Northwest
Public Health
Fall/Winter 2008 Volume 25 Number 2

Climate Change

Challenging Public Health

Remembering Susan McCabe

Dr. Susan McCabe of our editorial board was killed in a December car accident, along with a colleague, Dr. Carol Macnee. Both were on the faculty at the Fay W. Whitney School of Nursing at the University of Wyoming. Dr. McCabe was a nationally respected expert in psychiatric mental health nursing whose recent research focused on rural women and their health. The editors and editorial board of Northwest Public Health extend our sympathies.

Journal Staff

Patricia W. Wahl, PhD, Dean
School of Public Health University of Washington

Editor-in-Chief	Susan Allan, MD, JD, MPH
Guest Editor	Gregg Grunenfelder
Managing Editor	Katherine Hall
Designer	Leslie Wall
Proofreader & Web Developer	Richard Bruch

Cover photo: © dreamstime.com

The Soul Catcher logo of the School of Public Health, designed by Marvin Oliver, is a Northwest Native American symbol of physical and mental well-being.

Northwest Public Health
Fall/Winter 2008 Volume 25 Number 2

Climate Change: Challenging Public Health

Photo: Wyoming Interagency Hotshots

Wildland fires affect the health of crew members as well as the general population.

Columns

From the Dean

New Journal Leadership Team Approaches Climate Change

Before we turn to the excellent articles on climate change in this issue of *Northwest Public Health,* I'd like to let you know about some changes pertaining to the journal, the Northwest Center for Public Health Practice, and the field of public health itself.

We are the only school of public health with a journal focusing on public health practice. Under the guidance of Editor-in-Chief Aaron Katz and Managing Editor Judith Yarrow, *Northwest Public Health* became an award-winning regional journal with an active editorial board. Last summer, responsibility for the journal was transferred to the Northwest Center for Public Health Practice, a move intended to link it even more strongly with the network connecting the regional practice community and our School.

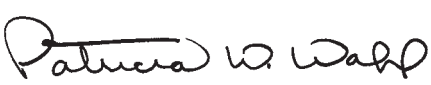
Now that Aaron and Judith have turned to new challenges, Susan Allan has become Editor-in-Chief, and Katherine Hall has taken over as Managing Editor. Kathy has worked in our School since 1999, most recently as the award-winning Communication Director of our Department of Environmental and Occupational Health Sciences. An experienced writer and editor, she is completing her PhD in the UW Department of Communication.

Susan's primary role is directing the Northwest Center, a position she assumed from Jack Thompson. During Jack's eight-year leadership, the Center became a vital resource to state and local health departments in a six-state region, especially in preparedness and capacity building. Jack will continue to be active in both the Center and our Department of Health Services. Susan brings a wealth of experience and talent to the Center and our School. She has worked as a public health practitioner for 23 years, including 18 years as Health Director of the Arlington County Department of Human Services in Virginia and, most recently, three years as Public Health Director and State Health Officer in the Oregon Department of Human Services. She holds medical and law degrees from Harvard University and a Master of Public Health from The Johns Hopkins University, and is Board Certified in Preventive Medicine and General Public Health.

Susan's interests include public health systems research, an emerging discipline that examines important questions about how best to structure, fund, and support our public health system. Susan notes that a century ago public health professionals were a significant part of the larger community dialogue about a wide range of needs and priorities. Then the focus of the field narrowed to the official systems we directly manage. In recent years, however, there has been more emphasis on the public health infrastructure, and many other fields are recognizing the value of public health methods and perspectives. One example described in this issue is the connection of public health to environmental planning.

Issues and leadership and even our climate may change, but what will not change is the importance of our field and our multidisciplinary contributions to solving old and new public health concerns. For example, we know particulate air pollution contributes to climate change. Our Department of Environmental and Occupational Health Sciences and its predecessors have been at the forefront of that issue since the 1950s, and today our School has several faculty members on the Climate Impacts Group, an interdisciplinary research group funded by the National Oceanic and Atmospheric Administration studying the effects of natural climate variability and global climate change on our region.

This edition of *Northwest Public Health* highlights our field's breadth and strengths in tackling what might be the greatest challenge facing the world today.



Patricia W. Wahl, Dean
UW School of Public Health

Northwest Public Health
Fall/Winter 2008 • Volume 25 No. 2

The mission of the journal is to provide a forum for practitioners, teachers, researchers, and policy makers in public health to exchange ideas, describe innovations, and discuss current issues.

Northwest Public Health (ISSN 1536-9102) is published biannually in the spring and fall.

Climate Change: Back to the Basics of Public Health

We are pleased to bring you this issue of *Northwest Public Health,* which explores the many challenges that climate change brings to our region. This issue also introduces several changes to the journal. We hope we have maintained the standards of high quality and a focus on public health practice that you have valued. For the continued quality and relevance of the journal, we credit the Editorial Board and the many authors and peer reviewers who contributed their thoughts and passions to the articles and commentaries you see here. (Please consider this an invitation for all of our readers to become more involved with the journal.)

Kathy and I took on our new roles in July, and we welcome your suggestions. Kathy's experience with environmental issues was especially helpful in developing this issue. We would like to thank our predecessors, Aaron and Judith, for creating such excellent momentum and systems. They are both fully engaged in other writing and teaching activities here at the University, and continue as valuable resources.

I come to the University with more than 23 years in state and local public health practice and a desire to better connect practice and academia. One of the exciting aspects of *Northwest Public Health* is its effective practice-academic collaboration, and I welcome the opportunity to be associated with this journal and the community it reaches.

The current issue examines climate change, a topic that stretches the current boundaries of public health. In its origins, public health was involved with community planning, but economic realities have restricted the scope of most health departments. Challenges such as climate change bring us back to the bigger vision of public health.

Our guest editor, Gregg Grunenfelder of the Washington State Department of Health, does an excellent job of setting a context for the other articles. Howard Frumkin and George Luber of the Centers for Disease Control and Prevention (CDC) link climate change to the 10 Essential Services of Public Health.

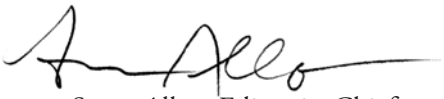
Vic Colman of our editorial board calls for an expansion of the public health role in the built environment. Darrah Kauhane-Floerke provides the perspective of a future public health practitioner, while Michael Heumann and Trish Neiworth suggest ways health agencies can reduce their carbon footprint.

This issue contains two articles about emergency preparedness: Michelle McDaniel describes King County's outreach to adult family homes and similar health-care providers and Jacqueline Poston poignantly describes Alaska's partnership with coastal villages that are at real risk of disappearing.

Paul Cieslak and Mel Kohn provide an excellent overview of climate change and communicable diseases and three regional articles give examples. Karl Musgrave and Emily Thorp describe Wyoming's veterinary surveillance system; Michael Bradley traces the spread of infectious agents to Alaska; and Alison Scherer and Elaine Faustman describe harmful algal blooms in shellfish.

Leonard Herr and Uwe Reischl describe models for climate change and air quality in Idaho's Treasure Valley. Jane Koenig rounds out the air pollution discussion by explaining the health effects of wildfires.

The contributions and facets of this topic exceeded the capacity of this journal. You will find additional articles and an annotated bibliography on our Web site. We hope all of these provoke discussion in health departments and communities throughout the Northwest.



Susan Allan, Editor-in-Chief
Director, Northwest Center for Public Health Practice
UW School of Public Health

Expanding the Public Health Role in **Mitigating Climate Change**

Victor Colman

Climate change continues to be a hot topic for many cities and states, including those in the Northwest. Three of our states (Montana, Oregon, and Washington) participate in the Western Climate Initiative, a regional collaboration among seven western states and four Canadian provinces. Seattle and King County are active in the US Conference of Mayors Climate Protection Center, launched in early 2007 to equip cities with knowledge and tools.

What is the public health role in these emergent efforts? Our epidemiologists are regularly tapped to assess potential health impacts of the various outcomes of climate change. Other public health specialties are less involved in climate change "adaptation and mitigation responses," which involve transportation and land use. There are several notable exceptions, particularly at Public Health - Seattle & King County.

The recent public health focus on the obesity epidemic suggests a relationship between the "built environment" and health. The Centers for Disease Control and Prevention (CDC) definition of built environment includes homes, schools, workplaces, parks and recreation areas, greenways, business areas, transportation systems, electric transmission lines, sewers, and land-use plans and policies.

See Region at a Glance on page 8.

The challenge for public health is not only in documenting the health impacts of the built environment, but also in early involvement with program and policy issues that shape how our communities are put together. We have a *bona fide* stake in building sidewalks, bicycle trails, and traffic calming strategies that reduce vehicle speeds and improve safety. We can create a greater sense of "place" by connecting streets, encouraging neighborhood businesses, and supporting a residential density that discourages driving. We can address health disparities such as a lack of access to recreational facilities in low-income areas and communities of color.

Public health leaders generally recognize the problem, but lack resources to address it. The National Association of County and City Health Officials (NACCHO), in conjunction with George Mason University and the Environmental Defense Fund, published a survey in 2008 on local public health engagement in climate change. While 60 percent of those surveyed thought climate change will lead to serious health problems, and more than half of local directors said preparing for climate change was an "important priority," only 19 percent said climate change was among their department's top ten priorities.

Sustainable funding is a constant strain for the public health system, which competes with other critical services and sectors, such as law enforcement and social services, for finite dollars. This dynamic puts a premium on continuing our core work and not taking on emergent issues such as the built environment.

For those in public health who provide direct service, jumping into the conceptual world of systems and policies may not be intuitive. We will need to work with new partners in zoning and planning, transportation, recreation, agriculture, and land conservation.

Public health is accustomed to taking a leadership role or working closely with other parts of the health care system. In the built environment arena, the public health viewpoint is not necessarily obvious to some of the new partners, and we may need to demonstrate our value to earn a seat at the table.

I do not mean to imply that public health always sits on the sidelines in the mitigation discussions. In Washington State, the 2007 King County Climate Plan calls out "land use and growth management" and "transportation" as two of the four key areas of its action plan, and includes the health department in both the Global Warming Action Team and the Adaptation Team. The report explicitly includes a goal section titled "Public Health, Safety and Emergency Preparedness."

In other jurisdictions, new concepts for planning and transportation are moving ahead without a public health perspective. This is unfortunate, as public health is adept at proposing, communicating, and implementing system-wide solutions with a population-wide impact. Improved health status is a strong selling point for built environment strategies, though it is currently underplayed.

The burden is clearly on public health to demonstrate our field's contributions to policy and systems solutions, especially in sectors that may lie outside our comfort zone. ■

Author

Victor Colman, JD, is President of Uncommon Solutions, Inc., in Olympia, Washington. He has toiled in the public health policy field for more than 25 years, and was a senior policy adviser in the Washington State Department of Health. He serves on the editorial board for *Northwest Public Health*.

