Extreme Weather Events

A Discussion Paper about Community Resilience   *June 2015*

Brief: Extreme heat or cold, especially for several days in a row, and increases in storm frequency and severity are becoming more common. Cities and counties can take steps to reduce impacts from these Extreme Weather Events or to be better prepared for them when they occur. Preventative or proactive measures can help reduce the cost of response and provide for more rapid provision of services during or immediately following such events.

Problem

Increases in storm severity, or extreme heat or cold periods, can impact communities in several ways. Power outages, damage to infrastructure and transportation routes, flooding, or the need to provide additional services to our most vulnerable populations are just a few examples. Local governments can address or reduce these impacts. Some methods, such as increasing tree canopy in urban areas, may include changes to the way the community develops over time. Other options include potential programmatic changes during or after such events. Cities and counties will be expected to protect residents, property, and provide critical services.

Introduction

The frequency of extreme weather events has increased. It is anticipated that trend will continue. For Washington, that includes floods, coastal storm surges, droughts, and heat waves.

According to the Observed Trends and Future Projections chapter of the State's Integrated Response Strategy, some of these related observed trends and future projections are as follows:

Observed trends: In the Pacific Northwest, average annual temperature rose 1.5°F between 1920 and 2003. The warming has been fairly uniform and widespread, with little difference between warming rates at urban and rural weather monitoring stations. According to Mote and Salathé (2010), Washington's temperatures will continue to rise in the coming decades (see future projections below).

The frequency of heavy downpours (defined as the top 1 percent of rainfall events) has increased by about 12% in the Pacific Northwest.

Future projections: Average annual temperature in the Northwest is projected to increase by approximately (relative to 1970-1999):

- 2°F by the 2020s (range of 1.1 to 3.4°F).
- 3.2°F by the 2040s (range of 1.6 to 5.2°F).
- 5.3°F by the 2080s (range of 2.8 to 9.7°F)

Increases of 5 to 10 percent in storm intensity are projected for the North Cascades and northeastern Washington, while increases in other areas of the state are not as significant (Salathé *et al*. 2010). In the Seattle-Tacoma area, the magnitude of a 24-hour storm is projected to increase 14 to 28 percent during the next 50 years (Rosenberg *et al*. 2010).
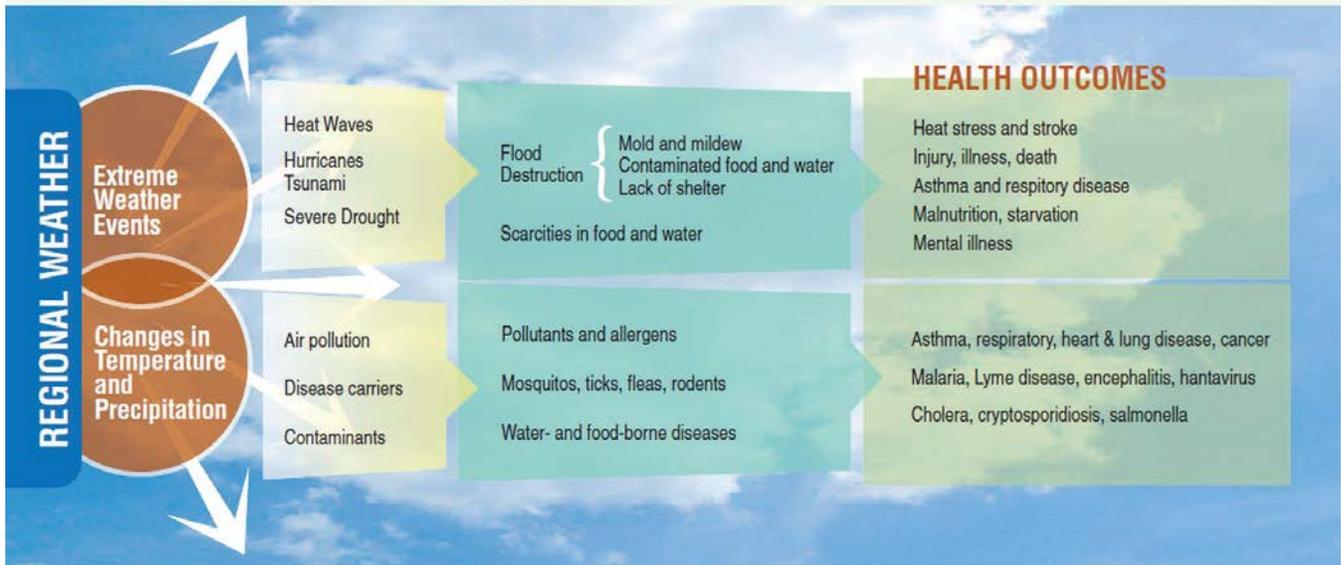
Figure 1. How climate change can harm human health
Source: American Public Health Association citing U.S. Global Change Research Program

