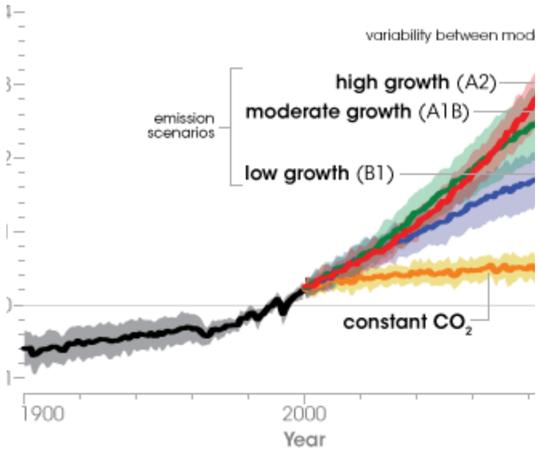
Making ecological restoration climate-smart: A framework and lessons learned

Tom Gardali, Nathaniel E. Seavy, John J. Parodi, Leia Giambastiani, and Stephanie C. Nelson
Cal IPC, October 2013



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Conservation science for a healthy planet.

Outline

1. Restoration Ecology
2. Climate-smart ecological restoration defined
3. Climate-smart ecological restoration principles
4. Principles to practice
5. Case study – lesson learned

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Restoration ecology

THE PAST

NOW

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Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed

Society for Ecological Restoration, 2004

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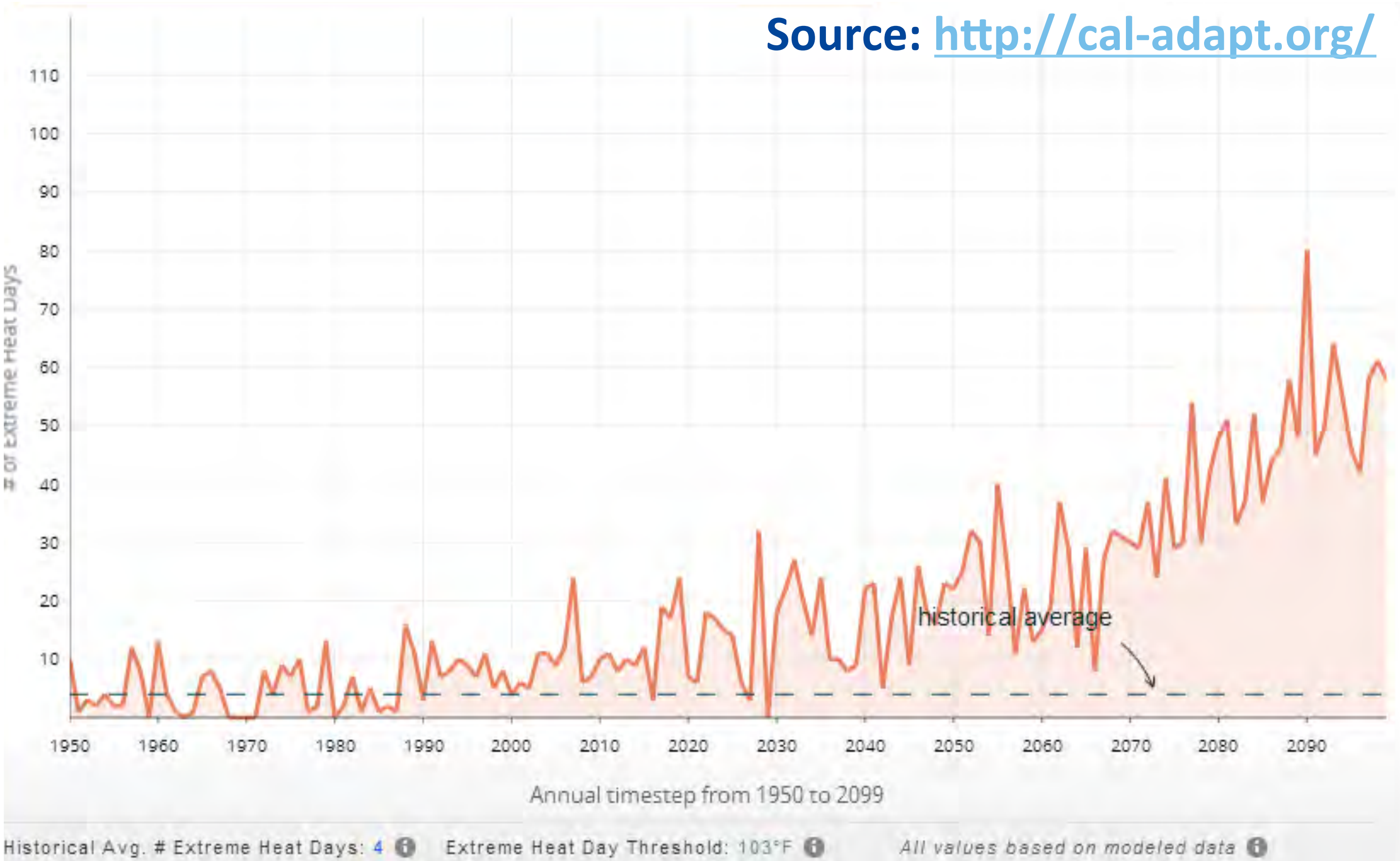
Climate change: Restoration game changer

