



Climate-Smart Adaptation for North-central California Coast and Ocean Habitats, Species, and Ecosystem Services

Gulf of the Farallones National Marine
Sanctuary
Ocean Climate Initiative

Sanctuary Advisory Council Meeting
August 20, 2014

Sara Hutto, Ocean Climate Initiative
Specialist



GFNMS Ocean Climate Initiative

Founded in 2008

Organizes Biennial Ocean Climate Summits (3 held)

Climate-Smart Conservation Program

Multiple partnerships formed

- Our Coast, Our Future sea level rise tool
- California King Tides Initiative
- SF Bay and Outer Coast Sentinel Site
- Bay Area Ecosystems Climate Change Consortium



GFNMS Climate Smart Conservation

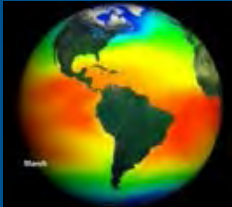
Integrating climate change....



mitigation



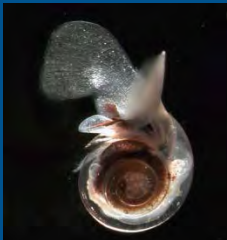
adaptation



science



communication



monitoring

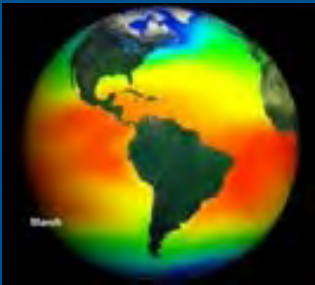
....into sanctuary management

GFNMS Climate Smart Conservation



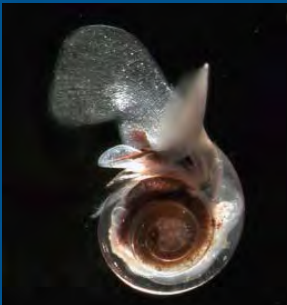
✓ **Green Operations: Reducing Our Carbon Footprint**

Working group developed over 130 strategies and annual emissions audits are conducted



✓ **Climate Change Impacts Report**

Joint CB/GF working group determined observed and predicted climate change impacts, foundation to guide future monitoring and inform outreach and management actions



✓ **Ocean Climate Indicators Monitoring Plan**

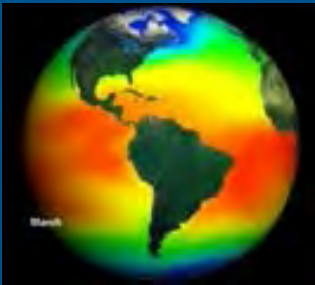
Regional scientific consensus on physical and biological indicators, working group developed comprehensive monitoring inventory and plan

GFNMS Climate Smart Conservation



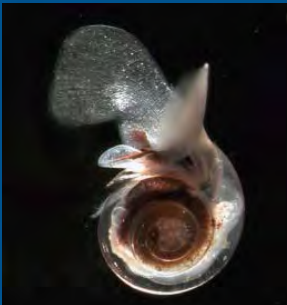
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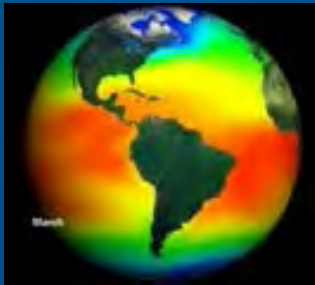
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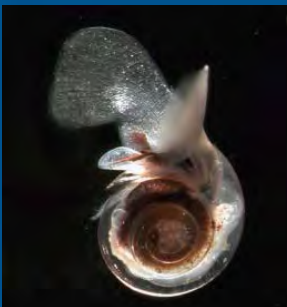
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GFNMS Climate Smart Conservation



Climate-Smart Adaptation

Assess resource vulnerability and develop adaptive management actions to address climate change impacts



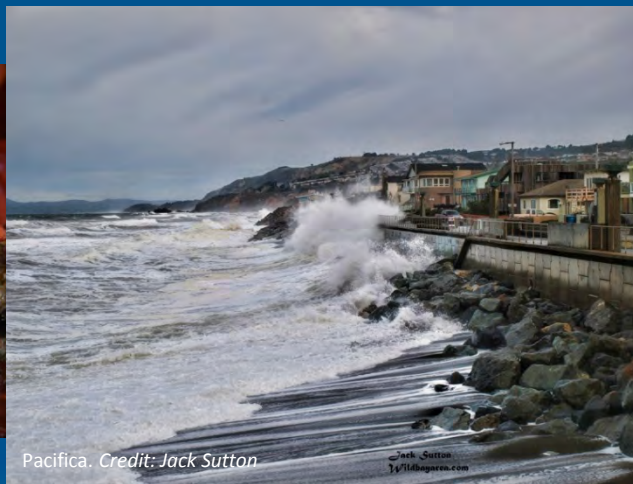
Communication (not yet initiated)

Develop project-specific communication strategies and education programs

Climate-Smart Adaptation



Hydrocoral. Credit: Steve Lonhart, MBNMS



Pacifica. Credit: Jack Sutton

Jack Sutton
Wildapex.com



Taylor's Sea Hare. Credit: Jennifer Stock, CBNMS

Climate-Smart Adaptation

promotes nature-based solutions to:

- Reduce greenhouse gas emissions and enhance carbon sinks
- Reduce climate change impacts on wildlife and people and enhance resilience
- Sustain vibrant, diverse ecosystems



Hydrocoral. Credit: Steve Lonhart, MBNMS



Pacifica. Credit: Jack Sutton



Taylor's Sea Hare. Credit: Jennifer Stock, CBNMS

Climate-Smart Adaptation Benefits Communities and Ecosystems

Future-focused
Ecosystem context
Adaptive and Flexible



Point Blue



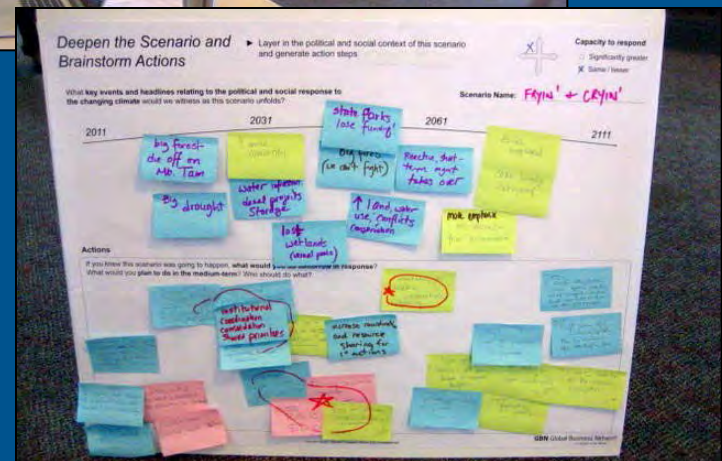
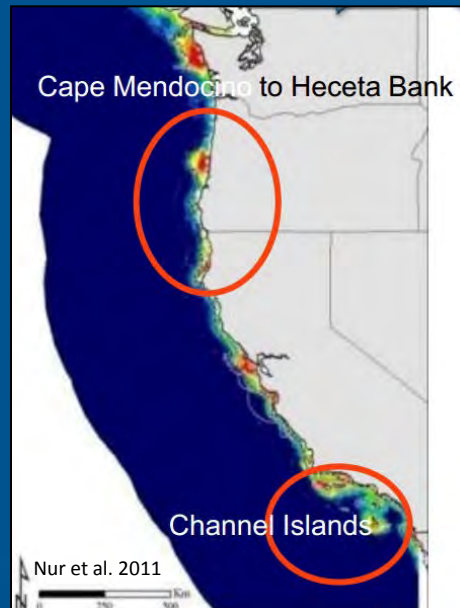
Ron LeValley



