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**The integration of ground-based and airborne  
laser scanning for coastal zone mapping**

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TIM WEBSTER<sup>1</sup>, NATHAN CROWELL<sup>1</sup>, DANIK BOURDEAU<sup>1</sup>,  
KATE LEBLANC<sup>1,2</sup>, AND STEPHANIE ROGERS<sup>1,2</sup>

*1. Applied Geomatics Research Group – NSCC, Middleton,  
Nova Scotia B0S 1M0, Canada <timothy.webster@nsc.ca>*

*2. Department of Earth and Environmental Science, Acadia  
University, Wolfville, Nova Scotia B4P 2R6, Canada*

Several coastal areas around the Maritimes have been surveyed with airborne LiDAR sensors to construct high-resolution digital elevation models (DEMs). While this technology provides unprecedented detail on horizontal surfaces, cleared land or forest covered, it has limitations on imaging steep slopes or vertical structures which are common for many coastal areas. These steep slopes are typically associated with cliff faces where the material is either bedrock or unconsolidated glacial sediments. These geomorphic features typically are not subject to coastal flooding from storm events due to their local relief, however they are susceptible to erosion, especially the unconsolidated glacial till deposits. Repeat airborne LiDAR surveys offer the ability to map both lateral and vertical changes for low relief morphologies such as dune systems. However, this method has limitations in quantifying the changes for steep slopes since fewer laser shots reflect off of these surfaces from an airborne sensor. To overcome this limitation and provide a more detailed baseline of elevation measurements to moni-

tor future changes, we have used a ground based laser scanner to survey the cliff face in the Joggins area of the Bay of Fundy. Joggins is a World Unesco heritage site because of the fossils preserved in the sand stone cliffs that are exposed to the high tides in the Bay of Fundy. Monitoring coastal erosion is an important aspect for this site considering the large tidal range and projected sea-level rise in the future. The methodology employed at this site will be used at other sites in the province that are even more susceptible to erosion where glacial till comprises the bank not bedrock.