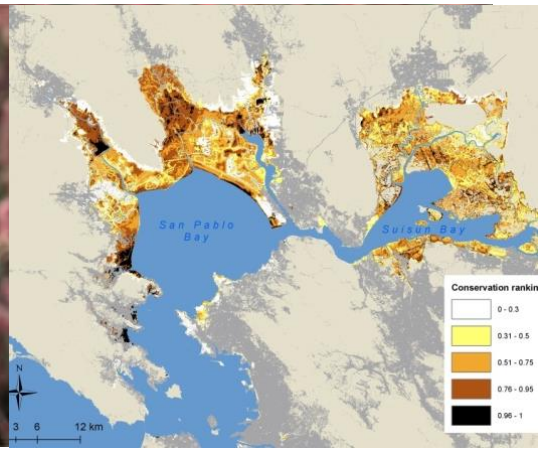
Using scenarios to find robust management solutions to highly uncertain futures

Sam Veloz, Nadav Nur, Leonardo Salas, Dennis Jongsomjit, Julian Wood, Diana Stralberg and Grant Ballard



Point Blue
Conservation science for a healthy planet.

History of Point Blue

- Founded as Point Reyes Bird Observatory in 1965 in the Point Reyes area

New Headquarters

- Migrated to Petaluma in 2006

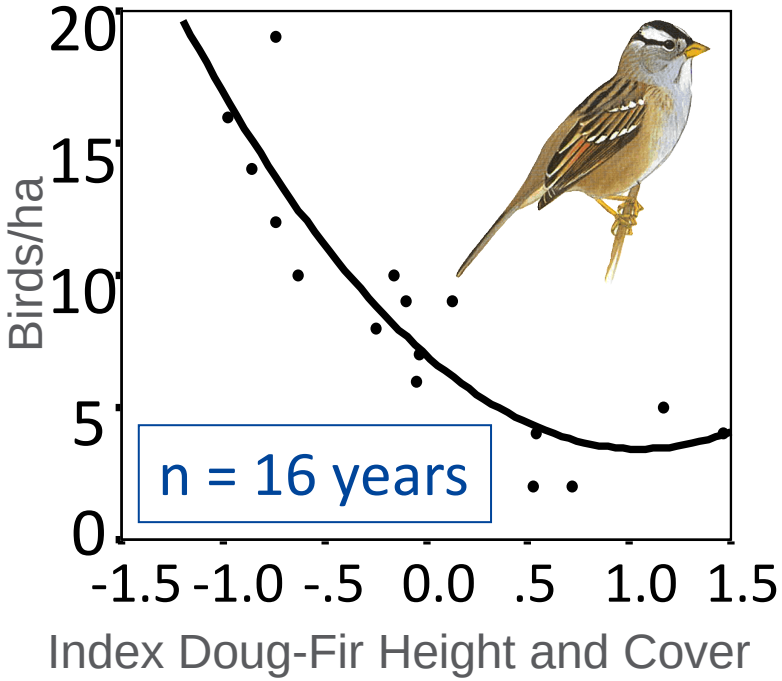
Bird & Ecosystem Science to Advance Conservation for Wildlife and People

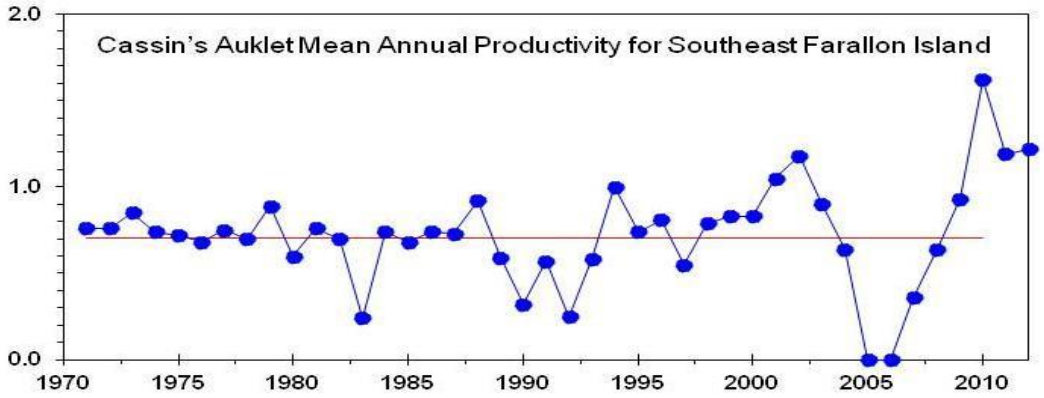
- 140+ staff and seasonal biologists
- 2013 Budget: ~$10 m

Point Blue Conservation Science

Point Blue
Conservation
Science

Leader: Long-term monitoring of birds and other indicators of environmental health





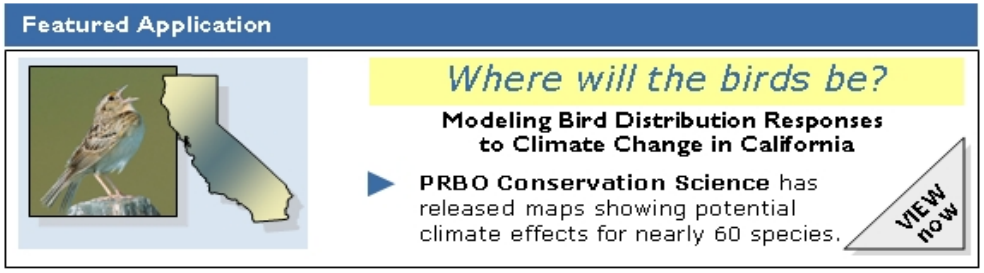
Leader: Data Sharing, Interpretation, Models, Tools

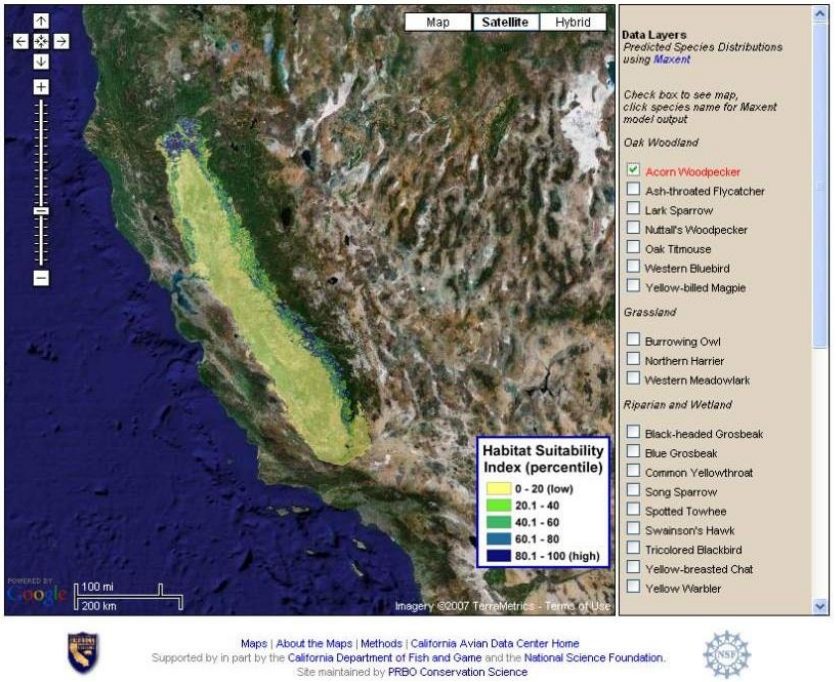
On-Line Ecological Data Center:

http://data.prbo.org/cadc2

~800+ million bird, vegetation, and other data records

PRBO and other data sets include: BBS,CA Natural Diversity Database, eBird, US Forest Service, CA Partners in Flight



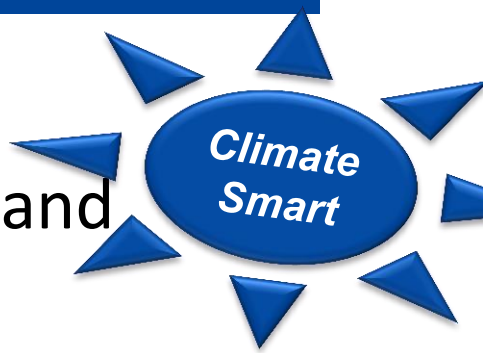


Point Blue Conservation Science

PRIORITY: Reduce Impacts of Habitat loss and Climate Change; Promote Nature-based Solutions

