

American Water Resources Association
2009 SUMMER SPECIALTY CONFERENCE
Adaptive Management of Water Resources II
June 29 – July 1, 2009
Snowbird, UT

Tuesday, June 30

3:30 PM – 5:00 PM

SESSION 26: Science Supporting Climate Change Adaptation

1. The Potential Use of Winter Cloud Seeding Programs to Augment the Flow of the Colorado River - Don Griffith, North American Weather Consultants, Sandy, UT (co-author: Mark Solak)

Recent drought conditions and the associated drop in Lake Powell storage generated renewed interest in means that might be used to better manage the water supplies for the seven basin states that share water from the Colorado River system through the 1922 compact. Several means of augmenting the flows of the Colorado have been suggested. One technique that has been frequently mentioned is that of weather modification or "cloud seeding" as it is more commonly known. The Upper Colorado River Commission contracted with North American Weather Consultants for the preparation of a White Paper that was entitled "The Potential Use of Winter Cloud Seeding Programs to Augment the Flow of the Colorado River." This paper identified areas within the upper Colorado River Basin where 1) new winter cloud seeding programs could be developed and 2) existing programs could be enhanced to provide additional runoff in the Colorado River system. Since 2006, the three lower basin states have contributed funds to augment existing programs in Colorado, Utah and Wyoming. The anticipated effects from cloud seeding programs range from 5-15% increases in precipitation. Streamflow model simulations performed by the National Weather Service, River Forecast Center located in Salt Lake City, Utah for Colorado, Utah and Wyoming predict increases of 650,500 acre-feet of April through December runoff into Lake Powell during an average year resulting from the conduct of new cloud seeding programs assuming a 10% increase in October through March precipitation. Similar projections for existing cloud seeding program areas indicate an estimated average increase of 576,504 acre feet of October through March runoff into Lake Powell. The total from new and existing upper basin programs would be 1,227,004 acre-feet. It is estimated that an additional 154,000 acre-feet of annual runoff could be generated from new seeding programs in the lower Colorado River Basin of Arizona. The total estimated average potential would therefore be 1,381,004 acre-feet during the April through December period. The approximate cost of the estimated additional water which could be produced through cloud seeding was estimated to average approximately \$ 5.00 /acre-foot.

2. Process and Significance of Interception in Colorado Subalpine Forest - Revisited 41 Years Later - Charles Leaf, Platte River Hydrologic Research Center, Merino, CO

An aerodynamic analysis which describes wind-induced snow deposition into natural and man-made forest openings is presented. Inherent in this analysis is a wind sheltering coefficient defined as a function of the ratio of mean local above-canopy wind to a mean characteristic prevailing wind in very large open areas above timberline. An equation is derived for quantifying wind-induced snow accumulations. An in-depth analysis of updated snow surveys on Fool Creek at Fraser Experimental Forest has shown that wind-induced snow accumulation on Fool Creek is responsible for approximately 50 percent of the increased snowpack observed in the clear-cut strips. The basic principles identified and discussed in this report have several engineering applications including snow hazard mitigation, silviculture, water yield improvement, transportation corridor planning and design, and developments such as ski areas. Key Words:

differential snow accumulation, snow interception, snow redistribution, snowpack, subalpine forest.

3. Possible Air Pollution Impacts on Winter Orographic Precipitation in the Western U.S. - Don Griffith, North American Weather Consultants, Inc., Sandy, UT (co-authors: Mark E. Solak, David P. Yorty)

Winter precipitation data from select locations in Utah and Nevada were analyzed to determine if there were any indications of reductions in mountain precipitation when compared with upwind valley precipitation. This work followed the approach utilized in a comprehensive study of precipitation in Israel and California that indicated the orographic component of precipitation was declining at precipitation stations at mountain locations downwind of major cities. The authors of that study theorized that the reductions were due to the transport of air pollution from the cities into winter storms at the downwind mountain locations, leading to microphysical changes within the affected clouds, resulting in reductions in observed precipitation. The work performed in Utah and Nevada indicated similar reductions in mountain precipitation downwind of the Salt Lake City/Provo metropolitan complex. The indicated reductions in precipitation extended downwind of the first mountain barrier into a mountain valley location and into the upwind slope of a second mountain barrier some 80km downwind. Reductions in precipitation at other mountain stations in Utah and Nevada were not indicated. Those stations were located in more rural settings, which may suggest that air pollution from major cities may, in fact, be related to the precipitation reductions that are indicated down wind of the Salt Lake City/Provo metropolitan complex.

4. Addressing Climate Change under the FERC Hydropower Relicensing Process – Katherine Smith, NOAA-NMFS Office of Habitat Conservation, Habitat Protection Division, Silver Spring, MD 20910, USA (co-authors: Ruth Ann Lowery, Jessica Cherry, Amy Tidwell, Nancy Fresco, Susan Walker)

Under the Federal Power Act (FPA), the National Marine Fisheries Service (NMFS) and other agencies may provide fish passage measures (“prescriptions”) to minimize the effects of Federal Energy Regulatory Commission (FERC) hydropower facilities on diadromous fishes. There is a growing awareness that climate issues should be addressed in FERC-issued licenses. While the FPA regulations do not directly address climate change, climate-related issues may be relevant and taken into account by NMFS in developing study requests, Section 18 prescriptions to address impacts of a hydropower project on species migration, and Section 10(j) recommendations to protect, mitigate and enhance fish and their habitat. NMFS and other agencies have or are considering providing climate-related recommendations or measures under these authorities. FERC, however, has expressed concern regarding these recommendations due to uncertainties in the science. In this presentation, we discuss: the regulatory avenues for addressing climate impacts on fish and fish habitat at FERC hydropower projects; the climate-related informational needs that should be filled to better support agency recommendations and measures; and recent collaborative research efforts to fill these information needs. In light of the uncertainty in the magnitude and timing of specific climate-change related effects, agencies should strive to make resource management decisions that can be modified or adapted as new information is available. Possible strategies for achieving such an adaptive management approach under the FPA are also discussed.