Managing Minnesota's Climate Risks

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Managing climate ***risks*** can result in ***resiliency*** of our infrastructure, environment and social systems.

- Our capital investments are, and will continue to be, ***impacted*** by climate extremes.
- Our ***exposure*** to these extremes is, in part, a function of our ***preparedness***.
- The choice today is whether we will be ***proactive*** or ***reactive***.

Change is here.

Average global temperature has increased over 2.0ºF since the 1880's.

Photo: NASA Data: NASA, 2021

Change is *here*.

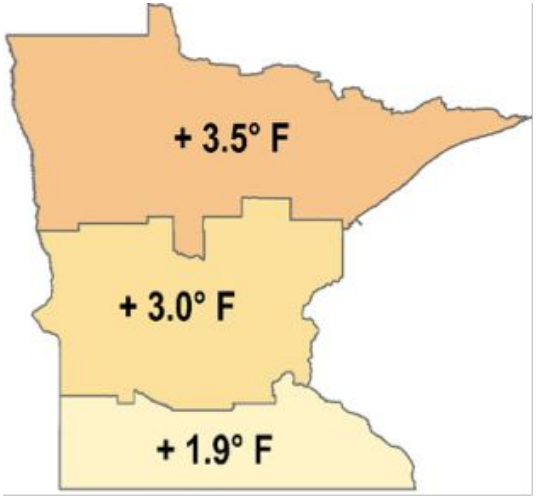
Minnesota’s average annual temperature has increased by nearly 3°F since 1895.

Data: MN DNR State Climate Office

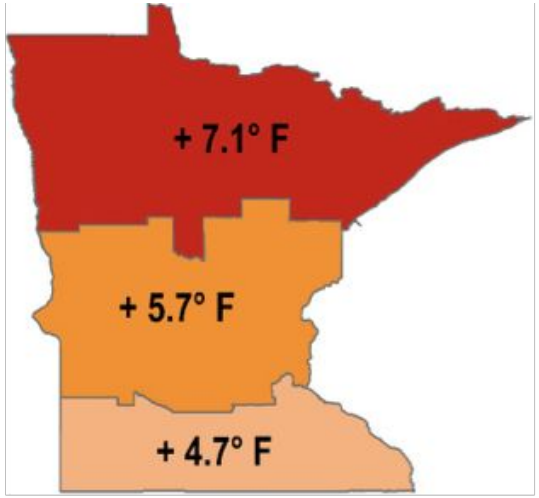
In Minnesota, we are observing change at different rates and scales.

Minnesota is warming.
Our winters are warming fastest.

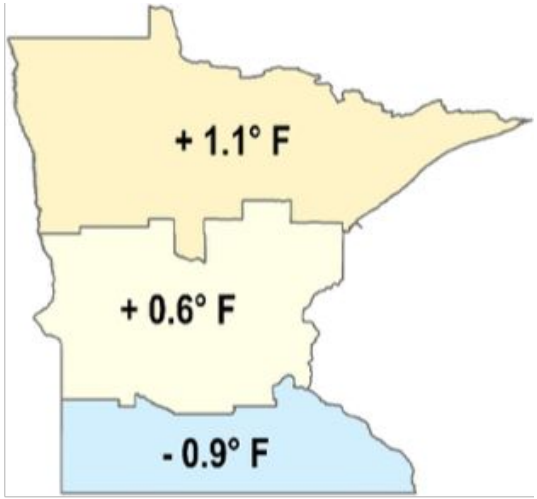
Total Temperature Change 1895- 2019



Annual average temperature change



Change in winter low temperatures

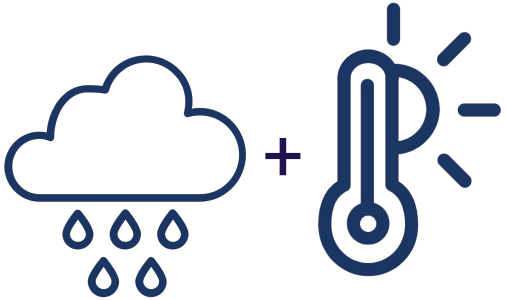


Change in summer high temperatures

Source: MN DNR State Climate Office

Average annual precipitation is increasing.