Left: Photodisc. Right: Corbis

Climate Smart Conservation
Key Principles- Decision Making Lens



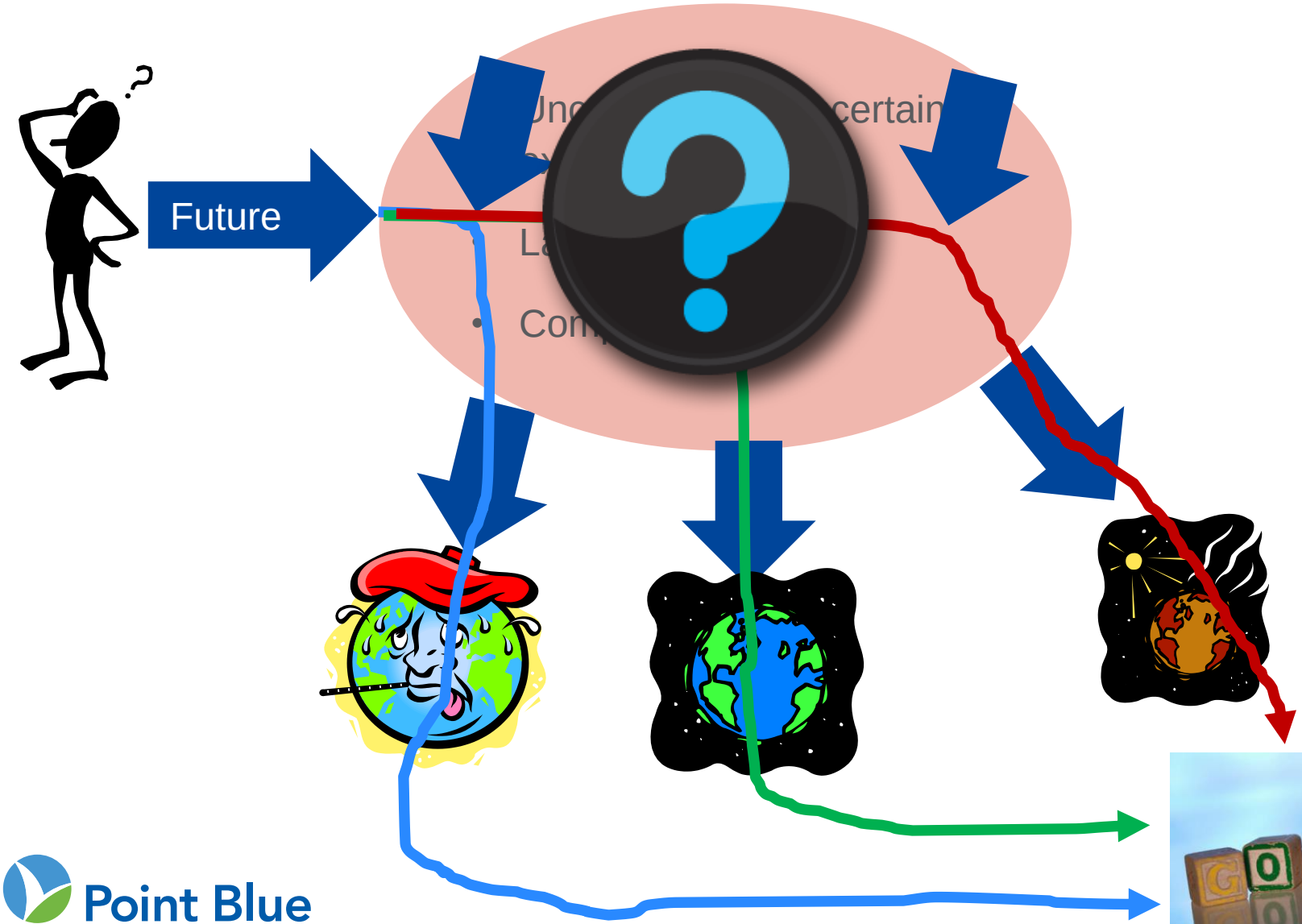
1. Plan for and focus on future, not past
2. Design actions in ecosystem, watershed and region-wide context
3. Employ flexible, adaptive approaches for timely response to continual change
4. Prioritize actions across multiple future scenarios for greatest benefits to wildlife and people
5. Collaborate & communicate across sectors for timely, long term solutions

Point Blue Conservation Science

www.pointblue.org

Adapted from: Draft Principles for CA Resources Agency Adaptation Update 2012; NWF Climate Smart Conservation Adaptation Principles 2011; CSIRO's Climate change impacts on Australia's biodiversity conservation & protected areas, Sept 2012 Update

Planning and uncertainty



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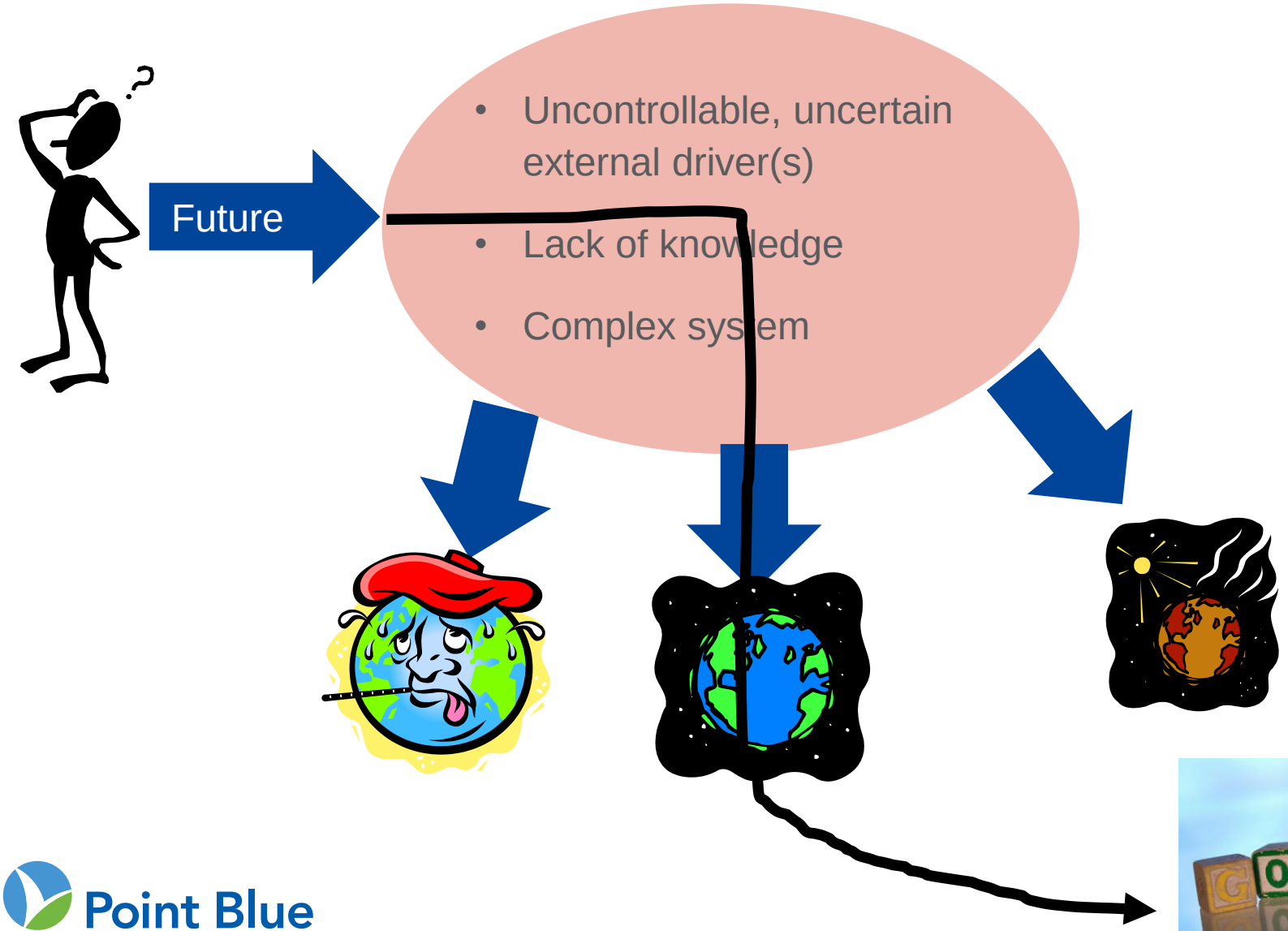
Planning and uncertainty



