American Water Resources Association
2009 SPRING SPECIALTY CONFERENCE
Managing Water Resources Development in a Changing Climate
May 4-6, 2009
Anchorage, AK

Monday, May 4
3:30 PM – 5:00 PM
Session 9: Water Quality II

1. Stream Temperature Monitoring Network for Alaska's Salmon Streams - Sue Mauger, Cook Inletkeeper, Homer, AK (co-authors: Jeff Davis, Gay Davis)

Water temperature plays a critical role in all phases of the salmonid lifecycle, especially in freshwater systems where fish spawn. Temperature increases have been shown to induce stress in salmon populations, which makes the fish more vulnerable to pollution, predation and disease. However, across watersheds or even among neighboring creeks within the same watershed, water temperatures do not respond uniformly to variation in air temperature patterns. Enhanced research to identify watershed characteristics with the greatest potential to buffer stream temperatures from climate change is vital to improve forecasting and in-season management to sustain healthy salmon returns in the face of warming temperatures. In the summer of 2008, Cook Inletkeeper and its Partners began implementing a Stream Temperature Monitoring Network to collect consistent, comparable temperature data in 48 of Cook Inlet's salmon streams. Regional GIS maps are used to illustrate temperature patterns, temperature exceedances and potential thermal refugia. By quantifying potential thermal stressors in Alaska's salmon streams, decision makers will be better-prepared to recommend various adaptation strategies – including but not limited to land use rules, escapement targets, and instream flow controls – that will create and utilize the thermal buffers and habitat refugia needed to sustain Alaska's wild salmon runs for years to come.

2. Climate Warming in California's Sierra Nevada: Potential Water Temperature Impacts and Resiliency - Sarah Null, UC Davis Center for Watershed Sciences, Davis, CA (co-authors: Joshua H. Viers, Jeffrey Mount, Michael L. Deas, Stacy K. Tanaka)

Global climate models predict that air temperature will rise in California's Sierra Nevada Mountains in coming decades. Implications include precipitation as rainfall instead of snowfall, changes to runoff timing and magnitude, and warming river water temperatures. This study assesses the extent to which unimpaired river and stream water temperatures may be affected by increasing levels of climate warming in west-slope Sierra Nevada watersheds. Climate warming alternatives examined for this study include baseline meteorological conditions, and increases of 2ºC, 4ºC, and 6ºC to air temperature. Water temperature predictions for unimpaired and climate warming alternatives were estimated using a weekly one-dimensional hydrologic model (WEAP21) and an equilibrium water temperature model (RTEMP) for fifteen major watersheds of the western Sierra Nevada. We identified watersheds and stream reaches for which water temperature is most impacted by climate warming, as well as thermal variability within watersheds. Model results were analyzed to highlight water temperature resiliency, including contributing factors such as elevation, latitude, baseflow, drainage area, and stream order. This study improves our understanding of water temperature resiliency for rivers in the Sierra Nevada with climate warming, which should help balance instream habitat protection and aquatic ecosystem functioning with utilitarian water uses, such as water supply, hydropower, flood control, and recreation. Future research will include assessing water temperature resiliency with climate warming alternatives and current infrastructure, such as hydropower facilities and appurtenant works.

3. Projecting the Impact of Climate Change and Urbanization on the Temperature of Surface Runoff Into Cold-Water Streams - Ben Janke, University of Minnesota, Minneapolis, MN (co-authors: William R. Herb, Omid Mohseni, Heinz G. Stefan)

Water temperature has a significant influence on the biological and chemical makeup of cold-water streams. The rise in stream temperature typically associated with urbanization is an issue of increasing importance as urban development expands into watersheds of cold-water streams. Urbanization typically contributes to thermal pollution by increasing impervious surface area, reducing shading by vegetation, and amplifying storm water runoff rates and temperatures, but the role of climate change must also be considered. The goal of our research has been to create a hydro- thermal model capable of determining the negative impact on stream temperature of urban development in watersheds of cold-water streams. A particular focus has been the development of a sub-model for predicting runoff rates and temperatures from a paved surface during a rainfall event. The runoff sub-model predicts runoff flow rates and temperature as a function of both distance and time on a paved surface, taking into account the magnitude of the atmospheric and conductive heat fluxes at the surface. The potential thermal pollution by a rainfall-runoff event is characterized by 'heat export', or the amount of heat contained in the runoff above a reference temperature. The model has been successfully applied to a parking lot study site, and total event heat export was found to be especially sensitive to rainfall intensity, rainfall (dew point) temperature, and initial pavement temperature -- quantities that would be influenced directly by changes in climate. Many climate change studies have predicted an increase in air temperature and precipitation over the next century in the Upper Midwest, with rainfall events becoming larger and less frequent. The implications of such future climate scenarios on the volume and temperature of storm water runoff are under investigation, especially for management of cold-water resources already threatened by the impacts of urbanization.

4. Variability, Seasonality, and Persistence of Fecal Coliform Bacteria in Alaska Urban and Semi-Urban Streams - William Schnabel, University of Alaska Fairbanks, Fairbanks, AK

In cold regions, a warming climate will initiate changes in loading and persistence of pathogenic microorganisms in surface waters. Such changes could result from shifts in a variety of contributing factors including animal population dynamics, surface thermal conditions, and human land use. As microbial water quality can impact drinking water management decisions as well as ecological health, it is important to gain a better understanding of present and future pathogen dynamics in cold region surface waters. This presentation summarizes the results from a series of investigations regarding the fate and persistence of pathogen-indicator microbes in Chester Creek, Anchorage, AK. In addition, the presentation provides preliminary results from an ongoing pathogen-indicator survivability study being conducted in Fairbanks, AK. Results from these studies are discussed in the context of current and future watershed management practices for urban/semi-urban cold region locations.