National Climate Assessment Health Sector Workshop

Northwest Region

February 23-24, 2012

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OVERVIEW

The U.S. Global Change Research Program (USGCRP) Climate Change and Human Health Working Group (CCHHG) convened two regional climate change and human health workshops in February 2012 as part of the National Climate Assessment (NCA) process. The workshops were supported by the National Oceanic and Atmospheric Administration (NOAA) Oceans and Human Health Initiative, the Centers for Disease Control and Prevention (CDC) National Center for Environmental Health, and the National Institutes of Health (NIH) National Institute for Environmental Health Sciences, with participant contribution of time and travel. This synthesis white paper summarizes the findings from the Northwest region workshop.

Context

Section 106 of the 1990 Global Change Research Act requires that the United States develop an NCA every four years. The NCA tracks the status of climate change in the nation by tracking the state of the science across seven sectors, including human health and welfare. To forward this objective, the interagency cross-cutting CCHHG was chartered in December 2009 and became the first group to assess societal and sector impacts as part of the NCA process. CCHHG is divided into several workstreams, including adaptation, assessment and indicators, education and engagement, joint research and application, international, and data integration.

Purpose

CCHHG organized the Southeast and Northwest regional workshops to help inform its contribution to the 2013 NCA. More specifically, the workshops are intended to help provide a more nuanced representation of regional climate change impacts on human health, since impacts in the health sector are place-specific and path-dependent. The workshops also provided an important venue for dialogue among regional climate change experts, public health experts, and other stakeholders.

The Northwest region includes Idaho, Oregon, and Washington. The Northwest was chosen as one of the two regions because of the enormous resources in the region (e.g., strong public health departments, NOAA Northwest Fisheries Science Center, University of Washington Climate Impacts Group, University of Washington School of Public Health, and others) and unique issues. The workshop was intended to leverage existing capacity, efforts, and discussions.

The goals of the Northwest workshop were to:

- Inform the 2013 U.S. NCA report;
- Increase the level of understanding of climate and health science in the region;
- Raise awareness of ongoing climate and health activities in the region;
- Improve tools for public health decision making by providing a forum for scientists and decision makers to share information and develop new or improve existing partnerships ; and
- Serve as a pilot for how to sustain an ongoing assessment process for understanding, predicting and adapting to the human health impacts of climate change across time scales.

This synthesis white paper serves as one of the products from the workshops and will be provided as technical input for the NCA. The paper documents participant input in the following six areas, which serve as the organizing structure for the *Summary of Input in Key Areas* section, below.

1. Current Regional Health Impacts of Climate Change
2. Regional Adaptation Efforts
3. Key Risks and Vulnerabilities
4. Future Projections of Health Impacts
5. Relevant Indicator Research and Tracking
6. Identification of Research and Monitoring Needs

Additional products from the workshops include:

- A survey of existing projects, research, publications, and decision-support tools on health effects of climate change in the region;
- A plan for building sustained collaborations needed to support ongoing assessment efforts including roles for different institutions; and
- Draft Monitoring, Early Warning, Data and Surveillance (MEDS) metadatabase, summarizing federal information related to climate change and health.

Format

The Northwest workshop took place over one full and one half day, February 23-24, 2012, in Seattle, Washington. The workshop was attended by approximately 50 individuals, including biological, physical, and social scientists as well as public health and natural resource decision-makers working on human health effects of climate change within the Northwest region.

The first (full) day of the workshop was devoted to plenary sessions, including presentations and discussion. Several plenary presenters have given permission for their presentations to be posted to the workshop website. These presentations are available at:
http://ww2p295[illegible]D0001[illegible]c003Tjc1[illegible]f2.9836es4.4153[illegible]D[illegible]c003Tj/TT51[illegible]f2.974d8c(for)Tj/TaTf224[illegible]D000es1.08

and Idaho presented key impacts, vulnerabilities, and adaptation actions in their state. Their key points are included in the *Summary of Input in Key Areas* section, below.

During lunch, Howard Frumkin presented the keynote address on *Climate and Health: The Northwest Context.* He provided additional context on the Northwest region, covering its geography, economy, culture, and challenges. He then discussed public perceptions of climate change and barriers to addressing it. He highlighted the particular challenge of overcoming the barriers of political and public opinion combined with a public health system in crisis to address climate change and health concerns. He ended by noting the importance of engaging in the NCA process to participate in the ongoing dialogue and efforts to identify and address health and climate needs. After his address, the participants engaged in a collaborative discussion exchanging thoughts on information, resources, and needs.