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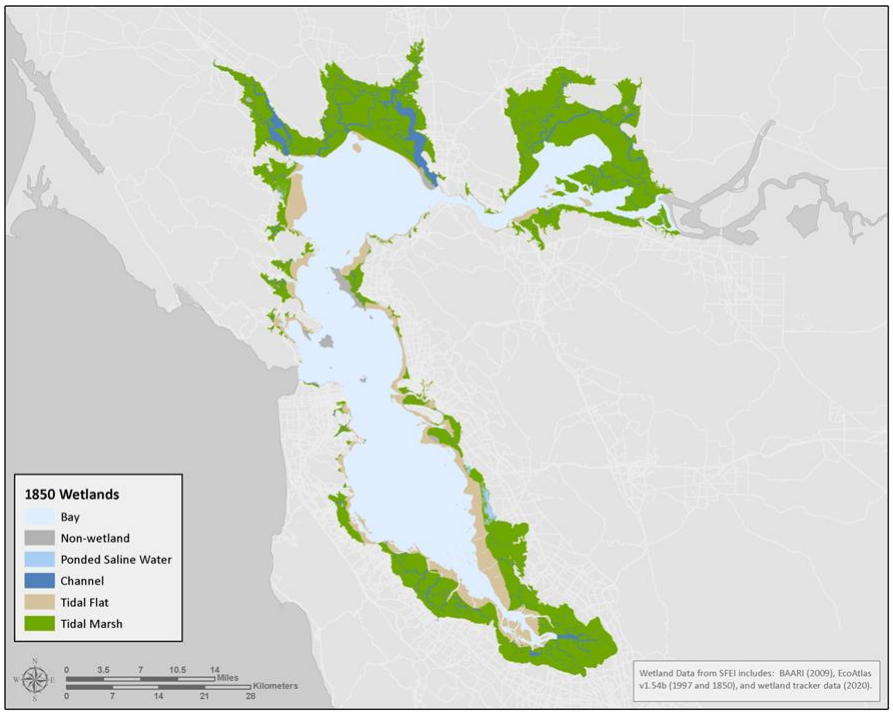
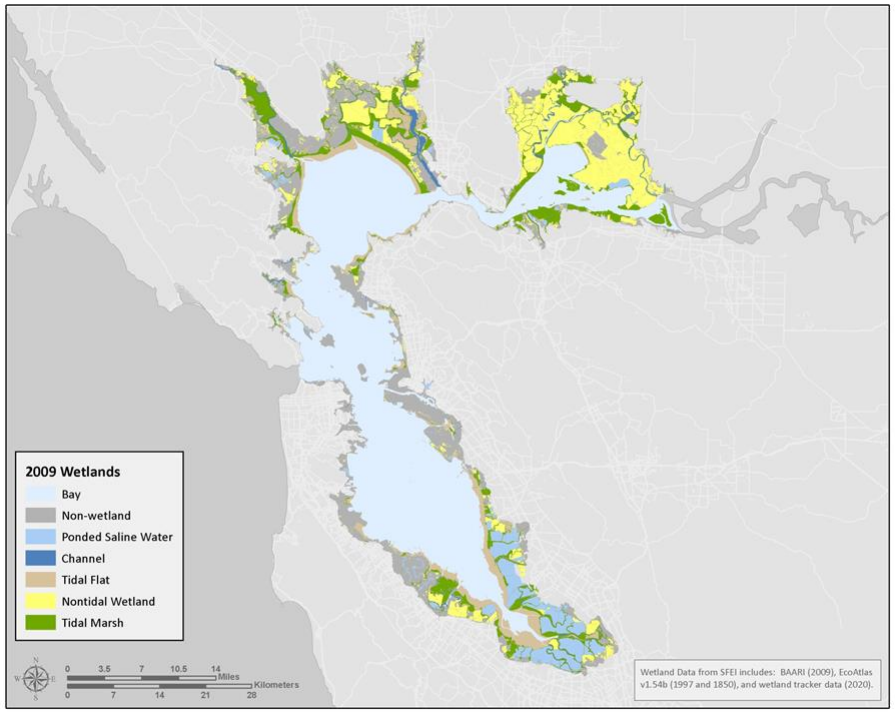
San Francisco Bay Estuary: A hotspot for wetland restoration

Point Blue

90% loss of historic tidal marsh ecosystems



1850



2009

Figures San Francisco Estuary Institute

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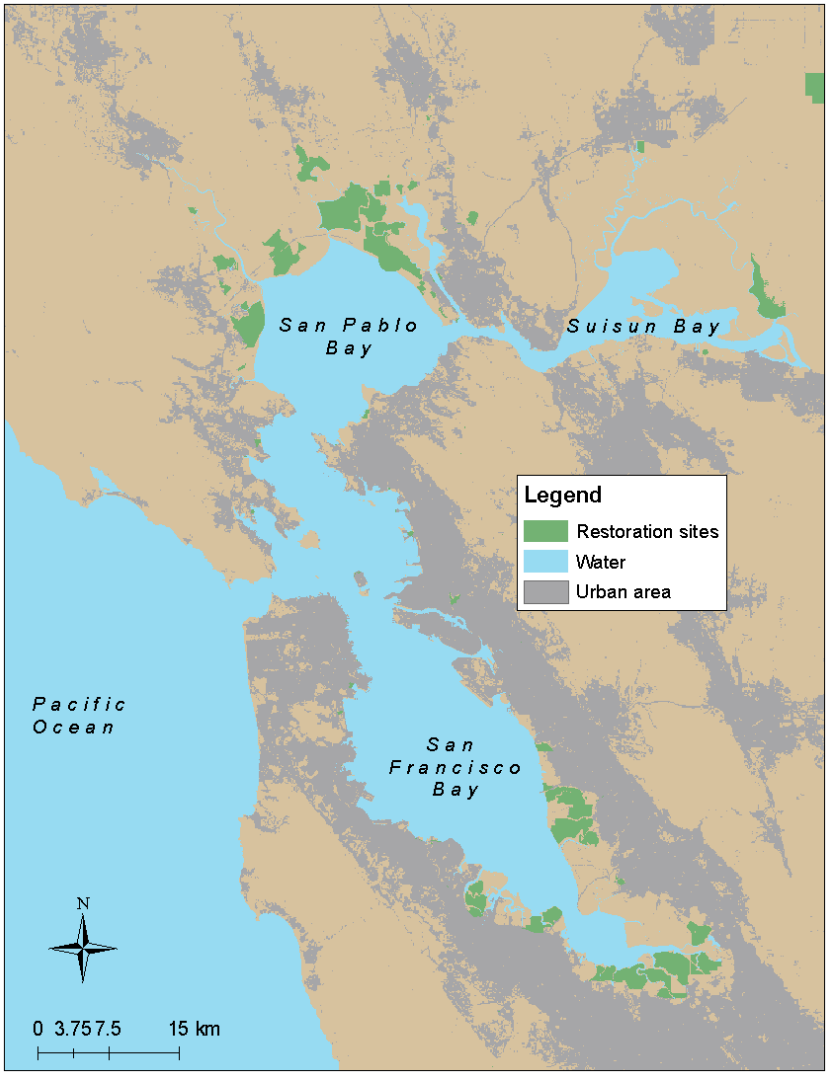
Sea level rise poses a restoration dilemma

- 1999 SF Bayland Goals report: 265% increase in tidal marsh habitat (100,000 acres)
- Will restoration projects be sustainable with sea level rise?
- Which projects should we prioritize?



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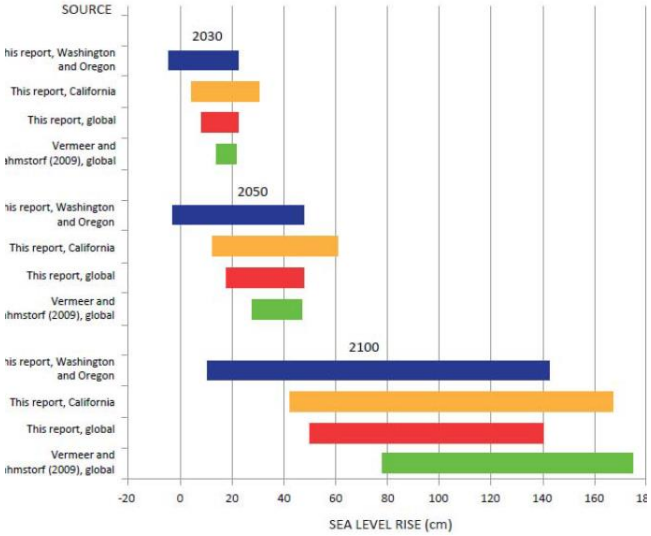
Major drivers of future changes in tidal marsh ecosystems

How do we know what future to manage for?

