Management strategies for climate change adaptation

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Climate change and impacts

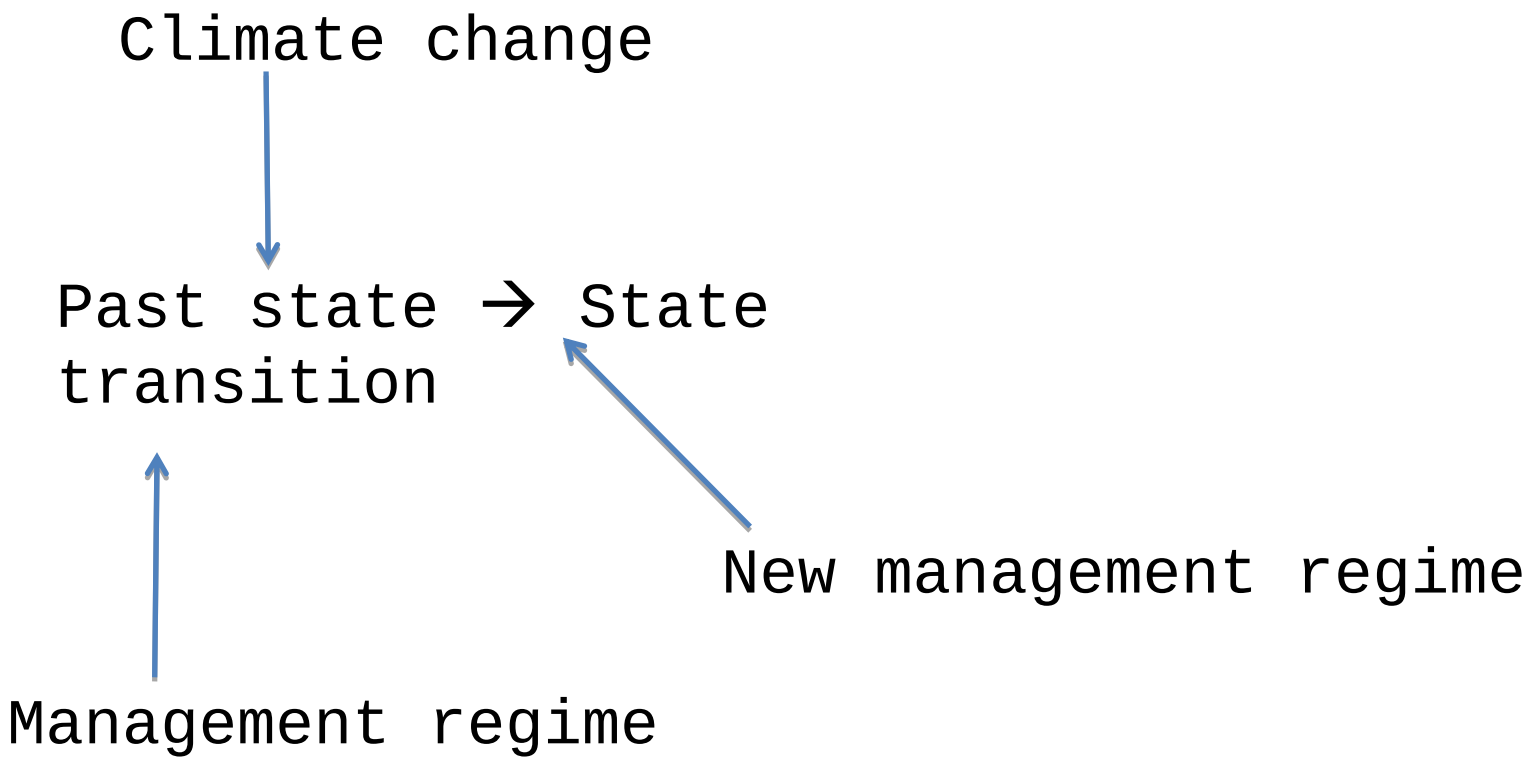
Climatic stimuli

- Warming temperatures, change in precipitation
- Increase extreme heat days, flooding events
- Increased climate variability

Impacts

- Changes in location of suitable habitat for species.
- Changes in phenology ~ de-coupling of key species interactions.
- Changes in stream flow rates and timing
- Changes in invasive species abundance, competitive

We cannot rely on management practices that worked in the past.




