RECLAMATION
Managing Water in the West
July-Sep. 2006

S&T Highlights

Director's Office (Denver, Colorado)

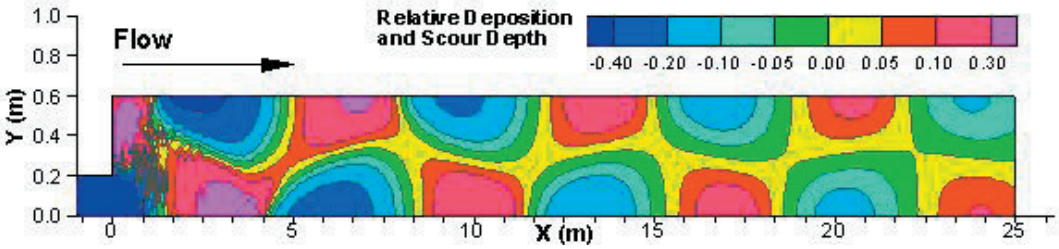
The proposal review process for FY 2007 has been completed; however, the status of the Science and Technology (S&T) Program's budget is uncertain. Reclamation is operating under a continuing resolution through at least November 17, 2006. Under these circumstances, the Research and Development Office can only provide limited funding for ongoing projects with time-critical tasks. Our top priority for funding projects in October will be to support the top-ranked ongoing projects that are a continuation of FY2006 research projects. Results for all proposals submitted will be released when Reclamation's budget is passed.

Our office is pleased to announce that Dr. Daniel Levish officially joined us in September as our new S&T Administrator. Dan spent the previous 15 years as a geologist in the Technical Service Center. In addition, we welcome two new employees, Janet Rogers and Samantha Zhang, who will be on board in mid-October. Janet will be replacing Mary Ann Tarr as our funds manager, and Samantha will be our new technology transfer officer. Please join us in welcoming them to the Research and Development Office. (Siegie Potthoff, 303-445-2136)

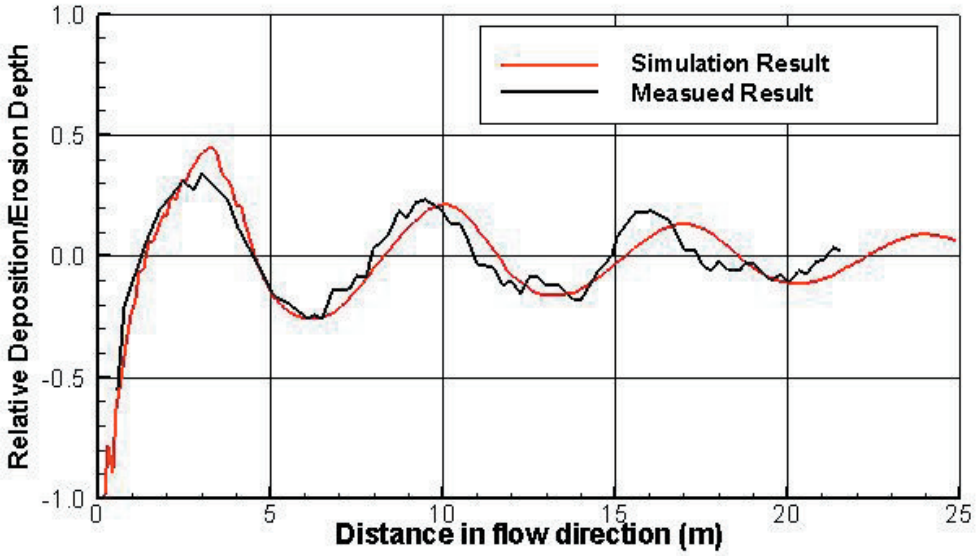
Improving Decision Support

RSED applied to alternate bar formation.—RSED, the two-dimensional sediment module, has been under development to assist prediction of river meandering and habitat formation. A recent application was made to predict the formation of alternate bars behind a dike inserted into a river. Due to the disturbance introduced, alternate bars were formed on an otherwise flat bed, as shown in the first figure below. Comparison with measured bed elevation is very promising, as shown in the second figure below. Once completed, RSED will provide Reclamation engineers with a viable tool to evaluate and assess the geomorphic and sediment transport responses to a project planned over a river reach. For example, in fiscal year 2007, Reclamation will use RSED to predict the deposition

and erosion at a diversion intake structure on the **Colorado River**. Reclamation will also use it to look at the movement of points bars on the **Sacramento River**. The tool can be used to decrease the amount of sediment excavation required to maintain diversion structures. It will also help predict locations of maximum scour and prevent costly damage to river structures. (Yong Lai, 303-445-2560; Blair Greimann, 303-445-2563)