Science of sea level rise

Sea level rise: other



Human decisions

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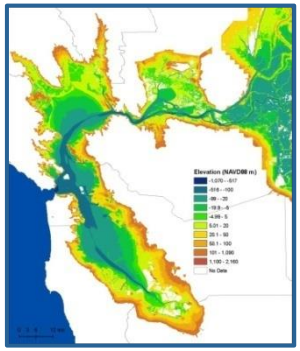
Modeling marsh accretion

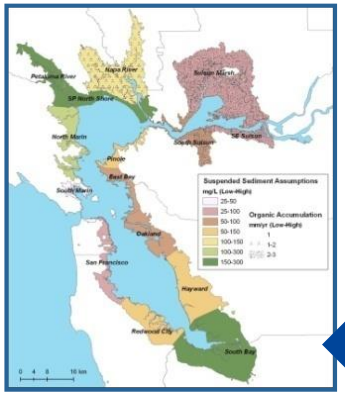
Bed model (Marsh98)

Spatial variation

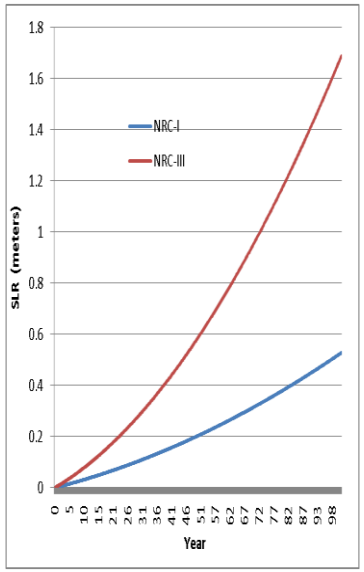
Base elevation



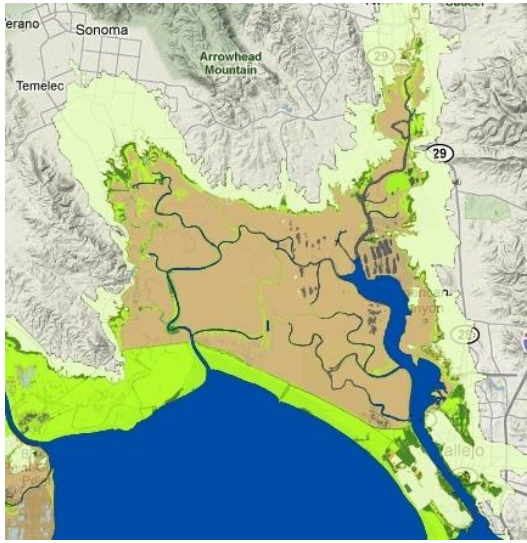
Sediment/ OM



Non-linear sea level rise



Habitat prediction maps



High impact/ high uncertainty

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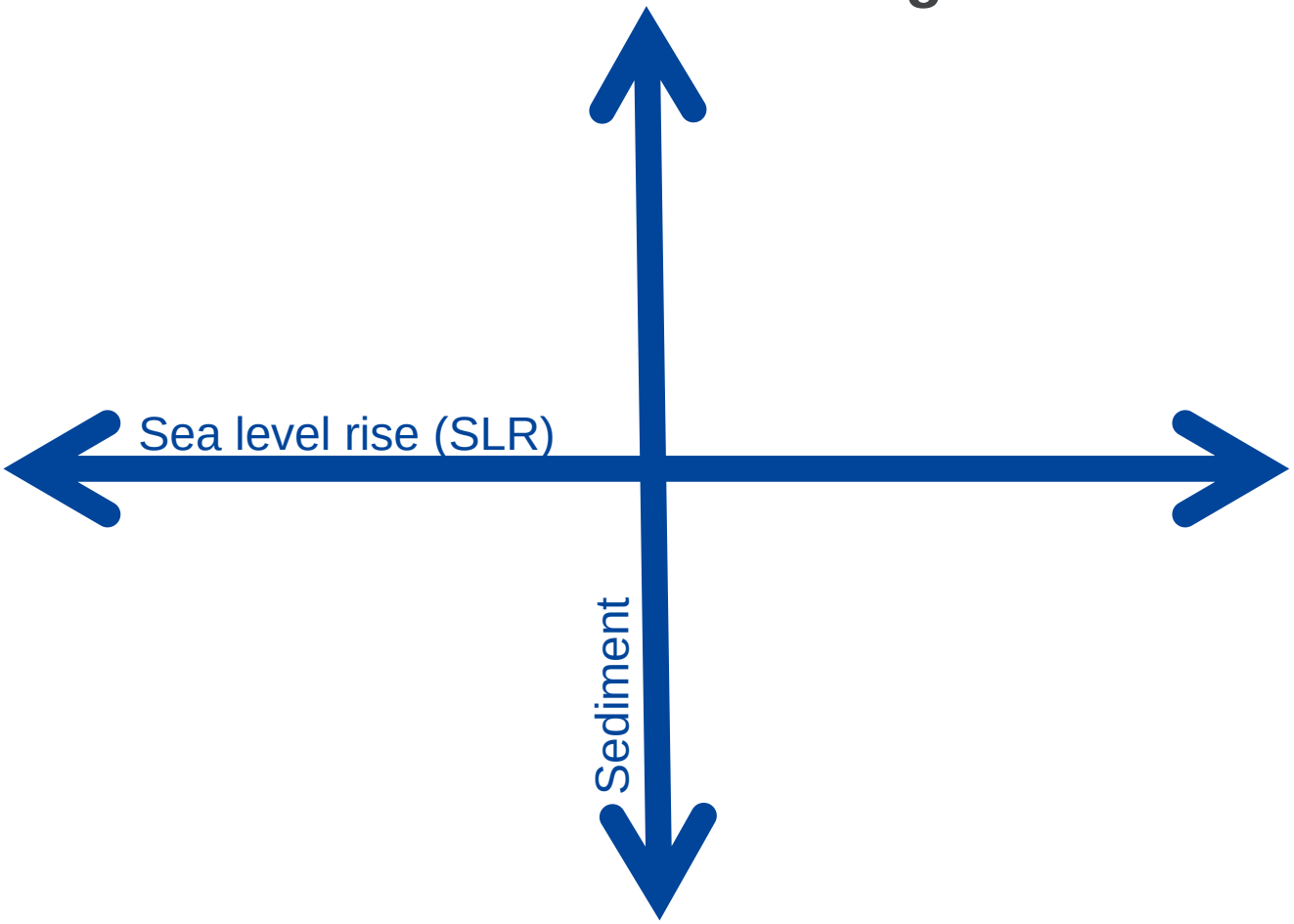
Future SF Bay Tidal Marsh Scenarios

