



## **Assessment of variability and uncertainty of regional soil organic carbon inventories in mountain environments (Canadian Rocky Mountains, Alberta)**

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Alpine environments are heterogeneous and dynamic geomorphic environments sensitive to land use and climate change. Still, apart from elevation gradients their Carbon soil inventories are rarely studied based on geomorphology. This generates potentially large uncertainties of our understanding of their Carbon stocks. In this study we analyzed the spatial variability and controlling factors of soil properties associated with the calculation of SOC inventories in an alpine heterogeneous environment in the Rocky Mountains (Canada, Alberta). Multiple regression analysis and ANOVA indicated that combinations of site characteristics (such as geology, geomorphic environment, elevation, slope etc.) explained up to 66% of the SOC variability. Furthermore the method of Gaussian error propagation is presented and applied to estimating variability in SOC stocks as a function of SOC concentration, bulk density, percent of coarse fraction and soil thickness. The results show coarse fraction and SOC concentrations had the greatest spatial variability, while bulk densities generated the largest uncertainties associated with the analytical precision. This study therefore confirms that SOC inventories should follow a sampling design with a high spatial density of samples regarding the estimations of the coarse fraction, SOC concentration and high precision measurements of bulk densities. It also shows that conventional sampling schemes do not cover the full range of spatial heterogeneity common in mountain environments.