






Outline for today

1. Restoration Ecology
2. Climate-smart ecological restoration defined
3. Climate-smart ecological restoration principles
4. Principles to practice

Restoration

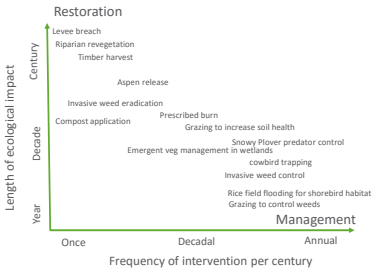




Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Society for Ecological Restoration (2004) 





Contrasting Restoration and Management

Climate change: Restoration game changer

Number of extreme heat days by year

Source: <http://cal-adapt.org/>


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

Gardali et al., In prep



Climate-smart principles

1. Show your work
2. Look forward but don't ignore the past
2. Consider the broader context
3. Build ecological insurance
4. Build evolutionary resilience
5. Include the human community
6. Monitor and Experiment



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

1. Show your work


Kyla is a member of the starting lineup of the school's basketball team. The heights of the other starting players are shown below.

160 cm, 156 cm, 148 cm, 147 cm

The mean height of the starting lineup is 152.4 cm. What is Kyla's height?


Show your work.

Kyla's height is 151 cm tall



2. Look forward but don't ignore the past


- Use best available climate predictions and summarize for project region
 - Make comparisons to current conditions
- Use information on past conditions if available
- Identify **climate-change vulnerabilities**



More on Vulnerability

Vulnerability is the susceptibility or amount of risk of a population to negative impacts

A **Vulnerability Assessment** seeks to determine how susceptible a species or a system is to the negative impacts of climate change




Sources: Smit et al. 2000. *Climatic Change* 45
Williams et al. 2008. *PLoS Biology* 6

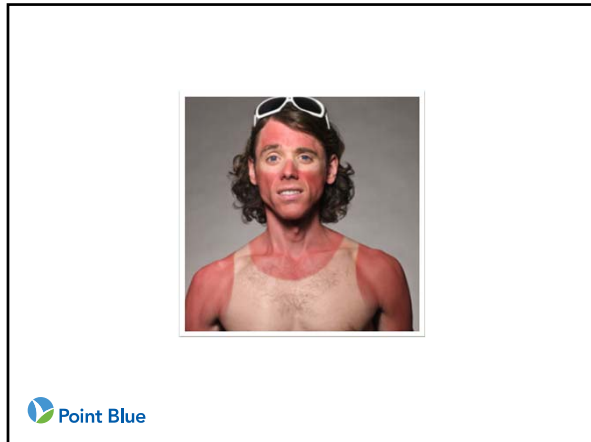
Components of a vulnerability assessment

Sensitivity refers to the intrinsic traits of organisms that make them vulnerable to climate change (such as physiological tolerances)

Exposure refers to the extrinsic factors that are driven by climate change (such as habitat loss)

Adaptive capacity addresses the ability of a species or system to accommodate or cope with climate change impacts.





Developing actions to address vulnerabilities

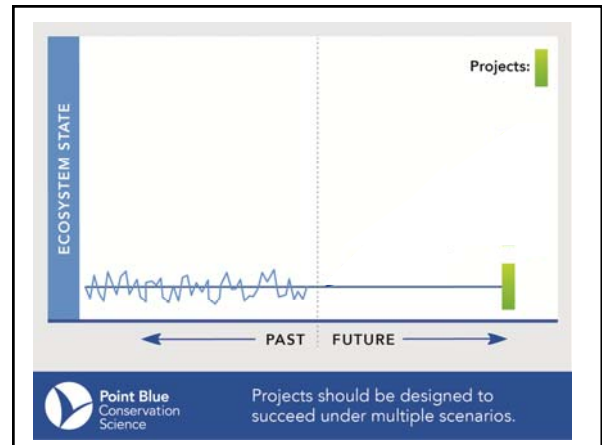
Goal	Climate vulnerability	Action
Protect water quality by slowing run-off	More extreme events (drought, floods) kill vegetation and create bare ground	Plant species that can survive extreme events
Provide wildlife habitat	Changes in timing cause mismatches in animal/plant phenology	Increasing the number of months that resources (cover, food) are available

Point Blue

3. Consider the broader context

- Identify **other stressors to the system** that could be addressed by the project
- Other logistical constraints
- Importance of project to the region and beyond

