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# Combining UAV LiDAR and Terrestrial Laser Scanning to investigate the impact of shrub expansion on local-scale Arctic snowpack distribution.

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Climate warming induces shrub expansion on Arctic herb tundra, with effects on snow trapping and hence snow depth. We have used UAV-borne LiDAR and Terrestrial Laser Scanning (TLS) to investigate the impact of shrub height on snow depth at two close sites near Umiujaq, eastern Canadian low Arctic, where dwarf birch and willow shrubs are expanding on lichen tundra. The first site features lichen and high shrubs (50-100 cm), a moderate relief, and a snowpack averaging 95 cm in spring. The second site consists of lichen and low shrubs (20-60 cm), more pronounced topography, and a deeper snowpack (101 cm). Digital Terrain and Surface Models were acquired in early fall to obtain topography and vegetation height. A Digital Surface Model obtained in spring produced snow depth maps at peak depth. TLS over a 400 $m^2$ area produced time series of snow depth throughout the winter. TLS data show preferential snow accumulation in shrubs, but also preferential melting in shrubs during fall warm spells and in spring. UAV data at the first site show a strong correlation between vegetation height and snow depth, even after snow depth has exceeded vegetation height. This correlation is not observed at the second site, probably because snow depth there is much greater than vegetation height. These data show the need to reconsider some paradigms on snow-vegetation interactions, for example that vegetation does not affect snow accumulation beyond its height.