



# NOT JUST USEFUL TO, BUT USED BY

LESSONS FROM 15 YEARS AT THE  
INTERSECTION OF CLIMATE SCIENCE AND  
DECISION MAKING

Amy Snover, PhD

Co-Director, Climate Impacts Group

*Regional Climate Services Workshop  
University of Victoria  
November 21, 2011*



*Climate Science in the Public  
Interest*



# The Climate Impacts Group

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*An integrated research team studying the impacts of climate variability and climate change in the PNW and western US*

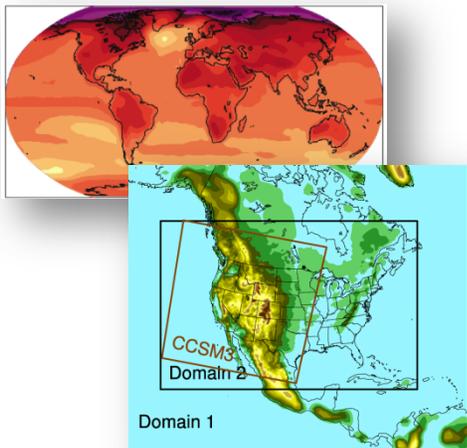


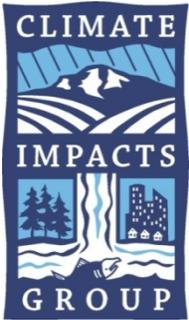
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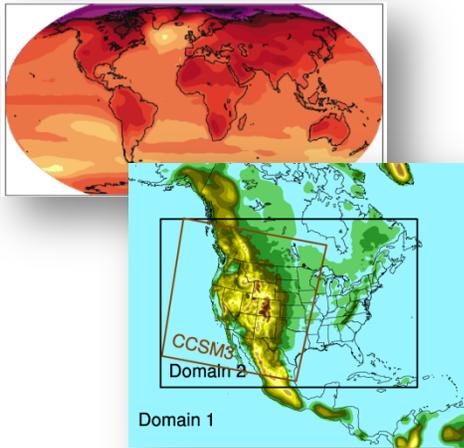




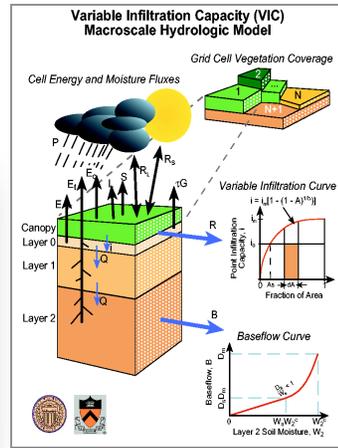
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Macro and fine-scale hydrologic modeling

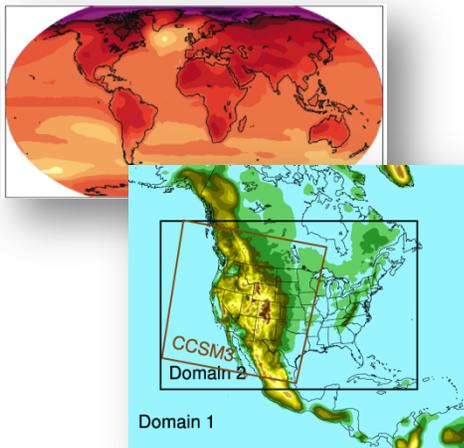




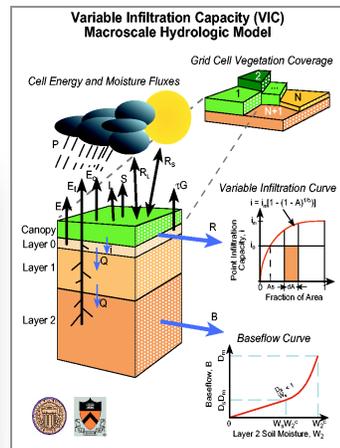
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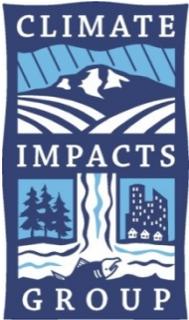


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Impacts assessments for water resources, terrestrial and aquatic ecosystems

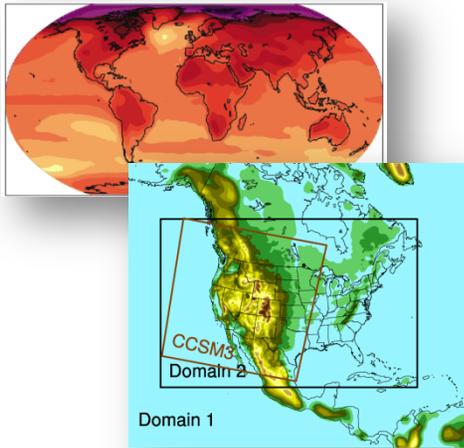




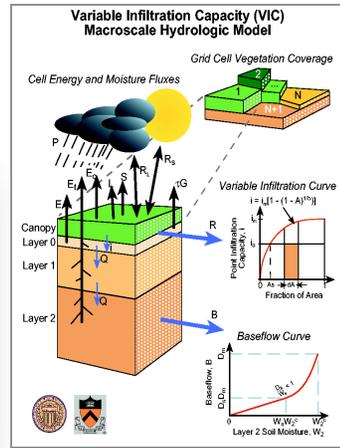
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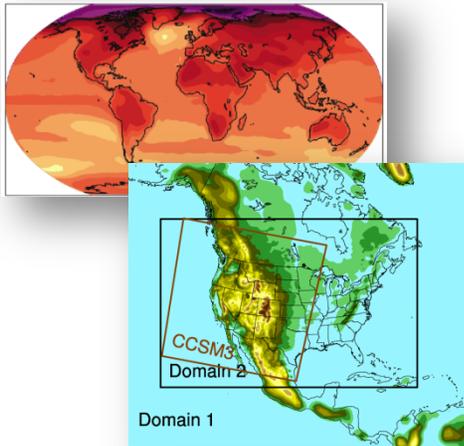




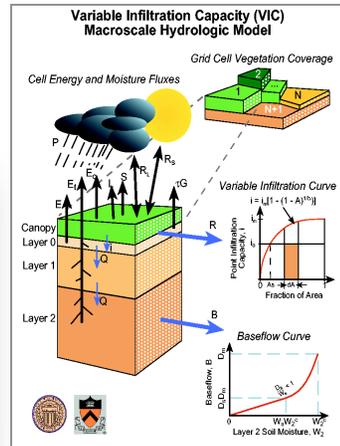
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**Working since 1995 to:**

- Perform climate science in the public interest
- Increase regional resilience to climate variability and change
- Produce science useful to (*and used by!*) the decision making community

# Supporting Climate Resilience Through....

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## **...Research**

- Investigating sensitivity and vulnerability to climate variability and change
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## **...Outreach**

- Designed to develop (and maintain) ongoing relationships with the stakeholder community

# Key Stakeholders

## **Federal:**

- Bonneville Power Administration
- National Park Service
- NOAA National Marine Fisheries Service; River Forecast Center; Sea Grant
- U.S. Army Corps of Engineers
- U.S. Congress
- USDA Natural Resource Conservation Service
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geologic Survey

## **Tribal:**

- Columbia River Inter-Tribal & NW Indian Fisheries Commissions
- Swinomish Tribal Community
- Institute of Tribal Environmental Professionals