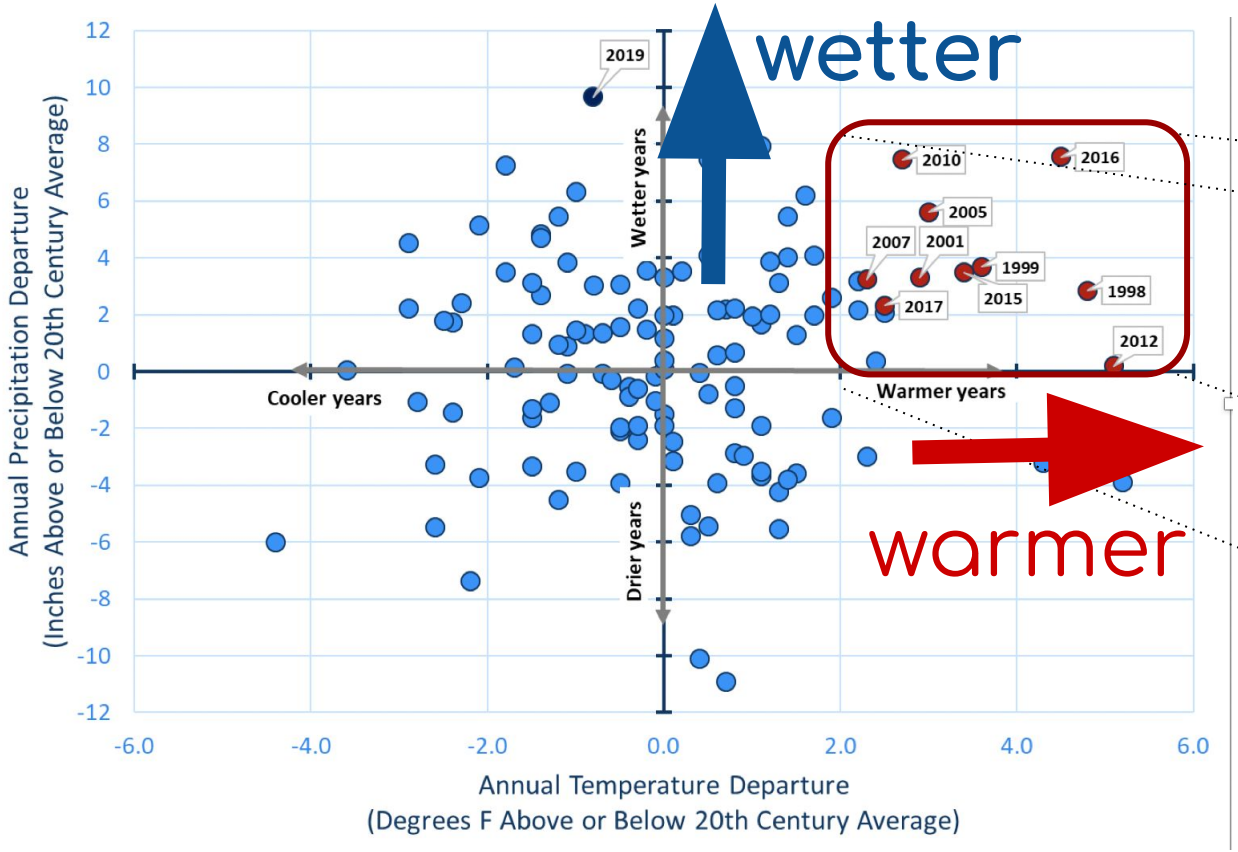
MN is experiencing more frequent & heavy downpours.



Shifting to warmer, wetter conditions.