CLIMATE CHANGE

A New Challenge for Public Health

Gregg Grunenfelder

In recent years, most of the scientific community has validated the climate changes we are experiencing across the globe. Now is the time for public health to prepare and adapt to the challenges of climate change.

Looking back, we may view 2008 as the turning point when the public health community took visible steps to join the discussions. This was the year that World Health Day's theme was "Protecting Health from Climate Change" and National Public Health Week had a theme of "Climate Change and the Nation's Health."

In the Pacific Northwest, the Climate Impacts Group (CIG) at the University of Washington formed to study the effects of climate change on our region. Climate models used by the CIG predict warmer temperatures (a rise in annual average temperatures of 1.4 to 4.6°F by 2040) and slightly wetter winters (a 2 percent increase in annual average precipitation by 2040). The result will be a reduced snow pack in the mountains, earlier peak stream flows in the spring, and reduced summer stream flows. The predictions have serious implications for public health in the Northwest.

Direct effects may first be seen in heat-related illnesses and deaths. Heat is already the leading cause of weather-related deaths in the United States, with an estimated 400 to 700 deaths each year, as estimated by Bernard and McGeehin in 2004. The cause of death from hyperthermia is usually some form of cardiovascular disease, so these figures likely underreport actual heat-related deaths.

Heat waves will become more frequent and intense in the future, particularly east of the Cascade mountains where summer temperatures often exceed 90°F. (The Centers for Disease Control and Prevention defines "extreme heat" as temperatures that hover 10°F or more above the average high temperature for the region and last for several weeks).

As is well documented in Eric Klinenberg's book *Heat Wave—A Social Autopsy of Disaster in Chicago*, the children, the elderly, the chronically ill, and the poor will be most at risk from the health effects associated with these events.

Climate change is likely to shift the patterns of infectious diseases. Changes in weather will affect the habitat and life cycles of potential disease vectors such as mosquitoes and ticks. Milder winters and hotter summers will create more conducive environments for faster breeding cycles, better survival rates over the winter, and expanded range.

Concerns with zoonotic diseases such as West Nile Virus, hantavirus, and mosquito-borne encephalitis are likely to increase along with changes in our climate. Hotter weather may influence the incidence of food-borne disease associated with pathogens such as *Vibrio parahaemolyticus* in shellfish, and of flooding, which can carry with it waterborne diseases.

Climate change is likely to increase air pollution, which has serious implications for human health. Warmer, drier summers will lengthen wildfire seasons and extend the range of lands vulnerable to fires. Washington has already experienced a fourfold increase in wildfires since 1986. The wildfire season is longer and the large fires have a burn duration of 37 days, compared with 8 days in 1986. Longer, drier seasons will increase people's exposure to fine airborne particles. Warm weather will likely lengthen pollen seasons too. New allergens may enter our area as new plant species become established.

Along with increases in ground-level ozone, which is associated with warmer temperatures,

Climate change is so important that it calls for a reinvestment in our public health system.

these pollutants will exacerbate the region's already significant cardiovascular and pulmonary problems (Washington is estimated to have 400,000 adults and 120,000 children suffering from asthma).

And finally, climate change will result in health effects and psychological/social disruption as extreme weather events dislocate residents and stress social and health care systems. Earlier spring runoff and rain-on-snow conditions are likely to increase the frequency and severity of floods. In addition to direct physical harm from high water, landslides, and falling debris, floods can cause numerous health problems through the contamination of water supplies and the spread of toxic and infectious agents.

Potential economic impacts of climate change will disproportionately affect the poor and disenfranchised populations in our communities. Whatever actions are taken to address issues associated with climate change, special consideration should be given to ensure such actions do not add further burden to those already disadvantaged segments of our population.

Our difficult economic times increase the challenge of preparing our communities to adapt to climate change. However, climate change is so important that it calls for a reinvestment in our public health system so that we can minimize its potential health implications.

The following strategies are recommended as initial steps to minimize human health impacts associated with climate change:

1. Enhanced Public Health Surveillance

The systematic collection of data is critical for monitoring changes to the magnitude of current public health threats and the early detection of new or emerging threats. Zoonotic disease surveillance should be expanded, including more robust efforts to detect the size, distribution, and makeup of disease vectors in our environment. Continued efforts are needed to improve the reporting and tracking of emerging diseases so early interventions can stop their spread in our communities. And expanded air quality monitoring is needed to give the public early warning.

2. Enhanced Emergency Planning and Preparedness

Public health involvement in emergency planning and preparedness efforts has progressed significantly in the past few years. We could do more in the area of heat emergency preparation and response by providing input into heat response elements of local plans and participating in exercises around extreme heat events. We can give further consideration to the potential psychological and social disruptions associated with extreme weather events and ensure

Climate Change: A Public Health Framework

Howard Frumkin and George Luber

As the scientific community rises to face the issues of climate change, Public Health can provide a useful framework.

In 1994, the American Public Health Association and its partners developed a standard framework for action known as the 10 Essential Services of Public Health. An adaptation of these essential services provides a lens through which to view climate change from a public health standpoint. We offer a brief overview here; more detailed discussion is available in the March 2008 issue of the *American Journal of Public Health.*

1. **Monitor health status to identify and solve community health problems:** Climate change will require public health professionals to develop a new level of risk data, including meteorological data, ecological data, and indicators of vulnerability. Expanded surveillance programs can incorporate such climate change indicators and help health authorities to understand the associations among long-term climate changes, weather events, ecological changes, and direct and indirect health outcomes.
2. **Diagnose and investigate health problems and hazards in the community:** Classic public health responsibilities include identifying, investigating, and explaining health problems at the population level. In a changing climate, public health laboratories will need the capacity to make rapid diagnoses and reports of altered distribution and frequency dynamics of diseases.
3. **Inform, educate, and empower people about health issues:** Although most Americans believe climate change exists, only 1 in 5 reports understanding the issue very well. Health communicators can inform the public and policymakers about climate change, its potential health effects, and actions that may reduce risk. To build effective health communication strategies, we must target specific groups, accounting for varying levels of understanding, cultural and ethnic differences, and vulnerability.
4. **Mobilize community partnerships to identify and solve health problems:** We will need to strengthen relationships among traditional partners, such as government agencies and academia, and develop new partners, such as faith institutions and city planning departments. Many of these relationships will evolve at the local and state levels, where services are delivered. As we identify vulnerable populations, respond to emergencies, and implement adaptive policies, we must integrate community expectations, beliefs, and values.
5. **Develop policies and plans that support individual and community health efforts:** Although the responsibility for climate change mitigation lies outside the scope of Public Health, health professionals can provide compelling arguments about strategies to reduce morbidity and mortality. Public health tools such as health impact assessments can provide evidence for positive and negative effects of various approaches to climate change mitigation. These tools will allow local and state health departments to collaborate across policy sectors to exemplify public health engagement.

6. **Enforce laws and regulations that protect health and ensure safety:** Few public health laws and regulations have a direct bearing on climate change. However, Public Health can provide science-based evidence for laws and regulations in the environmental, transportation, and energy arenas. There may be roles for state and local public health agencies in enforcing policies such as building codes, water quality regulations, and air quality laws.
7. **Link people to needed health services and ensure provision of care:** A strong infrastructure for delivering health care services must be part of the response to climate change. This premise is outlined in the National Response Plan, under Emergency Support Function No. 8, called Public Health and Medical Services. Although disaster medical planning often focuses on trauma care, disasters may interrupt care for chronic diseases, routine laboratory testing such as newborn screening, access to mental health care, and other services.
8. **Ensure a competent public and personal health care workforce:** Health systems must develop a wider range of expertise at every level to adequately respond to the challenges of climate change. Partnerships could be developed between health science schools and other academic institutions to train health professionals in non-traditional subjects such as economics, health impact assessments, ecology, urban health, and vulnerability modeling.
9. **Evaluate effectiveness, accessibility, and quality of health services:** Evaluation requires robust surveillance capacity, a well-trained public health workforce, and reliable systems for sharing information among different levels of government and parts of the health sector. Evaluation also requires a periodic inventory of available services and assesses the degree to which those services are accessible to the most vulnerable intended populations.
10. **Search for new insights and innovative solutions to health problems:** Several lines of health research will be needed to provide data-based support for public health action on climate change. These include empirical research on the association between climate change and health, scenario development to forecast health impacts and vulnerabilities, and development and testing of strategies to reduce risk. For each intervention and service, cost-benefit research is needed. ■

Authors

Howard Frumkin, MD, DrPH, is Director of the National Center for Environmental Health at the Centers for Disease Control and Prevention. George Luber, PhD, is an epidemiologist and Acting Associate Director for Global Climate Change at the Center.

Resources

Public Health Functions Steering Committee. *Public Health in America*. www.health.gov/phfunctions/public.htm

Frumkin H, Hess J, Luber G, Maililay J, McGeehin M. Climate change: The public health response. *American Journal of Public Health.* 2008; 98(3):435–445.

appropriate response actions are identified and planned for.

3. Enhanced Land Use Mitigations

One of the broader, more comprehensive, and unfortunately more difficult issues involves changes in land use policies to mitigate key causes of climate change, while at the same time addressing the key health issues of obesity and physical fitness. By planning our communities to be more conducive to walking, biking, and mass transit, we not only reduce the amount of green house gases and air pollutants we put into the atmosphere, but can enhance exercise and wellness.

As Albert Einstein once said: "We can't solve problems by using the same kind of thinking we used when we created them." Addressing the broad and complex implications of climate change will necessitate enhanced partnerships between health, environmental, and agricultural agencies at the federal, state, and local levels. It will also require building effective new partnerships between the public and private sectors.

Because the science of climate change is neither exact nor certain, it will take courage to step forward with actions now in the light of an uncertain future. However, action is needed now, because effective adaptation to climate change will only come about through a continuous series of discussions and actions undertaken by a broad range of partnerships. How soon we peruse those discussions and actions will have a significant influence in determining how successful we will be in protecting the health and well-being of those living and working in our communities. ■

Author

Gregg Grunenfelder is Assistant Secretary for the Division of Environmental Health, Washington State Department of Health.

