RECLAMATION
Managing Water in the West
Jan.-Mar. 2006

S&T Highlights

Improving Infrastructure Reliability

Unclogging wells and drains.—The Technical Service Center (TSC) is partnering with Smith-Comesky Groundwater Science to examine clogging pipes and the forces that create the problem: bacteria, geology, and chemistry. For Reclamation, clogged drains not only interfere with water delivery, but can also be a factor for dam safety, particularly in earthen dams.

Model work has shown that natural biofouling and geochemical processes can be induced and drain effects reproduced at the floor-model scale. One floor model is up and running, and it currently has enough clogging to have a measurable difference in water pressure. In May, three more small scale models with alternative geology will be set up. A number of drain-cleaning method improvements have been reviewed. This research will provide the information for a comprehensive manual to assist Reclamation operations and maintenance to prevent drains from clogging and treatments for drain clogging that will work in particular geological circumstances.

Reclamation research into biofouling can help prevent clogged drains.

U.S. Department of the Interior
Bureau of Reclamation
Science and Technology

This quarter, the Association of State Dam and Safety Officials (ASDSO) accepted an abstract titled *Current Research in Dam Drain Clogging and Its Prevention* for the 2006 ASDSO Annual Conference in September. This paper will review the findings of our current research and demonstration work defining clogging mechanisms and their practical mitigation to improve dam maintenance procedures. (Denise Hosler, 303-445-2195)

Improving Decision Support

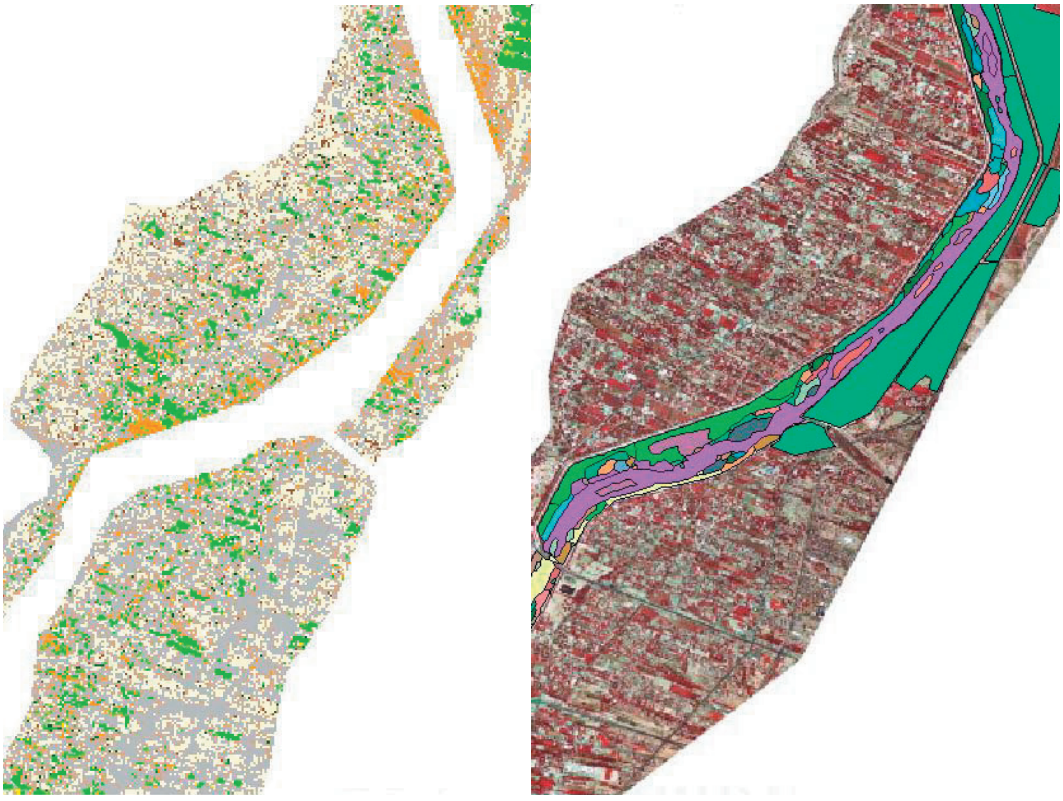
Enhancement of risk and uncertainty capabilities in decision-making tools.— This project is aimed at providing Reclamation's technical experts and decision makers with a rigorous, uniform approach to characterize model output uncertainty. Decision makers can then quantify consequences and derive meaningful risk estimates for potential management decisions. The research group has reviewed topic areas from the Risk and Uncertainty Questionnaire that was sent out last year and identified particular topics that stand out as being important to responders. Those topics of greatest concern include water supply forecast uncertainty, risk of drought, risks related to ecosystem support, demand uncertainty, and policy uncertainty. Project team members from the **Upper Colorado**, **Lower Colorado**, and **Mid-Pacific** regions shared brief summaries on aspects of risk and uncertainty on which they are working; works in progress included examples from all tree regions. The group has scheduled a 2-day focused workshop in Denver in July in which members will present their projects in detail and work out the specifics on how we might incorporate aspects of these projects into a cohesive, workable plan. Our goal for the workshop is to have at least a skeleton construction of our recommended tools for helping Reclamation's managers make decisions in conditions of uncertainty. We expect to be on schedule to present our report and future work plan to advance from the scoping phase of our work this fiscal year to the development phase next fiscal year. (Shana Tighi, 702-293-8572)