Low SLR/ Low Sediment

High SLR/ Low Sediment



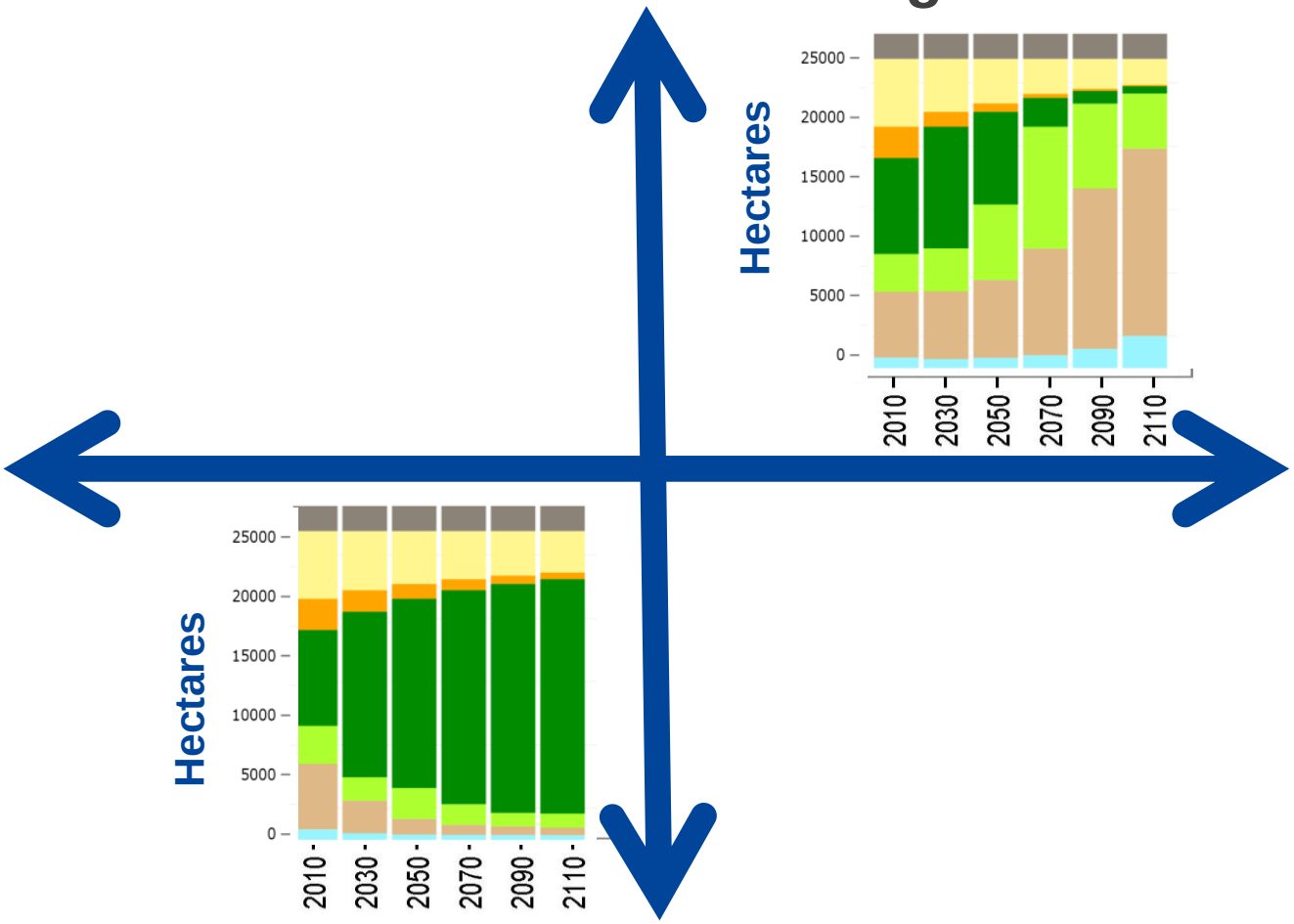
Low SLR/ High Sediment

High SLR/ High Sediment

Future SF Bay Tidal Marsh Scenarios

Low SLR/ Low Sediment

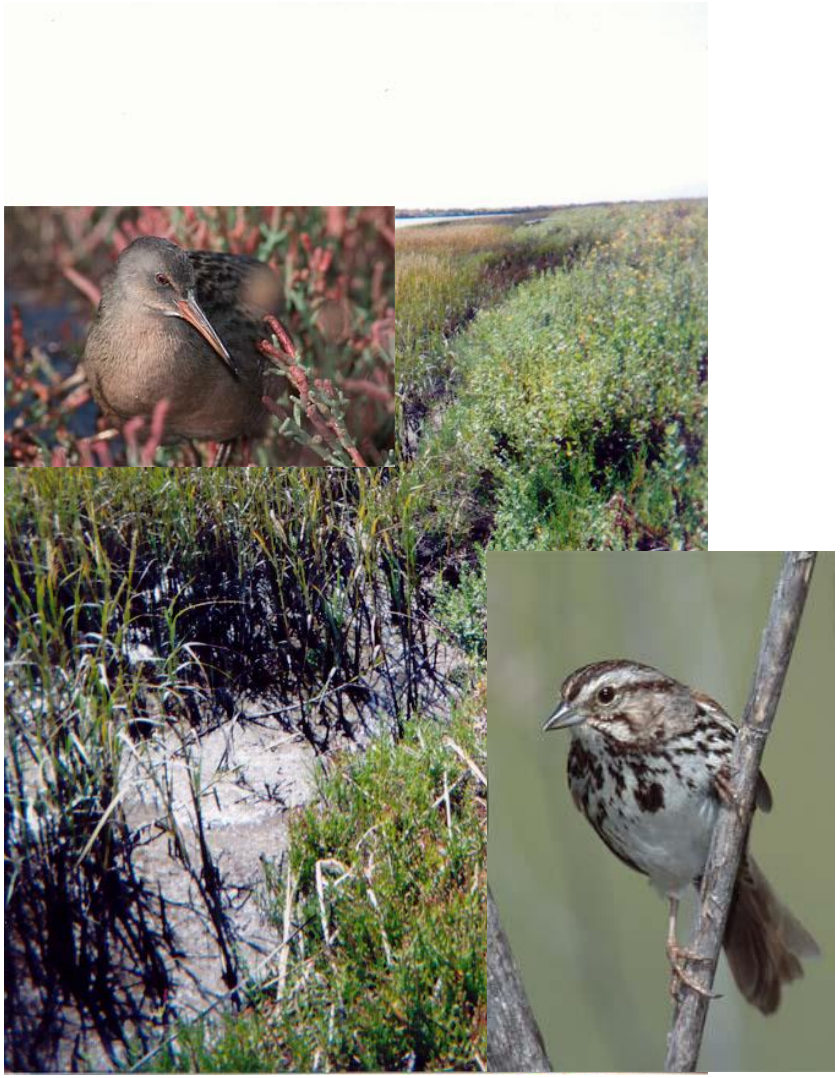
High SLR/ Low Sediment



Low SLR/ High Sediment

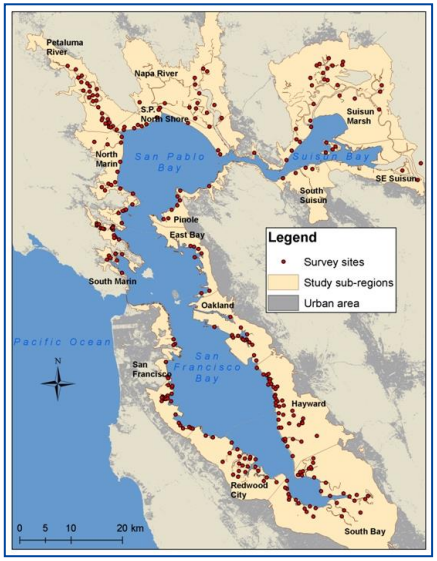
High SLR/ High Sediment

We could have more or less marsh but is all marsh created equal?