Number of extreme heat days by year



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Climate-smart ecological restoration is the process of enhancing ecological function of degraded, damaged, or destroyed areas in a manner that prepares them for the consequences of a rapidly changing climate.

Gardali et al., In review

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Climate-smart principles

1. **Look forward but don't ignore the past**
   - *Forward looking goals, use climate predictions, historic analogs*

2. **Consider the broader context**
   - *Landscape, non-climate threats, prioritization*

3. **Build in ecological insurance**
   - *Redundancies, ecological diversity*

4. **Build evolutionary resilience**
   - *Increase size/connectedness, source seeds from other regions*

5. **Include the human community**
   - *To implement, monitor, steward*

Adapted from: http://www.nwf.org/, Palmer Est. & Coasts 32, Hansen et al. Con. Bio. 24

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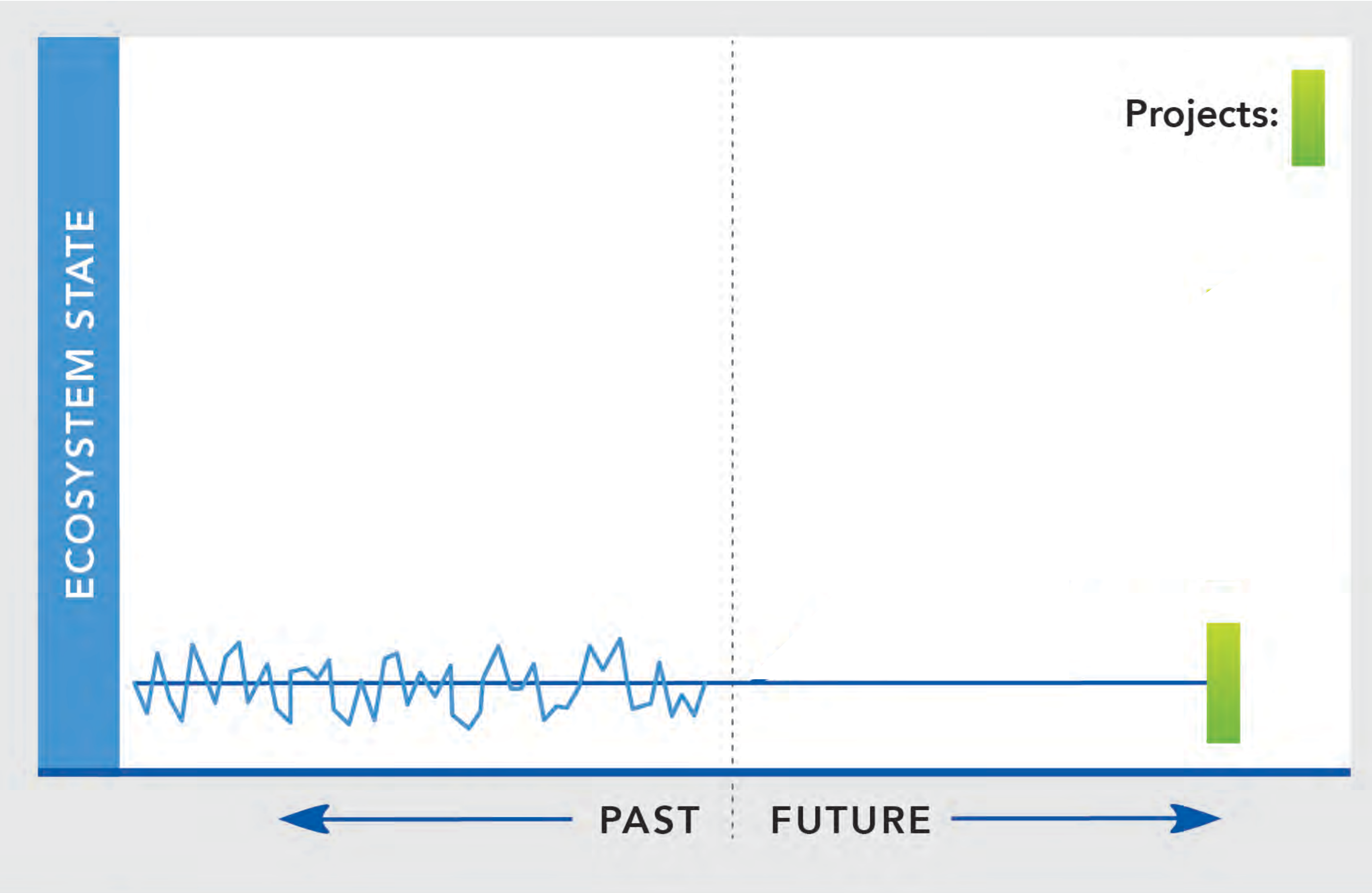

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Projects should be designed to succeed under multiple scenarios.

