Title: Evaluating dryland ecological and river restoration using repeat LiDAR and hydrological monitoring
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Publication: American Geophysical Union, Fall Meeting 2012, abstract #EP31C-0831
Publication Date: 12/2012
Origin: AGU
Keywords: 1824 HYDROLOGY / Geomorphology: general, 1895 HYDROLOGY / Instruments and techniques: monitoring
Bibliographic Code: 2012AGUFMEP31C0831H

Abstract

Recent improvements in the collection of multitemporal, high-resolution topographic data such as Light Detection and Ranging (LiDAR) have done a great deal to increase our ability to quantify the details of landscape change. Both Terrestrial Laser Scanning (TLS) and Airborne Laser Swath Mapping (ALSM) can be used to easily assess how Earth surface processes affect landscape form to a level of precision that was previously more difficult to attain. A comprehensive approach using ALSM, TLS-TLS comparison, and hydrological monitoring is being used to assess the effectiveness of a large scale ecological and river restoration effort by the Cuenca los Ojos Foundation at San Bernardino Ranch near Agua Prieta, Sonora, Mexico. In the study area, historical arroyo cutting and changes in land use led to the abandonment of a ciénega wetland and resulted in widespread ecological destruction. The current land managers have employed engineering methods in order to restore stream and ciénega ecology, including the installation of large rock gabions, earthen berms, and concrete spillways along channels. Our goal is to test the hypothesis that the use of dam and gabion structures leads to stream aggradation, flash flood dampening, and ultimately, increased available water and reestablishment of historic wetland plant and animal communities. We present results from LiDAR change detection that includes 2007-2011 ALSM to TLS change, and several 2011-2012 TLS-TLS comparisons. We also present results from streamflow monitoring, field observation, and monitoring of shallow groundwater and soil moisture conditions. Preliminary results show that channel aggradation occurs rapidly upstream of engineered structures. However, the apparent dampening of sediment transport by the structures leads to less aggradation and even incision immediately downstream of structures. Peak flood flows are decreased by the reservoirs formed behind large earthen berms. After several years of water retention, both in surface reservoirs and in the alluvium deposited upstream of gabions and berms, plant growth recovers.