Developing institutional and collaborative approaches.—This quarter, the Reclamation S&T Program hosted the Reclamation Research and Development Forum on Institutional and Collaborative Approaches to Water Solutions at the TSC in Denver. The meeting was a response to the recent publication, *Confronting the Nation's Water Problems: The Role of Research,* written by the Committee on Assessment of Water Resources Research, National Research Council, which calls for bringing social and economic studies into the nation's water research agenda. This report echoes the White House report by the National Science and Technology Council Committee on Environment and Natural Resources titled *Science and Technology to Support Fresh Water Availability in the United States*, which states, "Making decisions about water availability also requires an improved knowledge of the social and economic institutions which make decisions about water availability and use every day. Social and economic factors drive the demand for water (population growth, economic development,

shifting social values) and supply of water (technological change and adoption)." Speakers came from diverse backgrounds including private industry, government, and academia. (Ronald Miller, 303-445-2279)

Improving the evapotranspiration (ET) toolbox.—Reclamation updated the irrigated lands statistics and provided masking for riparian vegetation for the ET toolbox. A clear delineation of agricultural and riparian data was needed to provide proper statistics to the toolbox. Two-foot orthophotography and the latest riparian inventory were obtained from from the TSC's Ecological Planning and Assesment Group. The riparian inventory will be updated this year using newly acquired aerial imagery in 2005 and early summer 2006. Agricultural regions will also be acquired from the air and by satellite, as well as additional ground truth, starting next quarter. The higher resolution 2005-2006 aerial imagery will be tested in conjunction with data from the Landsat satellite imagery acquired for 2005-2006.

Together, the enhanced agriculture growth status database and multidate classifications will be generated to improve ET estimates and identify irrigation patterns. This database will provide better agriculture/riparian status inputs for ET modeling to improve water accounting and for comparison with other ET/ ground water models. (Ronald Miller, 303-445-2279)



Using airborne and hyperspectral monitor to identify salt cedar.—Salt cedar needle leaves cycle from green to yellow to orange to brown to leafless from November to February. In many areas, noninvasive species remain green (cottonwood, willow, arrowweed, attriplex). To help identify where invasive species (primarily salt cedar) are in the southern lower Colorado River, Reclamation is acquiring and evaluating late season low altitude, high resolution airborne imagery to distinguish areas of salt cedar from native species. A preliminary test flight using a high definition (HD) video camera mounted on a Reclamation helicopter was flown along portions of the Imperial National Wildlife Refuge (NWR) on January 4, 2005. The aircraft was flown 700 feet above ground level and produced 6-inch pixel images. From February 13 to 17, 2005, research members collected invasive and riparian field data—ground cover, digital photos, and global positioning system (GPS) points. The collections spanned approximately 45 kilometers in portions of the Imperial and Cibola National Wildlife Refuges between **Yuma, Arizona** and **Blythe, California**.

