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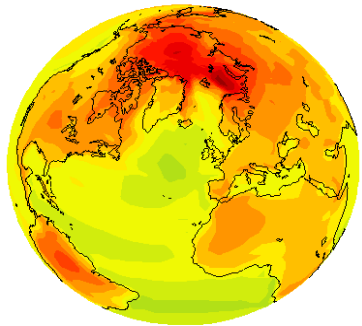

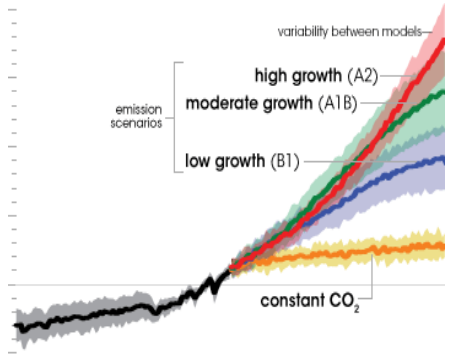

Doing restoration in a climate change context: examples for riparian systems

Thomas Gardali and Nathaniel E. Seavy

15 October 2009, *Laguna Science Symposium*

Presentation Outline

1. Climate change and restoration
2. Restoration goals and strategies
3. Importance of riparian habitat
4. Specific examples

Climate Change and Restoration – CHALLENGES

1. Rapid speed of change
2. Uncertainty is high
3. Moving target
4. Uncharted territory
5. Why bother?

Climate Change and Restoration

Novel ecosystems

ecosystems that differ in composition and/or function from present and past systems

Climate Change and Restoration

Novel ecosystems: implications for conservation and restoration

Richard J. Hobbs[1], Eric Higgs[2] and James A. Harris[3]

