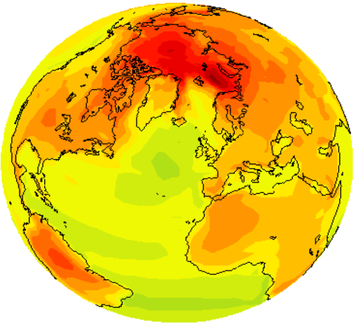
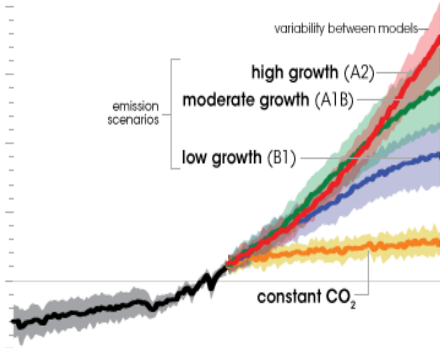
prbo

PRBO Conservation Science





Why climate change makes riparian restoration more important than ever

Nathaniel E. Seavy (nseavy@prbo.org)

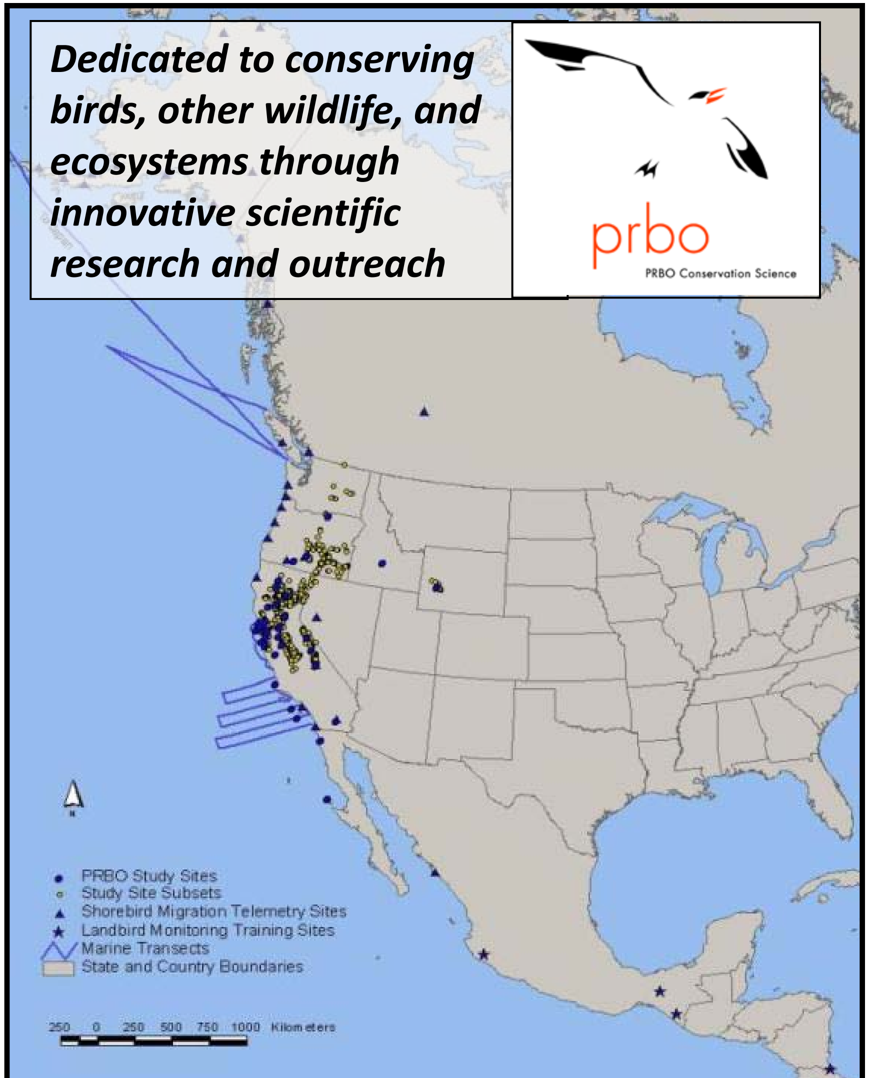
21 April 2010, *National Resource Damage Assessment and Restoration Workshop*

What (who) is PRBO Conservation Science?

Dedicated to conserving birds, other wildlife, and ecosystems through innovative scientific research and outreach

