Climate Communication Toolkit for Urban Planners in Puget Sound, WA

Rachel Chen
Created as part of a Master of Urban Planning Thesis
University of Washington, Seattle. 2023

PURPOSE

This toolkit was created as part of a Master of Urban Planning thesis and a capstone project for the Graduate Certificate in Climate Science. The purpose of this toolkit is to outline various climate communication strategies that would be practical for urban planners. It can be used by planners in Puget Sound, WA, as a guide for how to communicate climate change effectively to the community members they work with. Additional climate science education and planning resources are provided in the "Climate Resources" section.

CONTENTS

STRATEGY QUICK REFERENCE

1. Know your audience + tailor your communications
2. Use plain language + avoid using technical jargon
3. Clearly define + contextualize terms used
4. Prioritize the use of narrative forms of communication
5. Emphasize the benefits from acting now vs. the potential future losses from inaction
6. Emphasize *what* will happen, not *when*
7. Frame climate action to address the everyday concerns of your community
8. Focus on solutions to climate change that are being implemented
9. Provide specific, current, and local examples of mitigation + adaptation efforts
10. Use simple + local visuals rather than complex data visualizations
11. Present climate change as a local + current phenomenon
12. Incorporate opportunities + activities to co-produce knowledge + explore various climate solutions with your community

PROBLEM STATEMENT

Community-centered climate planning is increasingly becoming more crucial in our cities as we begin to experience and prepare for climate impacts. Community-centered climate planning is climate planning that utilizes local knowledge and community participation in the development of strategies. It can support climate justice, is valuable to give communities greater agency in determining their future, and increases the effectiveness of planning decisions.

Urban planners play an important role in preparing for climate change, and as part of this, should be able to effectively communicate and discuss climate change and local impacts with the communities they are planning with so that community members understand why this work is important and what role they play in it. Current engagement materials in urban planning are often not tailored to their specific audiences and often use complicated graphics and climate projections that confuse rather than educate or inspire others to act.

By having a solid understanding of effective climate communication strategies, and with greater access and knowledge of the tools available to help communicate climate impacts to their communities, planners can better utilize community engagement efforts to gain support for and adopt climate-friendly policies that increase cities' resilience to climate change and climate justice.

Source: Climate Action, The Essentials: Understanding and tackling climate change. (n.d.). Voices of Youth. Retrieved April 4, 2023, from https://www.voicesofyouth.org/climateaction

CLIMATE COMMUNICATION STRATEGIES

1. Know your audience + tailor your communications

Some communities are more amenable to discussing climate change than others, but most communities would probably agree that they want their cities to be protected from hazards and remain safe places to live. Targeting and tailoring your messaging can increase the likelihood of achieving climate communication goals.[1]

1.1 TERMINOLOGY + FRAMING

If your community members don't respond well to the term "climate change", it's important to figure out how to frame the issue so they are more open to discussing solutions. Some communities might be more receptive to discussing the implementation of their hazard mitigation plan, for instance. In this case, you could emphasize how planning actions can enhance the community's resilience to different natural hazards, foster safer communities, or improve infrastructure. This way, you are still addressing potential climate impacts but from a lens of enhancing community resilience rather than climate mitigation or adaptation. As community members begin to see the benefits of these plans, they might be more trusting of planning processes and eventually be willing to address climate change directly.

2. Use plain language + avoid using technical jargon

When discussing climate change, use as plain language as possible and avoid technical jargon in order to be approachable to wide audiences. It's widely suggested that using shorter words and sentences and avoiding jargon in general make for more approachable and clear communications.[2]

2.1 TECHNICAL JARGON

The vocabulary used in a planner's day-to-day work is not always familiar to broad audiences. For instance, the term "resilience" might not be well known or hold the same meaning among community members or people in other fields of work. While you can provide a definition for resilience or related terms as they come up, you can also substitute words like "preparedness" or similar terms.[3]

3. Clearly define + contextualize terms used

Clearly define and contextualize any terms used to ensure your audience has a shared understanding of the subject at hand and to increase the effectiveness of your communications. To combat misinterpretations, provide specific examples of what the terms you are using look like in practice.

3.1 CLEARLY DEFINE TERMS

Not everyone knows what the term "carbon dioxide" means or understands what it means in different contexts, such as "carbon neutral". Clarify that carbon dioxide, or CO2 for short, is emitted during the combustion of fossil fuels, and though there is a natural carbon cycle, human activity is contributing to unprecedented amounts of carbon dioxide being added to the atmosphere. Clarify what different terms referring to carbon dioxide mean; for instance, "carbon neutral" refers to a no net increase in the amount of carbon dioxide in the atmosphere.[4]

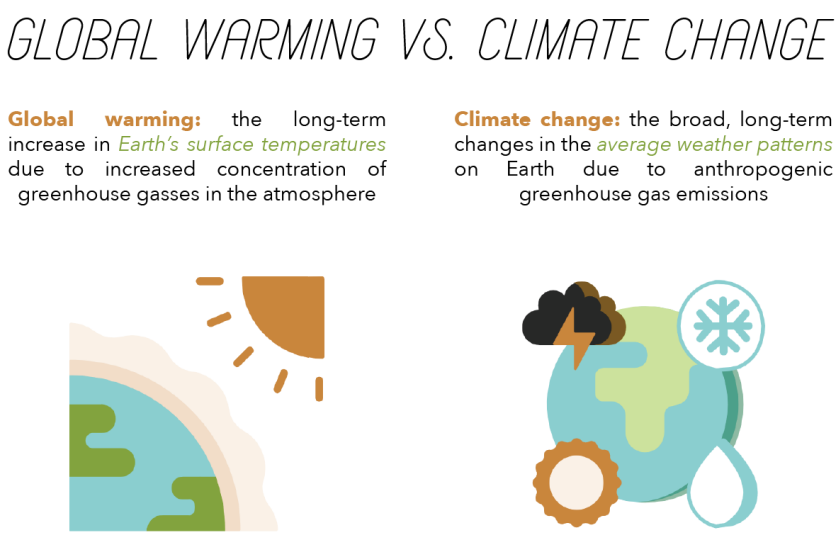
3.2 CONTEXTUALIZE TERMS

There might be words that mean completely different things in climate science than in other contexts. For instance, usually, the word "enhanced" means to make something better, but in the case of climate change, "enhanced global warming" means global warming is getting worse.[5] Additionally, a "positive feedback loop" doesn't necessarily mean it will have a positive outcome.

3.3 CLARIFY SIMILAR TERMS

Global warming and climate change are often used interchangeably but have distinct meanings (Figure 1). Global warming refers to the long-term increase in Earth's surface temperatures due to an increased concentration of greenhouse gas emissions in the atmosphere. Climate change refers to the broad, long-term changes in the average weather patterns on Earth due to anthropogenic greenhouse gas emissions.