Principles in action

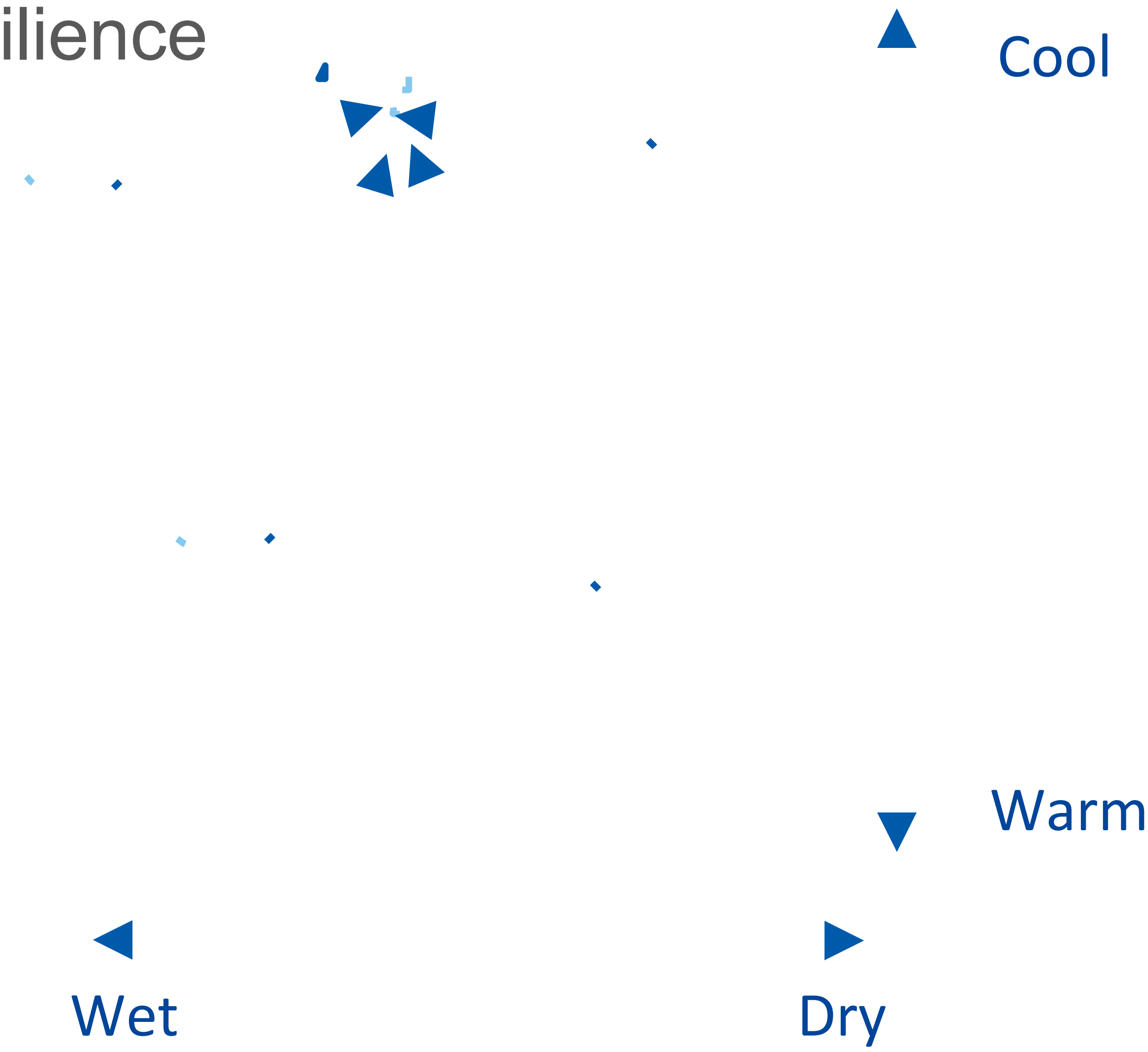
Increase component and structural **redundancy**