STRAW Climate-Smart Stream Restoration, Point Blue

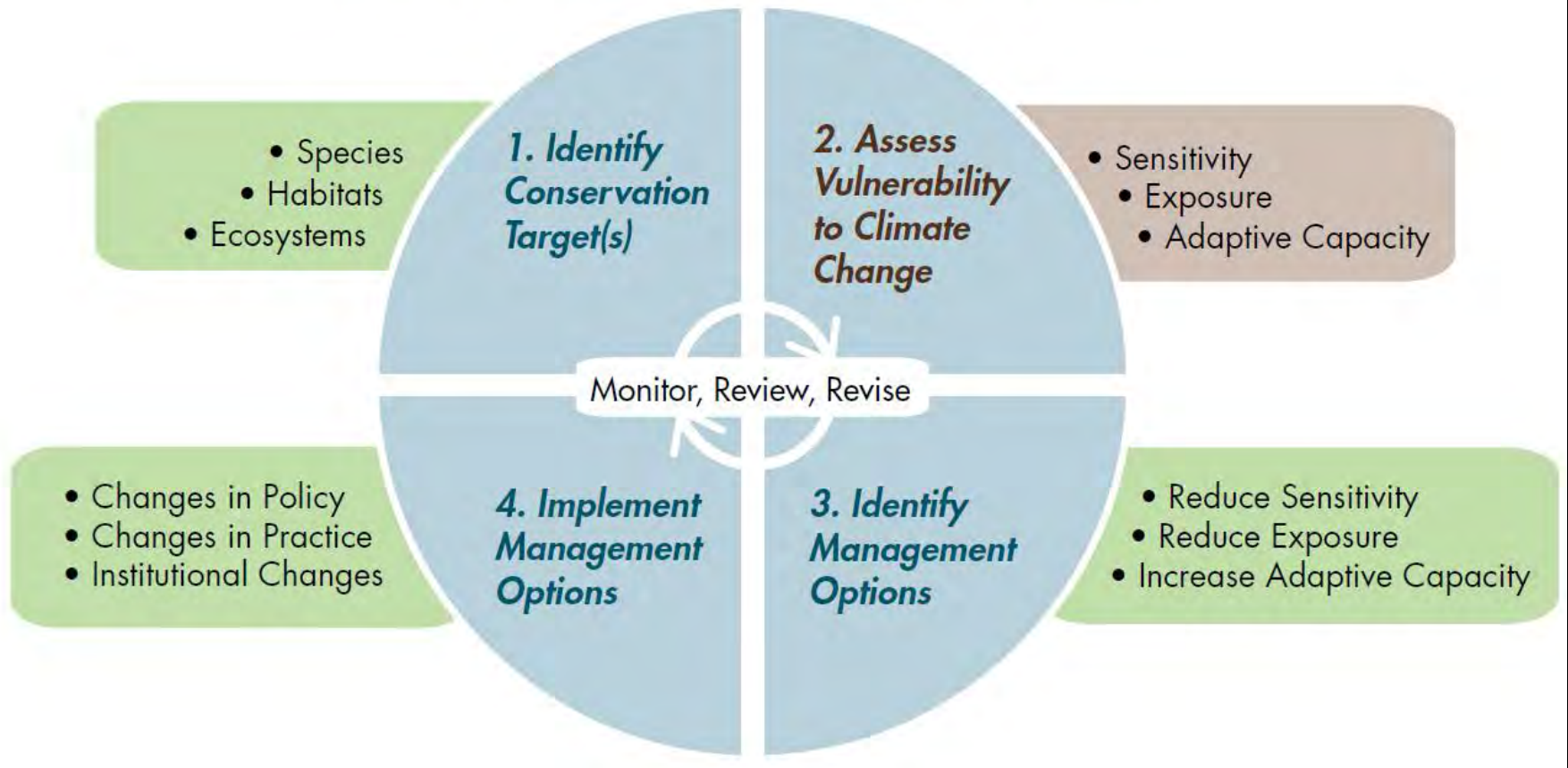
Climate-Smart Adaptation Benefits Communities and Ecosystems

Prioritized actions
Collaborative
Stakeholder-led



Futures of Wild Marin

Climate-Smart Adaptation is an Iterative Process



Glick et al. 2011 Scanning the Conservation Horizon

Climate-Smart Adaptation for the North-central California Coast and Ocean

Goal

Protect and maintain healthy ecosystems by enhancing the resilience of species, habitats and ecosystem services to the impacts of climate change through collaboratively developed adaptation actions that are feasible, effective, and nature-based.

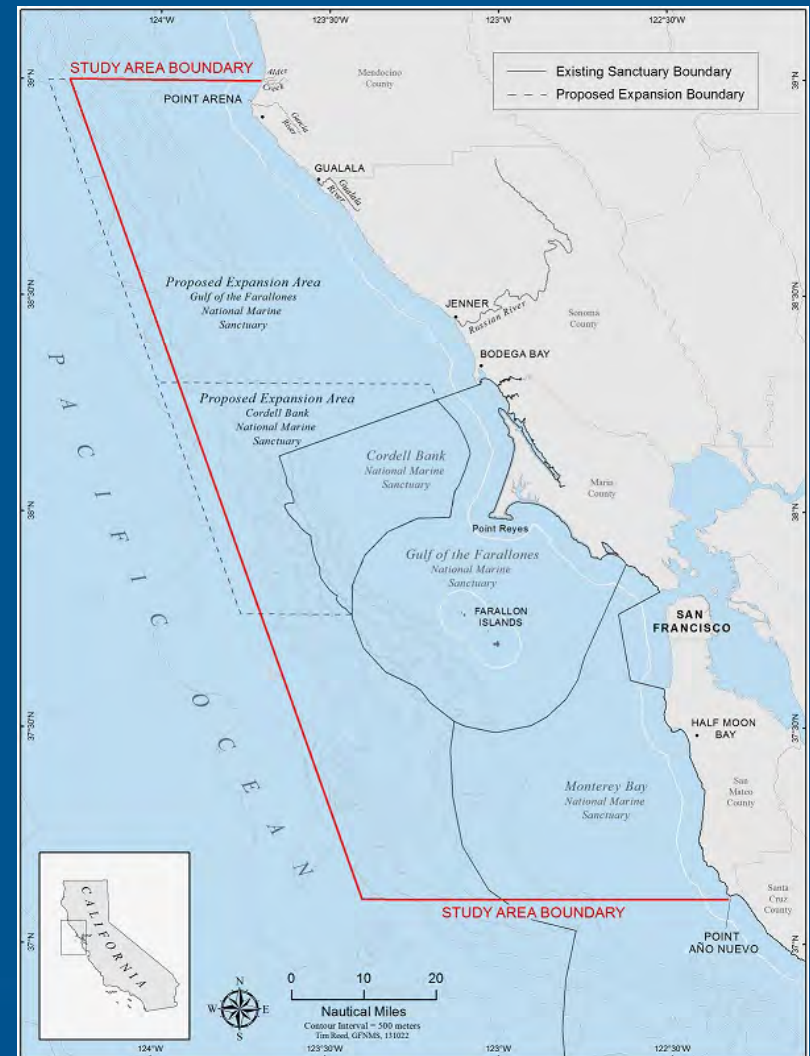
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Geographic Scope

Año Nuevo, San Mateo County to Alder Creek, Mendocino County



Two Big Questions:

1. How vulnerable to climate change are the species, habitats, and ecosystem services that we manage? [Vulnerability Assessment]
2. What can we do to limit or reduce vulnerability? [Adaptation Planning]