## **State:**

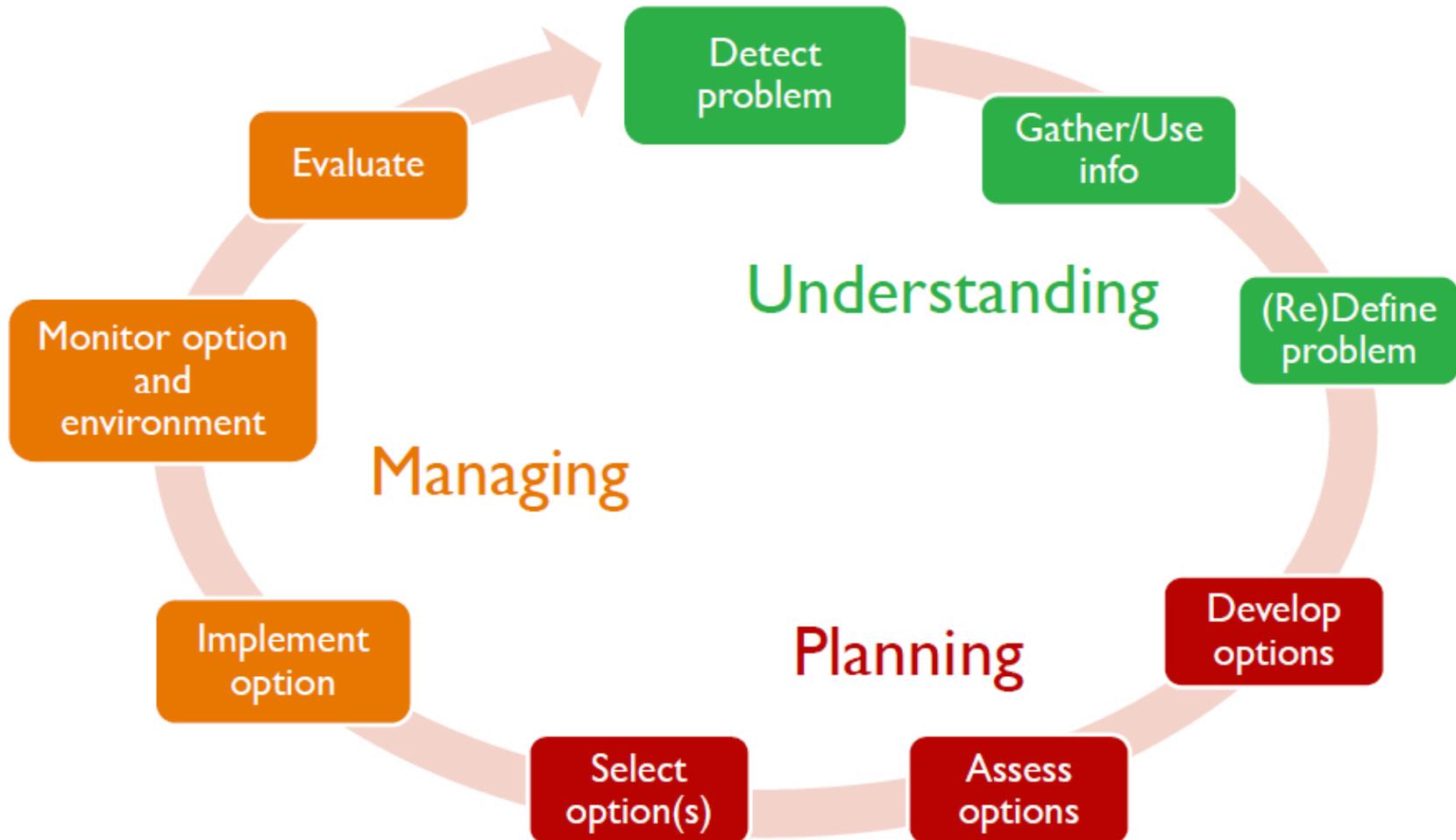
- WA, OR, ID State Governor's Offices
- WA, OR, ID State Legislatures
- WA Department of Ecology, Fish & Wildlife, Natural Resources, Transportation
- CA, OR, ID Depts. of Water Resources

## **Local/Other:**

- Northwest Power and Conservation Council
- BC Hydro
- WA watershed planning units
- Puget Sound Clean Air Agency
- Central Puget Sound Water Suppliers' Forum
- King County, WA
- Seattle City Light
- Portland Water Bureau
- Idaho Power Company
- National Wildlife Federation
- Wild Salmon Center
- News media



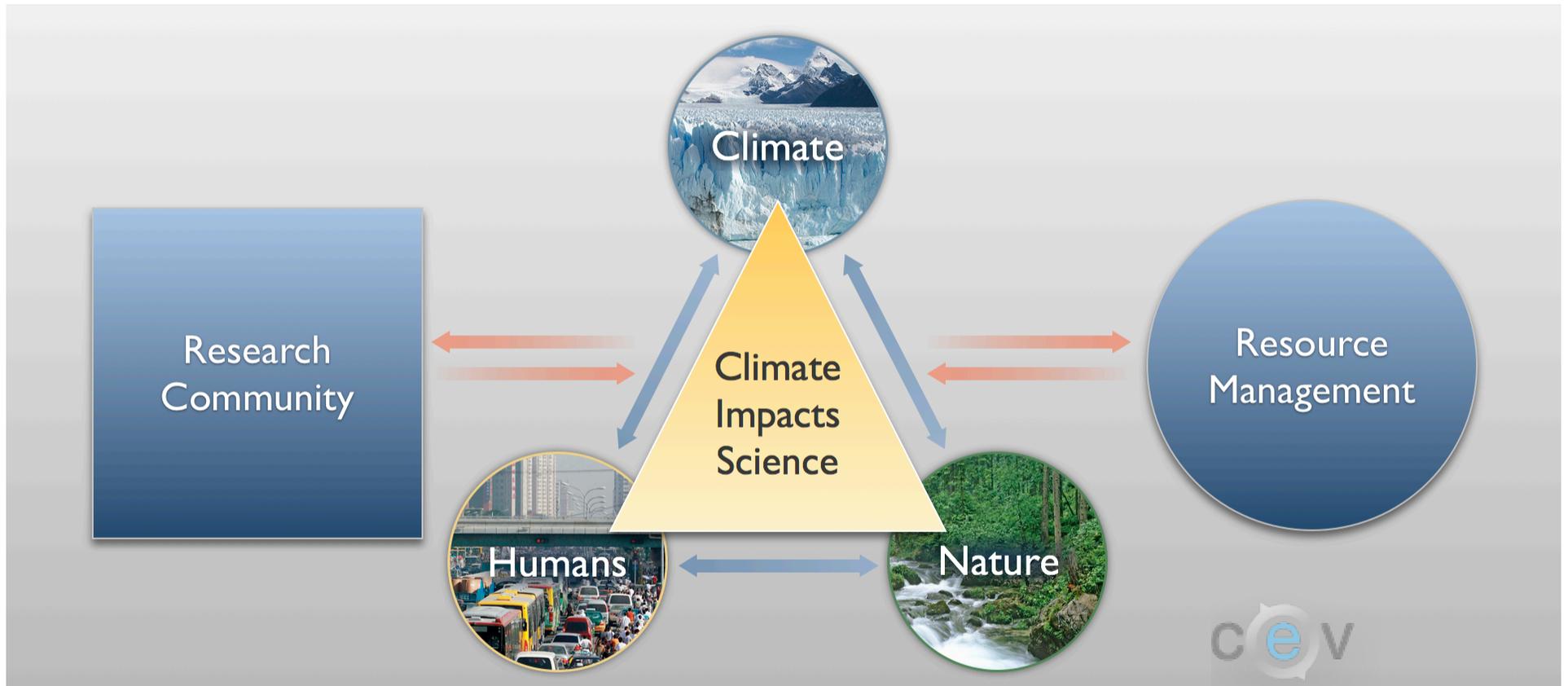
# Supporting Climate Resilience ....



Source: Moser & Ekstrom (2010, forthcoming)



# Square peg....round hole. Or are they?



## Traditional Products:

- Publications
- Forecasts
- Physical system models
- Theoretical models
- Case Studies
- Data

## Traditionally Operates in a world of:

- Formal planning
- Regulatory requirements
- Limited technical resources
- Hierarchical mgmt. authority
- Balancing stakeholder interests
- Risk-averse decision-making



# Setting priorities for regional climate services

## Science

Current state of knowledge  
Emerging understanding  
Exploratory science  
Not knowable anytime soon