Data: MN DNR State Climate Office

Minnesota is getting warmer & wetter



10 combined wettest & warmest years on record all occurred **after 1997.**

Data: MN DNR State Climate Office

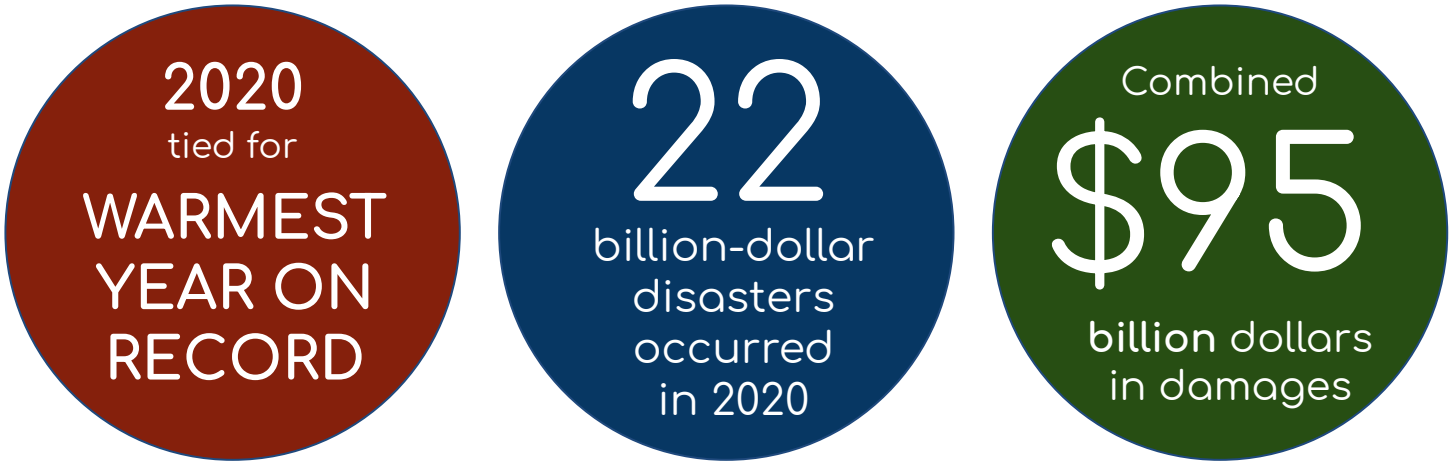
Increasing precipitation has elevated overall flood risk, causing disruption to transportation and damage to property and infrastructure across the Midwest.

Source: Angel et al., 2018; Winters et al., 2015

We are incurring costs from these changes *today.*

“2020 was a historic year of extremes.”

- NOAA National Centers for Environmental Information



Data: NASA, 2021; NOAA NCEI, 2021

Both observations & future projections indicate increases in very heavy precipitation.

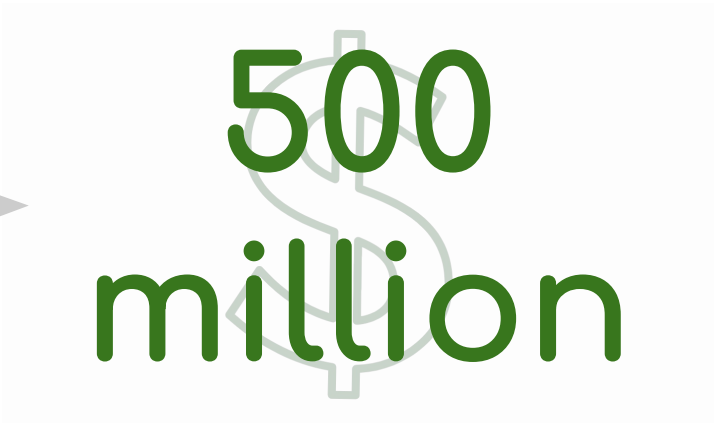
Data: NCA, 2018; Photo: H. Roop

These costs are projected to increase in the future.