Big Meadow Fire, Yosemite National Park
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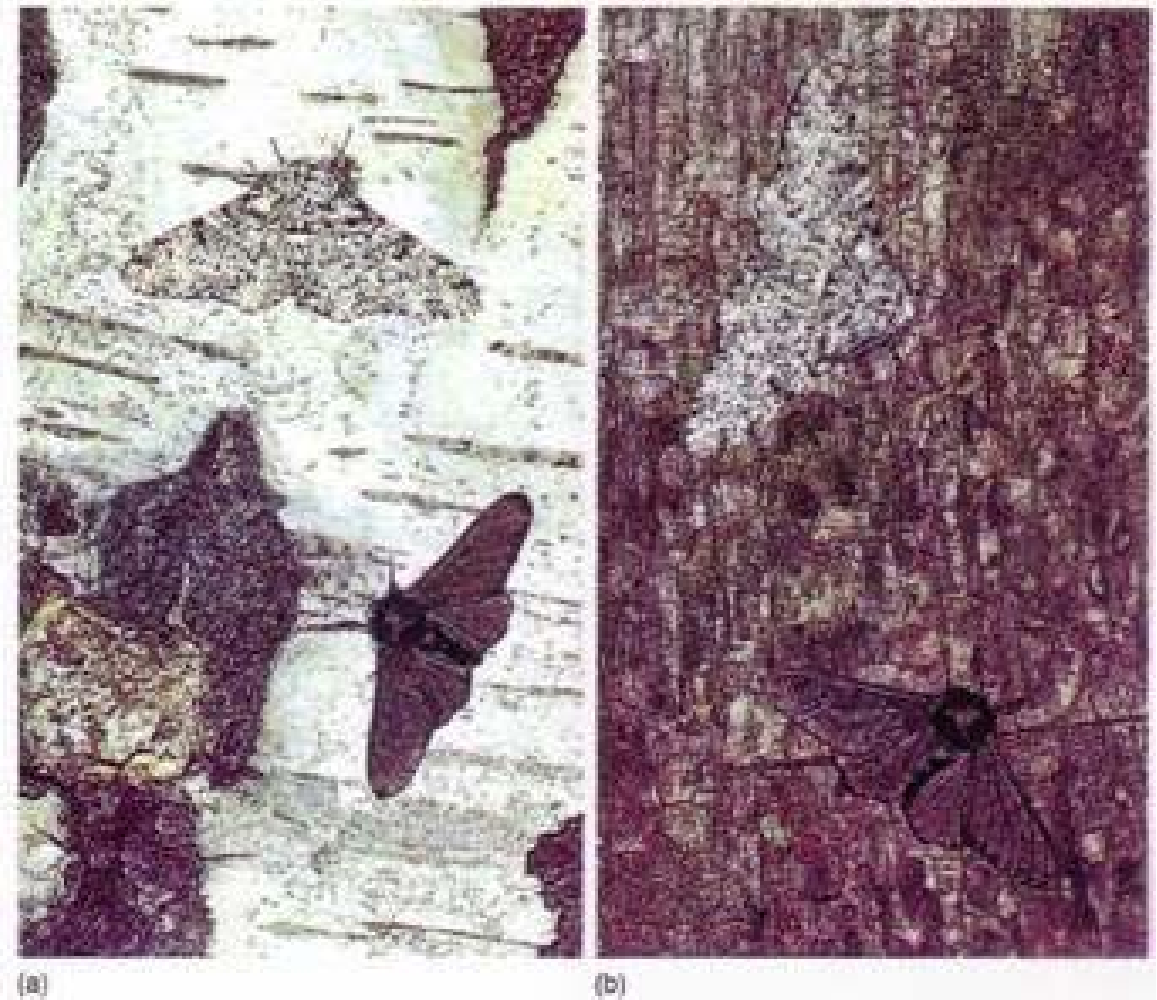
To adapt: become adjusted to new co