During the afternoon of Day One, five speakers provided case study presentations highlighting ongoing research in the Northwest region. The titles of their presentations are noted in the workshop agenda included in the appendix. Their research, as well as the gaps and needs they identified, are included in the *Summary of Input in Key Areas* section, below. At the end of Day One, the group addressed the following question: What existing indicators or tracking/monitoring efforts do you know of?

The second (half) day of the workshop was devoted primarily to breakout sessions. After a brief overview of Public Health considerations in the 2013 NCA and the NCA writing process, participants were divided into two groups and given their charge for the two breakout sessions. Both groups considered the same questions during the breakout sessions. During the first breakout session on vulnerabilities and health impacts, participants were asked:

- What regional impacts are you already seeing?
- What key vulnerabilities have you identified?
- Which vulnerabilities are you worried about for the future?
- What are key health impacts you have identified or already seen?
- What health impacts are you worried about for the future?

During the second breakout session on needs, collaborations, and next steps, participants were asked to identify:

- Research and monitoring needs
- Opportunities for collaboration
- Next steps

After the breakout sessions, representatives from each group reported out to plenary on their group's discussion. While the discussion in the two groups differed somewhat based on participant make-up, there was overlap between the two groups' input. Input gathered during the breakout discussions are summarized in the *Summary of Input in Key Areas* section, below.

UNIQUE CHARACTERISTICS OF NORTHWEST REGION

The workshop participants identified cultural, geographic, and institutional characteristics of the Northwest region that make it unique. Some of these characteristics, such as existing university partnerships on climate science and the region's cultural focus on sustainability, strengthen the Northwest's resilience to climate change. On the other hand, the dividing presence of the Cascades and the region's microclimates may present challenges in adapting to climate change. The participants mentioned the following unique characteristics of the Northwest region:

- Geographically, the Cascade Mountains divide the Northwest region into two subregions, the mild, rainy coastal areas west of the mountains and the dry, more variable inland areas. Not only are the weather conditions in these two subregions different, but the two regions also differ culturally and politically.
- Most of the population in Washington and Oregon live on the coast and are accustomed to a mild and rainy climate moderated by the Pacific Ocean. This population is less acclimatized to extreme heat events than the people who live on the eastern side of the Cascades, where large variations in temperature already occur.
- The shellfish industry is a key element of the Northwest region's culture and economy. However, this element could exposure the region to increased food-borne illness and economic impacts under future climate conditions.
- Washington and Oregon have enjoyed dedicated political leadership on climate change and have a strong record, both at the state and local level, of pursuing mitigation and adaptation measures. The Northwest culture tends to highly value sustainability, environmental justice, and the public good.
- The University of Washington and the University of Oregon are nationally-recognized centers for research on climate change. These universities work with many state and local partners and provide high-quality climate data to the region. The Northwest region also benefits from the NOAA science center and other marine research and monitoring programs throughout the area.

SUMMARY OF NORTHWEST CLIMATE CONDITIONS

This summary of historical, current, and projected climate conditions in the Northwest region is based largely on Meghan Dalton's "Climate of the Northwest: Past variations and future changes" presentation.

Northwest Climate Conditions

The participants emphasized that the Northwest region is topographically complex and contains many distinct climates. The western areas of the region experience mild temperatures year-round, abundant winter rains, and dry summers. These areas tend to experience high monthly precipitation in the winter with a peak in December, followed by low precipitation in the summer. On the eastern side of the Cascades, clear and dry conditions are much more common, with greater temperature ranges and less precipitation. Overall, seasonal variability in precipitation is lower in the eastern subregion.

Historical Climate Changes and Trends

Temperatures in the Northwest have warmed by about 1°F over the past century, with certain areas experiencing higher than average warming equivalent to 0.3°F per decade. The increasing temperature trends are more apparent in winter minimum temperatures, which have typically increased by 0.4°F per decade east of the Cascades. No clear trends in temperature are clear in the region west of the Cascades. In addition, summers in the Northwest are becoming hotter. Most locations east of the Cascades have been warming at a rate of about 1°F per decade, with higher maximum and minimum summer temperatures.

Over the past century, most areas of the Northwest have experienced increased precipitation, but the increase is less significant than the changes observed in the temperature record. In particular, the region is experiencing increased precipitation events in the November to December timeframe. In addition, April 1 snowpack has declined throughout the Northwest. In the Cascade Mountains, April 1 snowpack has declined by an average of 25%, with some areas experiencing up to 50% declines. Reduced snowpack results in an earlier peak of streamflow, which has implications for water availability. For example, the fraction of streamflow occurring in March has increased in the western parts of the region, while the fraction of streamflow occurring in June has decreased.

