prbo

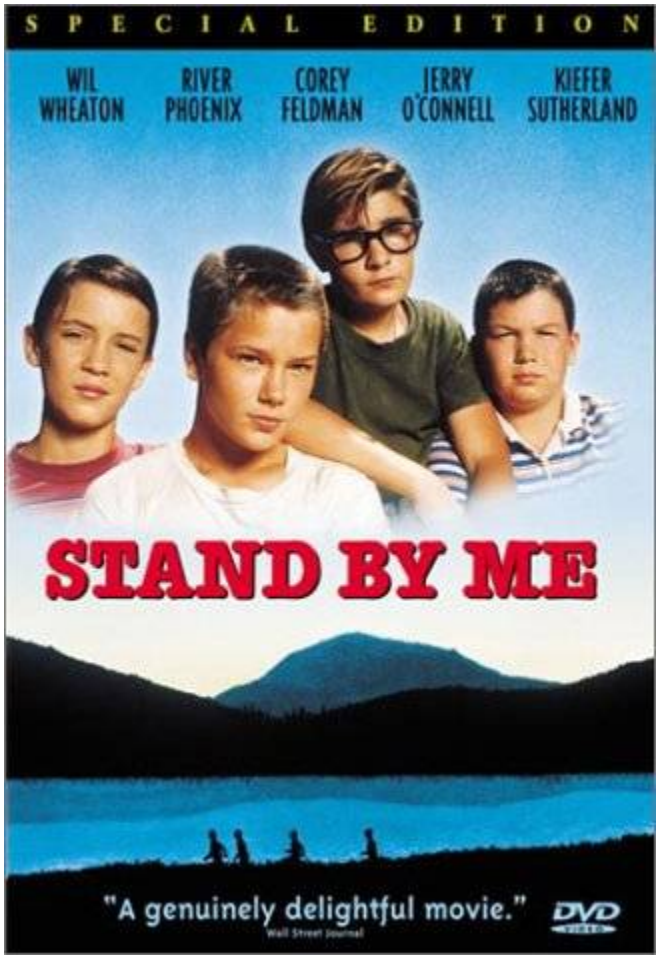
PRBO Conservation Science

Riparian restoration and climate change

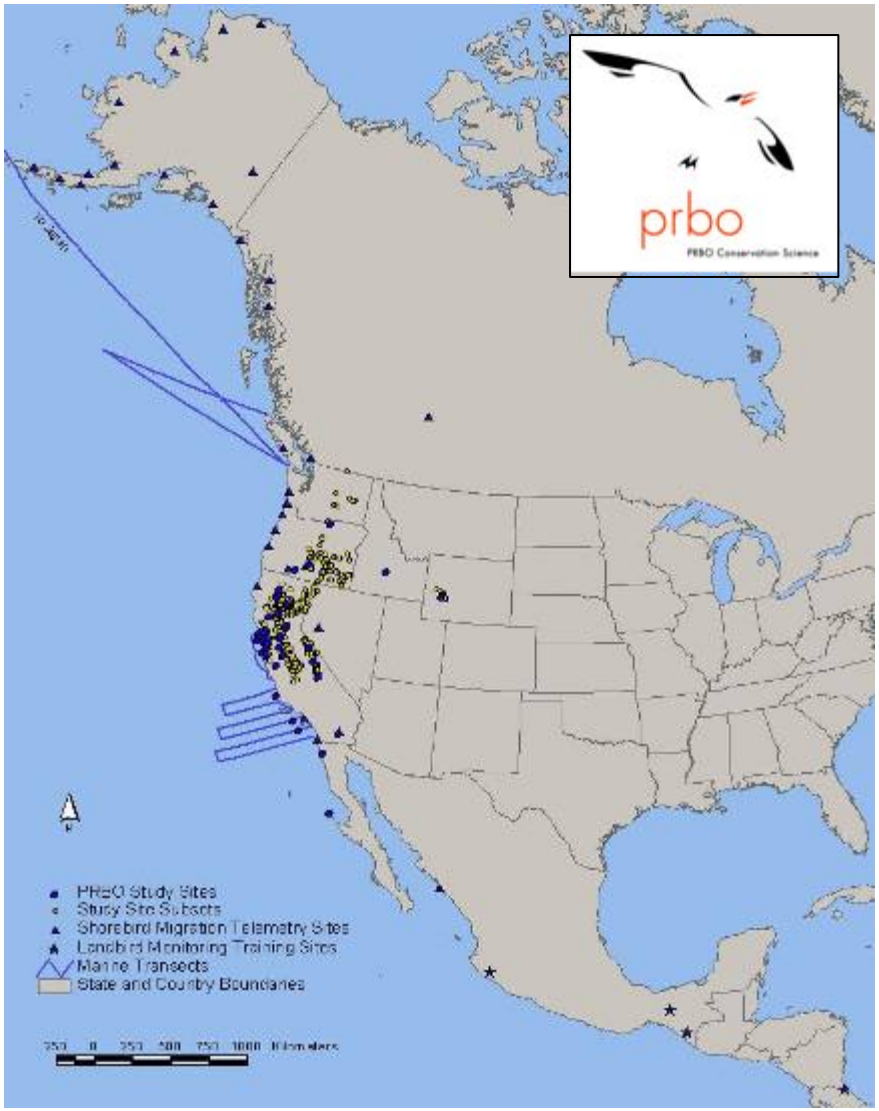
Nathaniel Seavy
nseavy@prbo.org


KEVIN·COSTNER
All his life, Ray Kinsella was searching for his dreams.
Then one day, his dreams came looking for him.
FIELD OF DREAMS


aninconvenienttruth


SPECIAL EDITION
WIL WHEATON
RIVER PHOENIX
COREY FELDMAN
JERRY O'CONNELL
KIEFER SUTHERLAND
STAND BY ME
"A genuinely delightful movie."
Wall Street Journal
DVD