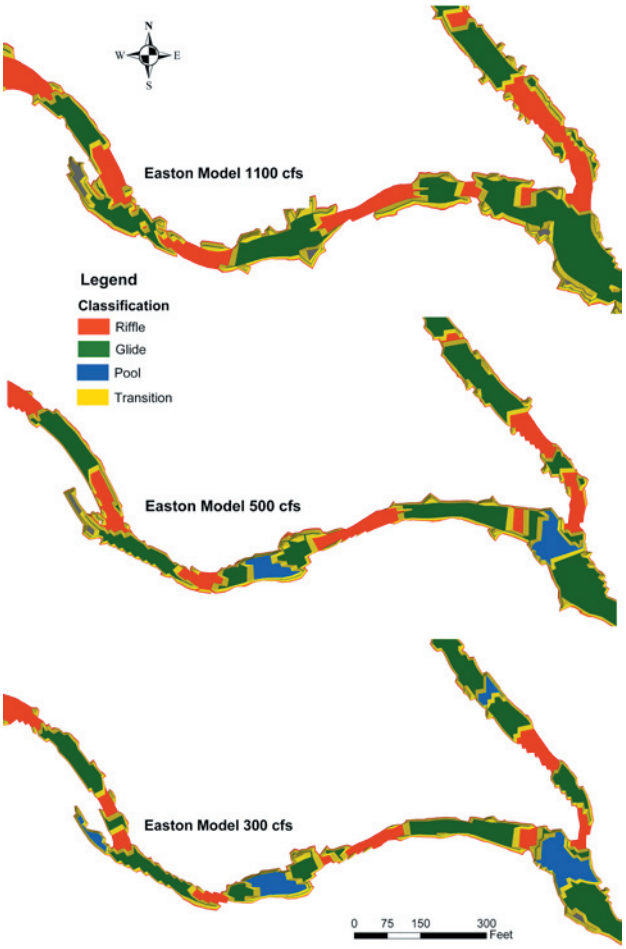
Pattern of predicted deposition and erosion depth (normalized by average water depth).



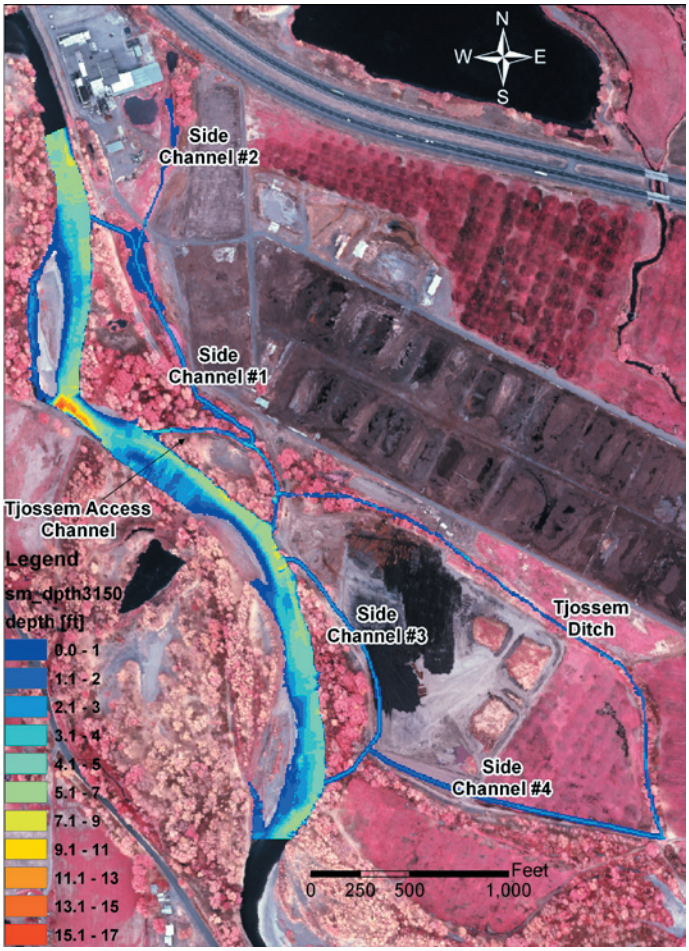
Comparison of predicted and measured deposition/erosion depth along the y = 0.1 m line.