In addition to the information provided in Meghan Dalton's presentation, the participants noted the following climate changes that are already occurring:

- Big ocean signals, such as the Pacific Decadal Oscillation, are exhibiting increased variability.
- The region is experiencing very hot summer nights, including the record highs experienced in 2009.
- There are fewer extreme cold events in the winter.
- Farmers are reporting longer growing seasons in Southeast Idaho.
- USDA shifted the climate zones for Lewiston, Idaho, which influences the crop choices of farmers.

Projected Climate Changes[1]

The North American Regional Climate Change Assessment Program (NARCCAP) projects increases in temperatures of between 3 and 10°F by 2100 for the Northwest region. These temperature changes are likely to be greatest in the southeast areas of the region, and least along the coast. Warming is projected to be most pronounced during the summer. The annual number of days warmer than 95°F is projected to increase, particularly in Southern Idaho. In addition, inland areas are projected to experience a relatively large decrease in cold days (defined as days colder than 10°F). For example, certain areas in Southern Idaho are shown to experience up to 30 fewer cold days by 2055.

[1] Meghan Dalton noted that these projections are from the NARCCAP data that Ken Kunkel is putting together for the Regional climate outlooks for the National Climate Assessment. NARCCAP forced with A2 emissions scenario, 50 km resolution, 9 simulations using different combinations of GCM+RCM, multi-model mean.

The NARCCAP work does not project major changes in annual precipitation across the region, but most areas will experience drier summers with wetter conditions during the rest of the year. The largest increases in annual precipitation are projected to occur in eastern Washington and the largest decreases in summer precipitation are projected to occur in the southeastern areas of the region. All areas of the region are expected to experience increased frequency of dry events, defined as the maximum run of days with little or no precipitation. The greatest increase in these dry events is projected to occur in western Oregon.

As more precipitation falls as rain, rather than snow, snowpack levels are expected to decrease. Based on an ensemble of 8 climate models, Chang and Jung (2010) found a decrease in low elevation snowpack by 2080 in the Willamette Basin. The changes in snowmelt will result in earlier spring melt and lower summer flows.

SUMMARY OF INPUT IN SIX KEY AREAS

This section summarizes participant input in six areas:

1. Current Regional Health Impacts of Climate Change
2. Regional Adaptation Efforts
3. Key Risks and Vulnerabilities
4. Future Projections of Health Impacts
5. Relevant Indicator Research and Tracking
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Current Regional Health Impacts of Climate Change

The participants agreed that the Northwest region is facing expanded public health challenges, but noted that it is difficult to attribute these patterns to climate change. The participants characterized the health impacts they discussed as "sensitive" to climate change and noted that they expected more of these changes under future climate conditions. The main regional health impacts that the participants identified as sensitive to climate change are listed below.

HARMFUL ALGAL BLOOMS (HABS):

- Research has conclusively shown that **HAB events are increasing both in the United States and globally**.[2] Further, there is growing evidence that climate change is contributing to this global

[2]Dr. Stephanie Moore cited the following sources in her presentation: Don Anderson and Jayne Doucette, WHOI. Retrieved 13:17, January 12, 2010 from http://www.whoi.edu/page.do?pid=23997&tid=441&cid=26891&ct=61&article=14086
Harmful algal blooms in the West Central Atlantic, 1970-96. (2001). In *UNEP/GRID-Arendal Maps and Graphics Library*. Retrieved 19:42, June 16, 2009 from http://maps.grida.no/go/graphic/harmful_algal_blooms_in_the_west_central_atlantic_1970_96.
GEOHAB, 2001. Global Ecology and Oceanography of Harmful Algal Blooms, Science Plan. P. Glibert and G. Pitcher (eds). SCOR and IOC, Baltimore and Paris. 87 pp.

increase and that the **frequency, duration, and geographic extent of HABs may continue to increase in a warming climate**.

- Since many HAB species are currently limited by cold temperatures, warmer conditions in the future may lead to more outbreaks. For example, Dr. Stephanie Moore's research indicates that **rising temperatures in the Northwest will promote earlier and longer lasting blooms of *A. catenella* in the Puget Sound Region**.[3] These blooms are correlated with shellfish toxicity.[4]
- While data on freshwater HABs is not nearly as complete as marine datasets, participants felt that freshwater HABs in rivers and lakes are beginning earlier in the year and lasting longer into the fall. Kitsap County, WA, monitors lake water quality and has found that **algal blooms are increasing and that some species have recently begun producing toxin**. Participants from Idaho observed that incidents of bluegreen algae appear to be increasing in reservoirs.