Advancing conservation through science



Headquarters in Petaluma

Riparian

Grassland

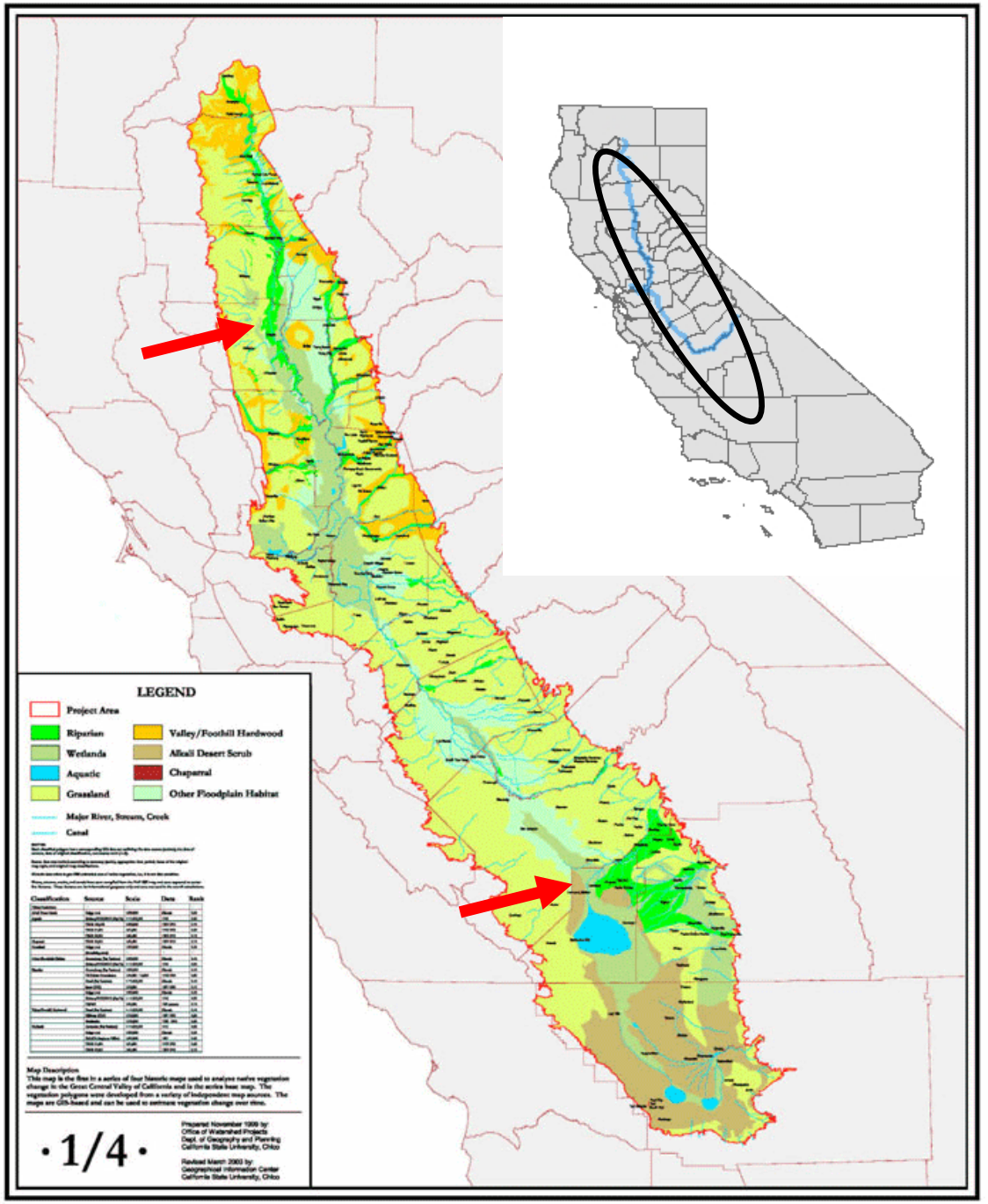
Urban/Agriculture

Aquatic

Pre-1900

Extensive riparian and grassland areas

CSU Chico GIC



Riparian

Grassland

Urban/Agriculture

Aquatic

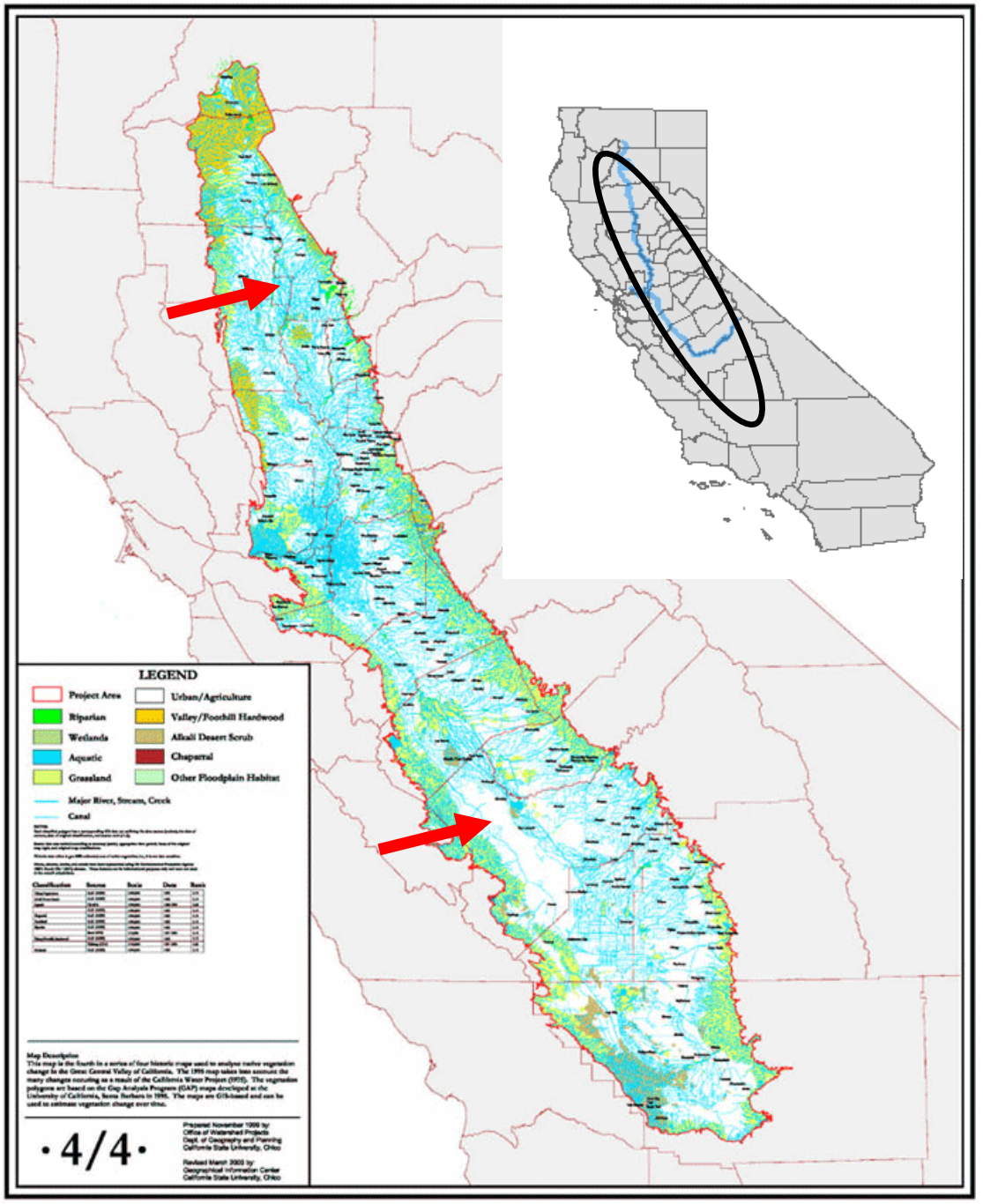
1995

More aquatic features

More urban/agriculture