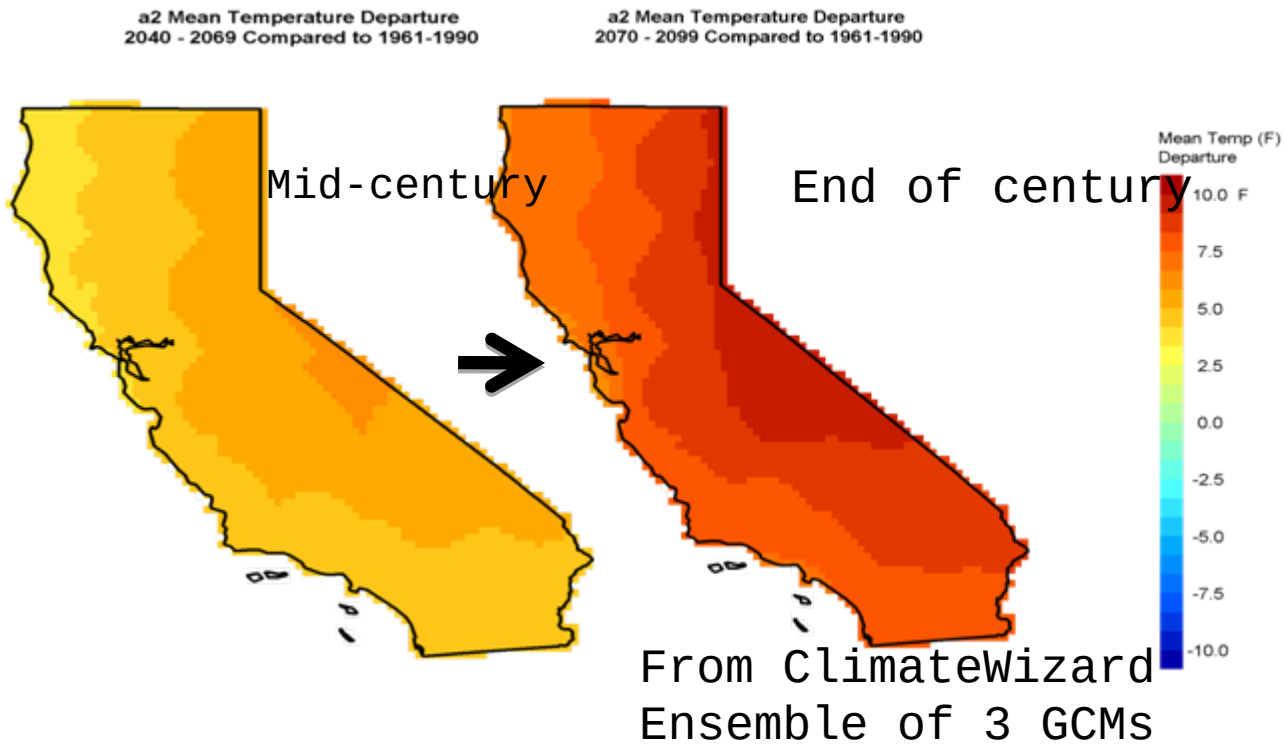
Peppered moths

Pre-industrial revolution

Post industrial rev

Climate change adaptation

- The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2007).