Project Partners



CALIFORNIA
ACADEMY OF
SCIENCES

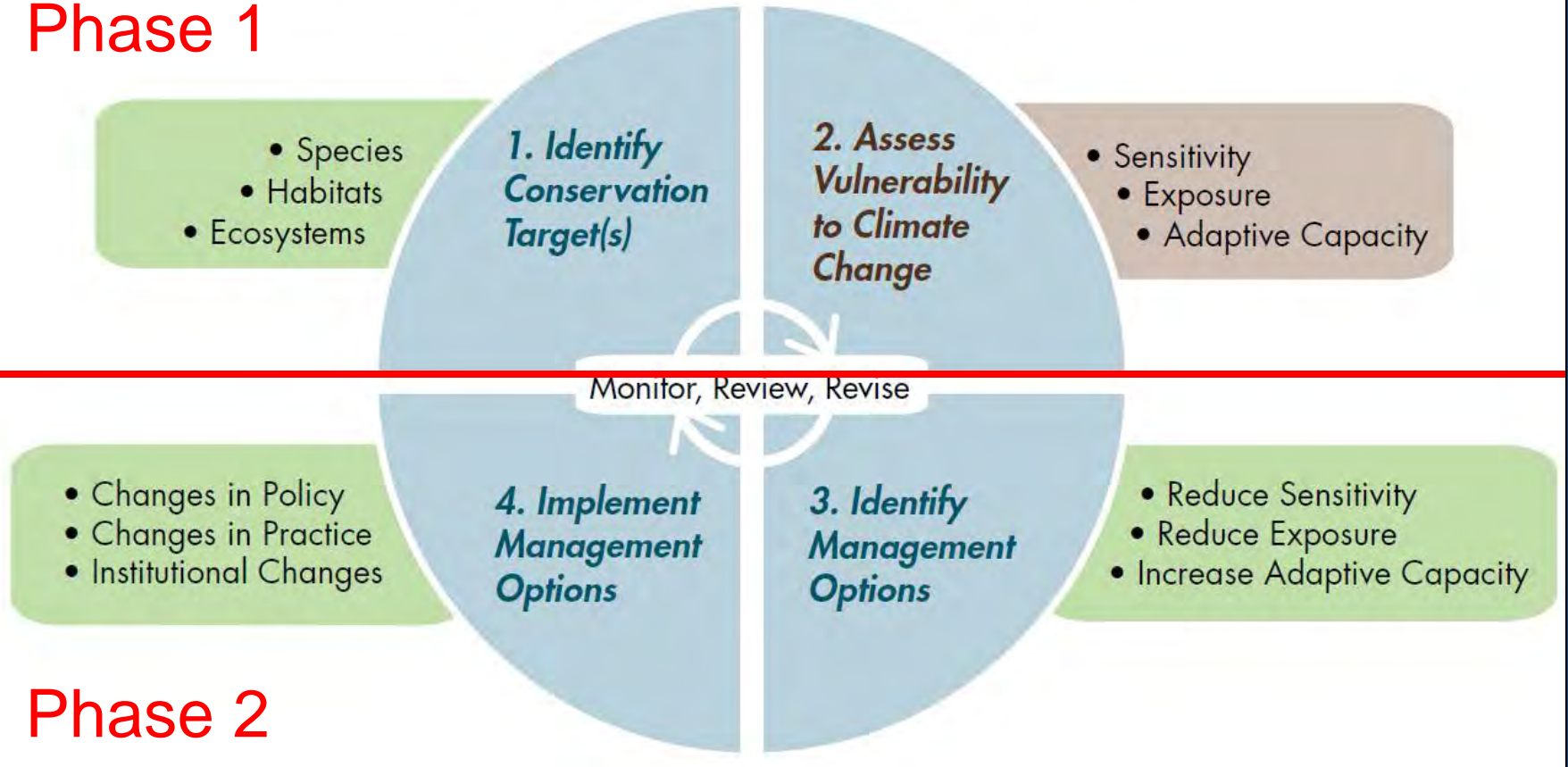


Point Blue
Conservation
Science



Climate-Smart Adaptation Process

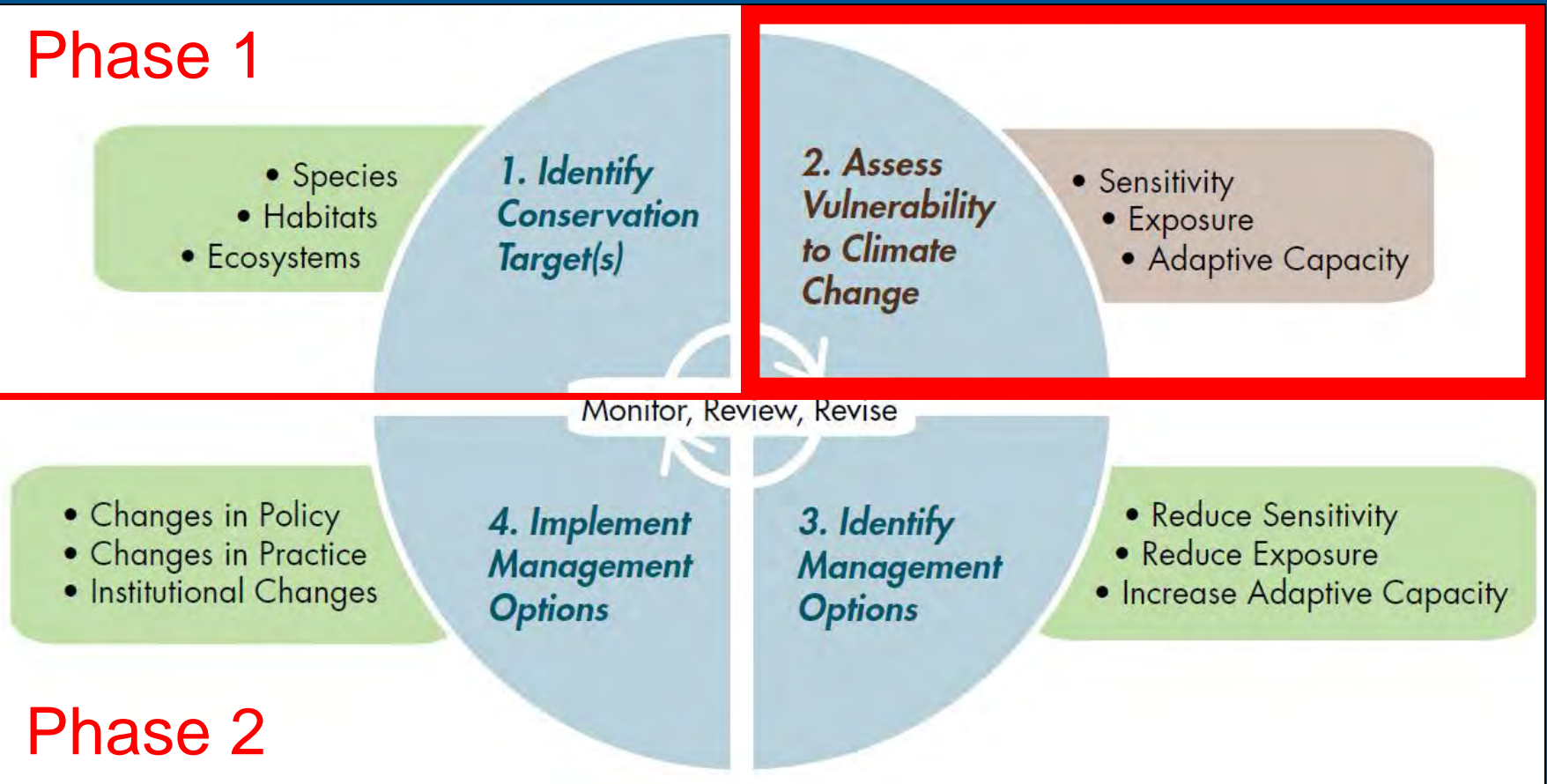
Phase 1



Glick et al. 2011 Scanning the Conservation Horizon

Climate-Smart Adaptation Process

Phase 1

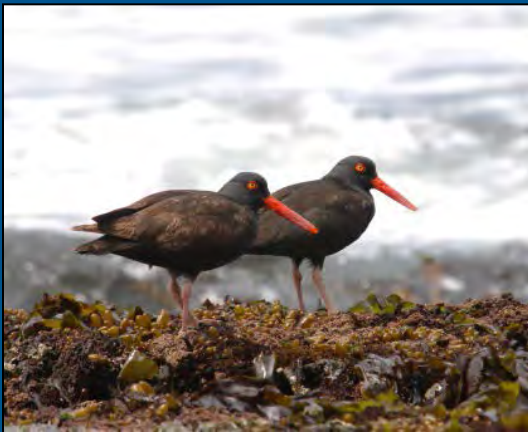


Phase 2

Phase 1: Vulnerability Assessment

Two Decision-Support Workshops:

1. Define focal resources (11 Feb 2014)
2. Assess resource vulnerability (10-11 June 2014)



Focal Resources Workshop

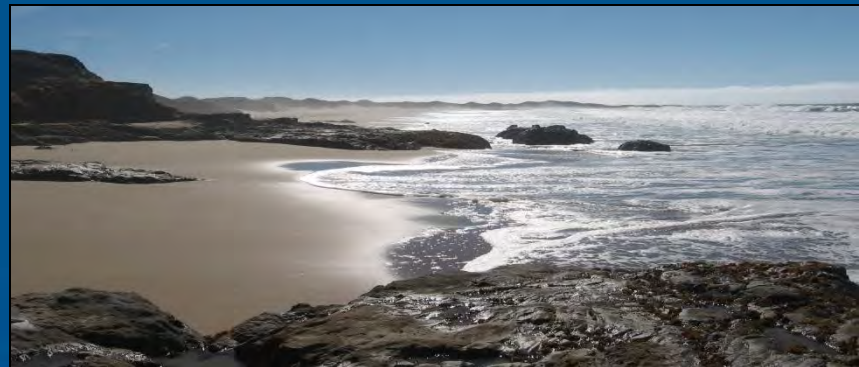
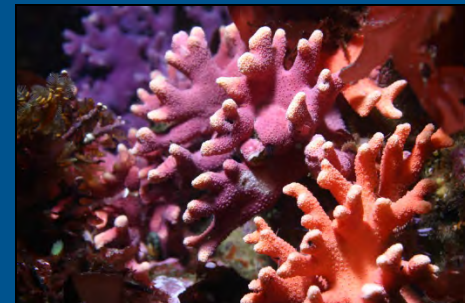
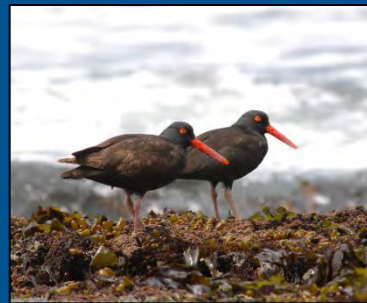
11 February 2014

Workshop Goal:

Recommend North-central California coast and ocean focal resources (species, habitats and ecosystem services) for use in vulnerability assessments.

