RECLAMATION Managing Water in the West

January 2012
Research and
Development Office
Bulletin 2012-08

The Knowledge Stream
Research Update

Using USGS LiDAR for Aquatic Habitat Mapping and Hydraulic Modeling

USGS LiDAR can measure channel depths to provide accurate representations of aquatic environments

Bottom Line

Using an airborne green laser to map terrain below water surfaces allows us to quantify physical conditions in the riverine environment. This project allows us to accurately map large areas of shallow streams with good water clarity.

Bigger, Better, Cheaper

Providing these data in any other way would be cost prohibitive or physically impossible in rugged and non-navigable streams. The airborne EAARL can cover much larger areas than sonar and using airborne mapping solves legal access problems.

Principal Investigator

Allyn Meuleman
gmeuleman@usbr.gov
208-383-2258

R&D Office Contact

Miguel Rocha
Science and Technology Program Coordinator
mrocha@usbr.gov
303-445-2841

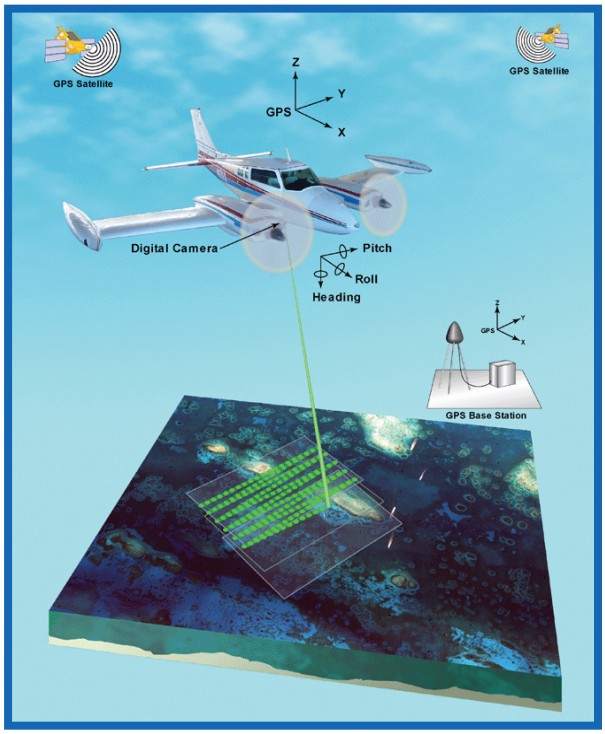
Collaborators

- **Reclamation**
- **U.S. Geological Survey**
- **U.S. Forest Service**
- **University of Idaho**
- **NASA**

Problem

Maps of the topography of streambeds are essential tools for analyzing most river management activities. These maps support habitat measurement, streamflow, temperature studies, and flow and sediment transport modeling.

Traditionally, river maps were made by field surveys. However, the costs and logistics of these field campaigns severely limit the spatial extent of the maps to very short samples of the full river domain. The larger the mapped area, the more accurate the analysis can be. Thus, methods are needed to map kilometer-scale river segments with high resolution and accuracy to assess the response of these critical environments to both management and natural disturbances.



Aerial mapping provides data for EAARL.

The Experimental Advanced Airborne Research LiDAR (EAARL) is an emerging technology that uses a green laser that can penetrate water to map the streambed and banks. However, EAARL hardware and data processing software are currently optimized for shallow marine surveys—rather than streams and rivers.

Solution

Reclamation has been collaborating with U.S. Forest Service scientists at the Boise Aquatic Sciences Lab, the U.S. Geological Survey (USGS), and University of Idaho scientists to adapt the EAARL system to mountain stream environments. We have compared EAARL data with aquatic physical habitat data collected in the field to test EAARL's capabilities. We also used EAARL data to support a one-dimensional hydrodynamic model with a water quality module and a two-dimensional aquatic habitat model. Developing the unique topographic dataset and this full suite of models greatly improves Reclamation's ability to quantify conditions and ecological responses in the riverine environment.

— continued

— continued

Application

To assess environmental conditions and biologic interactions with Reclamation dam and reservoir operations, Reclamation and USGS collected and processed EAARL data, covering a total of 146 river miles in three streams in southern Idaho. This information is being used to help investigate flexibility in operating Deadwood and Anderson Ranch Reservoirs to improve conditions for bull trout in the river below these two dams.

Future Plans

The information gained in this research is being used to guide construction of a new EAARL sensor, custom-designed for riverine applications. In addition, the information gained from this research will be shared with peers and stakeholders through presentations at public and professional meetings, journal publications, and reports.

More information

USGS LiDAR for Science and Resource Management website at:
http://ngom.usgs.gov/dsp

USGS, 2011 and 2009 Evaluation of LiDAR-Acquired Bathymetric and Topographic Data Accuracy in Various Hydrogeomorphic Settings in the Deadwood and South Fork Boise Rivers, West-Central Idaho, 2007 Scientific Investigation Reports 2011-5051 and 2009-5260.

"We can use these advanced tools and practices for increasing our knowledge base to help inform our water management decisions on other rivers where we have facilities."

Allyn Meuleman,
Principal Investigator

Figure below: Topographic and schematic analysis for the Deadwood Reservoir and Deadwood River. Dots show bathymetric data from EAARL.