Preliminary evaluation indicates that this sensor method used in conjunction with the leaf change timing will provide an effective source for discriminating salt cedar extent on the lower Colorado River. The field data from these and future flights will be used to interpret surveys, identify invasive plant species, and produce detailed status maps of Reclamation river systems. (Scott O'Meara, 303-445-2216; Ronald Miller, 303-445-2279)

Salt cedar (brown) in Cibola NWR. HD video (left) and high resolution digital camera (right) for two different locations.

Calibrating video cameras for precise time analysis of hydraulic models.— Camera calibration is necessary to make precise and accurate measurements for hydraulic laboratory models. By tracking introduced surface and subsurface objects in the flows, the models can be evaluated and measured after test runs. After tracking tests are completed, the monitoring system will be set up to better measure hydraulic operations on lab models such as water velocities. These methods will be far more efficient and accurate compared to manual techniques used in the past.

Tests were performed using two high definition stationary video cameras set up at different perspectives to track and measure moving objects. Research was performed to determine the best way to match frames from each camera of the same instant in time. Camera synchronization or time encoding can be used. Both need additional testing. (Ronald Miller, 303-445-2279)

Coded targets set up on the Rio Grande model that was used as a pilot in 2005 to test detailed surface measurement.

Improved cost-effective ways to survey invasive species infestations and endangered species habitat.—In the past, each GPS image file had to be rectified individually to create ground coordinates, speeding ground location and interpretation. Automating this process will improve reliability while reducing labor costs. Reclamation researched and purchased an inertial measurement unit and global positioning system (IMU/GPS) combination unit to be installed in Reclamation aircraft for automating aerial imagery rectification. The IMU/GPS unit will help to automatically produce ground coordinates of image data adjusted for aircraft attitude changes. The attitude and location data (from accelerometers and gyros) is recorded at the same time as the imagery data. The IMU records the orientation of the instrument in relation to true north and true vertical and outputs the accelerometer and gyro data as incremental velocities and angular rates.

The image/camera recording system was also upgraded using a specialized rack mount computer to achieve higher quality uncompressed image data. An external device allows higher bandwidth data transfers from the camera to the recorder, which results in crisper, more detailed imagery. These improvements will provide a significant contribution to mapping accuracy, efficiency of operations, and cost savings. The cleaner image data contains no artifacts, improves interpretation quality, and reduces the time to complete classifications. (Ronald Miller, 303-445-2279)

Improving Water Delivery Reliability

Reducing operation and management costs for Salvinia molesta and other invasive aquatic weed species using zero emission research and initiatives (ZERI) principles.—Biocontrol of salt cedar has worked, leaving masses of dead wood. The TSC is partnering with the University of Arizona (UA) to evaluate how this material might be used to defer some of the cost of controlling salt cedar. This will help Reclamation determine if the vegetation in these communities can recover on their own, or if we must allocate a portion of the budget on these sites for revegetation.

UA students conducted literature and biomass use surveys for giant salvinia and saltcedar. The results of these surveys include international references for these invasive plants and biomass uses that range from fertilizers and fish food to oil spill absorbents. Reclamation and UA surveys will be combined into one informational notebook. Further analysis on benefits to Reclamation salt cedar control projects will be conducted later this year.

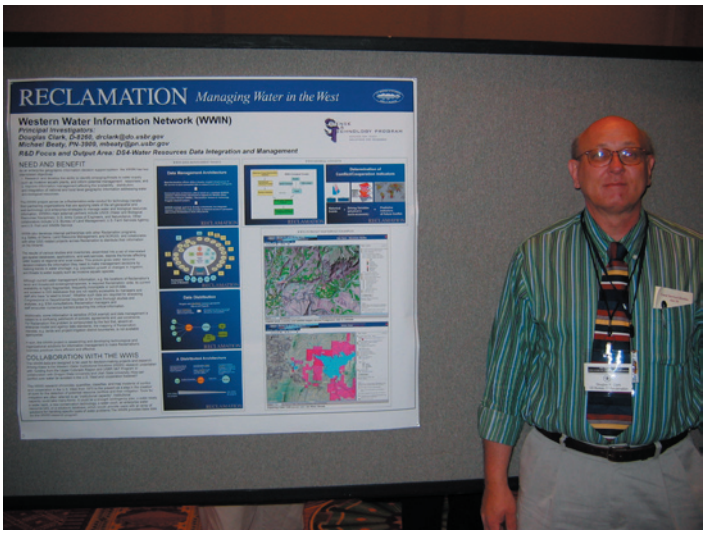
A second Reclamation study at the site is being conducted to determine how the biocontrol beetle responds to the resprouting salt cedar. This study involves the mature salt cedars where the beetles were originally released, several plots that have slightly different microclimates, and an old stand that has had the salt cedars mechanically removed. The goal of this research is to determine how well the biocontrol beetle will keep the population of salt cedar under control after the initial introduction. Another potential benefit is to determine if the beetle behaves or responds differently to the method of salt cedar control used. (Debra Eberts, 303-445-2217; Denise Hosler, 303-445-2195)