prbo

PRBO Conservation Science



Non-profit founded in 1965 as Point Reyes Bird Observatory

Headquarters in Petaluma, California

120 staff and seasonal biologists

Long-standing emphasis on conservation and restoration of riparian bird habitat

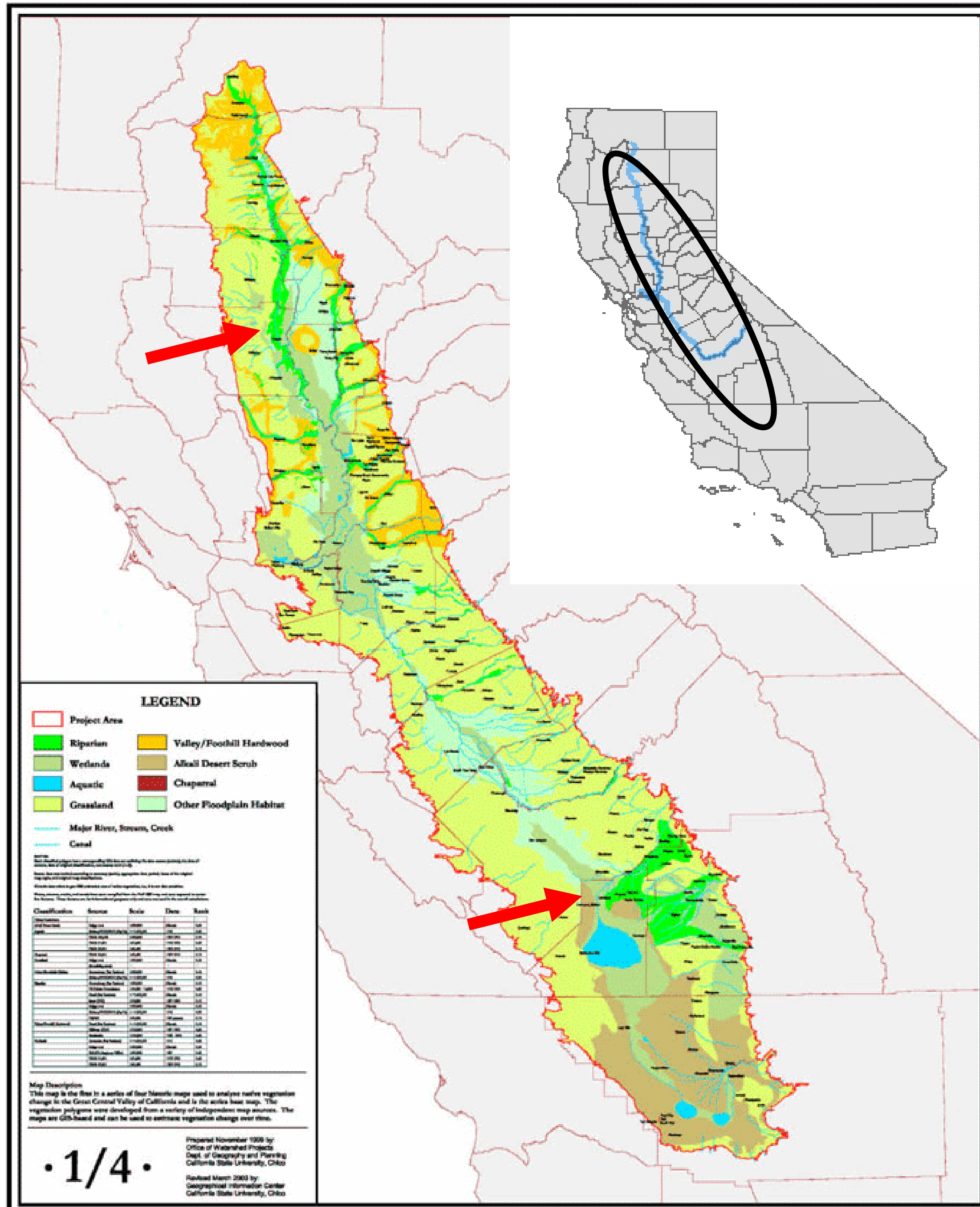
www.prbo.org

PRBO Conservation Science

- Riparian
- Grassland
- Urban/Agriculture
- Aquatic

<u>Pre-1900</u>
Extensive riparian and grassland areas

CSU Chico GIC



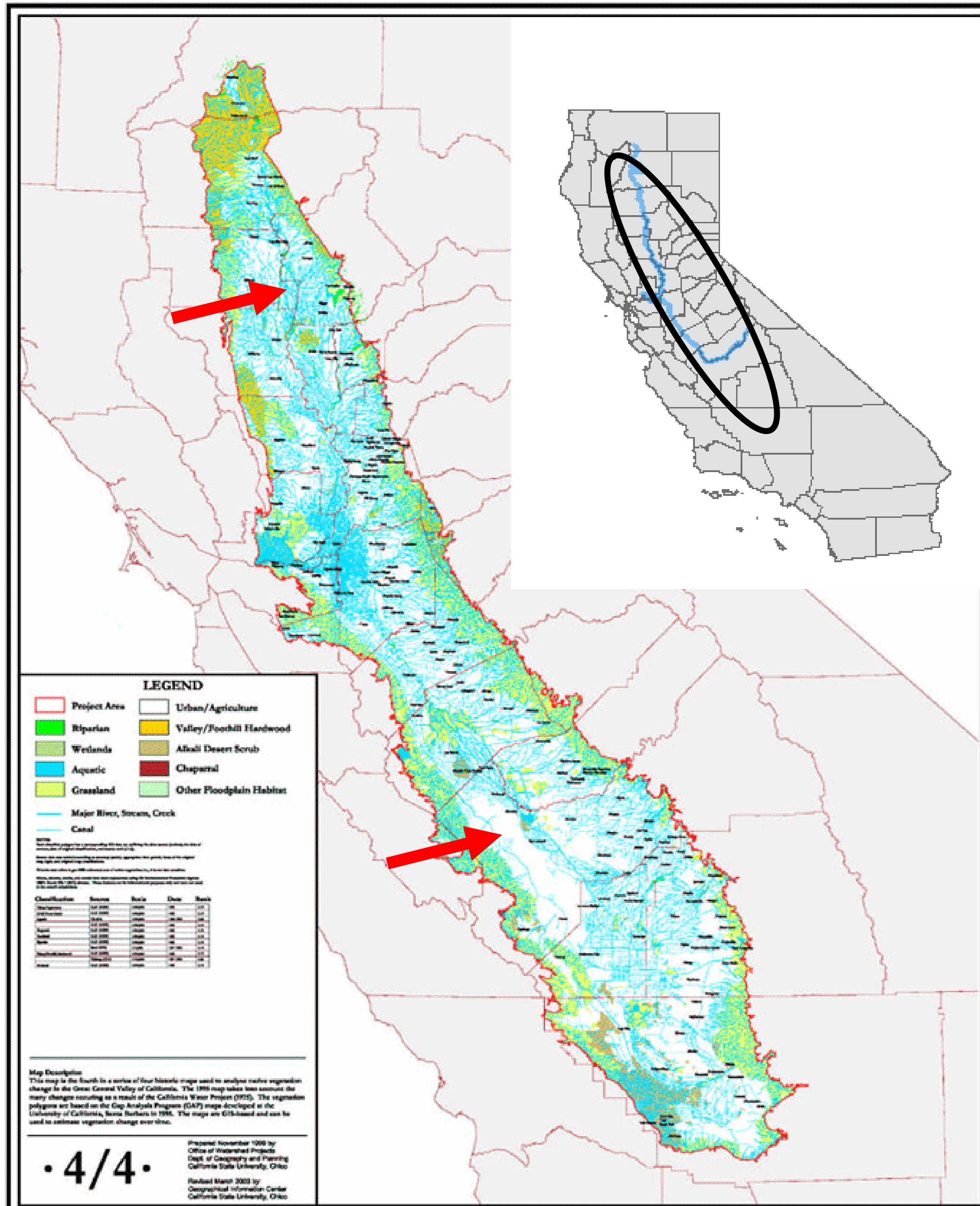
PRBO Conservation Science

Riparian

Grassland

Urban/Agriculture

Aquatic



1995

More aquatic features

More urban/agriculture

Less riparian & grassland

CSU Chico GIC

Presentation outline

1. **The challenge of climate change for resource management**

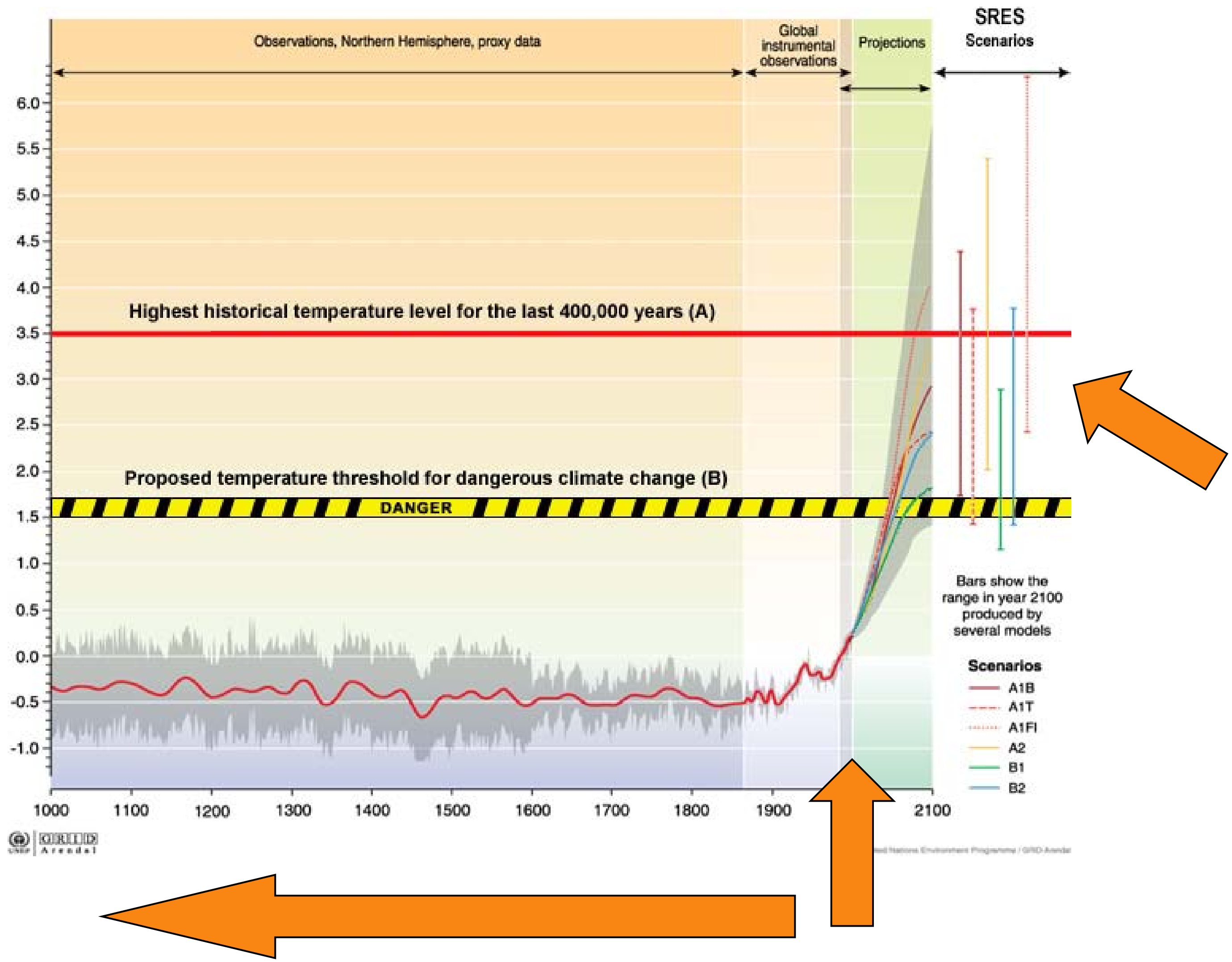