Figure 1. Graphic Depicting Global Warming vs. Climate Change



Note: Graphic made by Chen, R. Icons from: Social Issues Thesis: Climate Change | Google Slides & PPT. (n.d.). Retrieved May 23, 2023, from https://slidesgo.com/theme/social-issues-thesis-climate-change

4. Prioritize the use of narrative forms of communication

Utilize narrative forms of communication that emphasize the human impacts of climate change and appeal to the human experience.

4.1 COMMUNITY NARRATIVES

The use of narratives can help planners determine how communities understand and practice adaptation.[6] For instance, "a community in a flood-prone coastal town…constructs individual and collective stories about their historical experiences, their coping strategies, and problems encountered, which are passed down as intergenerational local knowledge".[7] Provide an opportunity for communities to talk about their experiences and share how they coped with past climate impacts to determine how you, as a planner, can supplement these efforts and better assist communities in the future based on their capacity and needs.

4.2 PERSONAL NARRATIVES

Utilize personal stories to help others think about how climate change has impacted their lives, make a connection between the science and their personal experiences, and see why taking action to address climate change is urgent. My personal story follows:

> Growing up in San Francisco, I never had a sunny and warm birthday celebration. My birthday is in July, which is often described as the coldest time in San Francisco because of the thick fog and grey skies that typically characterize our summers. As I got older and visited home in the summers during college, I began to notice that our weather was a lot more sunny than it used to be! I finally had a warm birthday celebration outdoors. Along with warmer summer temperatures, San Francisco also began to experience heat waves, which the city was vastly unprepared for. I'm sure you can think of similar examples of where you've also observed long-term weather changes.

Figure 2. Typical San Francisco Summer vs. New Normal

SFGATE, A. G. (2017, July 14). San Francisco's summer fog as you've never seen it before. SFGATE. https://www.sfgate.com/bayarea/article/Video-Watch-Karl-the-Fog-push-his-way-into-San-11288915.php

Chen, R. (2022).

5. Emphasize the benefits from acting now vs. the potential future losses from inaction

Emphasize the potential benefits of acting as soon as possible rather than the potentially devastating losses from inaction to help community members view climate action as a more worthwhile endeavor.[8]

5.1 COST-EFFECTIVE

The cost of implementing climate-friendly policies and investments now is significantly lower than the cost of paying for disaster recovery efforts following a natural disaster. It's important to emphasize how changes are low-cost, easy to implement, and will help make the city more efficient and resilient over time. If possible, present relevant numbers to your community to help demonstrate savings over time.

5.2 IMMEDIATE BENEFIT VS. LONG-TERM LOSS

Emphasize co-benefits of immediate climate action like increased green space and healthier communities rather than potential devastating effects of climate change from inaction like species extinction or damage to city infrastructure and services. Though mention of devastating impacts can be motivating as well, it might lead some people to feel hopeless. Discussing the many co-benefits of climate action, some of which are shown in Figure 3, can provide a positive vision of the future that incorporates community values.

6. Emphasize *what* will happen, not *when*

Many climate impacts are accompanied by a certain amount of uncertainty surrounding exactly when they will occur. While scientists agree climate impacts will happen in our lifetimes, and already are happening in many places, the exact timing of climate impacts such as floods or wildfires can be hard to predict.

6.1 FLOODING WILL OCCUR VS. 100-YEAR FLOODPLAIN

While planners and scientists alike may have a strong understanding on what phrases like a "100 year floodplain" mean, communities may misinterpret this information to mean they are relatively safe from flooding. However, as climate change is changing the timing and magnitude of such hazards, it's important to communicate how communities need to be prepared for such large flooding events to happen much more frequently. As such, it is important to clearly describe the consequences of such events rather than on the likelihood they will happen each year. Focus on painting a picture of what will happen the next time the community floods.

7. Frame climate action to address the everyday concerns of your community

Framing is a communication theory that argues how you craft a message, i.e., what information and how you present it, influences how others receive and interpret that message. Framing plays an important role in climate communication, as it can affect how messages around climate change are received.

