The Future Ain't What it Used to Be: Dealing with uncertainty in climate projections

Beth Miller and John Phillips

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American Water Works Association Pacific Northwest Section

Look to the future—Not the past

- We are locked into some level of global warming and need to plan accordingly
- Temperature and precipitation patterns will be unprecedented in the PNW
- Past climate is no longer a good predictor of the future
- Design to the future—not the past

Climate Change Scenarios

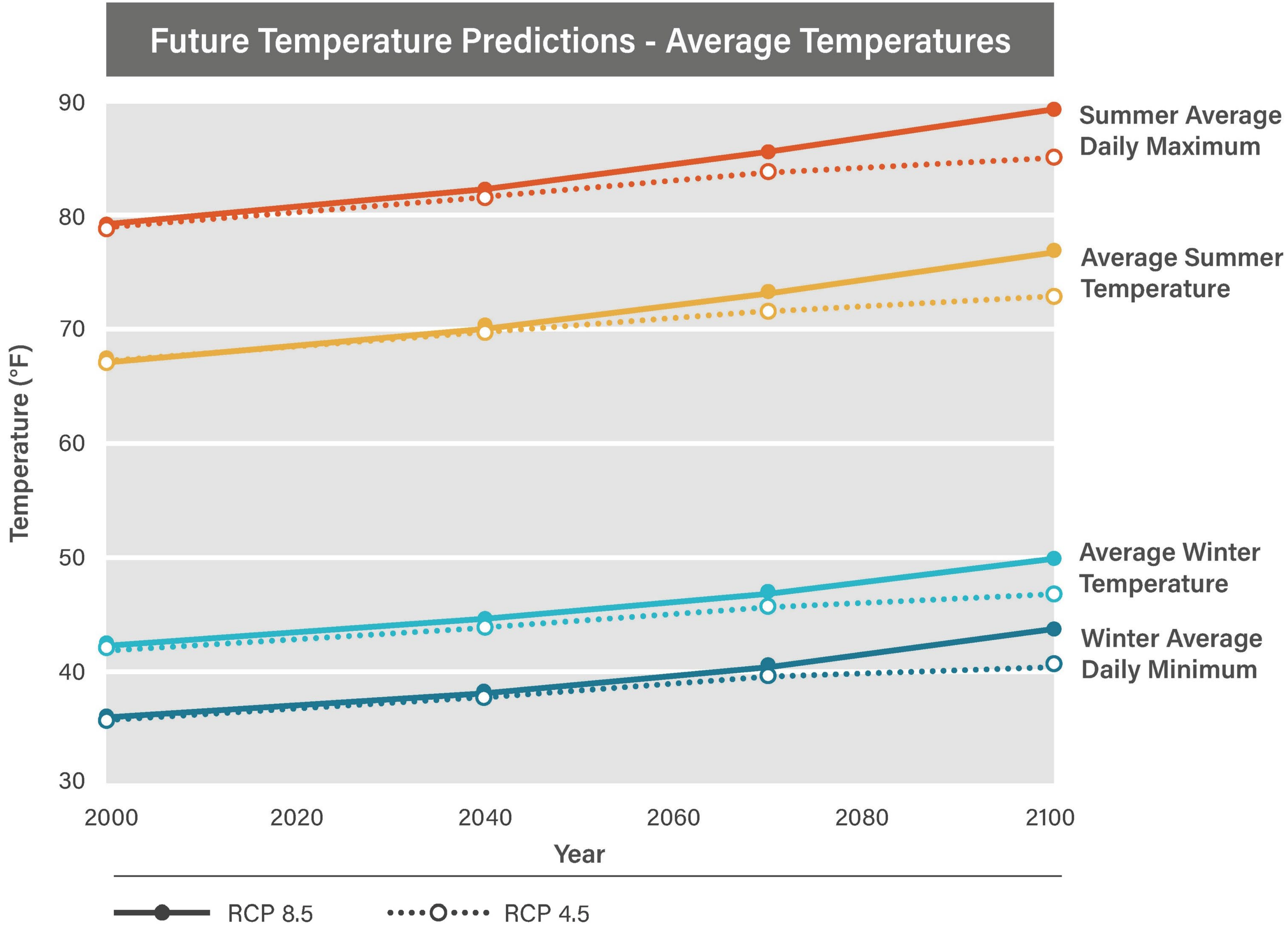
RCP 4.5

- Currently best-case scenario, to achieve better we needed to decrease emissions already (not just decrease the rate of increase)
- Emissions peak around 2040—Go to zero by 2100
- Average global surface temperature warming of around 3.6˚F to 5.4˚F (2-3˚C)

RCP 8.5

- Emissions continue to increase throughout the century
- 7.7˚F average temperature increases

- **Likely to fall somewhere in between**
    - Global action on emissions reduction is already happening
    - Emissions will peak this century—but not go to zero by 2100