Storm Intensity

Storms will be more frequent and more intense (Washington State Integrated Climate Change Response Strategy, 2012). Sea Level Rise and increases in wave height and storm surges will exacerbate impacts of some storms. As a result, urban flooding, flooding of critical infrastructure near coast lines, and storm-related power outages are also expected to increase.

Extreme Heat

Increases in average temperatures, especially in summer months, will lead to more heat related illnesses and deaths. According to the Centers for Disease Control (CDC), "Conditions of extreme heat are defined as summertime temperatures that are substantially hotter and/or more humid than average for a location at that time of year. Humid or

muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground." Cities and other developed areas have higher average temperatures than more suburban or rural areas because of the amount of land covered with asphalt, concrete, and other surfaces that absorb heat. This is known as the "urban heat island" effect.
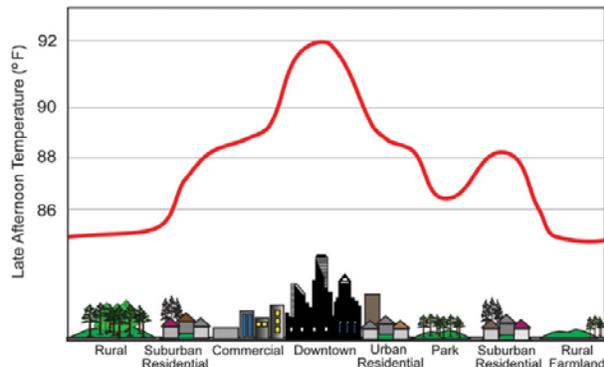

The "urban heat island" refers to the fact that the local temperature in urban areas is a few degrees higher than the surrounding area. Source: USGCRP (2009)

According to the Washington State Department of Ecology, *"Prolonged exposure to heat can lead to heat exhaustion, heat stroke, or even death."* In urban areas, these hardened landscapes hold the heat, which means they do not cool off as much at night as the more rural areas do, further exacerbating the health problem.

Some potential means to reduce temperature increases in cities include: encourage tree retention, increase tree canopy by planting more trees, and providing more green space through active and passive open space areas.

Heat waves can also result in stagnant air, which can cause respiratory issues for people. The elderly, very young, or persons with asthma or other respiratory conditions may be even more vulnerable during these times.
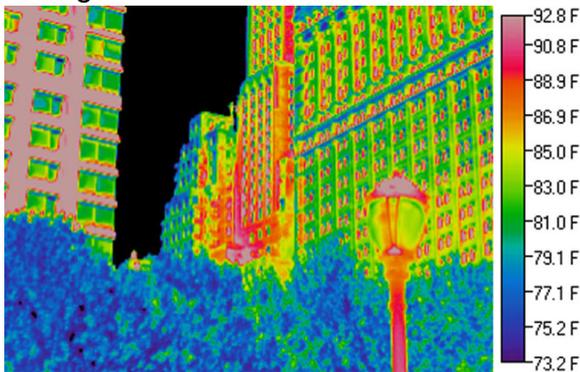
See the Sizzle: Infrared Photos Reveal the Brutal Urban Heatscape. Source: Wired http://www.wired.com/2013/08/urban-heat-nyc/

Most Washingtonians do not have air conditioning in their homes. At least in the western part of the state, many schools, businesses and work sites do not have cooling systems either, although it is becoming more common. During extreme heat events, local governments may need to provide cooling stations or places where people can go to escape the heat. Demand for air conditioning will increase during summer, when water availability for hydropower generation is typically at its lowest levels of the year.

According to the US EPA's Excessive Heat Event (EHE) Guidebook, "…broad consensus exists on the types of actions that will provide relief to those at risk during EHEs and help minimize associated health impacts. These actions include:

- Establishing and facilitating access to air-conditioned public shelters
- Ensuring real-time public access to information on the risks of the EHE conditions and appropriate responses through broadcast media, web sites, toll-free phone lines, and other means
- Establishing systems to alert public health officials about high-risk individuals or those in distress during an EHE (e.g., phone hotlines, high-risk lists)
- Directly assessing and, if needed, intervening on behalf of those at greatest risk (e.g., the homeless, older people, those with known medical conditions)."