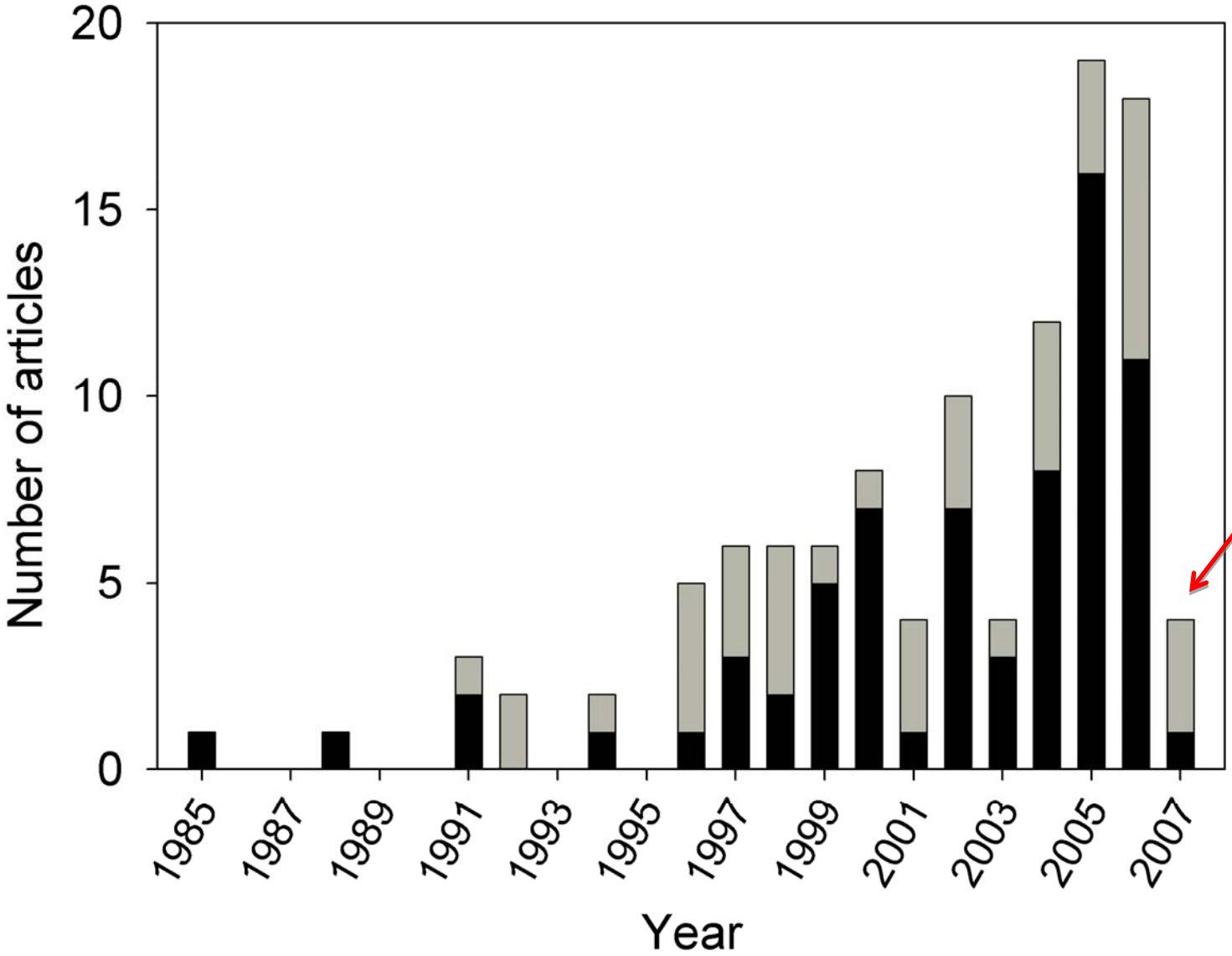


recommendations for climate change adaption made in the scholarly literature?

- Literature review 1985 – 2007
- Any paper that explicitly made a recommendation was included
- In the end, 112 papers were read which revealed 524 recommendations that were condensed into 113 categories.

Heller and Zavaleta, Bio.