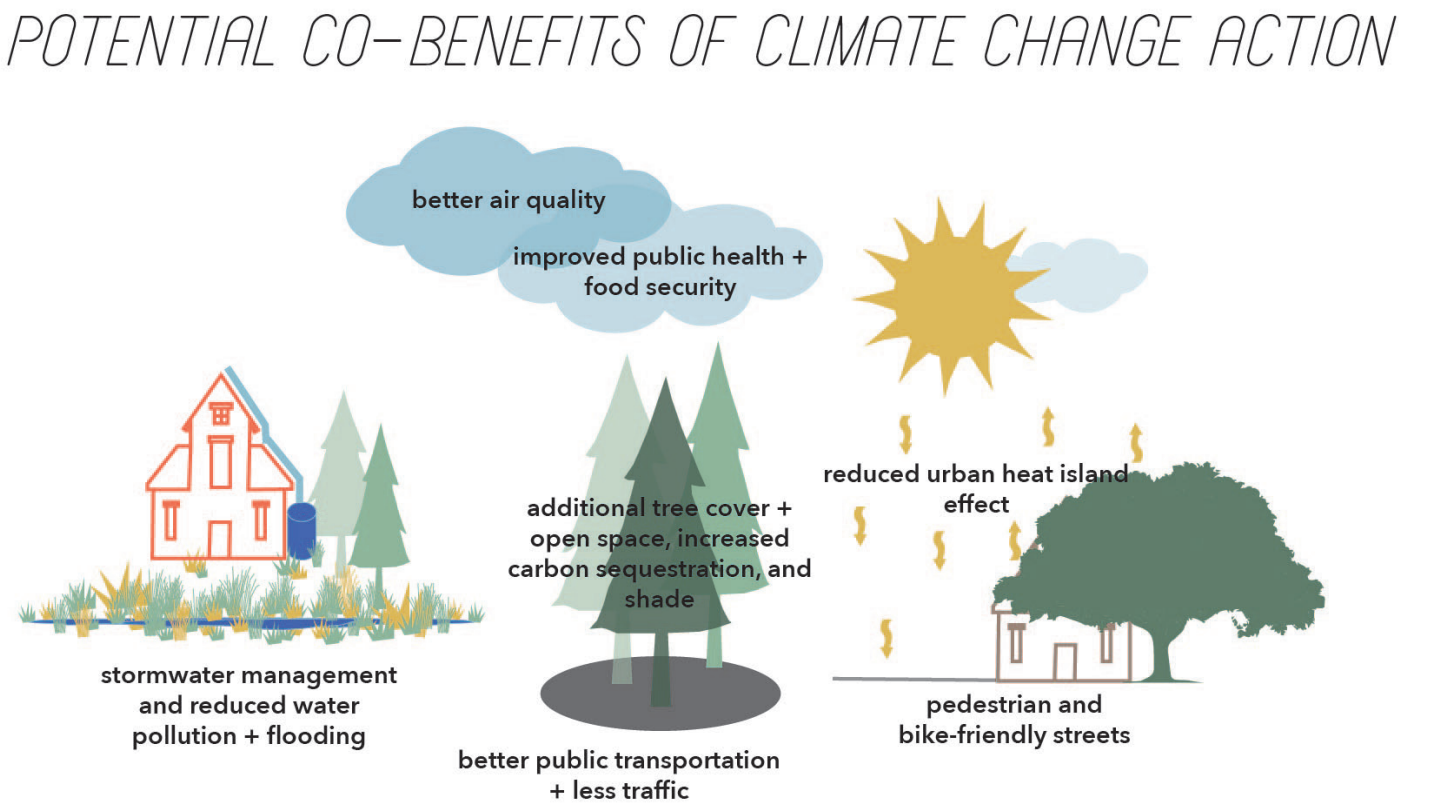
7.1 CO-BENEFITS

Frame climate change in terms of the co-benefits climate action has for the everyday concerns of your community members.[9] People may not be able to see the real-life, tangible benefits of climate action without these connections being drawn, and tend to view such issues as more important than climate change action, despite believing climate change will greatly affect their future.[10] At the same time, most people want to live in a more equitable city with ample green space, less air pollution, and well-maintained infrastructure, which are all potential co-benefits of climate action.

7.2 PUBLIC HEALTH

Using a public health frame is especially effective as climate change's impact on human health is "one of five key climate change beliefs that are strongly associated with [the] likelihood to support a societal response and to personally take actions that encourage a societal response".[11] Researchers also found that a public health frame was the "most likely to elicit emotional reactions consistent with support for climate change mitigation and adaptation".[12] It's important to be mindful of how climate action can foster equity to ensure health impacts aren't disproportionately experienced.

Figure 3. Some Potential Co-Benefits of Climate Change Action



8. Focus on solutions to climate change that are being implemented

Provide examples of climate mitigation and adaptation efforts to prevent people from feeling hopeless in the face of climate change. It's important to show that the solutions to climate change are available and are already being implemented; we just need to accelerate these efforts. Provide local examples where possible.

8.1 HIGHLIGHT EXISTING EFFORTS

Seattle's electricity provider, Seattle City Light, has been carbon neutral since 2005. Seattle City Light primarily relies on hydroelectric power, but is incorporating wind and other renewable energy sources to further diversify their renewable energy profile and meet future energy load demand.

8.2 CELEBRATE ACCOMPLISHMENTS

Greenhouse gas emissions in Seattle decreased by 6%, and per capita emissions declined by 17% from 2008 to 2018, despite a 13% growth in population.[13] Highlight accomplishments such as these to help people see that the changes necessary for climate action are not impossible.

9. Provide specific, current, and local examples of mitigation + adaptation efforts

Provide specific and local examples of climate mitigation and adaptation efforts in your community to help community members visualize what adaptation looks like, and encourage them to join in existing efforts.

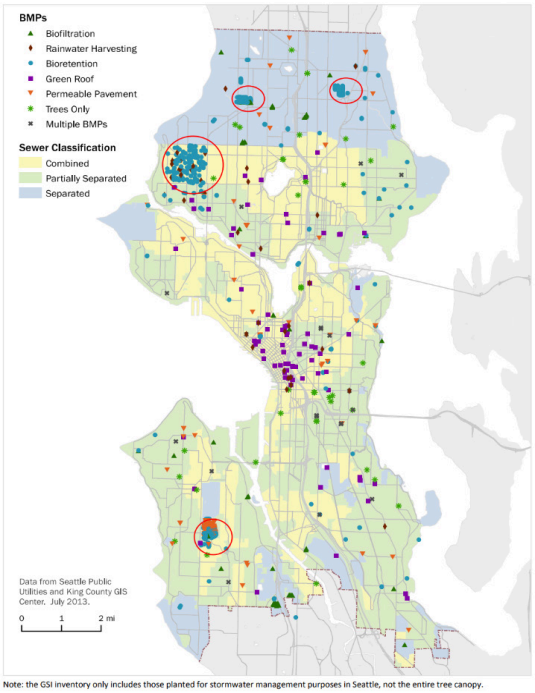
9.1 HIGHLIGHT EXISTING EFFORTS

Seattle has a goal of managing 700 million gallons of stormwater per year. As of now, Seattle manages 465 million gallons of stormwater, though many additional green stormwater infrastructure projects are underway (Figure 4).[14] As part of this, King County provides support through a RainWise program that assists homeowners with installing rain gardens on their property. These efforts not only help prevent extreme flooding in neighborhoods, but they also can mitigate the urban heat island effect, reduce water pollution, and sequester carbon by adding trees and other greenery.

9.2 REVIEW EXISTING GOALS

Seattle also has goals to adopt insulation and window requirements to reduce energy use during extreme hot and cold temperatures, improve energy efficiency, and increase cooling capacity during heat waves.[15]

Figure 4. GSI in Seattle in 2017



United States Environmental Protection Agency. (2017). Expanding the Benefits of Seattle's Green Stormwater Infrastructure. https://www.epa.gov/sites/default/files/2017-03/documents/seattle_technical_assistance_010517_combined_508.pdf

10. Use simple visuals rather than complex data visualizations

When discussing complex scientific information like climate science, it's important not to overwhelm your audience. Imagery can greatly increase understanding of climate change and encourage people to act.[16] Using appropriate images as outlined below can contribute to more memorable messages than using complex data to depict climate change.

10.1 SIMPLIFY, SIMPLIFY

Oftentimes information from climate change organizations like the Intergovernmental Panel on Climate Change (IPCC) is not appropriately communicated to local communities and is too technical and overwhelming to understand.[17] Graphs are generally accessible to most people, especially if supplemented with a patient explanation, but large amounts of text and tables are more difficult for people to understand and interpret.[18] Support your communication efforts with simple graphics to foster greater understanding.

10.2 INSPIRING IMAGES

Imagery featuring "fear-inducing images", though they capture people's attention, also "[tend] to distance or disengage individuals, rendering them feeling helpless, overwhelmed, and not empowered to act".[19] Alternatively, images showing solutions to climate change have been found to be more encouraging and inspiring, especially if they are local.[20]

10.3 HUMAN-SCALE + CENTERED IMAGES

Many previous climate communications have shown animals or landscapes at risk as a way to demonstrate climate impacts. However, while images showing impacts on humans were not as common until recently, they are more effective in encouraging action.[21] Wang et al. offer additional suggestions for using visuals in climate communications, as shown below in Figure 5.