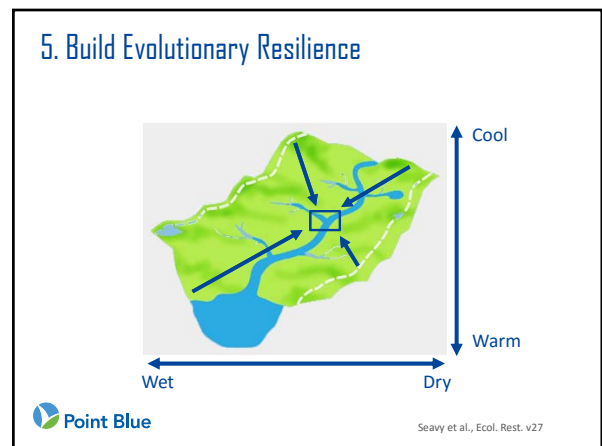
Point Blue

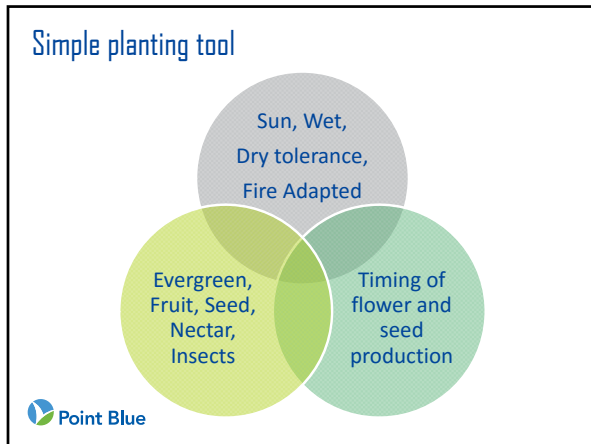


4. Build Redundancy

Point Blue

Dunwiddie et al., Ecol. Rest. v27



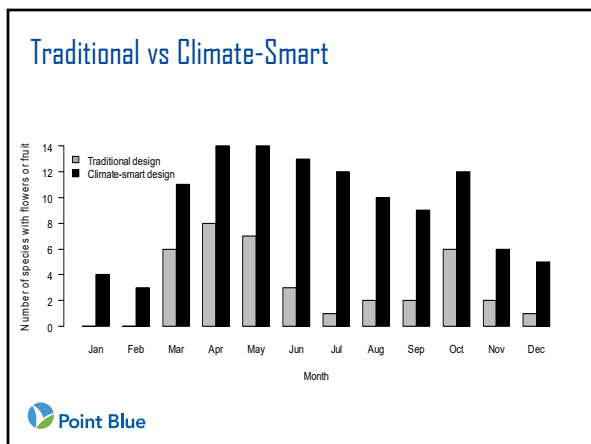
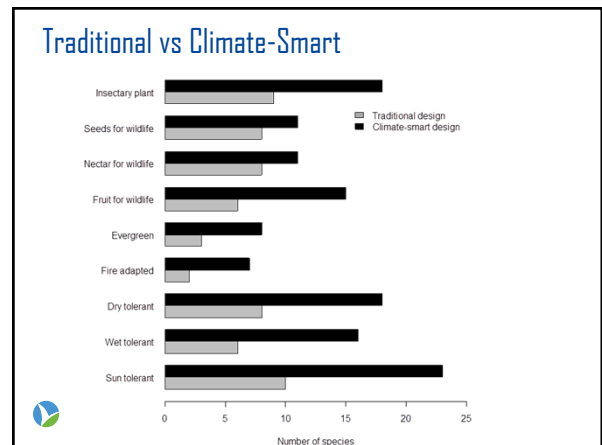


Developed planning matrix

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


Developed planning matrix

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


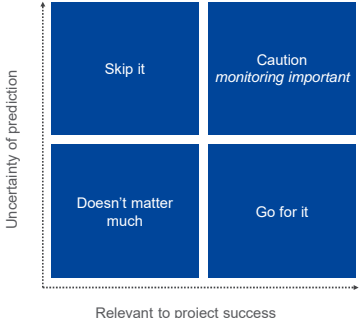


Risk

- The probability of an outcome (usually negative) in a specified period of time
- An estimate of risk can help provide the evidence (show your work!) to:
 - make restoration decisions
 - allocate scarce resources



Risk



7. Research and Monitoring

Given the great **uncertainties** around how climate change will impact ecosystems and how society will respond, it is important to **conduct ecological monitoring to manage adaptively**.

Restoration experiments can help provide **answer to key uncertainties**, provide **tools to access key information**, and help **evaluate effectiveness**.



Thank you

California LCC
Marin Community Foundation
Fledgling Fund



tgardali@pointblue.org

