Research Activities

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Marrying Novel and Traditional methods to estimate stream bank erosion more accurately

Streambank erosion can contribute 30 to 60 percent to as much 80 percent of the sediment load in incised streams. This occurs when accelerated and extensive stream bank erosion occurs and can have detrimental effects on aquatic and terrestrial ecosystems. Sediment is one major non-point source pollutant of streams in the world. High stream sediment load decreases water quality, degrades aquatic life, and increases flooding, sedimentation, and turbidity downstream. Increased sedimentation also decreases reservoir storage thereby providing less water for drinking, irrigation, and recreation needs.

An understanding of stream bank erosion is necessary to efficiently and effectively manage streams, rivers and their riparian areas. Many studies of stream bank erosion have been conducted during the last decades but, many facets of stream bank erosion processes are still not well understood, because of their high temporal and spatial complexity. In addition, stream bank erosion is a natural function of streams and cannot be eliminated entirely. The goal is to reduce stream bank erosion when it is accelerated to natural levels. In the BSB963 “Protect Streams-4-Sea” this is being studied with many different methodologies. Specifically, we are marrying traditional methods e.g., erosion pins and cross-sections with innovative methods e.g., laser scanning and drones. The combination of these methods allows the calibration of the innovative methods based on the traditional that will also allow the upscaling of the results.

The erosion pin method was used to measure the magnitude (mm) of streambank erosion. Erosion pins were preferred over other methods that measure the magnitude of erosion because erosion pins have much higher resolution (Figure 1a). Erosion pins can have difficulty accounting for spatial variability on streambanks and can also inflate erosion estimates.

Resurveys of channel cross sections are a standard method of analysis for measuring historic changes in stream channel geometry, such as incision and widening (Figure 1a). Several studies have used cross section measurements to compare stream channel temporal changes. Such surveys can show effectively the shape of a streambank changes over time from erosion or deposition for specific locations. Data can be coarse depending on the density of field measurements and always do not accurately model bank retreat and conditions.

Figure 1. a. Erosion Pins installed on stream banks. b. Stream Cross-sections measurements

A terrestrial laser scanner uses LIDAR technology to create high-resolution point clouds of a surface. These points can show the three-dimensional topography by combining laser-based distance measurements with precise orientation. A main advantage is that it can showcase even minute changes in surface along a streambank with up to one millimeter resolution. This allows managers to better monitor sediment sources spread over a channel network. This technique provides superior measurement precision and accuracy. Some issues occur with water reflection, vegetation obstruction and capturing the irregular surfaces of the stream bank that can interfere with measurement.

Figure 2. a. Laser Scanning Field Measurements

Unmanned aerial vehicles (UAVs or widely known as drones) are a recent tool which can be used as a research tool in order to examine geomorphologic changes as an aerial bird's eye. UAVs are used a remote-sensing photogrammetric tools because they provide high spatial resolution and accuracy. The produced point clouds, orthomosaics, digital surface models and three-dimensional models can be utilized in order to monitor the stream banks and the "hot-spots" where high erosion or deposition occurs (Figure 4a). Finally, drones can hover quickly and easily over the channel in order to spot detailed geomorphologic features, environmental quality aspects, habitats or even litters (Figure 4b).

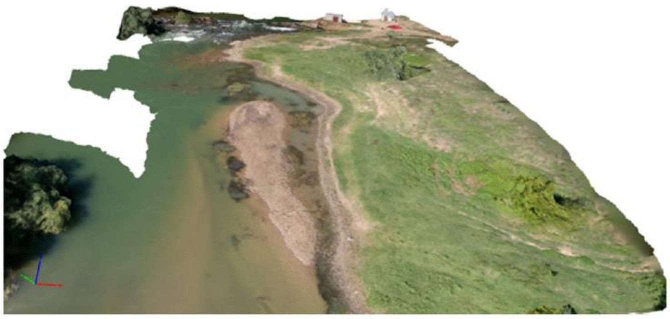


Figure 4 a. Developing a 3D model of a stream channel. b. *Capturing litter along a stream channel.*

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