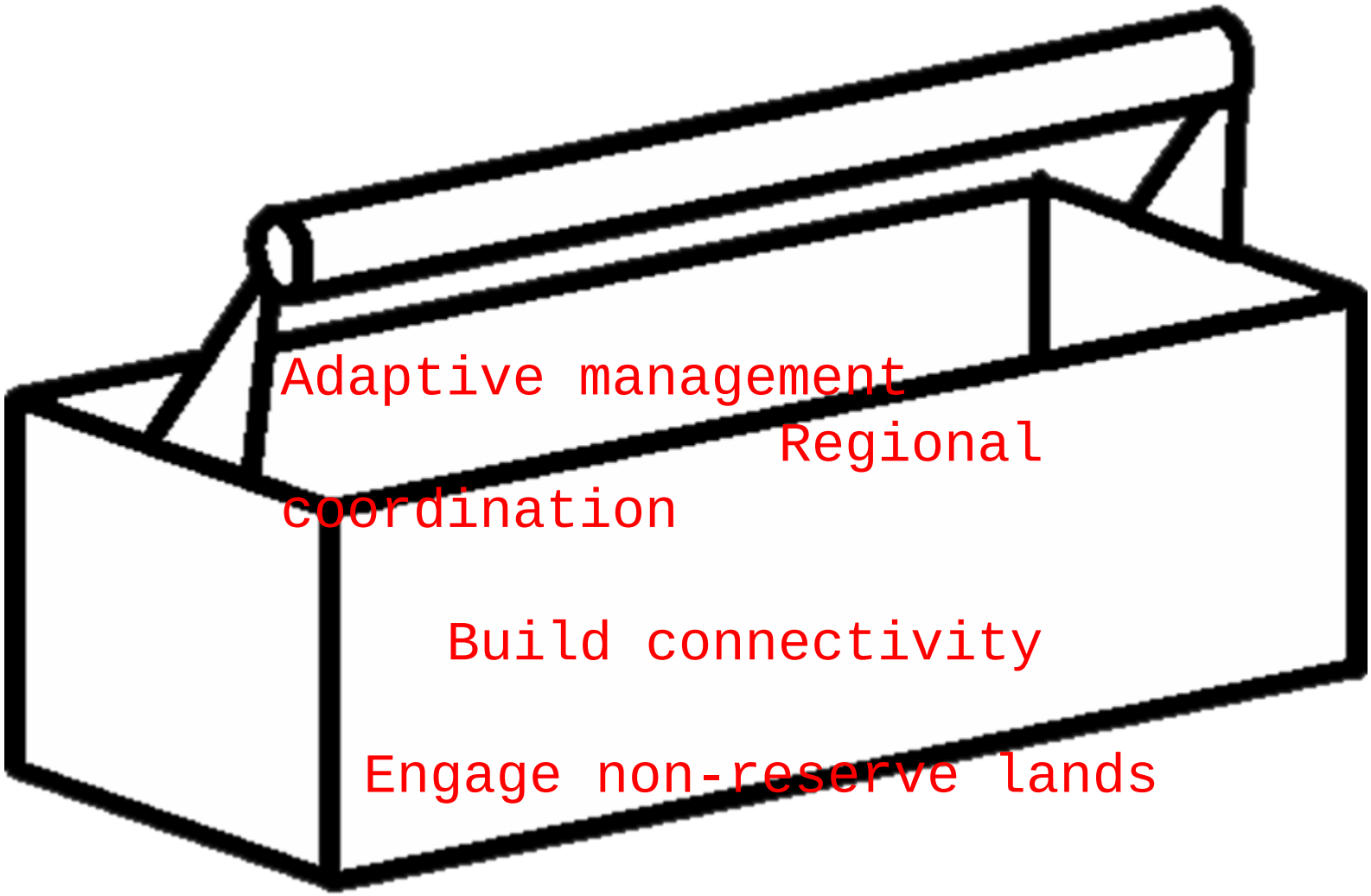
Proliferation of articles dealing with climate change adaptation
ecosystem services management



Lots mor
since

Heller and Zavaleta, Biol.