GSTAR-W applied to habitat modeling.—Two separate Reclamation projects in the **Yakima River Basin** in **Washington** are utilizing the numerical model GSTAR-W (Generalized Sediment Transport for Alluvial Rivers and Watersheds) to study aquatic habitat. One application maps pool, riffle, and glide habitat based on the Froude number, a description of flow character based on inertial and gravitational forces. Results have been verified with field surveys of the habitat types. This information will serve as input to the Ecosystems Diagnostic and Treatment (EDT), a tool being used to evaluate the biological potential of stream habitat for the Yakima River Basin Water Storage Feasibility Study. The first figure below shows an example of the change in habitat types with changing discharge.

The other application of GSTAR-W in the Yakima Basin is being applied to a study that removes levees and creates side channel habitat on property purchased by the Yakima River Basin Water Enhancement Program (YRBWEP). Various floodplain configurations of levee removal, setback, and side channel construction are being evaluated to enhance habitat for salmonid species. Providing regular floodplain inundation coupled with the re-creation of side channel habitat is expected to improve rearing and forage habitat for salmonid fish species. Prior to levee construction, side channels existed throughout this reach of the **Yakima River** (see the second figure below). (Robert Hilldale, 303-445-3135)



Example of changing habitat type with discharge.



Photograph showing proposed side channels (Nos. 1,2, 3, and 4) combined with an existing ditch (Tjossem Ditch).

Evaluating accuracy and precision of bathymetric light detection and ranging (LiDAR) surveys in rivers.—Airborne LiDAR bathymetry (ALB) was flown for two separate Reclamation projects on the **Yakima River** in **Washington** and the **Trinity River** in **California**. Until recently, ALB was limited to coastal applications with successful underwater surveys taking place to depths of 50 meters. Applying this technology to shallow river applications required the adaptation of signal processing algorithms by the manufacturer. Due to the recent

development and use of these new algorithms, the aerial surveys needed to be verified for accuracy and precision using ground surveys collected at the time of the flights.