Dunwiddie et al., Ecol. Rest. v27

Principles in action

Evolutionary resilience

Seavy et al., Ecol. Rest. v27



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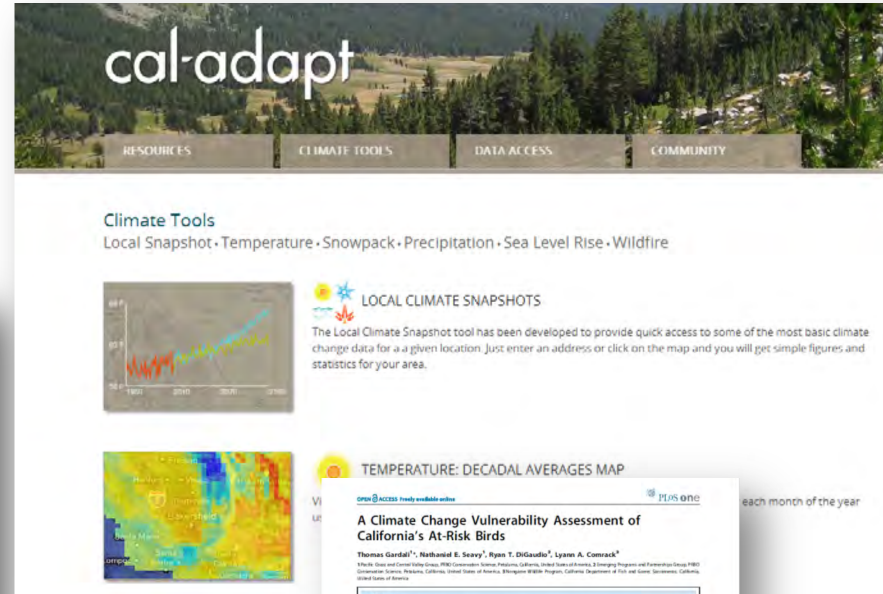
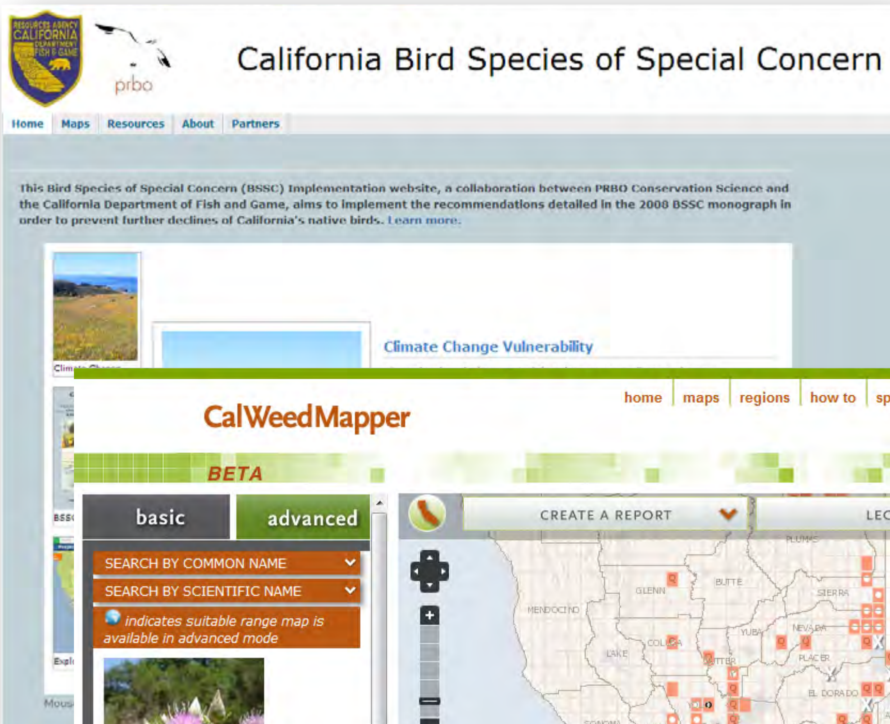
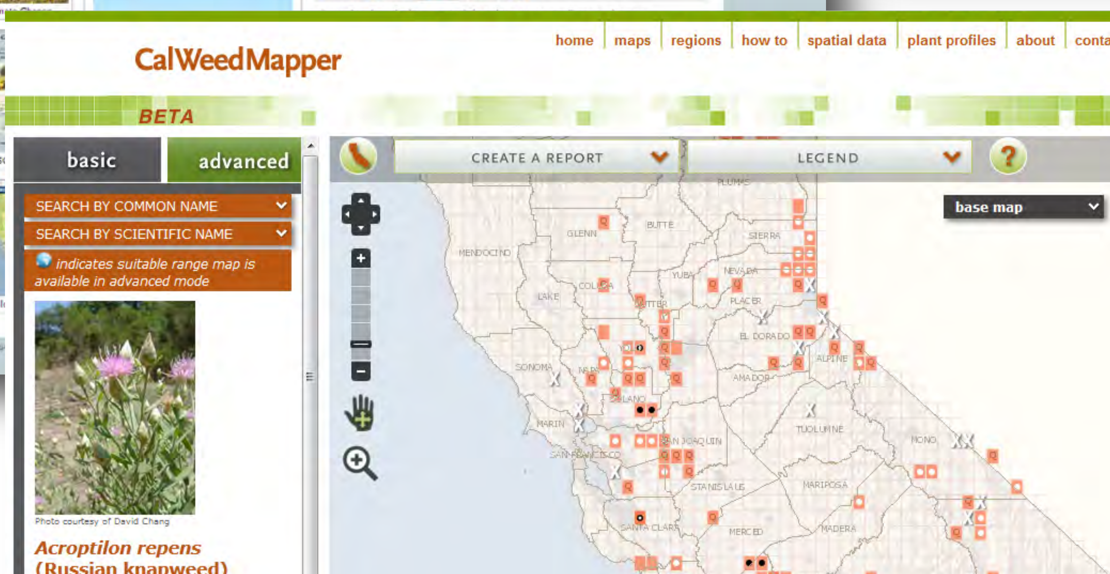
Principles in action