The State of Minnesota Department of Health prepared a toolkit for local governments to use when preparing to deal with Extreme Heat Events. The toolkit includes six steps:

Step 1: Create a heat response plan
Step 2: Predict extreme heat event and transfer information to lead agency

Step 3: Assess risk and determine activation of response plan

Step 4: Activate response plan and notify the public

Step 5: Implement response plan

Step 6: Evaluate response plan

Extreme Cold

Extreme cold, like extreme heat, can impact communities. Extreme cold can result in greater power demand to heat homes and businesses. Additionally there can be a greater demand for shelters or emergency housing.

When power outages occur during periods of cold weather the demand for emergency services may increase, as there are calls to address carbon monoxide poisoning, accidents, or fires resulting from people using alternative ways to stay warm or prepare food. The City of Seattle notes:

> The city's poorer and older residents are the hardest hit. The homeless are the most vulnerable. Although attempts are made to find extra space for them in shelters, many are still on the streets even in harsh weather. People without back-up sources of heat will also suffer from the cold during outages. In 2006, several incidents of carbon monoxide poisoning occurred when people attempted to burn charcoal indoors to maintain heat. Anyone needing medical care is vulnerable when the transportation system is impaired. Older people are indirectly affected since they require medical care most frequently and snow can make it

more difficult for them to receive it. When critical outpatient services cannot be accessed, medical needs may escalate.

Overall our temperatures are rising. However, we will still face cold periods. Storms or power outages will increase impacts during these times and we need to have plans in place to protect our communities.

Strategies to Address Extreme Weather Events

In addition to preparing an Extreme Weather Event response plan, communities can also take other steps to reduce impacts. Some examples include:

- Retain trees in urban areas, including parks and open spaces. Some cities have tree protection ordinances that limit tree removal on private property and require tree retention during development.
- Increase tree canopy and open space. Communities may add trees in existing urban areas by adding street trees, requiring parking lot landscaping with trees, or adding trees in plazas, pocket parks, or other open space areas.
- Education and outreach. Work with residents and stakeholders to raise awareness of the issues, the proposed responses, and encourage neighborhoods to participate. Consider having a method for people who may need additional assistance to sign up with the city or county,

such as through the police or fire departments. In the event of power outages, evacuation, or extreme weather spells, emphasis could be placed on checking on these individuals to ensure medical needs are met (e.g. provision of oxygen during power outages).

- Solar Ready Construction – is a building strategy that provides a few minor building additions that allow homeowners to more easily add rooftop solar photovoltaic systems for electricity or hot water at a later date.
- Weatherization – insulation helps keep structures warm in the winter and cool in the summer.   It works even when the power is out! Conservation measures help utilities meet their renewable portfolio standards, so your local utility provider may be a willing partner to increase weatherization efforts. Communities may want to focus efforts for rental housing (owners often are not incentivized to make improvements because tenants pay the utility bills. Tenants are not likely to make the improvements because they do not own the structures).
- Emergency response plans that include heating or cooling stations – Communities may want to plan to provide geographically dispersed heating or cooling centers and advertise those locations in advance of an Extreme Weather Event. Perhaps window decals or signage could be permanently placed near entryways to alert the community to these locations. These facilities should have back up power sources to rely on during power outages.

- Building orientation and passive solar – New developments (e.g. lots) and construction of buildings should be laid out and designed to take advantage of passive solar and allow for current or future addition of rooftop solar panels. Simple design features can improve structure heating in the winter, while strategically selected and placed tree varieties can help cool the structures in the summer.
- Cool roofs – light colored roofs help reflect sunlight radiation. Cool roofs will help keep buildings cooler in the summer.
- Green Roofs – Green roofs are rooftops designed to include vegetation. These can also provide urban open spaces and opportunities for urban agriculture. Significant cooling and storm water issues can be addressed through green roofs.
- Work with utility providers in advance to adopt agreements to ensure that electricity and water are not cut off due to nonpayment during extreme heat or cold events

These are just some examples of the opportunities local governments have to prepare for and address the impacts of Extreme Weather Events. Some of these can be encouraged, required for municipal projects, or required jurisdiction-wide.

Cities and counties can work with stakeholders and special purpose districts, as well as their citizens to determine which strategies will work best for them. Some strategies may be implemented more quickly than others,

while some may require a more deliberate approach in order to develop a program to implement it, or modifications to development regulations or architectural design standards.