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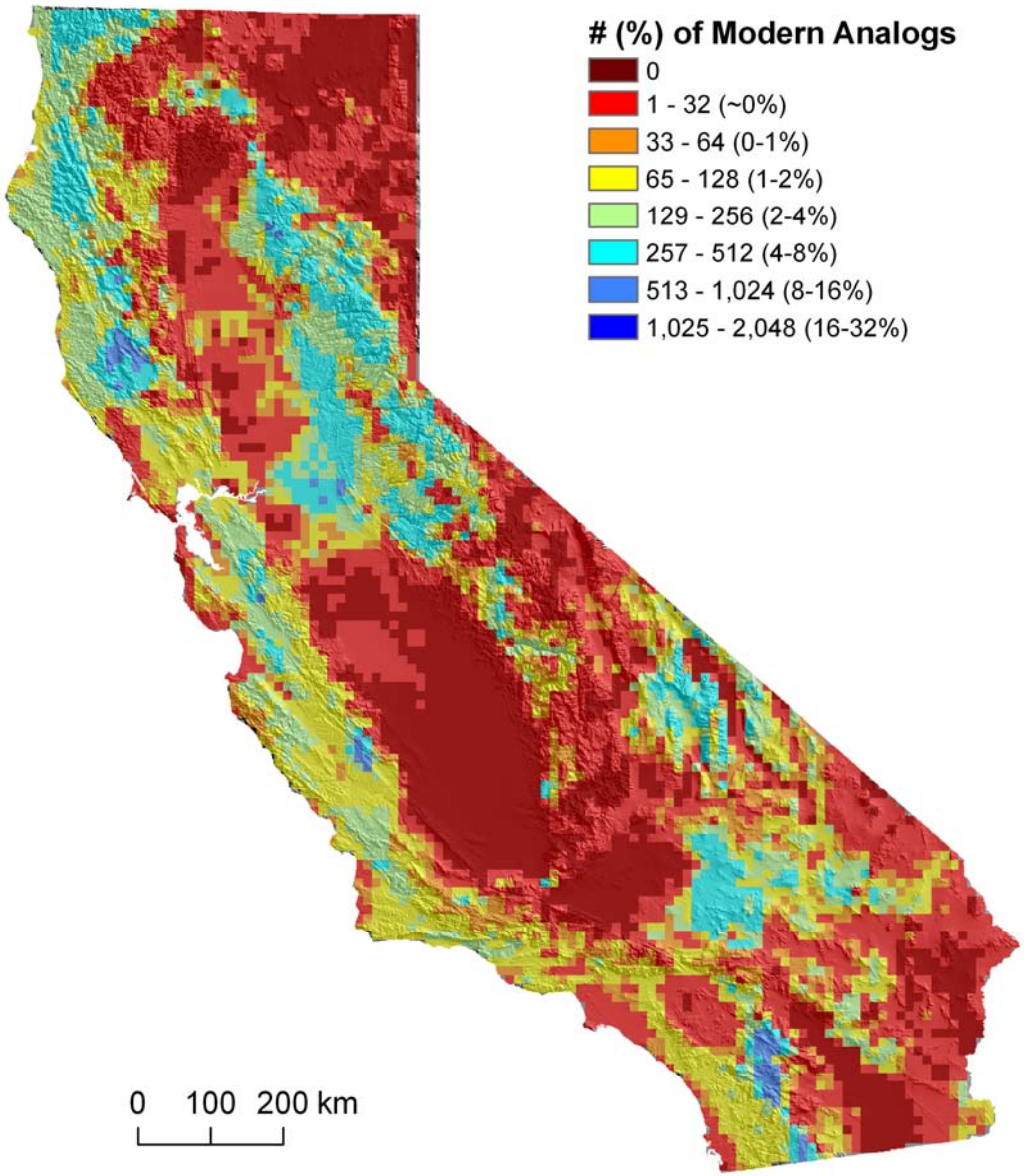
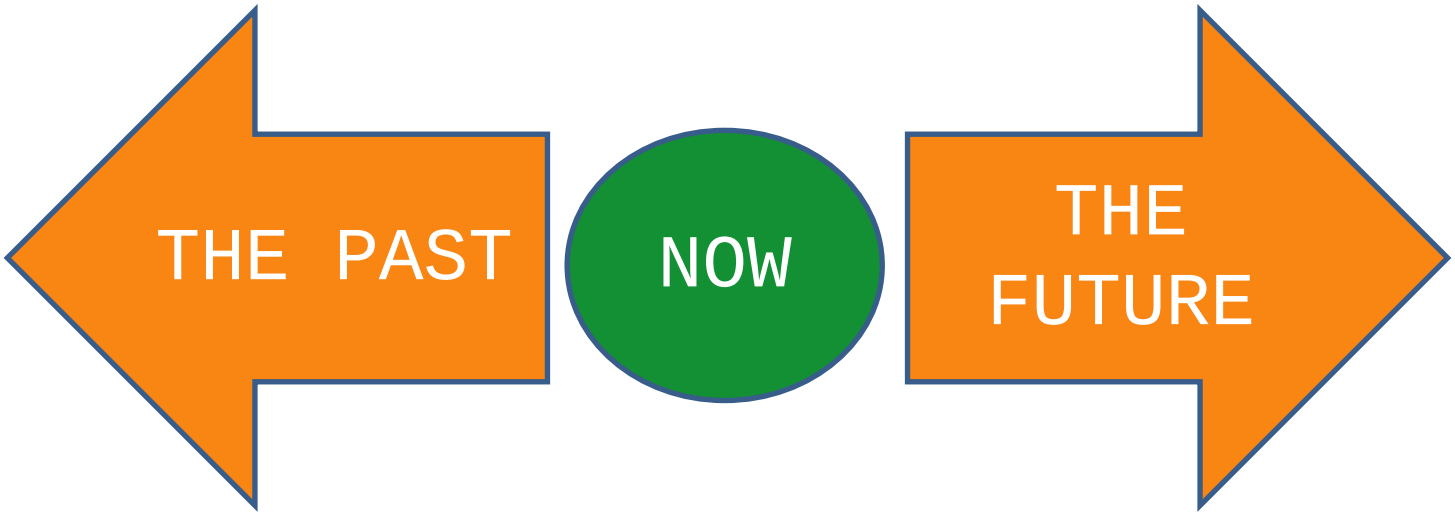
Trends in Ecology and Evolution Vol.24 No.11

As much as half of California could be occupied by new bird communities by 2070



Source: PRBO, Stralberg et al. 200

Restoration Goals and Strategies



storation often has past (historic
ystems as a goal, but also needs t
consider future conditions

Or put another way . . . .

