Increasing Greenspace in the City of Toronto: Climate Impacts of Changing Surface Albedo

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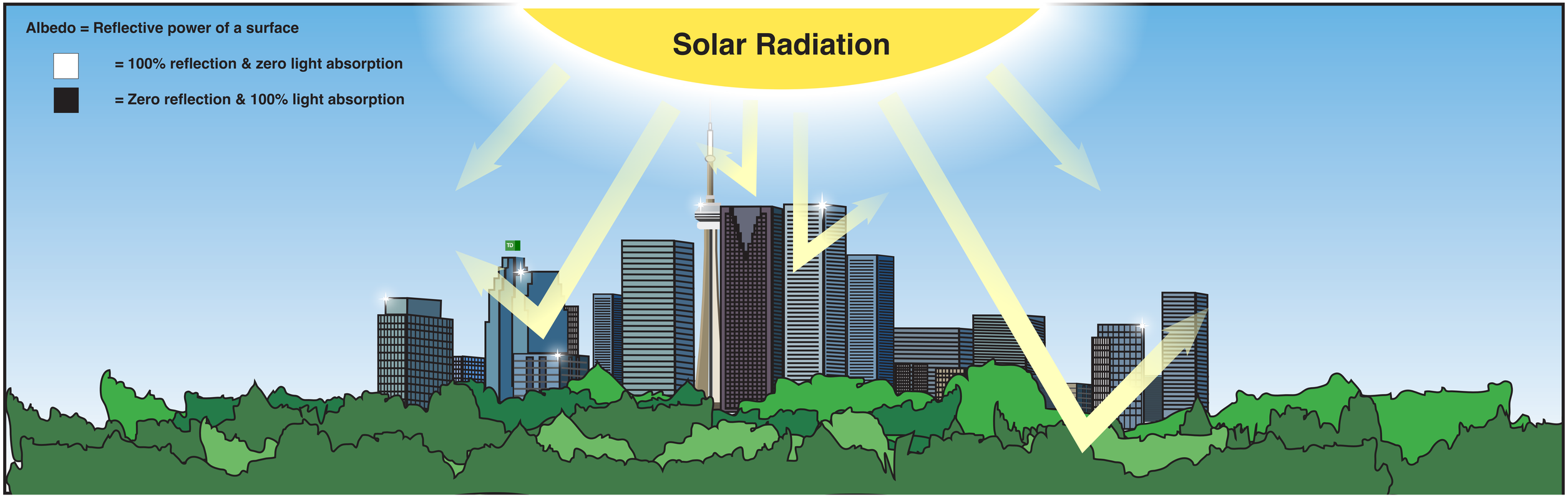
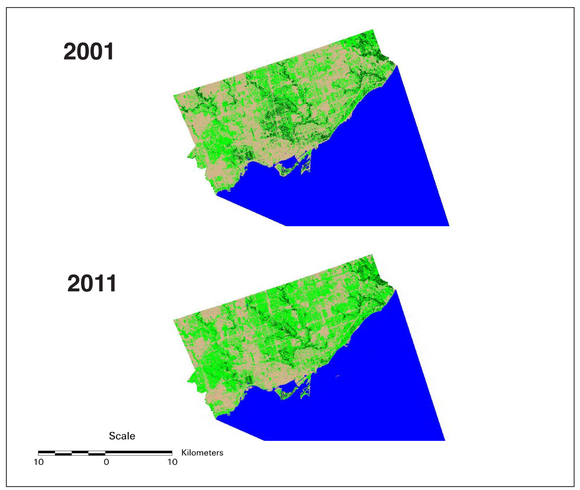


City of Toronto Land Cover Change



Introduction

Increasing greenspace in urban areas is a common goal among city planners and public stakeholders alike. An often overlooked impact of increased greenspace is the effect of these increases on surface albedo.

Surface albedo has significant impacts on ground temperature and greenhouse gas flux. Studies examining these impacts on urban centres are not rare however the vast majority of this research is limited to the context of city infrastructure. Ground temperature impacts facilitated by surface albedo varies greatly between tree genus and species and is complicated by seasonal variation.

The City of Toronto's Strategic Forest Management Plan for 2012-2022 aims to increase the City's urban forest canopy cover from ~28% to 40% (City of Toronto 2013). Consideration of tree species albedo offers an excellent opportunity to help guide and inform species selection to avoid any unintended climate impacts and optimize the City's urban forest management outcomes.

Objectives

1. Quantify land use change and corresponding surface albedo in the City of Toronto from 2001 to 2011

2. Determine percentage of existing urban forest composed of deciduous versus coniferous tree species

3. Provide recommendations to guide and inform tree species selection to optimize urban forest planting programs and associated climate impacts

Methods

Two summer time images of Landsat TM 5 of 2001 and 2011 were used for this study. A combination of band 4 (Near Infrared), 3 (Red), 2 (Green) (in Red, Green, and Blue channel respectively) was used for classifying land covers in both images. Images were cloud free and necessary radiometric corrections were made before classifying. Images were initially classified using unsupervised classification followed by supervised method. Surface shortwave albedo was calculated using band 1, 3, 4, 5, 7 following Liang (2000) and Smith (2010). Before calculating albedo, images were converted to radiance and then to reflectance. Image processing and modeling was conducted using ERDAS IMAGINE 9.2.

Results

Land Cover	Buildings/ Roads	Deciduous	Conifers	Water	Cover in 2001
Buildings/ Roads	26945.1	8646.66	47.52	358.2	35997.48
Deciduous	2443.14	18705.1	827.73	0.63	21976.6
Conifers	241.56	2717.55	3292.11	0.18	6251.4
Water	105.48	0.63	0	75328.3	75434.41
Cover in 2011	29735.28	30069.94	4167.36		139659.9

Recommendations

1. Increase planting of deciduous species for reforestation and afforestation.

2. Promote the use of native species with high albedo.

3. Review net albedo impacts of reforestation plans prior to implementation.

4. Limit the use of coniferous shrubs as vegetative cover.

Literature Cited

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