Collaborative on Health and the Environment – Washington

A Partnership Network for Environmental Health
Established and Coordinated by the
Institute for Children's Environmental Health

Climate Change and Public Health in Washington

Introduction

Scientists have reached a consensus conclusion that climate change likely will have large-scale impacts on human society at multiple scales, from global to local, for the remainder of this century and beyond.[1] The projected effects on human health are broad and serious, and put at risk many of the gains that have been made in the past century in disease prevention and treatment, and in building robust public health systems.

While health impacts of climate change will likely affect developing nations most severely, wealthy industrial societies, including the U.S. Pacific Northwest, are not likely to escape negative consequences.

Efforts are underway to fully understand how climate change will affect public health in Washington State. While much remains to be learned and quantified, several risk factors have come into focus. This fact sheet briefly describes those risk factors, identifying possible consequences and raising issues for ongoing consideration by the public health community.

Climate Change and Health—Identifying Connections

Research carried out by the Intergovernmental Panel on Climate Change (IPCC) and other scientific bodies has linked increases in global average temperatures largely to emissions of carbon dioxide (CO_2) and other heat-trapping "greenhouse gases" caused by fossil fuel combustion. Research carried out by the IPCC and others has identified spin-off impacts of increased heat energy in the atmosphere.[2]

From the perspective of Washington State and public health, those follow-on impacts include:

- Thermal Stress
- Air Pollution
- Water & Food Impacts
- Disease[3]

Thermal Stress

Heat waves are a serious public health threat, especially for vulnerable populations, such as the elderly. Pacific Northwest temperatures increased throughout the 20th century, and are projected to increase more rapidly across all four seasons in the 21st century. Model runs carried out by the University of Washington Climate Impacts Group project the largest temperature increases during summer months, with increases averaging 2.38 degrees F in the 2020s and 3.78 degrees F in the 2040s. At the high end, projected summer temperature increases are 3.98 degrees F in the 2020s and 6.6 degrees F in the 2040s.[4]

Long-time residents of western Washington, with its mild marine climate, are not accustomed to extended periods of hot, dry weather. The deadly impact of the European heat wave of 2003, in which an estimated 35,000 people died, demonstrate the severe consequences of prolonged heat stress on people unprepared for it.[5]

Conversely, warmer winter temperatures are likely to reduce need for winter heating,[6] a benefit for low-income residents often forced to choose between heat and other life necessities.

Higher summer temperatures likely will increase demand for air-conditioning. Northwest utilities are experiencing increases in summer peak loads. To meet higher loads, utilities could turn to coal, a source of primary and secondary pollutants, including mercury, low-level ozone, and ultra-fine particulates. However, the possibility of greenhouse gas emissions standards raise uncertainties about coal's prospects in the Northwest. [7]

Air Pollution

Ground-level ozone, also known as photochemical smog, typically forms in the summer during periods of high temperatures and extended sunlight. Ozone forms from precursors, emitted by fossil fuel combustion and volatilization of petrochemical-based cleaning and coating products. Research indicates a strong association between temperatures above 90 degrees F and ground-level ozone formation.[8]

Numerous epidemiological studies have linked ground-level ozone exposure to harmful cardio-pulmonary impacts, including lung irritation, breathing difficulties, reduced lung capacity, aggravated asthma, and increased susceptibility to bronchitis.[9]

Global warming can influence local meteorology, lead to increased emissions of ozone precursors, and accelerate chemical reaction rates. Washington State University and other institutions have prepared a study on how global warming may affect air quality in the Pacific Northwest. Preliminary results indicate a worsening of air quality caused by higher ozone precursor emissions and increased long-distance transport of ozone. The preliminary results indicate higher peak ozone levels and more frequent violations of ozone standards.[10]

Research carried out by the University of Washington-Bothell suggests that climate-related prolongation of fire seasons in Northern Hemisphere forests will result in increased long-distance transport of pollutants eastward that would cause ground-level ozone levels in Washington to rise.[11]

Water & Food Impacts

Global warming will result in numerous impacts on Washington's water resources in ways that will have significant implications for human health.

