

Estimation of biomass change by multi-temporal airborne laser profiling along S-N 750 km transect in northwestern Canada

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Multi-temporal airborne laser profiling missions over S-N 750 km transect along the Dempster highway from Dawson (64.0 degrees N, 138.8 degrees W), Yukon Territory to Inuvik (68.3 degrees N, 133.5 degrees W), Northwest Territories in Canada were conducted in summer of 2003 and 2011 for estimating terrestrial biomass change and monitoring how northern plants respond to possible global warming. By processing original surface profiles of the term-head and end missions, vegetation profiles were obtained as a difference between surface and ground profiles. Then standing stock, and aboveground biomass every 100 m along transect at the term-head and end were obtained by applying equation those vital indices measured at 80 sample plots on ground against average laser vegetation height. Average vegetation height, standing stock and biomass entire 750 km transect were increased from 0.51 m, 15 m³/ha and 9.0 ton d.m./ha in 2003 to 0.81 m, 23 m³/ha and 14.0 ton d.m./ha in 2011 as average annual increment of 0.037 m, 1.1 m³/ha and 0.64 ton d.m./ha. Biomass increment was much larger in forest dominated section (0-70 km from Dawson; nearly 2 ton d.m./ha/year) than tundra dominated section (450-550 km from Dawson; 0.1 ton d.m./ha/year). Air temperature and warmth index in recent 25 years have been rising 0.34 degrees and 1.2 degrees-month (more than 0 degrees Celsius in mean monthly temperature) in Dawson, 0.63 and 0.3 in Eagle plains (the middle point of transect), and 0.78 and 1.9 in Inuvik respectively and which supports soil temperature should have also been rising in this area. Both the air and soil temperature rising causes the releasing growth limitation of plants in this region. However, biomass carbon loss from forest fire seems not significant at least along the laser transect from year 2003 to 2011 from the combination of analysis of multi-temporal airborne laser profiling data set, fire history map from Yukon Territory, and observation from the air and ground.

Keywords: Canadian boreal forest, circumpolar, global warming, biomass change, airborne laser altimetry, multi-temporal measurement

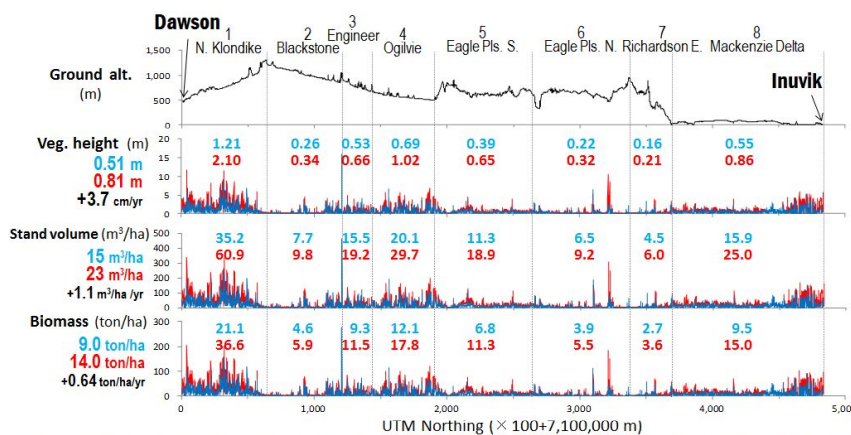


Figure Vegetation height, stand volume, and aboveground biomass in 2003 and in 2011