Recommendations produced in habitat break-out groups

- 53 species
- 9 services
- 10 habitats



Focal Resources Workshop

11 February 2014

Workshop Goal:

Recommend North-central California coast and ocean focal resources (species, habitats and ecosystem services) for use in vulnerability assessments.

Recommendations produced in habitat break-out groups

- 53 species
- 9 services
- 10 habitats

Finalized by staff and planning committee

- 42 species
- 8 services
- 8 habitats

Vulnerability Assessment Workshop

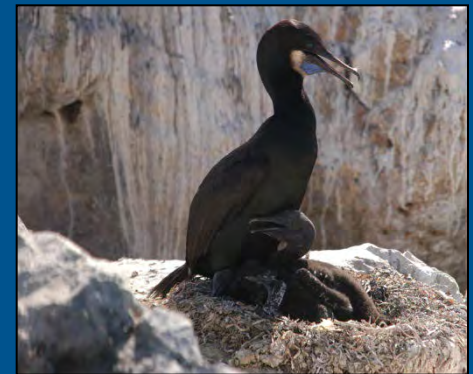
10-11 June 2014

Workshop Goal:

Assess the vulnerability of selected focal resources to climate change impacts

Habitat break-out groups assessed resource

- Sensitivity
- Exposure
- Adaptive capacity



Vulnerability Assessment Workshop

10-11 June 2014

Workshop Goal:

Assess the vulnerability of selected focal resources to climate change impacts

Habitat break-out groups assessed resource

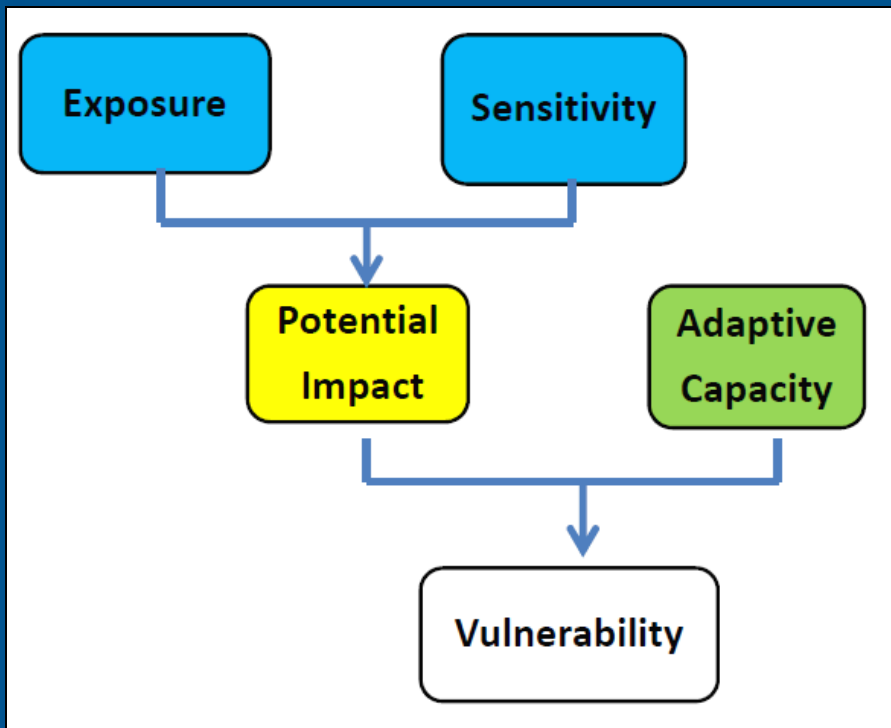
- Sensitivity
- Exposure
- Adaptive capacity

Resources assessed:

- 8 habitats
- 18 species, 11 post-workshop
- 6 ecosystem services

Defining Vulnerability

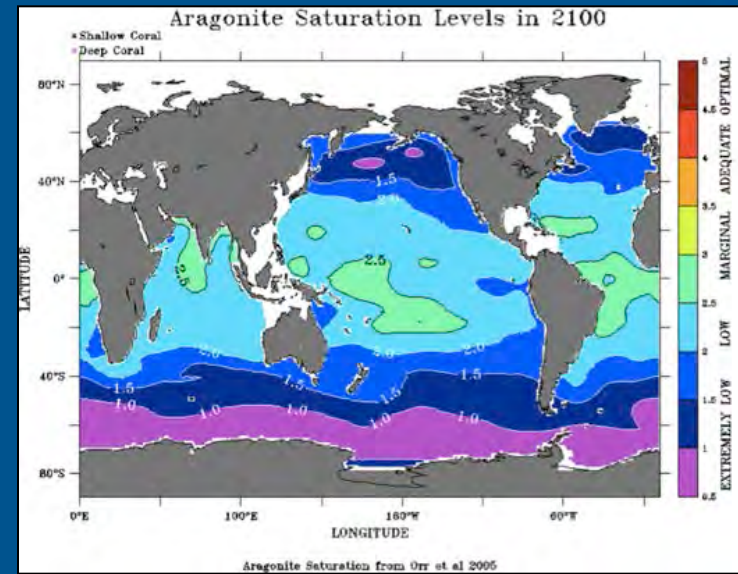
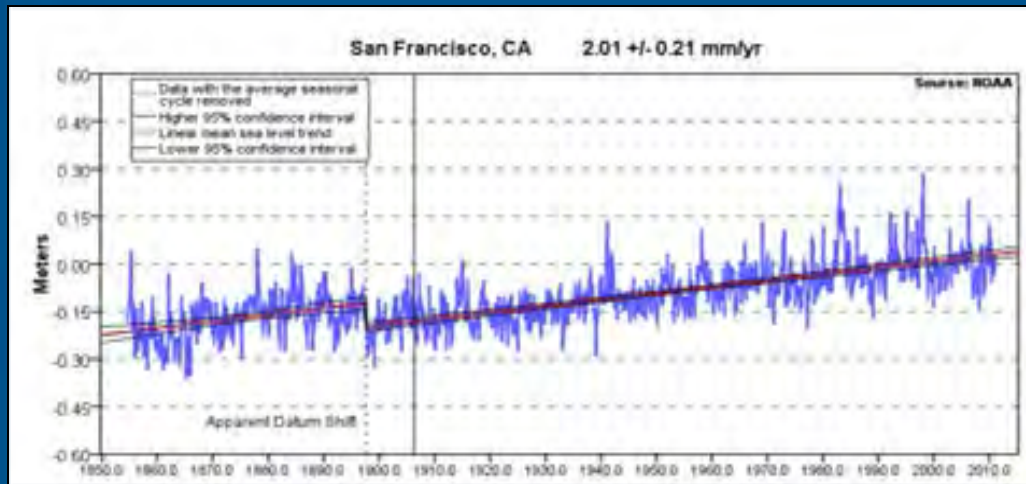
The extent to which a species, habitat or ecosystem service is susceptible to harm from climate change impacts



$$V = \frac{E * S}{AC}$$

Defining Vulnerability

Exposure: Measure of how much of a change in climate or other environmental factor a resource is likely to experience.



Defining Vulnerability

Sensitivity: Measure of whether and how a resource is likely to be affected by a given change in climate.



Factors to consider:

- ALL climate-related stressors
- Non-climate stressors
- Dependencies
- Life history

Defining Vulnerability

Adaptive Capacity: Ability to accommodate or cope with climate change impacts with minimal disruption.

