

## **Tribal Programs Spearhead the Adaptive Management Program's Efforts To Assess Human Dimensions of Watershed Change in the Grand Canyon Ecosystem**

Many federal agencies are currently collaborating on physical, biological and social assessments of environmental change and how it affects society economically and culturally. The USGS, for example, is one of several agencies involved in the U.S. Global Change Research Program (USGCRP) that uses many interagency mechanisms, such as publications, Internet-based services, regional and international conferences to involve the broader public in addressing the human dimensions of environmental change.

Nevertheless, one of the very best examples of such human dimensions monitoring efforts is going on right in our own backyard, where neighboring tribes have been assessing cultural issues relating to Glen Canyon Dam and managed floods with ingenious methodologies for over a decade. In a very real sense, the Hopi, Southern Paiute, and Hualapai, tribes have pioneered new approaches to assessing the human dimensions of watershed change in the Grand Canyon that are now having a ripple effect from there, out into other aquatic and riparian systems.

There are reasons for all of us to be proud of the methodological advances they have made, because unlike many human dimensions monitoring efforts, theirs are multi-cultural and multi-faceted, inclusive of all ages, professional backgrounds, and physical capabilities. In fact, they exemplify what the EPA and its collaborators call "environmental justice"—ensuring equity and more-than-token participation in environmental monitoring, protection and restoration.

Take the Southern Paiute involvement in the adaptive management program as an example. Tribal leaders, schoolchildren, educators and resource managers are among the many Southern Paiute groups that have gone down the river through the canyon to assess the changes that have occurred with varying Colorado River flows. It was the Southern Paiute knowledge of Grand Canyon plants that John Wesley Powell recorded more than a century ago, and tribal elders still educate their youth and policymakers about which of these traditionally-utilized plants have declined or increased with changing flood regimes. Even physically-handicapped tribal members have been accommodated on these river trips, reminding everyone that watershed dynamics affect us all, and should be understood by us all.

The Hualapai Nation—the tribal community that has stewardship responsibility for the largest stretch of the Colorado River shoreline in the canyon—has identified more than two hundred cultural properties along the river corridor important to the continuation of their cultural identity and heritage. They routinely assess not only the effects of floods on these sites, but the effects of changing visitation patterns related to sand bar accumulation or loss.

The Hopi have selected a slightly different approach to the human dimensions dilemma, since, for religious purposes, uninitiated Hopi men as well as women are not allowed to even enter this sacred landscape. However, the entire range of adaptive management research and monitoring reports—from sediment transport models to tamarisk recruitment surveys—are translated into culturally-appropriate presentations for political leaders, clan elders and educators. These constituencies are regularly surveyed on whether they feel environmental changes in the canyon are deleterious or positive for

Hopi resources, and whether management initiatives are perceived as going in the right direction to protect, enhance or accommodate cultural interest in the canyon. Through time, Hopi technical advisors can assess whether there are emerging trends in perception of change in the canyon among various tribal constituencies, from traditional priests to environmental educators. They are also engaged in taking Hopi youth and educators to analogous riparian corridors on the Hopi reservation and in the San Juan watershed to discuss management effects on environmental and human health.

These are but some of the many ways that tribal programs affiliated with the Grand Canyon's adaptive management program are at the cutting edge in assessing human dimensions of watershed change, and in communicating BOR and USGS research and management actions back to their societies. The research and monitoring being done in the canyon through the Glen Canyon Dam Adaptive Management Program is no longer restricted to Western science only, for it involves many cultures engaged in obtaining data, assessing trends, interpreting results, and recommending management actions that will influence future generations. In short, the Glen Canyon Dam Adaptive Management Program is a nursery grounds for growth of a vital new adjunct of hydrological and geological research – the monitoring of cultural responses to floods, drought and managed flows. This outreach to diverse peoples ensures that taxpayers –on reservations as well as those in cities—are more aware than they have ever been of natural resource management decisions that truly affect their lives.