Resources

Global perspective: World Health Organization, Climate Change and Human Health
www.who.int/globalchange/climate/en

National perspective: Centers for Disease Control and Prevention, Climate Change and Public Health
www.cdc.gov/ClimateChange

State perspective: Department of Ecology, Climate Change in Washington State
www.ecy.wa.gov/climatechange

Snapshot of Climate Change Efforts

Compiled by Victor Colman

ALASKA

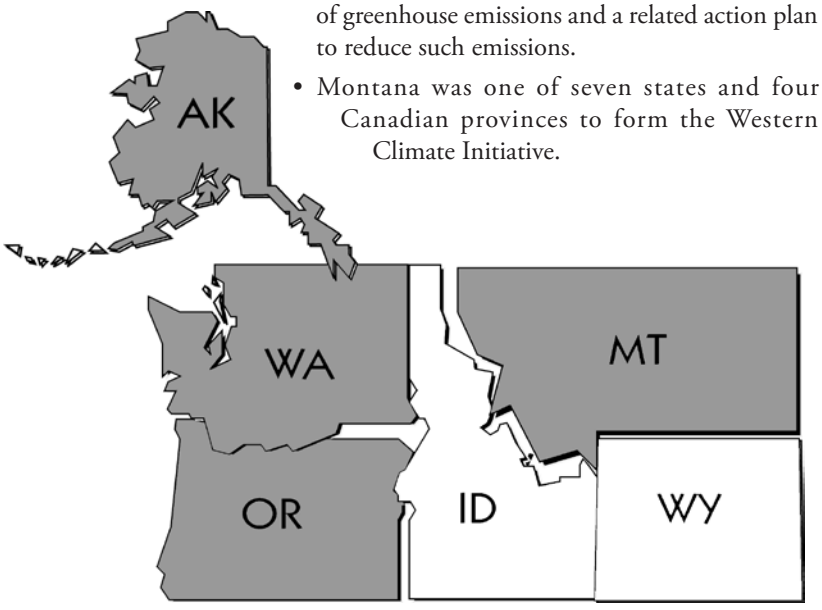
- Governor formed sub-cabinet in the fall of 2007 to prepare a climate change strategy.
- The Alaska Municipal League held a "communities conference" on climate change in late May 2008.
- Legislators also formed a Joint Alaska Climate Impact Assessment Commission and released final report in March 2008.

IDAHO

- Governor issued an executive order in May 2007, which gives lead responsibility to the Department of Environmental Quality (an agency separate from Health).
- Initial focus is very assessment-oriented, including: evaluating emissions, state vehicle fuel use, and being part of the North American Climate Registry that develops a common greenhouse gas emission reporting framework.

MONTANA

- Governor charged a Climate Change Advisory Committee to develop an inventory and forecast of greenhouse emissions and a related action plan to reduce such emissions.
- Montana was one of seven states and four Canadian provinces to form the Western Climate Initiative.



States shaded in gray have active climate legislation commissions and executive branch advisory groups. Source: Pew Center on Global Climate Change

OREGON

- Oregon's government was the first in the Northwest to develop an advisory group and develop a report to the Governor in March 2005.
- Next, a Climate Change Integration Group was formed to develop a framework for creating a preparation and adaptation strategy, implement and monitor mitigation measures, and explore research opportunities.
- Oregon was one of seven states and four Canadian provinces to form the Western Climate Initiative.

WASHINGTON

- Governor's Executive Order and House Bill 2815 engendered much activity among key government agencies and numerous stake-holders.
- The City of Seattle and King County are both heavily engaged in climate change adaptation and mitigation efforts.
- Washington was one of seven states and four Canadian provinces to form the Western Climate Initiative.

WYOMING

University of Wyoming's State Climate Office is sponsored by the state Water Development Office and is currently working on:

- Incorporation of climate change predictions into the State Water Plan
- Analyses of potential drought and climate change impacts
- Governor's "Climate Issues Task Force"
- Outreach related to impacts of climate vari-ability and climate change

The **New Generation** of **Practitioners**

One way to prepare for the future challenges of climate change is to give our next generation of public health practitioners the opportunities and experience to identify and treat emerging diseases and to understand the cultures and ways of life that may have brought these diseases to our country.

For me, the answer lies in international opportunities. As a junior pre-med, public health major, I have fallen in love with the field of public health. I have always wanted to be a doctor, and have now found a way to both heal and prevent disease. My life goal is to build clinics in underserved and forgotten villages around the world. Some of my classmates will work in public health agencies closer to home, but all of us share a global concern that has changed the way we look at health care and health needs.

This summer I had an opportunity to work in Central America and I feel that my whole outlook has changed because of this single trip. I helped conduct triages and run clinics in small villages around Belize. International Service Learning opened my eyes to a whole world of medicine and culture.

Along with being humbled and inspired, I learned about common diseases that most Americans may not even have heard of. I was shown different versions of certain diseases, exposed to the conditions that cause them, and introduced to the tests and remedies available in Belize. After my return, I received a message from a fellow volunteer from the trip. She had developed an unusual rash on her ankle. Doctors in her hometown in Montana couldn't identify it, but suggested ointment and ibuprofen. We decided to contact our host doctor in Belize and (as expected) he was able to identify the rash and suggest a treatment right away. It hit me then that American health workers are not exposed to the diversity we need.

Next summer I plan to travel to Kenya. I hope to have the chance to continue traveling to as many different countries, in as many different climate regions as possible to maximize my exposure to diversity in people, ways of life, and medical concerns. This variety will introduce me to new conditions and rich culture that will help me assess situations and understand what caused them. Whether these new diseases show up in immigrants, via travelers, or by zoonotic hosts, I hope to be able to recognize and treat them, and prevent others from catching the diseases.

The public health track has moved toward a global focus in recent years. I see optimism, innovation, and idealism in my fellow students. We are inspired by the work of our elders in the field and, like any other rising generation, we want to do more. I know students who want to travel to Darfur, Tibet, Guatemala, Cuba, North Korea…we see no limits. I understand that we may be perceived as a bit too idealistic, but is that really possible? How will any global health progress be made in these once-forbidden areas if we are afraid to expand our borders and address issues outside our comfort zone?

The University of Washington and Seattle in general seem to be a center for global progress, especially in the expertise of health. The UW's new global health department introduces new course work and even an undergraduate major (pending) in response to this movement. Our eyes have been opened to new opportunities at a crucial time in our world's progress. This includes a chance to address global warming. From a global perspective, we are seeing new and re-emerging infectious diseases due to the expanding range of animal hosts and changing seasonal patterns.

Industrialization and other human impacts create new challenges for public health. International travel is becoming more popular, more and more people are migrating to America, and climate change is increasing the span of disease-causing agents. Students and current health practitioners will need to reach previously underserved populations if we are going to be able to fight future infectious diseases in America and overseas. America is usually not the first to come into contact with the infectious diseases that purge nations as a whole, or more specifically the type of diseases that will emerge from the havoc of climate change and natural disasters. This is where international familiarity comes into play.

Please encourage your children, students, interns, and all young people who share a passion for making a difference to explore new territories and to learn the health issues of those peoples. Enable them to seek experiences that will introduce them to new cultures, new needs, and new ideas. Our awareness may be the key to saving lives in the future. ■

Photo: Courtesy of Darrah Kauhane-Floerke

Darrah Kauhane-Floerke (left) with Rachael Heck of the University of Oregon at their first clinic in the village of Arenol, on the border of Belize and Guatemala. Because of the black market for the over-the-counter medications, local police set them up in the local jail for security.

Darrah K. Kauhane-Floerke

Author

Darrah Kauhane-Floerke is a native of Hawai'i. She shares a love of the islands with thousands in the greater Seattle area. Her desire to serve the needs of others guides her daily efforts.

Reducing Your Carbon Footprint:

Health Departments Lead by Example

Michael Heumann
Latrissa L. Neiworth

Government has taken a leadership role in reducing its contribution to climate change. Idaho, Oregon, and Montana are among the states where agencies and local health departments are finding creative ways to reduce their carbon footprints:

- Idaho's governor directed state agencies to complete statewide emissions inventories, implement Greenhouse Gas (GHG) reduction strategies, and decrease the amount of gasoline and diesel used by state employees. Out of a fleet of 95 vehicles, the Idaho Department of Environmental Quality (DEQ) now owns 21 hybrids and is considering purchasing some fully electric cars.
- Oregon state employees exceeded the governor's carbon reduction goal by 19 percent and saved more than $125,000 on gas in response to the governor's commuter challenge. The state estimates that it saved 593,000 pounds of carbon dioxide from June 1 through August 29, 2008.
- A small rural Oregon health department in Curry County is piloting a demonstration project using 10–12 hour shifts and a shorter workweek in order to reduce travel and associated costs. The county reports that every eliminated commute saves $30 and an hour of staff travel time.
- Montana's Climate Change Advisory Committee has issued 54 policy recommendations to reduce greenhouse gas emissions to 1990 levels by the year 2020.

These are just a sampling of the state and local health department efforts underway to minimize the effects of climate change in our region.

The health sector—including hospitals, clinics, and health departments—faces greater challenges than other sectors due to a number of factors including the need for frequent patient contact, travel, and delivery of critical supplies. Especially in rural parts of our states, nurses and patients travel great distances. The total health sector carbon footprint, which includes indirect emissions through visitor, patient, and staff travel and the procurement of goods and services, is probably two or three times higher than direct emissions alone, according to the World Health Organization (WHO). Public health agencies will need to change the way we do business if we are to reach the US Department of Energy recommendation that all sectors reduce their carbon dioxide (CO_2) emissions.

Photo: Kelly James

Dr. Mel Kohn bicycles to work in Portland, Oregon.

What can be done?

There are a number of ways to reduce emissions including calculating a carbon footprint, assessing opportunities for reductions, and structuring an action plan. There are also ways to calculate an organization's direct and indirect emissions. Some simple spreadsheets are provided at www.ghgprotocol.org.

Direct emissions can include furnace heating systems, electricity by generators, and business travel in company cars. Indirect emissions include purchased electricity or heat; employee commuting in private cars; production of materials such as furniture, paper, equipment, toner cartridges and office products; and outsourced activities like shipping, courier services, and printing.

Areas to consider in reducing a carbon footprint include initial building design, procurement activities, transportation, waste management, capital improvements, energy saving tips, and small-scale measures such as lighting, incentives, and awareness.

Leaders in Government

In Oregon, leadership for decreasing emissions came from the top. Governor Ted Kulongoski has proposed and implemented a number of climate change measures statewide. The governor's goal for energy use in state-operated facilities is to reduce energy to the levels used in 2000. In 2007, the Portland State Office Building, the home of the Oregon Public Health Division, used 28 percent more energy than it did in 2000. By 2008, during a six-month period alone—January to July—the building's energy use was cut 13 percent below 2000 levels, and 41 percent below 2007 levels.

In Idaho, Governor C.L. "Butch" Otter issued an executive order in 2007 that directed the Department of Environmental Quality to be the point of contact on climate change. That set into motion a number of actions including establishing Idaho's GHG Working Group, identifying state agency GHG emissions, adopting changes to state vehicle fuel use and emissions, encouraging telecommuting, and offering incentives to state employees who use mass transportation.

Jess Byrne, Idaho DEQ, said the state has tried to focus primarily on common-sense practices. "We don't have a large industrial base in Idaho and nearly all of our in-state electrical generation is hydro [hydroelectric power]. But one of our largest sources of greenhouse gases is transportation," Byrne said. "We decided what made the most sense for us (state government) is getting our own house in order and leading by example."