Figure 5. Seven Principles for Visual Climate Change Communication

BOX 2

SEVEN PRINCIPLES FOR VISUAL CLIMATE CHANGE COMMUNICATION

1. **Show "real people," not staged photo-ops**. Discussion groups favored "authentic" images over staged photographs, which were seen as gimmicky or even manipulative.
2. **Tell new stories.** Familiar images are quickly and easily understood, but they also prompted cynicism and fatigue. Less familiar, thought-provoking images can help tell new stories about climate change, and remake the visual representation of climate change in the public mind.
3. **Show climate causes at scale.** When communicating the links between problematic individual behaviors and climate change, it is best to show these behaviors at scale, for instance, a congested highway, rather than a single driver.
4. **Climate impacts are emotionally powerful**. Images of climate impacts can prompt a desire to respond, but because they are emotionally powerful, they can also be overwhelming. Coupling images of climate impacts with concrete behavioral actions may help overcome this.
5. **Show local (but serious) climate impacts.** When images of localized climate impacts show an individual person or group of people, with identifiable emotions, they are likely to be most powerful. It is also important to strike a balance, to show local, relatable impacts, and simultaneously avoid trivializing the issue.
6. **Be careful with protest imagery.** Images of "typical environmentalists" only resonated with people who already considered themselves activists and campaigners. Images showing people directly affected by climate change impacts were seen as more authentic and compelling.
7. **Understand your audience.** Reactions to climate imagery differ according to level of concern, scepticism, as well as political affiliations. For instance, images of distant climate impacts produced flatter emotional responses among those on the political right than the left, whereas solutions images produced positive emotions for both sides.

Source: Wang, S., Corner, A., Chapman, D., & Markowitz, E. (2018). Public engagement with climate imagery in a changing digital landscape. WIREs Climate Change, 9(2), e509. https://doi.org/10.1002/wcc.509

11. Present climate change as a local + current phenomenon

Discuss the changes in climate that your community has already experienced and how these will increase with additional greenhouse gas emissions. Presenting climate change as a local phenomenon happening in real time helps people to make personal connections between things they might've observed in daily life, such as shifting weather patterns, to climate change.[22]

11.1 PHOTOS OF LOCAL IMPACTS

Show imagery of local climate impacts, such as an intersection or neighborhood that got flooded recently due to above-average rainfall (Figure 6).

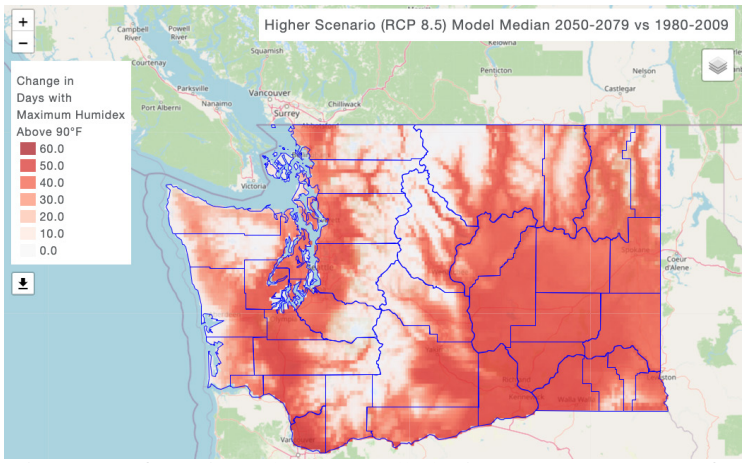
Figure 6. Recent Flooding in South Park, Seattle

Source: Kim, G. (2022, December 27). 'We lost everything': Duwamish River gushes into Seattle homes. The Seattle Times. https://www.seattletimes.com/seattle-news/duwamish-river-floods-seattles-south-park-neighborhood/

11.2 LOCAL CLIMATE PROJECTIONS

Present facts related to local climate changes, such as the increase in days above average temperatures. For instance, Seattle in 2022 experienced a record-breaking 13 days above 90˚F, which communities were vastly unprepared for due to the lack of air conditioning and infrastructure to mitigate extreme heat.[23] Show simplified, local climate projections that model how local climate will continue to change in the future. One useful tool for this is the Climate Impact Group's Climate Mapping for a Resilient Washington tool (Figure 7), which can be found in the "Climate Resources" section.

Figure 7. Climate Mapping for a Resilient Washington Tool Example



Source: Raymond, C., & Rogers, M. (2022). Climate Mapping for a Resilient Washington. Prepared by the Climate Impacts Group, University of Washington, Seattle and Research Data & Computing Services, University of Idaho, Moscow. Retrieved April 8, 2023, from https://cig.uw.edu/resources/analysis-tools/climate-mapping-for-a-resilient-washington/

12. Incorporate opportunities + activities to co-produce knowledge + explore various climate solutions with your community

Planners can use several hands-on strategies during community engagement to further increase learning and collaboration. Design participation in ways that allow for meaningful outcomes for participants; in some cases this requires working with communities to determine the outreach efforts themselves.[24]

12.1 PARTICIPATORY MAPPING

Participatory mapping "can be defined as 'the creation of maps by local communities - often with the involvement of supporting organizations including governments…and other actors engaged in development and land-related planning".[25] It can be effective not only in helping community members understand complex problems and visualize risks and potential changes to their community, but it can also identify more effective adaptation responses by incorporating local and traditional ecological knowledge.[26]

One specific example of this is to have participants "plot a transport route through a local interactive map with flood risk areas highlighted, or [explore] how they might retrofit a local existing building to cope with changing climate conditions".[27] In all, participatory mapping should be part of a broader engagement strategy in order to incorporate local knowledge and shouldn't function as the sole form of engagement.[28]

12.2 ASERT MODEL

The ASERT Model[29] is another participatory engagement strategy that involves several stations at which community members can complete various learning activities related to climate risks and vulnerabilities and receive a reward for completing them all. It allows for the co-production of policy-relevant knowledge grounded in local contexts, as it offers space for community members to share their experiences and voice their preferences for different solutions.[30] It provides an opportunity to support marginalized voices as long as the opportunity to participate reaches those communities effectively in the first place. Care should be taken to ensure the activities don't diminish the importance of the issue at hand or come off as belittling, especially if the community you are working with has recently experienced loss or trauma.

Closing Thoughts

These strategies are meant to be a starting place to help planners better tailor their climate communications to the communities they work with in order to increase understanding of the issues at hand, bolster approval and implementation of climate resilient policies, and build social capital in cities. While they are all listed as individual strategies, many are closely related, and they will all be more effective if used together.

As with all community engagement, engagement for climate planning is not a one-time occurrence. Engagement should be thoughtfully done throughout the planning process to ensure climate action is equitably distributed and implemented and to ensure planning policies and projects are able to achieve climate goals.