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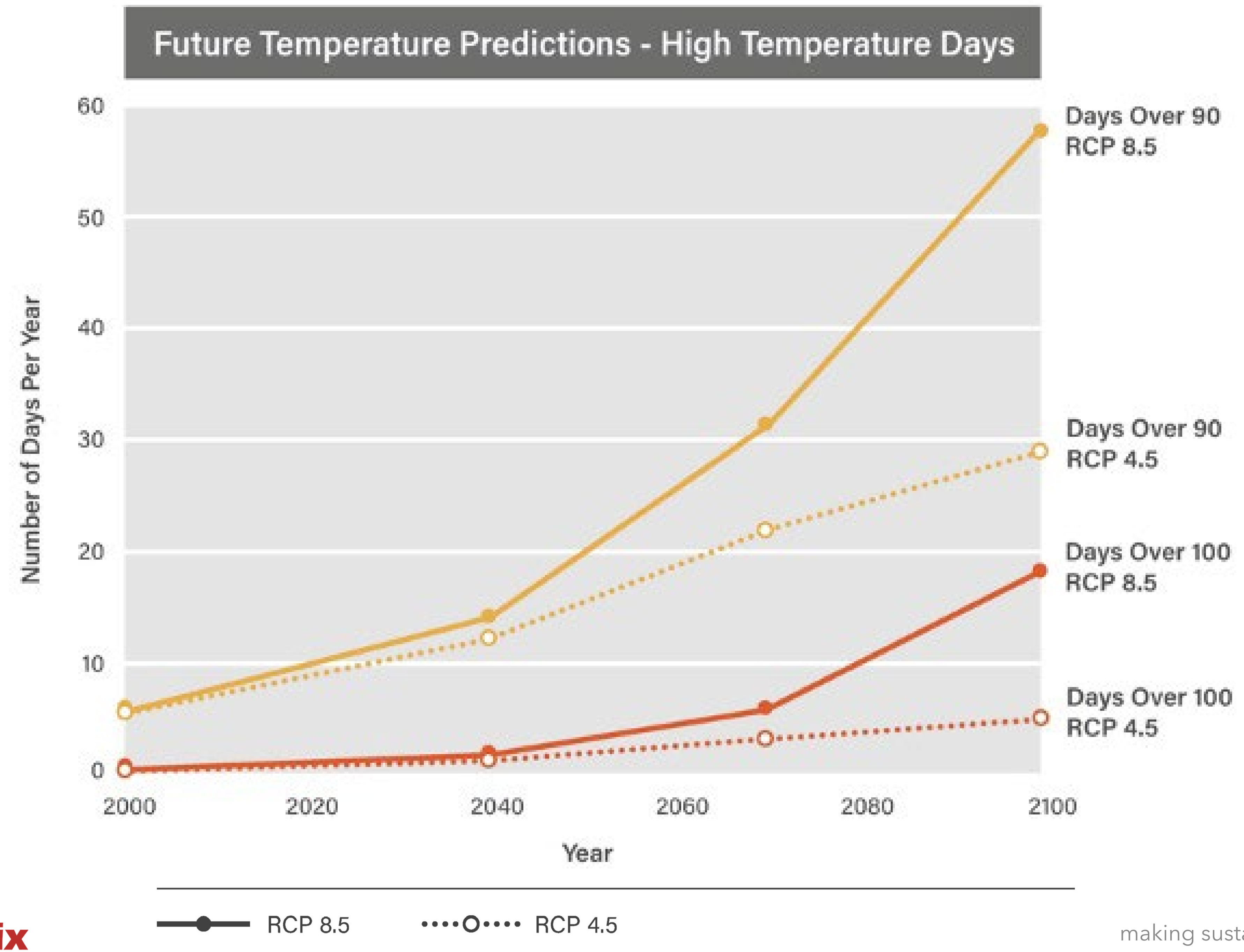
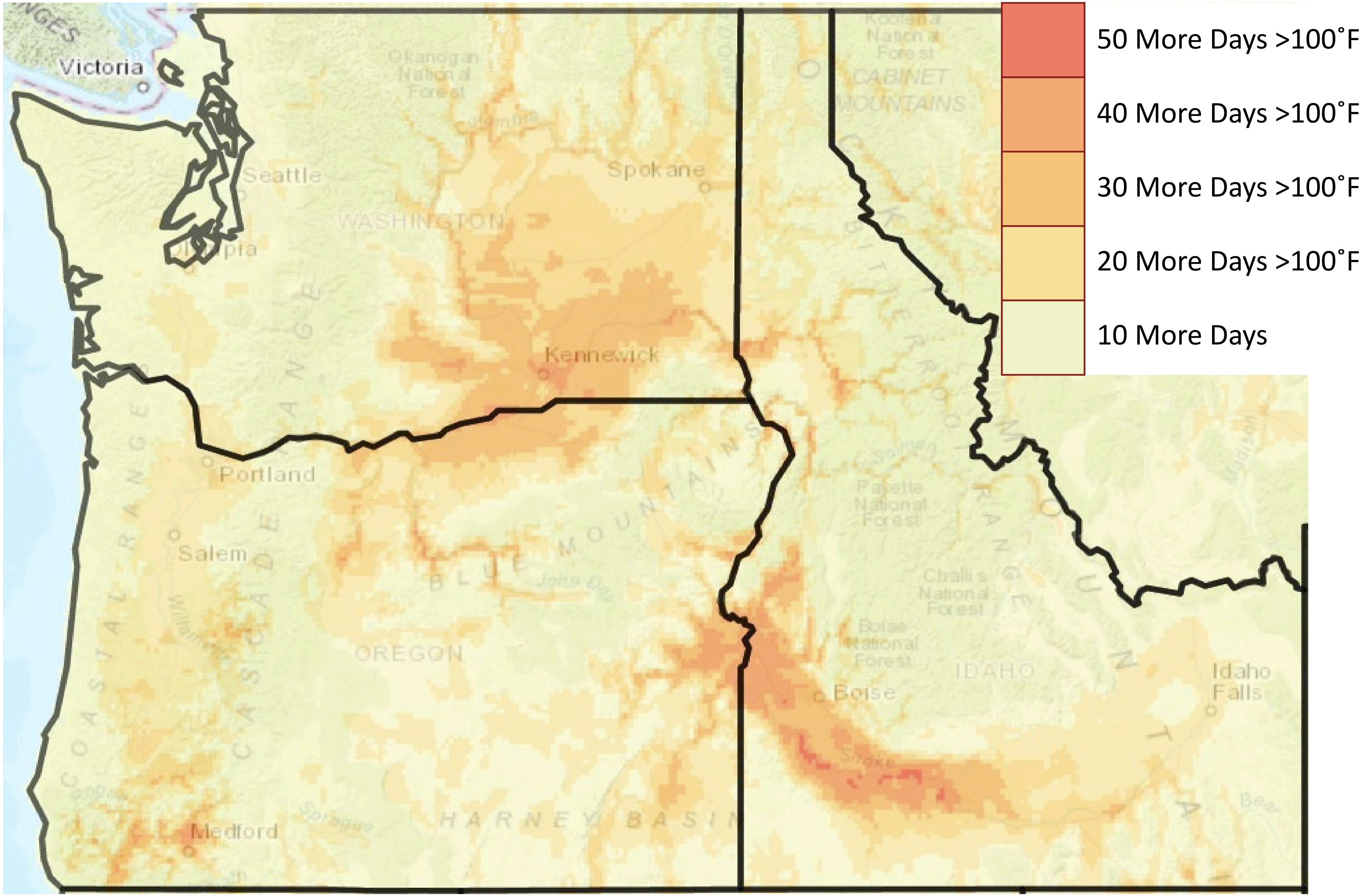
making sustainability work