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STRAW: Student and Teachers Restoring A Watershed

Developing actions to address vulnerabilities

1. **Look forward but don't ignore the past**
   - *Forward looking goals, use climate predictions, historic analogs*
2. **Consider the broader context**
   - *Landscape, non-climate threats, prioritization*
3. **Build in ecological insurance**
   - *Redundancies, ecological diversity*
4. **Build evolutionary resilience**
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5. **Include the human community**
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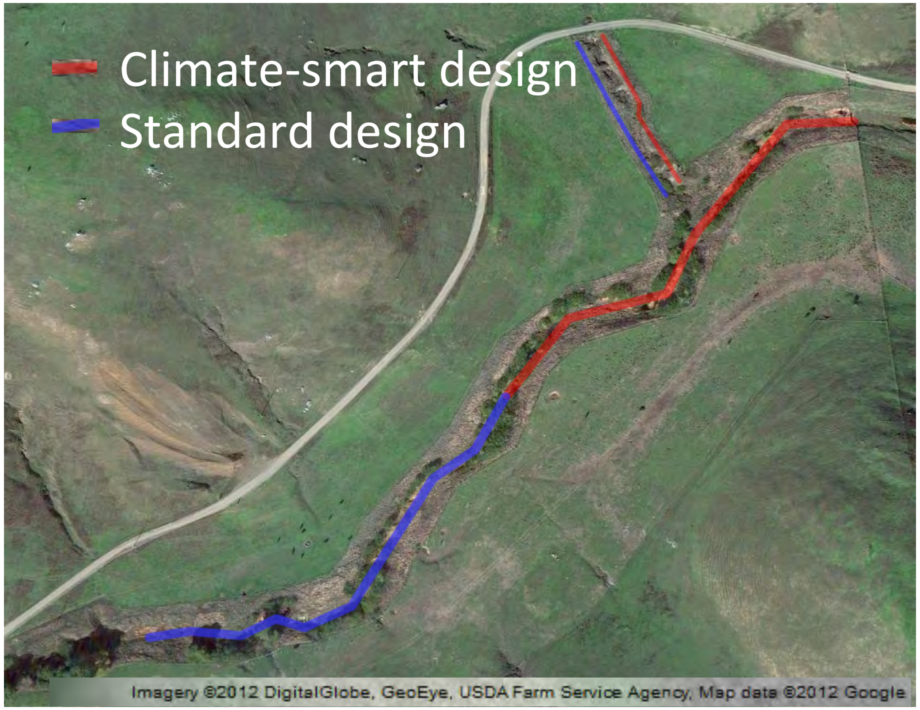
Action
Plant species that can survive extreme events
Increasing the number of months that resources (cover, food) are available

Project design

- Riparian restoration (revegetation)
- 0.35 river miles
- Side-by-side comparison



GOALS - water quality and wildlife habitat

(1) Reduce the vulnerability of the area to extreme weather events by increasing the capacity of the restoration to rebound from longer and/or more frequent periods of drought, floods, and to a lesser extent fire.

(2) Reduce the vulnerability of wildlife to phenological mismatches by increasing the number of months and the amount of resources (cover, food) available.

