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Characterization of a forest-tundra ecotone in Northern Canada: long-term monitoring possibilities

K. Hufkens
University of Antwerp, Plant and Vegetation Ecology, Biology, Wilrijk, Belgium (koen.hufkens@ua.ac.be)

Ecotones are gradual transitions between two adjacent ecological systems. They are characterized by their spatial properties which are reflected in an ecotone width and location. Characteristics of width and location of an ecotone vary across time, during succession or with environmental changes. Moreover, it has been shown that ecotones are good indicators of local and global changes. Furthermore, if only one main environmental factor drives this gradual change the shape of the ecotone is evident as a sigmoid wave.

We explored a two-dimensional sigmoid wave curve fitting algorithm that describes the ecotone for classified remote sensing data of a forest-tundra ecotone in the Northwest Territories of Canada. The estimated location and width of the forest-tundra ecotone were validated with digital land cover data. The algorithm was able to accurately delineate the forest-tundra ecotone based upon a classified remote sensing image and is robust for various algorithm parameter settings. Given the robustness of the algorithm and the easy implementation it should be considered a valuable tool to assess long-term global change of the forest-tundra ecotone.

However, to assure successful long-term monitoring some issues related to remote sensing of high latitude forest-tundra areas should be addressed. Optical remote sensing observations are limited to the short growing season. In Arctic tundra regions the limited drainage of the permafrost soil also creates a large amount of standing water and shallow lakes. Furthermore, as in all optical remote sensing analyses cloud cover hampers the acquisition of useful vegetation cover data. All these factors interfere with the acquisition and/or processing of remote sensing data. These challenges should be addressed before (automated) long-term monitoring of the forest-tundra ecotone becomes viable.