## Decision Making

Place-, time- and sector-  
specific  
Actionable  
Best available science



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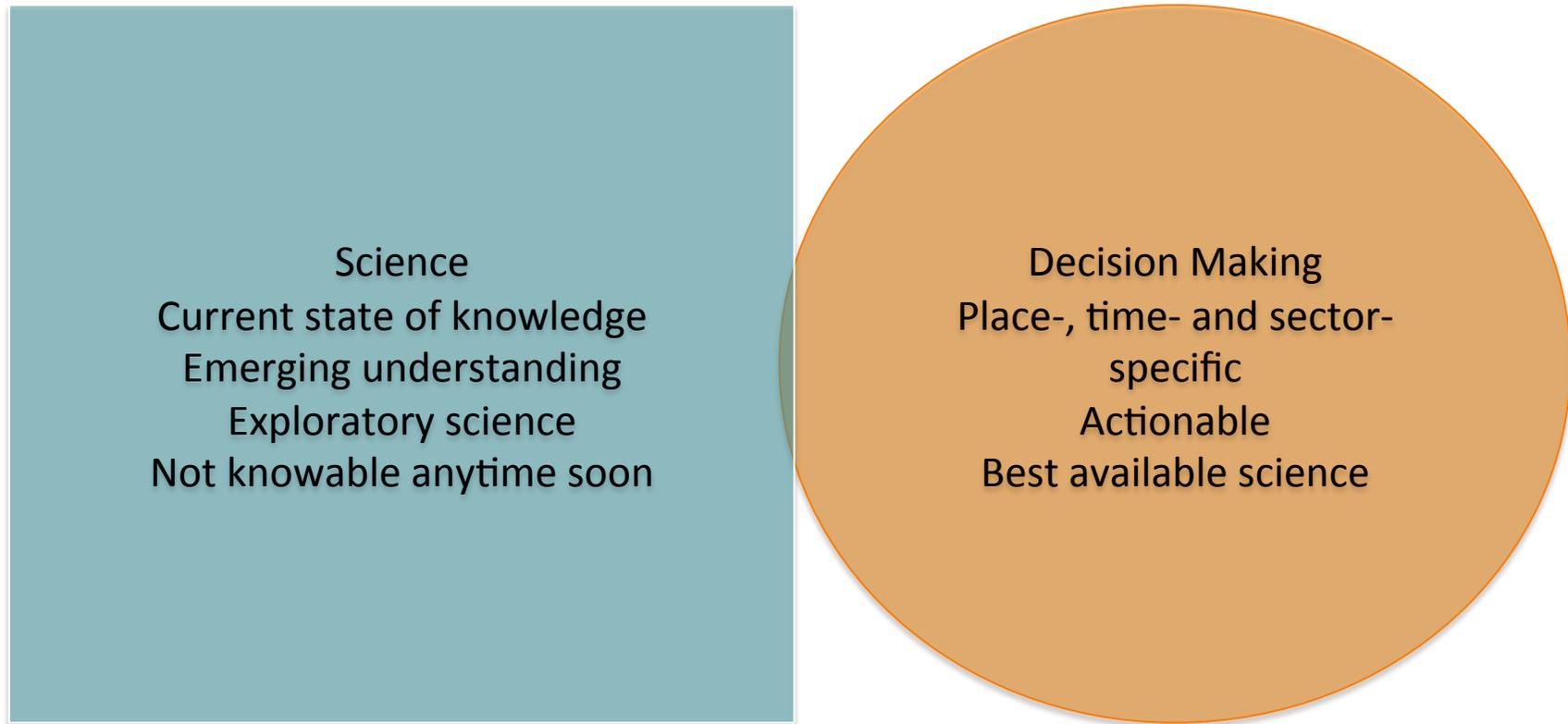
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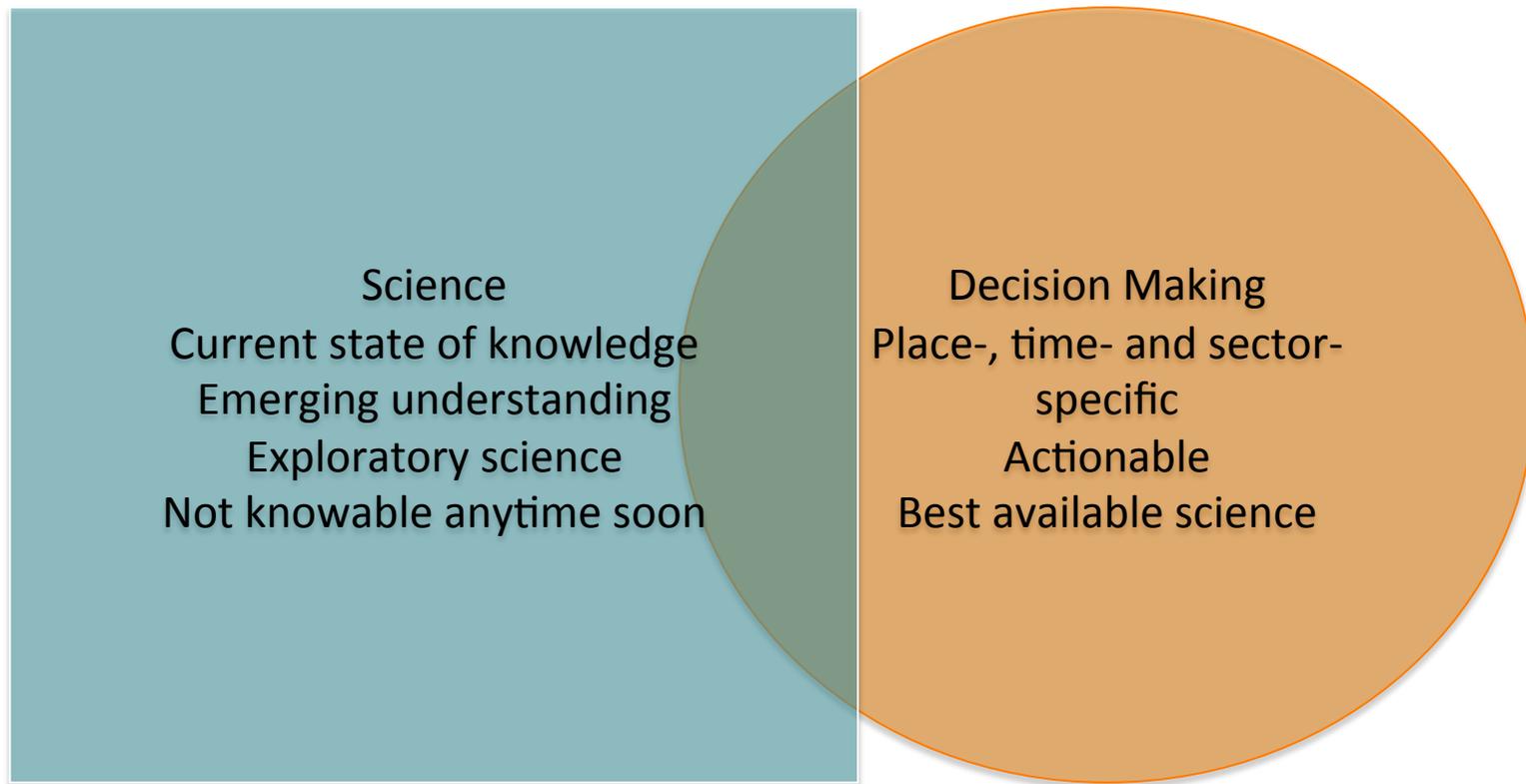
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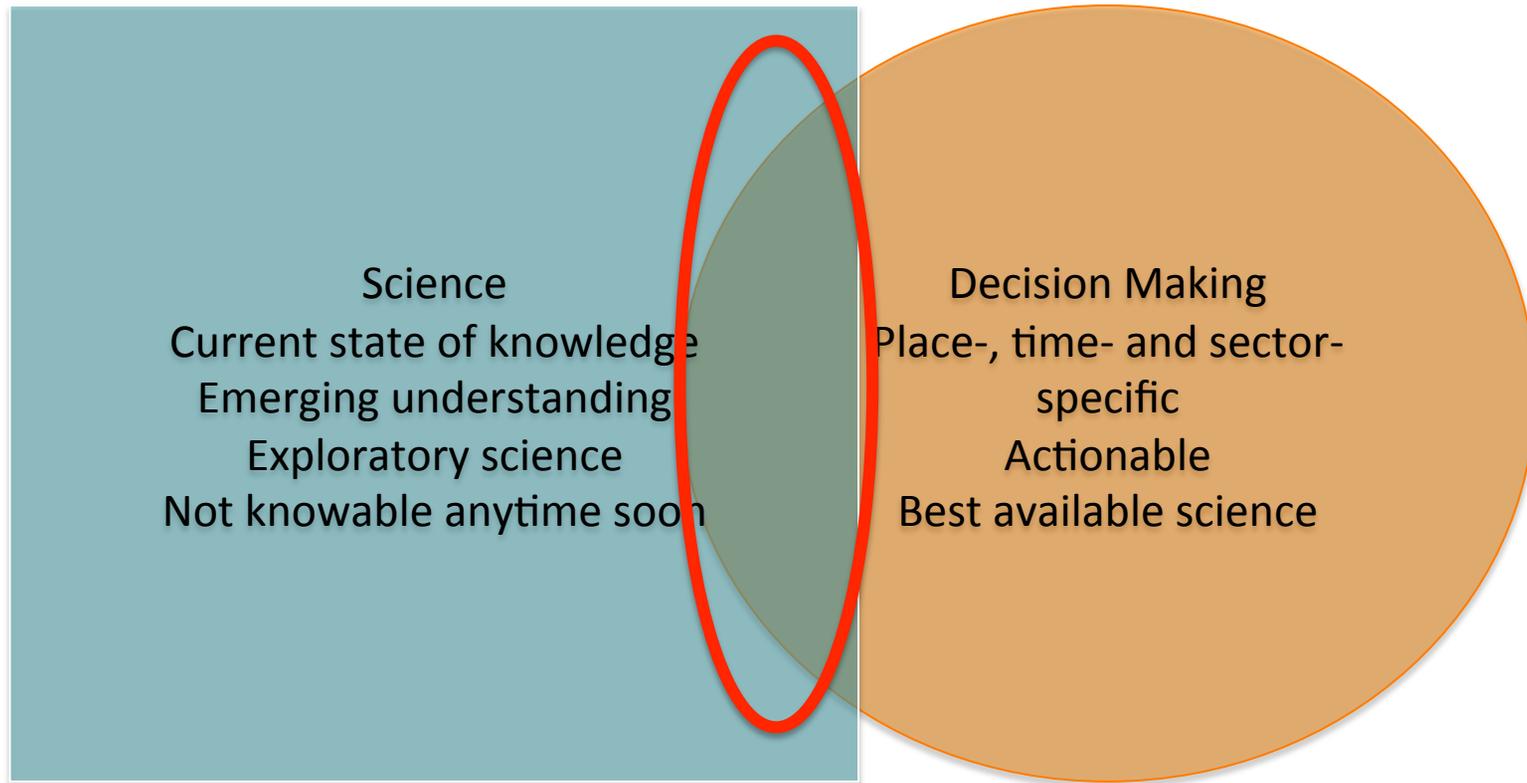
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# Consistent Future Climate for Resource Management: R1/R6 Project