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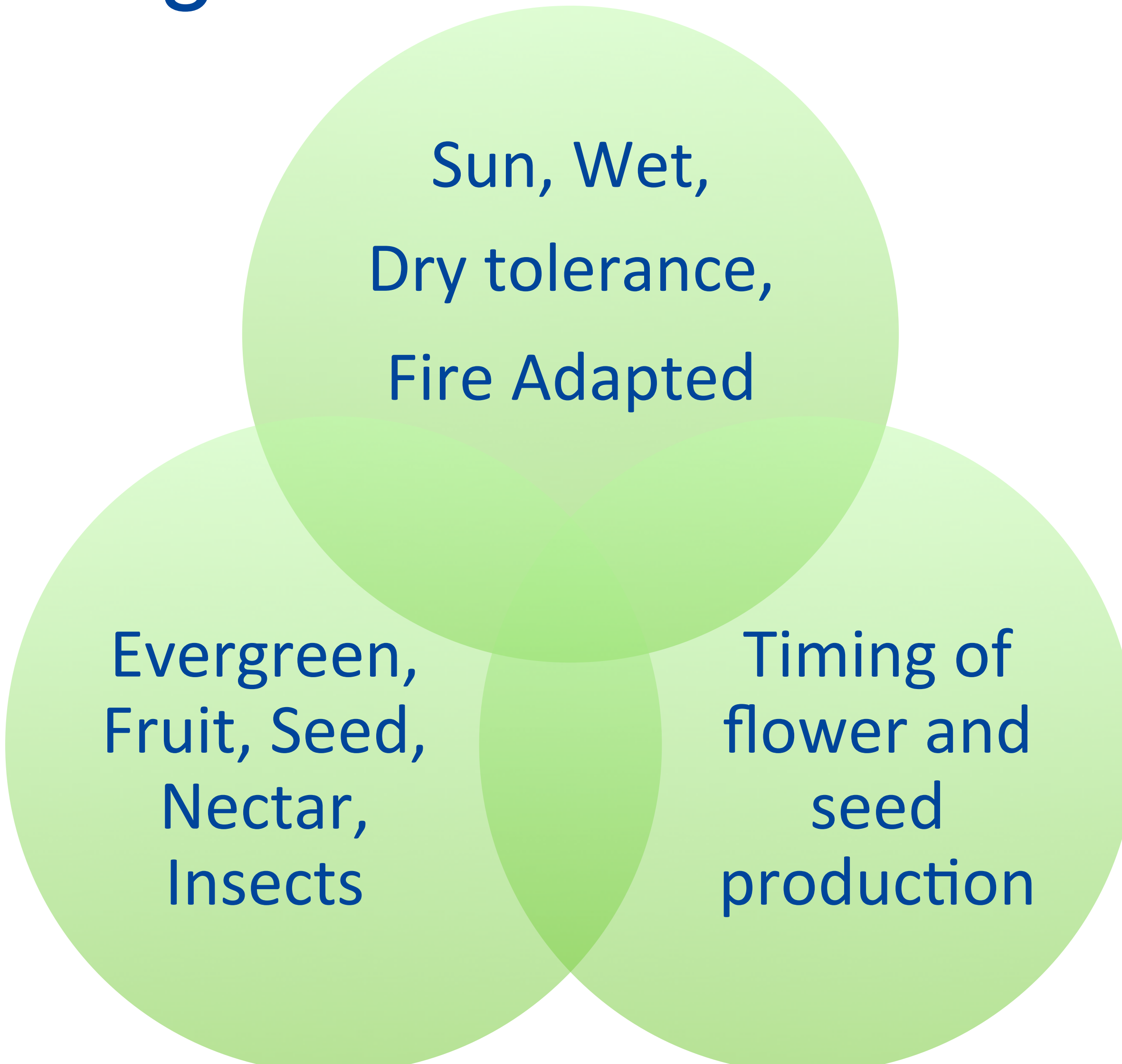
Simple planting tool



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Developed planning matrix

We created a tool to evaluate appropriate plant species and their environmental qualities