So far, 15 state agencies have completed GHG emissions inventories. Of the 87,500 metric tons of carbon dioxide emitted every fiscal year, Idaho found the top two producers were the Corrections and Health and Welfare programs. All 15 agencies that completed emissions inventories have also developed GHG Emissions Reduction Action Plans and are now implementing them.

Public Health Best Practices

In Oregon, energy efficiency in the public health sector is guided by the Climate Change Committee of Public Health Oregon, otherwise known as C^3PO. It encourages making double-sided printing the default setting for printers; requesting auto shut-off lighting in unused spaces; taking the stairs instead of elevators; and promoting alternative means of travel to work, including subsidizing public transportation, carpooling, and providing safe and convenient bicycle parking. Other efficiencies include increasing video conferencing capabilities to reduce travel; promoting telecommuting, varied workweeks, and other distance-working opportunities; and composting food waste to reduce methane gas.

Leading by Example

The consequences of inaction would make the role of public health even more challenging.

"Those of us working in public health should recognize that climate disruption affects promoting good health for us all," said Dr. Mel Kohn, Acting Director of the Oregon Public Health Division, Department of Human Services, and State Health Officer. He brings the public health perspective to his work on the Oregon Global Warming Commission. "There is an opportunity now for us to lead by example and take some responsibility for the impact on the Earth's climate," he said. ■

10 Tips to Reduce Your Health Agency's Carbon Footprint Today

- **Carpool or find ways to reduce commutes at least one day per week:** Burning just one gallon of gasoline produces about 20 pounds of carbon emissions. When doing community work, team up with other health department staff traveling in the same direction.
- **Unplug electric items when not in use:** The equivalent of two large power plants run continuously to power America's televisions when they are turned off. To eliminate your "phantom loads," plug electronics, computer, and chargers into a power cords that you can unplug or switch off when not using.
- **Have a "waste-free" lunch at least once per week:** Bring your lunch in reusable containers, including reusable silverware, napkin, etc.
- **Turn off the lights:** Turn off lights when not in use. Light sensors can be added to automatically power down lights in vacant rooms.
- **Break the throwaway coffee cup habit:** Using a reusable mug twice a day instead of disposable cups can save 135 pounds of carbon dioxide emissions per person per year.
- **Drink your water from a reusable cup:** This will save you money and reduce the number of water bottles thrown away. The Northwest region has clean, potable water.
- **Eliminate your office's junk mail:** According to Cornell's Green Living Guide, (www.campuslife.cornell.edu/campuslife/housing/green-living-guide.cfm) the average American receives 1.5 trees worth of junk mail each year. Leave trees standing, cut carbon emissions from paper production, and lighten the load on landfills by getting your office's name off junk-mail lists.
- **Reduce your office's paper consumption by about 20 percent this month:** You can do this by reviewing and editing drafts on screen, expanding margins when you print, printing double-sided copies, and collecting paper printed on one side and using the blank side as scrap paper.
- **Arrange to telecommute one day per week, if possible:** While this may not be feasible for all staff, consider looking into the possibility. By avoiding the average 22-mile commute to the office, telecommuting saves about 840 million gallons of gas nationally—the equivalent to taking two million cars off the road for a year.
- **Refill your ink cartridges:** Your office can order ink in bulk online or send your cartridges out to be refilled. By one estimate, it takes about a gallon of oil to make a new laser cartridge. ■

Adapted from Oregon State University's "50 things you can do" campus carbon challenge.

Authors

Michael Heumann is an Environmental Epidemiologist in the Office of Environmental Health and Latrissa Neiworth is a Community Outreach and Education Coordinator in the Office of Community Liaison, both in the Oregon Public Health Division, Department of Human Services.

Helping Health-care Providers Prepare for Extreme Weather

Michelle McDaniel

Across the street, flood waters are rising as the tenants of a mental health residential facility watch from the front window. With torrential rains still falling, the lead counselor hastily finalizes plans to relocate all 11 adult residents to safe and dry shelter. Some would stay with family or a friend, while others would move to the agency's other residential facility, which is nearby and on higher ground. But wherever they end up going, they must go soon.

The facility's operators had not foreseen this emergency and had not planned for it. However, as the climate changes, emergency preparation needs to become a standard part of their business plan.

Scientists and meteorologists predict that extreme weather events such as the Puget Sound's Hanukkah Eve 2006 wind and rainstorm will no longer be uncommon as climate change affects our region. Already, hurricane force winds, severe rainfall, and heavy snow storms have caused landslides, power outages, and building and road damage throughout the Northwest, making this among the nation's highest-risk areas for disaster.

We saw in hurricanes Katrina and Rita that non-hospital type health care facilities such as providers of long-term care, home health, ambulatory care, and mental health and chemical dependency were significantly challenged in their efforts to maintain adequate and safe levels of service. In some cases, services ceased altogether, creating a crisis that put people's lives in danger and stretched already-thin critical care resources.

To help health-care providers prepare for emergencies such as these, the King County Health-care Coalition developed the Business Resiliency for Healthcare Providers project. With funding from the Assistant Secretary for Preparedness and Response (ASPR) office of the US Department of Health and Human Services, the coalition staff designed a project to help providers prepare for emergencies through continuity of operations workshops and other training.

To be eligible for the program, providers needed to be state-licensed and work in one or more of the following "non-hospital" health-care sectors: mental health, substance abuse, long-term care (nursing homes, boarding homes, adult family homes, home health, and home care), pediatric care, ambulatory care, palliative care, or specialty services such as dialysis.

Selected health-care providers received funds via a Request for Proposal (RFP) process to support emergency preparedness efforts, including a two-day business resiliency workshop, a business resiliency workbook, and other help in developing a comprehensive emergency operations plan for their organization. They received technical assistance from a public health emergency management planner. The materials were developed by Coalition staff to meet the specialized needs of these providers.

Coalition staff targeted this type of provider for this program for two reasons. First, these sectors have few opportunities for comprehensive disaster preparedness assistance or funding. These small operations lack access to the types of Continuity of

Photo: Onora Lien

More than 150 people attended the Business Resiliency Workshops.

Operations planning available to larger companies, and little information exists that is customized for the health-care industry.

Second, Coalition staff recognized that non-hospital health-care providers must be able to bounce back from a disaster in order to keep the entire health-care system stable. A break in the continuity of care would risk an escalation of illness, which would overburden emergency departments and hospitals.

Agencies could apply for either a small grant of $2,499 or a large grant of $24,000. The coalition contacted providers directly, usually by phone, to let them know about these opportunities.

Large grants were awarded to nine agencies that agreed to help with regional planning. For example, Northwest Kidney Centers, the region's largest dialysis provider, established a robust emergency call center. Its purpose is to communicate changes in treatment schedules, location of services, and transportation plans, and to get help for home dialysis patients who have power failures. This call center supports other outpatient dialysis providers in the Northwest, as well.

The Coalition awarded 130 small grants to help providers deliver services during an emergency. These funds provided emergency preparedness supplies including flashlights, emergency water and food, communication equipment, First Aid kits, generators, and personal protective equipment. Grant funds could also be used to reimburse staff time for attending preparedness trainings and the Business Resiliency workshops.

The two-day Business Resiliency workshops had three major goals:

- Increase providers' knowledge of disaster-related risks that could affect their organizations
- Provide specific information about how and why to prepare at home and at work
- Provide an overview of local, state, and federal disaster response systems and how best to build a collaborative relationship with them before and after a disaster.

Participants represented a range of positions or roles, with the greatest percentage being an administrator, manager, or medical/nursing director. Both days, participants were surveyed to gauge the effectiveness of the workshops, workbooks, technical assistance, and other preparedness tools. Results were overwhelmingly positive with a large majority rating their satisfaction "excellent" or "very good."

The most important outcomes of the project have been the progress participants have made in understanding their role in a disaster and the increased level of preparedness within their agencies. One project participant wrote that the most important learning gained from the program was, "To systematically think through each possible disaster for our area with others and be able to use this information to implement strategies to strengthen our disaster plan." Two others said, "The scope of preparedness requires preparation in several different areas that we had not even considered yet," and, "It (Business Resiliency Project) prompted us to take many concrete steps that we had been putting off."

Among the lessons learned was to provide the workbook and other written materials in multiple languages, and to approach providers face-to-face or by telephone, as many of the smaller health-care providers do not use e-mail or the Internet. ■

Photo: Leslie Wall

Michelle McDaniel holding the workbook.

Author
Michelle McDaniel is an emergency preparedness planning manager for Public Health - Seattle & King County

More information
www.kingcounty.gov/healthservices/health/preparedness/hccoalition.aspx

Web Specials

The online version of *Northwest Public Health* contains several articles that are not in the print version, plus an annotated bibliography compiled by our librarian, Laura Larsson

An Overview of Deaths Associated with Natural Events in the Northwest United States, 1979–2004. Robin Lee, Raquel Sabogal, Maria Thacker, Alden K. Henderson, Centers for Disease Control and Prevention (CDC)

How Environmental Health Can Address Global Climate Change. Hilary Karasz and Ngozi Oleru, Public Health - Seattle & King County

Interagency Cooperation: Putting Emergency Preparedness to the Test. Kathleen Eussen and Doug Wangen, Lewis County Health Department

Health risks rise with temperatures for outdoor workers. Melanie Mesaros, Oregon OSHA

You can find these all at **www.nwpublichealth.org**

Joining Forces to Address Climate Change

Alaska Communities Threatened by Coastal Erosion & Flooding

Jacqueline H. Poston
Larry Hartig

On the edge of the Bering Sea, Yup'ik villagers have adapted to harsh elements for millennia. Until now, traditional knowledge and wisdom have enabled them to survive hardship and define their sense of people and place. Today, with erosion literally eating away their village, the Newtok tribal council has decided to move inland.

Relocating Newtok and other villages threatened by climate change has required an unprecedented cooperation among local, state, and federal entities. It took no less than an Act of Congress for the Newtok tribal elders to negotiate a land exchange with the US Fish and Wildlife Service.

Newtok, a native village of 321 where Traditional Council meetings are held in Yup'ik, has had to find common ground with, for example, the Army Corps of Engineers, which determined that the land under village residences and infrastructure will erode away before the end of the decade. Different realities exist between official Washington and the little village, where the Ninglick River and the Yukon-Kuskokwim Delta are swallowing the land at a rate of 90 feet per year.

A GAO report in 2003 identified 184 of Alaska's 213 Native villages at risk from flooding or erosion.

The solution was to design a planned community that can withstand the challenges of climate change while retaining native traditions. Newtok and three other endangered villages can serve as models for other Alaskans and Northwesterners as global warming reshapes our landscapes.

Newtok residents will move to a new village called Mertarvik nine miles away. The new village is based on Oujé-Bougoumou, a small community of Cree aboriginal people in Quebec who were repeatedly displaced by mining activity. After a lengthy process, the Oujé-Bougoumou won recognition by Canadian and provincial governments to locate a permanent village. So far, the physical elements are in place, and the Oujé-Bougoumou are focusing on rebuilding the intangible community life that will ensure long-term health and viability.