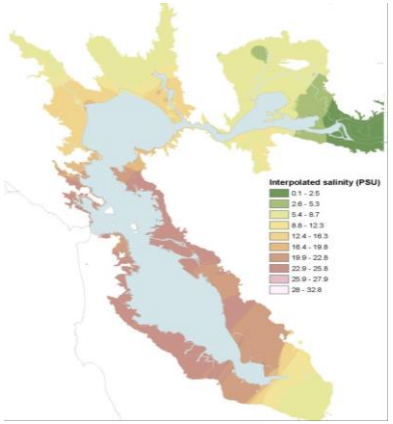


Modelling bird response to changing environmental conditions

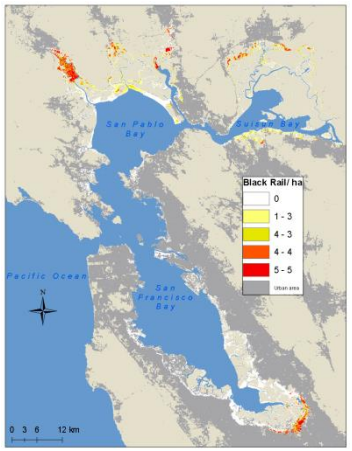
Bird observations



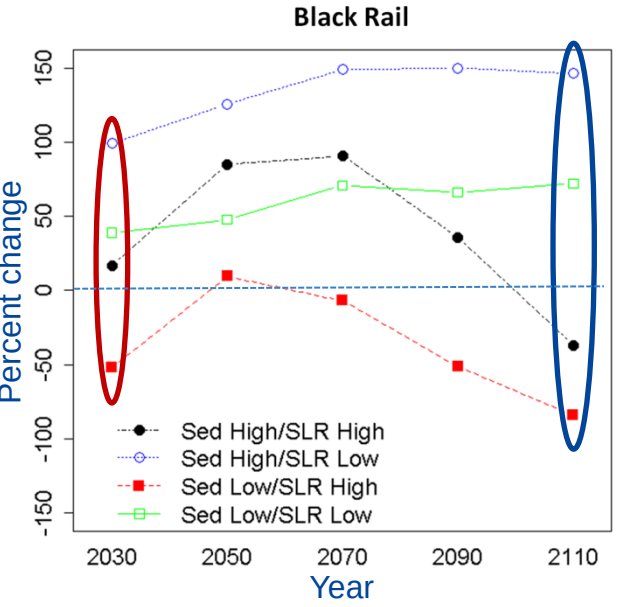
GIS environmental layers

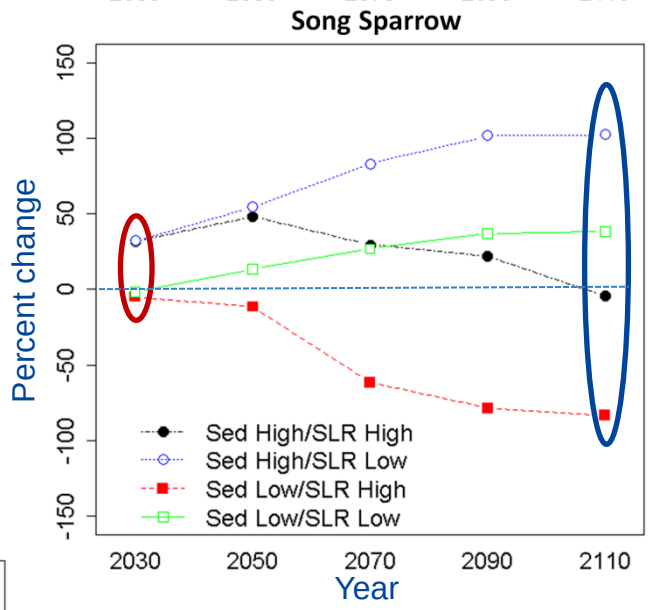


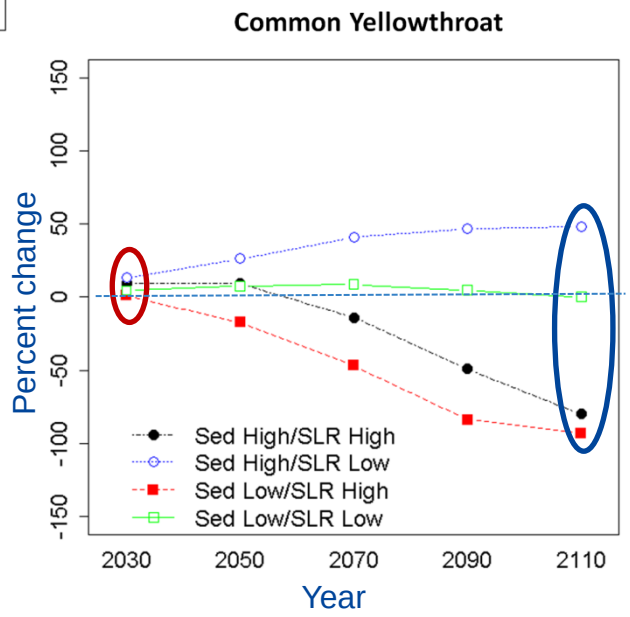
Projections of current & future density



Birds are sensitive to change in individual ways

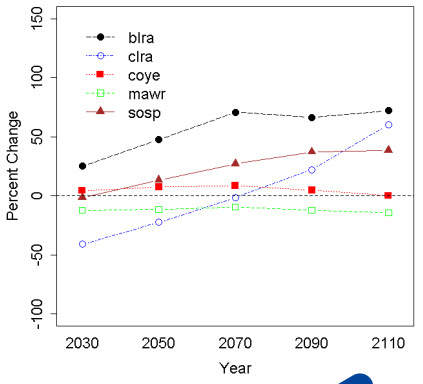


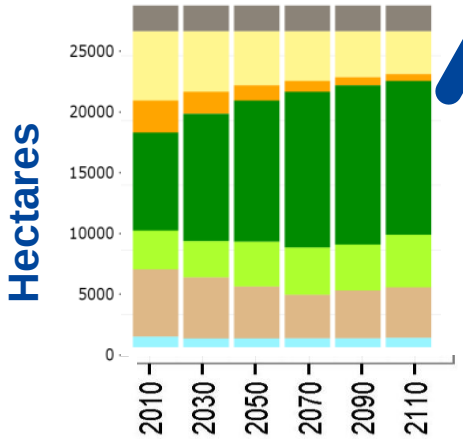




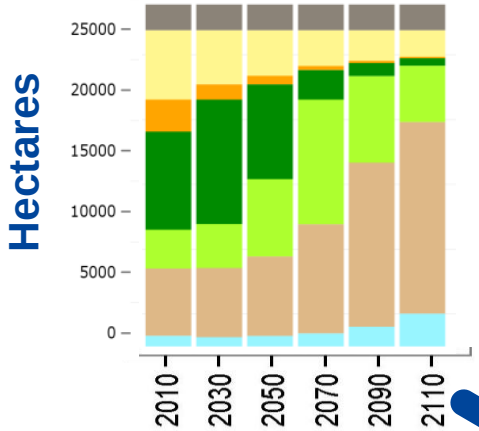
Future SF Bay Tidal Marsh Scenarios

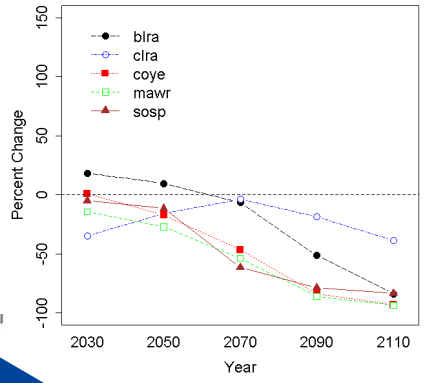
Low SLR/ Low Sediment



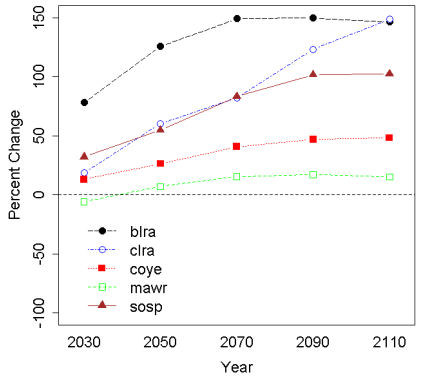


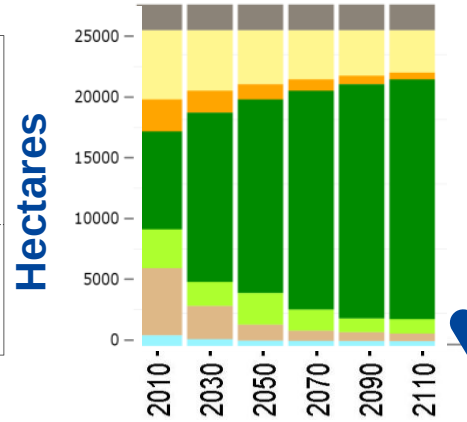
High SLR/ Low Sediment



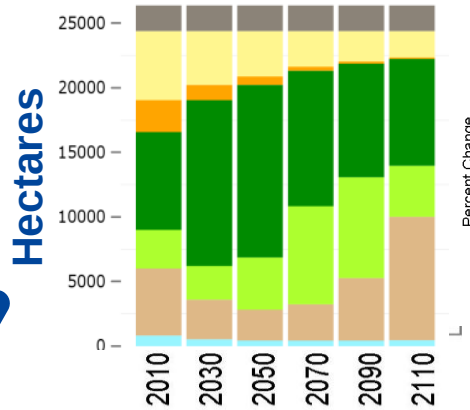


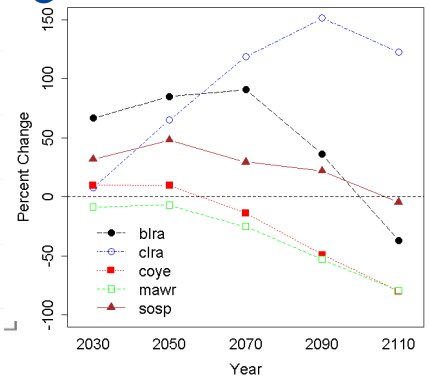
Low SLR/ High Sediment





High SLR/ High Sediment



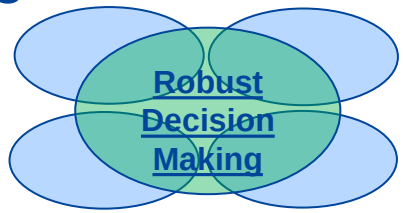


Different ways to select scenarios and prioritize

- “Head in the Sand”
  - Uncertainty is too high just use current conditions to prioritize.

- “I feel lucky”
  - Choose a single future scenario and use those models to prioritize.

