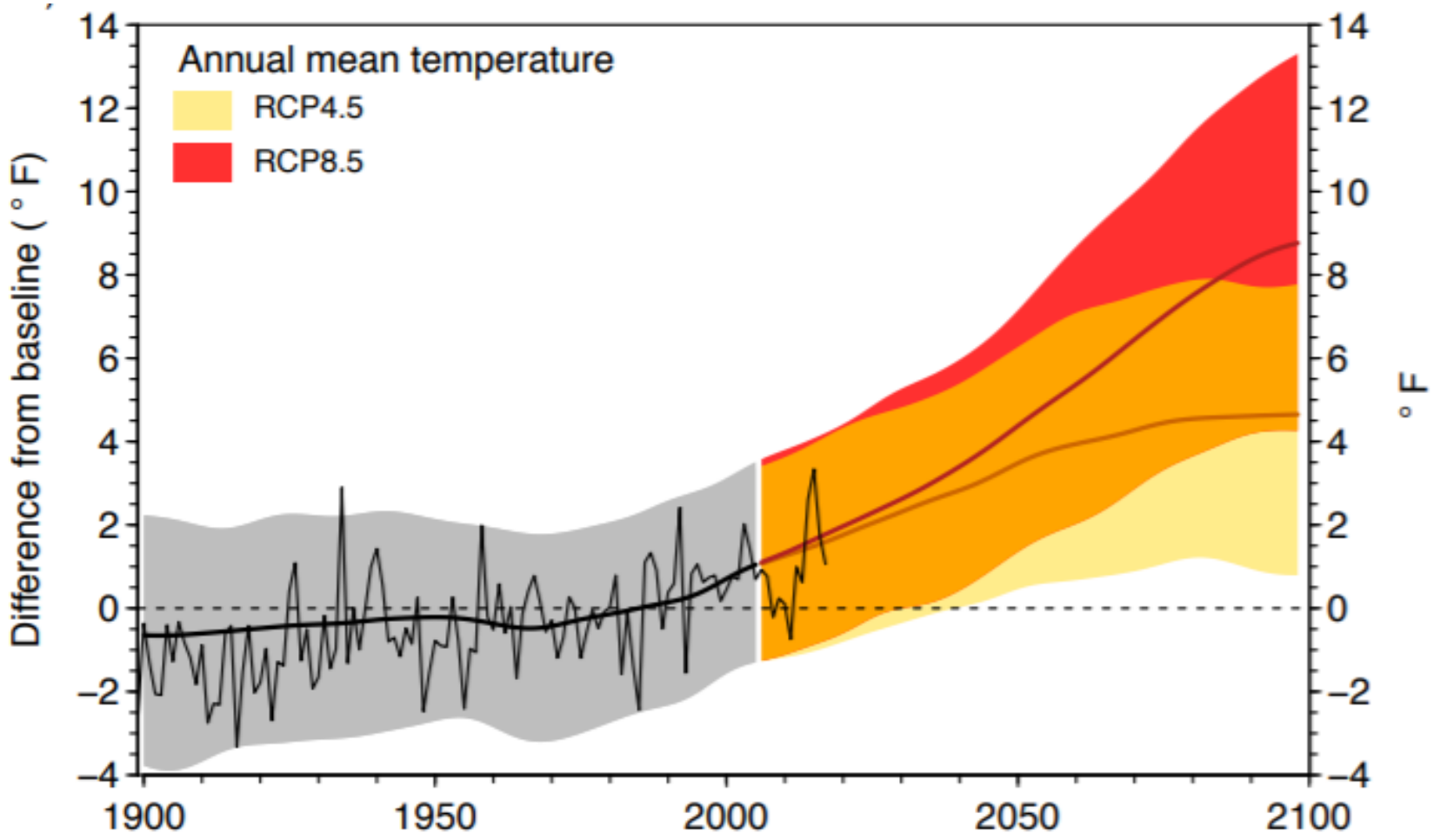
Multi-Bureau Efforts: Climate Change Adaptation and Preparation

- Michele Crim – BPS
- Kavita Heyn – Water Bureau
- Nishant Parulekar – BES
- Ericka Koss – BDS
- Jenn Cairo – PP&R
- Jonna Papaefthimiou – PBEM

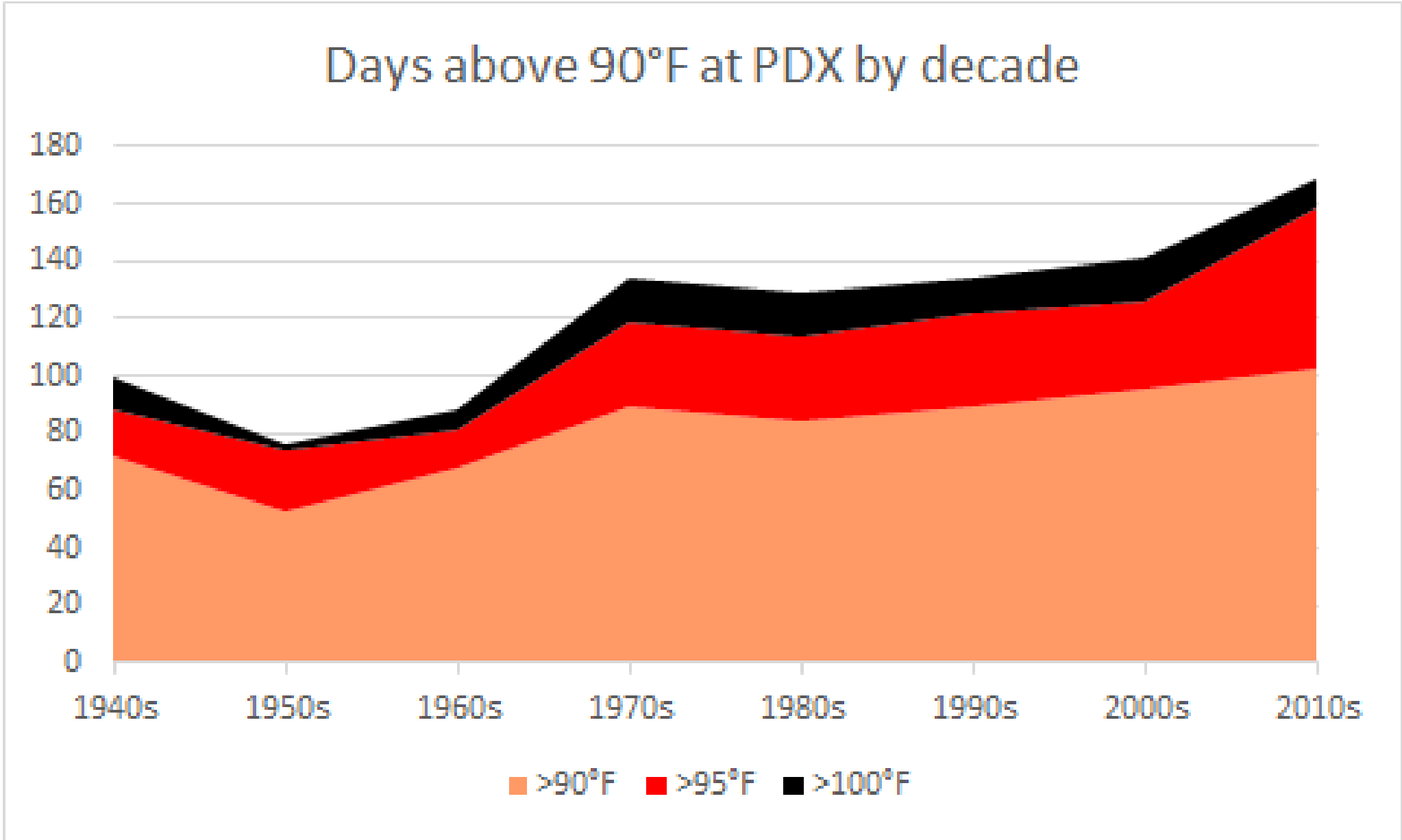
Climate impacts:

Portland's future climate will be warmer than its past, leading to...



