodiversity, and ecosystem services.

Purpose Our purpose is to implement effective climate adaptation strategies that sustain ecological and human communities of North San Francisco Bay watersheds.

Vision Our vision is that the North Bay has resilient, biologically diverse natural systems that provide lasting ecosystem functions and services.

northbayclimate.org





coupling climate-ecosystem
measurements

advancing real-time monitoring in
So Co and across region

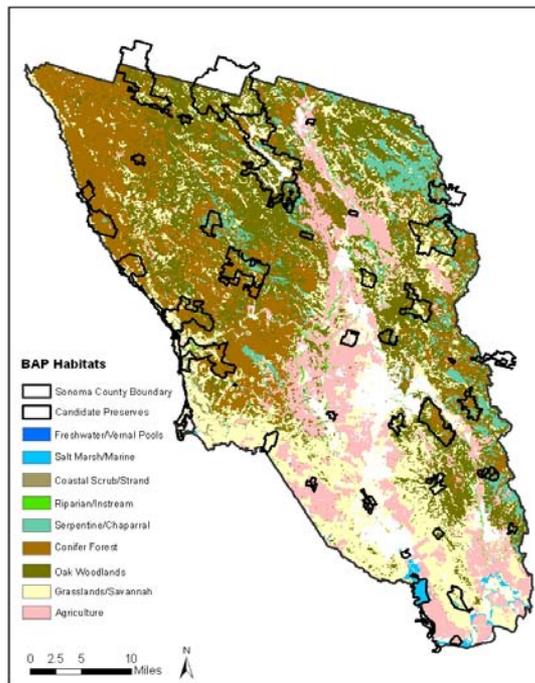
sharing data

creating a community of
practitioners

disseminating lessons learned

we need cost-effective means of measuring
climate in concert with biotic “vital signs”

Sonoma County NBCAI pilot



Monitoring Goals

Design and implement bio-physical monitoring stations located strategically on conservation lands and waters

Coordinate and standardize data collection methods, integrate aquatic (marine to freshwater), riparian, terrestrial protocols

Analyze data to detect change over time relative to climatic and other drivers



San Francisco Bay Area Conservation Lands Network

Implications for watershed management of conservation lands

change in vegetation cover to communities tolerant of more arid conditions (and more fire-prone?)

loss of habitats that require high soil moisture to support sensitive species. We can preserve the ball park, but the players are going to change!

protected headwaters will grow more important for fisheries, flood control and groundwater recharge



Controlling invasive species is more important than ever in the face of changing climates!



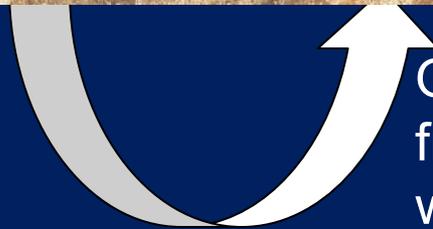
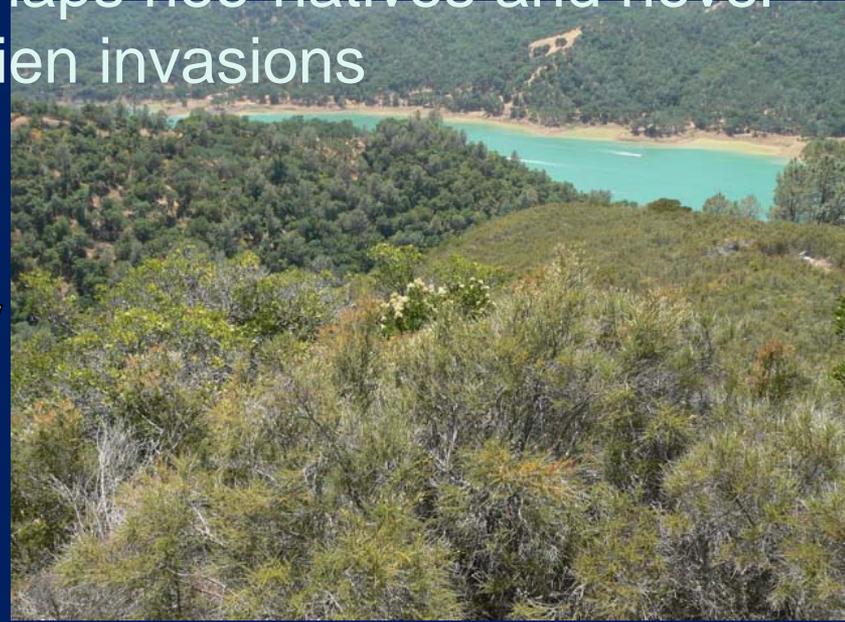
Watershed management will determine whether we experience native vegetation transitions (perhaps neo-natives and novel ecosystems?) vs. alien invasions

vegetation transitions depend on:

- 1) mortality of existing mature plants
- 2) propagule sources for new species



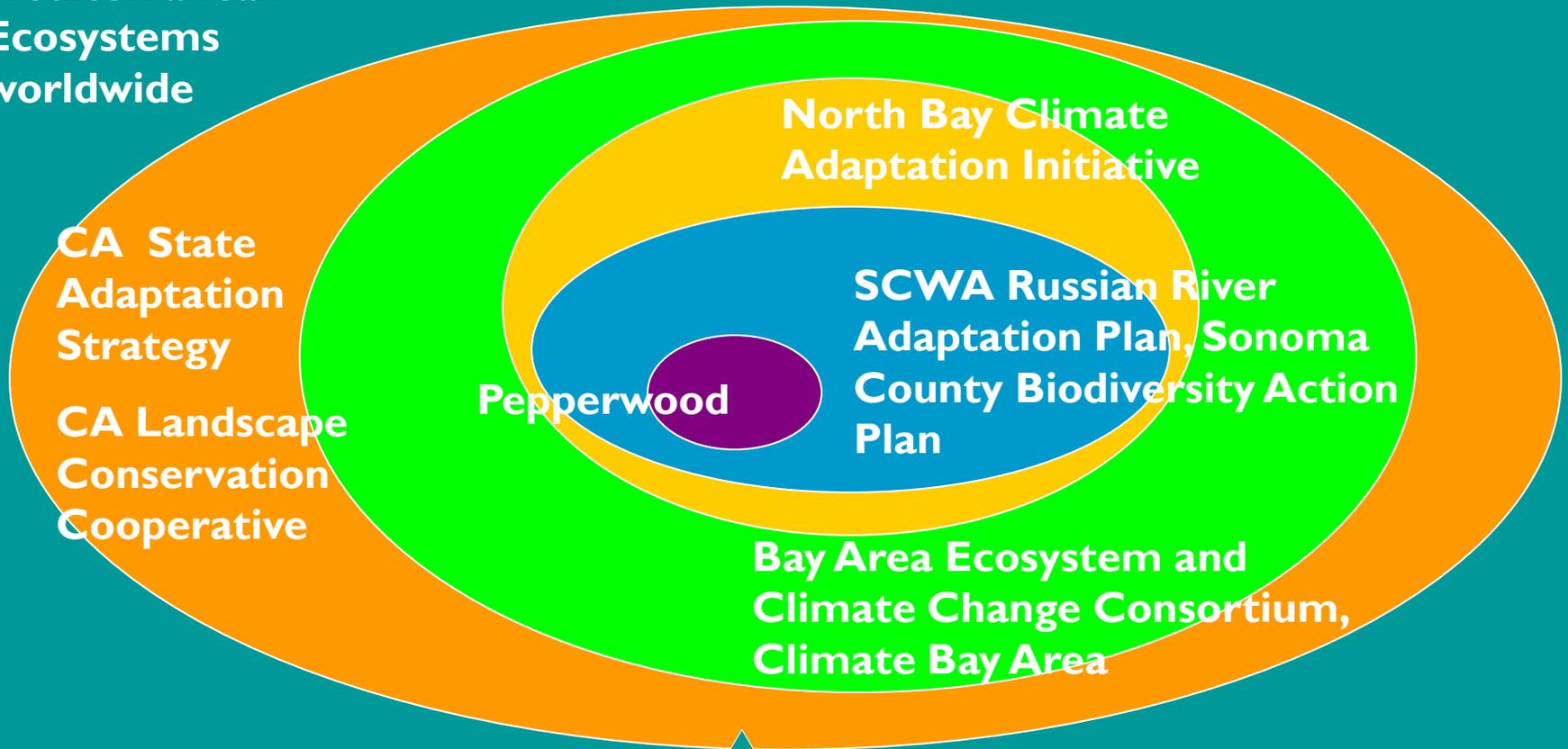
?



Our response to fires, floods, disease will make the difference

Nesting of climate adaptation efforts

Mediterranean
Ecosystems
worldwide



PRIVATE PHILANTHROPY, SCIENCE, and VOLUNTARY ACTION

THANK YOU

lmicheli@pepperwoodpreserve.org

707-591-9310 x 203