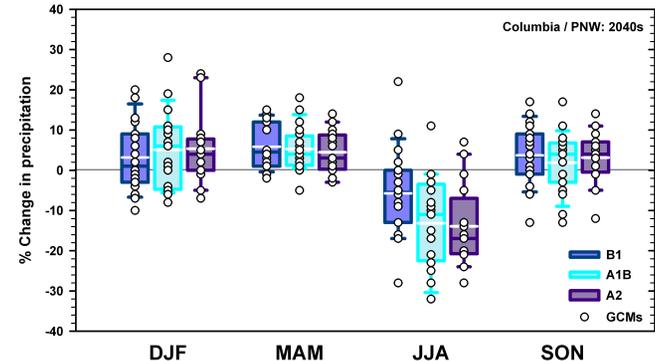
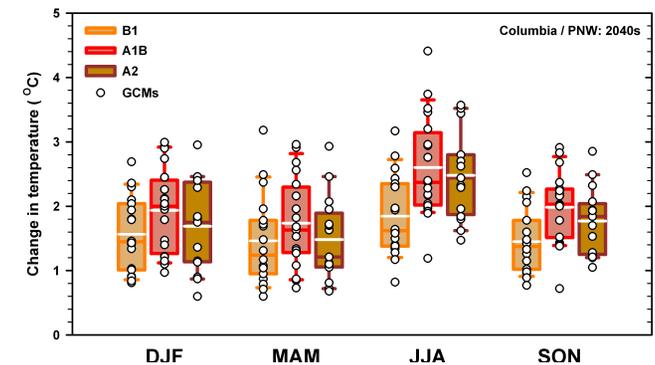
- Joint US Forest Service & US Fish & Wildlife Service consortium asked:
  - What risks does climate change bring?
  - How do these vary across the west?
  - How can we develop a consistent (west-wide) basis for forest planning, given climate variability and change?





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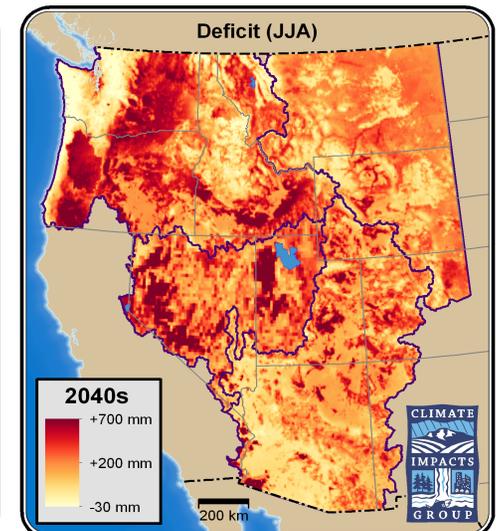
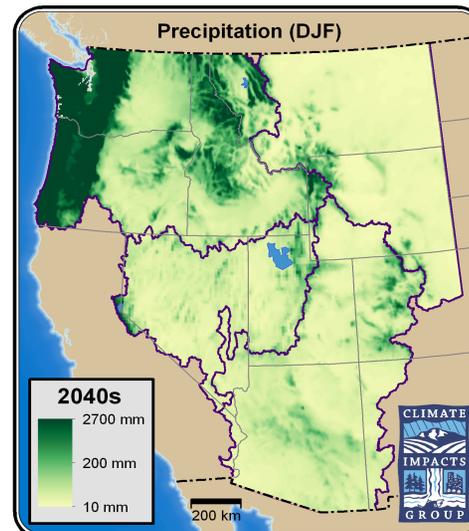
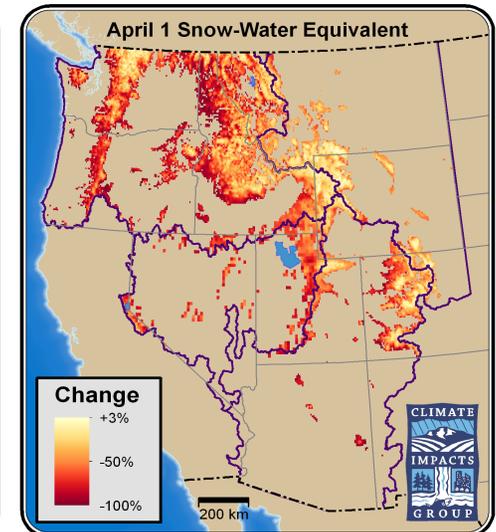
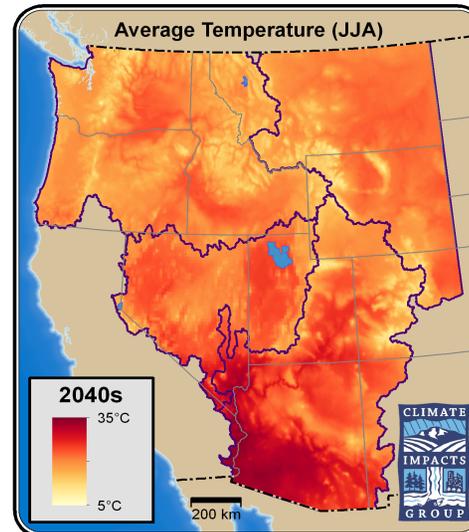
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  - What risks does climate change bring?
  - How do these vary across the west?
  - How can we develop a consistent (west-wide) basis for forest planning, given climate variability and change?
- Developed a consistent methodology to create gridded historical and future climate and hydrologic conditions for the Columbia Basin, Great Basin, Colorado River Basin, and upper Missouri Basin





# Consistent Future Climate for Resource Management: R1/R6 Project

- Evaluated global climate model performance, chose bounding scenarios based on impacts of interest
- Downscaled temperature and precipitation used to drive a distributed hydrologic model (VIC) to simulate past and future snowpack, combined flow, water balance deficit, soil moisture, etc.