Winter & **spring** precipitation are projected to increase

by the end of this century

Average **annual** damages from increased flood risk in the Midwest are projected to exceed



by 2050
(in 2015 dollars)

Data: Angel et al., 2018

AVERAGE WINTER MINIMUM TEMPERATURE IS PROJECTED TO BE NEARLY 10°F WARMER BY MID-CENTURY

Relative to 1981-2010 for 2050-2075 | MN Department of Health

MINNESOTA IS PROJECTED TO EXPERIENCE 5 to 15 MORE DAYS PER SUMMER WITH MAXIMUM TEMPERATURES ABOVE 95°F BY MID-CENTURY

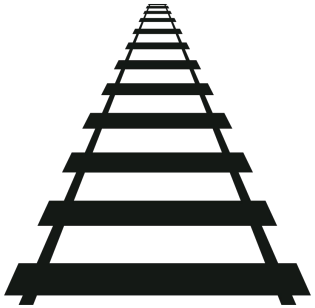
Timeframe: 2041-2070 | Data: Pryor et al., 2014

Extreme heat creates material stress on roads and buildings, bridge expansion joints, water infrastructure and railroad tracks.

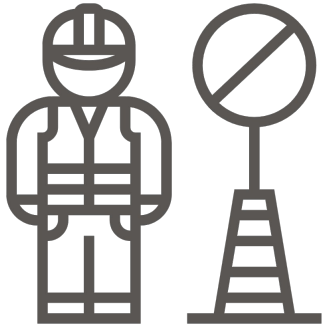
Data: Angel et al., 2018; EPA; WUCA, 2020

The EPA estimates that higher temperatures at the end of the century associated with unmitigated climate change would result in approximately:

$6 billion *annually* in added road maintenance costs
(in 2015 dollars)

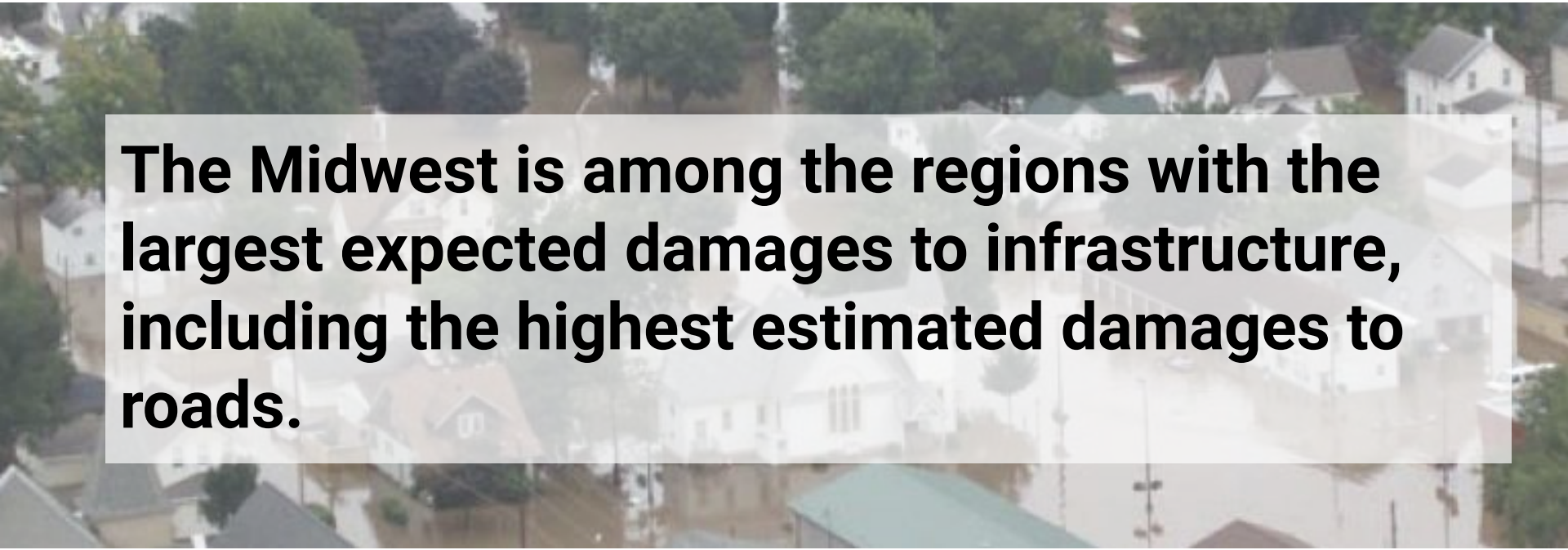


$1 billion *annually* in impacts to rail transportation maintenance costs
(in 2015 dollars)



$33 billion *annually* in losses in labor and associated economic revenue
(in 2015 dollars)

Data: Angel et al., 2018; EPA, 2017



The Midwest is among the regions with the largest expected damages to infrastructure, including the highest estimated damages to roads.