Future Temperature Predictions - High Temperature Days
60
50
40
30
20
10
0
Number of Days Per Year
2000
2020
2040
2060
2080
2100
Year
Days Over 90 RCP 8.5
Days Over 90 RCP 4.5
Days Over 100 RCP 8.5
Days Over 100 RCP 4.5
RCP 8.5
RCP 4.5



50 More Days >100˚F
40 More Days >100˚F
30 More Days >100˚F
20 More Days >100˚F
10 More Days
Victoria
Seattle
Olympia
WASHINGTON
Spokane
Kennewick
Portland
Salem
OREGON
Medford
BLUE MOUNTAINS
HARNEY BASIN
CASCADE RANGE
COASTAL RANGE
Okanogan National Forest
CABINET MOUNTAINS
BITTERROOT RANGE
Payette National Forest
Challis National Forest
Boise National Forest
IDAHO
Boise
Idaho Falls

Heat Effects

Supply

- Low Flow
- Toxic Algae

Infrastructure

- Buckled Roads
- Cracked Pipes

Demand

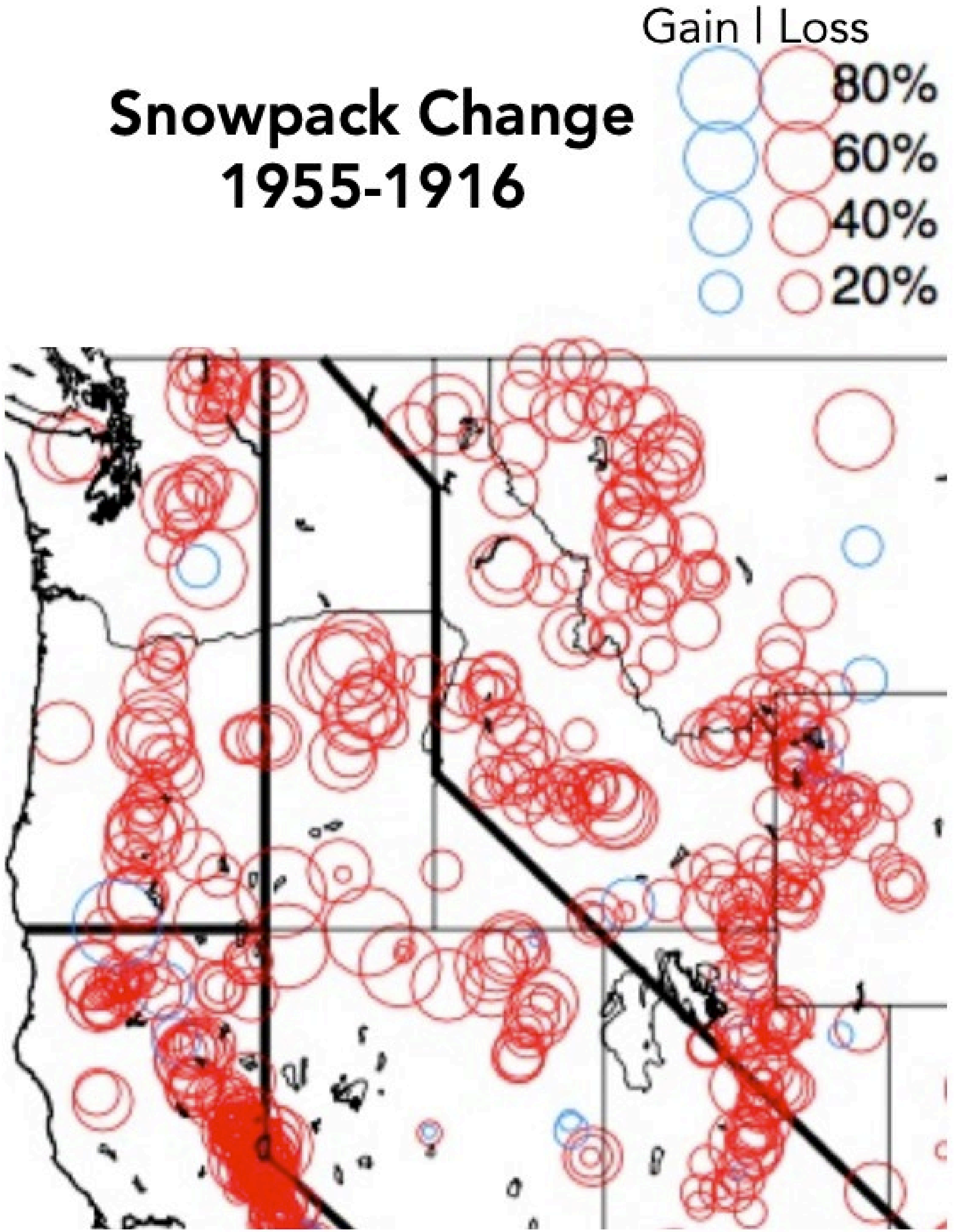
- Recreation
- Irrigation

Worker Safety

Vancouver Lake, 2020, OPB

Changes in Snowpack

- More precipitation as rain
  - Decrease in snowfall, increase in melting
- Earlier snowmelt peaks
- Lower summer flows
- Increased water temps



