Prairie Shelterbelt Inventory: Using High Resolution Imagery and Object-based Classification

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Abstract

The Shelterbelt Program established by the Prairie Farm Rehabilitation Administration (PFRA) has had several benefits to farmers and the prairie landscape. The effective planting of shelterbelts can mitigate the effects of soil erosion, provide a means to control snow drifting over highways and roads, provide wildlife habitat and control the odor around large intensive livestock operations. Due to growing concerns of about rising levels of Carbon Dioxide in the atmosphere shelterbelts have also been seen an effective way to sequester carbon dioxide from the atmosphere. Despite the positive effect of the Shelterbelt Program on the prairie landscape PFRA has limited channels to judge the success of the program. The current number of trees that exists and their exact location on the landscape is not known.

In this paper we use Definiens eCognition software along with SPOT-5 2.5m panchromatic image to produce an accurate inventory of Prairie shelterbelts which will be used in future research to create an inventory of carbon sequestration in Prairie Shelterbelts.

Background and Relevance

The Prairie Shelterbelt Program has distributed trees throughout the prairies for many years. Records have been kept on the number and location trees that have been distributed but no ground inventory has been done due to the large resources that would be needed. An earlier study was done to identify shelterbelts using high resolution aerial photography, along with Definiens Imaging, eCognition software (Wiseman et al., 2007) but was found to be expensive and time consuming due to the nature of acquiring aerial images. SPOT-5 2.5m panchromatic images were looked at as a more economical and time efficient source of data.

Methods and Data

The data used in this study is a, SPOT-5 2.5m panchromatic mosaic image, 34.5 by 28 kilometers, taken between July 1 and August 11 2006, in the area around Biggar, Saskatchewan. Other spatial data was used in the classification; Building, Roads and Limited Use Road shape layers from the National Topographic Database.

The classification of shelterbelts is a three step process; segmentation, classification, and classification refinement. Segmentation process involved the creation of shelterbelt-like objects on the image. Classification required the classification of three types of shelterbelts; field shelterbelts, roadside shelterbelts and farmyard shelterbelts. The classification refinement

incorporated other spatial data to separate field and roadside shelterbelts also to increase the accuracy of the farmyard shelterbelt classification.

Results

The results of the classification show that it is possible to provide an accurate inventory of shelterbelts using SPOT-5 panchromatic images.

The classification procedure that was used provided a positive classification of over 80% for all three types of shelterbelts found in a previous manual classification. The number of falsely classified shelterbelts objects was found to be acceptable rate for both field and farmyard shelterbelt, while roadside shelterbelts were falsely classified at a high rate.

Conclusions

It is evident that the Spot 2.5 m panchromatic images have a great potential to create an inventory of shelterbelts on the Prairie Provinces. In future research the shelterbelt inventory that is created by this methodology will be applied to carbon sequestration data to create an inventory of carbon sequestration by Prairie shelterbelts. Tree planting has great potential to reduce carbon emissions, noted in research done by Brandle (1992) and Kort and Turnock (1999). The expansiveness of the prairie landscape is an ideal location to develop such a program of tree planting. (Agriculture & Agri-Food Canada n.d.) The potential of a mass tree planting program on the prairies is substantial due to the over 61 million hectares of agriculture land that can be used for planting of shelterbelts. The creation of an inventory will hopefully demonstrate the impact that current shelterbelts have had in impacting the environment and show what future gains can be made in mitigating Co^2 emissions.

References

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