*“Plan backwards as well as forward.
Set objectives and trace back to see how to achieve them.*

You may find that no path can get you there.

*Plan forward to see where your steps will take you,
which may not be clear or intuitive.”*

-Donald Rumsfeld

Restoration Goals – the historical perspective

What do we restore for now?

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

Species groups (e.g., migra birds)

Historic acreage

Community composition

Restoration Goals

What are some alternative restoration goals?

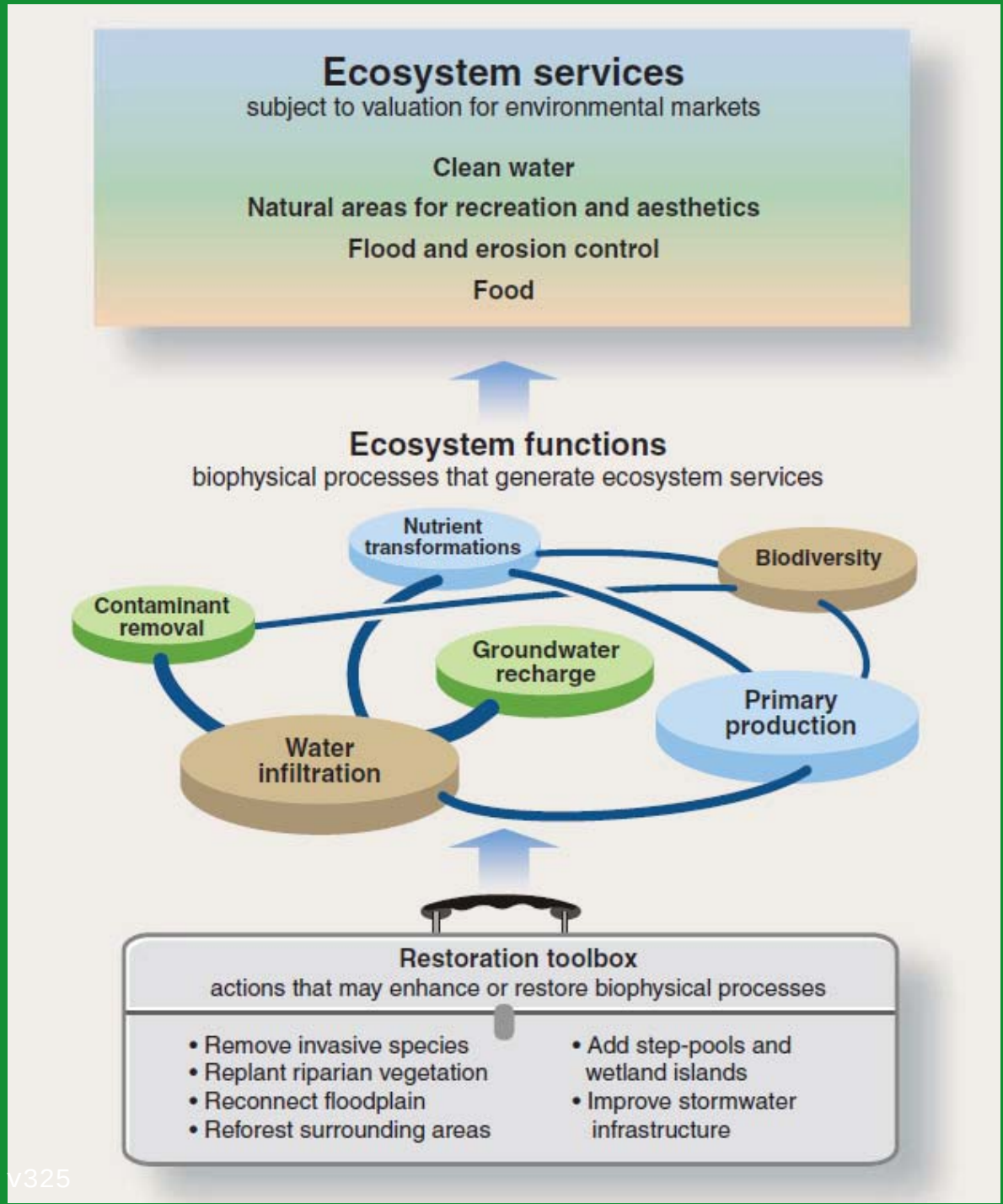
Ecosystem Structure
Shape and spatial distribution of ecosystem components