2. **Riparian restoration in the context of climate change adaptation**

3. **Will riparian restoration need to change?**

PRBO Conservation Science

Stationarity: the tendency for a mean and variance to remain constant over time

Temp difference from today (C)



Climate change and restoration = challenges

1. **Rapid speed of change**
2. **Uncertainty is high**
3. **Moving target**
4. **Uncharted territory**

Obvious questions:

What are you doing about it?
Why bother?

Why climate change makes riparian restoration more important than ever. *2009. Ecological Restoration.*

Tom Gardali and Chrissy Howell - *PRBO*

Greg Golet - *The Nature Conservancy*

Tom Griggs - *River Partners*

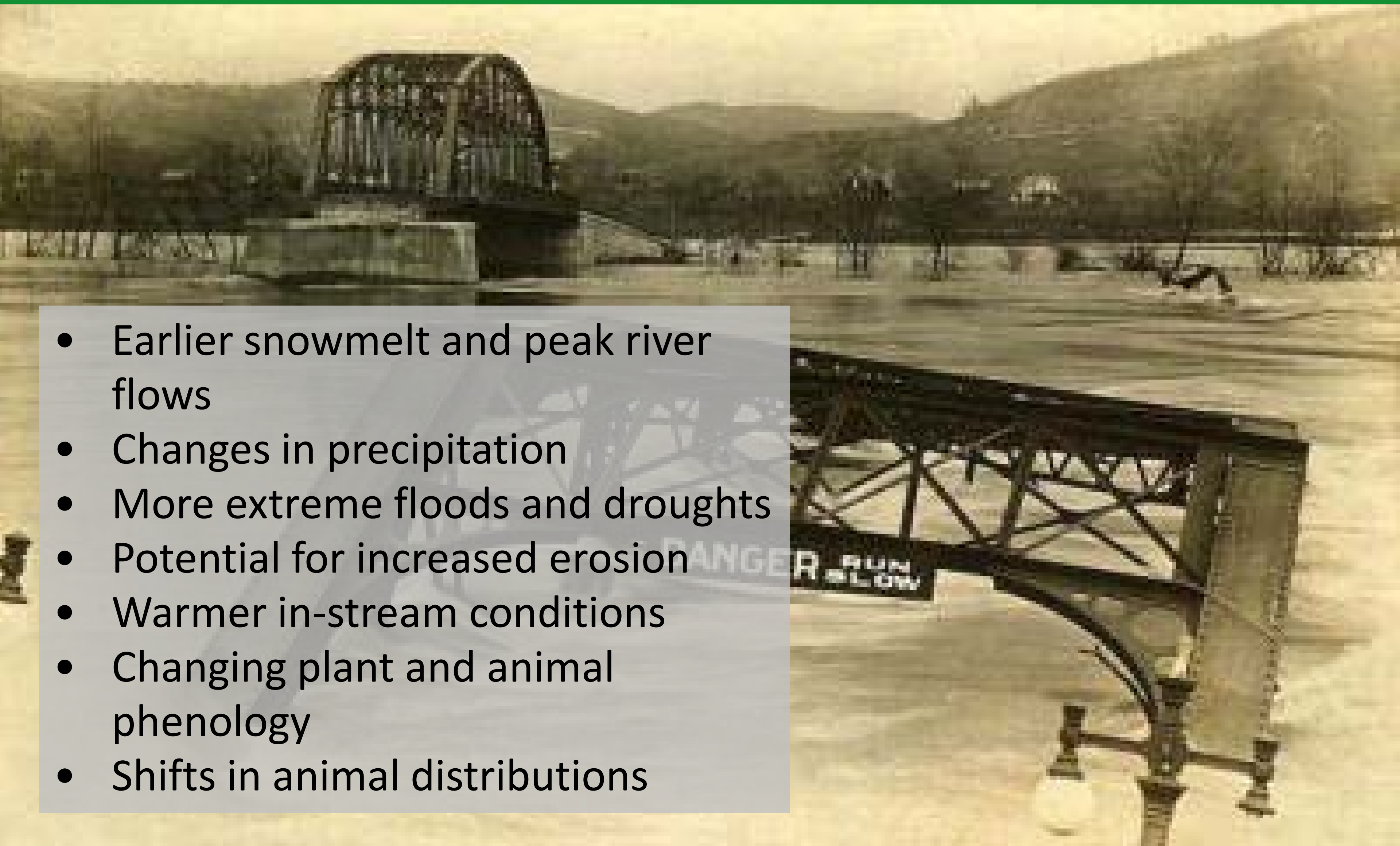
Stacy Small - *Environmental Defense Fund*