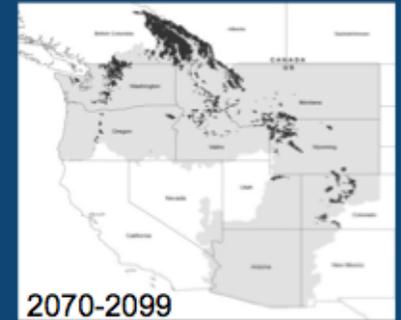


# Consistent Future Climate for Resource Management: R1/R6 Project

Snowpack



Wolverine habitat contraction: 63% by 2080s  
(McKelvey et al. in press)

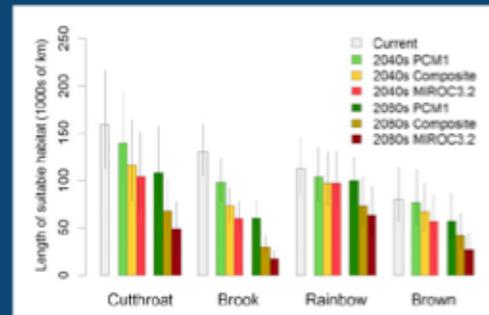


Temperature

Winter high  
flow frequency



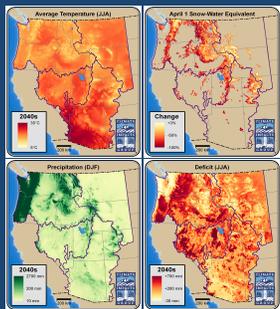
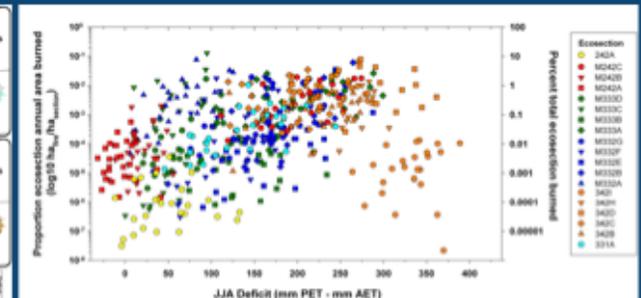
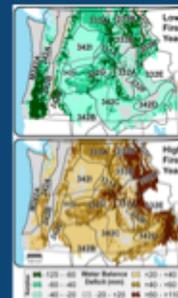
Cutthroat habitat contraction: 58% by 2080s  
(Wenger et al. 2011)



Water balance  
deficit



Area burned by fire related to PET - AET  
(Littell and Gwozdz 2011)



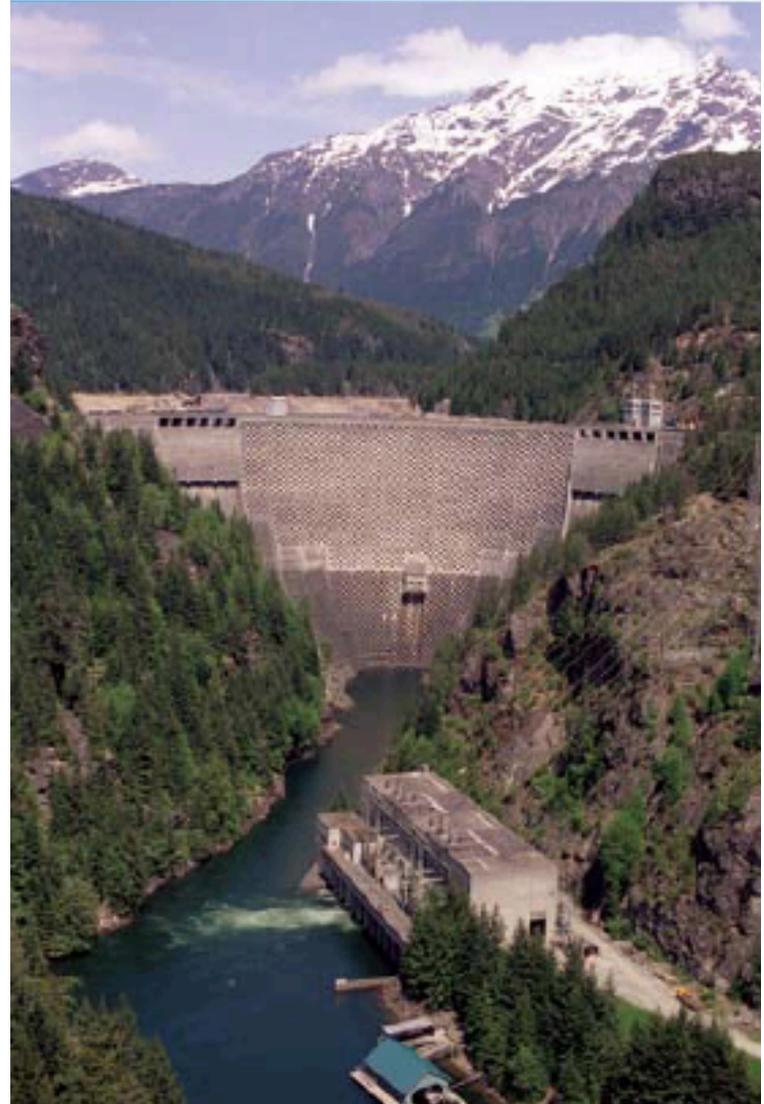


# Seattle City Light Climate Change Analysis

- SCL manages three dams on the Skagit River and must balance power generation, flood control and fish habitat.
- Climate change affects streamflow timing, stream temperature and low and high streamflow.
- Dams can be operated to balance power and habitat.



*Chinook (Spring) salmon. Photo by Josh Larios (CC-BY-SA-2.0) via Wikimedia Commons.*





# Seattle City Light Climate Change Analysis

## SCL Information Needs

- Integrated Resource Plan (WA ESHB 1010 [2006]) – Meet customers' needs over next 20 years
- Operation adaptations at Skagit River and Boundary Hydroelectric Projects
- Skagit Project
  - 711 MW - 20-25% of Seattle's Electricity
  - 3 dams – Ross, Diablo, and Gorge
  - Snow-dominant watershed, complex terrain, difficult to model



Skagit River Hydroelectric Project - Ross Reservoir



City of Seattle

*Slide: R. Tressler, SCL*



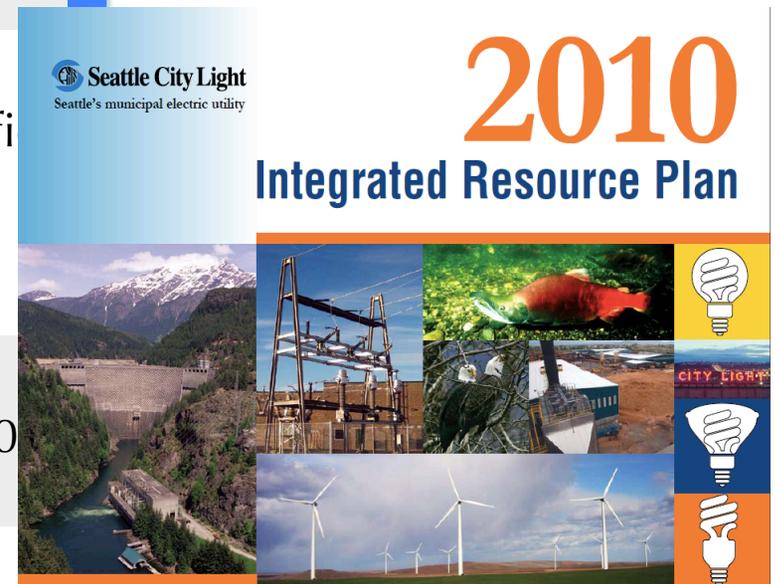
# Seattle City Light Climate Change Analysis

<b>SCL need</b>	<b>Product</b>
Future load estimates	Hourly time series from RCM for Seattle
Future generation projections	Simulated future hydrographs for specific streamflow locations under various climate change scenarios
	Projected change in magnitude of 5, 20, 100 year floods
Threats to endangered anadromous & resident fish	Projected change in summer low flows
	Projected summer stream temperature