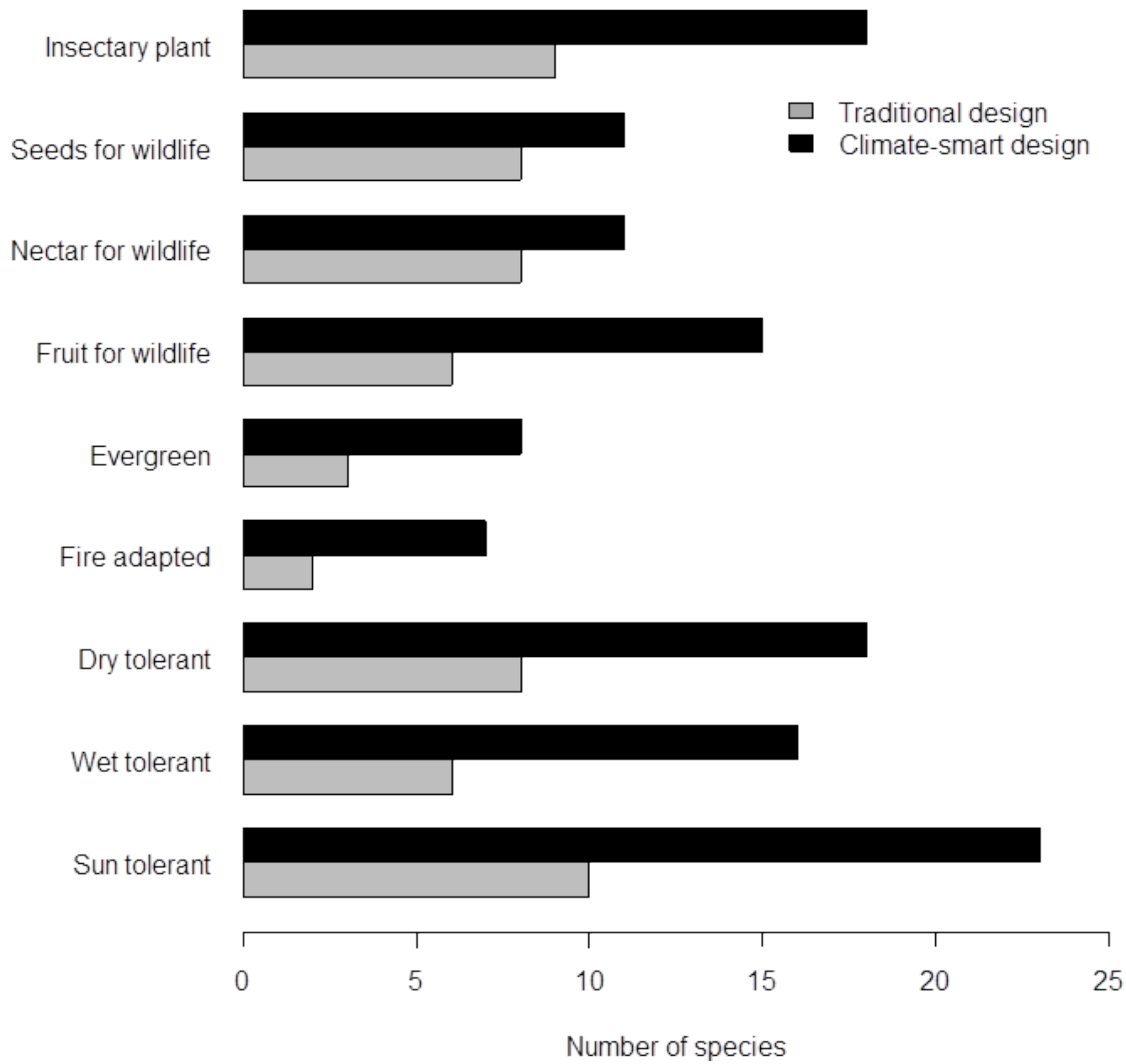
Common Name	Tolerates full or partial sun	Tolerates clay soil	Tolerates wet conditions	Tolerates dry conditions	Evergreen	Fire Adapted	Wildlife fruit source	Wildlife Nectar source	Wildlife Seed Source	Insectary Plant
Sticky manzanita	1		0	1	1	1	1	1		1
common manzanita	1	1	0	1	1	1	1	1		1
Bearberry	1	1	0	1	1	1	1	1		1
Marin manzanita	1		0	1	1	1	1	1		1
CA Sagebrush	1	1	0	1	1	1	0	1	1	1
Salt Marsh Baccharis	1	1	1	1	0					1
coyote brush	1	1	1	1	1	1	1	0	1	1
spice bush	1	1	1	1	0		0	0	0	1
Ceanothus	1			1	1	1	0	1	1	1
blue blossom	1		0	1	1	1	0	1	1	1
Mountain Mahogany	1	1	0	1	0	1	0	1	1	1
Creek dogwood	1	1	1	0	0		1	1	0	1
hazelnut	1	1	1	0	0		0	1	1	1
Hawthorne	1	1	1	1	0		1	1	1	1
Western leatherwood	1	1	1	0			1			
fremontia/ flannelbush	1	1	0	1	1	1	0	1	1	1
Toyon	1	1	0	1	1		1	1		
Creambush	1	1	1	1	0		0	1	1	1

Developed planning matrix

And evaluated timing of flowering/seeding to maximize the number of months that resources (food) are available for wildlife

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									
fremontia/ flannelbush					1	1	1					
Toyon						1	1			1	1	1
Creambush					1	1	1	1		1	1	
Pitcher Sage												