Josh Viers - *UC Davis*

Rodd Kelsey - *Audubon California*

Jim Weigand - *Bureau of Land Management*

How will climate change affect riparian systems?



- Earlier snowmelt and peak river flows
- Changes in precipitation
- More extreme floods and droughts
- Potential for increased erosion
- Warmer in-stream conditions
- Changing plant and animal phenology
- Shifts in animal distributions

PRBO Conservation Science

How do we prepare ecosystems for climate change?

GOALS

- **Resistance**
- **Resilience**
- **Response**

STRATEGIES

enhance connectivity

promote redundancy and buffers

reduce landscape synchrony

realign disrupted conditions

expect surprises

identify and protecting refugia

Millar et al. 2007. Ecological Applications

Riparian ecosystems are naturally resilient

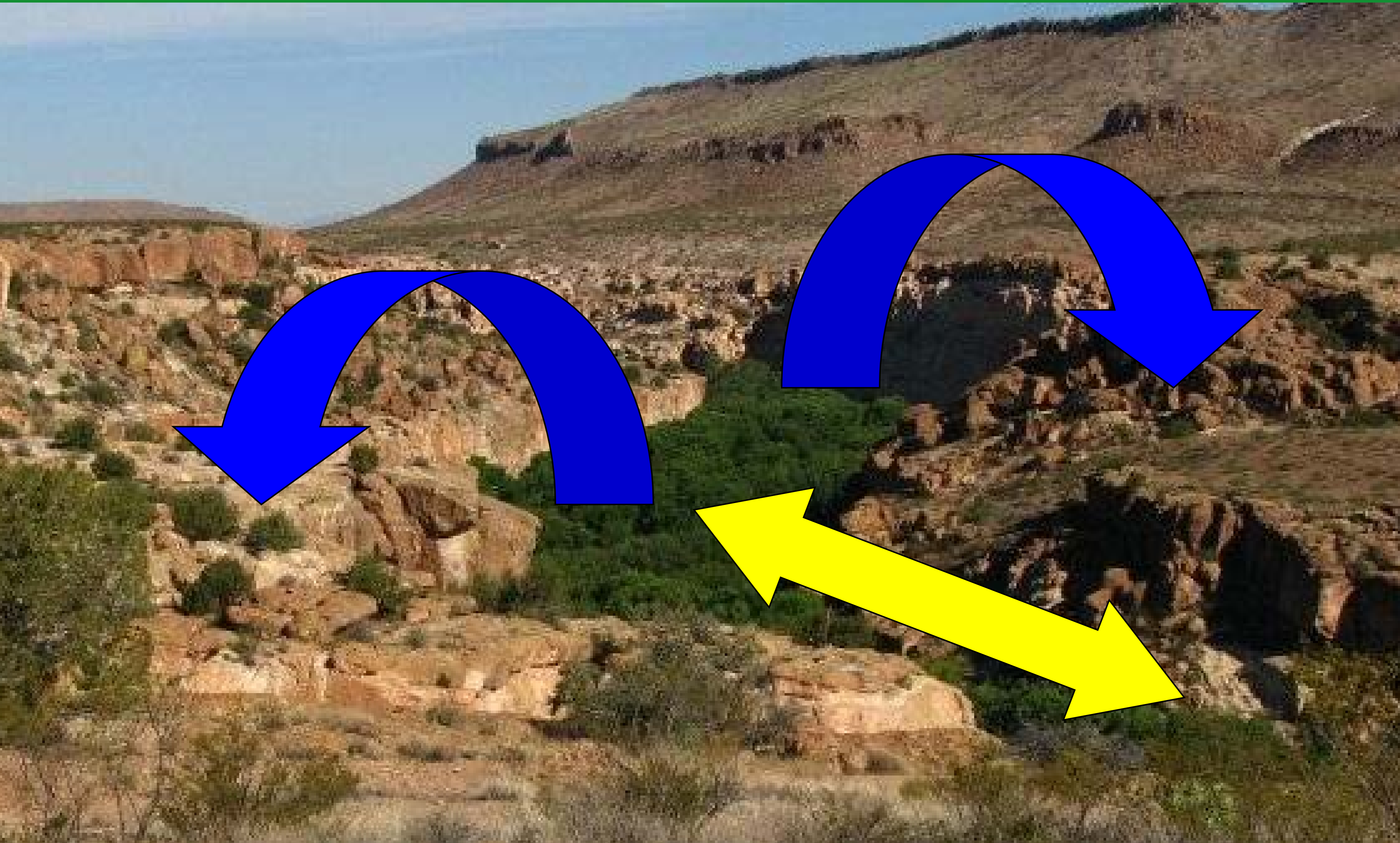
<u>If we invest in this site:</u>

Will extreme disturbances affect investments?