Heat-Related Impacts on Health

- **On average, a King County citizen's risk of death is 11% higher on a heat day** (defined as the hottest 1% of days). For people over the age of 85, the risk of dying is 24% higher on a heat day.[5]
- Research has shown that warm nighttime temperatures have significant impacts on human health.[6] The Office of the Washington State Climatologist and the Oregon Climate Change Research Institute at Oregon State University conducted a study which found that **warm nighttime temperatures are correlated with increases in hospitalizations and ER visits**.

Drinking Water Quality

- The participants have observed **decreases in groundwater quantity and quality**.
- Many of these contamination events are caused by flooding.

Infectious Disease

- The participants have observed **increased frequency of *Vibrio* events since the late 1990s**, including increases in both measured concentrations and illnesses due to *Vibrio*.
- The species of mosquito known to carry malaria has been spotted in Washington.
- **New pathogens, such as *Cryptococcus gattii*, have emerged in the Northwest region**; however, links to climate change are uncertain.

Air Quality Impacts and Allergies

- **Participants observed that the pollen season, particularly for grass seed, is longer and more intense**.
- There does not appear to be evidence of increased air stagnation events in Puget Sound, likely because control strategies and public outreach campaigns have become more effective.

[3] Moore et al. (2008): Environ. Health
[4] Moore et al. (2009): Harmful Algae
[5] Dr. Richard Fenske's presentation, "Excess Mortality and Hospitalizations in Washington State due to Heat Events"
[6] Kalkstein and Davis 1989; Bohr 2009 as cited in Karen Bumbaco's presentation.

Regional Adaptation Efforts

During the presentations and discussion on Day One, participants mentioned a number of adaptation efforts underway in the Northwest region. In addition, all of the participants reviewed the *Inventory of Climate Change and Health Activities: Northwest Region* and added any activities missing from the spreadsheet. This *Inventory* will be provided as a separate technical input to the NCA. During the workshop discussion, participants noted the following activities:

Regional

- In April of 2012, the Western Governors' Association will hold a **Pacific Northwest Climate Change and Health outlook forum**.

Washington

- Climate change and health have been of longstanding interest to Washington State. In 2007, the state began an effort that was co-chaired by the University of Washington and the Washington State Department of Health. In the 2009, the **State Agency Climate Leadership Act (SB5560)** was adopted. This act brought together multiple agencies to look at climate change issues affecting different sectors. While health was not mentioned as an explicit part of that legislation, it was included after the fact. **As a result of SB5560, Washington is currently drafting an integrated response strategy which includes a section on human health.**
- The University of Washington is developing **projections of impacts of excessive heat** and is attempting to integrate findings into local planning and adaptation strategies.
- At a local level, **Seattle and King County have formed a climate change team** which focuses on both mitigation and adaptation.
- **Clark County is working on a county comprehensive plan update which will include a health element** for the first time. This update will recommend establishing a county climate action community to address local climate risks. The updated plan is expected in April of 2012.

Oregon

- The Governor's Global Warming Commission was created in 2007 and the following year this group delivered a final report to the Governor which articulated a framework for addressing climate change. **One of the ten major framework pieces was the public health impacts of climate change**, which validated the engagement of the public health sector in this process. The **Oregon Climate Assessment and Oregon Adaptation Framework** were released two years later. The Department of Public Health contributed immensely to this framework, which categorized risks in terms of likelihood. The framework also **assessed the current and anticipated capacities of state and local governments to respond to likely scenarios**.
- In 2011, the Center for Disease Control provided the State of Oregon with a three year grant. As part of this work, the state has been **training local public health partners to make sure that local agencies understand the risks and have the capacity to respond to local changes**.
- Oregon has also focused on building state public health capacity. **The Oregon Health Authority has a climate change steering committee along with three working groups on the following topics: data and surveillance, communications and outreach, and partnership, planning, and**

sustainability. The Climate Change Initiative Steering Committee has looked at extreme heat events and created a **heat toolkit**.

