Accuracy of Light Detection and Ranging (LIDAR) Data

Background
Stream bank erosion has been identified as a possible significant source of sediment and phosphorus in surface water. However, despite the money allocated for research in this area on both local and national levels, there is still much information to be gathered.

Comprehensive cross sectional surveying and orthographic photography have been used in the Lake Champlain Basin of Vermont (Figure 1) to map stream banks and determine how they are eroding over time (DeWolfe et al., 2004; Sullivan et al., in press; DeWolfe et al., in review). The LaPlatte River and Lewis Creek watersheds are two regions of the Lake Champlain Basin that have been subject to surveying and analysis (DeWolfe et al., in review; Meals and Budd, 1998; Sullivan et al., in press). However, the surveying and photographic processes used in this past research are both extremely time consuming and expensive. New methods for topographic mapping have become available as recently as May of 2004 when Light Detection and Ranging (LIDAR) technology was used to map Chittenden County. LIDAR is a promising new technology that could be capable of measuring landscape topography over large areas very quickly and with much higher precision than standard surveying methods. This research will focus on three reaches of the LaPlatte River where there is both LIDAR and detailed survey data available. These three reaches are denoted in figure 1 by a large yellow circle around a smaller black dot. If the LIDAR data for these regions is found to be accurate, LIDAR could be used extensively instead of more expensive surveying and photographic techniques to determine elevations and slopes of stream banks. If taken periodically, LIDAR data would allow researchers to observe how stream banks erode over time, and thus eventually learn how erosion effects sediment and phosphorus levels in the streams themselves.

Figure 1: Lake Champlain Basin showing detailed and repeated cross sectional survey sites and LIDAR availability. The three focus sites are on the LaPlatte River and are indicated by large yellow circles surrounding smaller black dots.
Hypothesis
LIDAR technology can be accurately and effectively used to determine elevation and slope data for stream banks.

Objectives
1. Compare LIDAR and survey data to determine the accuracy of LIDAR’s elevations.
2. Estimate the accuracy of interpolated stream bank slope data.

Methods and Work Tasks
The methods and tasks can be divided into three distinct sections. The first involves organizing existing data and gathering necessary supplementary data. The second section requires the comparison of LIDAR and survey data and the third section consists of interpolating slope data for the stream banks.

1. Obtain relevant data
   a. Existing data includes the following:
      i. May 2004 LIDAR data
      ii. Possible spring 2005 LIDAR data
      iii. Survey data
      iv. Erosion data
      v. Topographic photography
   b. Collect further survey data at selected stream reaches (Figure 1).
2. Compare LIDAR and survey data
3. Estimate accuracy of interpolated stream bank slope data

Conclusion
Despite the importance of knowing the rates of erosion of local stream banks there is relatively little data about it and what data is available was extremely costly both in time and money to produce. LIDAR technology, if found to be an accurate method of mapping the topographic landscape, would provide a relatively inexpensive means of determining how stream banks erode over time. Conclusions from this research could have vast impact not only on future use of LIDAR technology, but also on stream bank erosion analysis.

References Cited