Less riparian & grassland

CSU Chico GIC



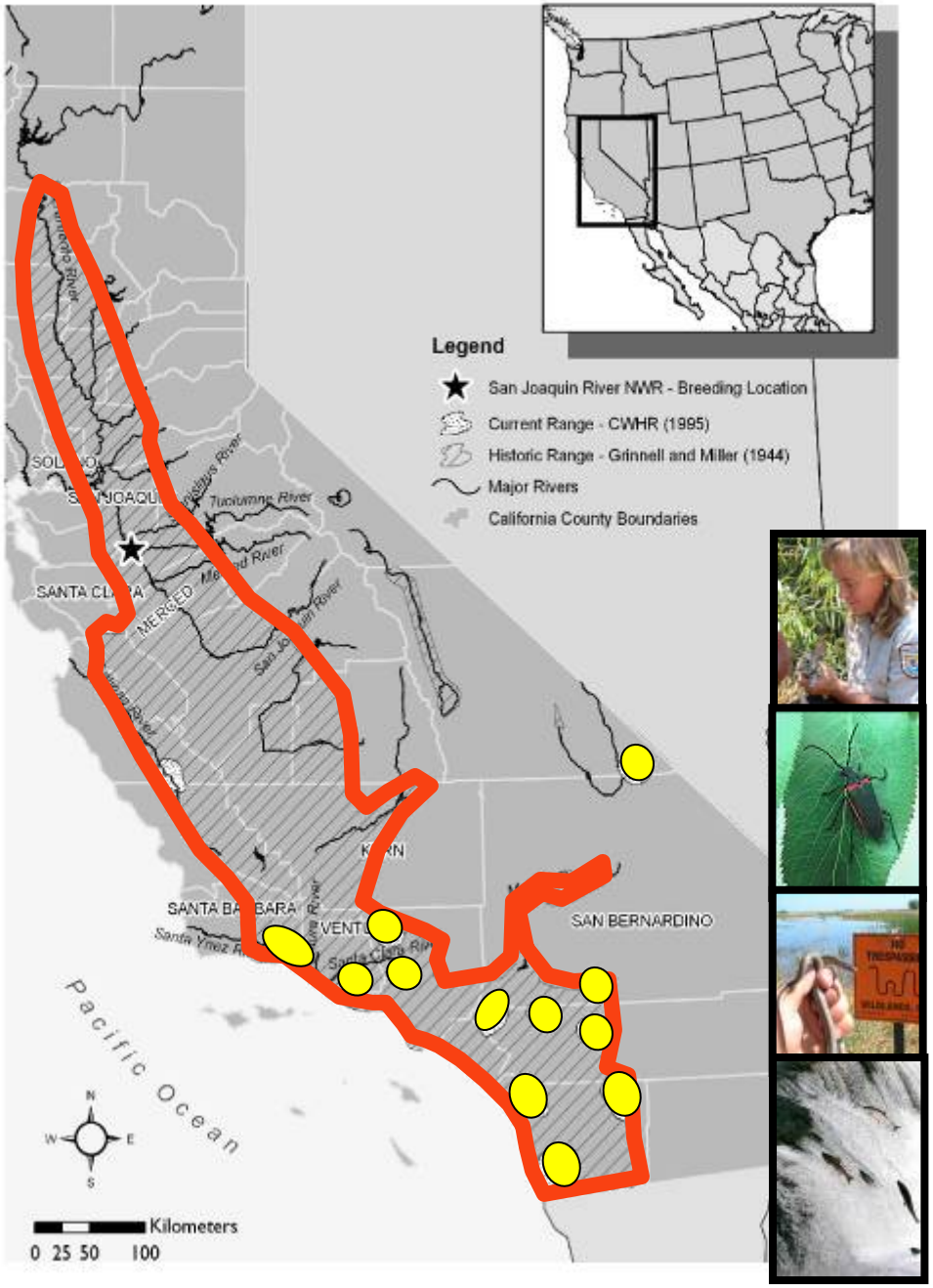
PRBO Conservation Science

Dramatic changes in bird abundance

"…what I believe will ultimately prove to be the greatest purpose of our museum… is that the student of the future will have access to the original record of faunal conditions in California and the west."