- Multnomah County is a grantee of Oregon's Public Health Division's Climate and Health Program, which is funded through the Centers for Disease Control and Prevention's Climate Ready States and Cities Initiative. The climate efforts at Multnomah County are lead by the Environmental Health Services with analytical support from Health Assessment and Evaluation. **The county has been successful in adding discussion of health equity and public health impacts to the local Climate Action Plan (CAP).** While the majority of the CAP focuses on mitigation, section 7 focuses on adaptation. There is no separate section on public health, but important public health themes are woven throughout the other sections. For example, one of the actions described in the plan is increasing Portland's tree canopy by one-third, which would have significant public health benefits. **The CAP is using the following cobenefit indicators**: percent of locally-sourced food service ingredients served at hospitals and schools, the number of safe routes to school, and the number of food and vegetable vouchers used at farmer's markets.
- **Multnomah County was also funded by the Oregon Health Authority to implement the BRACE framework, which is a roadmap for achieving the outcomes in the CAP**. For more information on the BRACE framework, see Matthew Davis' presentation, entitled, "Understanding the local health impacts of climate change in Multnomah County." The purpose of this project is to determine the impacts of climate change to the public's health, especially for vulnerable populations, to determine current and needed interventions to prevent further exacerbation of these impacts, and empower impacted persons and agencies with findings. **The project is focusing on asthma, heat-related illness, and vector-born disease as the three main climate change impacts.**

IDAHO

- The University of Idaho is currently holding an **Interdisciplinary Climate Change Seminar Series** which will be open to the public.
- **The City of Boise has launched a number of sustainability initiatives**, including heating important buildings, such as the City Hall and Public Library, with geothermal water, operating boilers with methane produced as a by-product of wastewater treatment, and incorporating gas-electric or gas-E85 vehicles into the City's fleet.

Key Risks and Vulnerabilities

Participants were also asked to identify key regional risks and vulnerabilities related to climate change impacts on human health. This list of participant-identified risks and vulnerabilities draws primarily on the input gathered during the first breakout session, with some additions from the presentations on Day One.

LOW PUBLIC HEALTH CAPACITY AND LACK OF POLITICAL CAPITAL

- Many of the participants commented that **funding for fundamental public health capacity has dwindled, leaving public health systems unable to operate basic health infrastructure**. Several participants felt that this lack of funding for basic public health programs was the region's

overriding vulnerability. For example, programmatic funding is disappearing for key areas such as information systems and epidemiology, health planning and community involvement planning, and partnership development and community mobilization. The participants expressed concern that **without these basic public health programs in place, the system would have very little resilience to climate impacts**.

- **The participants noted that public health departments typically have no authority to enforce public health best practices.** For example, in Oregon, farmers adapt to reduced yields by increasing fertilizer application to crops. While this practice results in drinking water contamination from nitrates, the Oregon Public Health Authority has no ability to influence the fertilization practices of farmers.
- Participants felt that a significant source of vulnerability was the **lack of public and political engagement around climate change**.

Shellfish, Fishing, and Recreational Water Use

- The shellfish and fishery industries are important to the Northwest region for both health and economic reasons. The annual value of the shellfish industry in Washington State is about $108 million per year and a single closure due to shellfish contamination can cost around $25-30 million (estimate based on recreational razor farm).
- The participants were concerned that **existing surveillance systems are not sufficient to monitor the spread of sickness from shellfish and HABs**. In particular, the participants highlighted that monitoring and assessment systems do not adequately cover freshwater systems.
- The participants noted that **recreational users of lakes and streams will be vulnerable**.

Drinking Water Systems

- The participants noted that **bacterial contamination due to flooding of drinking water systems** will likely be an important impact. Several participants recommended frequency and duration of boiled water advisories as a climate change indicator.
- Many people living on the Puget Sound have wells and septic systems near the coast. **As the sea-level rises, it may inundate these septic systems and wells, leading to water contamination**.
- Similarly, water systems throughout the region are vulnerable to **saltwater intrusion** and **contamination during major flooding events**.

Vulnerable Populations

- Heat is already the leading cause of weather-related deaths in the U.S.[7] **In the Northwest, King County residents currently face significantly higher risk of death and hospitalization on hot days.**
- Populations such as the elderly and those with preexisting conditions are already vulnerable to heat events. In addition, **the population in the Northwest is aging, which will increase the region's vulnerability.**

[7] NOAA – cited in Karin Bumbaco's presentation, "Heat Waves in Western WA and OR: Historical Analysis"

- In the Northwest, **people are increasingly moving into the wild-urban interface**, where they are isolated from public services and more exposed to impacts such as wildfire.
- **Renters may be more at risk than homeowners, since they can't make decisions to increase housing resilience**.
- **Populations where English is a second language are vulnerable since it is difficult to communicate impending risks and the need to relocate**. A recent example of this occurred during the flooding in the Green River Valley.