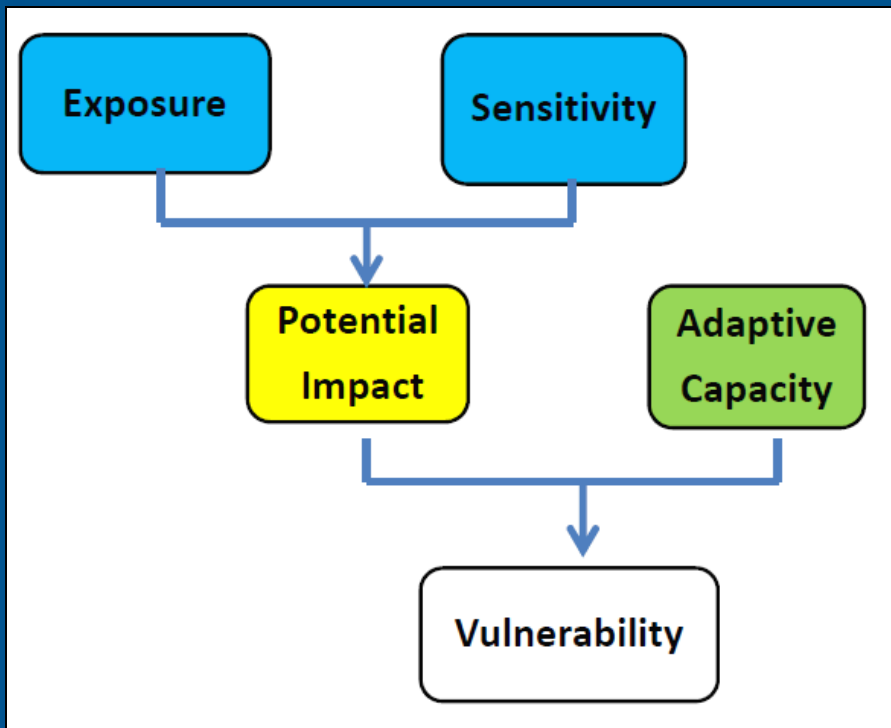


Factors to consider:

- Extent, status, dispersal ability
- Population connectivity
- Diversity
- Value of resource
- Management potential

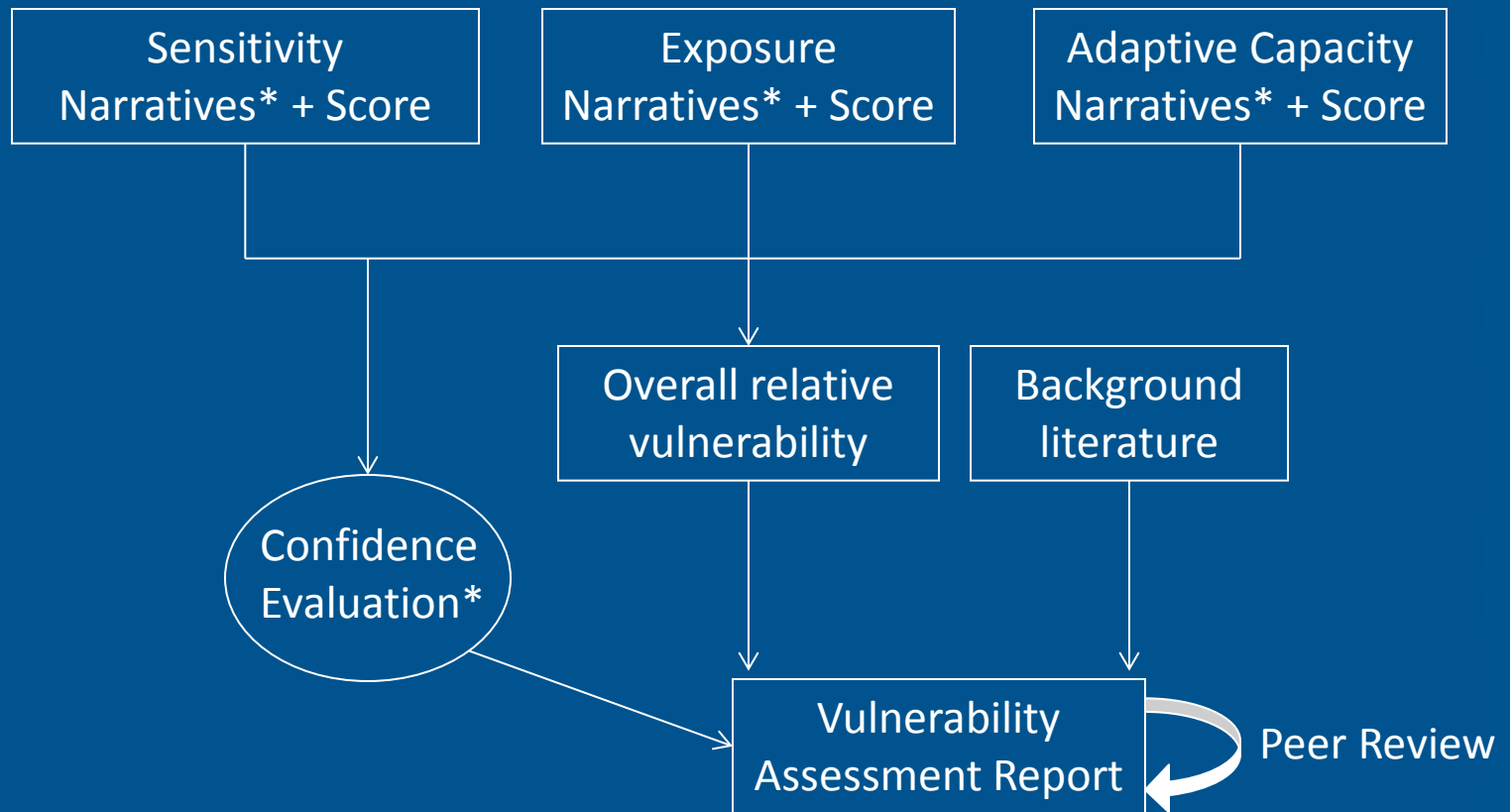
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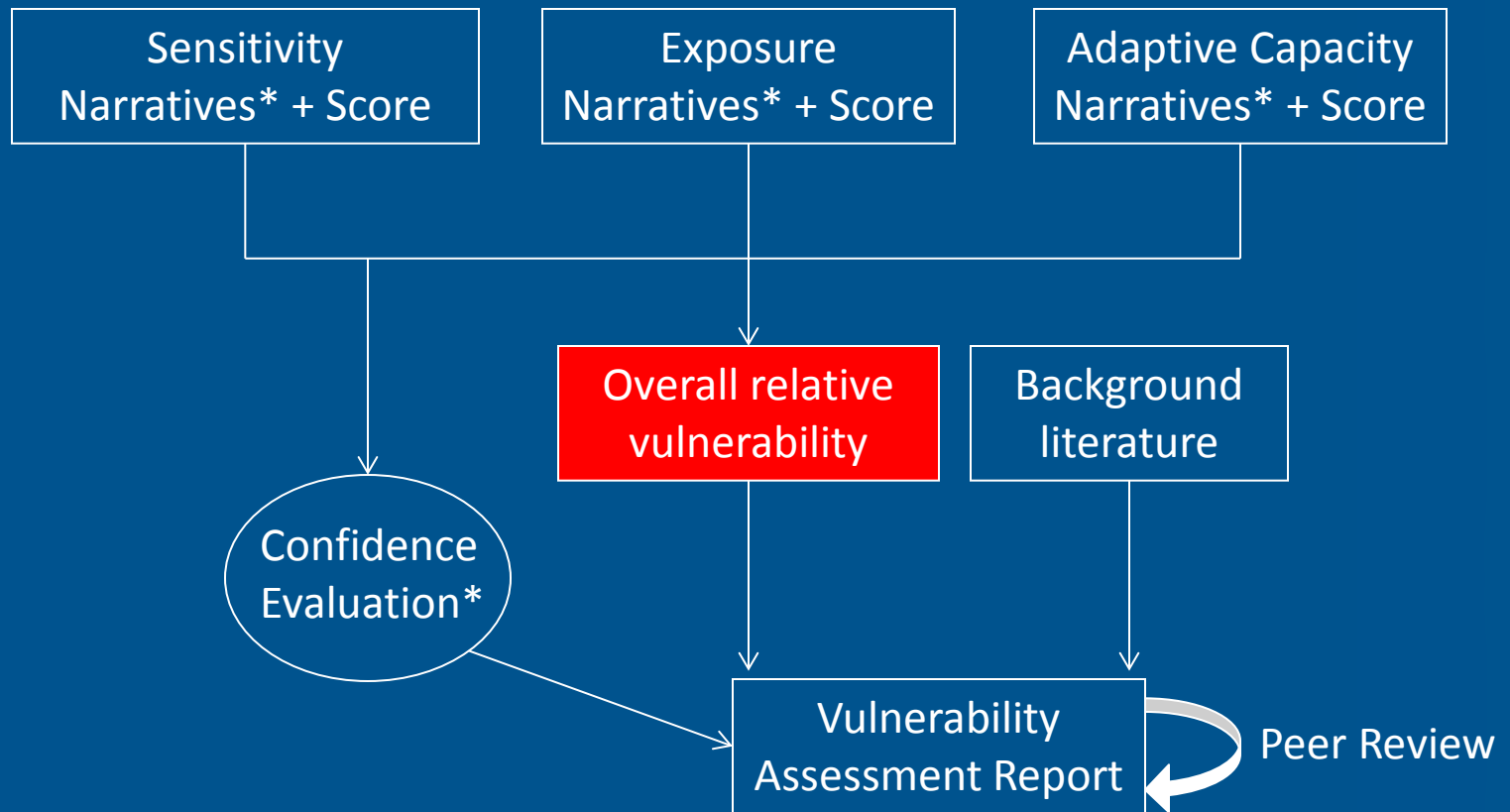
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Vulnerability Assessment Methods