Implementation



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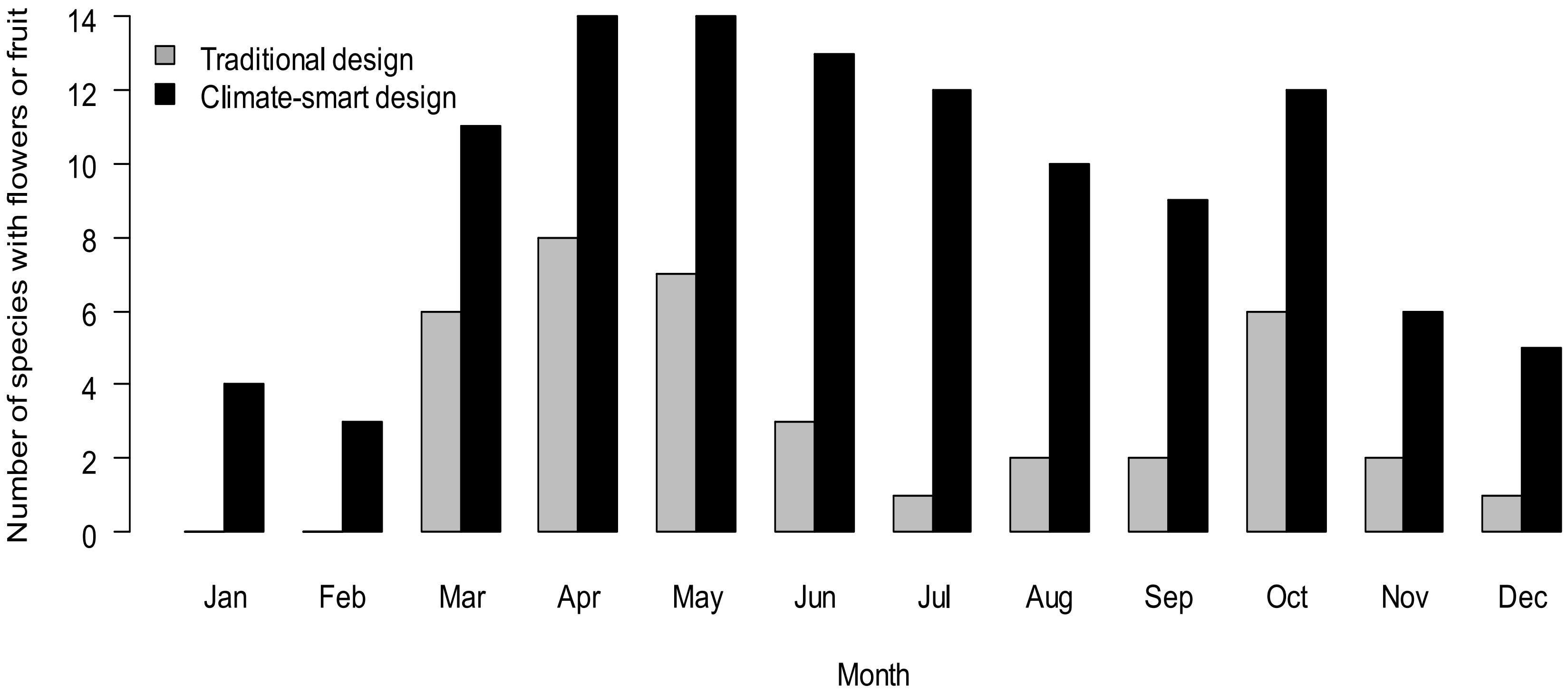
Implementation



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Implementation

282 students and 82 parents

Climate-smart design: 24 species
Traditional design: 10 species

Planting more species required ~2x the planting densities . . . .

Climate-smart: 249 individual plants
Traditional: 123 individuals plants

But, cost only 1.5 times that of the traditional design

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Lessons learned

- Species were not available from nurseries, limiting the final project's design
- A larger minimum project size is necessary for redundancy and self-propagation
- Potential regulatory challenges for projects with strict performance criteria
- There is a need to look beyond revegetation
- The public, planners, resource mangers, etc. are inspired and hungry to take actions to adapt to climate change

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Next steps

Science

- More case studies are needed
- New online tools such as analogue climates and planting designs
- Partnering with engineers – e.g., large woody debris projects
- Expanding our planting palette tool
- Working with a geneticist to include evolutionary resilience

Practice

- Additional habitat types
- Increase scale by expanding partnerships
- Restoration funders put language in their RFPs about how each project will address climate change in the context of our definition and principles.

Policy

- Work with the agencies that approve restoration plans to include climate-smart designs
- Work with agencies that provide guidance on restoration to include climate-smart designs
- Work with DFW to update their restoration handbook

Thank you!

Marin Community Foundation

Fledgling Fund

Marin Resource Conservation District

Prunuske Chatham, Inc.

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Questions:
nseavy@prbo.org