Once they have decided to relocate, communities find themselves in a legal and economic limbo. Agencies are reluctant to—or prohibited from—funding projects or infrastructure in communities that plan to relocate. This accelerates the deterioration of aging health clinics, schools, and airport runways—Alaskan villages' essential link with the outside world.

Newtok has forged a creative partnership with the US Navy's Innovative Readiness Training program, which is considering establishing a remote readiness site in the old village of Newtok. That partnership could create a win-win situation, leaving behind an evacuation shelter for use during the remainder of the relocation process that can ultimately serve as a community center once the new village is functional.

A 2003 report from the Government Accountability Office (GAO) identified 184 of Alaska's 213 Native villages that are potentially at risk from flooding or erosion. In addition to Newtok, the most endangered are Kivalina, population 377, located on a barrier island that is both overcrowded and shrinking; Shishmaref, population 562, on an eroding barrier island where a temporary seawall will buy time until relocation is possible; and Koyukuk, population 101, which is regularly flooded by the Yukon and Koyukuk rivers. Five other villages are shoring up eroding infrastructure, but have no immediate plans to move.

Consequences of a changing climate threaten the way of life for Alaska Natives. Elders are no longer able to rely on traditional means of predicting weather and ice conditions. Traditional harvesting of marine mammals has become more challenging and dangerous with thinning and retreating sea ice. Many subsistence foods, from berries to salmon to whales, are no longer adhering to past patterns, in some instances becoming inaccessible to harvest.

Environmental health

Climate change affects human health when drinking water and sanitation infrastructure are

compromised. In some communities, sewage lagoons overflow during storms. In Newtok, *E. coli* contamination was a problem and a Village Safe Water grant is part of the solution.

Storm surges, brought on by earlier seasonal melting and the reduction of the Arctic ice pack, hammer away at coastlines. The land itself is becoming increasingly susceptible to erosion due to the thawing permafrost. The resulting floods can drain freshwater lakes and replace them with seawater, endangering food stocks and drinking water.

These conditions pose serious threats to the health of the native communities, and public health professionals are forming new partnerships to resolve them in a culturally appropriate manner.

New partnerships

In September 2007, Alaska Governor Sarah Palin established a Climate Change Sub-Cabinet and asked its members to develop a long-term strategy for statewide action while addressing the urgent needs of the most imperiled communities. Thus, the Immediate Action Work Group was formed; the State invited the US Army Corps of Engineers to co-chair it. The Group was asked to identify actions that needed to be taken within 12 to 18 months to protect lives, critical services and infrastructure, and prevent substantial damage to property.

The Immediate Action Work Group has brought focus and coordination to the fore. In 2008 it identified critical needs, which with support of the Governor and Legislature, received $10.6 million from the state and helped mobilize $40 million in new federal funding.

The state has established a small grant program to build capacity and empower individuals at the local level. This year, the Alaska Division of Homeland Security and Emergency Management visited six communities in peril, providing evacuation training and assistance with emergency response planning.

Relocation provides communities such as Newtok with an opportunity to incorporate elements of sustainability into community master plans. The state's Village Safe Water program has worked with Newtok and other communities to ensure that efficiencies are built into the design for water and utility systems, and into the residential and public building grid. The Cold Climate Housing Research Center is playing a key role in design of the structures themselves, to maximize energy and environmental conservation.

Everyone involved with the Immediate Action Work Group is learning to respect and appropriately take into consideration the best of Traditional Knowledge, Science, and Technology. Together, they have brought significant resources to the project and have set an example for working together across disciplines, agencies, and cultures. This collective effort can be viewed as an effective model for a variety of endeavors. ■

Authors

Jacqueline H. Poston is project coordinator for the Alaska Climate Change Strategy, Alaska Department of Environmental Conservation. Larry Hartig is the chair of the Governor's Climate Change Sub-Cabinet and Commissioner of the Alaska Department of Environmental Conservation.

Resources

GAO report www.gao.gov/new.items/d04142.pdf

Alaska Climate Change Strategy www.climatechange.alaska.gov

New York Times articles on Hamilton (Nov. 12, 2006) and Newtok (May 27, 2007), both by William Yardley.

Moving a Town

Hamilton began life as a timber town in Washington's Skagit Valley. Of course, it was established on the banks of the Skagit River so logs could be floated to the sawmill.

A few years ago, the Washington State Department of Health, in concert with Skagit County Public Health Department, helped relocate the town's well field out of the flood plain, said Corinne Story, Environmental Public Health Manager. Her Department provides homeowners with information and technical assistance regarding home cleanup and on-site sewage septic systems after frequent floods. A Public Development Authority is planning to relocate the town's 445 residents to a new town site on higher ground.

While not universally accepted, the relocation project is viewed as an opportunity to revitalize the economy, enhance river habitat, and reduce the public and private costs of flood response, recovery, and reconstruction.

Climate Change & Communicable Diseases in the Northwest

Paul Cieslak
Mel Kohn

The past generation has seen the emergence of an array of infectious diseases—viral, bacterial, fungal, protozoan, and even parasitic worms. In its 2003 treatise on *Microbial Threats to Health,* the Institute of Medicine identified 13 factors that lead to such emergence, one of which was "climate and weather."

The effect of this factor is sure to be felt in the Pacific Northwest, where models predict an average increase in temperature of 5°–7°F year-round and, in the winter, a shift from snow to rain. This article illustrates mechanisms and explores potential effects of changes in climate and weather on communicable diseases in the Pacific Northwest.

Climate and weather may influence the emergence and epidemiology of infectious diseases through several mechanisms (see box, opposite page).

Vector-borne Disease

Many diseases borne by arthropod vectors are caused by pathogens whose reproduction is sensitive to temperature. Among these are "tropical" diseases such as malaria and dengue, but West Nile virus infection is similarly affected by temperature. The West Nile virus appears not to replicate within female *Culex* mosquitoes at temperatures lower than about 57°F. Titers of the virus within infected female *Culex* mosquitoes have been shown to be a function of time and incubation temperature. There seems to be a threshold viral titer within the mosquito, below which transmission does not occur. The pattern of West Nile infection already exhibits a strong seasonality, with peak transmission in late summer in the Northwest; longer summers and higher temperatures may have a substantial effect on incidence of human West Nile fever and encephalitis.

Image: Idaho Department of Health and Welfare

Idaho Department of Health and Welfare launched a Fight the Bite campaign to alert the public about the dangers of West Nile virus.

Vibrio Parahemolyticus

Vibrio parahemolyticus is a well-known agent of gastrointestinal illness in people who eat raw oysters harvested from sufficiently warm waters. This bacterium may require water temperatures 63°F or higher to proliferate and to reach quantities in oysters sufficient to infect humans. Oysters harvested in Oregon, Washington, and British Columbia during the summer have caused outbreaks of *V. parahemolyticus* infection. In 2004, an outbreak aboard a cruise ship implicated oysters harvested from Prince William Sound, Alaska—more than 600 miles north of the pathogen's previously recognized northern outpost. Warming waters in the Pacific Northwest are almost certainly likely to lead to higher concentrations of *Vibrio* species in shellfish beds and longer periods of summer risk.

Zoonotic Diseases

A review of infectious diseases in 2001 identified 175 that were caused by pathogens considered to be "emerging." Of these diseases, 132 (75 percent) were zoonoses—transmitted to human beings from animals. We should expect that animal host populations for zoonotic pathogens may, for better or worse, be affected by changes in climate.

Pathogenic microbes may be passively transported on air or in water. One concern is *Cryptosporidium parvum,* a protozoan agent of diarrhea that is found in cattle. Predicted increases in rain and flooding, multiplied by rain-on-snow events in the Cascades, may wash *C. parvum* and other animal intestinal indwellers into drinking water reservoirs.

Rivers swollen by spring rains and snow runoff may well have been the cause of contamination of the Milwaukee, Wisconsin, drinking water supply and the massive outbreak of cryptosporidiosis in 1993. A review of waterborne disease outbreaks in the United States from 1948 to1994 found a significant correlation with an "extreme precipitation event" in the two months before the outbreak. On the other hand, survival of cysts of both *Cryptosporidium* and *Giardia* is shortened by warmer water temperatures.

Environmental changes also can lead to shifts in the population of vector species. For example, the 1993 outbreak of hantavirus pulmonary syndrome in

New Mexico was preceded by increasing densities of *Peromyscus* mice, the definitive host for *Sin Nombre* hantavirus. *Peromyscus* densities were higher in areas where precipitation had increased in 1992 in association with the *El Niño* event of that year. Further studies of precipitation, *Peromyscus* densities, and *Sin Nombre* seropositivity among *Peromyscus* mice in several areas in the Southwest corroborated the association of higher rates of hantavirus pulmonary syndrome with periods of higher-than-usual rainfall, after a lag time that allowed for the mouse reservoir populations to increase and to become infected with *Sin Nombre* virus.

Fungal Diseases

The fungus *Cryptococcus neoformans* is an environmental saprophyte whose environmental niche is dead or rotting trees. *C. neoformans* has been notorious as a cause of meningitis in patients with organ transplants or AIDS, but one variety has shown a particular ability to infect hosts with intact immune systems. This variety, known as *gattii,* was formerly

Photo: istockphotos.com

Shucking oysters for eating at a market stall.

thought to have been restricted to tropical and subtropical areas. However, the pathogen emerged as the cause of an outbreak on the east coast of Vancouver Island beginning in 1999. Environmental sampling in a provincial park unveiled an ecological berth among several tree species there, notably our beloved Douglas Fir. The researchers hypothesized that the establishment of the fungus in this area may have been due to climatic changes.

Human Activities

Changes in where people eat, drink, dwell, and recreate will probably have more effect on the epidemiology of infectious diseases than specific changes in climate themselves. Legionnaire's disease has been uncommon in the Northwest, but increased use of air conditioning, should summers become warmer and longer, may lead to higher rates of this infection. Increased flooding or rising sea levels could lead to displacement and concentrations of populations, with consequent increases in diseases transmitted directly from person to person. In-migration of populations from a hotter and drier US Southwest could lead to increased settlement east of the Cascade mountains, and exposing more people to diseases such as hantavirus pulmonary syndrome or relapsing fever. Likewise, increased housing adjacent to forested areas west of the Cascades could lead to more contact with the *Ixodes* tick vectors of Lyme disease.

Surveillance

We cannot predict the net effect of climate change on the incidence of communicable diseases. Expected increases in vector-borne and other diseases might be more than offset by reduced incidence of diseases typically associated with cold weather, such as influenza or rotavirus infection. However, given the dynamic interplay among reservoirs, vectors, human hosts, and the environment, changes in communicable disease patterns are inevitable.

