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Studying Changes in Upland Landscapes and Archaeological Sites

During your trip, you may see scientists mapping and surveying areas in the Colorado River corridor and working at instrument stations that monitor weather conditions. These activities are part of a study coordinated by the U.S. Geological Survey's Grand Canyon Monitoring and Research Center (GCMRC), in collaboration with the National Park Service, to understand the environmental effects of Glen Canyon Dam operations on upland landscapes and archaeological sites in the river corridor through Grand Canyon National Park.

Background

Since the completion of Glen Canyon Dam 50 years ago, the natural flow and sediment conditions in Marble and Grand Canyon downstream have changed substantially. There is much less fine sediment (sand, silt, and clay) in the river corridor now, because most of the river's natural sediment load is trapped in Lake Powell reservoir upstream of the dam. Dam operations regulate river flows so that the magnitude of floods is greatly decreased, the magnitude of low flows is typically increased, and there are daily changes in flow caused by production of hydroelectricity. The combined effects of construction of Glen Canyon Dam -- >90% reduction in the amount of fine sediment delivered to Grand Canyon by the Colorado River – and operations of the dam that cause changes in the Colorado River's flow regime have significantly changed the distribution and size of bare sand bars that occur within the Colorado River's active channel. In many places, the size of these bars is smaller than during pre-dam times and parts of these formerly active bars are now covered by riparian vegetation. In addition, riparian vegetation now covers large portions of the lower channel margins that in pre-dam times were mostly bare sand and rocks.

These reductions in the amount of open, bare sand area within and adjacent to the active channel have consequences to higher elevation areas upslope from the channel. Because wind can carry fine sediment to higher elevations along the river's margins, the growth of new riparian vegetation and depletion of sandbars along the river has decreased the natural windblown sand supply farther inland. In some places, lack of windblown sand supply has resulted in less sediment that now buries archaeological sites, and gully erosion from rainfall is more pronounced. Scientists are studying these processes and are attempting to determine whether and how dam operations may be affecting archaeological sites in the river corridor by monitoring landscape changes from gully erosion, measuring weather events that move sediment, and surveying landscapes and cultural sites periodically.

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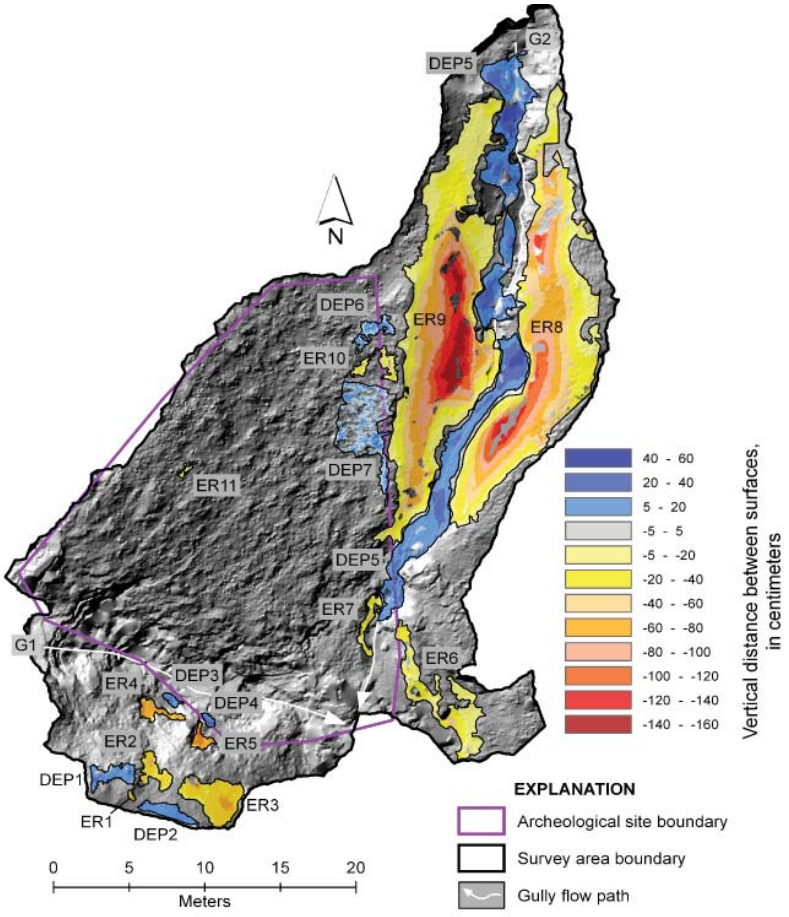
Field Work and Your Trip

You may see small groups of scientists mapping areas of windblown sand along the river corridor. You may also encounter scientists using survey instruments to measure landscape topography. In some places we collect high-resolution digital data of the landscape surface using lidar (light detection and ranging) technology. Lidar surveys involve a crew of two or more people working at a particular site for one or two days. The crew sets up surveying instruments and tripod-mounted equipment over survey marks. The lidar scanner makes its measurements using a laser that is eye-safe for anyone nearby. Please do not disturb any of the survey equipment if you encounter it, but feel free to stop and ask questions of the crew along the river.



Lidar map showing topographic change that occurred between 2007 and 2010 at one study site, showing erosion (warm colors) and deposition (cool colors). Image and data from Brian Collins, USGS.

In a few places, scientists have set up weather stations and cameras that may stay out in the field for up to several years. Cameras monitor changes in the landscape, and weather stations record the wind and rain events that cause those changes. The weather stations consist of a sensor mounted on a two-meter-tall tripod. The sensor measures wind, rainfall, temperature, humidity, and barometric pressure. The weather stations are powered by a solar panel that charges a battery. If you see a weather station, please do not disturb it; touching the sensor can damage the equipment, meaning that the data may not be reliable. All equipment will be removed upon completion of the study

The results of this study will be used to help understand the environmental effects of Glen Canyon Dam operations on important natural and cultural resources in the river corridor. Please feel free to contact Joel Sankey at the U.S. Geological Survey scientists, with any questions you may have.

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