A leading concern is availability of fresh water for domestic and agricultural needs. Signs of global warming impacts on water supplies already are apparent. In the past half-century, mountain snowpack has thinned throughout the Cascades. Summer stream flows into Puget Sound are down 18 percent.[12]

Even if climate change were not an issue, ensuring adequate water supplies to accommodate expected population growth will be difficult. Climate change will exacerbate the difficulty. Models show that higher temperatures will cause more winter precipitation to fall as rain rather than snow, resulting in a thinner mountain snowpack and reduced summer flows into drinking water reservoirs.[13]

A 2004 study estimated that Seattle Public Utilities' "firm" water yield will fall from 171 million gallons per day (mgd) to 147 mgd by 2040, as a result of dwindling snowpack.[14] A study carried out for the City of Portland estimated that climate change will increase by 50 percent the amount of new supply needed to accommodate population growth alone.[15] Lower summer flows and higher demand increase the likelihood of conflicts over water resources. Depletion of groundwater and surface water sources can result in increased concentrations of pollutants.[16]

Water availability will have significant implications for food production, especially in the drier region east of the Cascades. Global warming impacts on agriculture will vary depending on crops and water availability. Higher temperatures and increased levels of atmospheric carbon dioxide will likely mean higher crop yields, if water is available. CO_2 fertilization, however, could also mean greater weed growth, leading to increased use of herbicides. In addition, higher temperatures could accelerate insect life cycles and expand pest ranges. Statistical analysis indicates that global warming may increase the need for farm pesticides.[17] Pesticide use has been linked to health effects including skin and eye irritation, endocrine (hormone) disruption, nervous system impacts, developmental disabilities and cancer.[18]

In the Yakima Basin, the combination of reduced water flows and allocation requirements of state water law could combine to reduce crop yields for irrigated farms. For example, modeling carried out by Pacific Northwest National Laboratory estimated that a 3.6-degree F temperature increase would reduce water availability for irrigation, quadrupling the likelihood of severe "pro-rationing" of water allocations for junior water rights holders. Such pro-rationing would lead to substantial reductions in per-acre yield. [19]

With more winter precipitation falling as rain rather than snow, flooding danger is likely to increase. In addition, greater rainfall will likely result in more stormwater runoff and more combined sewer overflows, resulting in higher levels of fecal coliform bacteria contaminating beaches, shellfish beds, and Puget Sound's nearshore waters.[20]

Climate change may create more favorable conditions for algae that cause paralytic shellfish poisoning, but the extent of future algal blooms will depend on many environmental factors.[21]

Disease

Higher temperatures will expand the ranges of mosquito species and, under some conditions, boost their effectiveness as disease vectors. One vector-borne disease of concern is West Nile Virus. The first U.S. outbreak of the disease took place in New York City in 1999, and since then, West Nile Virus has spread to people and animals across the coterminous 48 states, including Washington. The disease is carried by the Culex pipiens mosquito, which thrives in shallow water pools during droughts.[22]

Changes in Washington forests linked to climate changes have public health implications. Drought and higher temperatures will increase trees' vulnerability to wildfire and pest organisms. Loss of forests may create ecological conditions conducive to growth in tick populations that, under certain conditions, can spread hantavirus.[23]

Another concern with higher temperatures and higher levels of atmospheric carbon dioxide is higher growth rates of allergenic plants, resulting in longer and more intense allergy seasons.[24]

Further Steps
A state-mandated study is underway to better understand the possible health impacts of global warming in Washington. A report is due December 1, 2007. The study's goal is to develop epidemiological models quantifying climate change impacts on public health. Such information will be useful for developing policies, surveillance, and response systems to mitigate climate change impacts. More specific information also can help justify greenhouse gas emissions reduction targets and timetables.

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What Citizens Can Do
Carbon dioxide is the most important of the greenhouse gases, and the leading cause of CO_2 emissions is combustion of carbon-rich fossil fuels—coal, petroleum, and natural gas—for energy.[25] Reducing the quantity of fossil fuels burned through greater energy efficiency and substitution of non-carbon energy sources is the most effective means for individuals, households, and businesses to reduce greenhouse gas emissions.