The most prudent strategy for protecting the Northwest from these changes are those advocated by the CDC ten years ago to address the problem of emerging infectious diseases: ensuring that we have a robust, sustainable, and influential public health system that can detect changes in disease patterns quickly using public health surveillance, investigate as needed, and mount an appropriate response.

Authors

Paul Cieslak, MD, is manager of the Acute and Communicable Disease Section, and Mel Kohn, MD, MPH, is acting director and State Health Officer, Public Health Division, Oregon Department of Human Services.

Further reading

Centers for Disease Control and Prevention. Preventing emerging infectious diseases: a strategy for the 21st century. *MMWR* 1998;47(RR-15).

Effects of Climate on Infectious Diseases

Direct Effects

- microbial multiplication rate
- microbial movement
- movement and replication of vectors and animal hosts
- evolutionary biology

Indirect Effects

- effects operating through ecological changes
- effects operating through changes in human activities

Monitoring Animal Diseases & Their Impact on Public Health in Wyoming

Karl Musgrave
Emily Thorp

Dr. Tim Graham drove his pickup loaded with trash down the dusty dirt road and through the entrance gate to the Big Horn County Landfill. He looked forward to seeing and talking to Connie Stolk, the landfill manager, as they had known each other for most of Tim's 57 years. Tim had been Connie's veterinarian for many of those years.

As Tim pulled up to the tiny shack where Connie collected the landfill fees, he immediately noticed the troubled look on Connie's face.

"Hey Tim, what is causing all the sheep deaths?" Connie asked. "We have buried probably ten sheep brought in by ranchers over the past week."

This incident illustrates one of the unexpected sources of animal disease information that has been discovered during the beginning years of a pioneering surveillance program at the Wyoming Department of Health (WDH). The program, initiated in 2004, collects information on zoonotic diseases and adverse health events in animals that may potentially affect humans. A zoonotic disease is one that can be transmitted from vertebrate animal to humans.

Because most of the biological agents that could be used as weapons against human populations are zoonotic, illness or death in animals could be early indicators of the release of a biological agent during a bioterrorism event.

The surveillance activity is accomplished through the use of seven regional veterinary public health coordinators (RVPHCs), who collect information from veterinary clinics and other sources each week. Dr. Tim Graham is one of the RVPHCs. The information is then forwarded to the State Public Health Veterinarian, who compiles a summary report that is distributed widely throughout both the public health and animal health communities.

In the landfill incident described above, the cause of the sheep deaths was not known for several days, though two zoonotic diseases were suspected. Anthrax was considered because many of the sheep were found dead without any previous illness observed by the rancher. Sudden deaths are often seen with anthrax. The other, less well known, zoonotic disease considered was Orf, or contagious ecthyma. Orf is caused by a *parapoxvirus* and causes lesions on the lips and mouth of sheep and goats. Most of the sheep at the landfill had oral lesions.

The outbreak, which occurred in the summer of 2007, was determined to be caused by Bluetongue disease. Also known as Catarrhal fever, Bluetongue is not a zoonotic disease and did not represent a danger to public health. It is caused by a virus transmitted through the bite of an infected fly, primarily to livestock such as sheep, cattle, goats, and to some wildlife including buffalo, deer, and antelope. When Dr. Graham alerted authorities to the outbreak, fewer than 25 sheep had died. However, those sheep came from several separate ranches, and even though a quarantine preventing movement of sheep in the area was instituted, the disease eventually spread to more than 900 sheep and caused the deaths of about 300. Dr. Graham's early discovery was instrumental in controlling what could have been a much larger outbreak.

Wyoming started designating veterinarians to monitor and report animal disease activity in their regions after the September 11, 2001, terrorist attacks. Because most of the biological agents that could be used as weapons against human populations are zoonotic, illness or death in animals could be early indicators of the release of a biological agent during a bioterrorism event. The state wanted to avert potential acts of agroterrorism that could negatively affect the Wyoming livestock industry. The directors of the Wyoming Office of Homeland Security, Wyoming Livestock Board, and the Wyoming Department of Health collaborated to initiate the program, which is supported through funds from the Wyoming Public Health and Emergency Preparedness Program. In the early stages of the program, the seven veterinarians, originally referred to as regional veterinary coordinators (RVCs), focused on preparedness activities related to a potential bioterrorism and agroterrorism incident. Disease monitoring was passive—the RVCs periodically informed area veterinarians, ranchers and others that they were available to respond to suspected or confirmed outbreaks.

The Bluetongue outbreak pointed out an unfortunate side effect of the passive approach. Inves-

This publication was supported by Grant/Cooperative Agreement Number 5 U90 TP 816984 from CDC. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC.

tigators learned that a veterinarian suspected the disease on one ranch but withheld the information out of concern that the flock would be quarantined, economically harming the rancher. Because of an apparent reluctance of veterinarians, ranchers and others to report diseases to their RVCs during the first two years, a confidential, active surveillance system was implemented in September 2007. The RVCs were encouraged to build good working relationships with source veterinarians and the general public by ensuring their confidentiality and discussing the importance of such a system for the safety of their livestock and public health.

Under the new surveillance system, RVCs are now referred to as regional veterinary public health coordinators (RVPHCs) to better reflect their public health role, and are required to spend at least two hours a week actively contacting their reporting sources. Each week, they report their findings to the State Public Health Veterinarian.

The type of contact between source and RVPHC varies. Some use e-mail while others contact their sources by phone and request reports by fax. A few RVPHCs meet in person each week with critical sources, such as the owner of the busiest veterinary clinic in their region. It is hoped that this active surveillance system will identify problems early, as reporting sources are now directly asked about animal diseases seen over the previous week.

A preliminary data analysis shows that, from September 2007 to October 2008, the system received 589 reports, 488 of which were confirmed or suspected zoonotic diseases. It showed 228 reports of animal bites or rabies-related incidents, including 20 confirmed cases of animal rabies, 63 cases of animals being confined and observed after biting a human, 7 cases of animals being quarantined after exposure to wild animals potentially infected with rabies, and 16 animals euthanized and tested for rabies.

Among the confirmed or suspected zoonotic diseases, campylobacteriosis and salmonellosis were most common, with 35 and 15 reports respectively.

The information flows both ways. Some were initially reported by the health department as human cases where laboratory or epidemiological evidence pointed to an animal source of the illness. These included, in addition to the salmonellosis and campylobacteriosis cases, 12 poisonings, 9 wild animal die-offs, 15 undiagnosed illness syndromes, and a surprisingly high number of rattlesnake bites (14).

This surveillance system has numerous strengths. First, it has the ability to collect animal disease information that was missed by previous reporting mechanisms, including diseases diagnosed through private laboratories or those seen by nontraditional reporting sources such as landfill operators. Second, although Wyoming has an animal reportable disease list that includes major zoonotic diseases, it omitted many zoonotic pathogens such as *Campylobacter* and *Salmonella* species. Third, the program is inexpensive. The annual operating budget is $83,000, which includes the RVPHC contracts ($800 per month).

There are limitations to this surveillance system. In order to promote timely investigations and communication, veterinarians are encouraged to report suspected zoonotic diseases. However, further diagnostics may never be performed to determine if the veterinarian's suspicions are correct, and it can be difficult to determine the true incidence. Since the program is funded through a cooperative agreement from a federal agency, the long-term sustainability is susceptible to federal budget pressures. Furthermore, the voluntary nature of the program, as opposed to legally mandated reporting, makes it dependent on the willingness of individual veterinarians to participate. Currently, about half of the 70–80 veterinary clinics in Wyoming report information to the RVPHCs. The applicability of this program to other geographical areas where there are many more veterinary clinics may be limited; as the RVPHCs had met most, if not all, of the limited number of veterinarians in their regions before the program began. Nevertheless, the system provides a model of how an active surveillance system can be implemented at a modest cost. Efforts are underway to increase the number of reporting veterinary clinics as well as to recruit reporting from other sources such as animal control organizations. ■

Photo: Tim Graham

Sheep ranchers Kay Neves and Randall Jones discuss the Bluetongue outbreak.

Authors

Karl Musgrave, DVM, MPH, is the State Public Health Veterinarian at the Wyoming Department of Health. Emily Thorp, MS, is a Surveillance Epidemiologist at the Wyoming Department of Health.

Resources

Heryford AG, Seys SA. Cattle and campylobacter risk factors in rural environments. *Northwest Public Health* 2003; 20(1): 10–11.

Zoonoses and Communicable Diseases Common to Man and Animals. 3rd edition, PN Acha, B Szyfres (Pan American Health Organization, Washington, DC, 2001, 2003).

Animal & Zoonotic Diseases in Alaska as an Indicator of Climate Change

Michael Bradley

Alaskans don't need to read about global warming to understand the effects; we see them all around us. Alaska Natives have observed profound changes in the ecosystem for the past two decades—things we now recognize are related to climate change. One of the most dramatic changes has been melting permafrost, which is damaging buildings, roads, bridges, and airport runways across the state. Physical changes are the most obvious, but more subtle ecosystem changes are happening.

As global temperatures warm and previous barriers shift, species expand their ranges toward the poles. As they colonize new areas, these species will bring their diseases with them, which can spread into established species. A classic example is the northern and northwestern expansion of beaver in Alaska. Beaver are very good carriers of the parasite *Giardia.* As they colonize new regions, they contaminate new water sources and spread the disease to other animals such as caribou. As caribou migrate, they could spread the parasite across thousands of Alaska miles.

Giardia is a zoonotic disease, or a disease of animals that can also infect humans. Another example of a zoonotic disease that has recently appeared in Alaska is gastroenteritis caused by the bacteria *Vibrio parahemolyticus*. In 2004, Alaska cruise ship passengers were stricken with the illness after eating raw oysters harvested in Prince William Sound. The disease had not occurred previously in Alaska seafood, primarily because Alaska waters were too cold for the agent to survive. But in 2004 water temperatures exceeded 60°F, the minimum temperature required for the bacteria to infect shellfish. Shellfish poisoning caused by toxic algae is another concern (see the Scherer and Faustman article opposite).

Another category of zoonotic diseases that could become a greater threat are those transmitted by insect vectors. Since its appearance in the western hemisphere in 1999, West Nile Virus has spread across North America and as far northwest as the Prairie Provinces of Canada. Many species of birds that migrate to Alaska can carry the virus and could readily bring it to the state. As with shellfish, Alaska has an active surveillance program to identify diseases as they emerge.

Because of the complexity of ecosystems it is hard to predict changing disease patterns that might be related to climate change. *Echinococcus* is an animal parasite found in rodents in Northwest Alaska. It can be fatal in humans, who are incidental hosts. Rodent population density is a key factor in the disease and rodent numbers depend on climate and weather patterns. An expansion of rodent ranges and populations could pose a greater risk to human health. Last week, I was in Toksook Bay, a delightful Eskimo community on the Bering Sea. In late morning a fox walked into the community and bit a child. Very likely the fox was rabid. If rodent numbers increase, predators such as fox will follow and diseases associated with both are apt to increase.