ENDNOTES

1 Bostrom, A., Böhm, G., & O'Connor, R. E. (2013). Targeting and tailoring climate change communications. WIREs Climate Change, 4(5), 447–455. https://doi.org/10.1002/wcc.234

2 Bruine de Bruin, Wändi, Lila Rabinovich, Kate Weber, Marianna Babboni, Monica Dean, and Lance Ignon. "Public Understanding of Climate Change Terminology." Climatic Change 167, no. 3 (August 12, 2021): 37. https://doi.org/10.1007/s10584-021-03183-0.

3 Moser, S. C. (2017, September 26). Communicating Climate Change Adaptation and Resilience. Oxford Research Encyclopedia of Climate Science. https://doi.org/10.1093/acrefore/9780190228620.013.436

4 Bruine de Bruin, Wändi, Lila Rabinovich, Kate Weber, Marianna Babboni, Monica Dean, and Lance Ignon. "Public Understanding of Climate Change Terminology." Climatic Change 167, no. 3 (August 12, 2021): 37. https://doi.org/10.1007/s10584-021-03183-0.

5 Nerlich, B., Koteyko, N., & Brown, B. (2010). Theory and language of climate change communication. Wiley Interdisciplinary Reviews. Climate Change, 1(1), 97–110. https://doi.org/10.1002/wcc.2

6 Paschen, J.-A., & Ison, R. (2014). Narrative research in climate change adaptation—Exploring a complementary paradigm for research and governance. Research Policy, 43(6), 1083–1092. https://doi.org/10.1016/j.respol.2013.12.006

7 Ibid.

8 van der Linden, S., Maibach, E., & Leiserowitz, A. (2015). Improving Public Engagement With Climate Change: Five "Best Practice" Insights From Psychological Science. Perspectives on Psychological Science: A Journal of the Association for Psychological Science, 10(6), 758–763. https://doi.org/10.1177/1745691615598516

9 Lieberknecht, K. (2022). Community-Centered Climate Planning: Using Local Knowledge and Communication Frames to Catalyze Climate Planning in Texas. Journal of the American Planning Association, 88(1), 97–112. https://doi.org/10.1080/01944363.2021.1896974

10 Ibid.

11 Sarfaty & Maibach, 2015, as cited in Weathers, M. R., Maibach, E., & Nisbet, M. (2017). Communicating the Public Health Risks of Climate Change. Oxford Research Encyclopedia of Climate Science. https://doi.org/10.1093/acrefore/9780190228620.013.428

12 Myers, T. A., Nisbet, M. C., Maibach, E. W., & Leiserowitz, A. A. (2012). A public health frame arouses hopeful emotions about climate change. Climatic Change, 113(3), 1105–1112. https://doi.org/10.1007/s10584-012-0513-6

13 City of Seattle. (2018). Seattle Climate Action Strategy. City of Seattle. http://greenspace.seattle.gov/wp-content/uploads/2018/04/SeaClimateAction_April2018.pdf

14 Seattle Public Utilities. (2020). 2020 Green Stormwater Infrastructure Progress Report: A Natural Approach to Stormwater Management. https://kingcounty.gov/~/media/services/environment/wastewater/cso/rainwise/2103_GSI_2020-Annual-Report.ashx?la=en

15 Office of Sustainability & Environment, City of Seattle. (2017). Preparing for Climate Change. City of Seattle. https://www.seattle.gov/Documents/Departments/OSE/ClimateDocs/SEAClimatePreparedness_August2017.pdf

16 O'Neill, S. J., Boykoff, M., Niemeyer, S., & Day, S. A. (2013). On the use of imagery for climate change engagement. Global Environmental Change, 23(2), 413–421. https://doi.org/10.1016/j.gloenvcha.2012.11.006

17 Reis, J., & Ballinger, R. C. (2020). Creating a climate for learning-experiences of educating existing and future decision-makers about climate change. Marine Policy, 111. https://doi.org/10.1016/j.marpol.2018.07.007

18 Ibid.

19 O'Neill, S. J., Boykoff, M., Niemeyer, S., & Day, S. A. (2013). On the use of imagery for climate change engagement. Global Environmental Change, 23(2), 413–421. https://doi.org/10.1016/j.gloenvcha.2012.11.006

20 Wang, S., Corner, A., Chapman, D., & Markowitz, E. (2018). Public engagement with climate imagery in a changing digital landscape. WIREs Climate Change, 9(2), e509. https://doi.org/10.1002/wcc.509

21 Ibid.

22 van der Linden, S., Maibach, E., & Leiserowitz, A. (2015). Improving Public Engagement With Climate Change: Five "Best Practice" Insights From Psychological Science. Perspectives on Psychological Science: A Journal of the Association for Psychological Science, 10(6), 758–763. https://doi.org/10.1177/1745691615598516

23 King 5 Staff. (2022, September 11). Seattle breaks record for most 90-degree days in a year. King5.Com. https://www.king5.com/article/news/local/seattle/seattle-90-degree-day-record-most-in-a-year/281-f472a02d-003c-46a0-8b05-093f4dc09398

24 Fung, A. (2015). Putting the Public Back into Governance: The Challenges of Citizen Participation and Its Future. Public Administration Review, 75(4), 513–522. https://doi.org/10.1111/puar.12361

25 IFAD 2013, as cited in Yusuf, J.-E. (Wie), & St. John III, B. (Eds.). (2022). Communicating Climate Change: Making Environmental Messaging Accessible (1st ed.). Routledge. https://doi.org/10.4324/9781003037378

26 Kamaci, 2014, as cited in Yusuf, J.-E. (Wie), & St. John III, B. (Eds.). (2022). Communicating Climate Change: Making Environmental Messaging Accessible (1st ed.). Routledge. https://doi.org/10.4324/9781003037378

27 Reis, J., & Ballinger, R. C. (2020). Creating a climate for learning-experiences of educating existing and future decision-makers about climate change. Marine Policy, 111. https://doi.org/10.1016/j.marpol.2018.07.007

28 Yusuf, J.-E. (Wie), & St. John III, B. (Eds.). (2022). Communicating Climate Change: Making Environmental Messaging Accessible (1st ed.). Routledge. https://doi.org/10.4324/9781003037378

29 ASERT Approach – ASERT. (n.d.). Retrieved May 28, 2023, from https://sites.wp.odu.edu/asert/approach/

30 Ibid.

CLIMATE RESOURCES

Climate Science

CLIMATE CHANGE 101

EPA Climate Change Science Overview
EPA Greenhouse Gases Overview
Global Carbon Budget Graphs + Climate Information
IPCC Reports
IPCC Adaptation and Vulnerability Summary for Policymakers
IPCC Mitigation of Climate Change Summary for Policymakers
New York Times The Science of Climate Change Explained
NOAA U.S. Climate Normals