INFRASTRUCTURE

- The participants noted that there are places in the current transportation system with **single access roads**, which increases the isolation and vulnerability of those populations.
- The power grid is another source of vulnerability, since **lack of power leads to food-borne illness, delays in medication delivery, and other public health concerns**.
- The participants expressed concern that **increased migration to the Northwest region (as a result of climate changes) could strain existing infrastructure and public health services.**

Future Projections of Health Impacts

The participants expressed concern over public health implications of climate change. This list of participant-identified projected impacts draws primarily on the input gathered during the first breakout session, with some additions from the Day One presentations.

HEAT-INDUCED HEALTH IMPACTS

- Jackson et al. (2010) predict **significant increased heat-related mortality in the greater-Seattle area under a moderate climate scenario**.[8]
- Dr. Richard Fenske found that in King County, very hot days with a humidex (a combined measure of temperature and humidity) of 36.3 or higher increased the mortality risk by 11% for all non-traumatic deaths. **Dr. Fenske also found a percent increase in mortality for every degree increase in the humidex. The research showed that the elderly were the population segment at greatest risk.**
- In the Northwest, **heat impacts will likely be more significant on the west side of the mountains due to the urban density and the population's lack of acclimation to heat stress.**
- **Heat and air pollution will exacerbate cardiovascular disease.**
- Hot water can lead to **accidental drowning** as people attempt to cool themselves.

RESPIRATORY AILMENTS

- **Expected increases in the number, size, and duration of wildfires, increasing summertime heat, and the possibility of an extended pollen season will result in respiratory health impacts.**
- In Washington, one out of every nine households already has a child with asthma and asthma is a leading cause of hospitalization.

[8] As cited in Karen Bumbaco's presentation.

Harmful Algal Blooms and Impacts to Water Quality

- Participants noted that climate change will likely result in **the spread of water-borne diseases and well contamination as a result of extreme weather events**.
- Participants predicted that the increase in frequency, duration, and toxicity of HAB events will **strain the resources of public health monitoring systems**.

Psychological and Social Disruption

- The participants emphasized the **psychological and social disruption** that climate change could cause in the Northwest. The people most likely to be affected are socioeconomically disadvantaged populations.

Migration

- Several participants expressed concern that changing climate conditions across the country would increase migration to western Oregon and Washington over the next 50 years. The participants felt that this migration would strain existing water and infrastructure services, while exacerbating air quality.

Emerging Diseases

- *Cryptococcus gattii* is an emerging disease in the Northwest region. The species is a fungus associated with trees and soil in tropical and subtropical climates which can cause meningitis or pneumonia. An outbreak of *Cryptococcus gattii* occurred on Vancouver Island, where over 280 human cases were identified with a mortality rate of 8%. **Currently, over 80 cases have been reported in Oregon and Washington. Since fungi respond to environmental cues such as temperature, climate change may influence the spread of this and other similar organisms.**

Relevant Indicator Research and Tracking

At the end of the first day, the participants discussed the indicators and datasets that they use to track public health impacts. Overall, the participants emphasized the importance of leveraging existing systems rather than building new systems for collecting data.

Table 1 contains the full list of these indicators and datasets mentioned.

Identification of Research and Monitoring Needs

During the breakout sessions and the group discussions, the participants identified important research and monitoring needs for the community. Broadly, the participants voiced the need to better match environmental monitoring with public health monitoring in order to correlate health impacts with environmental conditions. Baseline data are particularly important for tracking trends in indicators. In many cases, the participants felt that effective indicators could be created using existing datasets, if the resources were available to develop methods. The participants also noted the importance of identifying "early" or sentinel indicators which would warn of a health threat before actual impacts to human health.

Table 1 contains the full list of these indicators and datasets.

TABLE 1: EXISTING INDICATORS AND DATASETS AND A "WISH LIST" OF INDICATORS AND DATASETS FOR FUTURE WORK AT THE INTERSECTION OF CLIMATE CHANGE AND PUBLIC HEALTH