Zoonotic diseases are a threat to human health, but other animal diseases can affect Alaska Natives who depend on traditional food. This has already happened with the most important economic and traditional food species in Alaska—salmon. Beginning in the late 1980s Alaska Natives along the Yukon River began to notice salmon that had a strange odor and did not dry normally in the traditional smokehouse environment. Eventually, a lab in Oregon identified the cause as "white spot disease," a parasite that in some years infects 25 to 30 percent of Yukon salmon. Its incidence increases when water temperatures rise above 59°F. Viral hemorrhagic septicemia has also appeared in Alaskan Pacific herring, Pacific hake, and walleye pollock, all of which are important economic species. These could have huge economic impacts on the billion-dollar Alaska fishing industry.

Efforts are now underway in Alaska to establish enhanced surveillance for existing and emerging diseases that could become greater threats because of climate change. As Dr. Musgrave notes (page 18), surveillance of animal populations can help us anticipate emerging diseases in our human populations. ■

Author

Michael Bradley, DVM, MPH, is the Traditional Food Safety Coordinator for the Alaska Native Tribal Health Consortium.

Climate Change & Seafood Safety

Alison Scherer
Elaine Faustman

It was not a welcome headline that graced the *Chinook Observer* the morning of October 2, 2002: "Clam opener canceled due to high toxin count." That day the Washington coast's largest newspaper relayed disappointing news to the thousands of would-be razor clam diggers who are drawn each fall to Washington's coastal beaches for the limited harvest season. Harvest closures have been a recurring problem on the Washington coast. They result from marine biotoxins, including domoic acid and paralytic shellfish poisoning toxin, and bacteria that cause intestinal disease in humans.

Because marine biotoxin production seems to hinge on a complex set of factors, including water temperature, researchers are beginning to wonder what role climate change might play in future seafood harvest seasons and the availability of safe seafood resources throughout the Pacific Northwest.

Pacific Northwest seafood resources, both recreational and commercial, represent a means of sport and employment. They also represent a way of life among tribal communities that depend on these resources for sustenance and cultural identity.

The University of Washington's Pacific Northwest Center for Human Health and Ocean Studies, directed by Elaine M. Faustman and Ginger Armbrust, researches how environmental factors trigger blooms of the marine algae that produce domoic acid, which caused the 2002–2003 harvest closure. When people eat seafood contaminated by domoic acid, they may experience nausea, memory loss, confusion, seizures, and even death. Faustman, Professor of Environmental and Occupational Health Sciences, leads the center's human exposure research project.

While controlled laboratory studies are beginning to illuminate environmental and genetic factors that contribute to domoic acid production, Armbrust, Professor of Oceanography, says researchers are not certain of causes of domoic acid production in the environment. Domoic acid has prompted beach closures dating back to 1991 and has become an emerging concern in Puget Sound, where three closures have occurred since 2003. The 2002–2003 harvest closure on the Washington coast cost the local economy an estimated $10 million.

Some studies suggest that harmful algal blooms, including blooms of domoic acid, are on the rise. According to an article by Moore *et al.* in the journal *Environmental Health,* little progress has been made in teasing out the role of climate impacts from the many other variables thought to contribute to harmful algal blooms. The article suggests that studying documented and predicted impacts of ocean warming from large scale climate variability (such as *El Niño*) can help predict future anthropogenic climate change. While researchers suspect that a type of algae known as diatoms might struggle because of its physiology, a type called dinoflagellates might fare better. If warmer waters occur for greater lengths of time each year and favor growth of some kinds of dinoflagellates, such as the kind that produce paralytic shellfish poisoning (PSP) toxins, harvest closures could increase. In Washington State, harvest closures result when PSP toxin levels in seafood are too high.

In addition to testing for domoic acid and PSP toxins, the Washington State Department of Health tests for bacteria that cause the intestinal disease vibriosis. Levels of these bacteria in shellfish increase as summer temperatures rise. A large outbreak of vibriosis in 2006 in Washington State sickened dozens of people. Nationwide, about 300 people were infected by contaminated Pacific Northwest oysters that year, threatening the entire industry. Another outbreak in 2004 in Alaska made dozens ill. The Alaska outbreak is of particular note because, at the time, scientists did not think Alaskan waters were warm enough to permit the growth of the *Vibrio parahaemolyticus* bacteria sufficient to make people ill. Researchers who studied the outbreak concluded that increased ocean temperatures played a role.

The effect of future climate change on susceptibility of Northwest seafood resources to biotoxins and bacterial contamination is not yet fully known. However, as we put more effort into understanding these mechanisms now, the story may help those who count on these resources for income, food—and even cultural identity—to weather the changes. ■

Authors

Alison Scherer, MS, is a Research Scientist in the University of Washington's Pacific Northwest Center for Human Health and Ocean Studies and Elaine Faustman, PhD, is the Center's Co-director.

Resources

Moore SK, Trainer VL, Mantua NJ *et al.* (2008). Impacts of climate variability and future climate change on harmful algal blooms and human health. *Environmental Health*, 7(Suppl 2): S4.

Climate Change & Idaho's Treasure Valley Air Quality

Potential Impact on Community Health

Leonard Herr
Uwe Reischl

The Boise metropolitan area is growing rapidly, with new housing developments, new shopping centers, and new roads. Automobile traffic is increasing and air quality declining as more people move into this region, long called the Treasure Valley for its natural riches.

International epidemiological studies have shown a strong correlation between ambient air pollution and respiratory illnesses. Such conditions appear to disproportionately harm children and elderly people who suffer from asthma and other respiratory illnesses, and anyone with chronic cardiovascular disease.

Because the Treasure Valley now accounts for about 60 percent of Idaho's population, it is a focus of state concern about air quality, overall environmental quality, and public health. Environmental changes could restrict the region's potential for future growth and development because the Clean Air Act requires that the Treasure Valley meet national air quality standards. Air quality conditions associated with winter inversions have already placed the Valley near noncompliance limits.

How air pollution forms

Two factors determine the ambient concentrations of air pollution: Emissions and weather. If there are no emissions (man-made or natural), air pollution problems are not expected. Depending on weather conditions, however, even a moderate amount of emission can create potentially serious air quality problems.

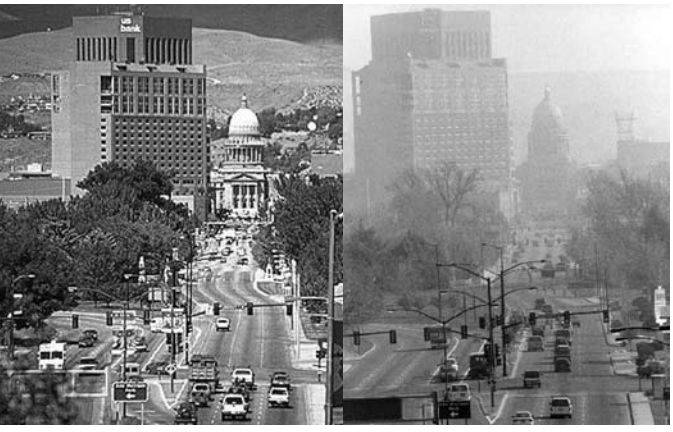


Photo: Idaho Department of Environmental Quality

Downtown Boise on a clear day (left) and during a winter inversion period (right).

As changing climate conditions in the Pacific Northwest influence seasonal weather patterns, we can extrapolate how different climate regimes may affect air quality in the Treasure Valley, and how this can affect the health of our population.

Because of our topography (a perfect bowl) the Treasure Valley can experience some of the most severe wintertime inversions in the intermountain west. Inversions occur when heavier, colder air settles into the valley while warm air sits above it. This causes the air to stagnate and trap pollutants until another weather system moves through and mixes the air mass. Particulate matter is the pollutant of primary concern during such episodes, and concentrations in our region frequently exceed national health standards.

In the summer, the valley experiences problems with ground-level ozone concentrations. Stagnant air conditions combine with high heat and intense sunlight to produce unhealthy levels of ozone from volatile organic compounds (VOC) and nitrogen oxides (including NO and NO_2) Over the past decade, the number of "Good" air quality days, as rated by EPA's Air Quality Index or AQI system, has been steadily decreasing in the Treasure Valley, from a high of 300 days rated as "good" in 2001 to fewer than 170 in 2007. Concentrations of ozone and particulate matter in the Valley occasionally exceed national health criteria, and barely meet the National Ambient Air Quality Standards.

Computer models allow us to project current patterns of weather and air pollutant concentrations, and extrapolate them according to various scenarios of climate change. The Community Multi-scale Air Quality (CMAQ) modeling system is used by the Idaho Department of Environmental Quality (IDEQ) to model ozone and fine particulate concentrations in the Treasure Valley, and can be used to evaluate both long-term (annual to multi-year) as well as short-term climate changes. We can vary the scenario to assume the climate is warmer and more humid, warmer and less humid, colder and more humid, or colder and drier. Each of these scenarios produces a different pattern for summer and winter.

Climate change: hot & humid

With warmer average winter weather, more precipitation would fall as rain instead of snow, and

inversions would be unlikely. Higher rainfall and more frequent storm fronts would keep the air well mixed and would wash out particles. Also, roads would be sanded less often and residential wood stoves would be used less often.

A wetter than normal summer would lower ozone concentrations as weather fronts mix the air.

Climate change: warm & dry

Fewer weather fronts could lead to long periods of stagnant air. While inversions would not be exceptionally strong in this type of weather pattern, average particulate levels could be high.

Warm, dry summers are a recipe for high ozone concentrations in the Treasure Valley because of high evaporative VOC emissions. Without weather fronts, pollutants would build up rapidly to unhealthy levels. Dust and wildfires could increase ambient concentrations of particulate matter. Ozone concentrations would be expected the worst under this scenario because temperature and ozone formation are linked.

Climate change: cold & humid

Cold, wet winters would bring large amounts of snow to the Treasure Valley. A heavy snow pack on the valley floor can worsen temperature inversions, but weather fronts would result in a net reduction of particulate concentrations in the ambient air.

Just as hot, dry summers are ideal for ozone formation, a cooler and wetter summer would likely lower ozone concentrations, particularly with substantial cloud cover.

Climate change: cold & dry

Cold, dry winters typically are associated with extensive inversions in the Treasure Valley. Snow on the ground amplifies the cooling effect. This scenario has been associated with the worst air quality in the Treasure Valley and high particulate matter levels.

A summer that is cool but dry would likely improve ozone concentrations by inhibiting evaporative VOC emissions.

Health Issues

Data from clinical, epidemiological, and animal studies indicate that exposure to ambient ozone is an important risk factor for short and long-term health effects. These can include chest discomfort, cough, and shortness of breath in healthy people as well as those with lung disease; asthma attacks in people with asthma; the possible development of new cases of asthma and other respiratory disease in people exposed to ozone over many years; and possibly mortality in people with lung disease. For example, when ozone levels are high, people with asthma may experience worsening respiratory symptoms, need more medication, and be more likely to go to emergency rooms or be admitted to the hospital. Of course, as with most triggers, some people may be more severely affected than others. In general, people suffering from chronic obstructive pulmonary disease (COPD), including emphysema, chronic bronchitis, and asthma, are at increased risk.