Data: Angel, 2018; EPA, 2017; Photo: Flooding in Rushford, MN 8/07; courtesy of MN DNR Floodplain Program

Climate extremes are costly.

Our exposure to these impacts is largely dependent upon how well we **understand** and **manage** them.

How we experience these extremes depends on:

+

=

Climate-ready communities, infrastructure & economies

How well we **prevent** further warming *(mitigation)*

How well we **prepare** for the changes we've set in motion *(adaptation)*

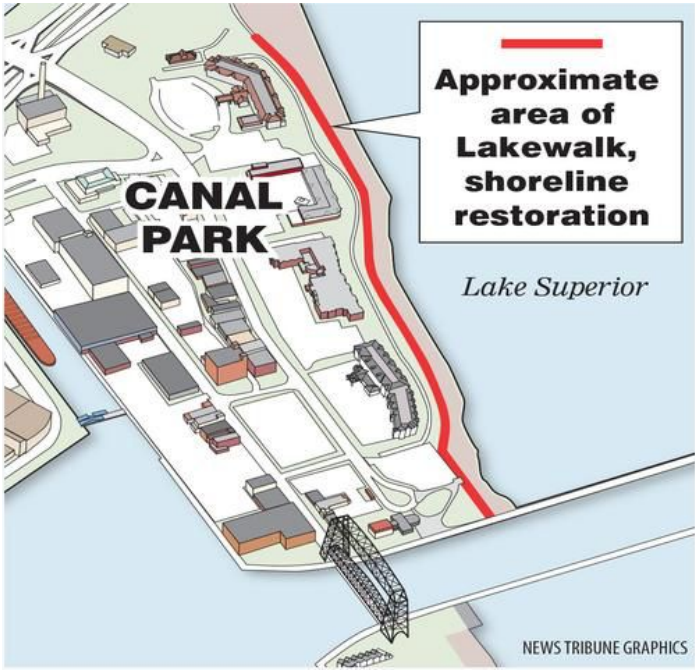
For each dollar **invested in natural hazard mitigation**, governments can save between $6 - $12.

Data: National Institute of Building Sciences, 2019; Photos: CIG with aerial support from LightHawk

Shifting Our Stance

Building resilience requires a shift from being *reactive* to *proactive*.