Examples

One city strategy that is fairly common, which is likely started in a community for issues other than adapting to climate change impacts, is that of becoming a Tree City USA city. Over 80 cities in Washington State have achieved the Tree City USA designation. In addition, the Urban and Community Forestry program at the Washington State Department of Natural Resources (DNR) provides technical assistance to communities on urban forestry issues.

In 2012, during a heat wave, several communities[1] opened up cooling centers, including Auburn, Bellevue, Centralia, Federal Way, Kirkland, Pierce County, Poulsbo, Thurston County, and Seattle.

Some residential contractors are offering homes that are built "solar-ready". This means it will be easier for homeowners to add rooftop solar photovoltaic systems to the home at a later date, because there will be conduit, physical space, extra space in the electrical panel, and a few other measures that allow for easier and less expensive addition of renewable solar energy systems to the homes. A city or county could actively encourage solar ready construction. Some communities are even requiring it.

Additionally, Counties and Cities can work to become Northwest Solar Communities, those jurisdictions that work to make the process of going solar simple, fast, and cost effective. Tools have been developed to help local governments streamline the permitting process and address renewable solar energy in comprehensive plans and development regulations.

Weatherization programs can certainly help homes, especially older homes or rental housing, be more energy efficient. Adding insulation and sealing air leaks can make big changes in the year-round comfort of those who live inside.

Additional Resources

http://www.ecy.wa.gov/climatechange/2012ccrs/health.htm

http://www.epa.gov/climatechange/impacts-adaptation/health.html#impactsheat

WA Department of Ecology Human Health Fact Sheet: https://fortress.wa.gov/ecy/publications/publications/1201009.pdf

Chapter 4: Human Health, Washington State's Integrated Response Strategy: https://fortress.wa.gov/ecy/publications/publications/1201004f.pdf

US EPA Excessive Heat Events Guidebook (EPA 430-B-06-00) http://www.epa.gov/heatisland/about/heatguidebook.html

Georgetown Climate Center's Adapting to Urban Heat: A Tool Kit for Local

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[1] http://www.kirotv.com/news/weather/list-cooling-centers-western-washington/nRCym/

Governments http://www.georgetownclimate.org/adaptation-tool-kit-urban-heat

Appendix A of the Community-Based Climate Adaptation Planning: Case Study of Oakland, California http://www.pacinst.org/reports/oakland_climate_adaptation/index.htm

NOAA's Responding to Extreme Weather and Climate Events: Adaptation Strategies and Information Needs, specifically see *Tools for Planning and Responding to Extreme Events* on the last two pages.

Minnesota Department of Health Extreme Heat Toolkit http://www.health.state.mn.us/divs/climatechange/docs/mnextremeheattoolkit.pdf

Centers for Disease Control, Emergency Preparedness and Response, Extreme Heat Prevention Guide http://emergency.cdc.gov/disasters/extremeheat/heat_guide.asp

Intergovernmental Panel on Climate Change (IPCC) Special Report: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation https://www.ipcc.ch/pdf/special-reports/srex/SREX_Full_Report.pdf

Washington State Department on Natural Resources, Urban and Community Forestry Program http://www.dnr.wa.gov/ResearchScience/Topics/UrbanForestry/Pages/rp_urban_commandurbanforestry.aspx

Tree City USA https://www.arborday.org/programs/treecityusa/

Washington State Department of Commerce, Growth Management Services, Energy Aware Communities http://www.commerce.wa.gov/Services/localgovernment/GrowthManagement/Growth-Management-Planning-Topics/Climate-Change-and-Energy/Pages/Energy-Aware-Communities.aspx

City of Seattle Office of Emergency Management, Hazard Identification and Vulnerability Analysis – Snow, Ice, and Extreme Cold (2014) http://www.seattle.gov/Documents/Departments/Emergency/PlansOEM/SHIVA/2014-04-23_SnowIceandExtremeCold.pdf

American Planning Association, Hazard Mitigation Policy Guide, 2014 https://www.planning.org/policy/guides/pdf/hazardmitigation.pdf

American Planning Association, Planning for Sustainability Policy Guide, 2000 https://www.planning.org/policy/guides/adopted/sustainability.htm

American Planning Association, Washington Chapter, Sustainable Washington 2009: Planning for Climate Change http://www.washington-apa.org/sustainable-washington