OCCRI: Fourth Oregon Climate Assessment, 2019

…an increase in the number of high heat days

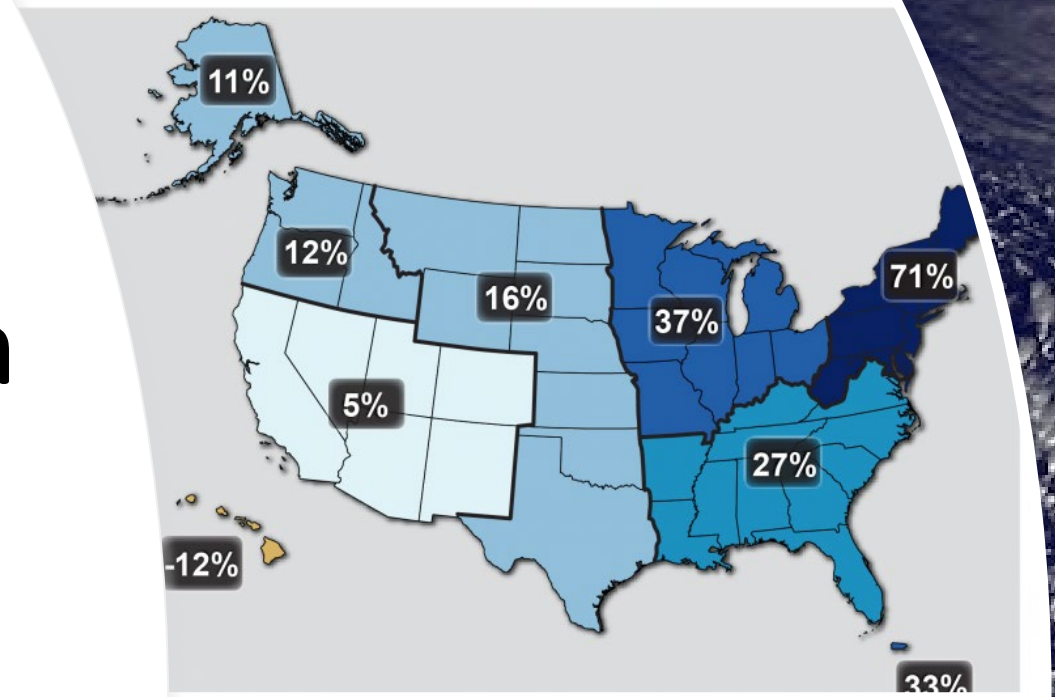


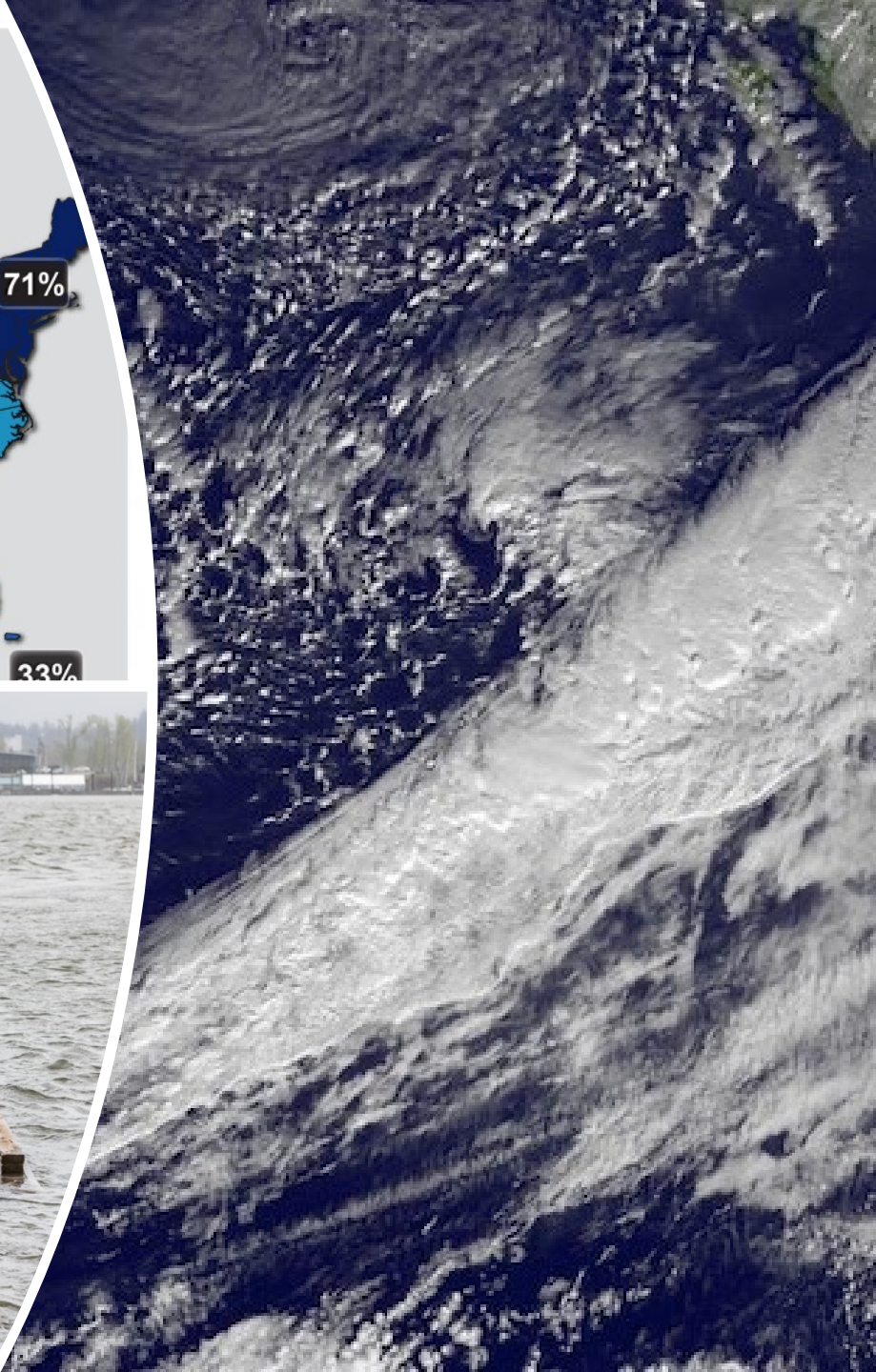
Data: NOAA PDX weather station;

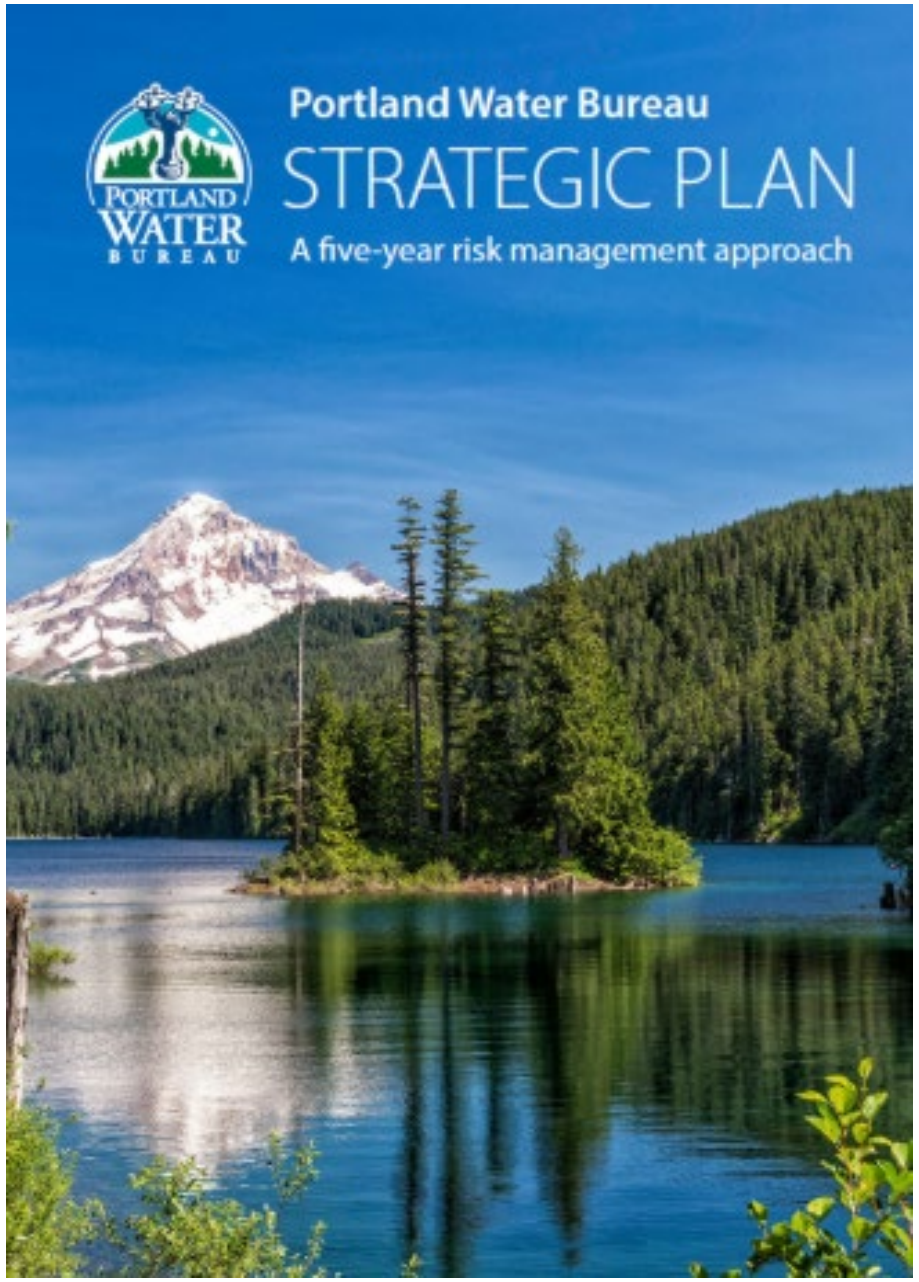
Graphic: Portland Water Bureau

…greater risk of drought, wildfires and smoke waves

...and a shift in intensity of the water cycle (rainfall, snowfall, and flooding).





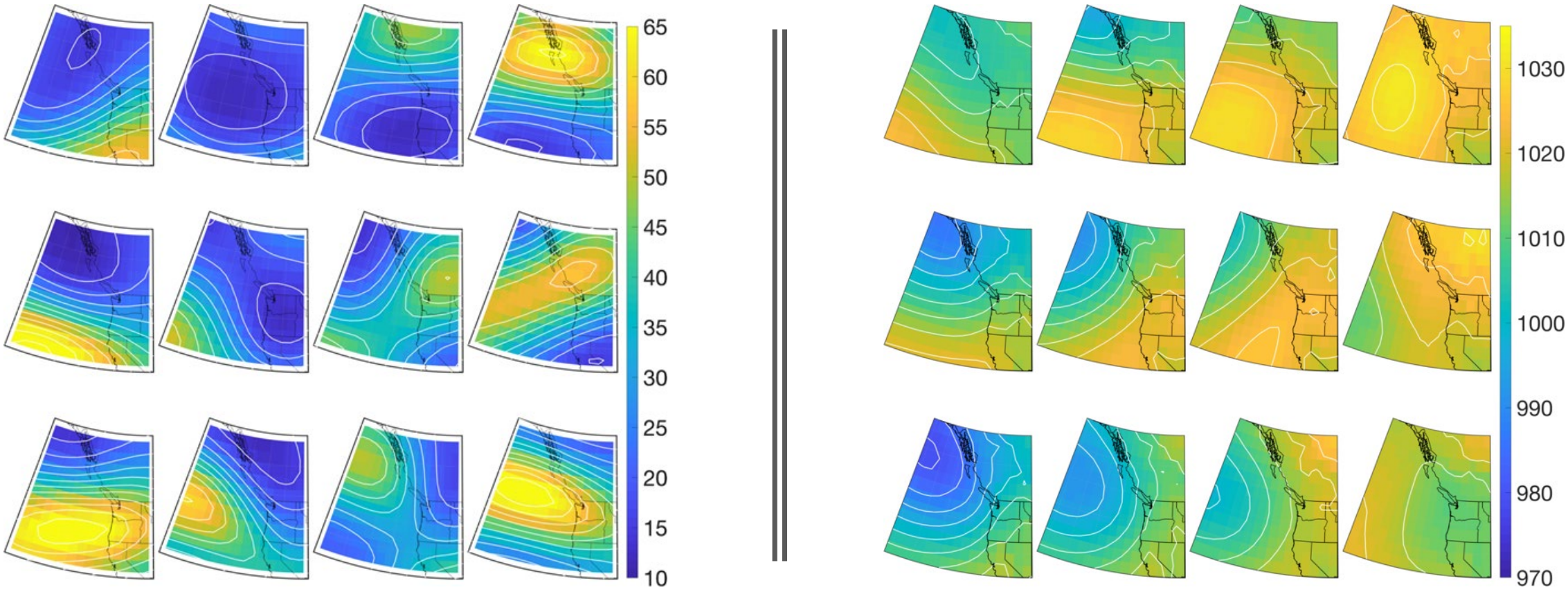


WUCA
Water Utility Climate Alliance

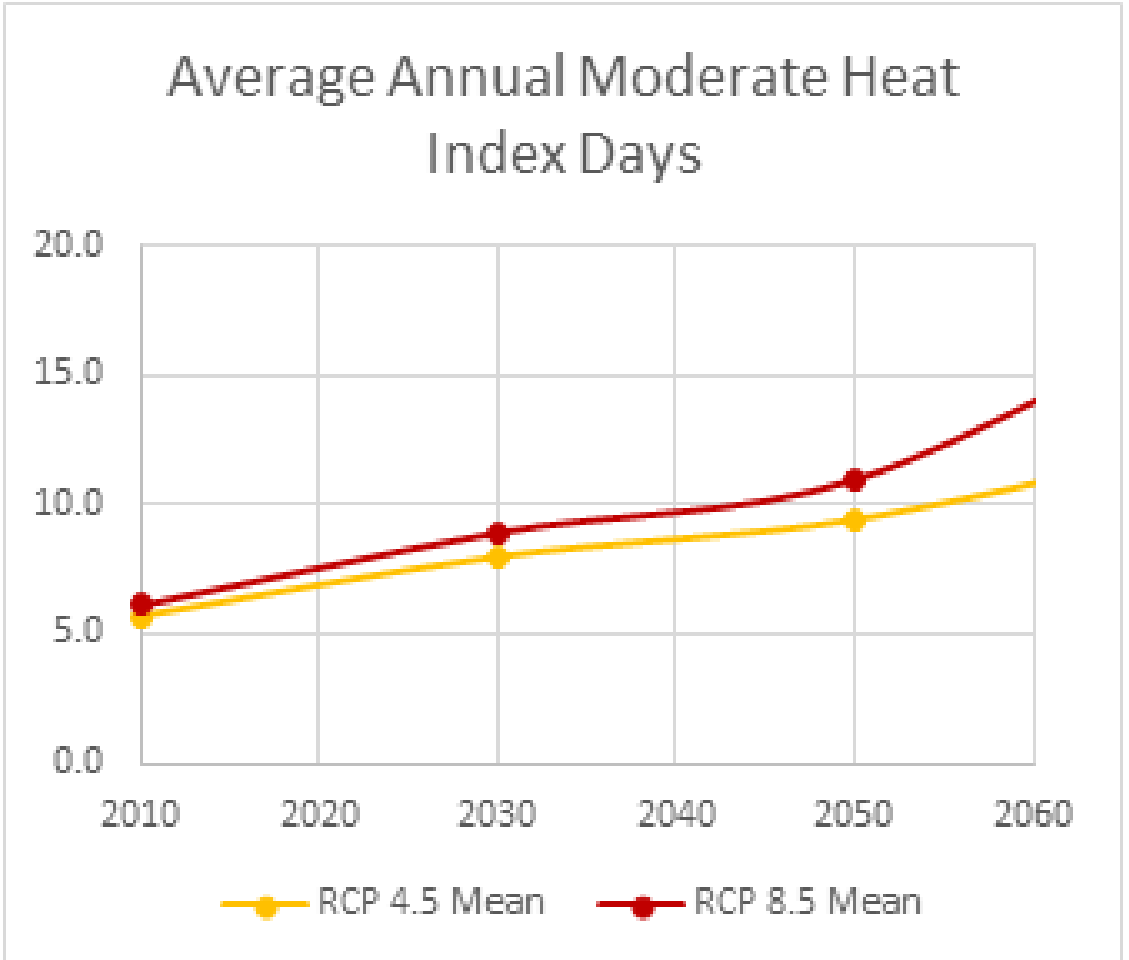
Portland Water Bureau climate adaptation:

Plan for a range of future conditions, build adaptive capacity & consider equity

PWB: Using self-organizing maps to assess future extreme storms & dry weather systems (with P. Loikith & PSU Climate Science Lab)



PWB: Evaluating heat impacts to the outdoor workforce and infrastructure (with the Water Utility Climate Alliance)



BES Climate Adaptation

- **Rainfall changes**
- **Flooding risks**
- **Other Impacts**
  - Vegetation impacts
  - Urban heat
  - Landslides and erosion
  - Water quality and discharge standards

Video: Dave Whitaker 12/7/2015

Photo: The Oregonian 3/15/2017

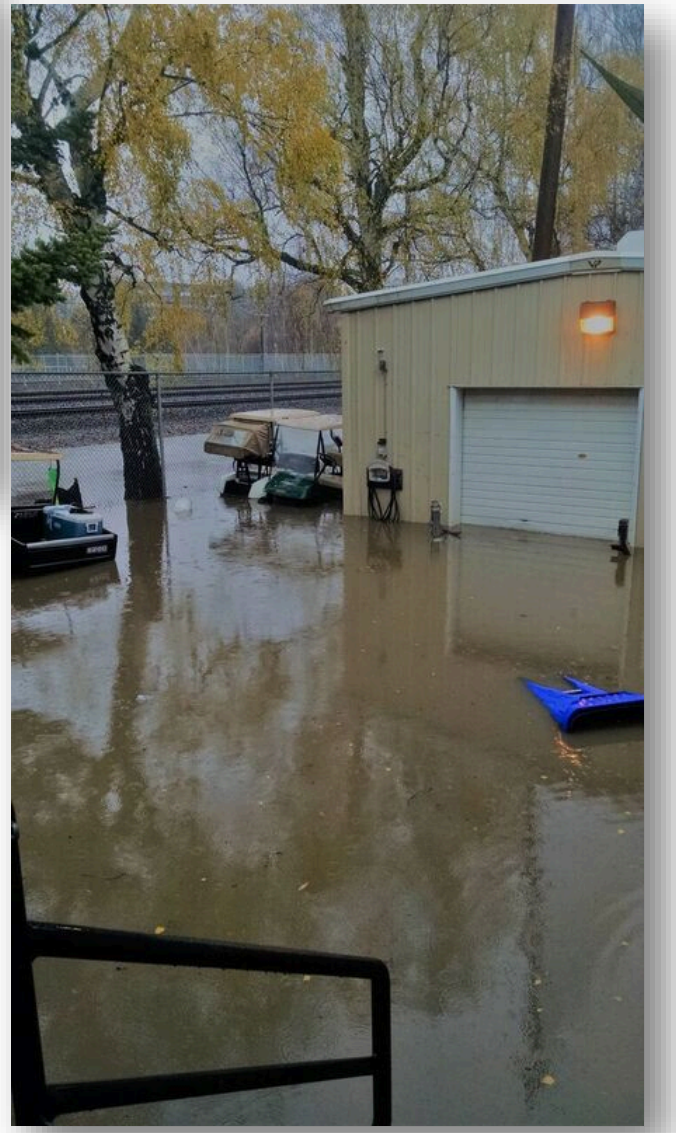


Photo: Isaac Gardener 3/14/2017

BES Climate Adaptation

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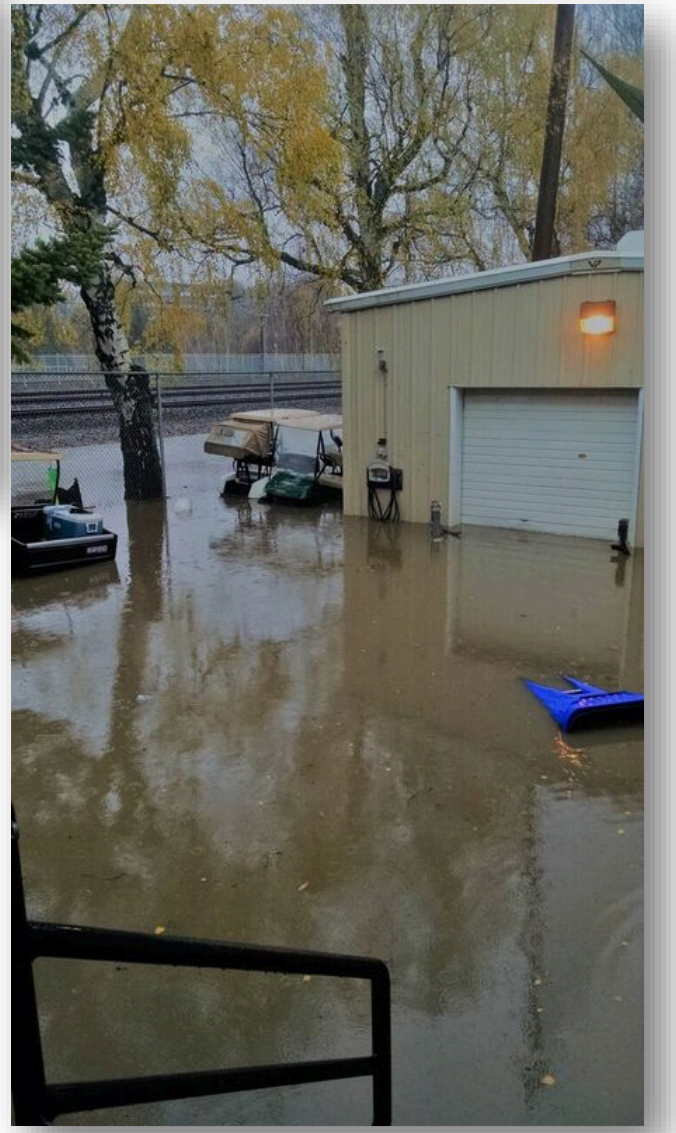
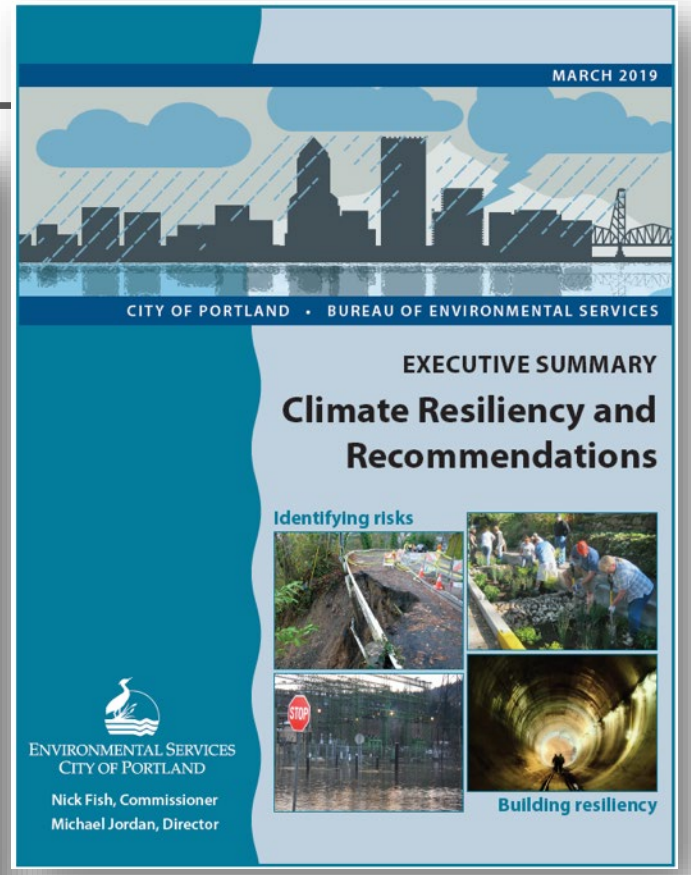


Photo: Isaac Gardener 3/14/2017

BES Climate Resiliency

BES Services	Heat	Droughts	Wildfires	Floods	Landslides
Wastewater collection	Low	Low	Low	High	Moderate
Wastewater treatment	Moderate	Low	Low	Moderate	Low
Drainage (flooding)	Low	Low	Low	High	Moderate
Drainage (landslides)	Low	Low	Moderate	High	High
River/stream flooding	Low	Low	Low	High	Moderate
Water quality	High	High	High	Moderate	Moderate
Watershed health	Moderate	High	High	Moderate	Moderate
Regulatory compliance	Low	Moderate	Low	High	Low
Operations and maintenance	Low	Moderate	Moderate	Moderate	Moderate



Climate sensitivity

- Low
- Moderate
- High

Green Infrastructure

- Vegetated swales
- Green streets
- Ecoroofs
- Trees
- Revegetation & Invasive species
- Ponds
- Treatment wetlands
- Natural areas