Ecosystem Function
Biophysical processes and ecosystem features

Ecosystem Services
The benefits humans derive from ecosystems

Goals not mutually exclusive

Set specific goals and quantitative performance measures



Source: Palmer & Filoso, Science v325

Restoration Strategies for an uncertain future

Component Redundancy & Functional Redundancy

ACTION:

Increase or replicate the number of components (e.g., species) and those with similar functions.

CONSEQUENCE:

- Increased survival due to higher abundance and increased genetic diversity
- Taxa better suited to future climates introduced

Source: Dunwiddie et al., Eco

Restoration Strategies

Increased Connectivity

ACTION: restore areas important for dispersal between populations or to new habitats

CONSEQUENCE:

- Increased survival of populations due to increased pathways to dispersal and repopulation
- Increase diversity of pathways/corridors
- Increase potential for inter-

Source: Dunwiddie et al., Eco

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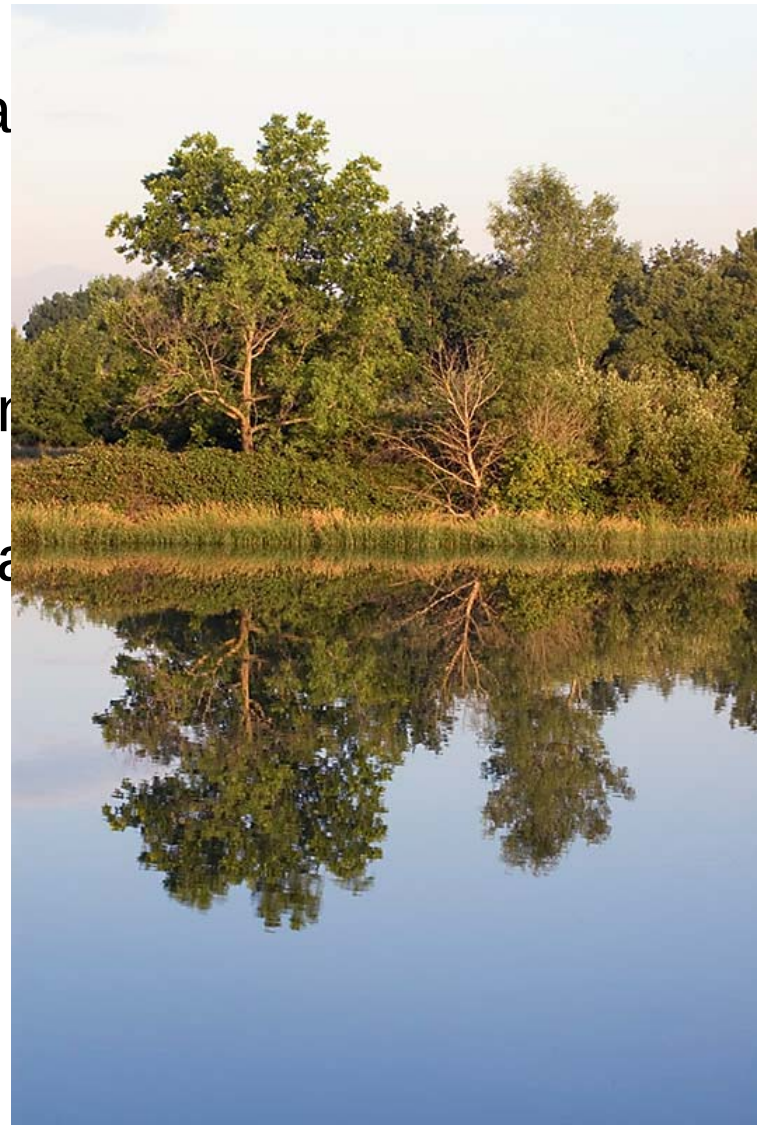
Climate change makes riparian restoration more important than ever