Good news


Adaptive management
Regional coordination
Build connectivity
Engage non-reserve lands

Bad news

- Tactics are often harder to implement.
- Require additional resources.
- There is more uncertainty to confront.
- Some of the more proactive strategies are very risky.
- We may have to give up on goals that

#1

Increase connectivity (design corridors, located reserves near each other, remove barriers to dispersal)

#2

Integrate climate change in planning exercises (reserve design, pest outbreaks, management plans, grazing limits)

#3

Mitigate other threats (invasive species, pollution, fragmentation)

#4

Study response of species to climate change (physiological, behavioral, demographic)

Practice intensive management to secure populations (i.e. irrigation, predator control, woody plant removal)

Translocate species

#5

Increase number of reserves

#6

Address scale-problems (match modeling and management scales)

Improve interagency, regional coordination

#7

Increase and maintain basic monitoring programs

Practice adaptive management

Protect large areas, increase reserve size

8

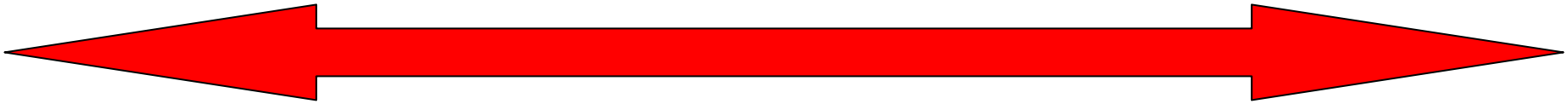
Create and manage buffer zones around reserves

See Heller and Zavaleta 2009 for 1

What are the recommended tactics for implementing robust adaptation programs?

Adaptation measures

Full uncertainty **Faith in determi**



Boost resilience
More of the same

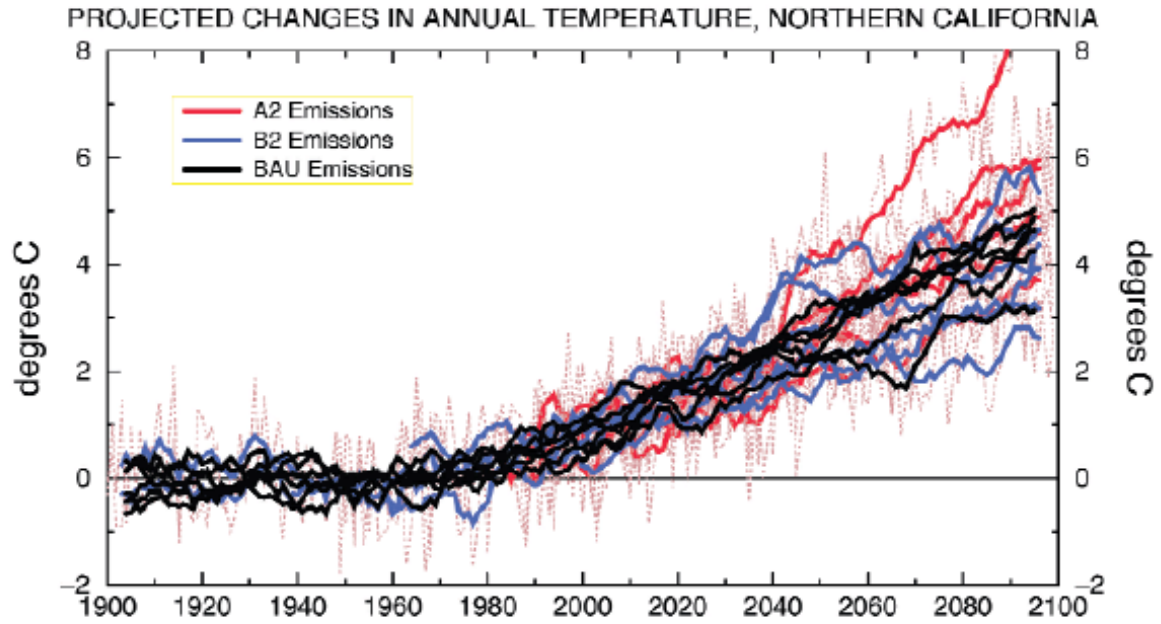
- *Mitigate other threats*
- *Increase number of reserves*
- *Restore habitat in agriculture lands*