Climate Communication

Columbia Guide to Effective Climate Change Communication
EcoAmerica Connecting on Climate
Metcalf Institute Inclusive Science Communication Starter Kit
NACRP Community Driven Climate Resilience Planning
Oxford Encyclopedia of Climate Communication
UNFCC Communicating Climate Change: A Practitioner's Guide
Vancouver Public Engagement Toolkit for Sea Level Rise

Climate Mapping

CLIMATE IMPACTS

Climate Central Tools + Resources
Climate Impacts Group Analysis Tools
Climate Impacts Group Climate Mapping for a Resilient Washington
EPA Climate Impacts Overview
FEMA National Risk Index Map
Puget Sound Regional Council Displacement Risk Map
Puget Sound Regional Council Regional Hazards Map
Risk Factor Mapping Tool
The Climate Toolbox Climate Mapper Tool
U.S. Climate Resilience Toolkit Climate Mapper for Resilience and Adaptation
U.S. Climate Resilience Toolkit Climate Impacts Tools
U.S. Climate Resilience Toolkit Climate Tool Library
USGS National Climate Change Viewer

HEALTH + EQUITY IMPACTS

Climate Impacts Group Tribal Climate Tool
EPA Environmental Justice Screening Tool
Seattle Race and Social Equity Index
Washington State Department of Health Environmental Health Disparities Map

Climate Planning

GUIDELINES

C40 Cities Guide to Integrating Climate Action
Georgetown Climate Adapting to Urban Heat: A Toolkit for Local Governments
National Wildlife Federation Green Works for Climate Resilience

CLIMATE IMPACTS

APA Urban Heat Management and the Legacy of Redlining
C2ES Heat Waves and Climate Change
Carbon Brief What Climate Models Tell us About Future Rainfall
CDC Climate Impacts on Human Health
Climate Impacts Group State of Knowledge: Climate Change in Puget Sound
EPA Climate Indicators: Heat Waves
EPA Climate Indicators: Heavy Precipitation
NRDC Flooding and Climate Change
Union of Concerned Scientists Heat Waves
Union of Concerned Scientists Heat Waves and Human Health
World Health Organization Heat Waves

Heat Waves

GUIDANCE

APA Planning for Urban Heat Resilience
Georgetown Climate Center Adaptation Toolkit: Sea Level Rise and Coastal Land Use
Low Carbon Living Guide to Urban Cooling Strategies
Northern Institute of Applied Climate Science Tree Species Guide

URBAN HEAT ISLANDS

EPA Urban Heat Islands
Google Tree Canopy Viewer
NOAA Urban Heat Tools
Tree Equity Score Mapper

HEALTH IMPACTS

Future Heat Events and Social Vulnerability Map
CDC Heat and Health Tracker

Urban Flooding

GUIDANCE

APA Getting Ready for the Rain: Urban Flooding and Planning for Community Resilience
C40 Cities Flooding Implementation Guides
C40 Cities How to Increase Your City's Permeability
EPA Flooding Guidance
Urban Floods Community of Practice Land Use Planning for Urban Flood Risk Management
Washington Department of Ecology Planning for Flood Hazards
Washington Department of Ecology Comprehensive Planning for Floodplain Management

VISUALIZATION TOOLS

Climate Impacts Group Projected Changes in Extreme Precipitation Tool
Climate Impacts Group Sea Level Rise Viewer
FEMA National Flood Hazard Layer
NOAA Tides and Currents Map
NOAA Inundation Dashboard
NOAA Sea Level Rise Viewer
Seattle Public Utilities Sea Level Rise Mapper
US Fish and Wildlife Service National Wetlands Inventory
Washington Coastal Resiliency Network Washington Coastal Hazards Risk Reduction Project Mapper

GREEN STORMWATER INFRASTRUCTURE

EPA Green Infrastructure Modeling Toolkit
EPA Stormwater Trees Technical Memorandum

Wildfire

GUIDANCE

NOAA Wildfire Climate Connection
USDA + USFS Wildfire Crisis Strategy Implementation Plan and Confronting the Wildfire Crisis

WILDFIRE + SMOKE MAPPING

Air Now Fire and Smoke Map
DNR Community Wildfire Resilience Resource Library
U.S. Climate Resilient Toolkit Landfire Mapping Tool
USGS Current Wildfires Map
USGS Wildland Fire Trends Tool
Washington State Department of Ecology Smoke Forecast

APPENDICES

Appendix A: Heat Waves PowerPoint
Appendix B: Urban Flooding PowerPoint

APPENDIX A:
HEAT WAVES POWERPOINT

Heat Waves

What's causing them, how they relate to planning decisions, and how planners can discuss them more effectively with communities

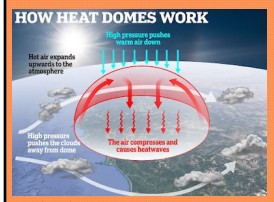
1

What is a heat wave?

a period of hot weather above historical averages for the area that lasts for two or more days (CDC)

2

What causes heat waves?

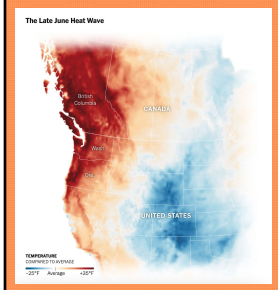


High pressure systems strengthen and remain in the atmosphere for multiple days

These systems push hot air down and:

- Prevent heat from rising back to the atmosphere
- Trap hot air rising from the ground
- Minimize wind and cloud cover
- Prevent other weather systems from coming in

3



Climate Change + Heat Waves

- Increasing frequency, duration, and intensity of heat waves
- Changing seasonality
- Affecting more people annually as the Earth warms, 100 heat related deaths in Seattle 2021 (WA DOH)

4

CITY	NUMBER OF DEATHS PER EXTREME HEAT EVENT (PER 100,000 PEOPLE)		
	With a 5.4° F increase	*3.6° F increase*	*2.7° F increase*
Miami	520	323	248
Detroit	204	135	109
St. Louis	113	87	75
Seattle	103	63	49
Philadelphia	95	63	51
Atlanta	94	73	66
Washington, D.C.	71	45	37
Dallas	68	45	33
New York	68	45	36
Chicago	66	42	34
Los Angeles	64	45	37
Boston	49	32	25
San Francisco	40	31	27
Houston	34	23	19
Phoenix	33	20	14

Climate Change + Heat Waves

- Increasing frequency, duration, and intensity of heat waves
- Changing seasonality
- Affecting more people annually as the Earth warms, 100 heat related deaths in Seattle 2021 (WA DOH)