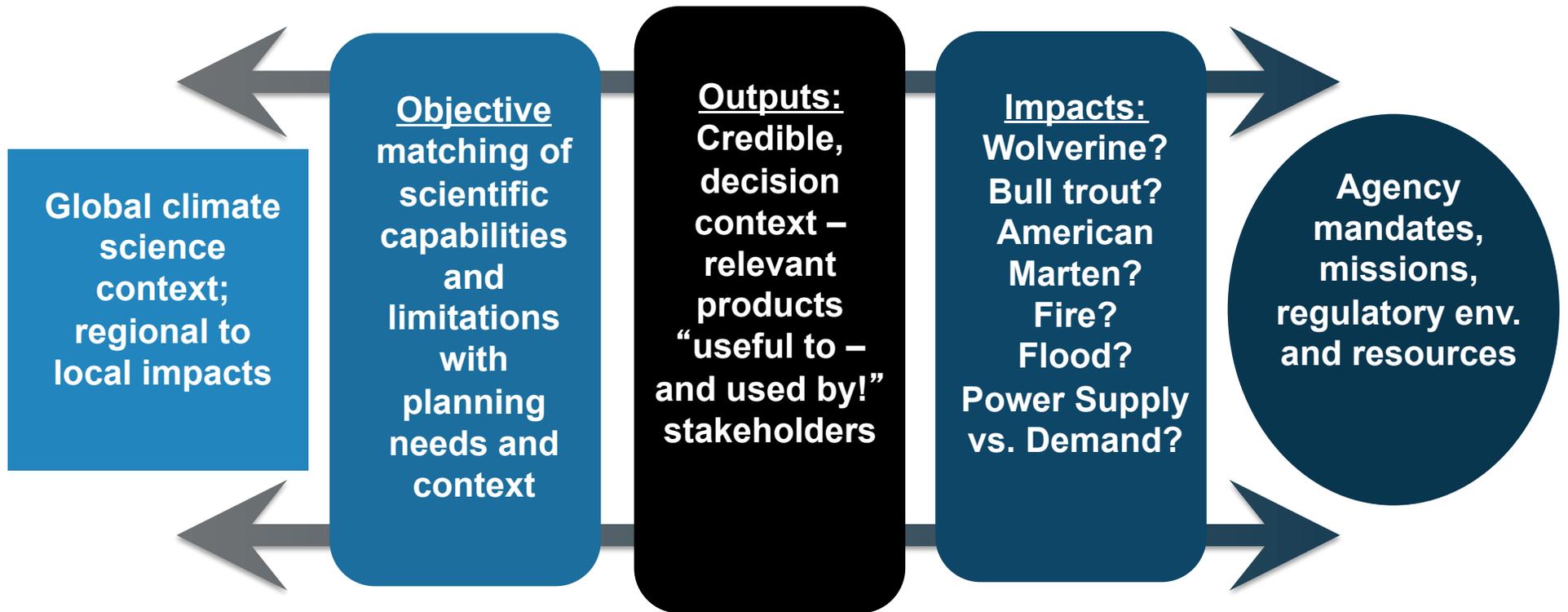


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# Matching Scientific Capabilities with Planning Needs





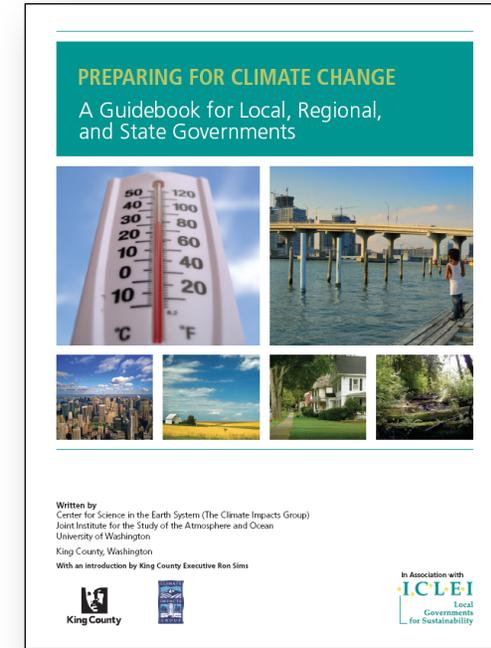
# Destination & Voyage

- Climate services must not “just” deliver information ...
  - Development and delivery of useful information, tools, data requires understanding the decision contexts, temporal/spatial scales of management, decision calendars, etc. etc.
- ... but provide guidance and assistance for its use
  - Ensuring its use often requires additional investment: advising on nature and implications of uncertainty, pros & cons of different analytical approaches, strategies for communicating with stakeholders, keeping up with evolving science...
- The need for this “technical advising” is often overlooked when assessing the resources needed for providing climate services.
  - Training sessions on appropriate use of data, tailored data products, data support



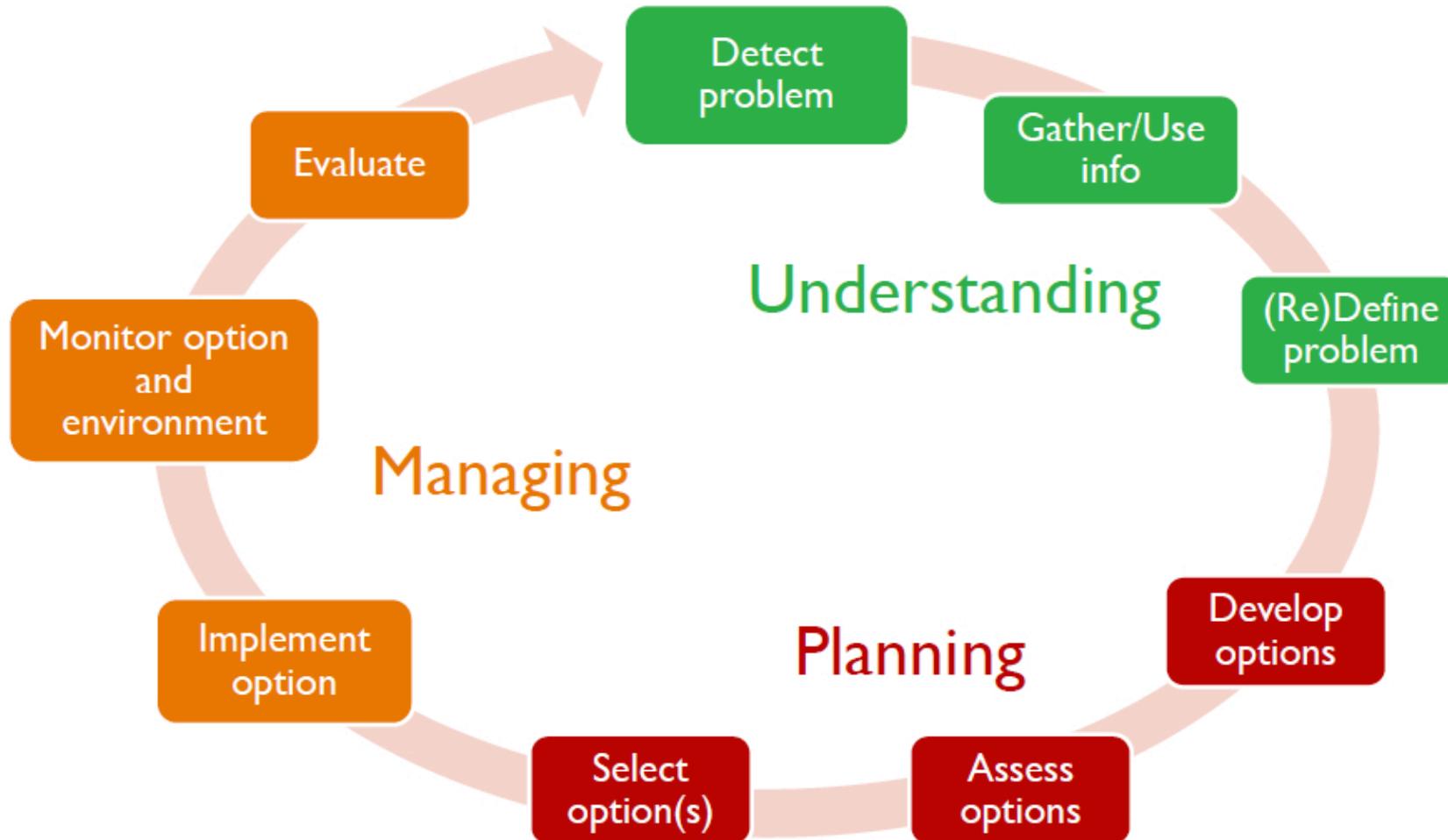
# Going along for the ride

- **Setting the course for adaptation: A guidebook for planning for climate change**
  - Detailed description of why and how to prepare for climate change at the local/regional scale
  - Embodiment of years of collaboration between Climate Impacts Group and King County, Washington
  - Published by ICLEI – Local Governments for Sustainability
- **Washington State Climate Change Adaptation Strategy**