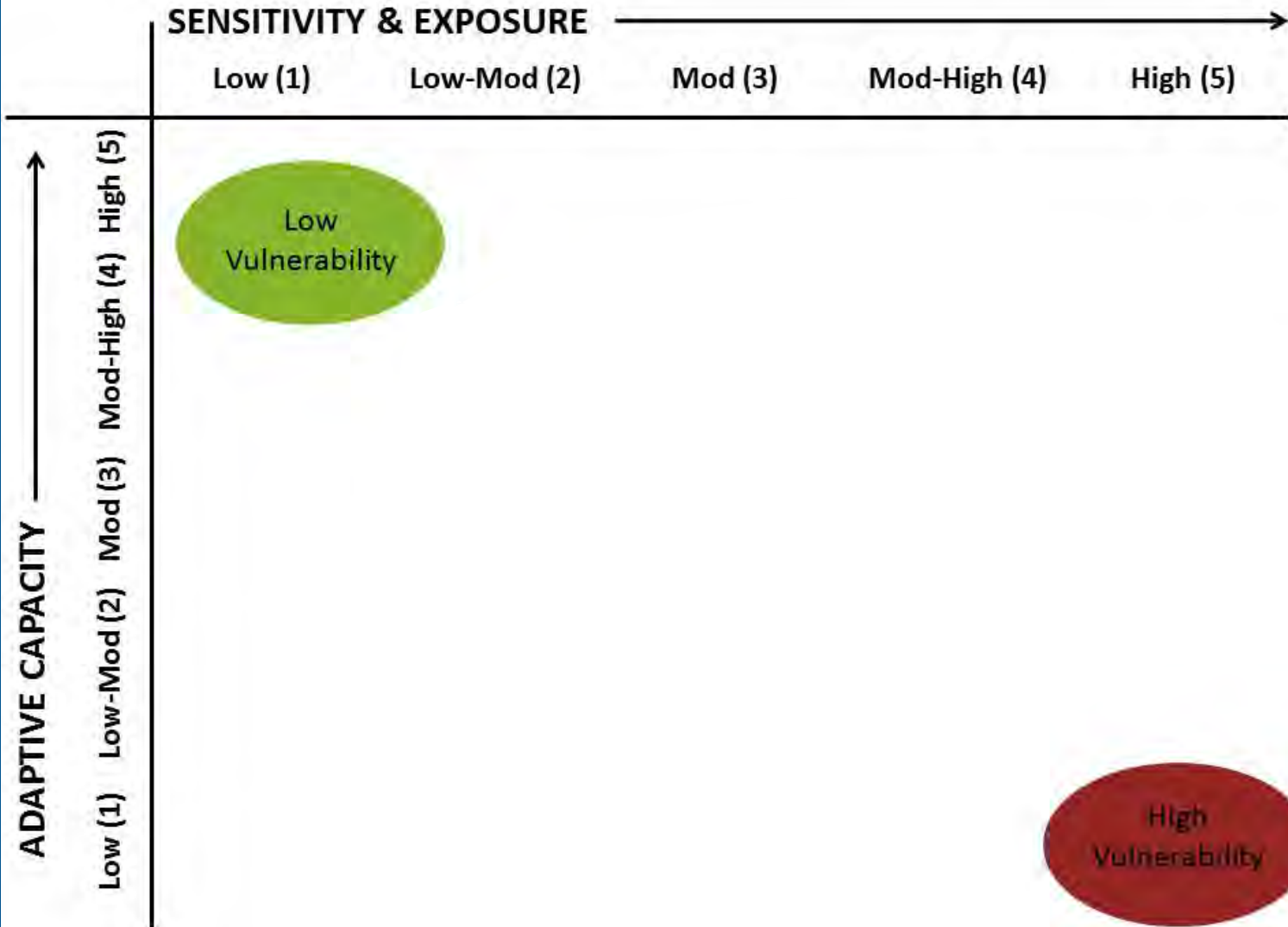
*documenting uncertainty

Vulnerability Assessment Methods

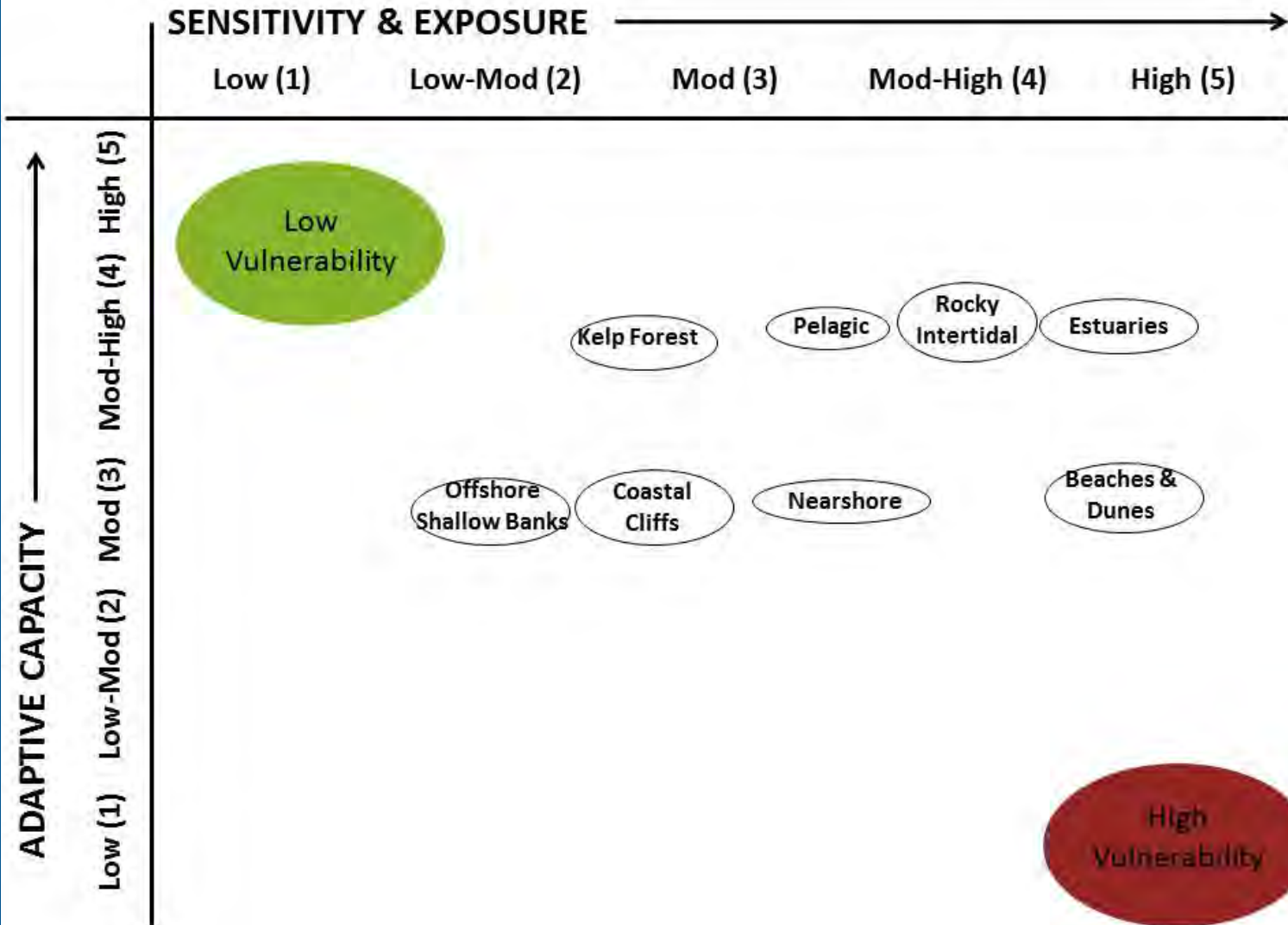


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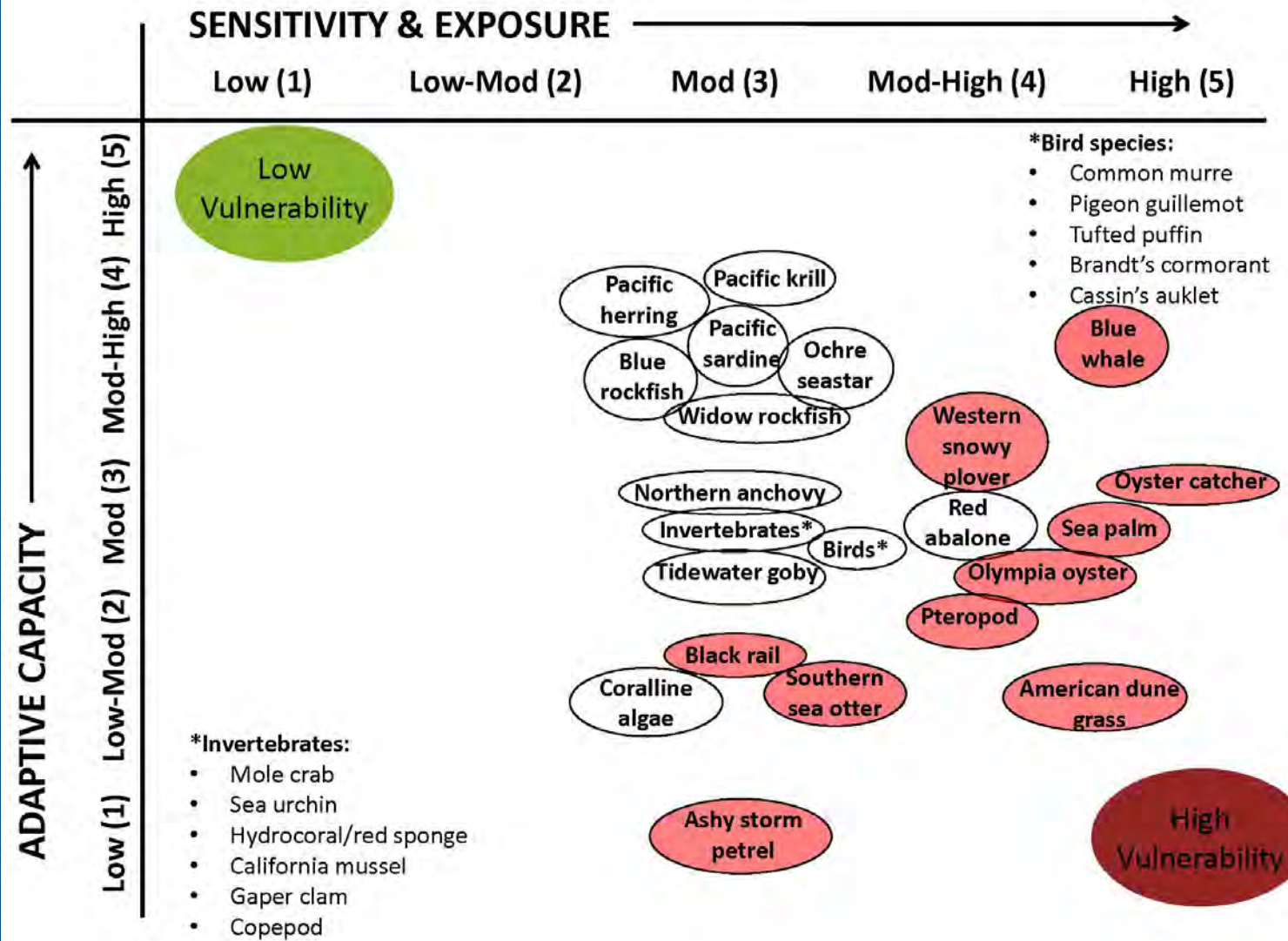
Relative Vulnerability



