

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

Wednesday, May 6

3:30 PM – 5:00 PM

Session 37: Changing Ecosystems

1. Is The Mountain Pine Beetle Infestation in Colorado Due to Climate Change - Michael McHugh,
Aurora Water, Aurora, CO (co-authors: Laurel Stadjuhar, Kristina Wynne)

It is estimated that nearly 2 billion acres of Lodgepole Pine will be infected by the mountain pine beetle infestation in Colorado within the next five years. Although the pine beetles are indigenous to the area, the extent of this infestation has not previously been seen in Colorado's forests. Various factors play a role in the far-reaching infestation including forestry practices, drought, and increased temperatures but is climate change the root cause? A survey of research literature indicates that there may be other causes. Regardless of the root cause, the infestation has the potential to impact the local water supply. Studies have shown that runoff and infiltration from beetle killed areas can either increase or decrease depending on the variation of stand maturity. These studies were reviewed, and additional data were analyzed to further study the effect of the beetle kill on a small mountainous watershed. Historic streamflow records and nearby snowpack records were analyzed for similar precipitation years in the high-elevation watershed in North Central Colorado as the continuing story unfolds.

2. Recent Woody Invasion of Wetlands on the Kenai Peninsula Lowlands, South-Central Alaska; A Major Regime Shift After 18,000 Years of Wet Sphagnum-Sedge Peat Recruitment - Edward Berg,
U.S. Fish & Wildlife Service, Kenai National Wildlife Refuge, Soldotna, Alaska (co-authors: Kacy McDonnell, Roman Dial, Allana DeRuwe)

We document accelerating invasion of woody vegetation into wetlands on the western Kenai Peninsula Lowlands using: (1) three generations of historical aerial photography, (2) tree-ring ages of encroaching wetland trees and shrubs, and (3) radiocarbon-dated peat cores. The aerial photography for 11 wetland sites showed that open graminoid-herbaceous areas shrank 5% per decade from 1951-1968, and 9% per decade from 1968-1996. Tree-ring ages of black spruce forests on three wetland perimeters showed that all trees had recruited since the end of the Little Ice Age in the 1850s; we found no evidence of earlier woody vegetation, such as logs or stumps, in the underlying peat. Dwarf birch shrubs at three wetland sites showed a mean apparent tree-ring age of 14 years (range 5-32 years), indicating the recentness of shrub colonization at these sites. Peat cores at 25 wetland sites (basal peat ages 2,520 to 18,740 calibrated years Before Present) indicated that these peatlands originated as wet *Sphagnum*-sedge fens with very little woody vegetation; most wood was concentrated in the upper 30 cm of the cores, and consisted of live shrub roots. Taken together, these results suggest that wet *Sphagnum*-sedge fens initiating at various times since the end of the Wisconsin glaciation began to dry in the 1850s, and that this drying has greatly accelerated since the 1970s. The recent drying is documented in the meteorological record at the City of Kenai Airport which shows a 55% decline in available water since 1968, as measured by the difference between precipitation and potential evapotranspiration (P – PET). Approximately one-third of this decline is due to higher summer temperatures and increased evapotranspiration, and two-thirds is due to lower annual precipitation.

3. Forest Fuel Moisture Disturbances across the United States in Response to Climate Change and Variability - Yongqiang Liu, USDA Forest Service, Athens, GA

Forest fuel moisture is an important factor for fire weather index calculation, fire and smoke behavior simulation, and the associated energy and pollutant release estimation. It is mainly determined by fuel type, the water cycling, and atmospheric conditions. Significant changes and increased variability in these parameters have been projected for many U.S. regions due to the greenhouse effect by various general circulation (GCMs) and vegetation models. As a result, disturbances in fuel moisture are expected. This study investigates fuel moisture disturbances induced by the changes in water and other climate parameters using a physically based fuel moisture model. This model, called the forest fuel moisture scheme (FFMS), is

developed based on the energy and water conservations of the forest ecosystem and driven by the atmospheric conditions simulated with mesoscale models. Current fuel moisture is estimated using outputs of a mesoscale meteorological simulation for a normal year. The magnitude and spatial and temporal patterns of fuel moisture are analyzed. Comparisons with fuel moisture for two extremely abnormal years are made to understand the impacts of climate variability. The data prepared by the Intergovernmental Panel on Climate Change (IPCC), including the projected climate in the 2080s from the Hadley Centre Coupled Model, version 3 (HadCM3), are used to estimate fuel moisture disturbances due to the greenhouse effect. The FFMS model, fuel moisture features, the impacts of climate change and variability, as well as uncertainty due to the differences in GCM projections and IPCC scenarios will be presented.

4. Predominate Selection of Low Water Using Trees in California Communities Would Preserve the State's Water Resources - David Dudley, HDR, Folsom, CA

The demand for water in California is forecasted to exceed supply by 2020 if the selection of low water using trees are not predominantly planted in predilection of tree species dependent upon copious irrigation. Analysis of transpiration rates and examination of the natural habitat of tree species commonly planted in the California Central Valley shows that many tree species subsist on up to hundreds of gallons more water per day, individually, than native or more arid type tree species. Numerous tree species frequently planted in California naturally necessitate significantly more water for vitality and typically require a source of recurrent irrigation. Twenty-six Sacramento metropolitan area jurisdictions have collaborated to plant five million trees by 2025 for a variety of valid reasons and anticipated benefits. Other California communities have similar plans. Property owners throughout the state will also continue planting trees. A high proportionate selection of low water using trees over high water using species for future plantings is imperative to delay or prevent the date in which the demand for water in California is expected to exceed supply.