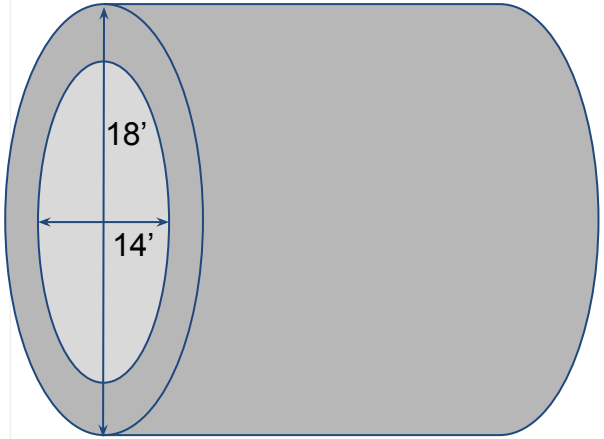
Reactive: fixing climate damage



Duluth News Tribune

Oct. 30, 2017. Bob King / Forum News Service

Proactive: change planned design specs



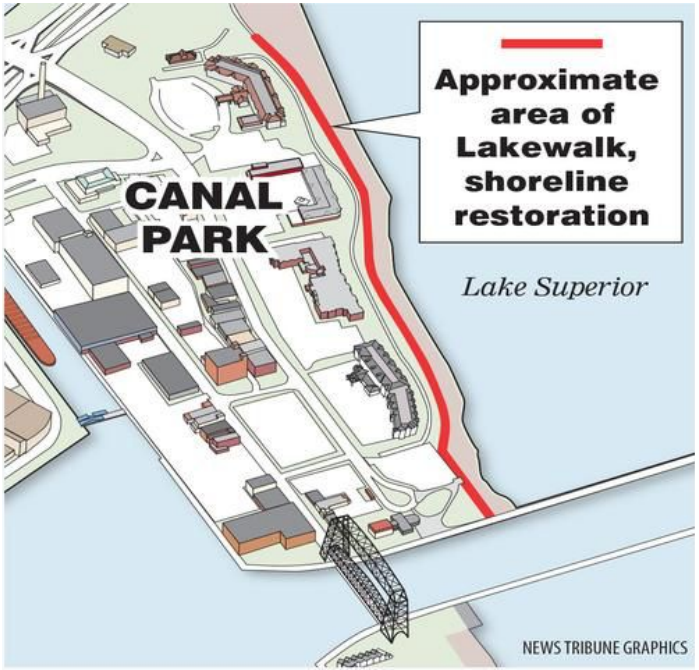
Ship Canal Water Quality Project, Seattle, WA

Seattle Public Utilities

Proactive: change planned design specs

Mercy Joplin Hospital
Joplin, MO

Reactive → proactive?



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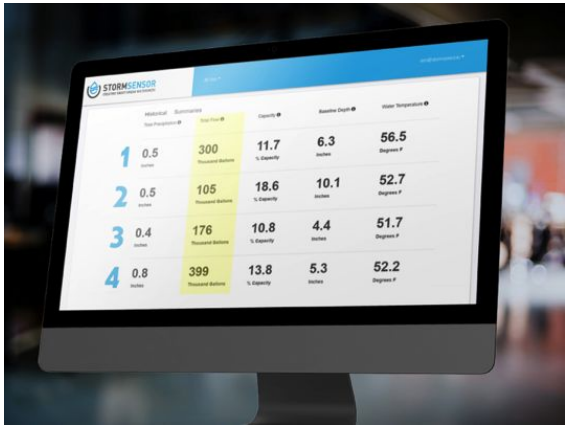
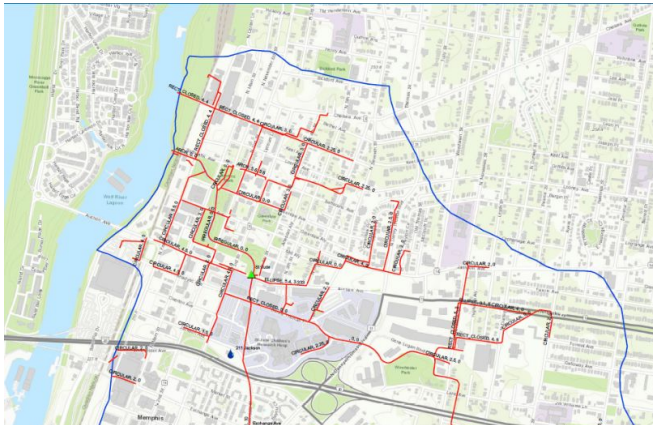
Strategies

- Rebuild (*reactive*)
- Build for resistance or resilience (*proactive*)
- Retreat
- Change expectations (e.g., for maintenance or useful life)
- “Smart” for enhanced system management
- Alternatives to built infrastructure (e.g., nature-based solutions)