– J. Grinnell, 1910

http://mvz.berkeley.edu/Grinnell/



Horticultural riparian habitat restoration

Orchard Removal

New Planting

Horticultural riparian habitat restoration

3 years old

13 years old

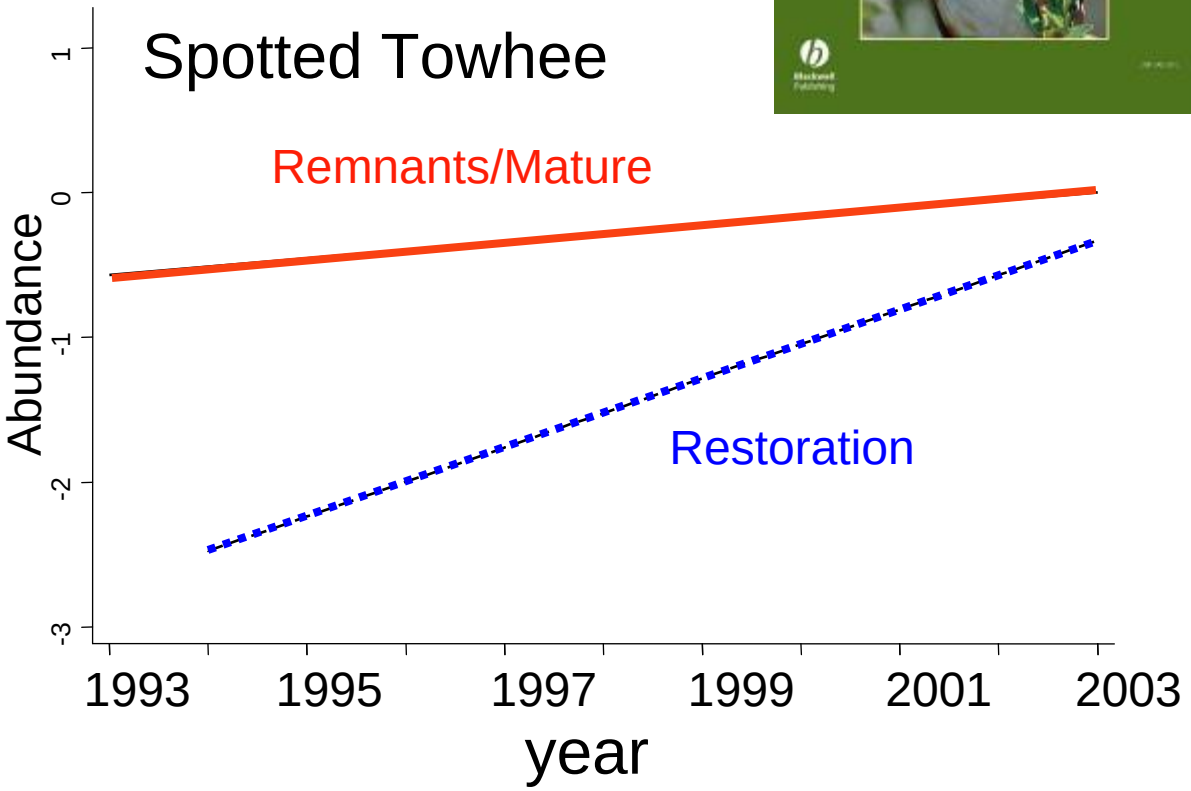
PRBO Conservation Science

Riparian birds respond to restoration


San Francisco Chronicle

SCIENTISTS CREDIT THE RESTORATION OF THOUSANDS OF ACRES OF HABITAT WITH RESURGENCE OF WILDLIFE POPULATION

Along the Sacramento, songbirds flourish again



Gardali et al. 2006. Abundance patterns of landbirds in restored and remnant riparian forests on the Sacramento River, California, USA. *Restoration Ecology* 14:391-403.

PRBO Conservation Science

Riparian birds respond to restoration

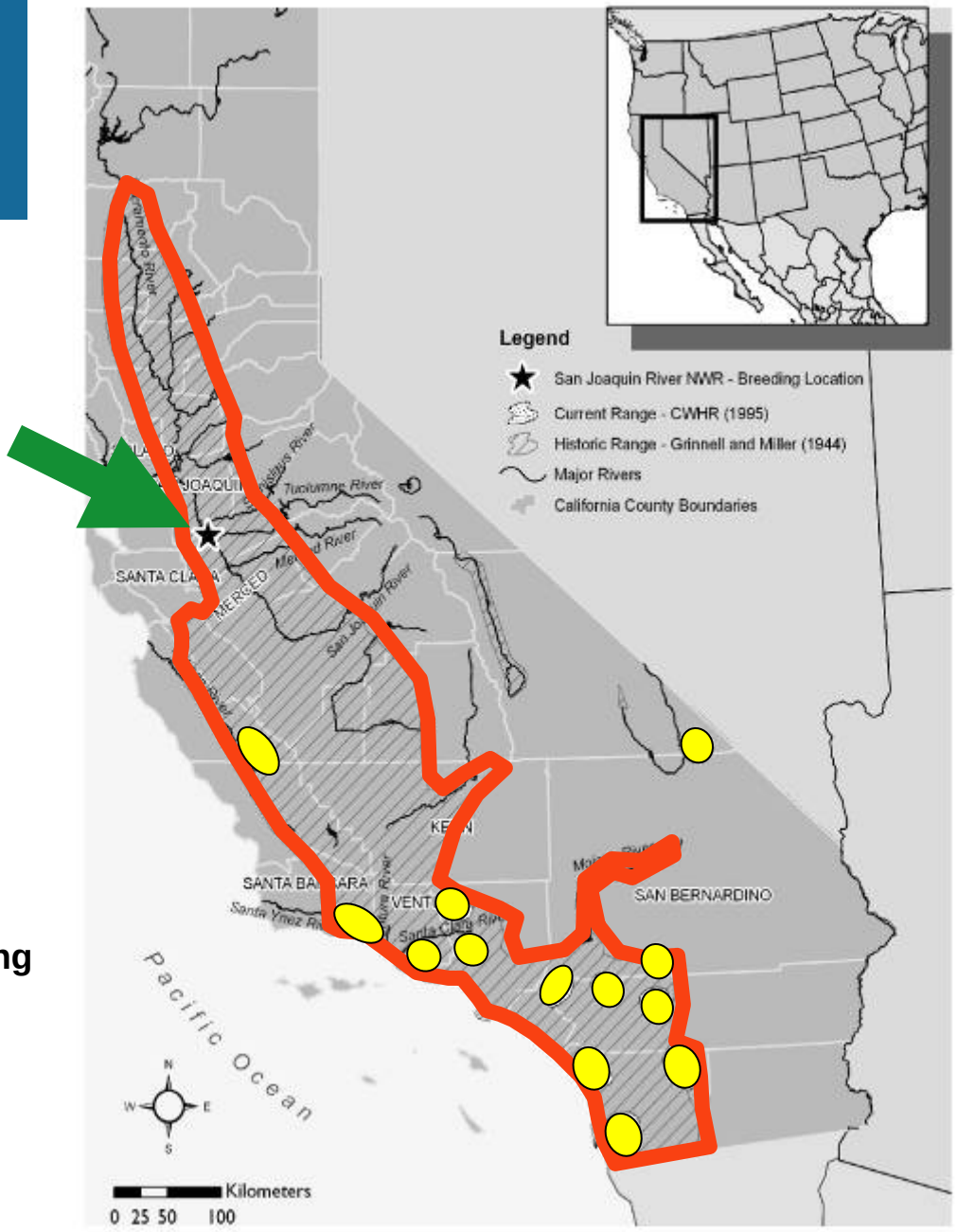
The New York Times ON THE WEB

Rare Chatty Songbird Spotted in Calif.