Existing Indicators	Existing Datasets	Indicator or Dataset "Wish List"
Public Health		
• Air quality • Incidence of asthma • Heat-related mortality and morbidity • Food insecurity (USDA standard measure) • Percent of locally-sourced ingredients in food served at hospitals and schools • Number of food and vegetable vouchers used at farmers markets • Tree canopy	• Draft Monitoring, Early Warming, Data and Surveillance (MEDS) system • Environmental Public Health Division (EPHD) portal • Department of Motor Vehicle data on height, weight, and address • Departments of Health data on air quality, watershed health, and heat-related mortality and morbidity • Metagenomic datasets • County-level vector control	• Weather-related injuries and death • Asthma syndromic surveillance • Pollen count data (fine grain) • BMI data for children that is geocoded to location • Mapping of vulnerable populations • Frequency and duration of drinking water advisories • Mosquito and vector-borne diseases • Air conditioning use and prevalence • Locations of cooling centers • Emergency room visits (expected soon) • Electronic medical records (to establish baseline health conditions) • 911 calls • Hospital discharge data (Idaho)
Water, Shellfish, and Fisheries		
• Toxin concentrations in shellfish • Salinity • Dissolved Oxygen • Nutrient inputs • Watershed health	• Fishery observing programs • Oregon Marine Mammal Stranding Network, Central Puget Sound Marine Mammal Stranding Network • Animal strandings	• Marine mammal health • Fish dieoffs • Occupational monitoring system for the fishing industry • Frequency and duration of boiled water advisories • Aquifer levels • Impacts of salinization on Columbia River • HAB monitoring
Land Use and Transportation		
• Transit use • Vehicle miles traveled • Land use densities • Park acreage (indicator of tree canopy) • Land use changes		
Climate and Weather		

• Temperature	• NOAA National Climatic Data Center (NCDC) data	• Coastal flooding projections, including both inundation and runoff • Aquifer levels • Sea level rise and impact on Columbia River • Physical and biological oceanography
Knowledge, Attitudes, and Behavior		
While some data on cultural aspects of climate change are already being collected, the participants noted that more information on these types of indicators is needed. The Oregon Global Warming Commission conducted a state-wide survey on communicating climate change issues.		

POTENTIAL COLLABORATIONS AND NEXT STEPS

The participants agreed that in the future, it will be critical to correlate climate changes with public health outcomes. Partnerships between public health agencies and environmental health monitoring will be a key part of making this connection. The participants noted the importance of forming interdisciplinary partnerships that cross state and national boundaries (e.g., with Canada). For example, the partnerships that the Climate Impacts Group at the University of Washington has formed have been very successful.

During the second day of the workshop, the participants also identified the following next steps:

Proposed Coordination Efforts

- The participants suggested organizing monitoring efforts in order to understand the **changes in snowmelt around the Willamette River Basin**.
- The participants discussed the need to set up a **public alarm system to alert populations during heat events**.
- The participants suggested **better integration with departments of health and the Environmental Protection Agency on smoke, ozone, and particulate matter monitoring**.
- The participants discussed collaboration with tribal governments and noted the **importance of involving tribal representatives in planning and decision making**.
- Since British Columbia has experience working with tribal governments and dealing with similar public health concerns, the participants recommended fostering **greater collaboration with organizations such as the British Columbia Centre for Disease Control (BCCDC), Health Canada, and the Medical Research Council in Canada**.

Vector-Born Diseases

- The participants commented that **more information is needed on vector control efforts**. Since these issues are new the Northwest, participants are less certain of how to monitor and test for these elements.
- The participants also recommended **improved communication to hospitals about the emergence of new vector-borne diseases**.

Citizen Scientists and Social Media

- Since public health funding is inadequate to cover needed monitoring systems, the participants discussed using **"citizen scientists" and social media** to collect data. Many of these efforts are already occurring. For example, the Community Collaborative Rain and Hail Survey (COCORAHS.org) tracks rain gauges in people's backyards and the Northwest Fisheries Science Center runs a citizen water sampling program.
- Social media could be a particularly effective way to collect data on climate change attitudes.

APPENDIX

This appendix includes the following workshop materials:

1. Workshop Agenda
2. Participant List
3. Workshop Overview

Note: several presenters have given permission for their presentations to be posted to the workshop website. These presentations are available at: http://www.joss.ucar.edu/ohhi/nw_nca_health_sector_feb12/presentations/.

National Climate Assessment Health Sector Workshop
Northwest Region
February 23rd and 24th, 2012
Hotel Deca, 4507 Brooklyn Avenue Northeast
Seattle, Washington

Thursday, February 23rd

8:00 AM Coffee and continental breakfast

8:30 **Welcome** - John Balbus, Senior Advisor for Public Health, National Institute of Environmental Health Sciences, National Institutes of Health; and Juli Trtanj, Director, NOAA Oceans and Human Health Program

8:45 **Brief overview of NCA** - Ralph Cantral, Sectoral Coordinator, NCA

9:15 **State of regional climate, downscaling impacts / scenarios** - Meghan Dalton, Oregon Climate Change Research Institute, PNW Climate Impacts Research Consortium, College of Earth Ocean and Atmospheric Sciences, Oregon State University

10:00 *Break*

10:15 **Panel discussion: A Regional Health Perspective on Climate Change**
Moderator: Phil Rockefeller, Northwest Power and Conservation Council, Former Washington State Senator and chair of the Committee on Environment, Water & Energy