System management





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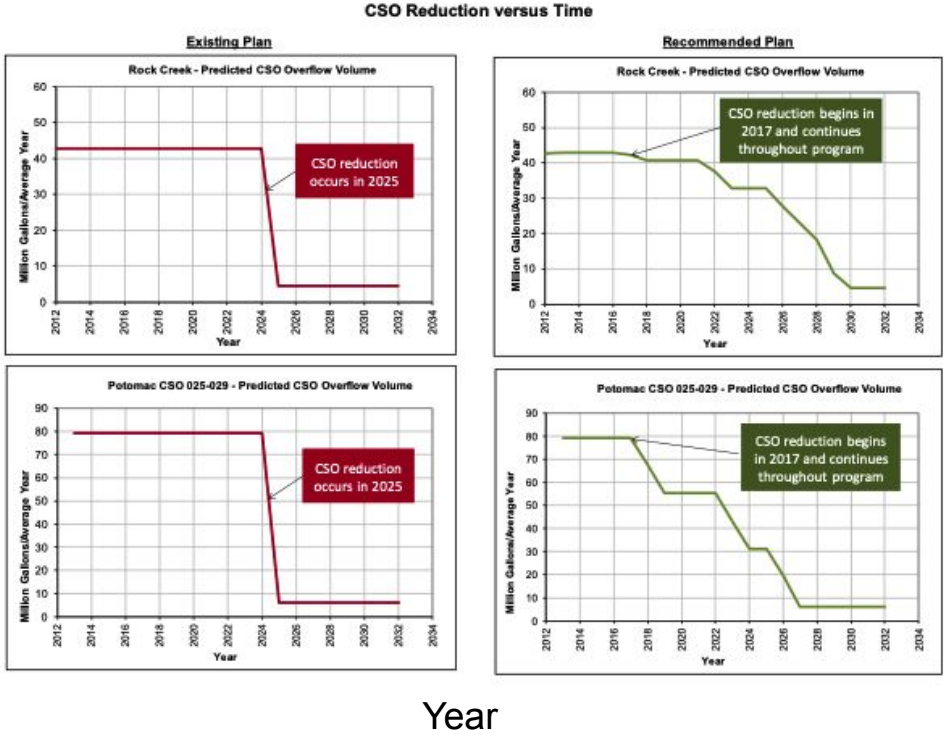
Green infrastructure



Aaron Volkening / Flickr

wolfpaving.com

District of Columbia, Water & Sewer Authority 2015

Consequences of *in*action

- Public needs or services diminished
- Projects require upgrades, replacement, higher maintenance or insurance costs
- Decreased rating for state issued bonds