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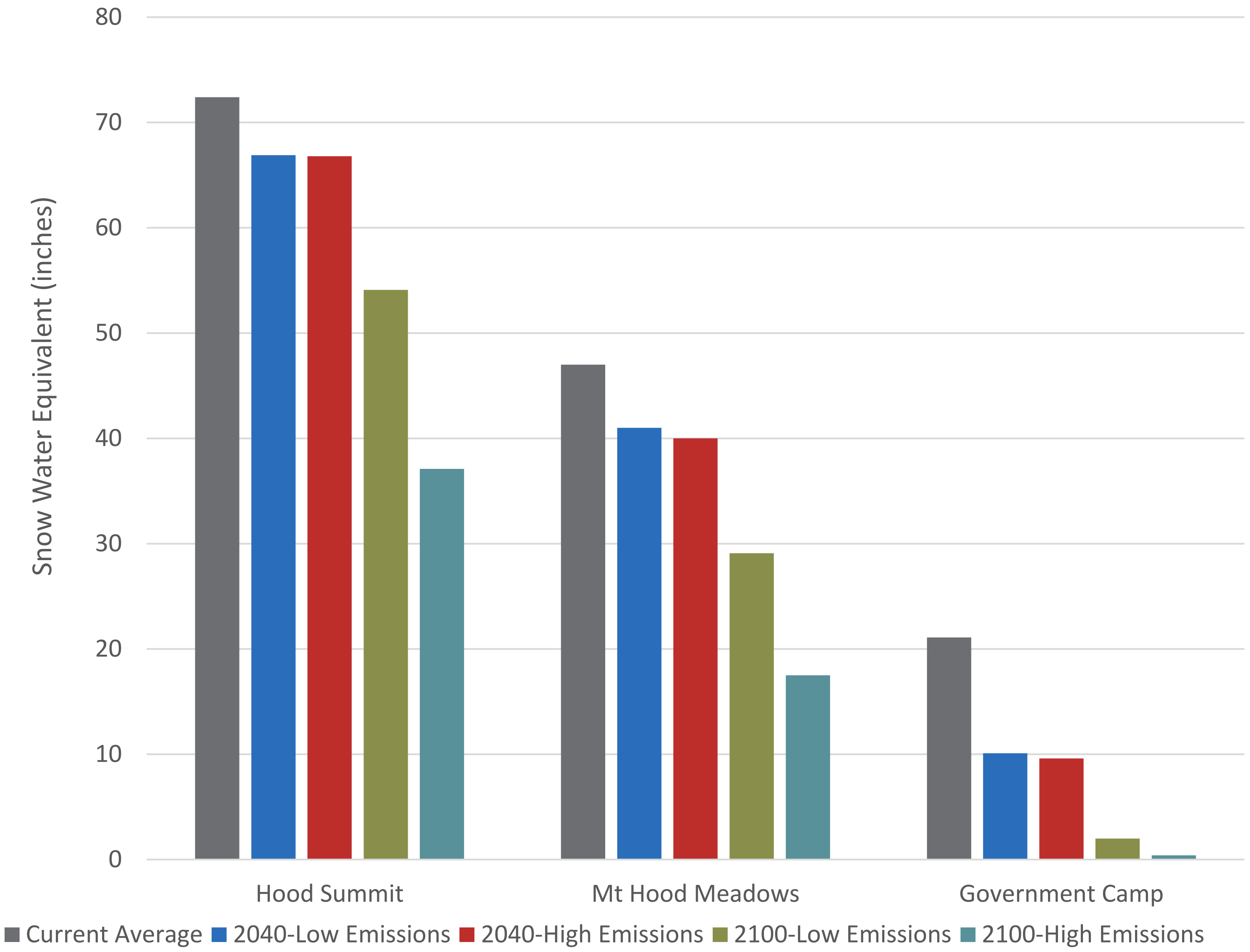