How long will recovery take?

PRBO Conservation Science

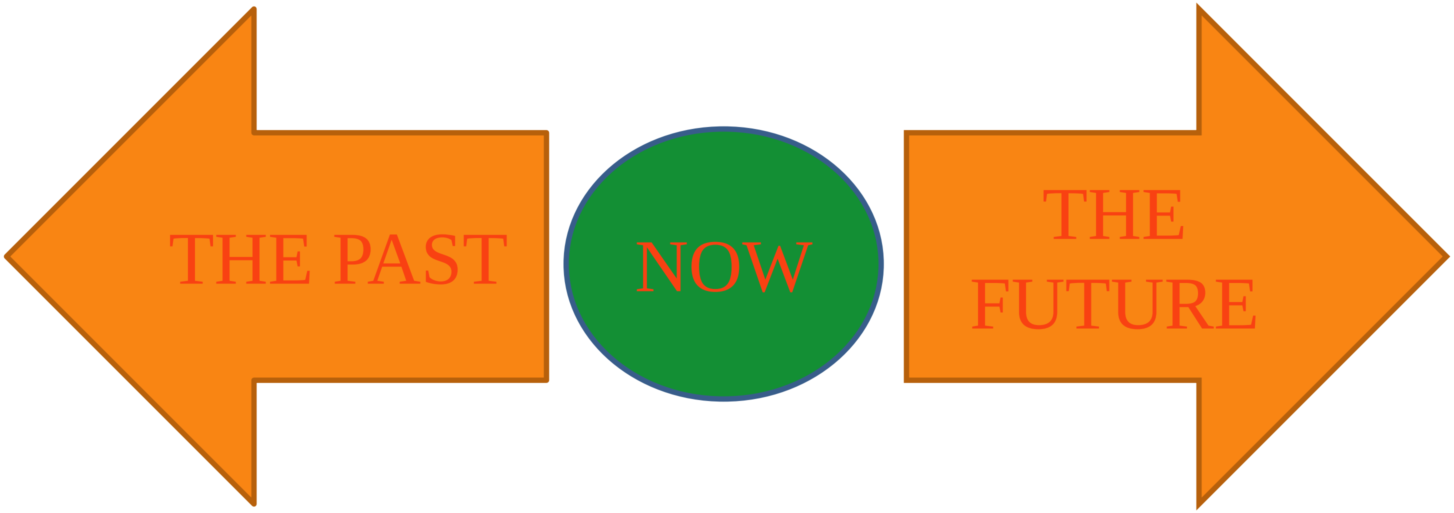
Riparian areas provide connectivity



PRBO Conservation Science

Riparian vegetation and hydrological connectivity create thermal refugia

Will restoration goals and strategies need to change?



Restoration often has past (historic) systems as a goal, but also needs to consider future conditions

Restoration Goals – the historical perspective

What do we restore for now?

Specific species (e.g., threatened and endangered)

Species groups (e.g., migratory birds)

Historic acreage

Community composition

Restoration Goals

What are some alternative restoration goals?

Ecosystem Structure
Spatial components - connectivity

Ecosystem Function
Ecosystem processes and features – resiliency, redundancy

Ecosystem Services
The benefits humans derive from ecosystems

The San Joaquin River history and restoration

- 1930-40's construction of Friant Dam
  - area below dam estimated to support 15,000 spawning salmon (one of the southernmost runs)
- 1950-2000's 27 km reach of river often dry
- 2006 18-year settlement reached to restore water and salmon to the river
- 2009 First test flows return water to dry reaches of San Joaquin
- 2012 Date by which salmon are to be reintroduced

Restoration goal: To restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.

Photo: Josh Uecker

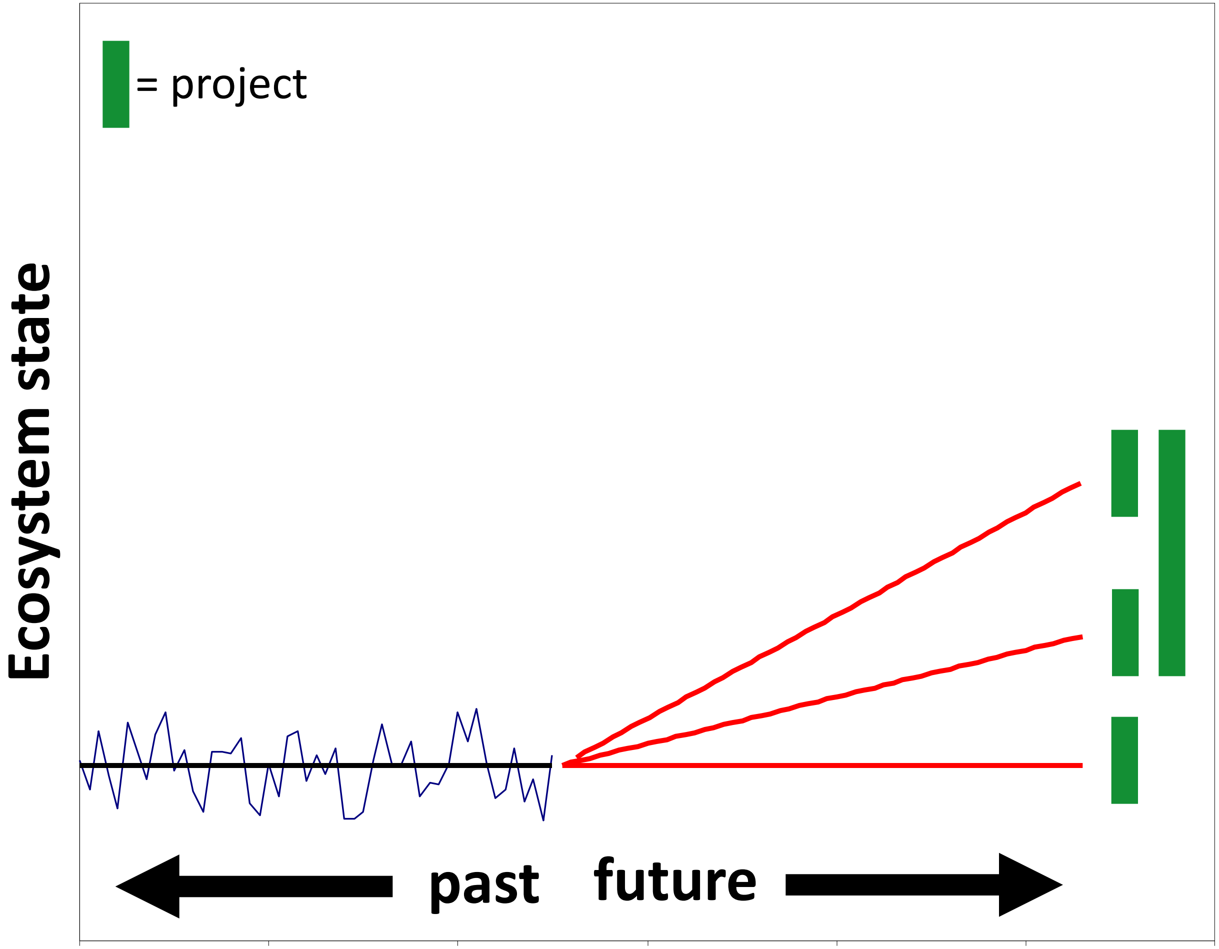
San Joaquin restoration goals: A thought experiment