- “Combined”
  - Use current and all future scenarios together



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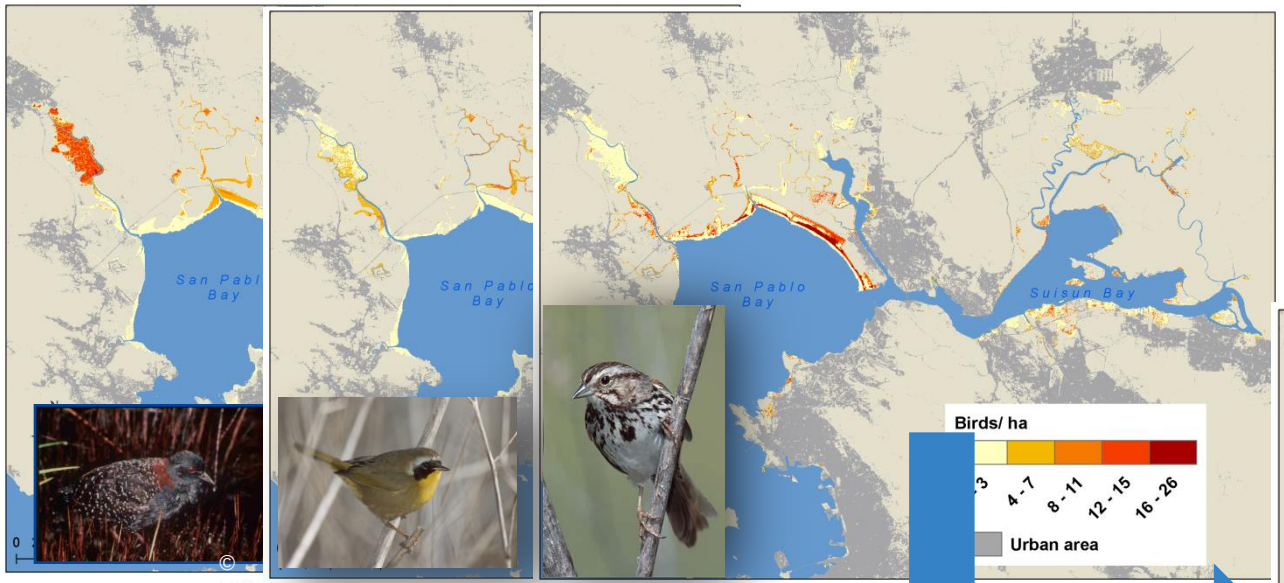
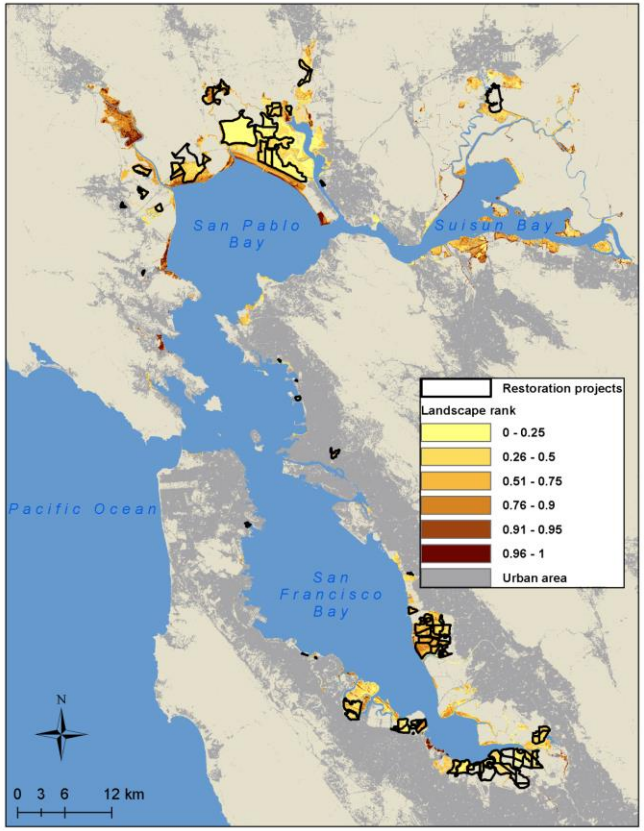
Which restoration projects will be successful under which scenario?



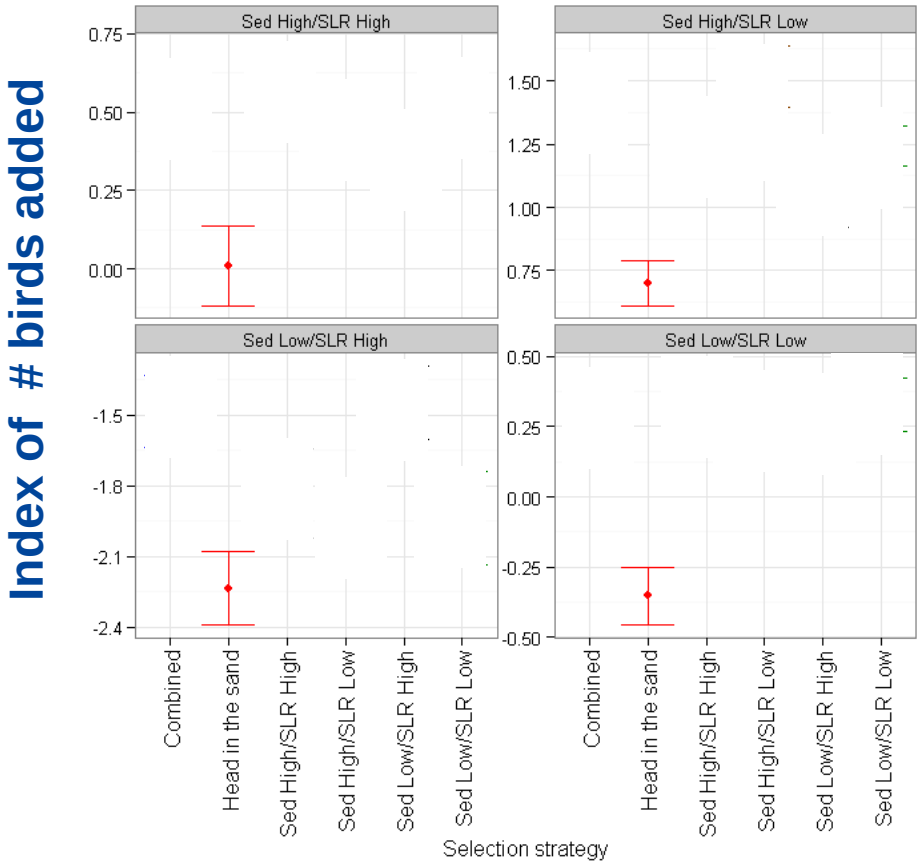
1. Select top 25% of restoration projects
2. Evaluate performance using all future scenarios



Scenario planning results

The most robust strategy is the combined approach

None of the scenarios are right but together they can frame robust decisions.



Veloz et al. Ecosphere, 2013

Some lessons learned: Planning with deep uncertainty

- All restoration projects provide additional bird habitat today but…
- Many projects are not resilient to some future scenarios
- A plausible range of future scenarios can help prioritize projects that consistently perform well

Point Blue

Acknowledgments

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Collaborators: John Callaway (SFU); Lisa Schile & Maggi Kelly (UC Berkeley); Tom Parker & Ellen Herbert (SFSU); Lynne Stenzel, Gary Page (Point Blue)

Technical Assistance: Doug Moody, Sherie Michaile (Point Blue) Conservation Science); Justin Vandever (PWA)

Conservation Input: Coastal Conservancy, SF Bay Joint Venture, BCDC, USFWS, Sonoma Land Trust, Sonoma Open Space District

Scientific Input: Dave Schoellhamer (USGS), Neil Ganju (USGS), Stuart Siegel (WWR), Bruce Jaffe (USGS)

Elevation Data: Noah Knowles (USGS), FEMA, Joel Dudas (DWR), Stuart Siegel (WWR), Sonoma County

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scrap

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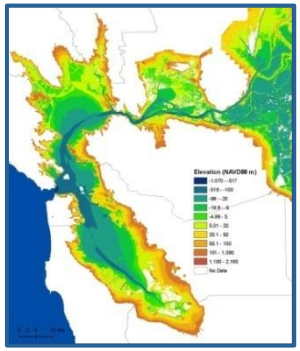
Modeling marsh accretion

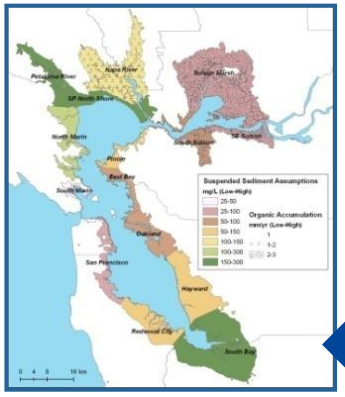
Bed model (Marsh98)