Improving Water Supply Technologies

Harvesting invasive species data affecting water supply.—The National Institute of Invasive Species Science (NIISS) is a consortium of governmental and nongovernmental partners, led by the U.S. Geological Survey (USGS), whose aim is to provide reliable information and advanced decision support tools for documenting, understanding, predicting, assessing, and addressing the threat of invasive species in the United States. The NIISS web site (www.NIISS.org) is a forum for land managers to share information for the management of nonnative species. Users can upload data to the web site, use the site as a data management system with the ability to edit data and create metadata, integrate their data with others, do analysis on their data or the merged data, create maps to save or print, and download any subset of the data they want. Reclamation personnel are working on ways both to harvest data from the site and to contribute Reclamation-generated studies and geographic data to the site.

The Western Water Information Network (WWIN) group, headed by Reclamation personnel, is working with the NIISS to make geographic data on nonnative and invasive species available to water managers in the West using enterprise geographic information technology. Reclamation held a meeting in March to further this work. (Michael Beaty, 208-378-5172; Douglas Clark, 303-445-2271)

Presentation at the national meeting of the Association of American Geographers.—The TSC's Douglas Clark presented a poster detailing research being conducted on the WWIN and the Western Water Institutional Solutions project at the national meeting of the Association of American Geographers in Chicago (www.aag.org) in March. The poster showed not only the principal architecture of the WWIN, but also how geographic data on factors impacting water supply can be used in research on the dynamics of water conflict and cooperation. Personnel from the TSC, the Regional Offices, and Oregon State University jointly produced the poster. (Douglas Clark, 303-445-2271)



Workshop on portal technologies.—Portals provide a single focus point of access on the web to information assembled on specific topics. In April, the WWIN team, in conjunction with the USGS, presented a workshop on USGS/NBII implementation of portal technology for the biological and natural resources community and also discussed opportunities for collaboration between agencies. The sessions focused on public portals, various tools, case studies, and strategies for acquiring capabilites. (Douglas Clark, 303-445-2271)

Use of activated charcoal to protect native seeds from herbicides.—Reclamation is working to retire 200,000 acres (80,000 ha) of agricultural lands in the western **San Joaquin Valley** of central California from irrigation and/or cropping to reduce contaminated groundwater and toxic drainage. The multiagency Land Retirement Demonstration Project (LRDP) explores the effects of restoring native salt-tolerant shrub/forb plant communities to reduce contamination of valley groundwater and drainage by selenium, boron, and other toxic elements. Annual grasses and broadleaf weeds make restoring these sites extremely problematic. Chemical weed control methods could injure seeded species. Reclamation is investigating a technique used in the turfgrass industry—applying activated charcoal to seeded rows to safeguard plants before broadcasting herbicides.

Three techniques were evaluated for seed drilling. Charcoal banding over the seed row, whether applied as a dry powder or slurry, appears to provide effective multispecies weed control and protect native seedlings from the herbicides applied. In addition to a no-herbicide control, five different pre-emergent herbicide treatments were applied to compare their effects on mixed weed control and seedling emergence under the charcoal safener treatments.

Future research will focus on refining herbicide and charcoal formulation and rates, expanding target weed applicability, and expanding the number of native species tested. If significant levels of control can be achieved using natural precipitation to activate and move the herbicides into weed root zones, with activated charcoal serving as safener for seedling natives, special local need permits may be pursued for selected successful herbicides for broad-scale use within the Land Retirement Project. (Ken Lair, 303-445-2005)

Activated charcoal being applied in slurry bands over rows of seeded native plant species near **Fresno, California**.