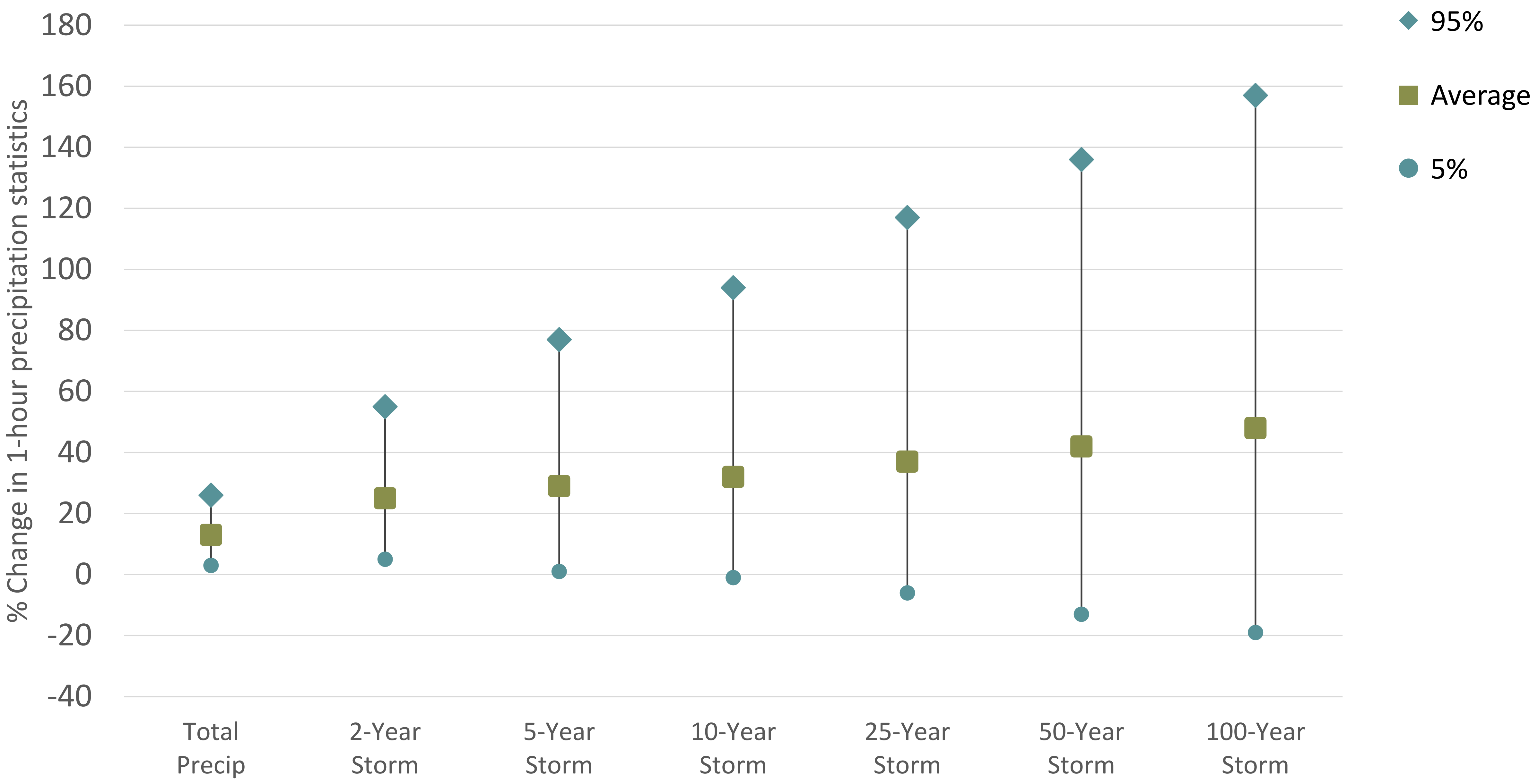

% Change in 1-hour precipitation statistics
180
160
140
120
100
80
60
40
20
0
-20
-40
Total Precip
2-Year Storm
5-Year Storm
10-Year Storm
25-Year Storm
50-Year Storm
100-Year Storm
95%
Average
5%

Storms

- Winter flooding
- Increased stormwater
- Combined sewer overflow

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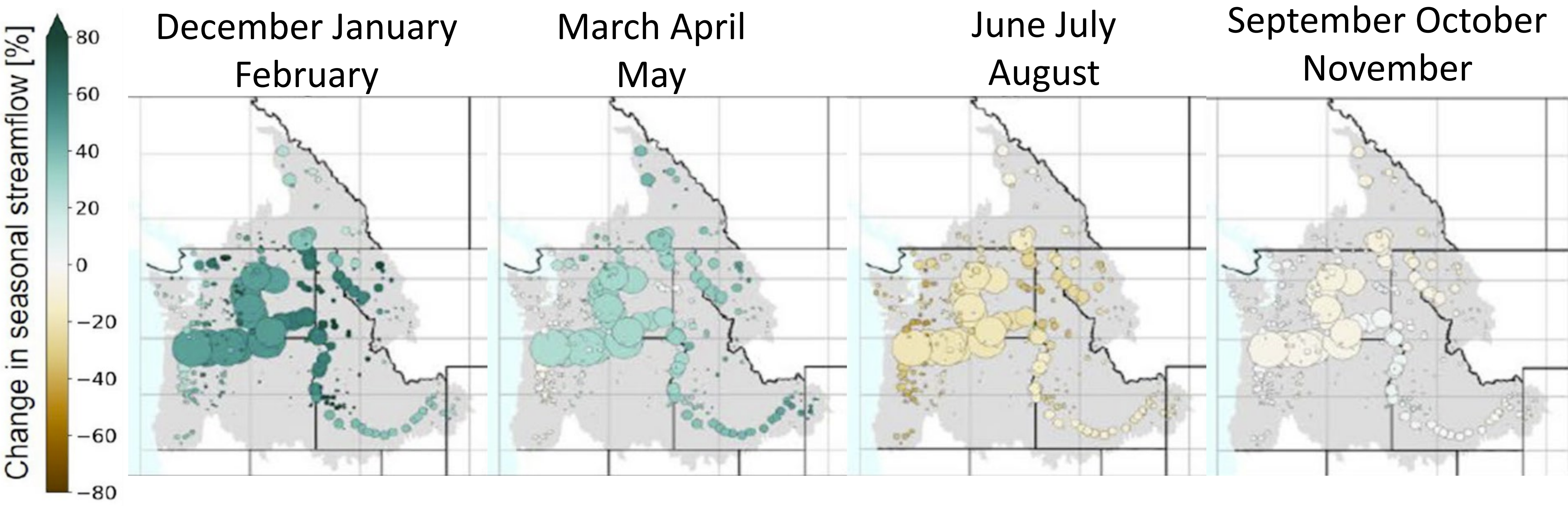
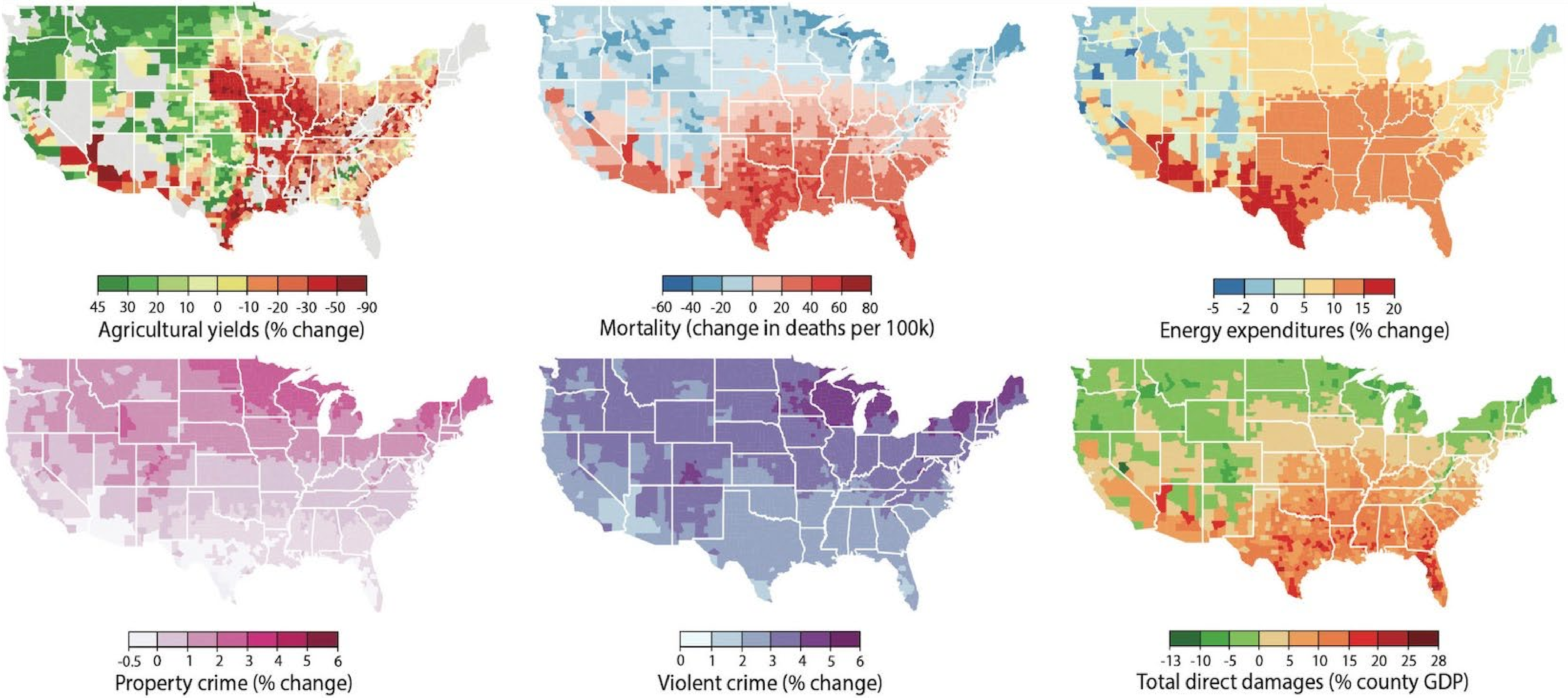
Flooding and River Levels



