Exploring the use of unmanned aerial vehicles (UAVs) to study the evolution of beaches and cliffs in Newfoundland and Labrador, Canada

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In Newfoundland and Labrador, most communities are built near the coast, and thus the geologic stability of these environments has economic, cultural, and environmental importance. Many areas of the province have low vulnerability to coastal issues due to the steep and rocky nature of the coastline; however, certain areas are highly vulnerable to erosion and flooding. Low-lying areas such as the bayhead barriers near Holyrood Pond along the southern Avalon Peninsula, and low-lying beach-ridge complexes in Placentia, are subject to flooding and overwash, especially during storm surges. Landforms at risk to erosion include unconsolidated Quaternary deposits, such as the cliffs along St. George's Bay, Conception Bay, and the Gulf of St. Lawrence in western Newfoundland. This is also the case at Parsons Pond, where a short-term recession rate of the clifftop of 73 cm/annum was measured. Coastal erosion and flooding will continue to have an influence due to rising sea levels and projected climatic changes. Accurate predictions of coastal evolution are important in determining vulnerability to flooding and erosion. Town planners, policy makers, and other stakeholders can utilize this information to prioritize mitigation efforts, to guide planning decisions, and to ensure that the necessary adaptations are made if development close to the coast is necessary.

The use of an Unmanned Aerial Vehicle (UAV) is currently being explored to study coastal environments (beaches and cliffs), in Newfoundland and Labrador. UAV provide an effective tool to understand coastal environments, because they are able to cover a large area in a time-efficient manner, access difficult to reach locations, and collect a significant quantity of accurate data. The UAV operates by flying at a low altitude (maximum of 100 m above the ground) and collecting overlapping aerial images. After the flight, the images are processed using photogrammetric software, and a digital elevation model (DEM) is created based on a point cloud. To increase data accuracy, topographic survey equipment, specifically a Real Time Kinematics (RTK) system, is used to geo-reference the DEM. Repeated surveys provide an understanding of how beaches are evolving: specifically an assessment of sediment accretion, deposition and the net sediment budget. Data collected from the UAV include measurements from the entire cliff face, and will be used to assess volumetric changes over time. These data will provide a more complete dataset of slope stability, compared to traditional data acquisition which has involved only the clifftops and bases of landforms in coastal surveys.