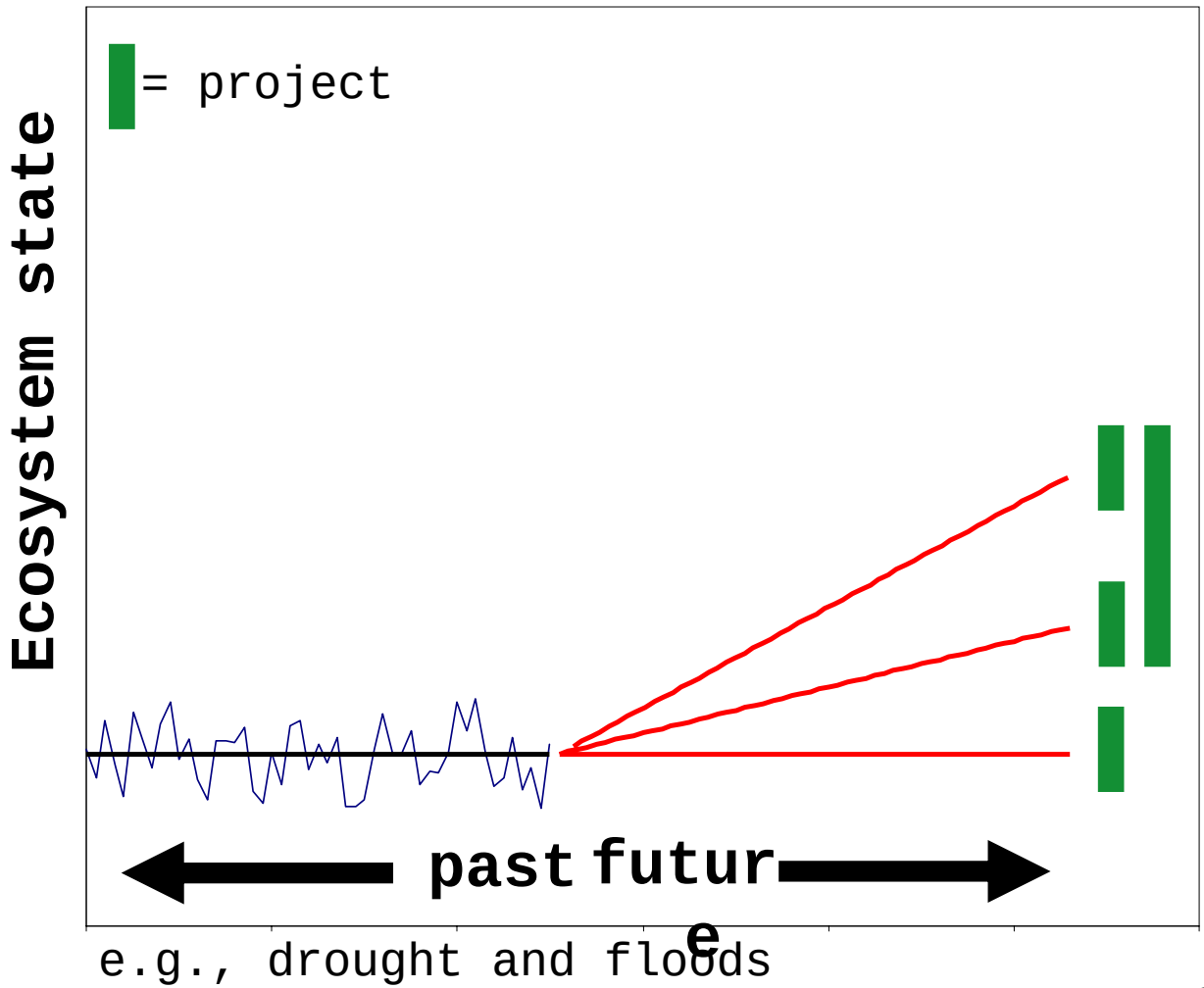
Characteristics of riparian a

1. naturally resilient
2. provide linear habitat conn
3. link aquatic and terrestria ecosystems
4. create thermal refugia for