5

Humidity

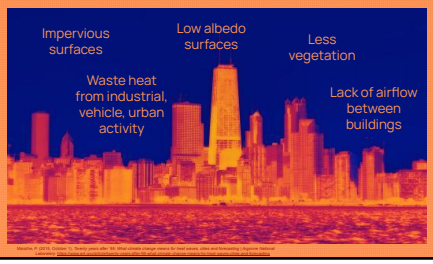
Increased global warming also increases the humidity of the air

- As the air warms, it can hold more water vapor
- For every degree of warming, water vapor increases 7%

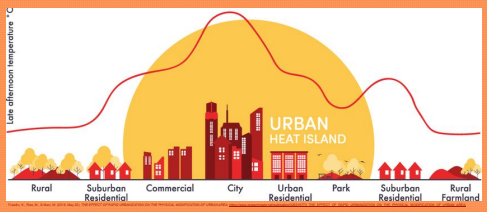
Exacerbates how high temperatures actually feel → wet bulb temperature: reports how hot it actually feels outside in terms of heat stress on the human body

6

Urban Heat Island Effect



Urban Heat Island Effect



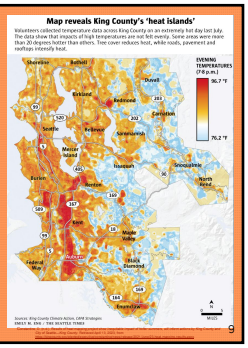
Temperatures in the city are several degrees warmer than rural counterparts due to abundance of impervious surfaces that absorb, rather than reflect heat

UHI + Heat Waves

Night time temperatures remain high as urban surfaces slowly release the heat they absorbed during the day

Previously redlined neighborhoods experience disproportionate impacts of human heat due to decades of disinvestment

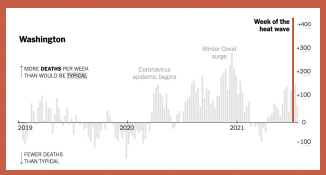
Up to *12.6 °F warmer* than non-redlined neighborhoods



Impacts of heat waves in cities

Human Health

- Can cause heat related illnesses: heat stroke and heat stress, worsen existing health conditions, and in extreme cases: death



Impacts of heat waves in cities

Built Environment

Can damage infrastructure i.e. roads, bridges, disrupt industry i.e. airlines, worsen air quality

Impacts of heat waves in cities

Energy Infrastructure

Can overload energy grid through increased air conditioning use, decrease efficiency of grid due to slower transmission, can cause brownouts/blackouts to prevent widespread grid failure

Urban Planning + Heat Wave Adaptation

Increase greenspace, tree cover, shade structures, green roofs, etc

Green buildings, improve wind circulation through street grid and building arrangement

Implement equitable heat management strategies and increase access to air conditioned spaces

Communication of heat impacts

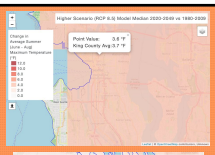
LOCAL IMPACTS
What areas will be most affected? Which populations are most at risk?

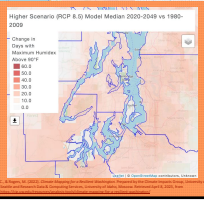
LOCAL ACTION
What is your city doing to mitigate and adapt to heat waves? What resources are available to residents?

LOCAL KNOWLEDGE
How are communities adapting and how can planners assist in these efforts?

Local impacts

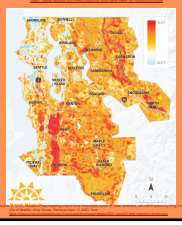
- Using CIG's Climate Mapping for a Resilient Washington Tool
- Seattle is expected to experience
  - A 3.6˚F increase in average summer maximum temperature by mid-century
  - An average of 14.7 days above 90˚F by mid-century





Local action

- Trees for Neighborhoods Program to help residents plant trees on their property
  - Since 2009, over 13,400 trees have been planted
- Seattle to develop first Extreme Heat Mitigation Strategy

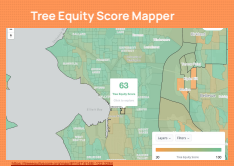


Local knowledge

- Ask where people go when it is hot outside, what do they need in their community to supplement adaptation?
  - Air conditioning assistance programs, trees/greenspace, water features, something else?
  - Participatory mapping or other hands-on engagement

Visualization Tools

- FEMA National Risk Index
- CDC Heat and Health Tracker
- CDC Future Heat Events and Social Vulnerability Map
- Washington Health Disparities Map



- Google Tree Canopy Viewer
- Tree Equity Score Mapper
- Climate Impacts Group Climate Mapping for a Resilient Washington

APPENDIX B:
URBAN FLOODING POWERPOINT

Urban Flooding

What's causing it, how it relates to planning decisions, and how planners can better communicate the risks of flooding

1

What contributes to urban flooding

- Increased annual precipitation
- Larger precipitation events
- Sea level rise
- Changes in streamflow
- Increase in impervious surfaces in cities
- Insufficient stormwater infrastructure
- Many more!

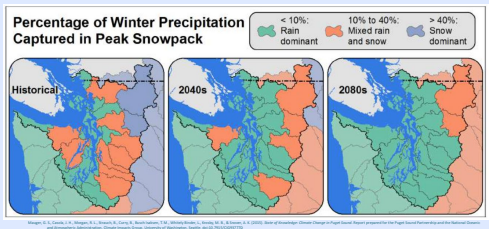
2

Climate change is shifting precipitation patterns

- Overall increase in annual precipitation
- More precipitation is falling as rain rather than snow
- With less snowpack, timing of runoff changes
  - More melting earlier in the year and less stream flow in the summer
  - PNW snow melting 10 days earlier on average

3

Puget Sound changes in precipitation patterns



4

Wet gets wetter dry gets drier

- With increased temperature, areas that already experience relatively high levels of precipitation are expected to experience even more precipitation, while drier areas will receive less precipitation.
- In Puget Sound, climate change will lead to an increase in overall precipitation and more intense precipitation events
  - Seattle fall-winter of 2021 saw 19in of rain, breaking record since 1945

5

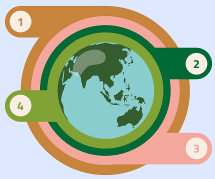
- With every degree of warming, water vapor increases by 7%
- Atmosphere can hold more water, which means more water is now available for precipitation
- Additional water vapor in the atmosphere also leads to more warming because it is a greenhouse gas that traps heat in the atmosphere just like carbon dioxide or methane (positive feedback loop)

Global warming increases the amount of water vapor the atmosphere can hold

6

Positive Feedback Loop

Increased global temperature due to greenhouse gas emissions will lead to more water vapor being held in the atmosphere.



More water vapor in the atmosphere traps even more heat because it is a greenhouse gas.

More heat trapped in the atmosphere means more warming.