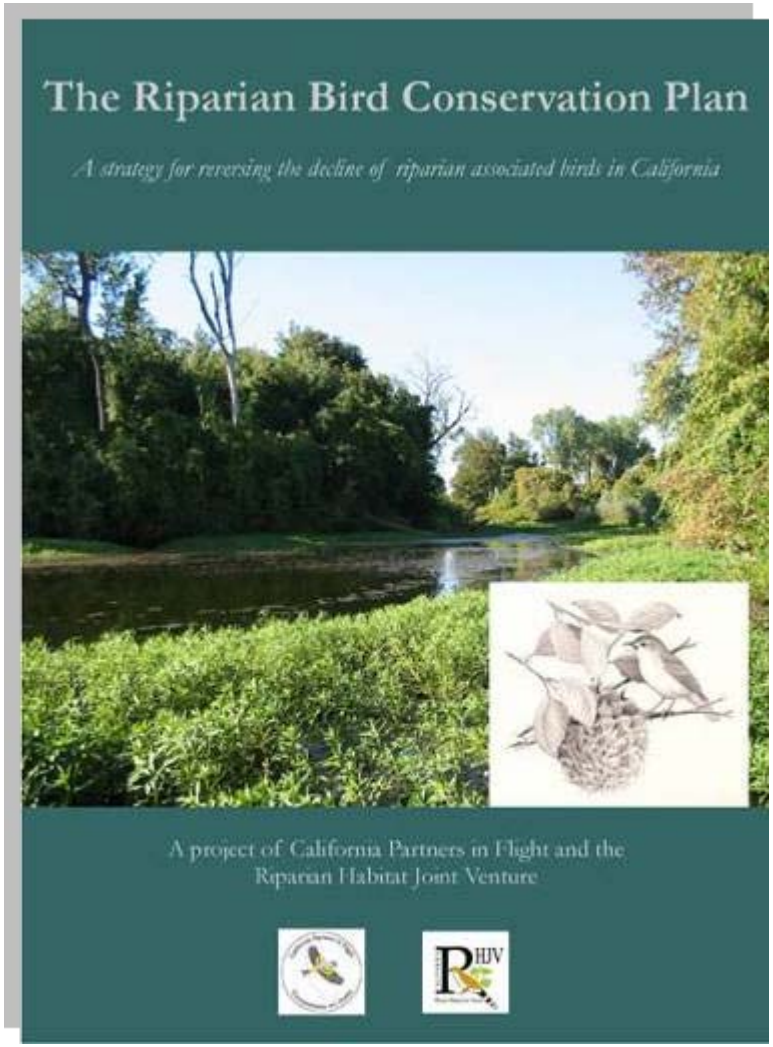
By THE ASSOCIATED PRESS
Published: June 17, 2005

FRESNO, Calif. (AP) -- A chatty songbird thought to have disappeared from the Central Valley 60 years ago has been spotted nesting in a patch of restored habitat along the San Joaquin River.

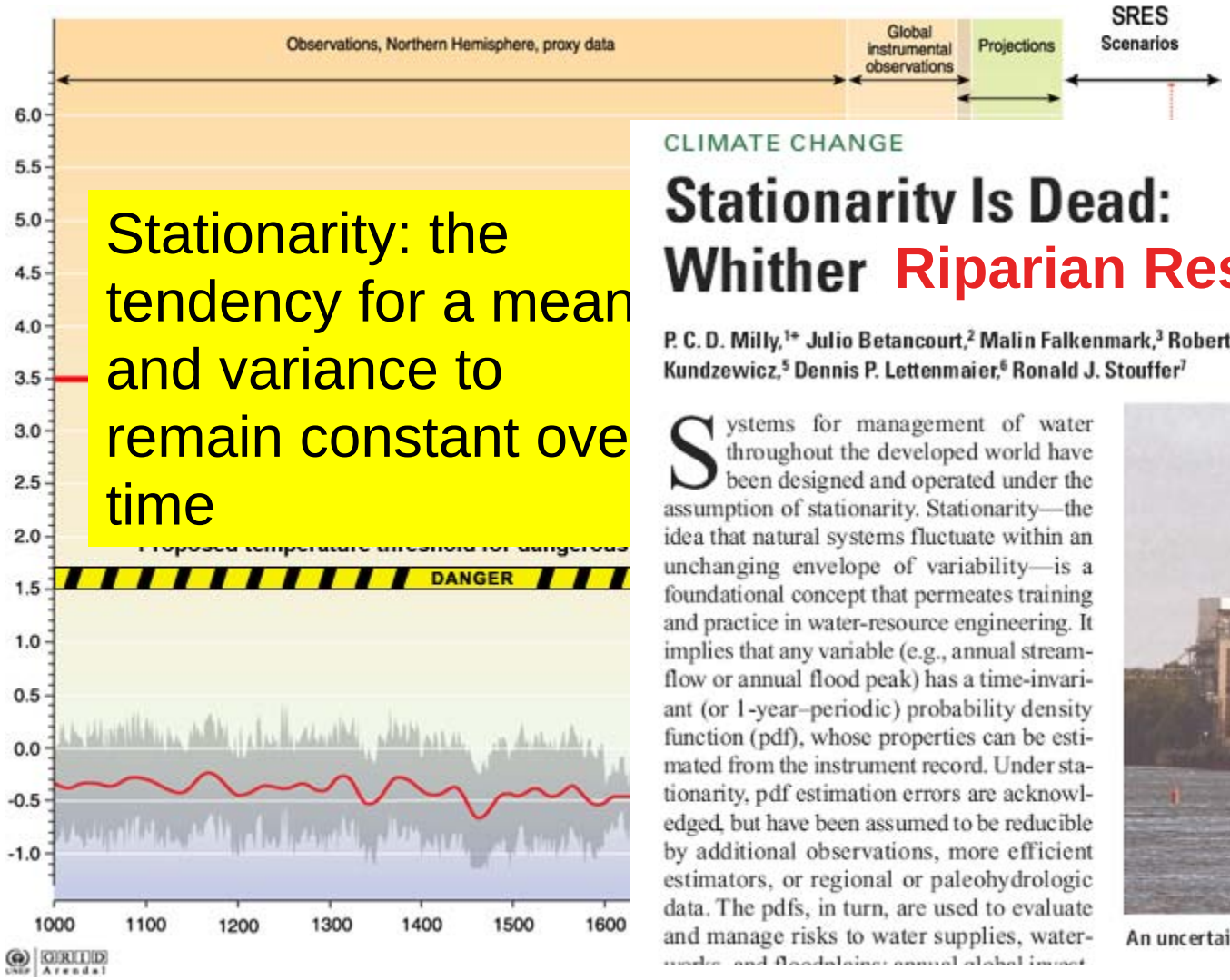
Howell et al. In review. Least Bell's Vireo breeding records in the Central Valley following decades of extirpation. Submitted to *Western North American Naturalist*