Source: PRBO, Seavy et al., Ecol. Rest v27

Plan for extremes, wider range of variability



Prioritize projects that could succeed under multiple scenarios

Projects could cover any of the strategies

Source: PRBO, Seavy et al., Ec

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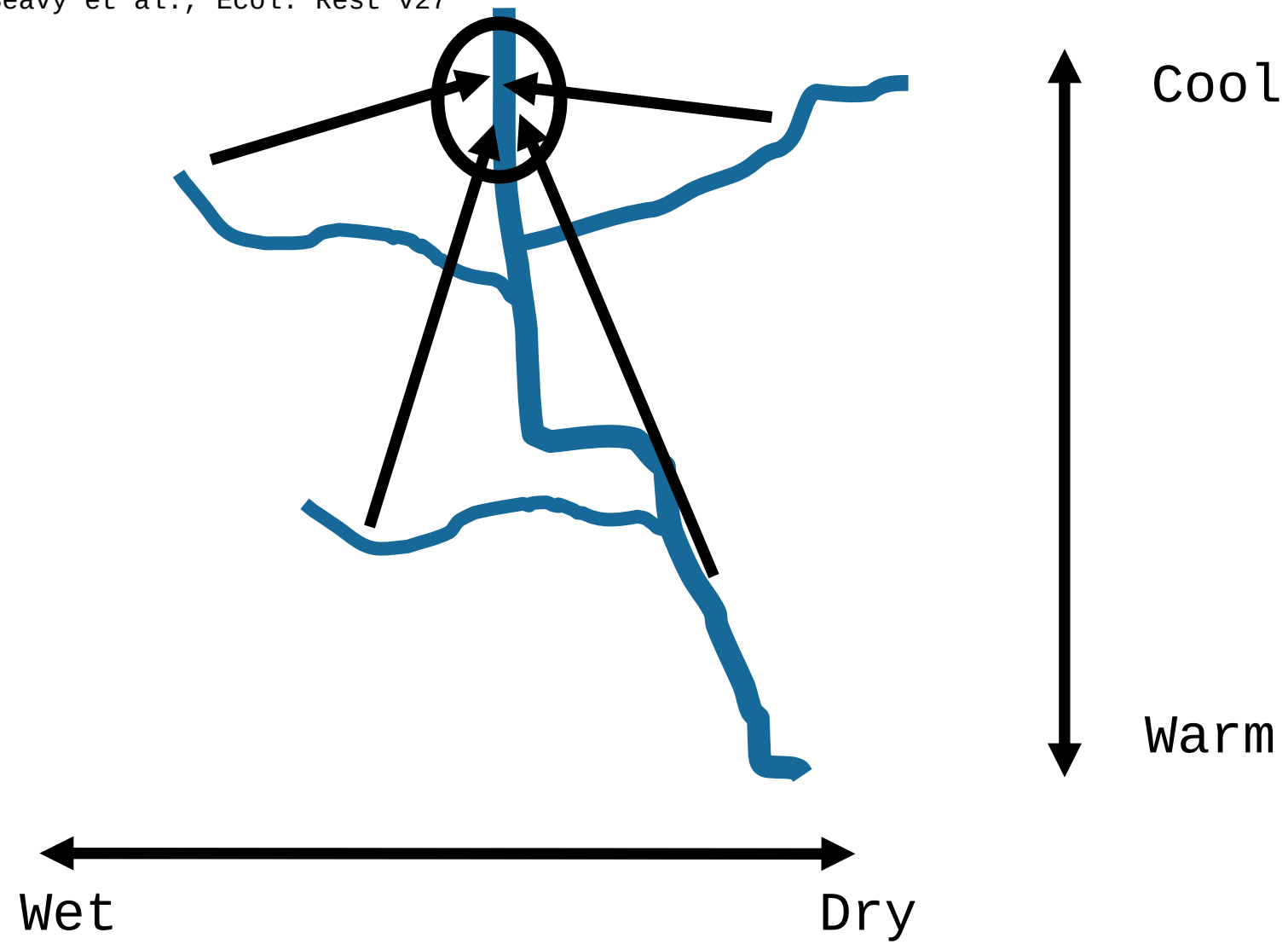
Plant for genetic diversity