Crystal Springs Watershed Restoration

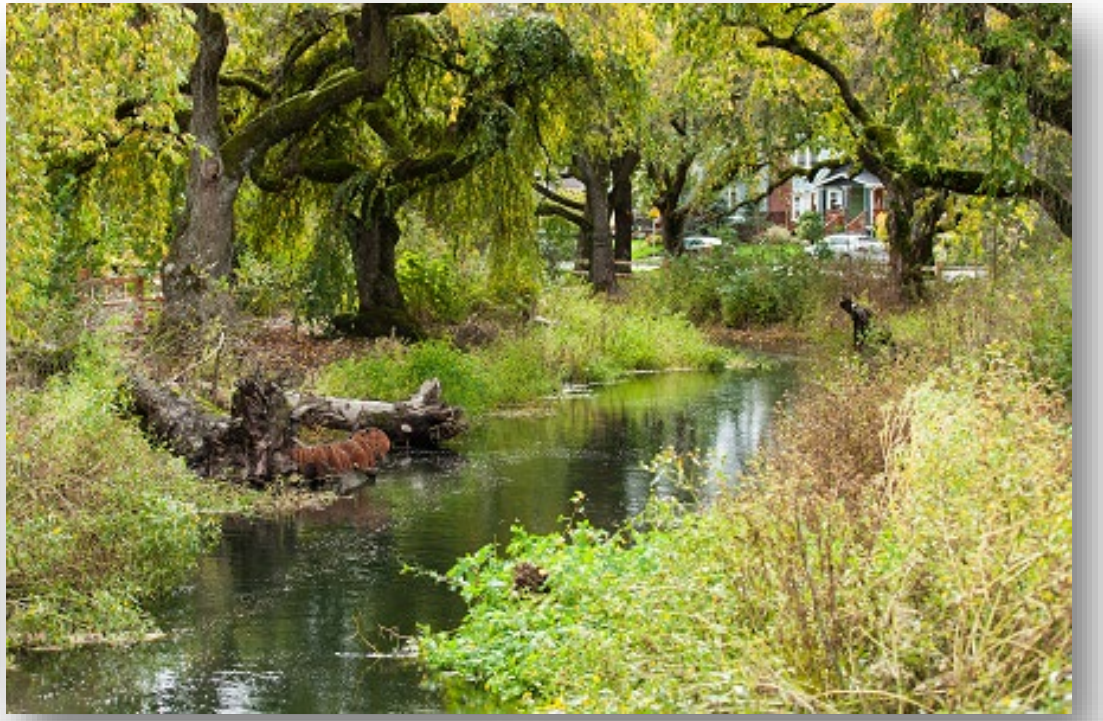
C40 CITIES

Cities Networks Programmes Research Events

2019 C40 Cities Bloomberg Philanthropies Awards Finalists:

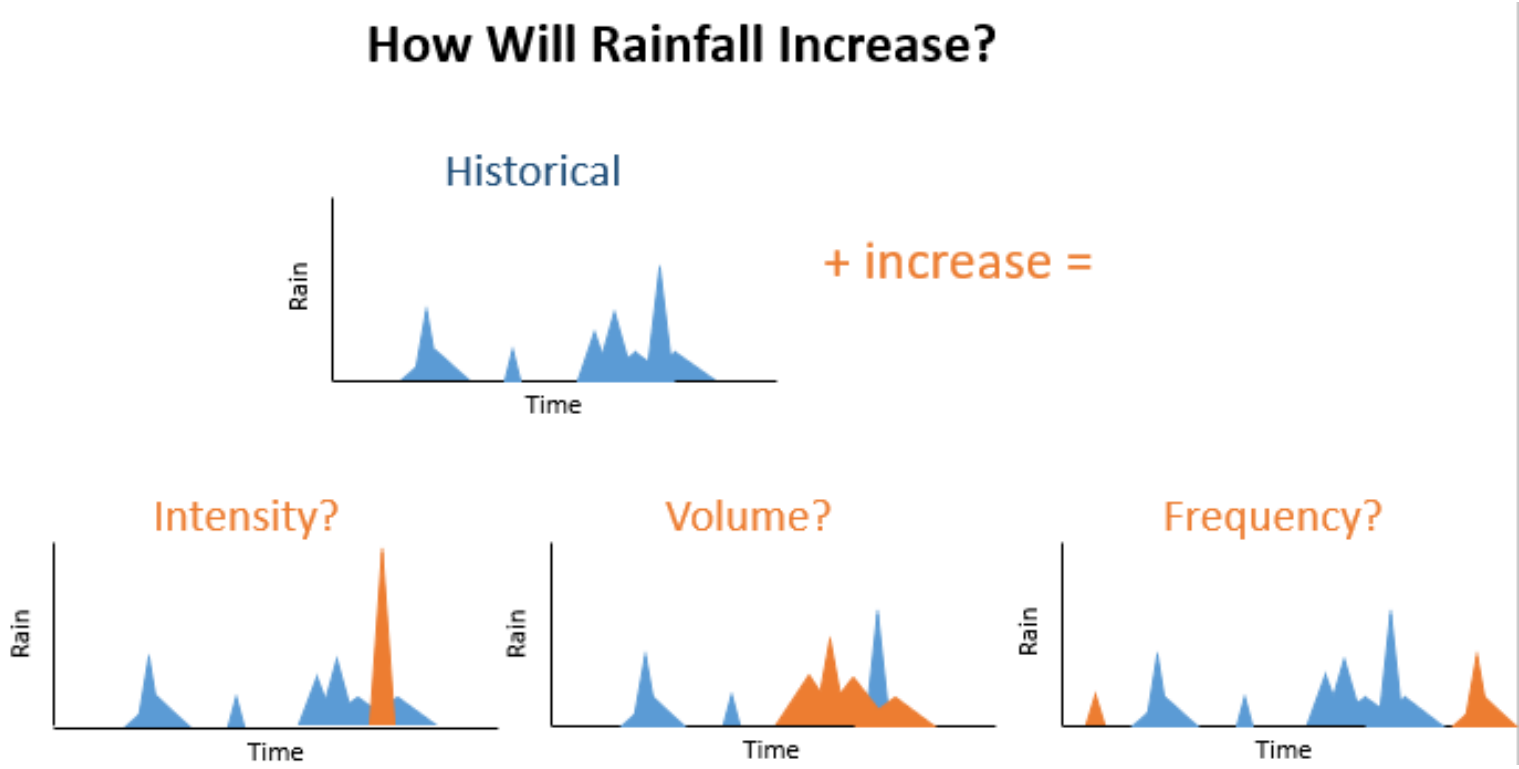
Category: Resilience

Portland, Oregon, USA – Crystal Springs Watershed Restoration
Medellín, Colombia – Avenida Oriental Green Corridors
Quezon City, Philippines – Quezon City's Socialized Housing Program
National Capital Territory (NCT) of Delhi, India – "Jal Swaraj" Safe Drinking



Grey Infrastructure

- Stormwater
- Combined sanitary
- Pump stations
- Other facilities and assets



Source: PermaSeal

Source: KATU News

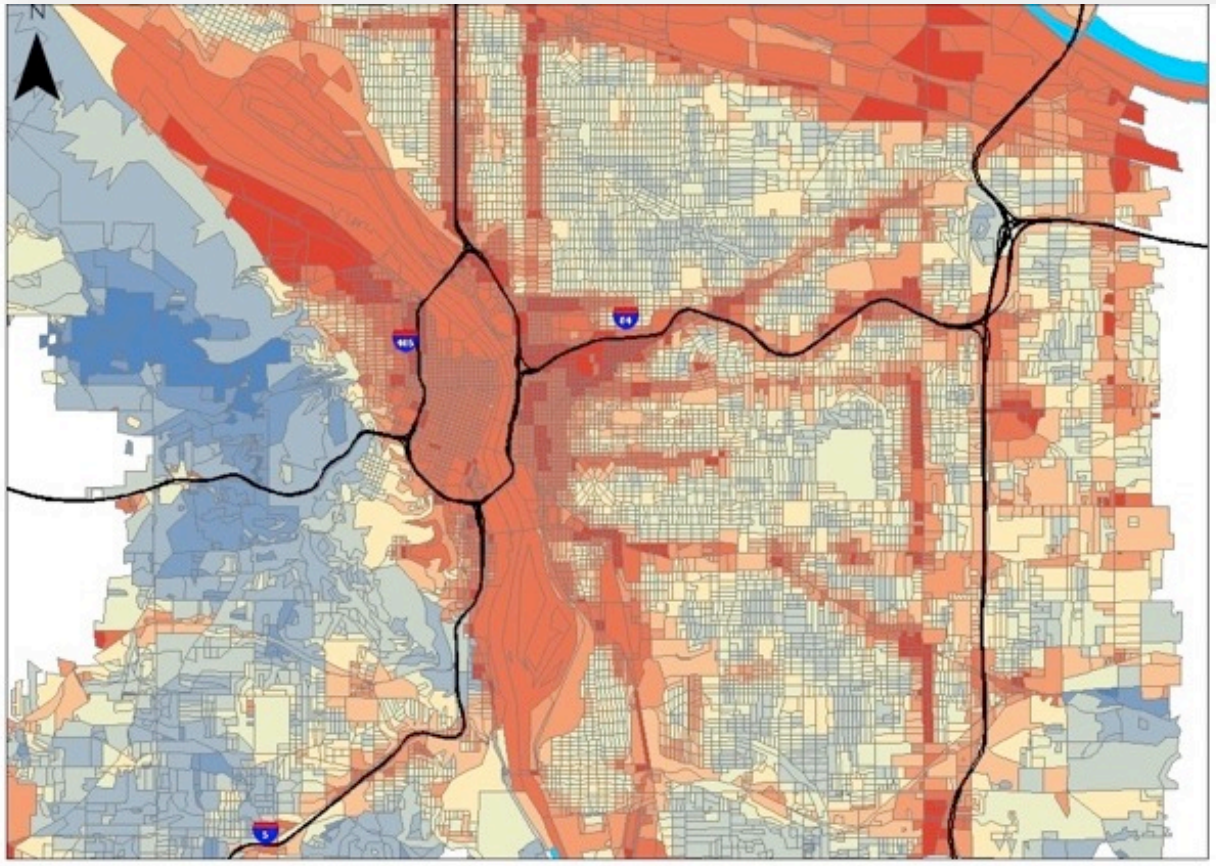
Equity, Climate Justice, and Cultural Resilience

- Indigenous Traditional Ecological Toolkit (ITEK)
- Clean Rivers Education Program
- Community Watershed Stewardship Program

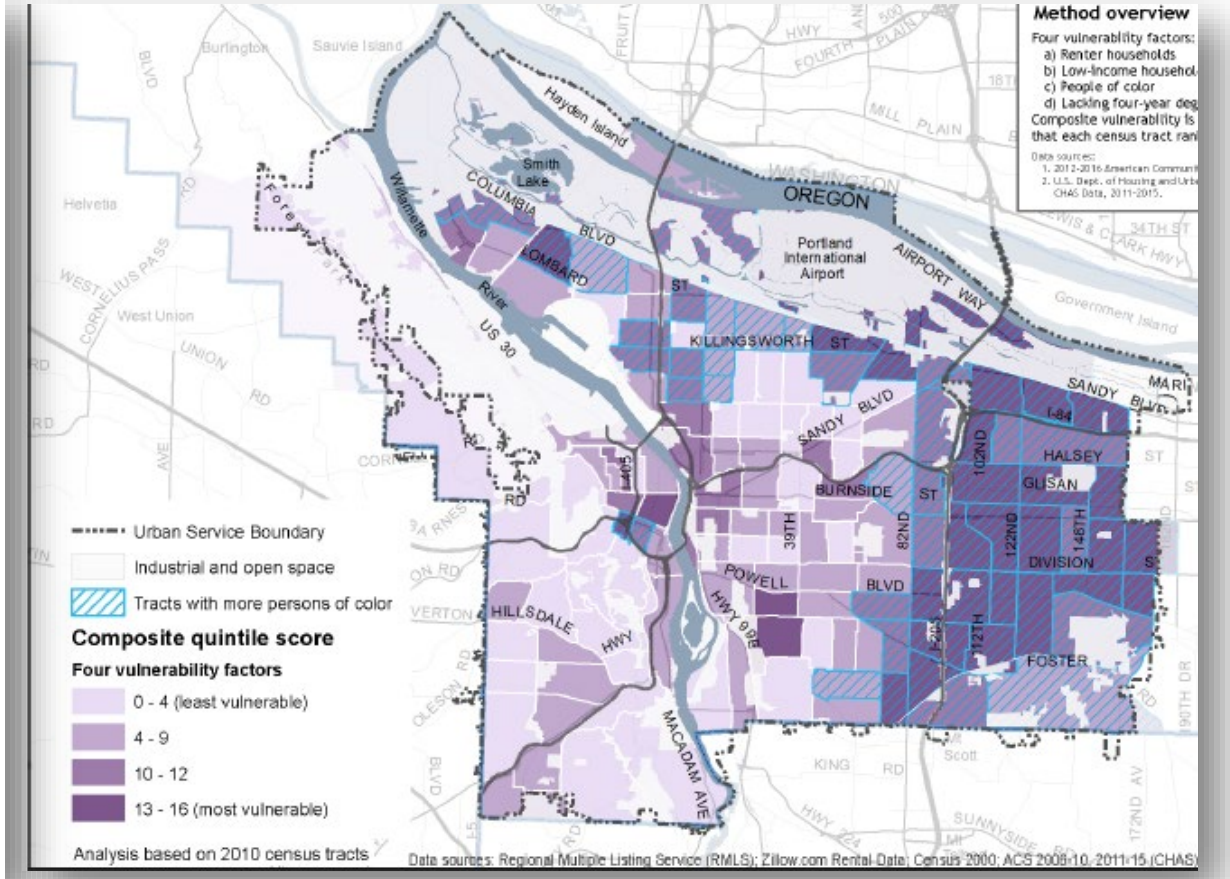
Source: [350pdx.org](350pdx.org)

Equity Cont.— Prioritizing Adaptation Work

Urban Heat Island Map



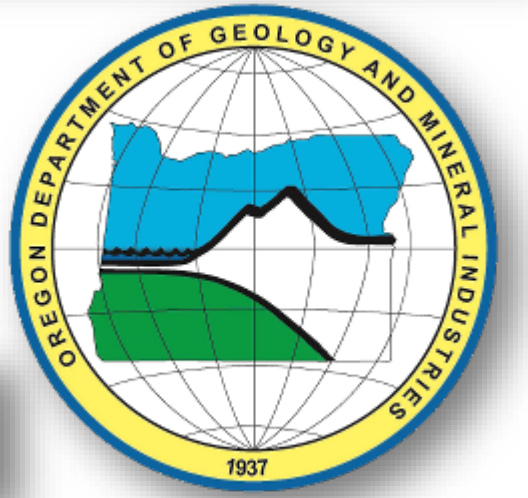
Economically Disadvantaged Areas Map



Source: [PDX.edu](PDX.edu)