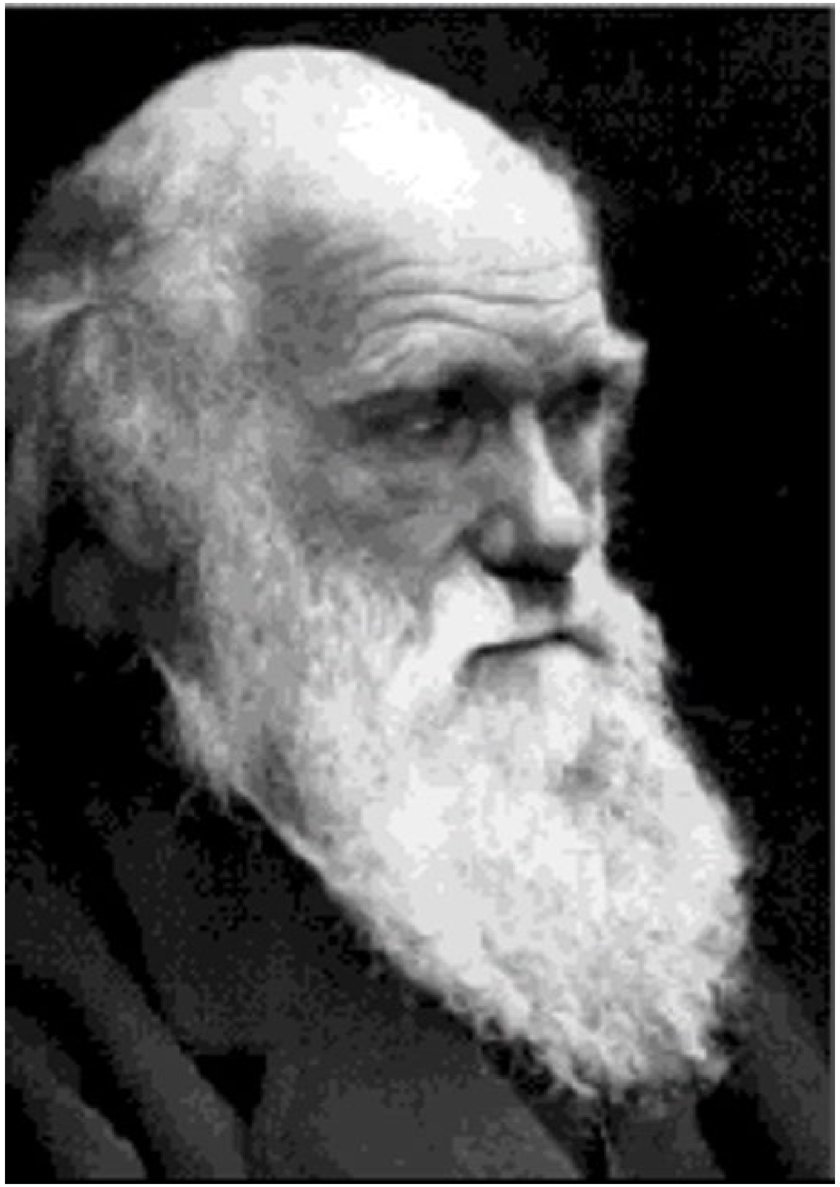
Data From ACOE RMJOC-II Part II: Reservoir Regulation and Operations—Modeling and Analyses



Hsiang, Kopp, Jina, Rising, et al. (2017)

Theory of Evolution

- Adaptation is the transformation in living organisms that allows them to live successfully in a changing environment
- Climate change presents us with a changing environment to which we must adapt



Charles Darwin

Learning Objectives

Objective 1

Discuss the use of climate science to make organizational decisions, such as capital project impacts, operational impacts and vulnerability of facilities.

Objective 2

Discuss ideas for better decision making and policy work by developing adaptive strategies to address climate impacts for the long-term

How Can an Organization Think Differently?

Knowledge to Action

Example Problem Statement

How does the change in heavy precipitation impact stormwater management approaches? (Random Acts of Adaptation)

OR

Can you manage a large capital program to the uncertainty?