to prepare f

Source: PRBO, Seavy et al., Ecol. Rest v27



Consider planting “new but nearby” species

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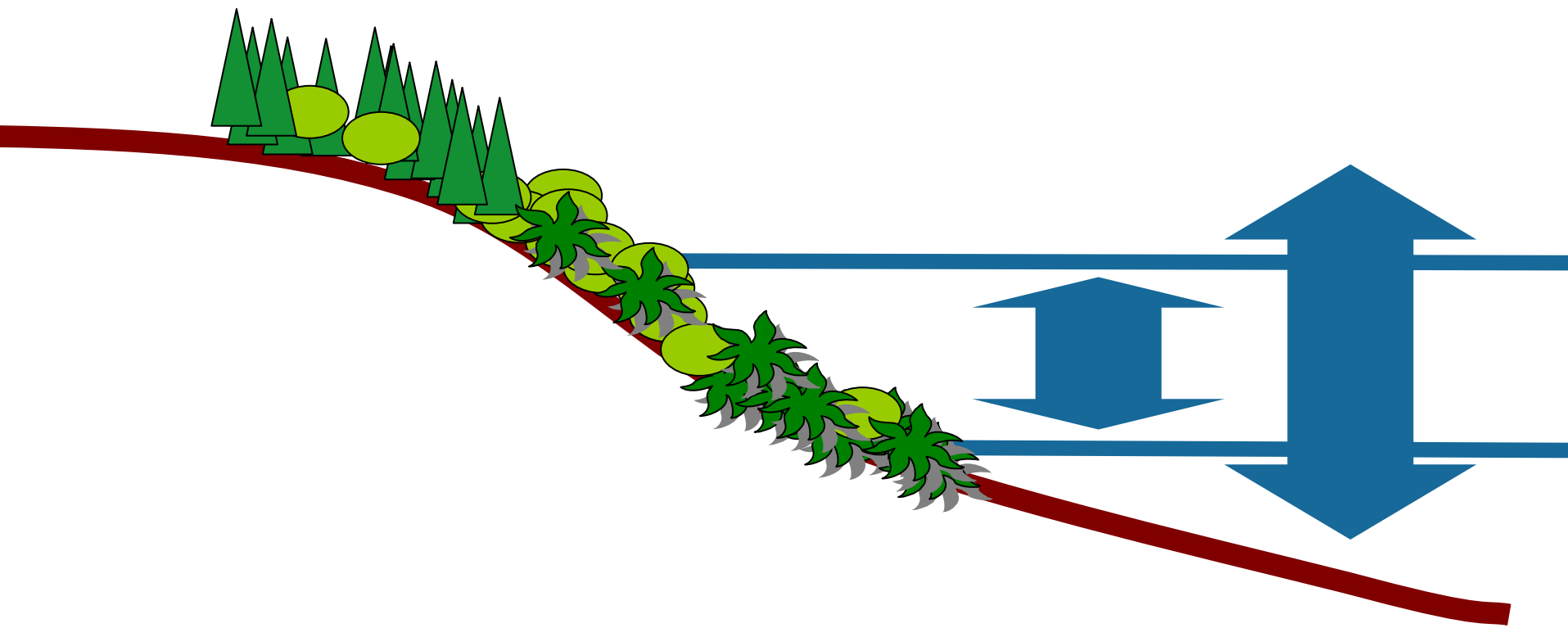
Plan restorations for an unpredictable hydrograph