Exposure to particle pollution occurs when people inhale a mixture of microscopic solids and aerosols or liquid droplets suspended in air. Components include acids, organic chemicals, metals, soil or dust particles, and allergens. The size of particles is directly linked to their potential for causing health problems. Small particles less than 2.5 microns in diameter pose the greatest problems because they can be inhaled deeply into the lungs. Larger particles are of less concern, although they can irritate the eyes, nose, and throat. The health effects associated with the exposure to particulate air pollutants can include inflammation of lung tissue in young, healthy adults; increased numbers of heart attacks, especially among the elderly and in people with heart conditions; increased severity of asthma attacks in children; and increased emergency room visits for patients suffering from acute respiratory ailments.

Pollution and climate change scenarios for Idaho's Treasure Valley

Climate Change Scenario	Meteorological Conditions	Ozone	Particulate Pollutants	Air Quality Conditions
Warm and wet	Unstable	Low	Low	Good
Warm and dry	Stable	High	High	Poor
Cold and wet	Unstable	Low	Low	Good
Cold and dry	Stable	Low	High	Poor

Such evidence is found, for example, in a review of daily hospital admission rates constructed from the Medicare National Claims History files for cardiovascular and respiratory outcomes (11.5 million Medicare enrollees in 204 US urban counties between 1999 and 2002). The study revealed a short-term increase in hospital admission rates during times of high particulate pollution. Admissions increased for all health outcomes except injuries, with the largest association for heart failure.

Authors

Leonard Herr is Regional Airshed Manager for the Idaho Department of Environmental Quality. Uwe Reischl is a Professor of Health Sciences at Boise State University.

The Health Effects of Wildland Fires

Jane Q. Koenig

Health effects of wildland forest fires are similar to those associated with urban air pollution. The most common air pollutant from wildland fires is fine particulate matter (PM). However wildland fires are known to emit several other notably toxic air pollutants such as carbon monoxide, aldehydes, nitrogen oxides (NOx), and polycyclic aromatic hydrocarbons (PAHs).

Adverse health effects include respiratory illness in children and elders, cardiovascular events such as heart attack and stroke, decreased lung function, asthma aggravation, emergency department visits, hospitalization, bone marrow abnormalities, respiratory and cardiac symptoms, and airway inflammation.

Public health concerns involve two populations: the firefighters themselves and the residents living near enough to the fires to experience increased levels of pollutants.

Residents at the most risk include infants, pregnant women, the elderly, people with pre-existing diseases or with certain genetic variations, and people who exercise heavily.

A study by University of Washington School of Public Health graduate Christine Betchley (MS, 1993) found reduced pulmonary function among forest firefighters in Washington and Oregon. She measured lung function in 76 subjects before and after shifts at a prescribed fire (one ignited by management actions to meet specific objectives). Other studies have seen similar findings when studying fire crews.

It is harder to study the health effects for people living nearby. Natural disasters come without warning and don't give researchers time to marshal a scientifically sound study. One attempt was made in 1999 by the Centers for Disease Control and Prevention. Mott *et al.* reported on health effects of a fire in Hoopa, California, the fifth-largest wildland fire in the US that year. The investigators used numbers of hospital visits and self-reported symptoms as the health outcomes. Hospital visits were 50 percent higher than normal, and 63 percent of the patients reported increased respiratory symptoms.

In 2003, southern California was inundated with a rash of wildfires, which produced heavy smoke that affected large populations. Because a Children's Health Study (Kunzli *et al.*, 2006) was already underway in the area, scientists could obtain scientifically valid data from children who had already completed health effects evaluations. Risks of nose, eyes and throat irritations; cough; bronchitis; cold; wheezing; and asthma attacks, medication use, and physician visits increased with the number of reported smoky days.

Data from fires in Southeast Asia offer additional information on health effects. During the summer of 1997, brush fires spread through Southeast Asia as land was cleared for developments. Tan *et al.* (2000) studied healthy male army recruits in Singapore who spent hours exercising outdoors. Blood samples showed an increase in abnormal neutrophils, a type of white blood cells that can indicate underlying respiratory inflammation. This finding was replicated in rabbits exposed to similar concentrations of particular matter in the lab.

In 2002, Sastry reported the results of another study on the health effects of wood smoke. During a period when average PM increased sixfold, daily mortality from heart attacks increased in a dose-related fashion.

The most vulnerable populations are the young and the elderly. Census data show that 6 percent of Washington's population is 5 or younger, and 11 percent is older than 65. The Washington State Department of Health estimates that 24 percent of this older population has cardiovascular disease and 9 percent of the total Washington state population reports they currently have asthma.

This means that more than a quarter of the population of Washington State belongs to groups known to be susceptible to adverse health effects from wildland fire smoke. Previous experience shows that these are populations less likely to be able evacuate their homes for reasons ranging from logistical to psychological. Public health preparedness planning can address wildfires, as well as other types of emergencies that require evacuation. ■

Wildfires & Climate Change

The threat of Northwestern wildfires was called out in a 2007 report from the Pew Center on Global Climate Change, titled *Regional Impacts of Climate Change: Four Case Studies in the United States*. In the Northwest, the report describes wildfire conditions fostered by a combination of earlier snowmelt and warmer summers. Other factors include thunderstorms and lightning strikes, livestock grazing, logging roads, and diseases such as spruce budworm. The report is at www.pewclimate.org/publications.

Resource

Naeher LP, Brauer M, Lipsett M, Zelikoff JT, Simpson CD, Koenig JQ, Smith KR. Woodsmoke health effects: A review, *Inhalation Toxicology*. 19(1):67–106, January 2007.

Author

Jane Q. Koenig, PhD, Professor in the University of Washington's Department of Environmental and Occupational Health Sciences, studies respiratory and cardiac health effects of air pollution.

Free Training Opportunities

The **Northwest Center for Public Health Practice** (NWCPHP) provides education, training, and technical assistance to improve the quality and effectiveness of public health practice by linking academia and the practice communities.

Visit us online and develop your skills in:

Emergency Preparedness	Leadership & Management
Communication	Program Evaluation
Environmental Health	Public Health Law
Epidemiology	Public Health Practice

Resources

Online training modules

- Take over 25 free, interactive, and self-paced modules
- Earn a certificate of completion and CEU credits

New modules available

- Workforce Resiliency series
- Measuring Risk in Epidemiology
- Basic Concepts in Data Analysis for Community Health Assessment series

Hot Topics in Preparedness

- Sign up for our popular monthly web-conferencing series
- Learn about high priority and emerging topics in public health
- View past sessions online or order on CD-ROM

Join our training email list

Get the most up-to-date information on NWCPHP education and training opportunities.

www.nwcphp.org

Public Health Trainings and Conferences

Regional		
Montana Summer Institute	Jun 15–19	Bozeman, MT
NWCPHP Summer Institute	Aug 10–14	Seattle, WA
Oregon Workforce Conference	Aug 26–27	Portland, OR
Montana Public Health Association Conference	Sep 15–19	Missoula, MT
Washington Joint Conference on Health	Oct 5–7	Yakima, WA
National		
NACCHO Annual 2009 Conference	Jul 29–31	Orlando, FL
ASTHO Annual Meeting	Oct 7–10	Vienna, VA
APHA Annual Meeting	Nov 7–11	Philadelphia, PA

New Advanced Practice Nursing Certificate in Environmental Health Nursing

Are you interested in developing advanced skills and expertise in environmental health nursing?

If so, consider pursuing the University of Washington School of Nursing's 15 credit certificate in Advanced Practice Environmental Health Nursing.

You will learn about:

- Health disparities and social determinants of health
- Technical topics addressing specific agents (e.g., water quality) and methods (e.g., risk assessment)

For more information go to:

www.son.washington.edu/admissions/certificates/apehns

or contact:

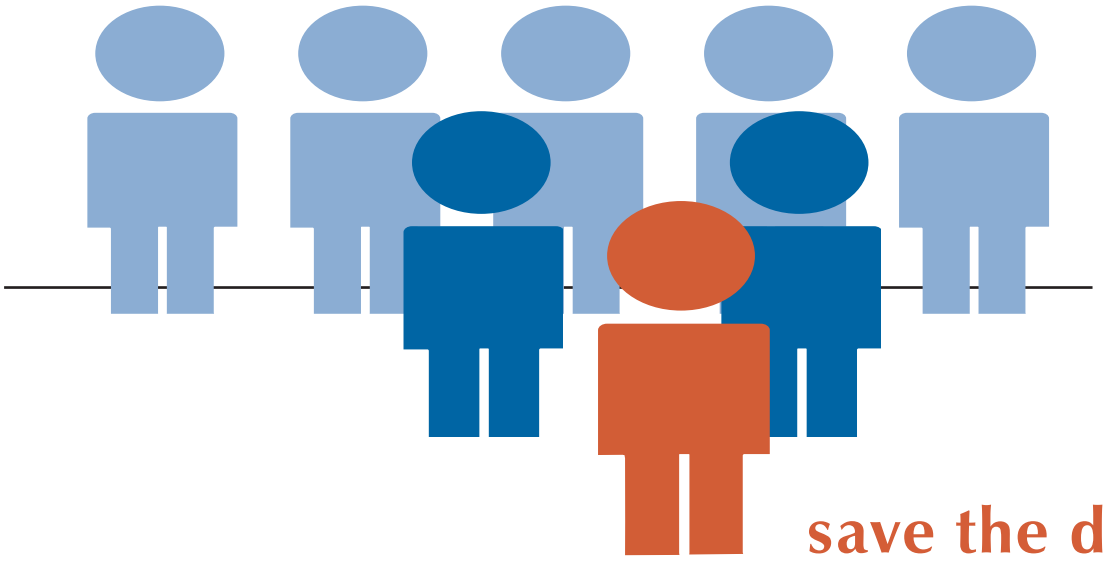
Kathleen Tharp
Program Coordinator
klat@u.washington.edu
206.685.8494

Open to graduate students and post-Master's professionals.

Northwest Center for Public Health Practice
SCHOOL OF PUBLIC HEALTH ◆ UNIVERSITY OF WASHINGTON

Summer Institute for Public Health Practice

In these changing times, get together with colleagues from other states and sharpen your skills.



save the date

www.nwcphp.org/si **Seattle** **August 10–14, 2009**

Northwest Center for Public Health Practice
SCHOOL OF PUBLIC HEALTH ◆ UNIVERSITY OF WASHINGTON
Box 354809
Seattle, Washington 98195-4809

75-5721

Nonprofit Organization
U.S. POSTAGE
PAID
Seattle, WA
Permit No. 62