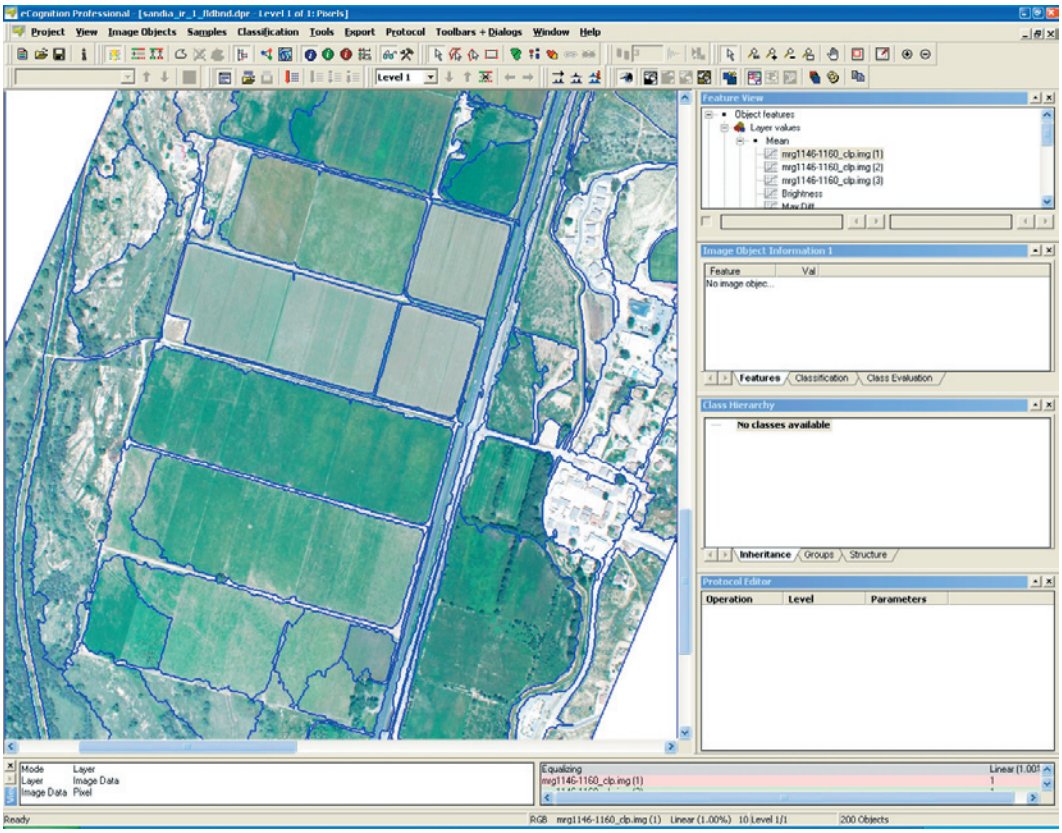
ALB is a promising, emerging technology that may provide efficient data collection of stream channel geometry for study reaches greater than approximately 8 kilometers. Data density provided by ALB is either 2 by 1 meter or 2 by 2 meters depending on the method of collection (helicopter or fixed wing, respectively). This sort of data can have many applications, including geomorphic studies of channel change (e.g., aggradation/degradation), sediment transport, and hydraulic modeling (e.g., habitat studies), and could be used in conjunction with multi-beam Sound Navigation And Ranging (SONAR) for large reservoir surveys. (Robert Hilldale, 303-445-3135)

Investigating alternate irrigated and natural vegetation classification methods for water accounting.—Improvements in enhanced resolution (2- to 4-meter) aerial imagery are needed periodically to provide sufficient detail for water accounting along the **Middle Rio Grande**. This imagery also needs to be acquired and inexpensively corrected to actual ground distances. In August, high resolution cameras mounted on a Reclamation plane acquired photographs and video from Cochiti to Elephant Butte Reservoirs. Leica Geosystem's Autosync improved upon this imagery using additional ground information (see the *S&T Highlights* for April-June 2006 for details).

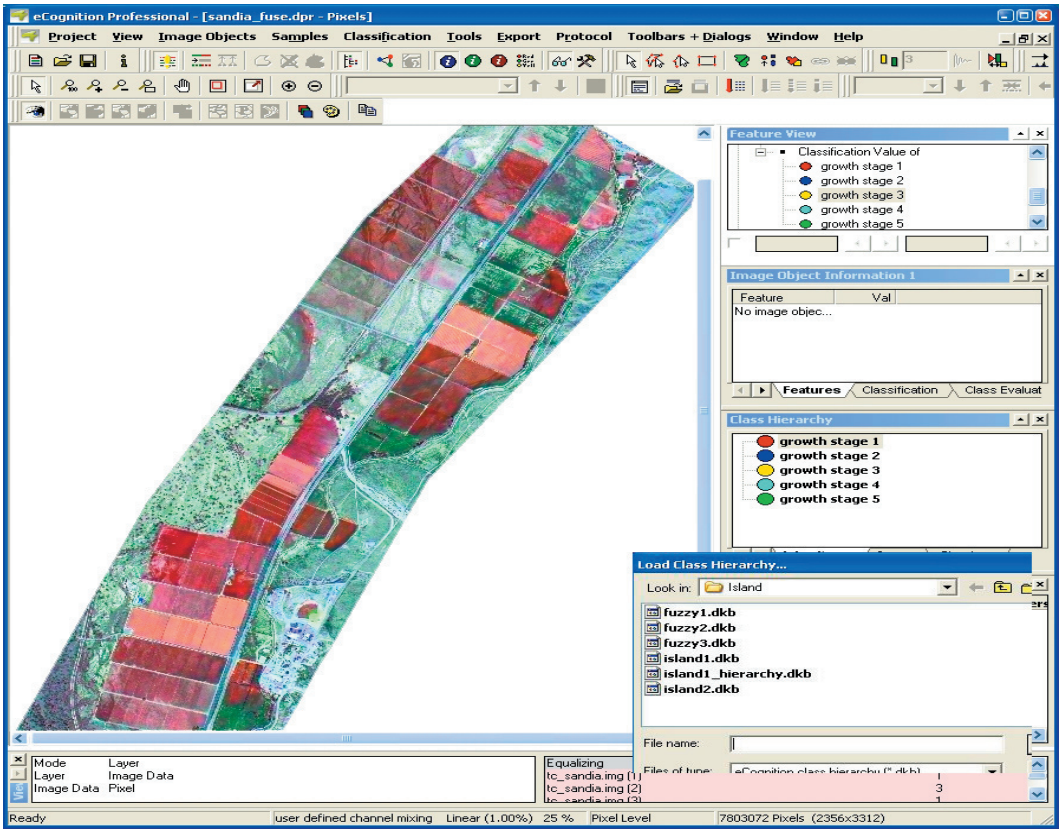
The high resolution photography will be used to develop a detailed field boundary database (as in the first figure below) and agriculture growth stage classification. Then Landsat imagery was matched to the aerial photography also using Autosync. The two registered datasets allow crop type classifications to be associated with the irrigation status and growth status at the field level.

