Focus: Remote Sensing of Stream Channels

Laser Pulse

Research | **Technology Transfer** | **Science Application**

Key Findings:

- A new water penetrating green lidar system is being successfully tested and applied in mountain streams.

- Green lidar can provide synoptic data for submerged channel features, floodplains, and terrestrial vegetation structure.

- High-resolution (1–2 m) data across broad areas can be rapidly collected.

- Green lidar data can be used for inventory mapping, monitoring and change detection, or dynamic modeling of stream environments.

- The technology promises great improvements in costs and efficiency of stream studies.

Challenge

Streams are dynamic landscape elements that integrate and reflect the terrestrial components of a watershed. The costs, logistics, and spatial extent of stream networks on Forest Service lands often limit stream studies and monitoring efforts to restricted spatial scales. Methods are needed to seamlessly map terrestrial and aquatic features at high resolution across broad areas if the response of these critical systems to management and disturbances is to be adequately understood.

Context

There has been considerable progress in using remote-sensing techniques (e.g., aircraft or satellite mounted sensors) to map biophysical characteristics in the terrestrial realm, but aquatic applications have been limited by the inability of most sensors to penetrate water and directly measure submerged features.
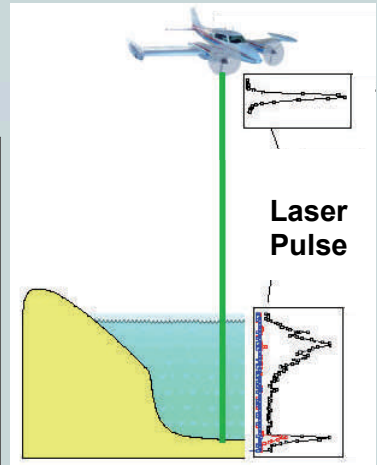
Actions

RMRS scientists at the Boise Aquatic Sciences Lab have been collaborating with NASA and USGS scientists to explore application of a high-resolution, water-penetrating green lidar to mountain stream systems. During 2004 and 2007, data were collected for approximately 200 kilometers of stream in central Idaho during five hours of flight time.
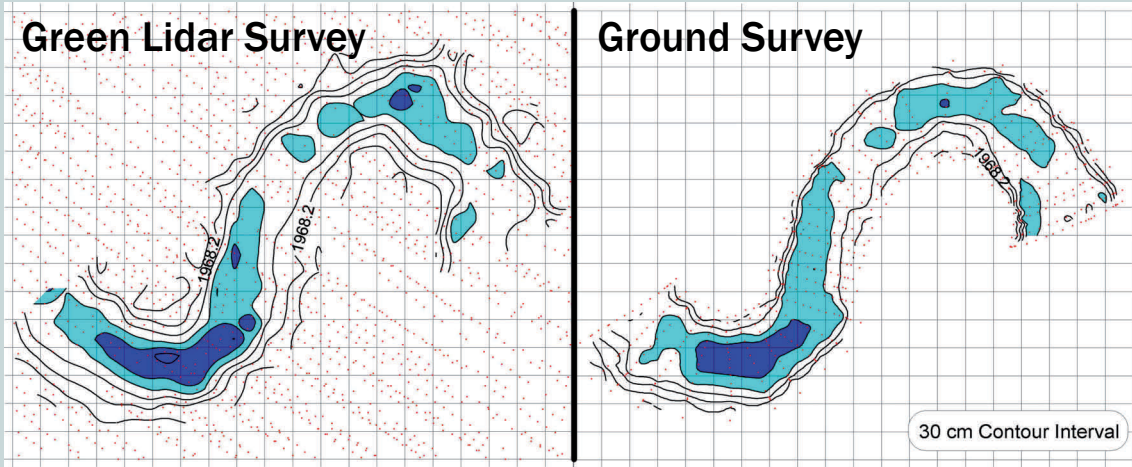
Results

Spatially continuous topographic maps of stream channels and associated floodplains were successfully constructed from the elevation data measured with green lidar. Individual channel units (i.e., pools and riffles) and floodplain characteristics were easily defined from these maps. Repeat sampling of the same stream in 2004 and 2007 revealed subtle shifts in channel morphology and suggest green lidar surveys could provide a powerful monitoring tool. Channel topographies are of sufficiently high resolution that dynamic flow and substrate characteristics can be modeled to simulate the potential responses of streams to different management and disturbance scenarios. Green lidar data also provided information on riparian and floodplain vegetation structure.

Air, Water & Aquatic Environments Science Program

Accuracy Assessment

Green Lidar Survey

Ground Survey

30 cm Contour Interval

Comparison of stream morphologies derived from green lidar surveys that required a few seconds of flight time vs. ground surveys conducted over several days.

Stream & Floodplain Mapping

Green lidar data provide synoptic mapping, monitoring, and modeling capabilities for stream features, floodplains, and terrestrial vegetation.
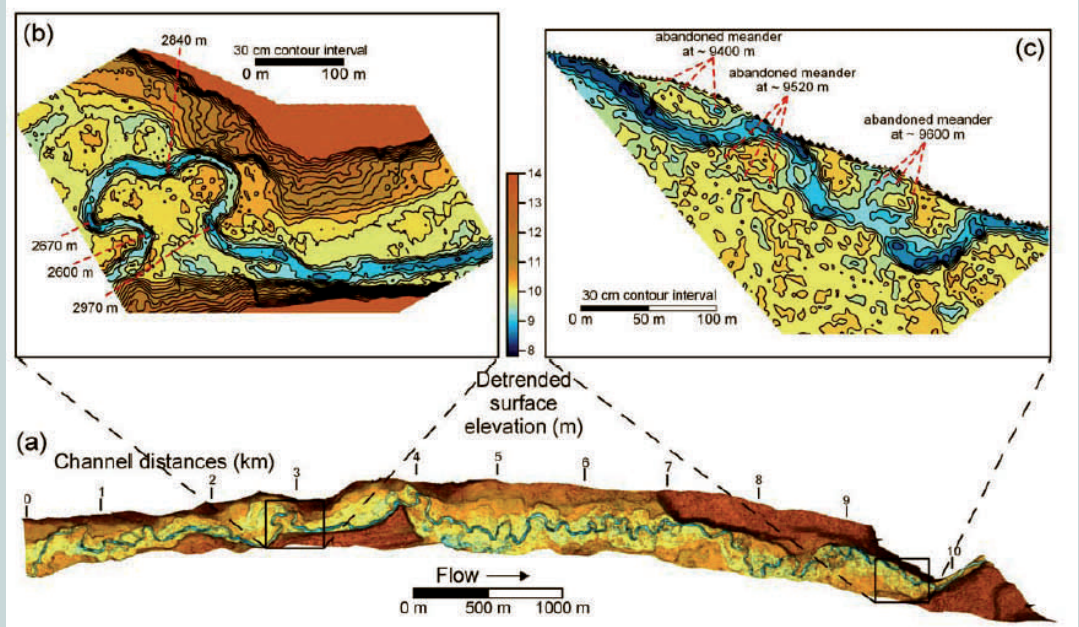
Project Publications

McKean, J., Isaak, D., and Wright, C. 2008. Geomorphic controls on salmon nesting patterns described by a new, narrow-beam terrestrial-aquatic lidar. Frontiers in Ecology and the Environment 6:125—130.

Project Science Team

Jim McKean
Research Geomorphologist
US Forest Service
Email: jmckean@fs.fed.us

Dan Isaak
Fisheries Research Biologist
US Forest Service
Email: disaak@fs.fed.us