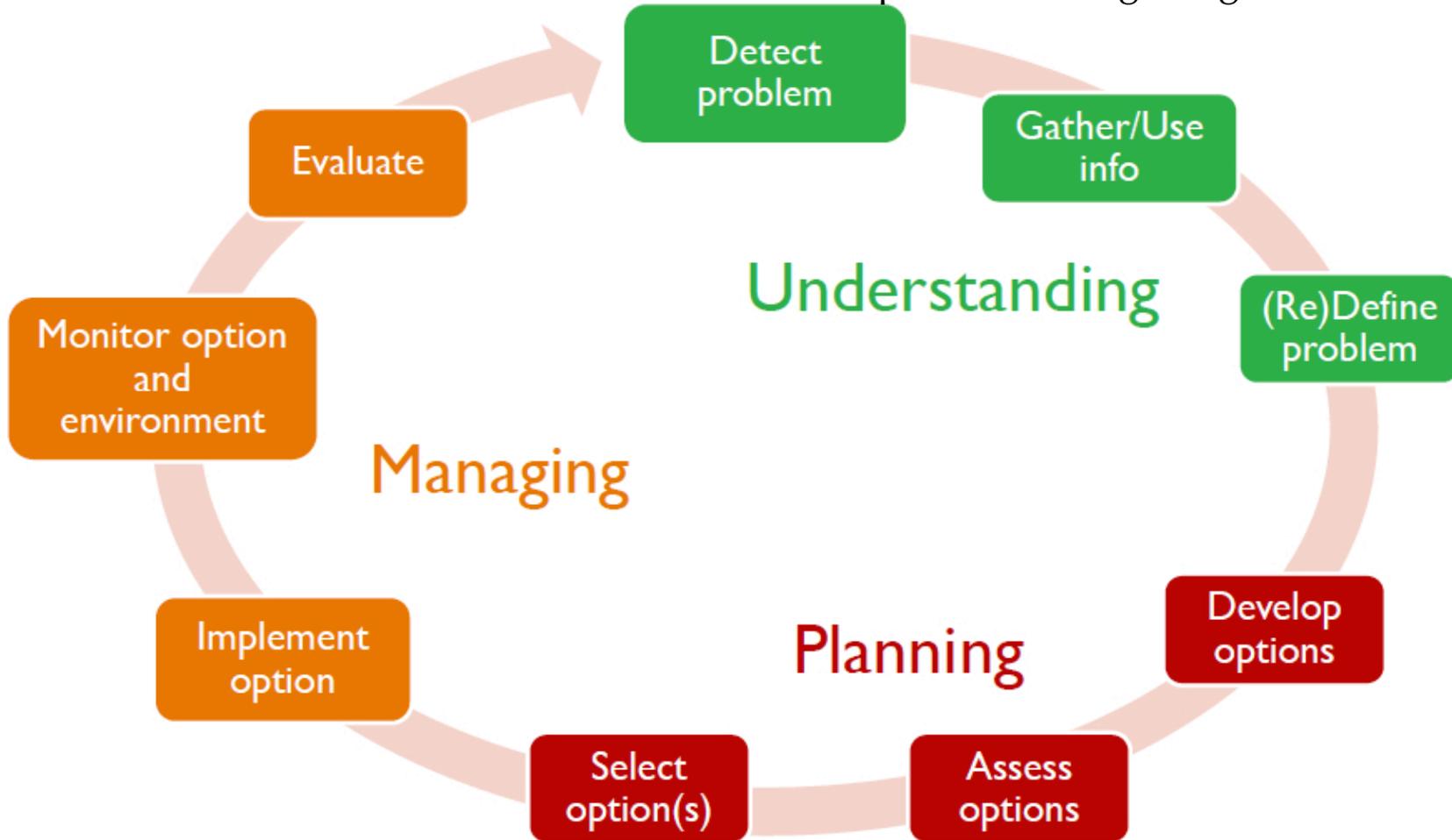
- **R1/R6 risk assessment**
  - Dialogue between stakeholder and scientists
  - Translating and explaining science behind products
  - Relating to risk defined by USFS managers
  - Result: climate-informed risk mapping → forest plans

