Measuring sediment movement

Wildfires can lead to considerable geomorphological and environmental change. Terrestrial laser scanning is being trialled as a new tool for measuring erosion and sediment movement in South Australia.

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- The latest technology when you need it
- We invest in the technology for you
- Rapid turn-around time
- Accurate survey results

Wildfires can lead to considerable geomorphological and environmental change, both directly by weathering bedrock surfaces and changing soil structure and properties, and indirectly through the effects of changes to the soil and vegetation that influence hydrological and geomorphological processes.

Investigations of accelerated hillslope erosion and post-fire debris flow have been at the forefront of fire impact research in recent years, with terrestrial laser scanning as a new tool of interest.

For several years, researchers from the School of Environmental Science at the University of Adelaide, South Australia, have been working with other Australian scientists and the Bushfire CRC to evaluate laser scanning as a geomorphological measurement tool.

Scientists are particularly interested in the ability of 3D laser scanning technology to quantify and model sediment movement along slopes after a bushfire.

Study site

On 10 January 2007 a wildfire burnt 1700 ha of the Mount Bold water reservoir catchment south of Adelaide. Soils here are predominantly shallow on rock, with native vegetation cover or pine tree plantations. Concerns were held about sediment pollution in the water reservoir.

The fire reduced the vegetation cover, removing most of the surface and near-surface litter, burning some of the shrubs and either completely or partially scorching the canopy.

Nine days after the fire, 46 mm of rain fell in 3 days, with subsequent water flow resulting in substantial erosion. The I-Site 4400LR laser scanner was brought in to measure the erosion at two sites. This was important for assessing the viability of varying mitigation works, with the aim of restricting the volume of sediment entering the water reservoir.

Laser scanning allows users to visualise, measure and process scan data in a much shorter time compared to traditional techniques such as observation, erosion pins and sediment traps. Photogrammetry,

APPLYING NEW TOOLS

Laser scanning will become more common for scientific studies in diverse fields as it becomes more widely available and more affordable.

For studies such as this one, renting the I-Site system for a short period was the ideal solution.

The streamlined interface and workflow in I-Site Studio overcome the difficulties sometimes associated with processing laser scan data.

water quality parameters, tracers and airborne laser scanning are other methods. Images captured simultaneously with the I-Site inbuilt high resolution camera, along with survey measurements, were analysed and compared to measuring erosion pins with ruler and callipers.

With I-Site, volume measurements are possible in previously inaccessible steep terrain, and the improved detail enables researchers to understand the erosion processes occurring along hill slopes.

The 700 metre range of the I-Site 4400LR scanner allowed the study area to be surveyed in 2 days.

Data captured during the 2 days in the field was used to generate surface displacement models. This information was then made available for decisions on where to place post-fire sediment control structures in the event of future wildfires.

Ease of use was a major consideration in this project, where steep, slippery and uneven ground within the catchment area had to be accessed. Setting up and operating the scanner and capturing data using the streamlined handheld controller won universal acclaim.

Much larger areas were covered than possible using traditional erosion pin or sediment trap methods. Repeat scans can be taken without interfering with the natural processes and no sediment laboratory work is required. Being able to quickly generate volumes for steep, inaccessible areas was a huge advantage.

The study found that it was possible to measure the amount of sediment displaced and deposited on steep slopes using 3D scanned images.

Comparing pre and post-fire terrain showed that the sediment was derived predominantly from concave topography along the slopes, which was then collected into colluvial fans feeding directly into the tributary.

Compared to traditional survey methods, terrestrial laser scanning can provide increased spatial and temporal data acquisition for interpreting surface sediment transfers with minimal interference.

Other potential uses for sediment transfer data include residential areas and landslips, road construction, and building sites on steep slopes. Laser scanning is a useful tool to monitor sediment transfer in order to protect our waterways.

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