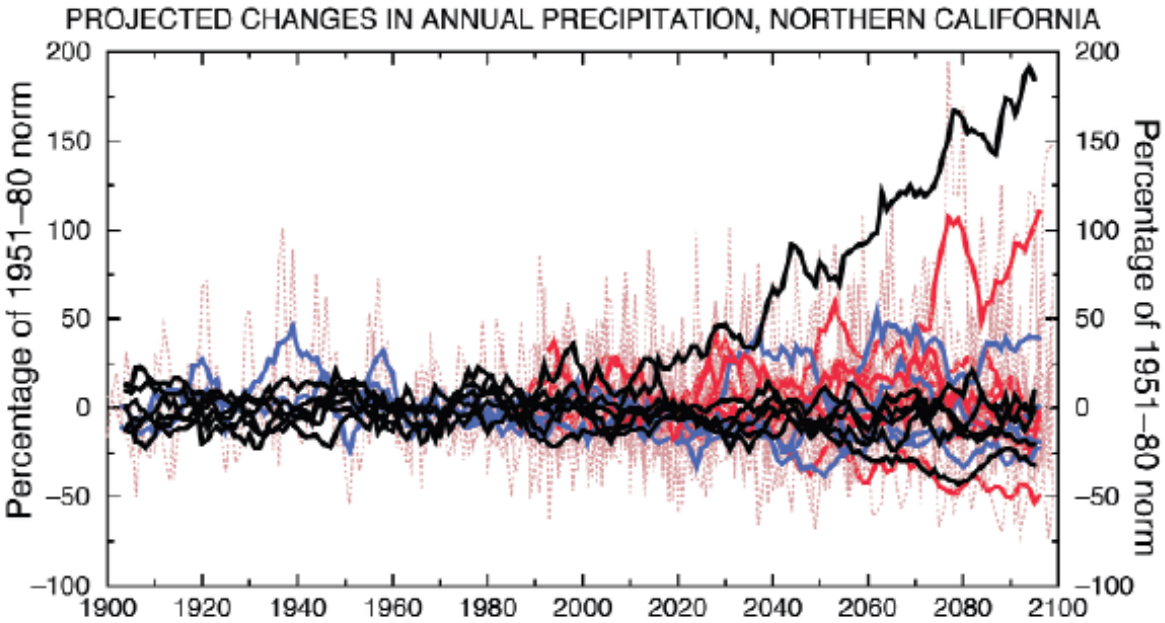
Trend- and model-informed decisions
Scenarios
Sensitivity analysis

- *Increase connectivity along projected migration corridors*
- *Drought interventions for valuable species*

Commit pre-emptively to specific predictions

- *Translocate species based on climate data from one GCM*
- *Make a plan robust to 1 meter of sea level rise*