# Where are we now? Where are we going?

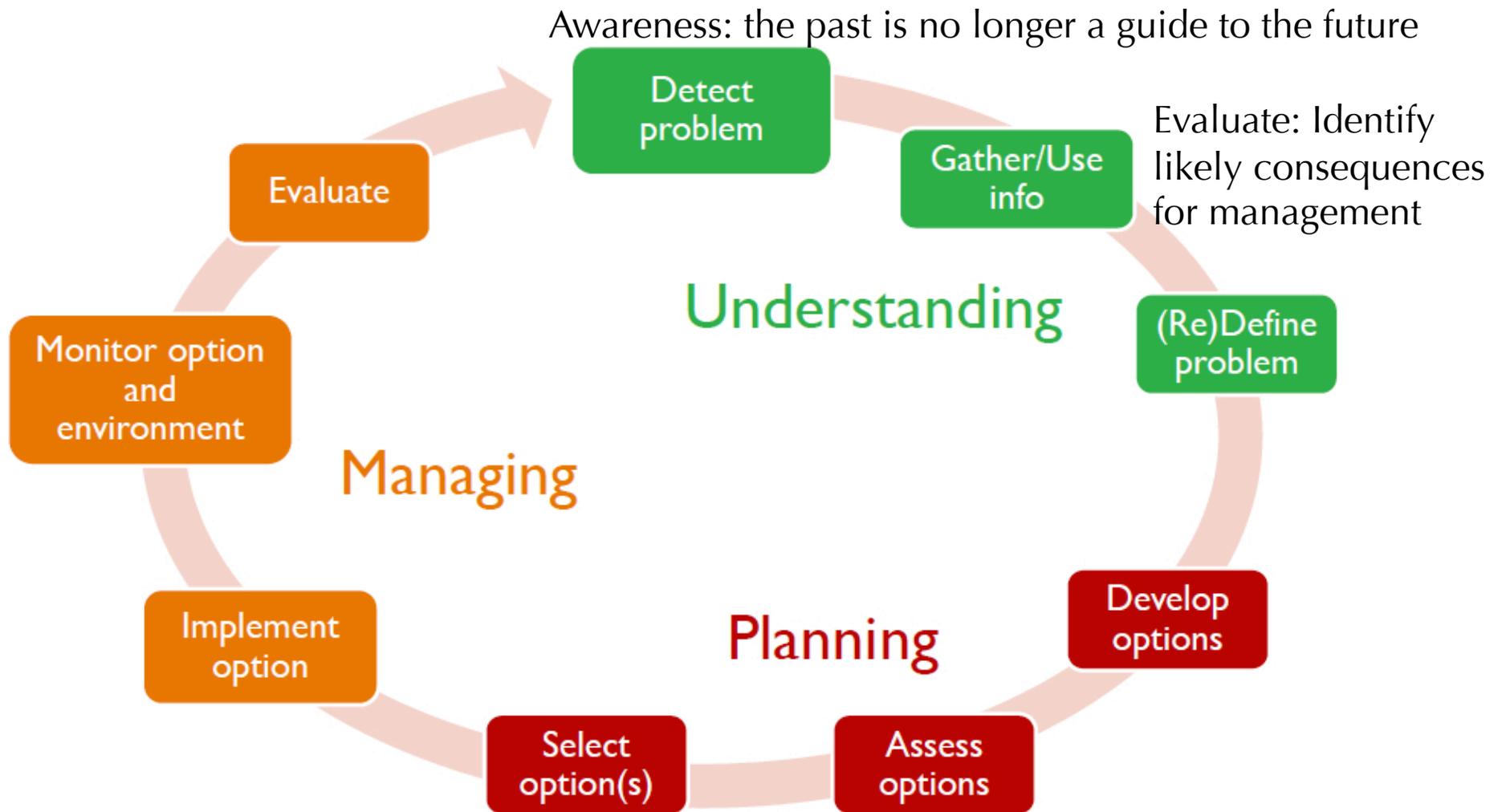


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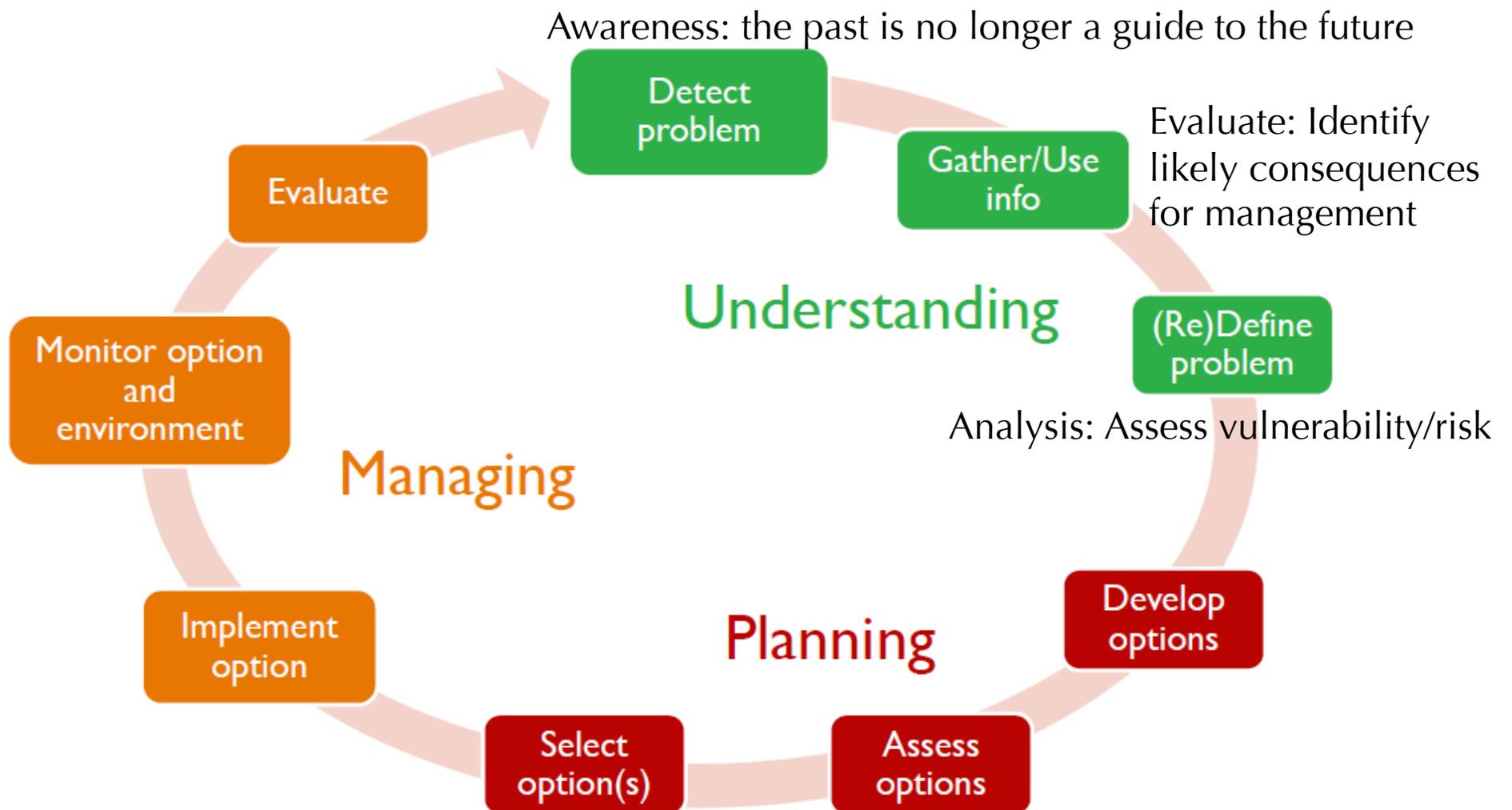
Awareness: the past is no longer a guide to the future



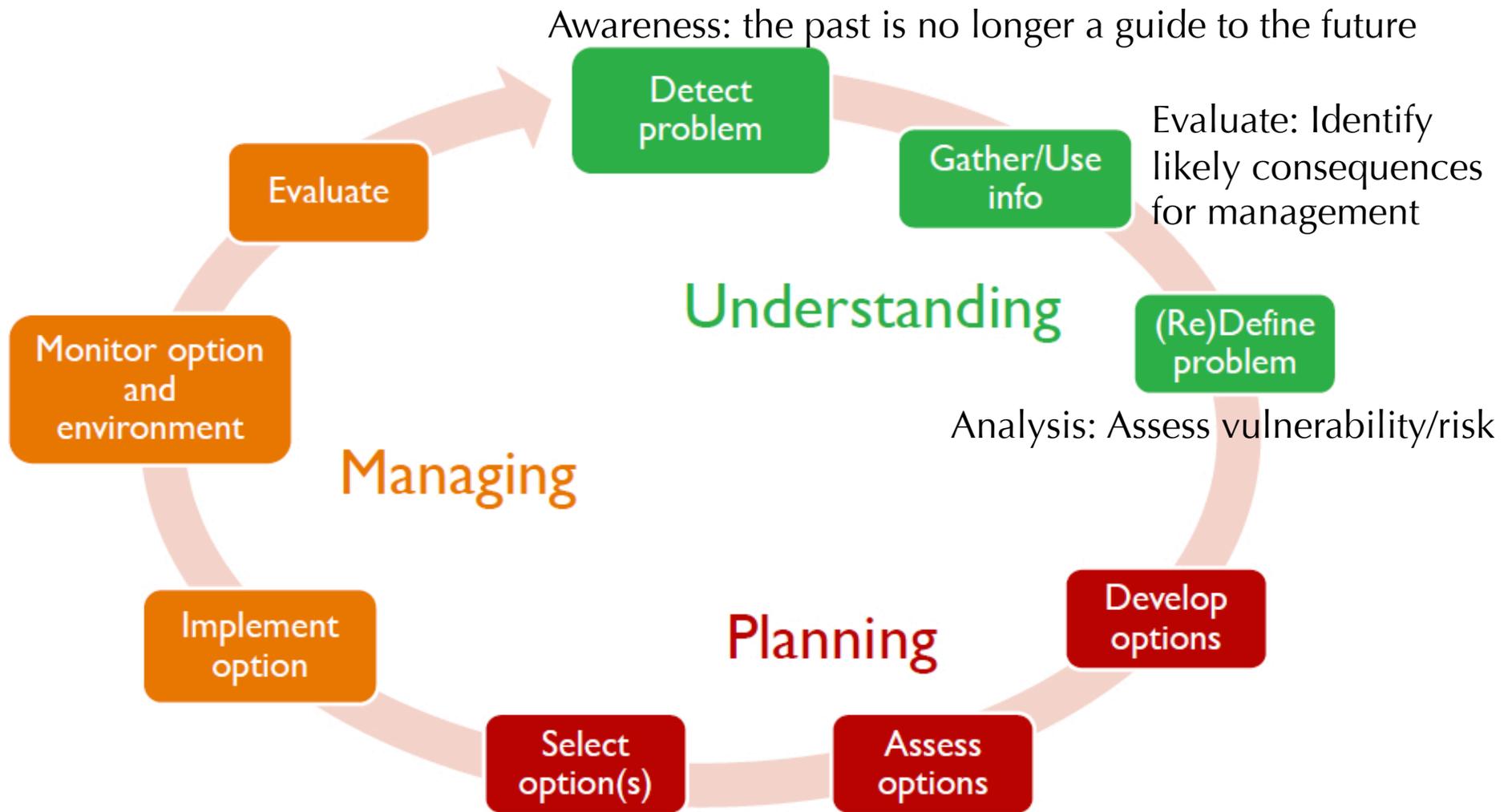
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Need research to support:

- design of adaptive management/policy approach
- appropriate management drivers and policy instruments

(a la Steffen 2009)

# Lessons

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- Climate services exist at the interface between science (research, modeling, observations) and decision making (planning, policy, management)
- Their unique contribution (and, one hopes, skill) is to create, define, maintain, enhance the overlap between the capabilities of science and the needs of decision making
- Communication efforts intended to stimulate and support the development of climate resilience must be reframed, over time, from “outreach” to “engagement”
- Climate services have a role in shaping the outcome and process (“destination” and “voyage”) towards climate resilience
- The decision context (and its scale) – municipality, watershed, Forest / Park, region - defines the nature of the process and the roles of science and stakeholders

# Challenges

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- Is there a difference between public service and stakeholder support?
  - Questions of equity
  - What's the appropriate role of climate services, vis a vis "pushing" vs ."supporting" the development of climate resilience?
- We're spinning up a big enterprise for the production and delivery of useful information. What about for development and support of the iterative, interdisciplinary, science-management partnerships necessary for (1) defining "useful" information and (2) supporting its use?
  - This is still the new challenge (not science or decision making alone, but both together)
  - Who sets research priorities, and how?
  - Challenges of "boundary organization" work in a non-boundary environment – climate services in academia
- Are we doing any of this quickly enough and at a large enough scale to meet the coming challenges?
  - Texture of decision making, need for tailored products & guidance...
- Developing climate resilience will require support from science – and strategies for bridging the science/policy gap – at every stage of the adaptive management loop.

# The Climate Impacts Group

[www.cses.washington.edu/cig](http://www.cses.washington.edu/cig)