More warming leads to even more water vapor in the atmosphere, and the cycle continues

How urban planning influences flooding

- Development of cities has led to more impermeable surfaces like concrete, that don't allow for water to infiltrate into the soil as well
- During heavy rains, this leads to surface runoff and potential flooding
- More runoff overwhelms drainage pipes which can overflow during large precipitation events, causing flooding

Kent, J. (2022, December 27). *Seattle neighborhoods flooded following heavy rain, king tide*. KOMO. https://komonews.com/news/local/heavy-rain-strong-wind-king-tides-seattle-flooding-urban-city-flood-south-park-winter-weather-pacific-northwest-washington-storm-rains?photo=1

Impacts of flooding in cities

Trees and other greenery can be damaged

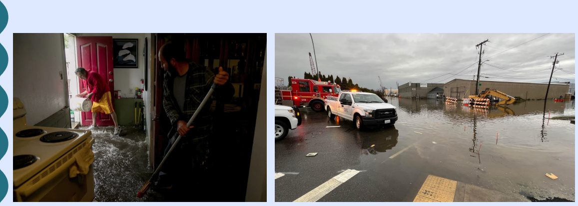
Drainage systems can be overwhelmed with too much rain

Stormwater runoff can increase water pollution

Infrastructure and other critical services can be interrupted or damaged

Flooding can damage property + in extreme cases cause loss of life

South Park, Seattle Flooding Winter 2022-3

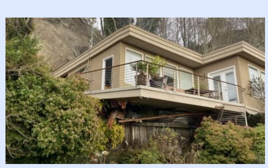


Source: Kim, G. (2022, December 27). 'We lost everything': Duwamish River gushes into Seattle homes. The Seattle Times. https://www.seattletimes.com/seattle-news/duwamish-river-floods-seattles-south-park-neighborhood/

King 5 Staff. (2022, December 10). *Storm impacts: Homes, businesses flooded across western Washington*. King5.Com. https://www.king5.com/article/weather/timeline-severe-winds-flooding-western-washington/281-f0d623ad-3e3c-4b57-8567-c35b9a779969

Erosion + Landslides

- Large precipitation events can lead to erosion and the destabilization of slopes that can lead to landslides and other geologic hazards.
- Large property loss, potential loss of life, can worsen water quality as stormwater picks up sediment and pollutants



D'Angelo, B. (2022, January 8). *Landslide destroys Seattle home, injures 2 people*. WPXI. https://www.wpxi.com/news/trending/landslide-destroys-seattle-home-injures-2-people/T6ZBCLNJ4FCXHKJOFYOTJUH5PY/

Recurrent flooding

- Occurs in coastal areas during high tide
- Sea level rise, storm surges, or heavy precipitation can all increase flooding risks
- Some infrastructure and communities will be more affected than others i.e. stormwater infrastructure, roads near the coast, etc.

Urban Planning + Flooding Adaptation

King County FLOOD ALERT

Early Warning Systems

County-wide alerts, prioritize assistance for low income and high risk neighborhoods.

Ensure people know what resources are available to them i.e. evacuation centers, guidance on what to do before, during, and after floods

Green Stormwater Infrastructure

Permeable pavement, bioswales, bioretention ponds, green roofs, tree cover, etc.

i.e. High Point neighborhood in Seattle

2020 Updates to Seattle's Floodplain Development Regulations

1. The elevation that the first floor of a new structure must be built at to keep the first story above anticipated flood levels
2. Structures must be engineered to withstand wind from anticipated storms
3. Structures must be engineered to withstand flood waters should anticipated flood levels be exceeded

Zoning and Natural Buffers

Prohibits new development in known flood plains (FEMA), but increase flood zones to include sea level rise estimates if appropriate.

Increase natural buffers and improve vegetation along riverbanks

COMMUNICATE:

local impacts

what areas and who will be affected?

local action

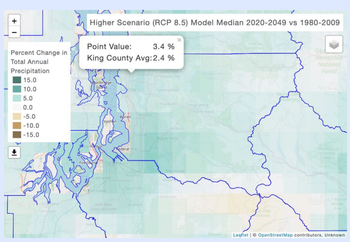
what is being done? What resources are available?

local knowledge

how are communities adapting?

Local impacts

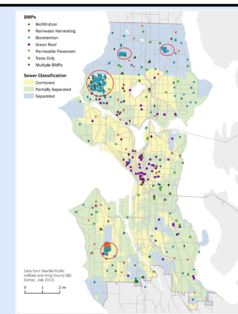
- King County is expected to experience an average of 2.4% increase in precipitation by the mid-century
- Show clear images and maps vs. data projections



Raymond, C., & Rogers, M. (2022). *Climate Mapping for a Resilient Washington*. Prepared by the Climate Impacts Group, University of Washington, Seattle and Research Data & Computing Services, University of Idaho, Moscow. Retrieved April 8, 2023, from https://cig.uw.edu/resources/analysis-tools/climate-mapping-for-a-resilient-washington/

Local action

- Seattle currently manages 465 million gallons of stormwater annually, goal of managing 700 million gallons per year
- RainWise Program in King County assists people with building rain gardens on their property



Note: the GSI inventory only includes those planted for stormwater management purposes in Seattle, not the entire tree canopy.

United States Environmental Protection Agency. (2017). Expanding the Benefits of Seattle's Green Stormwater Infrastructure. https://www.epa.gov/sites/default/files/2017-03/documents/seattle_technical_assistance_010517_combined_508.pdf

Local knowledge

- Participatory mapping in the Duwamish to understand community's vision for the Duwamish Valley
- Resulted in Duwamish Valley Action Plan incorporating goals such as improving natural filtration and reducing flooding risks

Duwamish River Cleanup Coalition. (2009). *Duwamish Valley Vision Map & Report*. https://seattle.gov/documents/departments/environment/environmentalequity/duwamish-valley-vision-report-2009.pdf

Visualization Tools

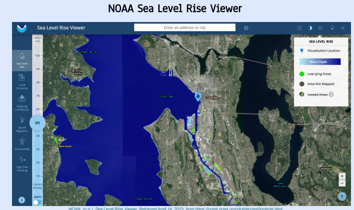
Tides and Currents

- NOAA Tides and Currents Map
- NOAA Inundation Dashboard

Floodplain

- FEMA National Flood Hazard Layer
- Climate Central Coastal Risk Screening Tool

NOAA Sea Level Rise Viewer



NOAA. (n.d.). *Sea Level Rise Viewer*. Retrieved April 14, 2023, from https://coast.noaa.gov/digitalcoast/tools/slr.html

Sea Level Rise

- Climate Impacts Group SLR Visualization Tool
- NOAA SLR Viewer (shown above)
- Seattle Public Utilities SLR Mapper
- Climate Central Coastal Risk Screening Tool