Metric	**Current conditions**	**Worst case climate projections**
Historical river flows	Unlikely	Unlikely
Historical salmon numbers	Possible	Unlikely
Historical wildlife community composition	Possible	Unlikely
Improved ecological redundancy and resiliency	Likely	Possibly
Connectivity	Likely	Likely

PRBO Conservation Science

Goal: Enhance ecological resilience

Strategy: plan for a wider range of conditions

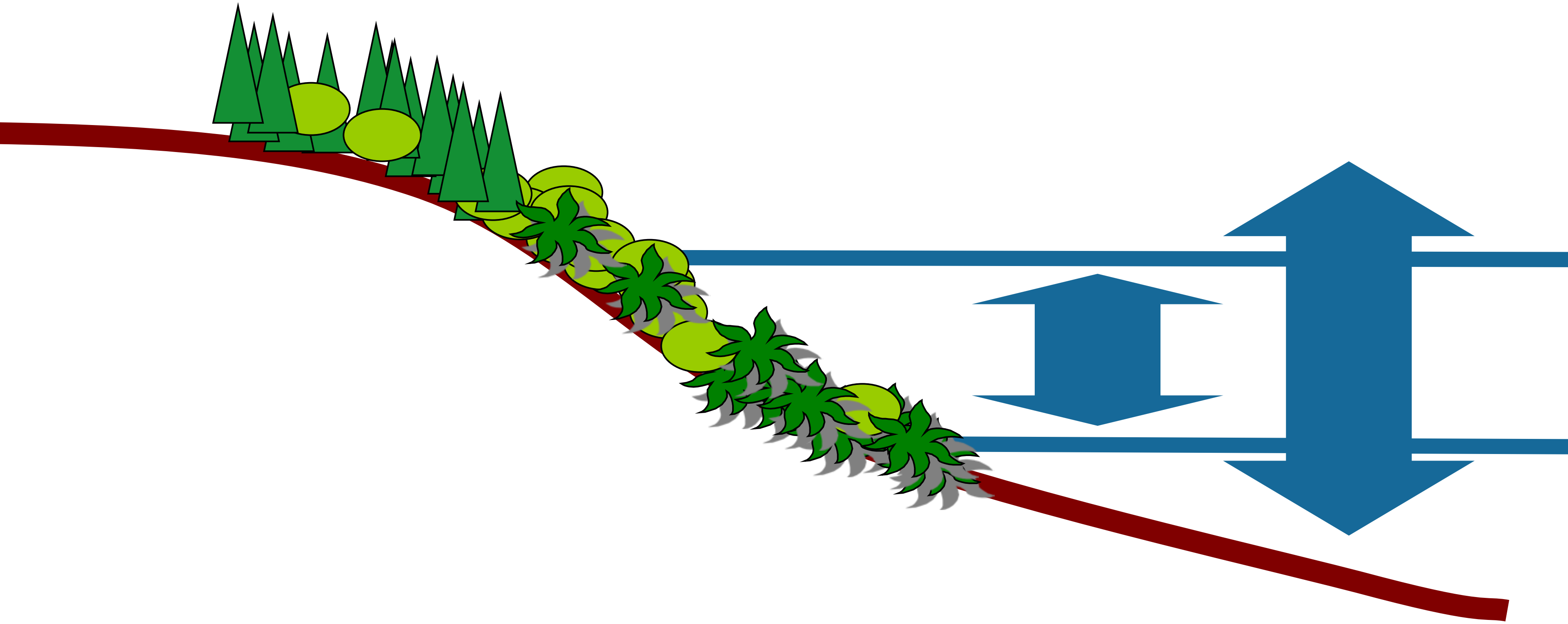


e.g., drought and floods

Prioritize projects that could succeed under multiple scenarios

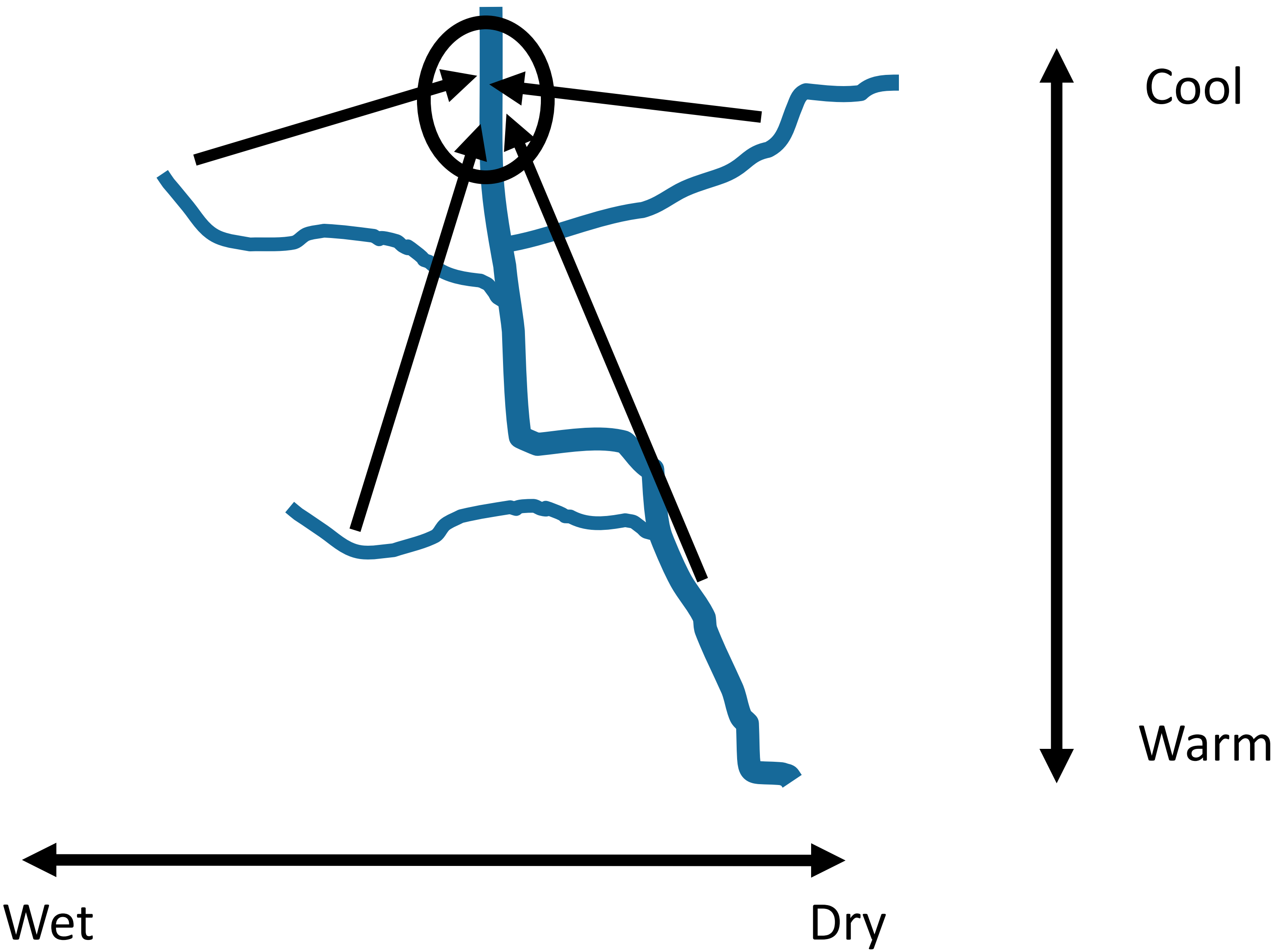
PRBO Conservation Science

Example: planting for an unpredictable hydrograph



Plant early seral colonizers adapted to flooding together with late seral species that may be less tolerant of flooding but grow better on drier sites.