Spatial variation

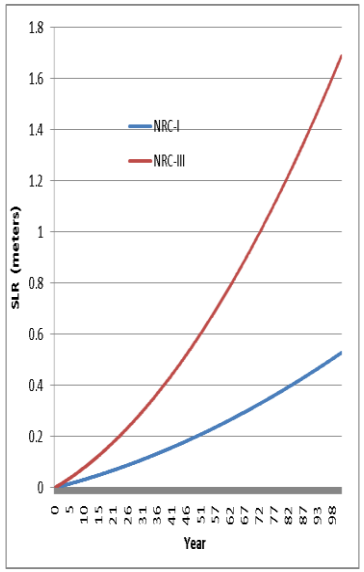
Base elevation



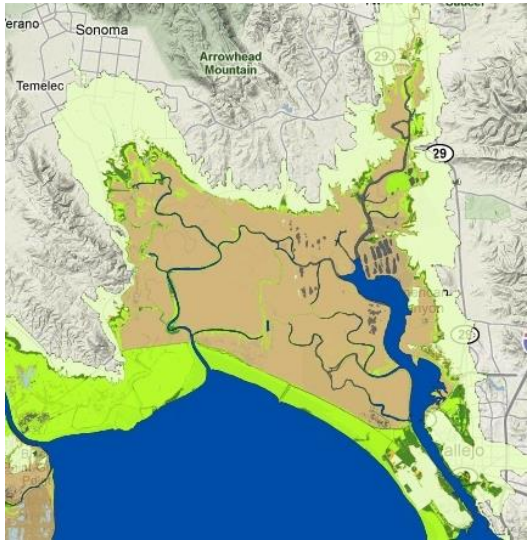
Sediment/ OM



Non-linear sea level rise



Habitat prediction maps



Define Scenarios

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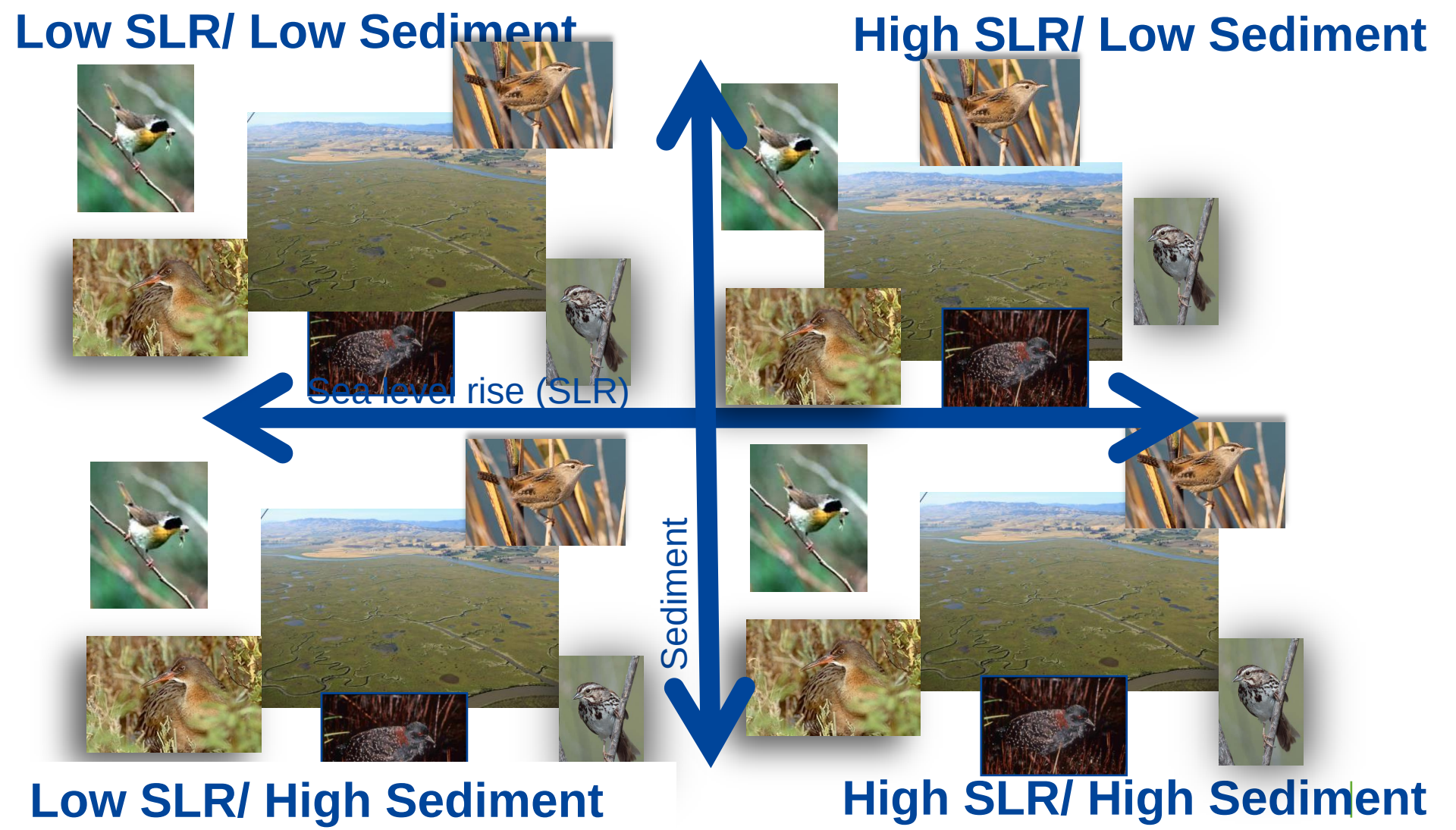
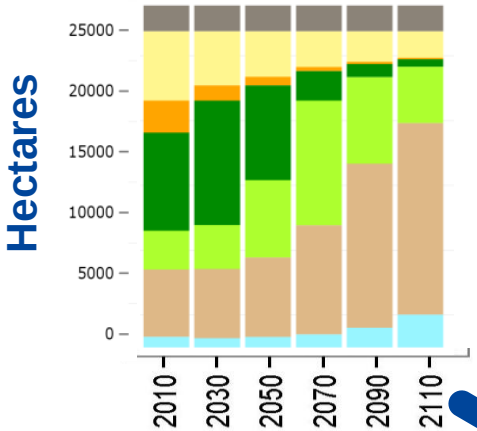
Future SF Bay Tidal Marsh Scenarios

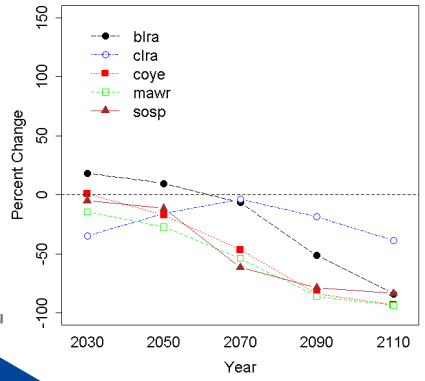


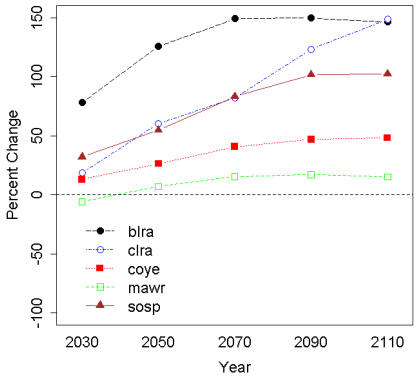
Deep uncertainty

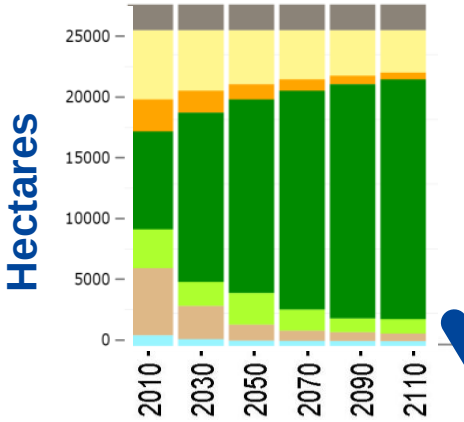
Are you an optimist or a pessimist?

High SLR/ Low Sediment









Low SLR/ High Sediment

Color Palette Reference Guide

Please use this page as a visual reference only for choosing colors from your custom color palette. This page is not editable.

Primary Palette

Bright Blue | Green | Dark Blue

Bright Blue, Green, and Dark Blue are
the primary colors and take priority over the secondary palette.

Secondary Palette

Lichen | Poppy | Light Grey | Dark Grey

Lichen, Poppy, Light Grey, and Dark Grey are used minimally and when you need more colors than the Blues and Green.

Point Blue