Providing bird science to guide conservation



The context of resource management is changing



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

CLIMATE CHANGE

Stationarity Is Dead: Whither Riparian Restoration?

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

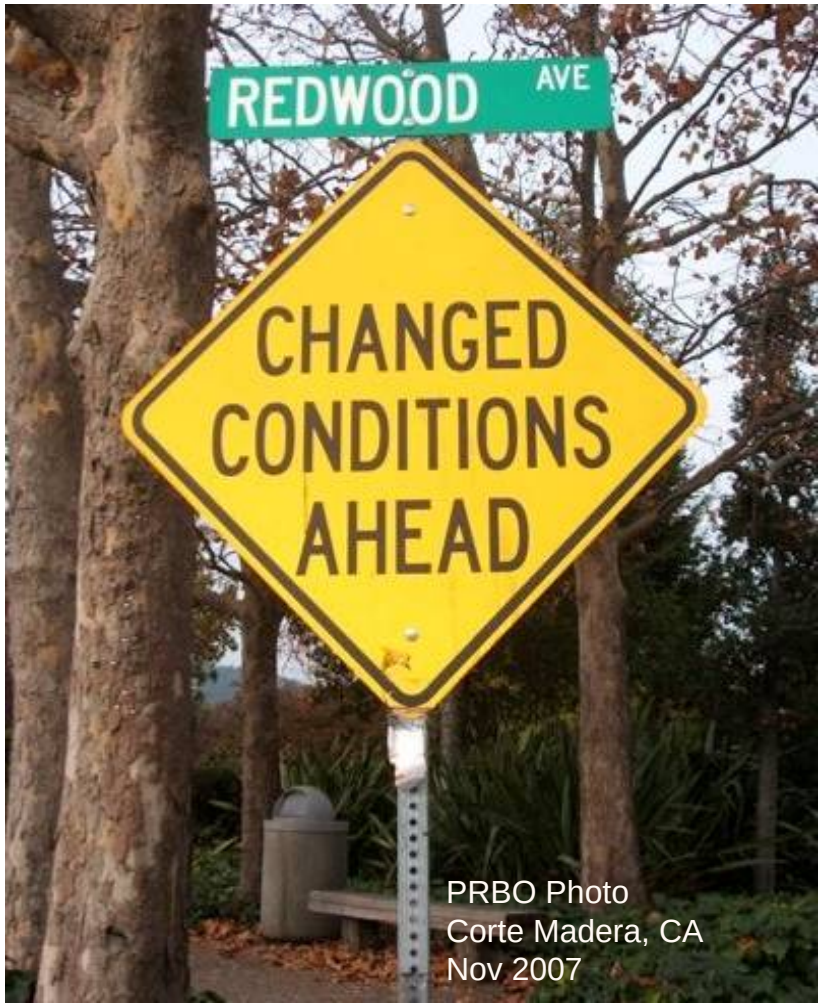
PRBO Conservation Science

What does climate change mean for riparian restoration?

Lots of uncertainty, but general consensus for:

1. **Warmer air (and water) temperatures**
2. **More rain, less snow**
3. **More extreme events**

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. In press. Biodiversity management in the face of climate change: a synthesis of 20 years of recommendations. Biological Conservation

PRBO Conservation Science

What does climate change mean for riparian restoration?

Tom Gardali and Chrissy Howell (PRBO)
Greg Golet (The Nature Conservancy)
Tom Griggs and Stacy Small (River Partners)
Josh Viers (UC Davis)
Rodd Kelsey (California Audubon)
Jim Weigand (Bureau of Land Management)