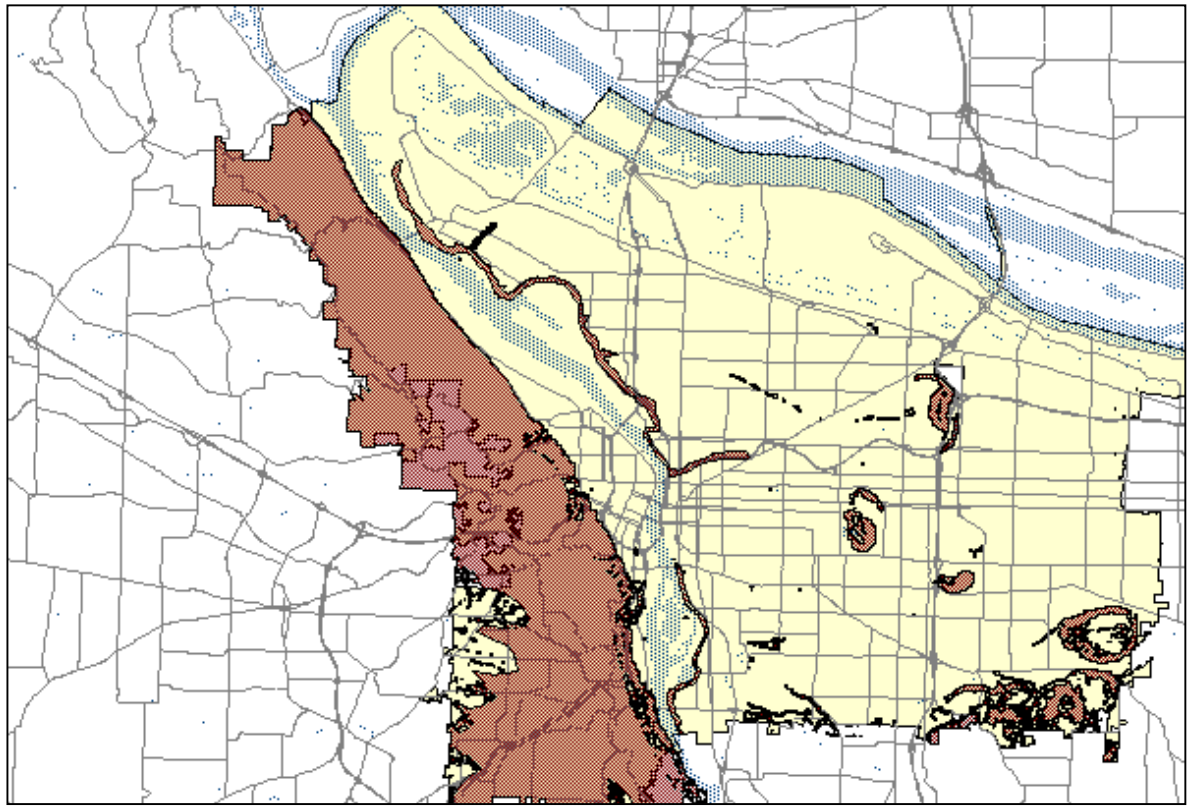
Climate Research and Collaboration

- Climate projection data
- Interdependencies and coordinated adaptation
- River elevation changes
- Channel zone migration
- Mitigation and adaptation best practices
- Other