- Gregg Grunenfelder, Deputy Secretary, Washington State Department of Health
- Gail Shibley, Administrator, Environmental Public Health, Oregon Health Authority
- Jim Vannoy, Program Manager, Environmental Health Education and Assessment Program, Idaho Division of Public Health

12:00 PM Lunch and keynote address – Dr. Howard Frumkin, Dean, School of Public Health, University of Washington

2:00 – 4:45	**Case study presentations: synthesis of current efforts in the Northwest including surveillance gaps and future needs**
2:00	*Excess Mortality and Hospitalizations in Washington State due to Heat Events: A Research-to-Practice Model.* Richard Fenske, Professor and Associate Chair, Department of Environmental and Occupational Health Sciences, University of Washington School of Public Health
2:25	*Implementation of "Building Resilience Against Climate Effects" (BRACE) framework.* Matthew Davis, Environmental Health Educator, Multnomah County Health Department, Environmental Health Services
2:50	*Toxic Harmful Algal Blooms (HABs) in a changing world: a Puget Sound case study*. Stephanie Moore, Research Scientist, University Corporation for Atmospheric Research and NOAA's Northwest Fisheries Science Center
3:15	*Break*
3:30	*Heat waves in Western Washington and Oregon.* Karin Bumbaco, Office of the Washington State Climatologist
3:55	*Cryptococcus gattii: An emerging disease in the Pacific Northwest.* Nicola Marsden-Haug, Zoonotic Disease Epidemiologist, Washington State Department of Health
4:30	**Summary and Conclusions**
5:00	**Adjourn**
5:30 – 7:00	**Reception**

Friday, February 24th

8:00 AM Coffee and continental breakfast

8:30 **Welcome** - John Balbus, Senior Advisor for Public Health, National Institute of Environmental Health Sciences, National Institutes of Health; and Juli Trtanj, Director, NOAA Oceans and Human Health Program

9:00 **Breakout session one:** Regional impacts and vulnerabilities

10:15 *Break and compilation of input*

10:30 **Breakout session two:** Research needs, gaps, and collaboration

11:30 *Break and compilation of input*

11:45 **Report outs.** Next steps, summary and moving forward

12:30 PM **Adjourn**

Breakout topics and questions:

- What regional impacts are you already seeing?
- What key vulnerabilities have you identified?
- Which vulnerabilities are you worried about for the future?
- What are key health impacts you've identified or already seen?
- What health impacts are you worried about for the future?
- What are the existing indicators or tracking/monitoring programs you have identified?
- Identification of research and monitoring needs
- Collaboration and steps forward

U.S. Global Change Research Program

National Climate Assessment

National Climate Assessment
Health Sector Workshop
Northwest Region
February 23-24, 2012
Seattle, Washington

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On National Climate Assessment Health Sector Workshop
Northwest Region
February 23rd and 24th, 2012
Hotel Deca, Seattle, Washington

This workshop is held under the auspices of the U.S. Global Change Research Program, Climate Change and Human Health Working Group and is designed to**:**

1) Inform the US National Climate Assessment;
2) Increase the level of understanding of climate and health science in the region
3) Raise awareness of ongoing climate and health activities in the region
4) Improve tools for public health decision making by providing a forum for scientists and decision makers to share information and develop new or improve existing partnerships; and
5) Serve as a pilot for how to sustain an ongoing assessment process for understanding, predicting and adapting to the human health impacts of climate change across time scales.

This workshop will bring together biological, physical and social scientists, with public health and natural resource decision-makers working on human health effects of climate change such as ocean and coastal related health risks, vector-borne and water-borne disease, heat and weather-related effects, and cardiovascular and respiratory diseases. Integrated adaptation efforts and a One Health approach will be stressed.

Products:
Products from these workshops will include

- A survey of existing projects, research, publication and decision-support tools on health effects of climate change in the region,
- Synthesis white papers that document inputs from participants in six areas:
    - current regional health impacts of climate change
    - regional adaptation efforts
    - key risks and vulnerabilities
    - future projections of health impacts
    - relevant indicator research and tracking
    - identification of research and monitoring needs
- A plan for building sustained collaborations, needed to support ongoing assessment efforts including roles for different institutions.
- Draft Monitoring, Early Warning, Data and Surveillance (MEDS) metadatabase, summarizing Federal information related to climate change and health.

The workshops are supported in large part by NOAA Oceans and Human Health Initiative, CDC National Center for Environmental Health, and NIH National Institute for Environmental Health Sciences, with participant contribution of time and travel greatly appreciated.