Connie Millar's work as a roadmap

Millar et al. 2007. *Ecological Applications*

GOALS

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

STRATEGIES

enhance connectivity

promote redundancy and buffers

reduce landscape synchrony

realign disrupted conditions

expect surprises

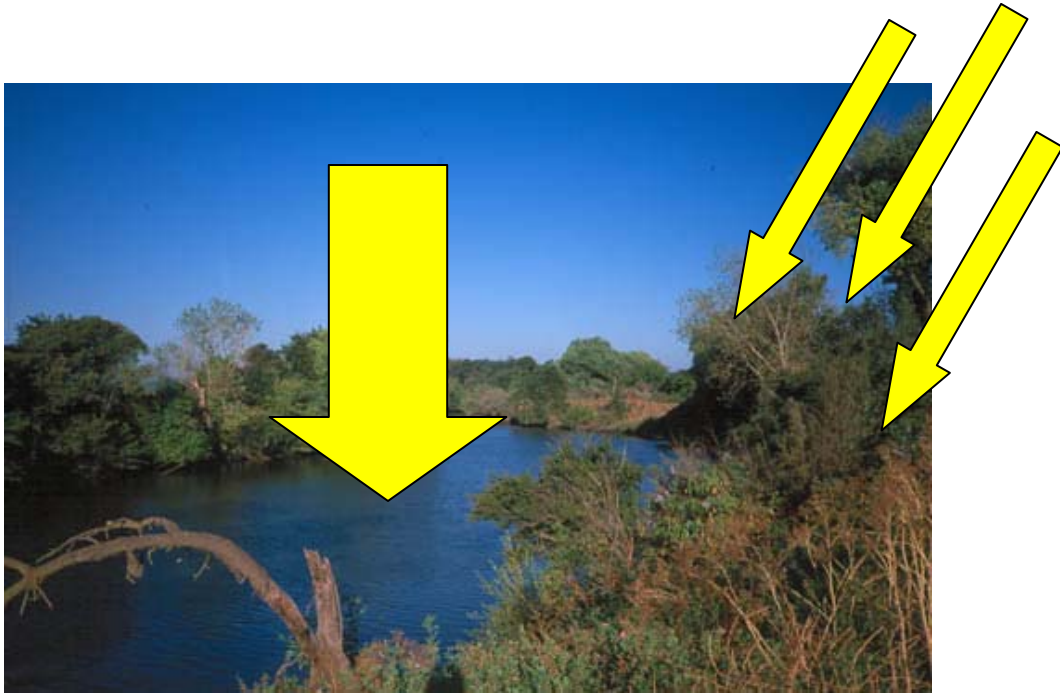
identify and protecting refugia

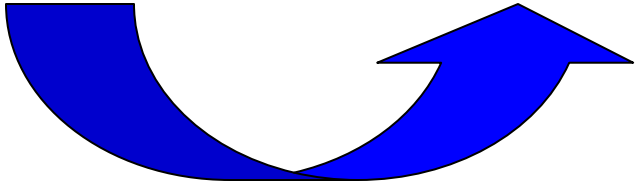




Riparian ecosystems are naturally resilient

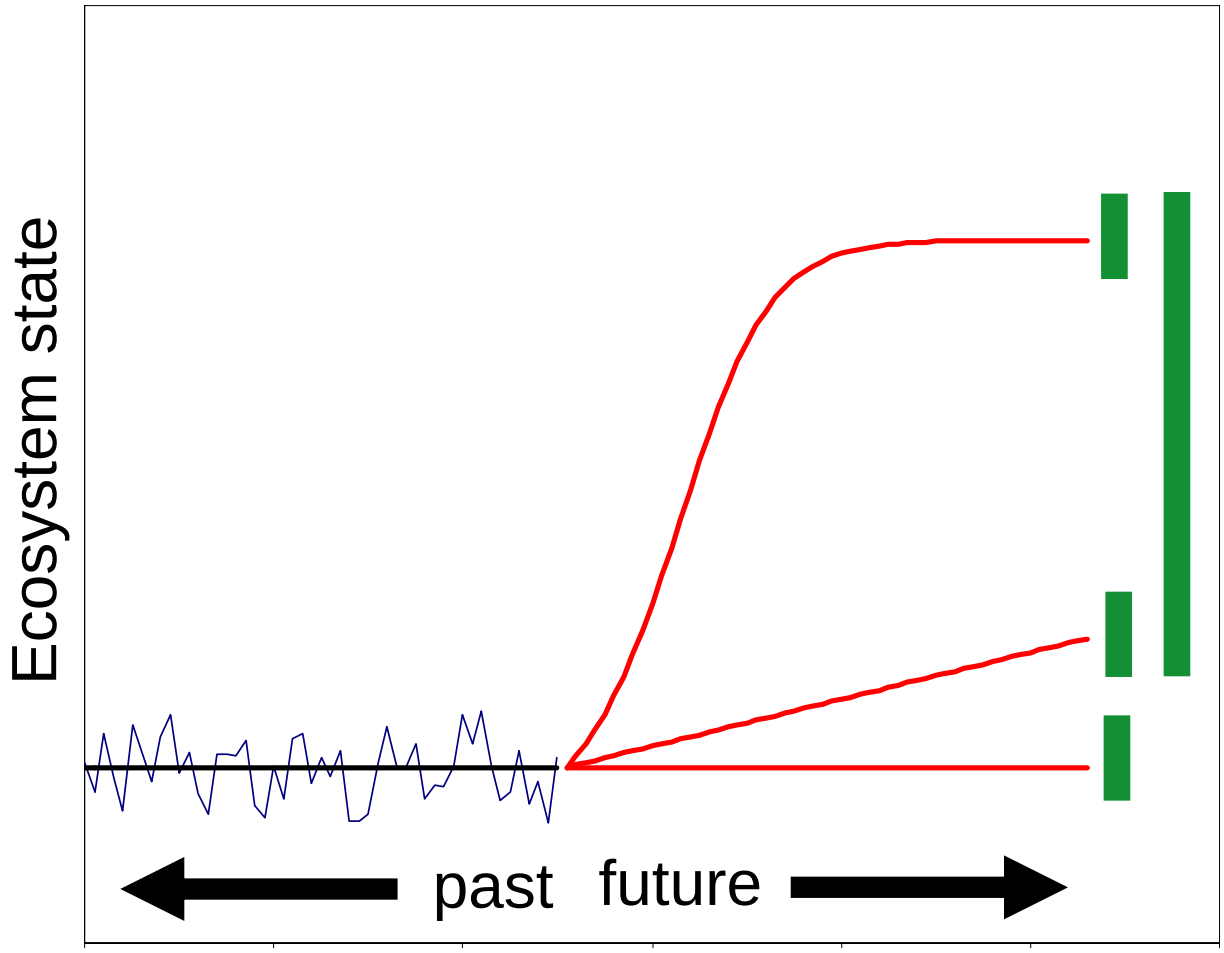
Riparian Areas as thermal refugia



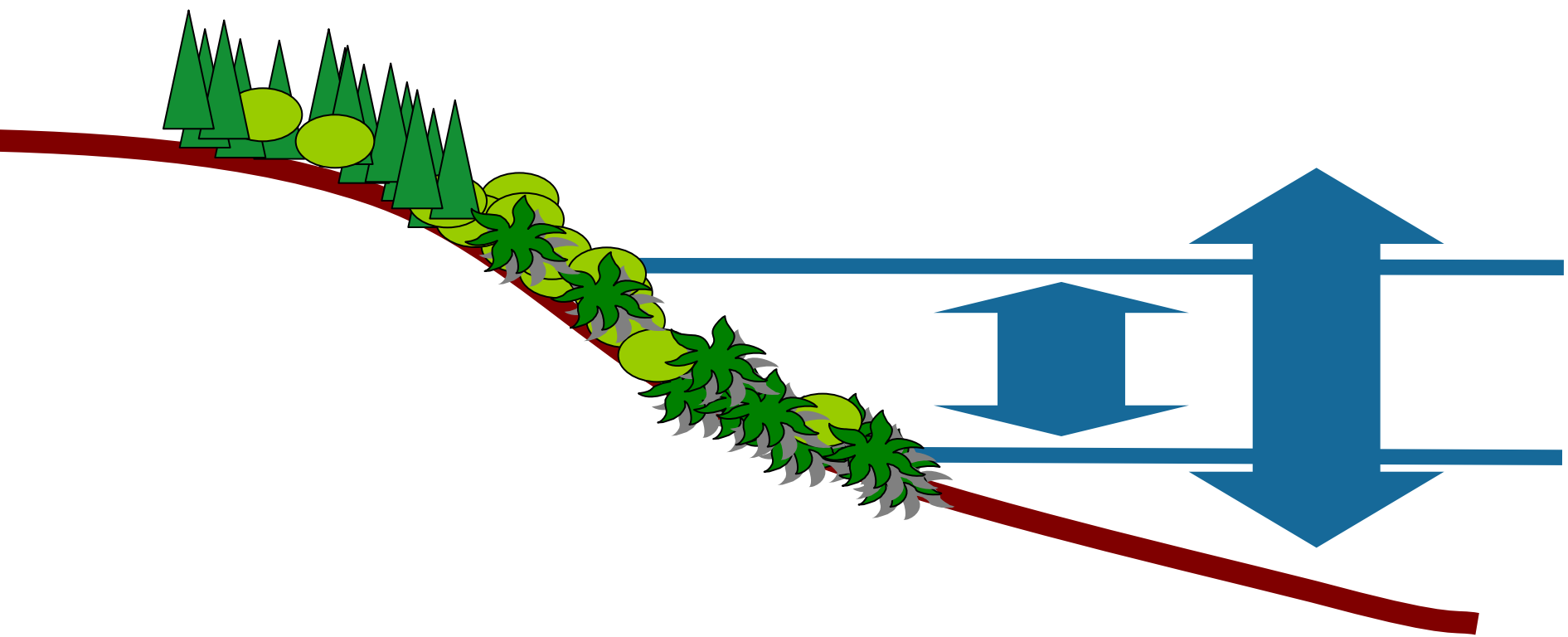


Riparian habitat provide connectivity

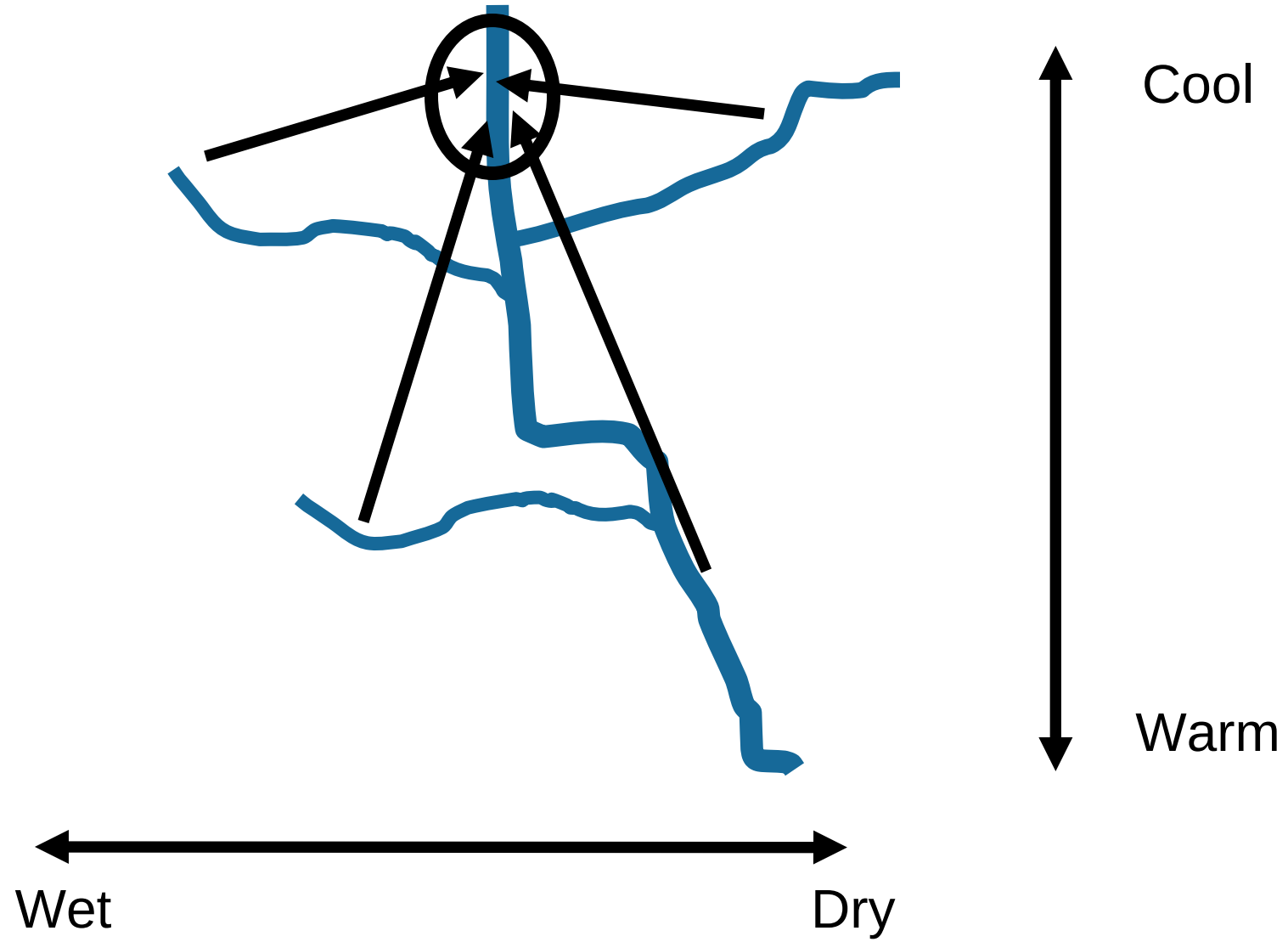
The challenge of expecting surprises



Plan restoration for an unpredictable hydrograph



Relax genetic guidelines



Conclusions about riparian restoration

With respect to birds – it works

An important component of enhancing ecosystem resistance, resilience, and response

Need to think about surprises – how can we adapt restoration to an uncertain future





Climate change adaptation – where next?

Invest in monitoring

Enhance ecosystem resistance, resilience, and response

Provide specific guidance for adaptation

Support restoration/management as it comes-of-age in the context of climate change





Many thanks to:

PRBO scientists, support staff, Board, members, and:

American Bird Conservancy
Anonymous
S.D. Bechtel, Jr. 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 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