20 Dec 2017
Moody's

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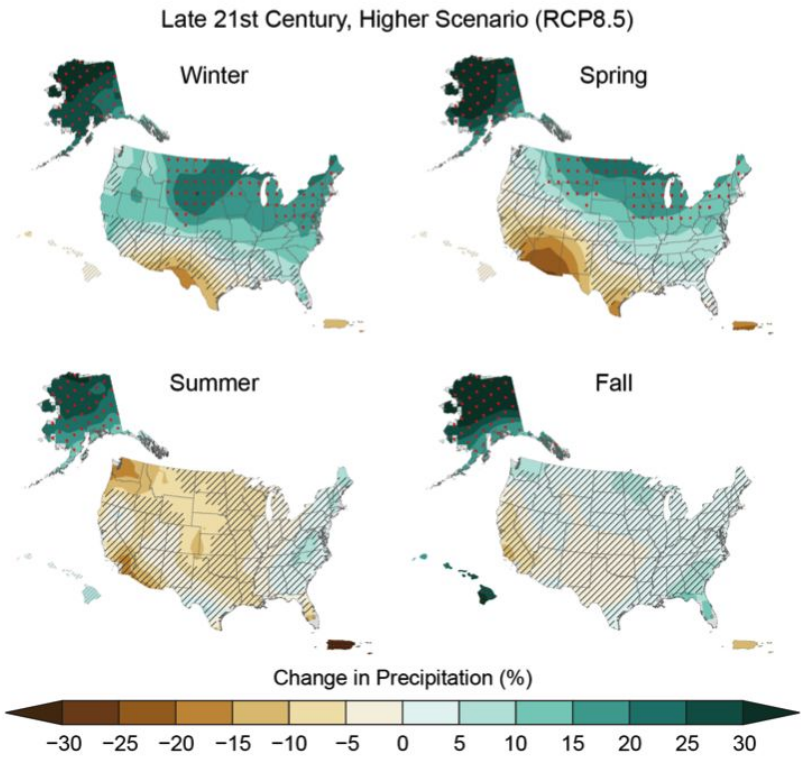
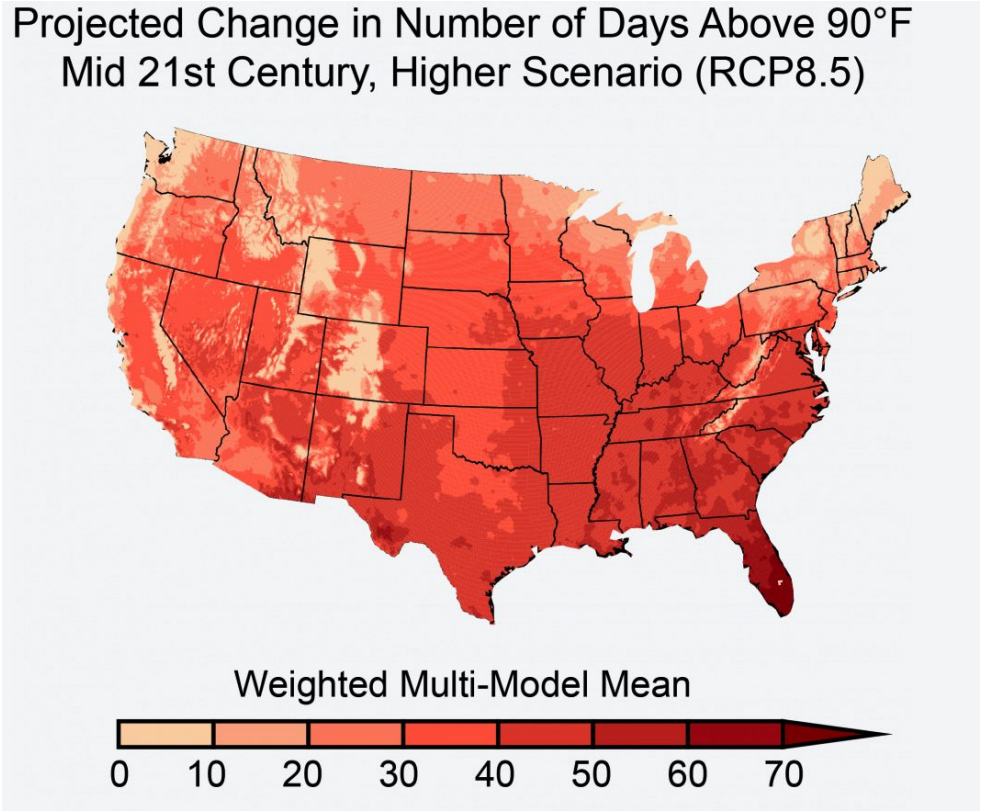
Article

Moody's announces decision to assess climate change risks in evaluating government creditworthiness

Positioning our state

- evolving landscape of federal assistance
  - FEMA Building Resilient Infrastructure & Communities
- indirect effects of a changing climate


Late 21st Century, Higher Scenario (RCP8.5)
Winter
Spring
Summer
Fall
Change in Precipitation (%)
−30 −25 −20 −15 −10 −5 0 5 10 15 20 25 30


Projected Change in Number of Days Above 90°F
Mid 21st Century, Higher Scenario (RCP8.5)
Weighted Multi-Model Mean
0 10 20 30 40 50 60 70

Recommendations

- Expect risk & resiliency are the “new normal”
  - w/ new monitoring and baselining
- Require the future be considered
  - with projections or scenarios
  - guard against bond rate downgrading
- Encourage climate resilient design standards
  - allow flexibility in building standards
  - make projects & processes “adaptive”
  - in professional standards

Recommendations

- Make best use of limited resources
  - Use climate in priority-setting
  - Consider non-capital approaches
  - Be competitive for Federal grants and programs
  - Creative ways to increase resources (e.g., “infrastructure bank”)

- Learn from other states and regions

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