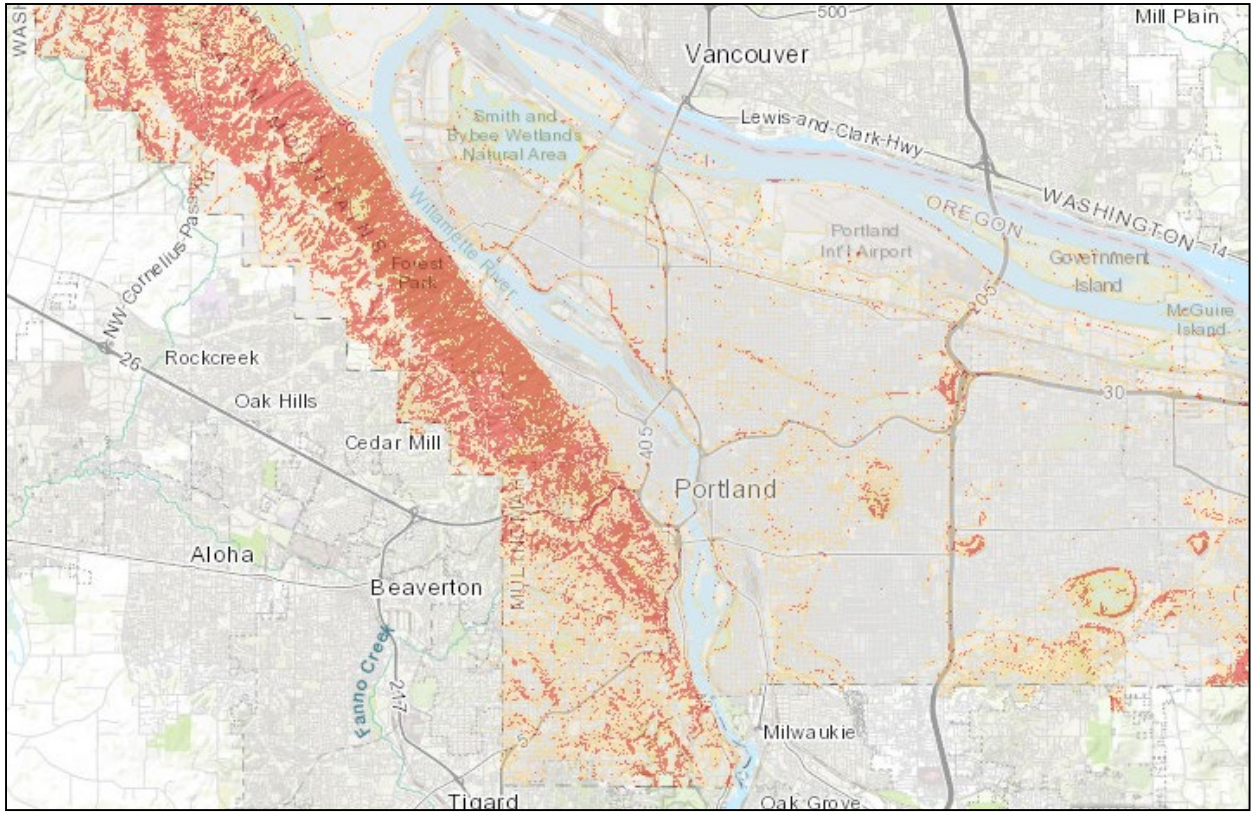


Landslide Hazard Risk Reduction

Landslide Hazard Map Before



2012 DOGAMI LiDAR Based Shallow Landslide Hazard

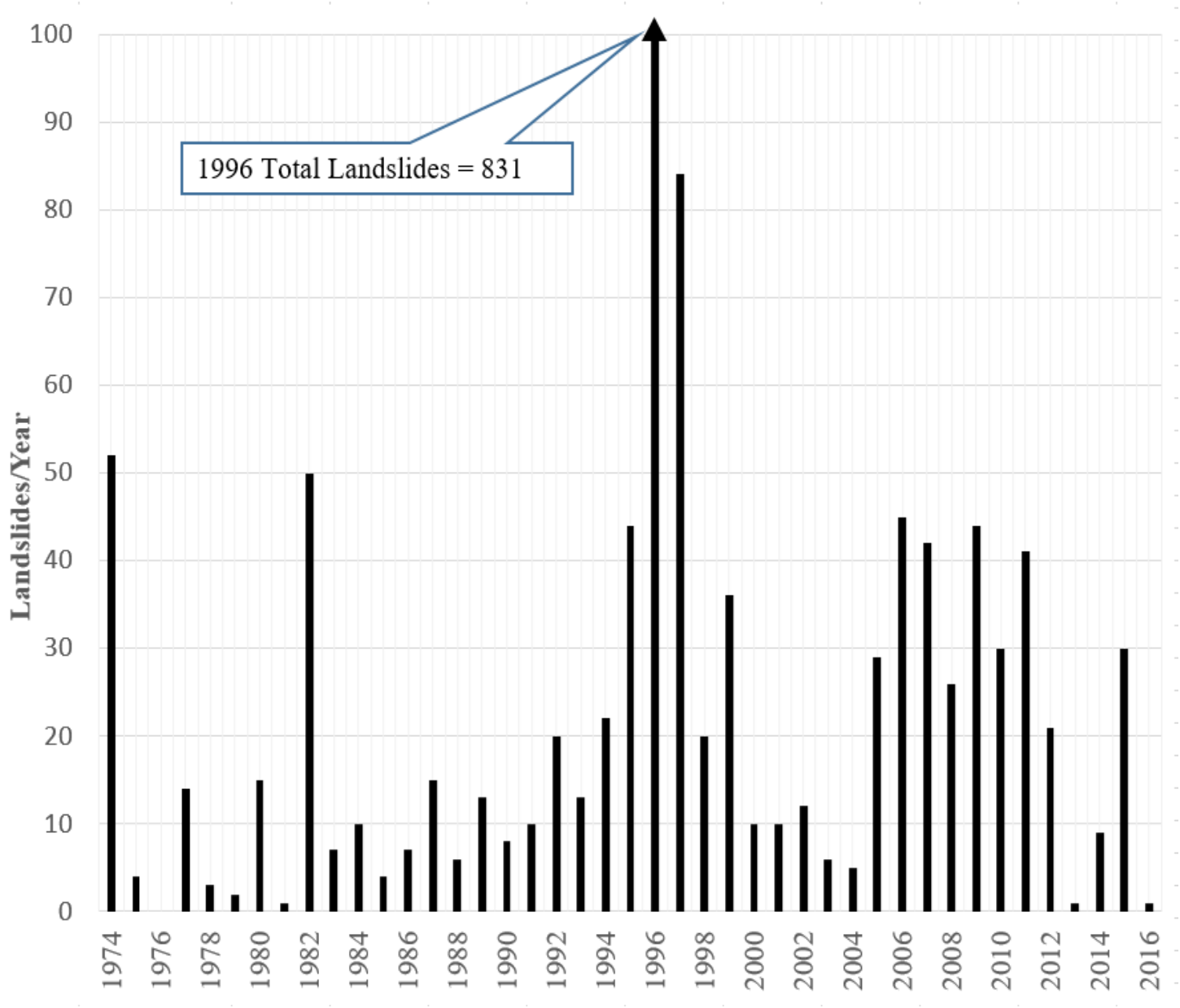


2016-2017 Landslide Database Compilation

BDS Landslide Database Before

Current DOGAMI SLIDO Database

2016-2017 Landslide Database Compilation



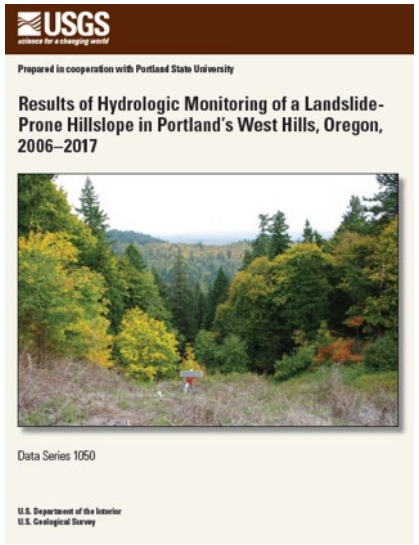
2016-2017 Landslide Loss Analysis

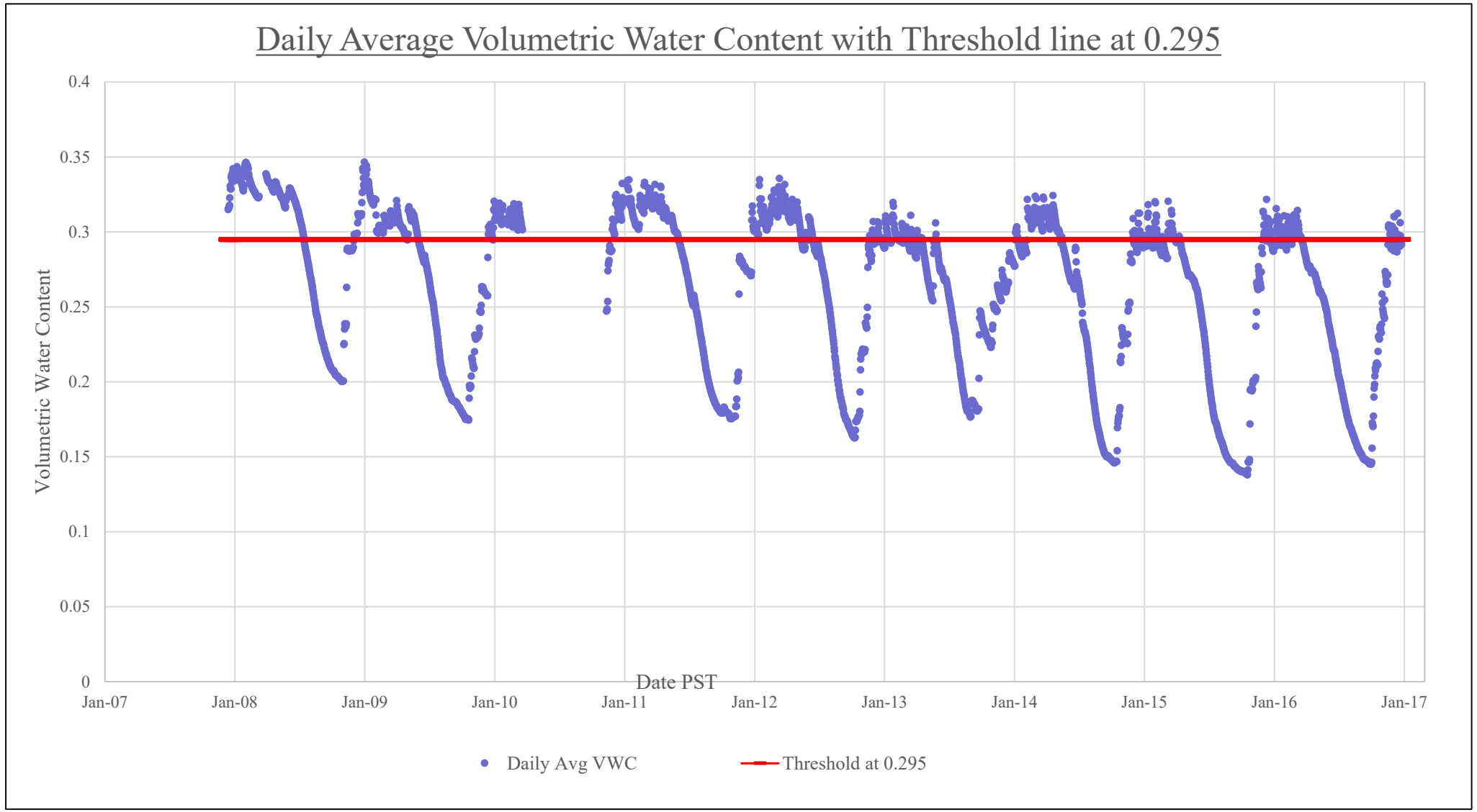
Calculated Landslide Losses

Dataset	Estimated Mean Dollars per Landslide	Estimated Loss in Typical Year (20 Landslides)	Estimated Loss in Extreme Year
Public land (extrapolated from 1996 data)	$67,600#	$1.4M	$34M
Public land (extrapolated from 1996 data)	$102,500##	$2.1M	$34M
Private land exposure (1996 landslide polygons)	$144,000	$2.9M	$47M*
Private land (1996 permits)	$99,000	$1.9M	$32M*
Private land (permits 2000-2013)	$93,100	$1.9M	$30M*
Private & Public (2015-16 season)	$67,500	$1.4M	$56M**

2008 Burlingame Landslide

2017-2018 Landslide Hydrologic Analysis





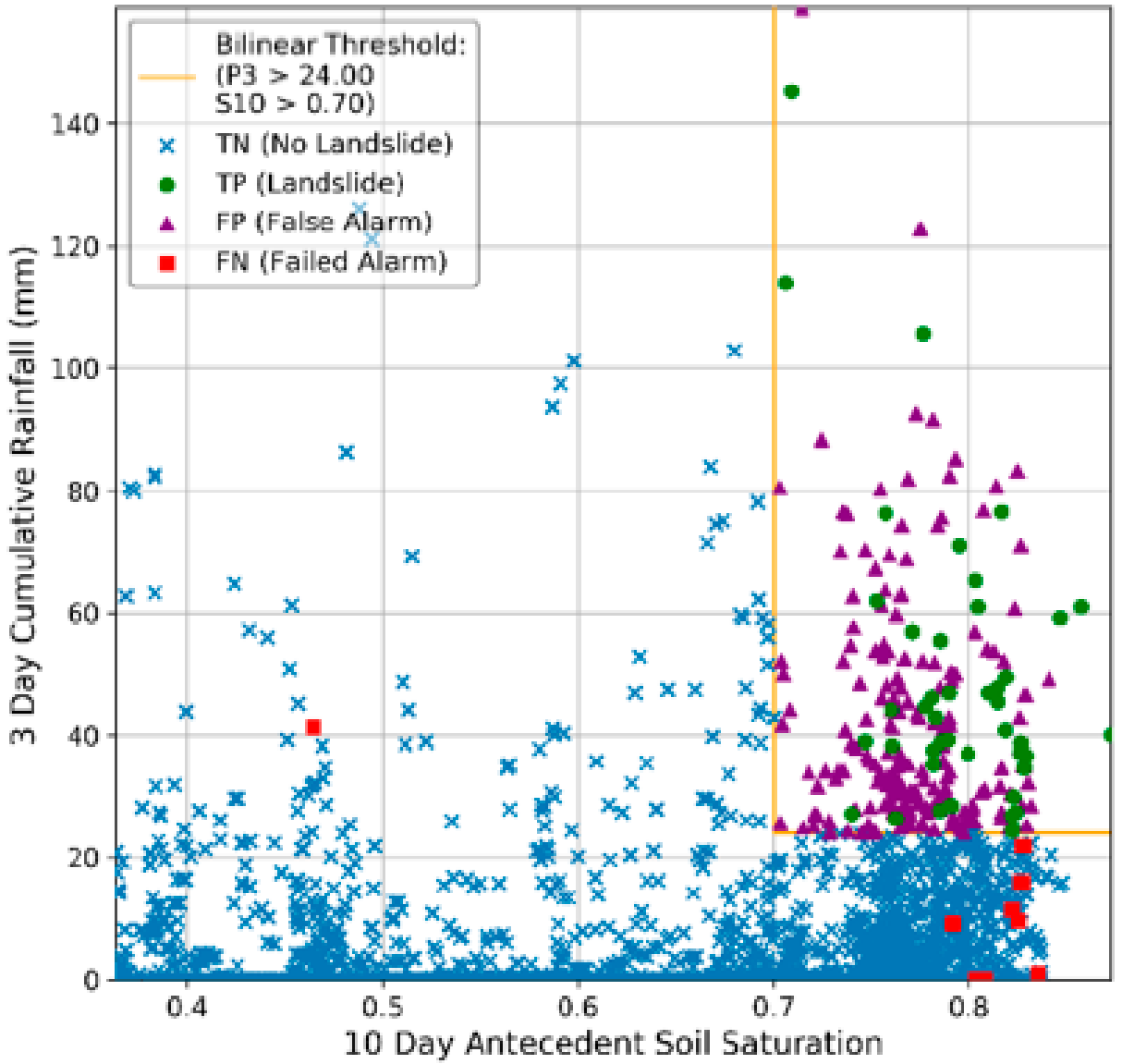
2017-2018 Landslide Hydrologic Analysis

Developing Hydro-Meteorological Thresholds for Shallow Landslide Initiation and Early Warning

Benjamin B. Mirus [1,*], Michael D. Morphew [1,2] and Joel B. Smith [1]

[1] Landslide Hazards Program, U.S. Geological Survey, Denver, CO 80225, USA; mdmorphew@gmail.com (M.D.M.); jbsmith@usgs.gov (J.B.S.)
[2] Department of Geophysics, Colorado School of Mines, Golden, CO 80401, USA
* Correspondence: bbmirus@usgs.gov; Tel.: +1-303-273-8613

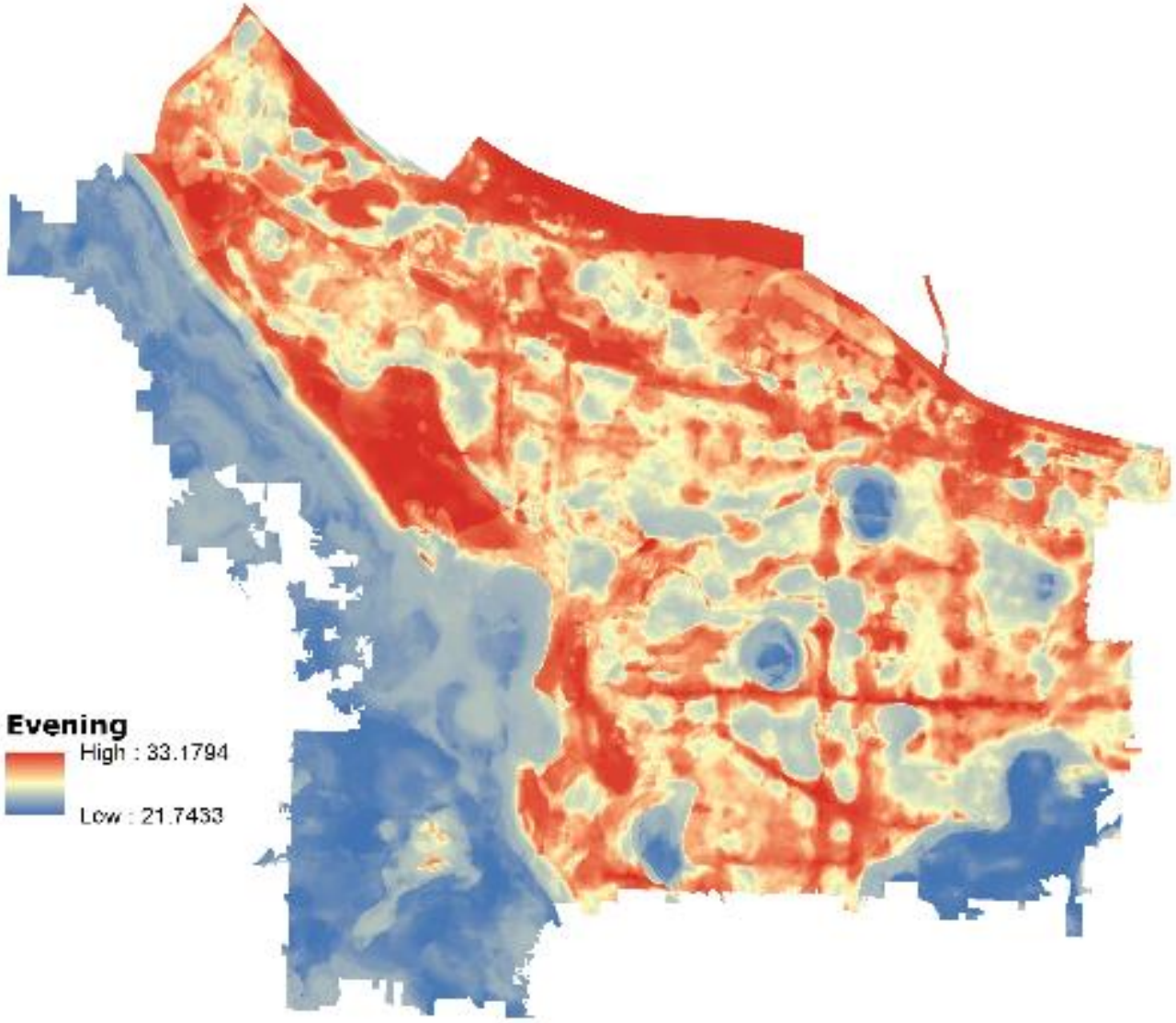
Received: 10 August 2018; Accepted: 7 September 2018; Published: 18 September 2018