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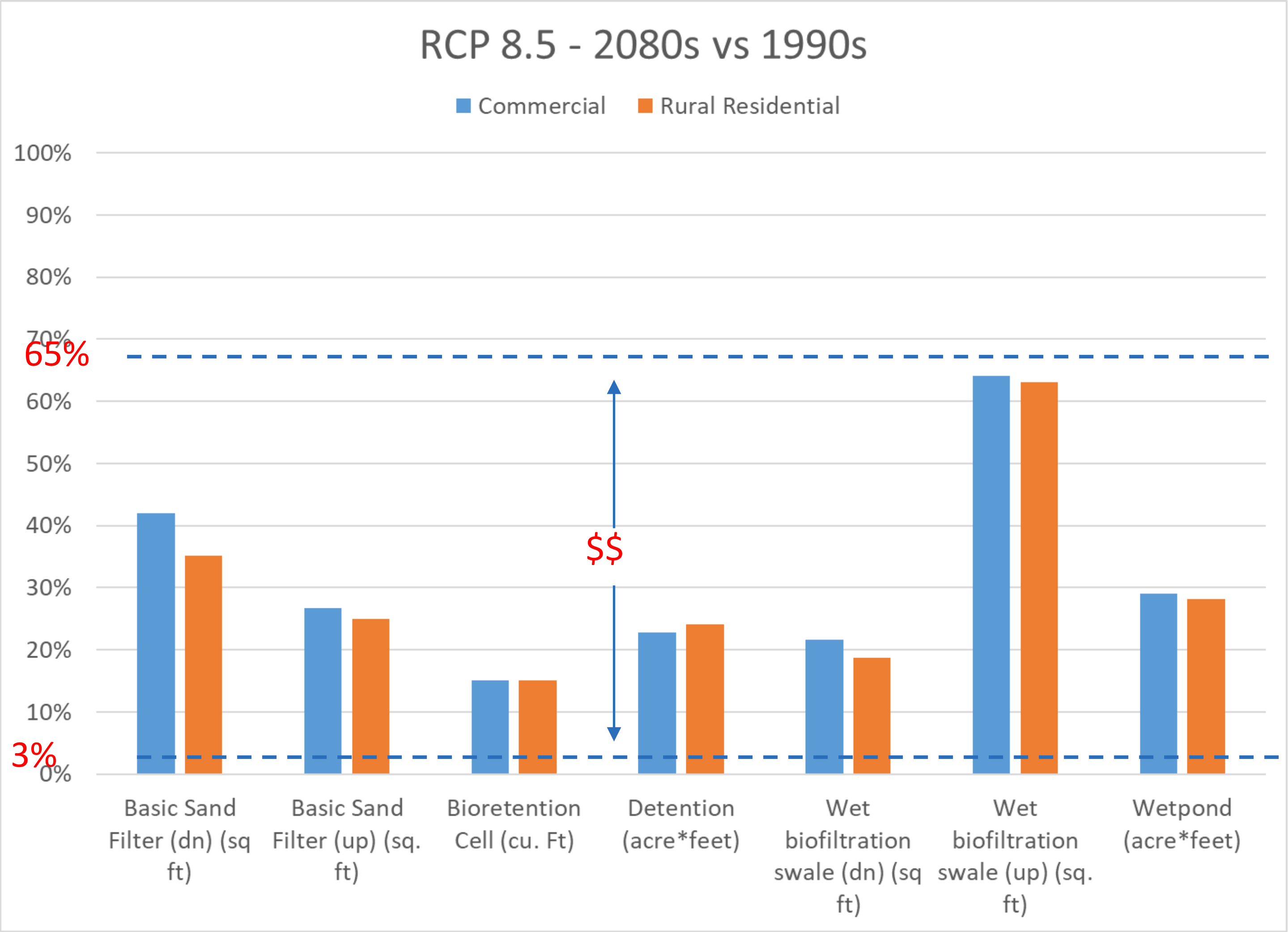
Static Climate Policy

- Does not address the uncertainty in climate model.
- How do you justify the number?



Approach to Decision Making

Challenges

- Evolving nature of climate change and uncertainty around future events
- Associated impacts to projects poses an issue for long-term decision making
- High degree of uncertainty around current understanding
- Difficult to address impacts on project delivery intended for long-term use

Approach to Decision Making

Conditions

- Scenarios representing uncertainties and how they evolve
- Different actions to handle vulnerabilities
- Pathways that sequence actions to undertake
- A construct that provides for a feedback loop and monitoring system

