Applying knowledge to improve water quality

Pacific Northwest

Regional Water Program

A Partnership of USDA NIFA
& Land Grant Colleges and Universities

Winter 2008
PNWWATER 124

## Summer Regional Meeting:

# *Climate Change in Alaska*

The Pacific Northwest Regional Water Quality meeting in September 2007 was held at Denali National Park, Alaska. Part of the program was a presentation by Dr. Dan White, Director, Institute of Northern Engineering, University of Alaska Fairbanks. His presentation was on the effects of climate change in the Arctic. The following are high points of his presentation.

Within the instrumental record for the Arctic, surface air temperature has increased, warming 0.6˚C since the early 20th century, with the 20th century believed to be the warmest in the past 400 years. On average, Alaska has shown warming on both an annual and seasonal basis, with the exception of the fall season. A change in temperature could affect the winter frost depth, period of snow cover, form of precipitation (rain vs. snow), and permafrost condition, all with significant impacts on the water resources.

Precipitation is difficult to measure in the Arctic and complex to predict. Arctic precipitation has generally increased by 1 percent per decade over the last century. While precipitation has increased, the summer surface water balance (precipitation minus potential evapotranspiration, or P-PET) has decreased for Alaska's North Slope and interior regions since 1960. Winter precipitation has increased since the 1970s, and arctic winter precipitation is projected to increase with continuing climate change.

Permafrost warming, degradation, and disappearance are of particular importance to hydrology and water resources in cold regions. Multiple studies report trends of increasing permafrost temperatures in the Arctic and sub-Arctic. In Alaska, the changes are attributed to both increased temperature as well as the insulating effect of greater winter snow depth. Permafrost degradation resulting from continued temperature increases may have important implications for the distribution of water over land. In regions of discontinuous permafrost, thawing permafrost is associated with the loss of surface water as previously perched surface water drain to deeper aquifers. Such behavior has been observed in Siberia and the Seward Peninsula of Alaska.

Ecosystem changes resulting from climate change have also been observed and recorded, with many more anticipated. A longer growing season favors a possible northward expansion of agriculture, as well as northward shifts in natural plants and animals. Some observed land cover changes include the expansion of shrubs in the tundra, and a northward drift of the arctic tree line.

In the end, incremental changes in the water cycle are adding up. Many changes are consistent with those expected from a changing climate. The impacts of the changes on people and livelihoods could be dramatic as the water cycle undergoes significant, and potentially long-term changes. Lakes that drain, for example, due to

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State of Washington Water Research Center
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### *The Project*
Land Grant Universities, Water Research Institutes, and EPA Region 10 have formed a partnership to provide research and education to communities about protecting or restoring the quality of water resources. This partnership is being supported in part by the USDA's National Institute of Food and Agriculture (NIFA).

### *Our Goal and Approach*
The goal of this Project is to provide leadership for water resources research, education, and outreach to help people, industry, and governments to prevent and solve current and emerging water quality and quantity problems. The approach to achieving this goal is for the Partners to develop a coordinated water quality effort based on, and strengthening, indivudual state programs.

### *Our Strengths*
The Project promotes regional collaboration by acknowledging existing programs and successful efforts; assisting program gaps; identifying potential issues for cross-agency and private sector collaboration; and developing a clearinghouse of expertise and programs. In addition, the Project establishes or enhances partnerships with federal, state, and local environmental and water resource management agencies, such as by placing a University Liaison within the offices of EPA Region 10.

loss of permafrost will not refill, as increased precipitation will not restore the permafrost confining layer. These changes will impact biota, including humans, that have adapted to a permafrost landscape and permafrost affected water cycle.

In addition to the ecological and physical effects there will be economic consequences. Existing infrastructure will be affected and repairs and replacement will be costly. New construction will have to be based on new designs and technology. The longer and greater ice-free period along the arctic coast will open up trade along the Arctic Ocean competing with the longer route through the Panama Canal. New port facilities will be in demand.

Climate change is having and will continue to have large-scale consequences in the Arctic and Alaska. Research is continuing and more will be needed to address these effects. Extension has a role in providing a bridge between the research and the people of Alaska in helping to adapt to the new environment.

Acknowledgement: Portions of this text will be published in an article documenting the impacts of a changing water cycle on food and water security in the Arctic. The article is currently in press in Environmental Research Letters (http://www.iop.org/EJ/erl).

### *National Water Quality Program Areas*

The four land grant universities in the Pacific Northwest have aligned our water resource Extension and research efforts with eight themes of the USDA's National Institute of Food and Agriculture.

1. Animal Waste Management
2. Drinking Water and Human Health
3. Environmental Restoration
4. Nutrient and Pesticide Management
5. Pollution Assessment and Prevention
6. Watershed Management
7. Water Conservation and Management
8. Water Policy and Economics

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