Example: planting for genetic diversity



PRBO Conservation Science

<u>Goal</u>: Enhance connectivity

<u>Strategy</u>: Expand restoration to private lands

Actively partner with adjacent landowners - public and <u>private</u>

Risks and considerations

Given uncertainties of change, our limited understanding of complex systems, etc. **all restoration strategies mentioned here have risks.**

For example . . . .

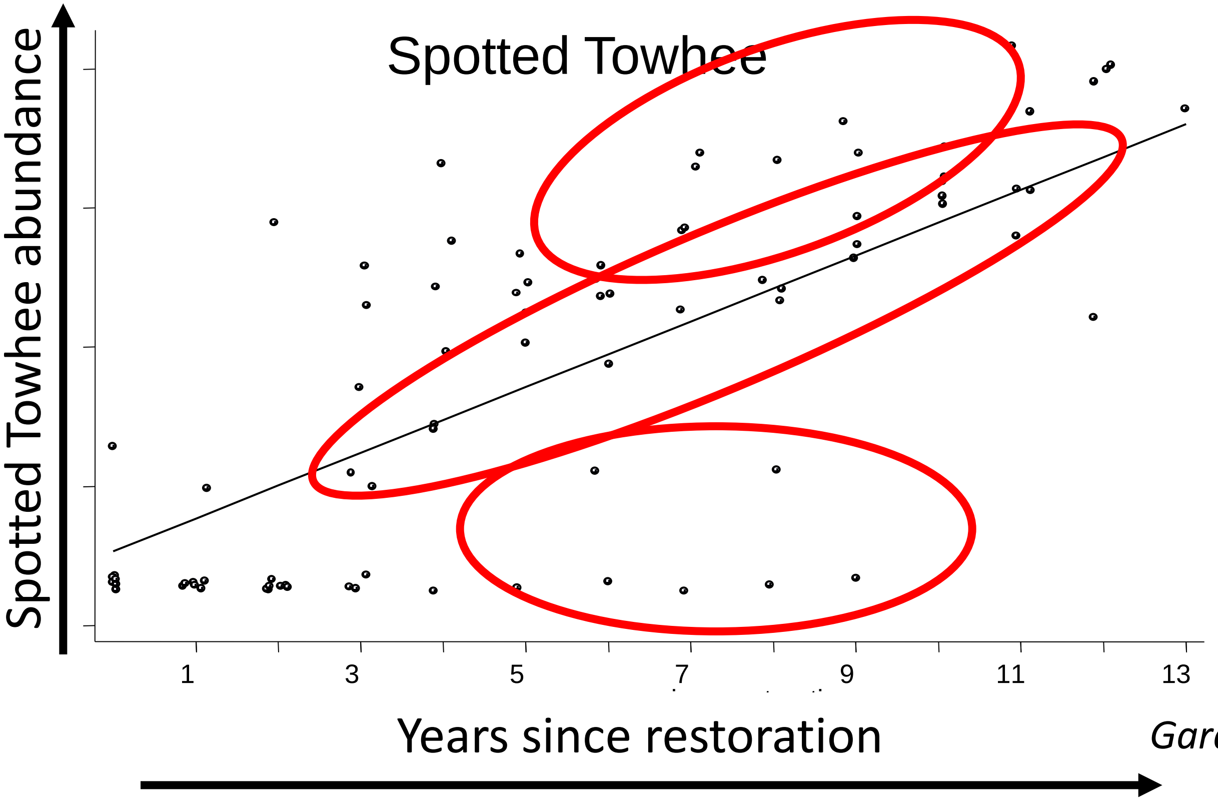
- Unanticipated species interactions
- Homogenization of species
- Loss of locally adapted genotypes
- Facilitate movement of pathogens
- Etc., etc.

Risks and considerations

"Business as usual" restoration is also a risk!

Ignoring the future is not an option

Monitoring and adaptive management will be critical



Gardali et al., 2007. Restoration Ecology

What can science do to help reduce risk?