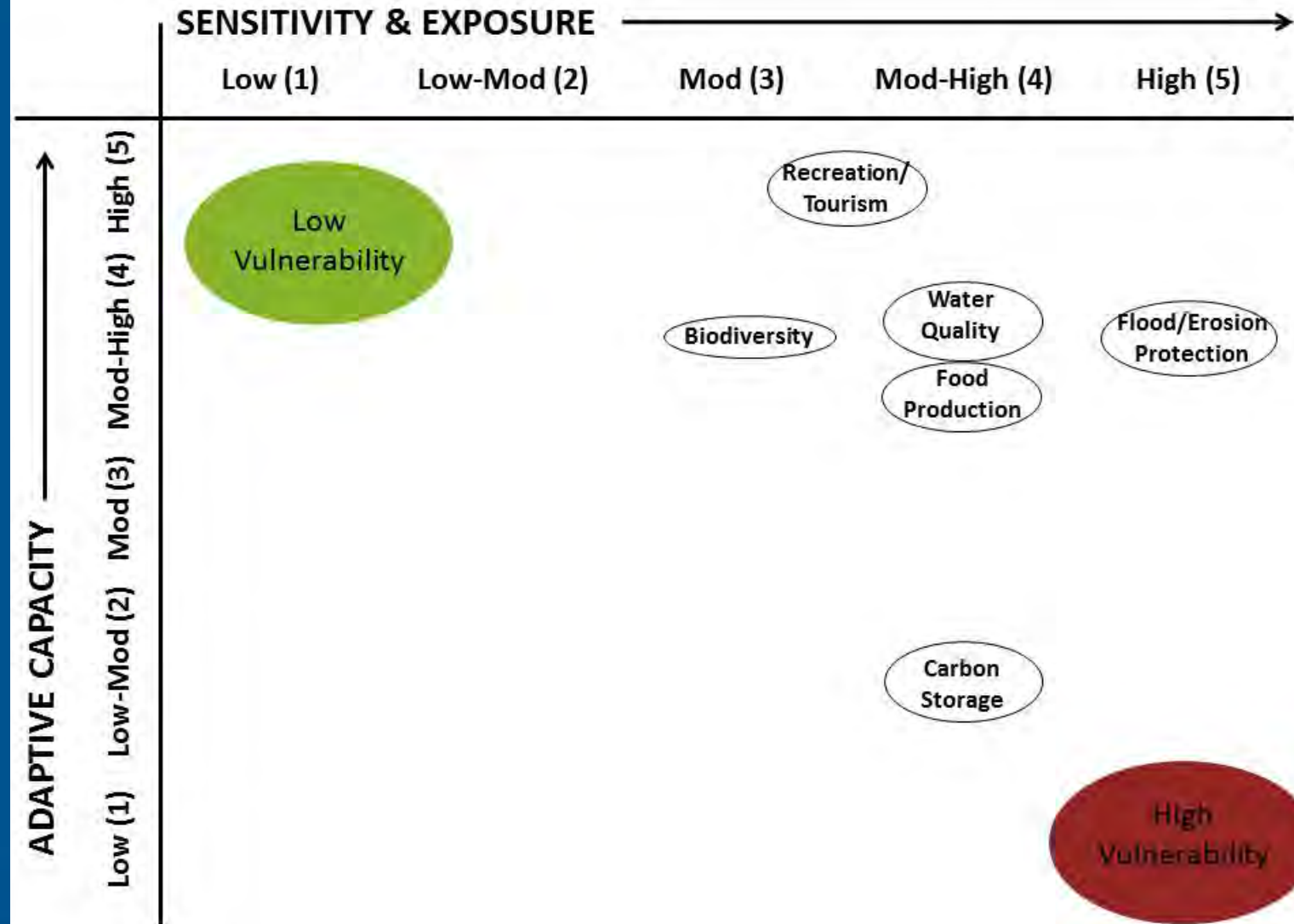
Relative Vulnerability: Habitats



Relative Vulnerability: Species

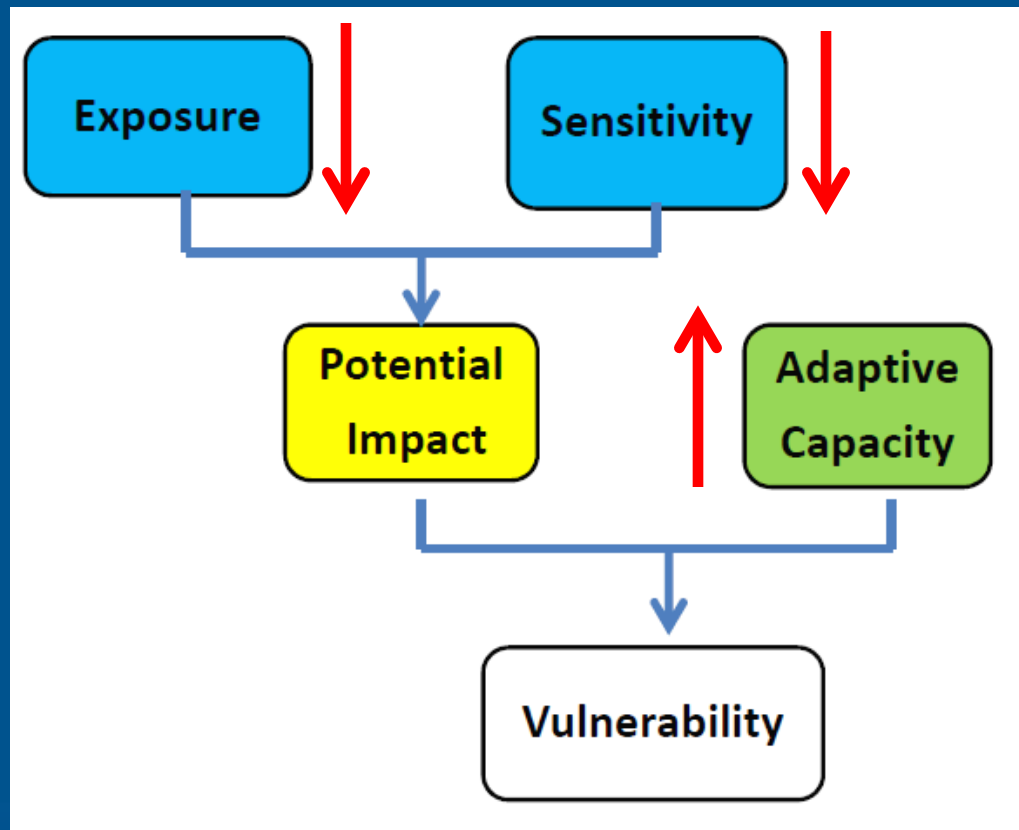


Relative Vulnerability: Ecosystem Services



Phase 2: Adaptation Planning

Use assessment results to develop management strategies that will:



Phase 2: Adaptation Planning

How to accomplish phase 2?

- Preferably through a working group of the advisory council

What would this entail?

- ~4 meetings over 8 months
- First meeting in January 2015

Who should be involved?

- Managers/scientists with knowledge of climate impacts/adaptation within the study region

Phase 2: Adaptation Planning

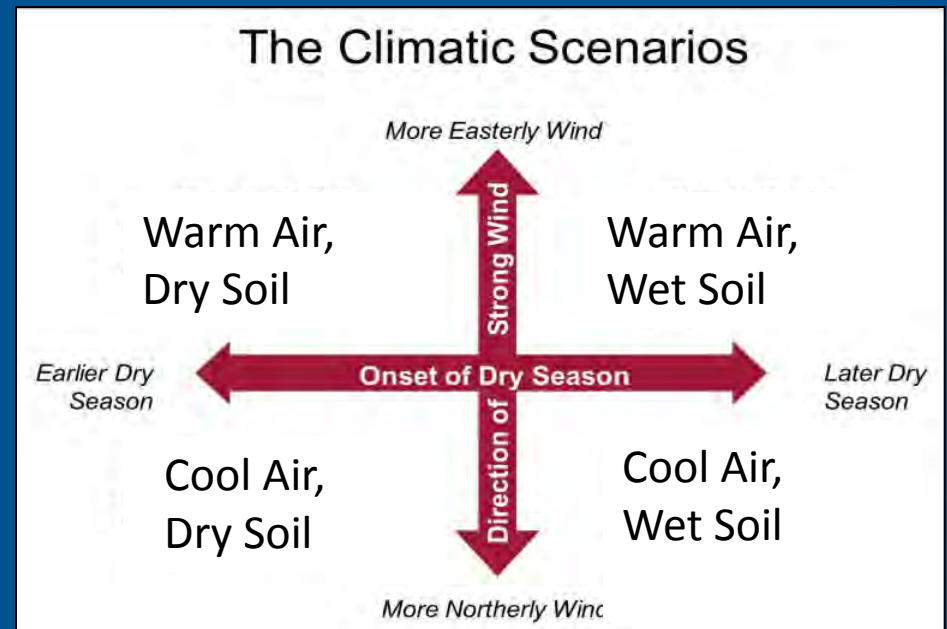
Two priority actions:

- 1) Define distinct climate scenarios**
- 2) Provide Adaptation Recommendations**

Phase 2: Adaptation Planning

1) Define distinct climate scenarios:

Multiple plausible futures based on most uncertain and impactful drivers of change



Futures of Wild Marin, Scenario Planning for Climate Change Adaptation

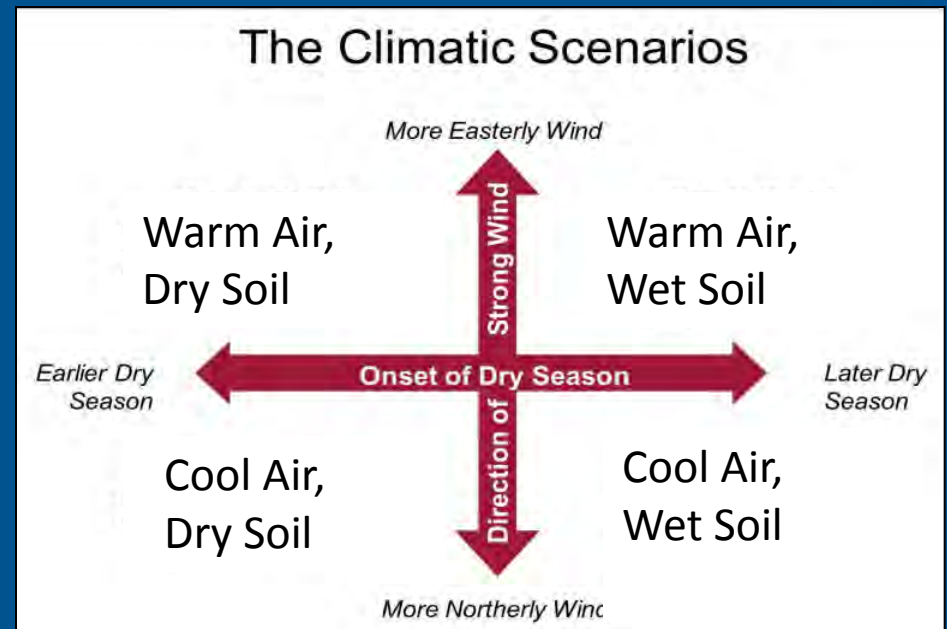
Phase 2: Adaptation Planning

1) Define distinct climate scenarios:

Multiple plausible futures based on most uncertain and impactful drivers of change

2) Provide Adaptation Recommendations:

Develop, evaluate and prioritize potential actions for each climate scenario based on vulnerability assessment results



Futures of Wild Marin, Scenario Planning for Climate Change Adaptation

Phase 2: Adaptation Planning

Approval of recommended actions

- Forwarded to Sanctuary Superintendent
- Made available to other management agencies

Sanctuary Implementation Plan

- Summary of approved and/or modified adaptation actions
- Implementation prioritization and schedule
- Estimated cost and potential funding sources
- Participating partners



Proposed Project Timeline

Decision
Support
Workshops

Phase 1
Summary
Report

Vulnerability
Assessment
Reports

Phase 1

2014

2015

2016

Phase 2

Scenario
Planning

Phase 2
Summary
Report

Convene Climate-
Smart Working
Group

Adaptation
Planning

Implementation
Plan

Thank you!

Contact:

Sara.Hutto@noaa.gov

415-970-5253

<http://farallones.noaa.gov/manage/climate/welcome.html>