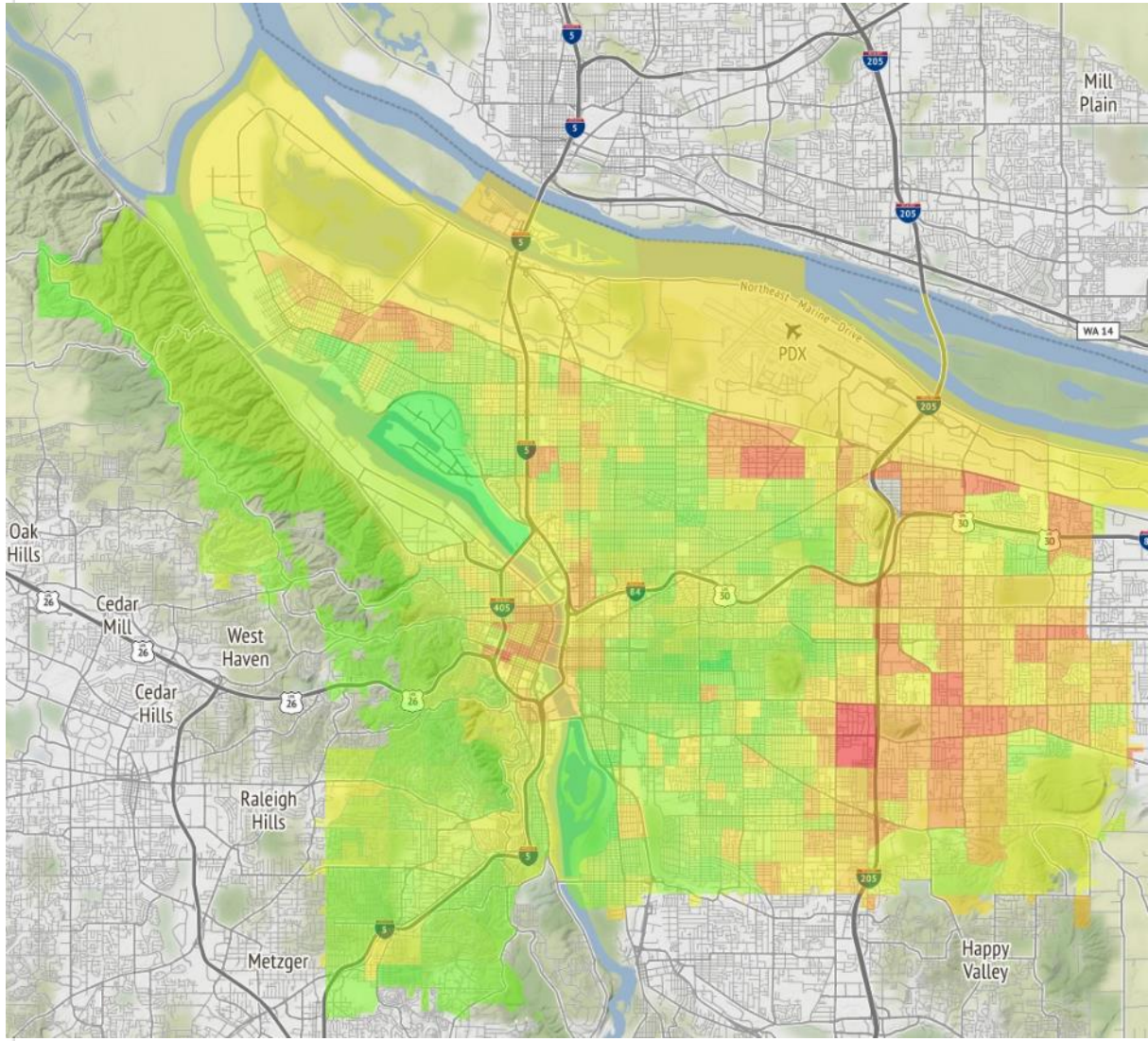


Climate Change and Landslides

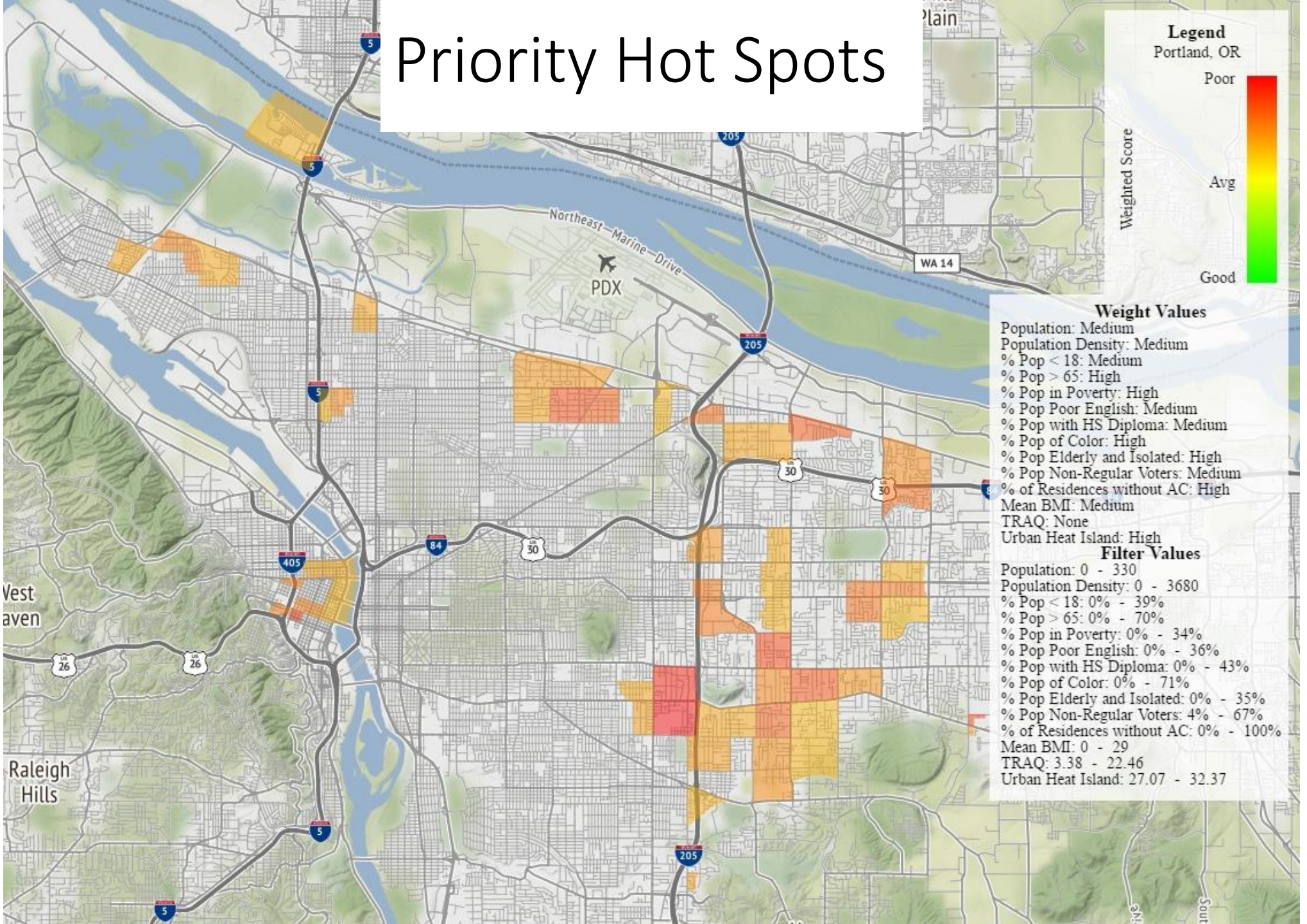
- Increased storm events may lead to increased landslides
- Increased storm events given same precipitation totals may lead to increased runoff and decreased landslides
- Increased temperatures may cause increased evapotranspiration decreasing soil moisture and decreasing landslides
- Conclusion: further research needed

Heat + Vulnerability

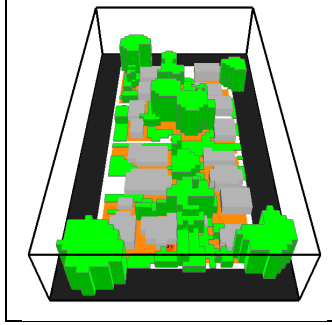
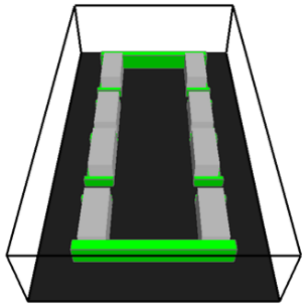
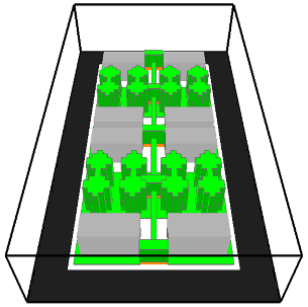
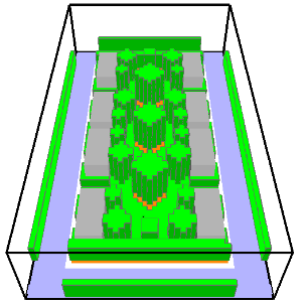