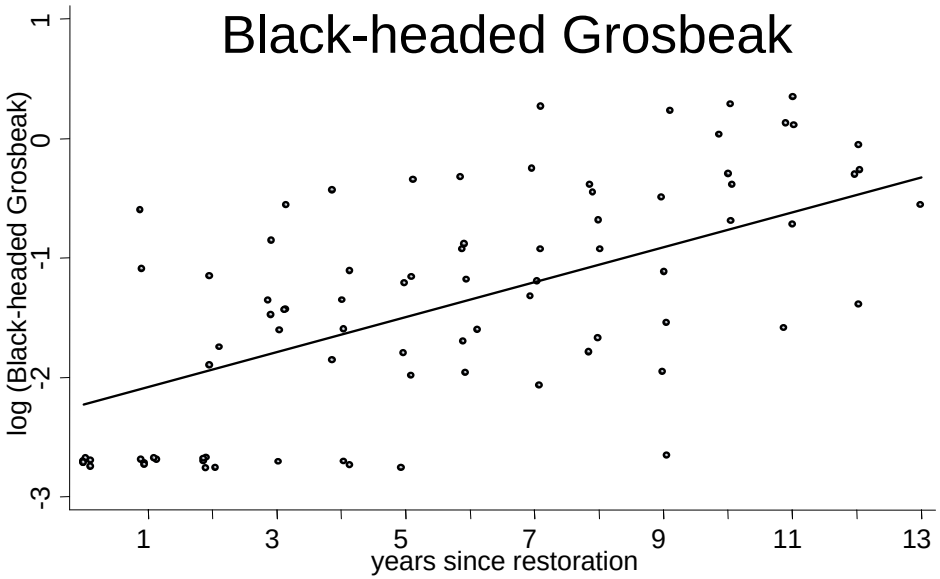
Plant early seral colonizers adapted to flooding together with late seral species that may be less tolerant of flooding but

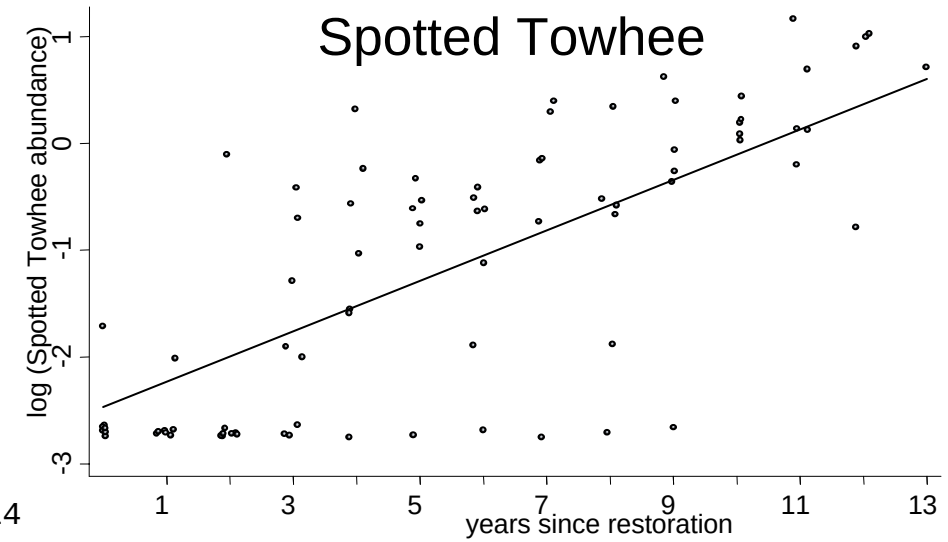
Source: PRBO, Seavy et al., Ec

Increase connectivity

Actively partner with adjacent landowners - pu

Measuring success





Source: PRBO, Gardali et al., Rest. Ecol v14

Restoration Goals and probability for success

Consider the San Joaquin Valley . . . .

Metric	Current conditions	Worst case climate predictions
Historical hydrograph	Unlikely	Unlikely
Salmon	Possible	Unlikely
Community composition	Possible	Unlikely
Component redundancy	Likely	Likely
Connectivity	Likely	Likely

Risks and consideration

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

For example . . .

- Unanticipated species interactio
- Homogenization of species
- Loss of locally adapted genotype
- Facilitate movement of pathogens
- Etc., etc.

Risks and considerations

“Business as usual” restoration is also a risk!

Ignoring the future is not an option

What can science do to help reduce risk?

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

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