- Reduce uncertainty of climate projections
- Study novel systems
- Indentify specific risks and benefits of different strategies
- Monitoring and Adaptive Management - *It is time to really put this into practice*

Adapting to climate change

The good news is . . . .

Ecological restoration can be an adaptation strategy for climate change.

Answering the tough questions

What are you doing about it?

- Understand the challenges climate changes will pose for your systems

- Design restoration to prepare ecosystems for climate change

Why bother?

- Restoration can prepare ecosystems for climate change

Acknowledgments

CALFED, S.D. Bechtel, Jr. Foundation, National Science Foundation, The Nature Conservancy, David and Lucile Packard Foundation, William and Flora Hewlett Foundation, National Fish and Wildlife Foundation, Natural Resource Conservation Service

Especially all of our Department of Interior partners

More information:
www.prbo.org

Questions, comments?
nseavy@prbo.org

prbo
PRBO Conservation Science

The context of resource management and regulation is changing

CLIMATE CHANGE

Stationarity Is Dead: Whither Water Management?

P. C. D. Milly,[1*] Julio Betancourt,[2] Malin Falkenmark,[3] Robert M. Hirsch,[4] Zbigniew W. Kundzewicz,[5] Dennis P. Lettenmaier,[6] Ronald J. Stouffer[7]

Systems for management of water throughout the developed world have been designed and operated under the assumption of stationarity. Stationarity—the idea that natural systems fluctuate within an unchanging envelope of variability—is a foundational concept that permeates training and practice in water-resource engineering. It implies that any variable (e.g., annual streamflow or annual flood peak) has a time-invariant (or 1-year–periodic) probability density function (pdf), whose properties can be estimated from the instrument record. Under stationarity, pdf estimation errors are acknowledged, but have been assumed to be reducible by additional observations, more efficient estimators, or regional or paleohydrologic data. The pdfs, in turn, are used to evaluate and manage risks to water supplies, water-

An uncertain future challenges water planners.

Milly et al. 2008. Science 319:573-574

"STATIONARITY IS DEAD"[†] — LONG LIVE TRANSFORMATION: FIVE PRINCIPLES FOR CLIMATE CHANGE ADAPTATION LAW

*Robin Kundis Craig**

While there is no question that successful mitigation strategies remain critical in the quest to avoid worst-case climate change scenarios, we have passed the point where mitigation efforts alone can deal with the problems that climate change is creating. Because of "committed" warming — climate change that will occur regardless of mitigation measures, a result of the already-accumulated greenhouse gases in the atmosphere — what happens to coupled socio-ecological systems over the next decades, and most likely over the next few centuries, will largely be beyond human control. The time to start preparing for these changes is now, by making adaptation part of a national climate change policy.

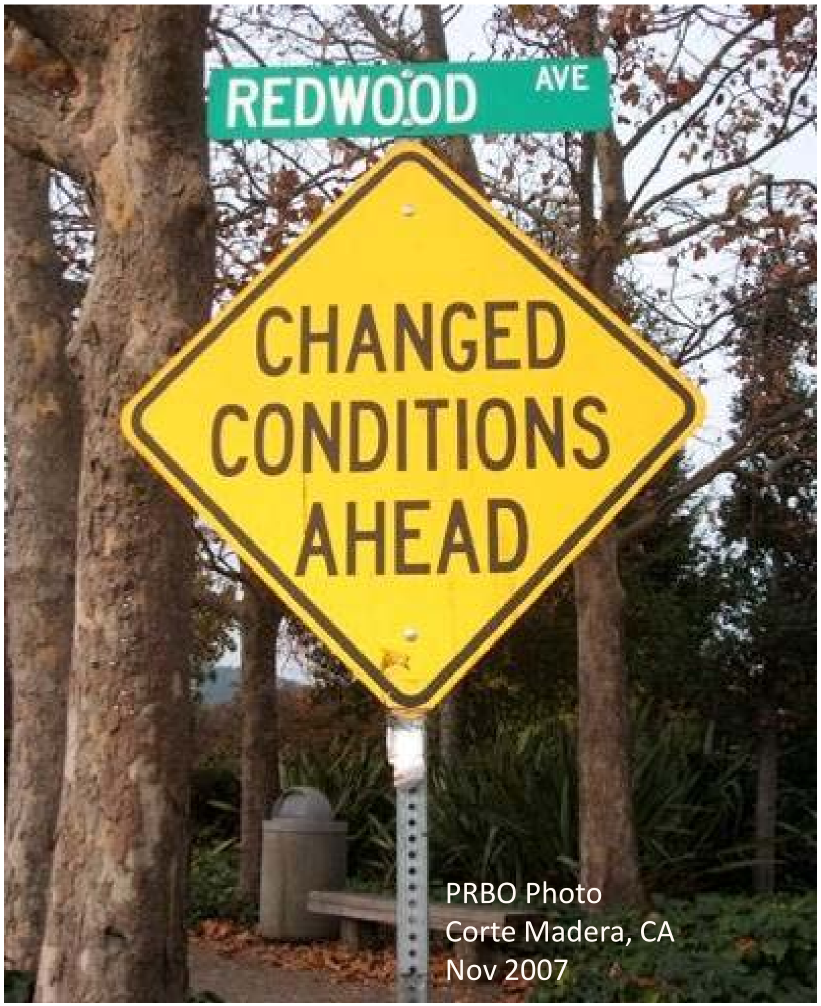
American environmental law and policy are not keeping up with the need for adaptation. For example, environmental and natural resources law are currently based on assumptions of ecological stationarity and pursue goals of preservation and restoration. Neither those assumptions nor those goals fit a world of continual, unpredictable, and nonlinear transformations of complex ecosystems — but that is the world that climate change is creating.

This Article argues for a principled flexibility *model of climate change adaptation law to pursue goals of increasing the resilience and adaptive capacity of socio-ecological systems. In so doing, it lays out five principles and several subprinciples for the law of environmental regulation and natural resource management. Structurally, this Article also strongly suggests that climate change adaptation law must*

Craig. 2010. Harvard Environmental Law Review 34:10-73

PRBO Conservation Science

How do we adapt to the challenges of climate change?



PRBO Photo
Corte Madera, CA
Nov 2007

"The longer action is delayed, the more it will cost."

- *IPCC. 2007*

"Most recommendations are vague or general principles… Few suggested a process a manager could use to develop an adaptation plan and evaluate its usefulness."

- *Heller and Zavaleta. 2009. Biological Conservation*