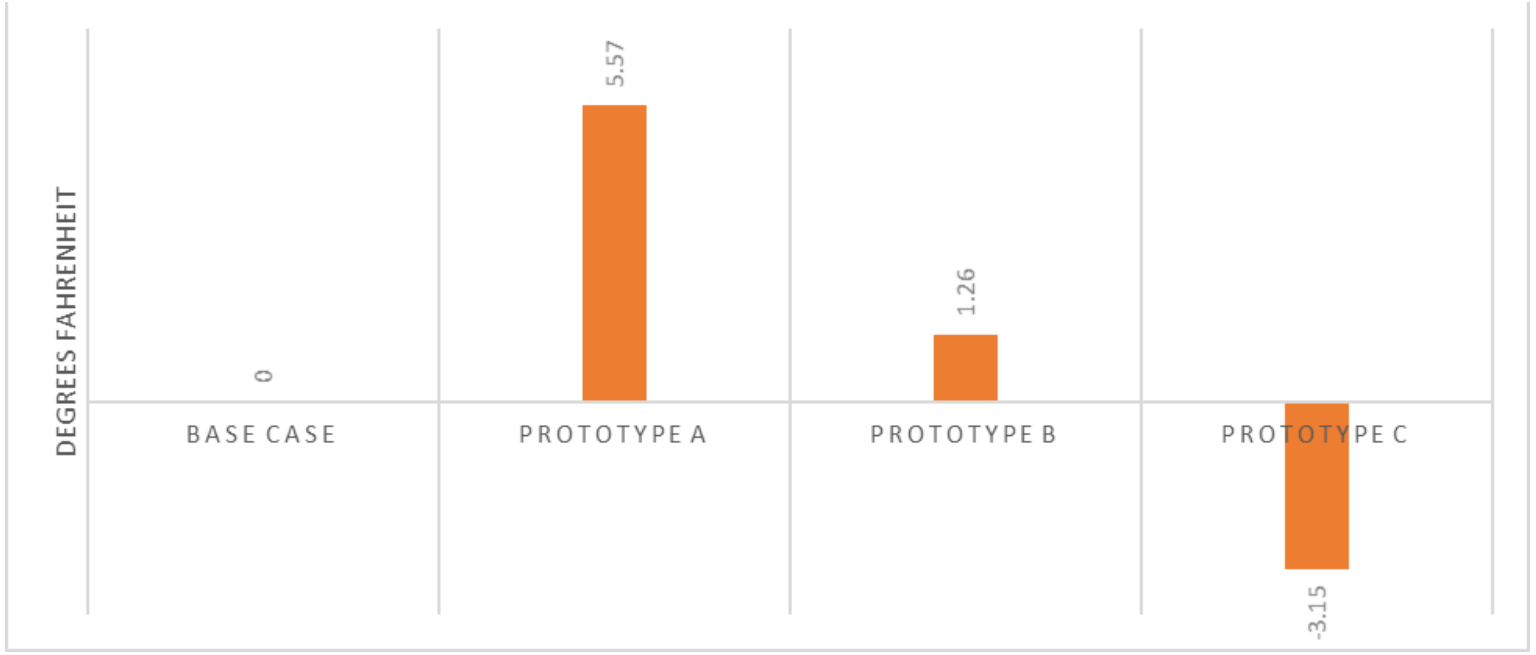


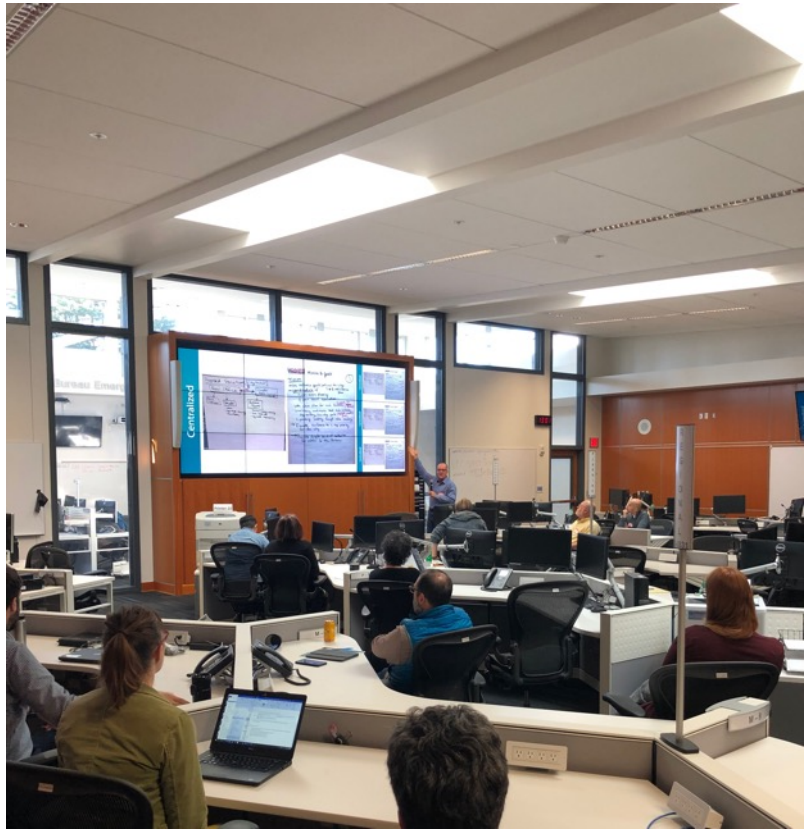
Priority Hot Spots



Better Housing by Design Project

Base case	Prototype A	Prototype B	Prototype C
			





Disaster Resilience and Recovery Action Group

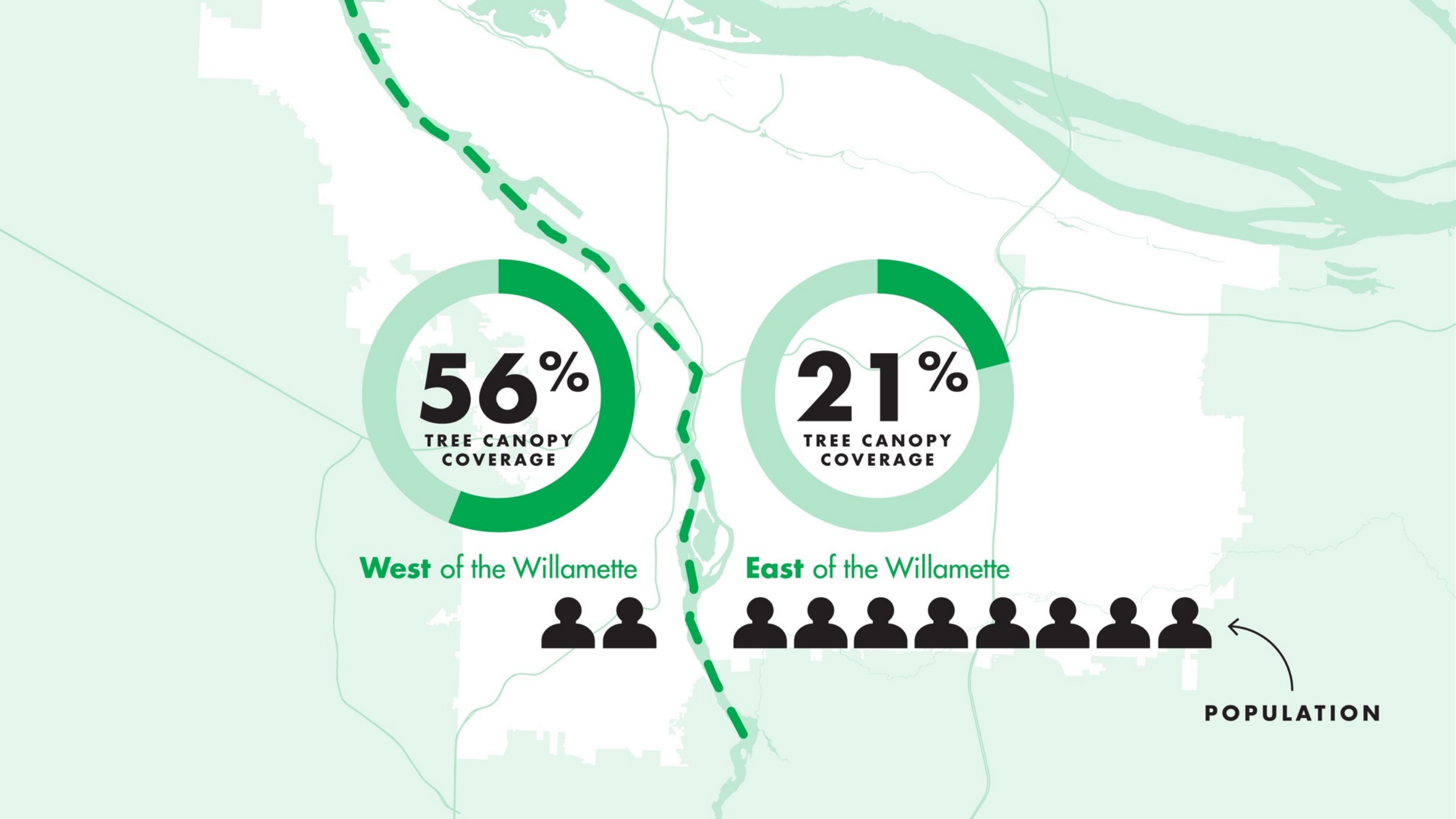
"DRRAG"

Nature's Services

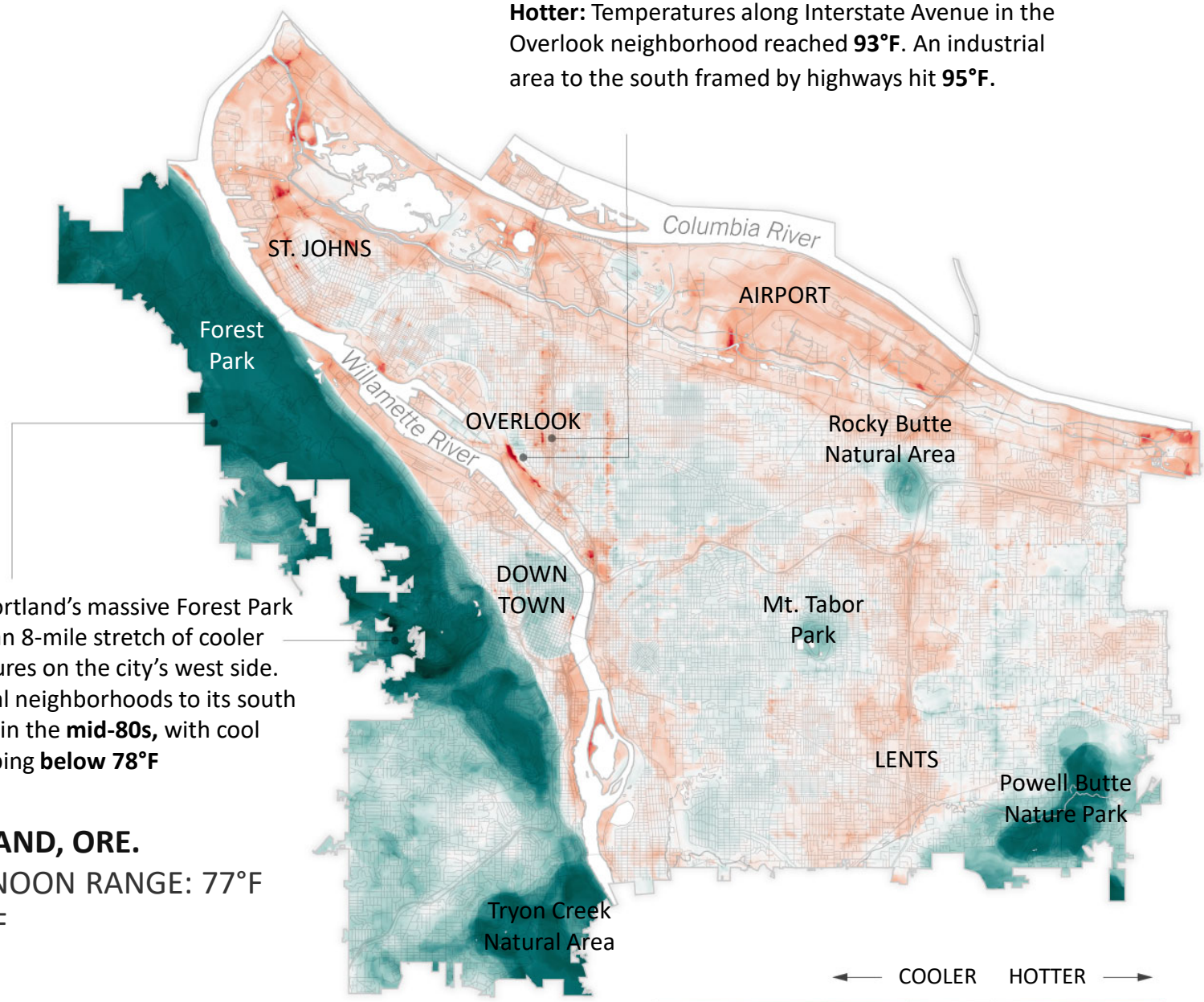
Oxygen
Shade and cooling
Carbon sequestration
Air quality
Stress reduction
Community Building
Stormwater management
Water Quality
Wildlife Habitat
Beauty and Joy
Jobs
Environmental Justice

~150,000,000 dead trees in CA, and counting…

U.S. Forest Service


56%
TREE CANOPY COVERAGE
West of the Willamette
21%
TREE CANOPY COVERAGE
East of the Willamette
POPULATION

Hotter: Temperatures along Interstate Avenue in the Overlook neighborhood reached **93°F**. An industrial area to the south framed by highways hit **95°F.**



Cooler: Portland's massive Forest Park provides an 8-mile stretch of cooler temperatures on the city's west side. Residential neighborhoods to its south remained in the **mid-80s,** with cool spots dipping **below 78°F**

PORTLAND, ORE.

AFTERNOON RANGE: 77°F TO 95°F

Graphic and article: The New York Times 8/9/2019
Source: Hoffman, J.S.; Shandas, V.; Pendleton, N. The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas. *Climate* **2020**, *8*, 12

Growing a More Equitable Urban Forest
Portland's citywide tree planting strategy

Image courtesy of Google, 2017

Disaster Resilient Communities

Community Partnerships

Classes on disaster preparedness and first aid in partnership with community organizations such as Urban League, Latino Network, Verde, Voz, African Family Holistic Health Organization, others.

Currently providing direct service to community though same CBOS – diapers, cleaning supplies, etc.

Community Resilience Districts

Builds on the Neighborhood Emergency Team (NET) volunteer program: neighborhood-based.

Includes people with all levels of interest and ability.

Questions?