Additional ground truth was collected in August to enhance the crop knowledge base used to train and test agriculture classifications. Three Landsat dates were acquired for June, July, and August 2006 to analyze green biomass status and refine crop classifications. A multi-temporal database (six dates between 2005 and 2006) is being finalized that will include irrigation status, including fields that were shorted or fallowed, and added back into irrigation. This should also be completed at the end of the year.

These activities improve the agriculture inventories and crop statistics and provide the basis for enhanced water consumption models for the Middle Rio Grande Area. (Ronald Miller, 303-445-2279)



Field boundaries generated from object classification of aerial photography.



Example of Landsat-aerial photography fused dataset in the object classifier.

Improving Water Delivery Reliability

Saltcedar control impacts on wildlife and endangered species.— Reclamation recently completed the second year of an ongoing biological study to determine the impact of saltcedar control on wildlife species. Avian point counts, acoustic bat surveys and riparian butterfly surveys were conducted on the **Pecos, Rio Grande, Canadian, Arkansas, and Colorado Rivers**. Data were collected from untreated and treated as well as native riparian sites. Treatment types included mechanical clearing, prescribed burning, aerial herbicide, and biocontrol. Both pre- and posttreatment data were collected as well.

Biological information obtained will be applied to the development of management guidelines that can be used by Reclamation resource managers who are planning saltcedar removal. These guidelines will be designed to reduce or eliminate potentially negative effects to wildlife communities, particularly to threatened, endangered and special status species that can interrupt water delivery operations through adverse regulatory actions. Reclamation is partnering with the Socorro Soil and Water Conservation District, Carlsbad Soil and Water Conservation District, the National Park Service, Bureau of Land Management, and New Mexico Game and Fish Department. (Susan Broderick, 303-445-2235)

Conducting avian point counts in a mechanically treated area near Lake Meredith on the Canadian River.

Improving Water Supply Technologies

Scanning Raman LiDAR provides further benefits.—During August, the ET Workgroup deployed the world's only scanning Raman LiDAR in Middle Rio Grande State Park. The LiDAR was constructed by Los Alamos National Laboratory and is now maintained by the University of Iowa. The LiDAR can sense a three-dimensional moisture field over various plants, measuring some aspects of evapotranspiration.

The LiDAR was deployed to improve the accuracy of the ET Toolbox, by providing the data necessary to correlate local weather conditions to actual evaporation. Once the data are analyzed and correlated, a new numerical model for open-water evaporation and wet-soil evaporation will replace the existing evaporation method in the ET Toolbox. Better ET Toolbox accuracy helps water managers and the Upper Rio Grande Water Operations Model (URGWOM). (Steven Bowser, 505-462-3592)