Projected futures vary with GCM and emissions scenario

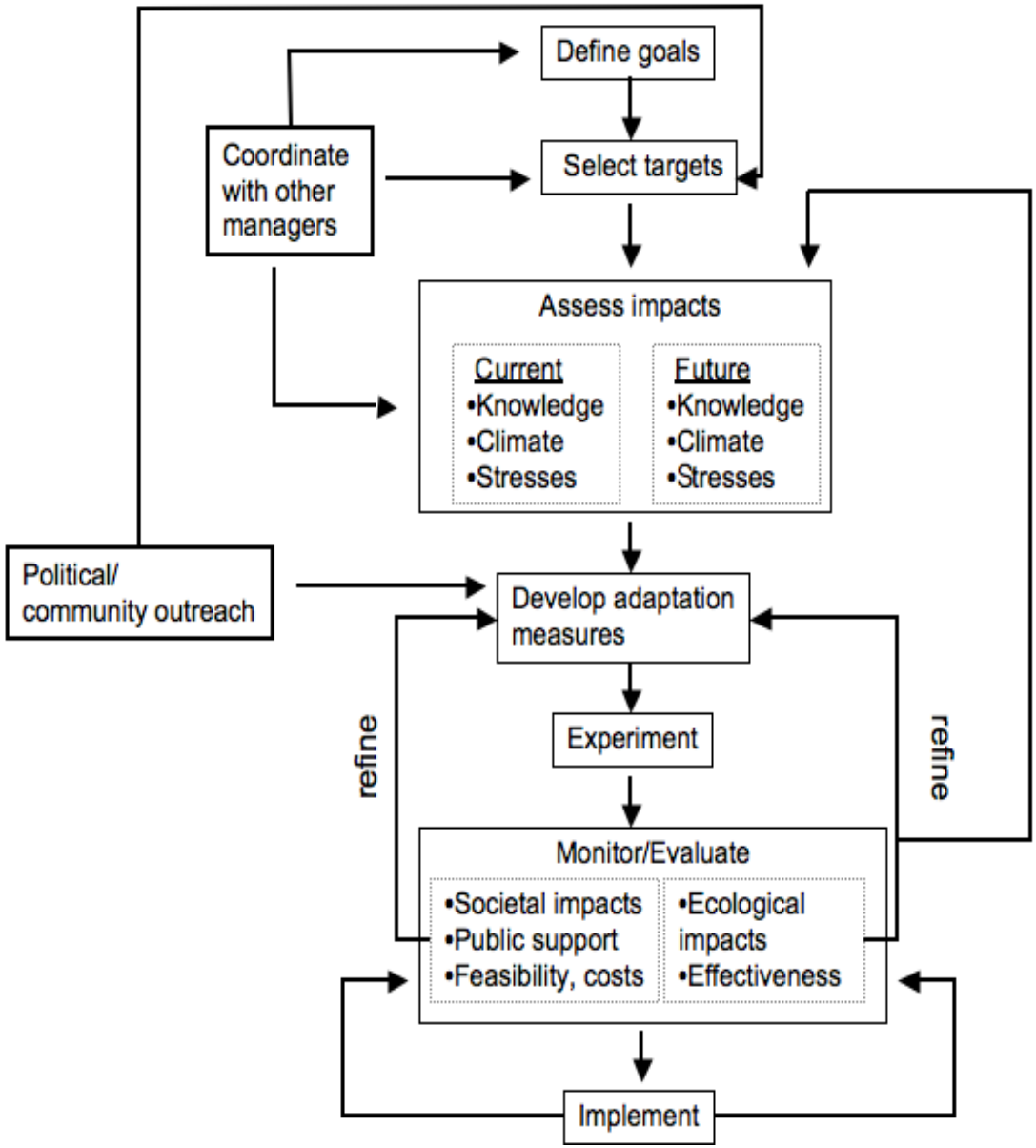
Dettinger 2005,
SF estuary and watershed

Importance of Scenarios & Sensitivity analysis

Q: How does my proposed management intervention affect the system if precipitation decreases in the future? What about if it increases?

Q: How does my intervention perform if mean temperature increases 7 degrees F instead of 4 degrees by 2080?

Climate change adaptive management



We are engaged in a *paradigm sh*

Recommendation # 10

Make friends with change (re-evaluate goals and categorizations, Shift focus from pattern to

Thanks!

Collaborator: Erika Zavaleta

Useful discussions: Phil Duffy, Claudia Tebaldi

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