Transportation
In Washington, half of the state's greenhouse gas emissions originate from transportation, including cars, trucks, rail, aviation, and shipping.[26] Transportation-related emissions can be reduced through choice of more efficient vehicles, greater use of alternatives to auto transportation, and alternative fuels. Emissions also can be reduced by purchasing products made closer to home. Aviation is a special case. One 6,000-mile round trip by air can generate more than four tons (CO_2-equivalent) of greenhouse gases.[27] Before flying, ask yourself: Is this trip really necessary?

Transportation Resources

Fuel-Efficient Vehicles

Green Vehicles, U.S. Environmental Protection Agency
http://www.epa.gov/greenvehicles/

FuelEconomy.gov
http://www.fueleconomy.gov/

Alternatives to Auto Transportation

Commuter Challenge Commute Options
http://www.commuterchallenge.org/commute_options.html

Bicycling in Washington
http://www.wsdot.wa.gov/bike/default.htm

Alternative Fuels

Alternative Fuels Data Center
http://www.eere.energy.gov/afdc/

Travel Calculator

Bonneville Environmental Foundation
https://www.greentagsusa.org/GreenTags/travel_calculator_intro.cfm

Energy
Electricity generation and consumption of energy account for one-third of Washington's greenhouse gas emissions.[28] Greater energy efficiency and use of electricity generated by

non-carbon sources will reduce emissions from those sources. Electric and gas utilities are good sources of information about energy efficiency. Many utilities offer audits, rebates, loans, and other incentives for improving home, office, and business energy efficiency. In addition, many utilities offer "green energy" programs that give consumers the option of purchasing electricity from renewable resources.

Energy Resources

Energy Efficiency
Puget Sound Area Electric & Gas Utility Programs
http://www.pscleanair.org/actions/energy/default.aspx

Washington Incentives for Renewables and Efficiency – General Guide
http://www.dsireusa.org/library/includes/map2.cfm?CurrentPageID=1&State=WA&RE=1&EE=1

Alliance to Save Energy
http://www.ase.org/section/_audience/consumers

Green Energy
Renewable Northwest Project – Consumer Guide
http://www.rnp.org/GreenPower/default.html

Natural Resources Defense Council – Consumer Guide
http://www.nrdc.org/air/energy/gcleanen.asp

Food Choices
Diet is a significant factor in the quantity of greenhouse gas emissions that are linked to personal activities. Raising and processing red meat results in emissions of CO_2 and other greenhouse gases, including methane and nitrous oxide. A typical American diet generates nearly 3,300 pounds of additional greenhouse gases (expressed in carbon dioxide-equivalent) per person than a plant-based diet generates. Increasing the proportion of fruits and vegetables in diets can lower greenhouse gas emissions.[29]

Food Resources

Eating Made Simple – Scientific American, September 2007
http://www.sciam.com

U.S. Department of Agriculture – Organic Food Standards and Labels
http://www.ams.usda.gov/NOP/Consumers/brochure.html

Puget Sound Fresh
http://dnr.metrokc.gov/wlr/farms/

Water
Even in rainy Washington, careful management of water will be more important in the future as population growth and global warming put greater pressure on water supplies. It is important to note that providing fresh water and treating wastewater consume energy. More efficient use of water will be essential for reducing energy use and for ensuring adequate supplies of clean water in a warmer world.

Water efficiency measures indoors include fixing leaks and installing more water-efficient fixtures. Outdoors, water can be conserved through better landscape and lawn care

practices—building up healthy soils, choosing the right plants for the right location, and avoiding overwatering. Many water utilities offer rebates and other incentives to install efficient fixtures and irrigation equipment.

Water Resources

U.S. Environmental Protection Agency – WaterSense: Efficiency Made Easy
http://www.epa.gov/watersense/water/simple.htm

Saving Water Partnership
http://savingwater.org/

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For more information, please see: http://washington.chenw.org

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