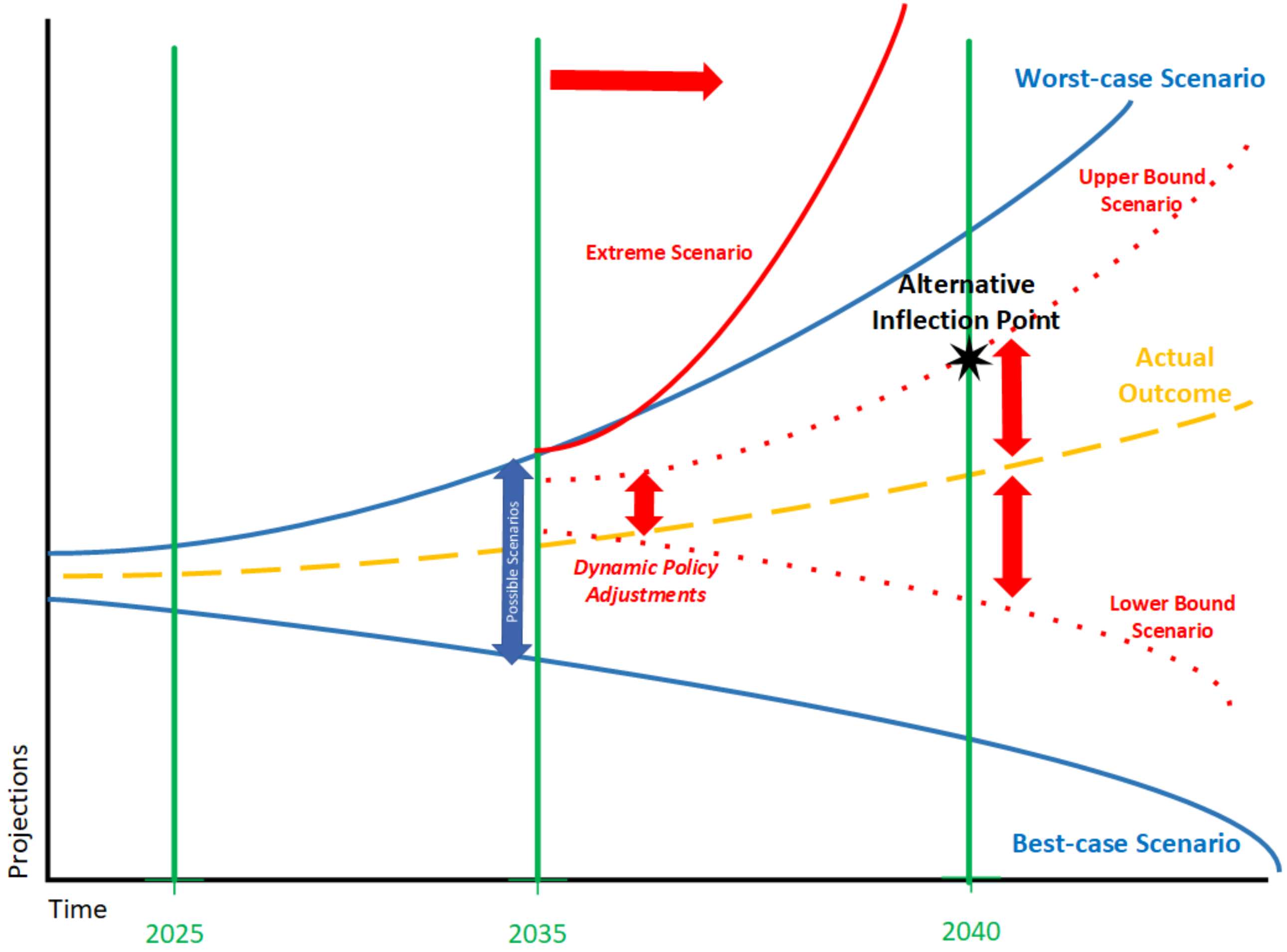
Approach to Decision Making

Dynamic Policy Model

- Establish the organization’s range of acceptable, probable outcomes
- Progressively update that policy over time
- Fluid approach to general policies
- Deviates from the traditional practices

Application of Adaptive Management Practices to Long-term Planning

- Make decisions
- Identify scenarios
- Identify the role climate has in your decision
- Be flexible and adaptive to an uncertain future



Example 1: Critical Drainage Review

- Evaluate negative consequences of a drainage system failure from any cause.
- Estimate the risks and threats
- Appropriate level of analysis to mitigate risks and improve resiliency

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Example 2: Beyond 30-years Flood Planning

- Consider adaptive management with critical social or physical infrastructure.
- Reevaluate criticality at each update
- Fund or recommend further studies to reduce the uncertainty

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Thank You

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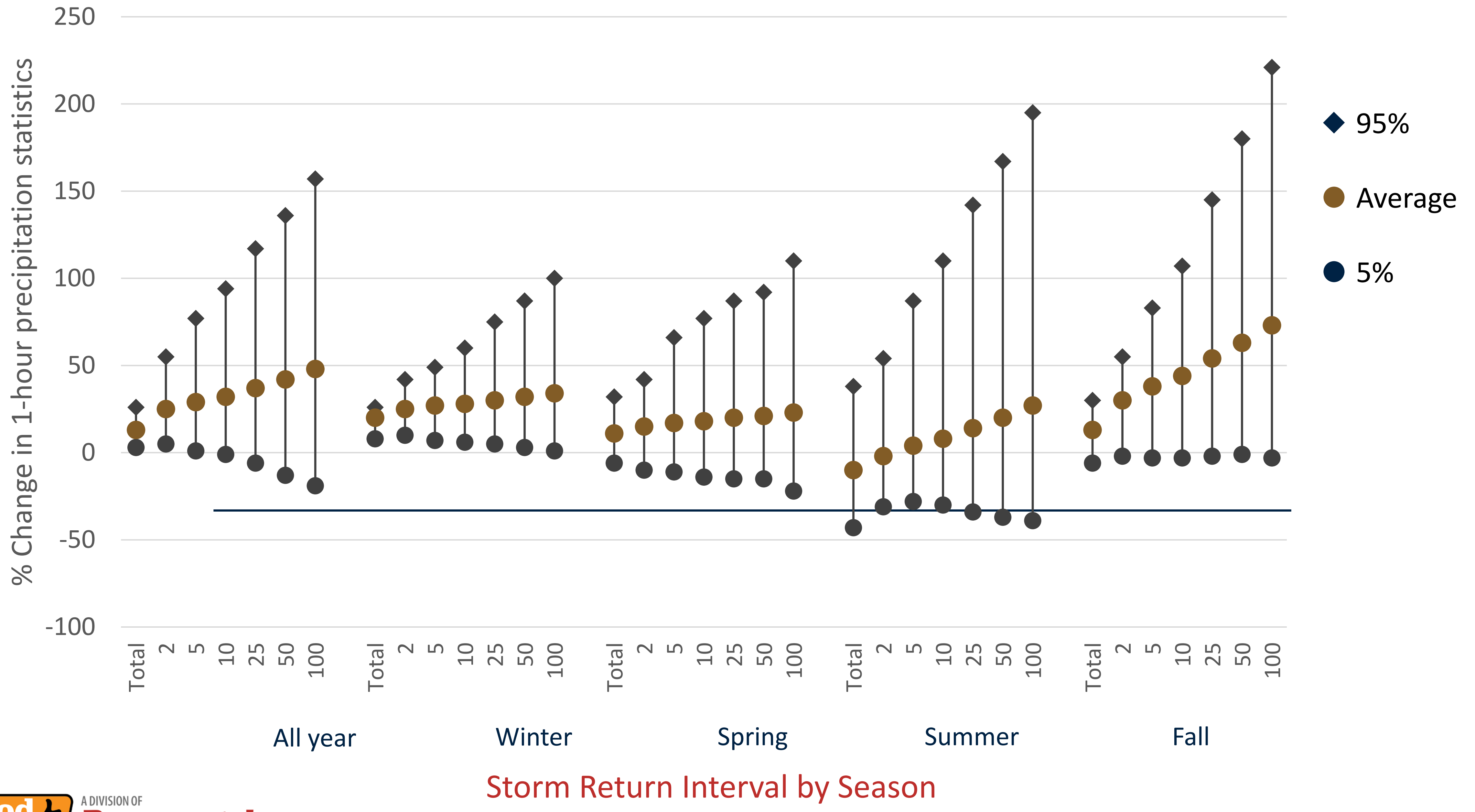
Storms



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