MAIA
Mapping and Assessment for Integrated ecosystem Accounting

Assessing the accuracy of remote sensing of land cover change detection for urban ecosystem accounting

Introduction

Time-series of satellite imagery have a large potential for the continuous monitoring of urban land cover changes. Slow and fragmented land cover change in urban ecosystems pose a challenge for urban ecosystem extent and condition accounting. Little research has been done on the accuracy of high-resolution open source data such as Copernicus Sentinel-2 for this purpose. Assessment of uncertainty and confidence in trend detection is rare in ecosystem accounting applications

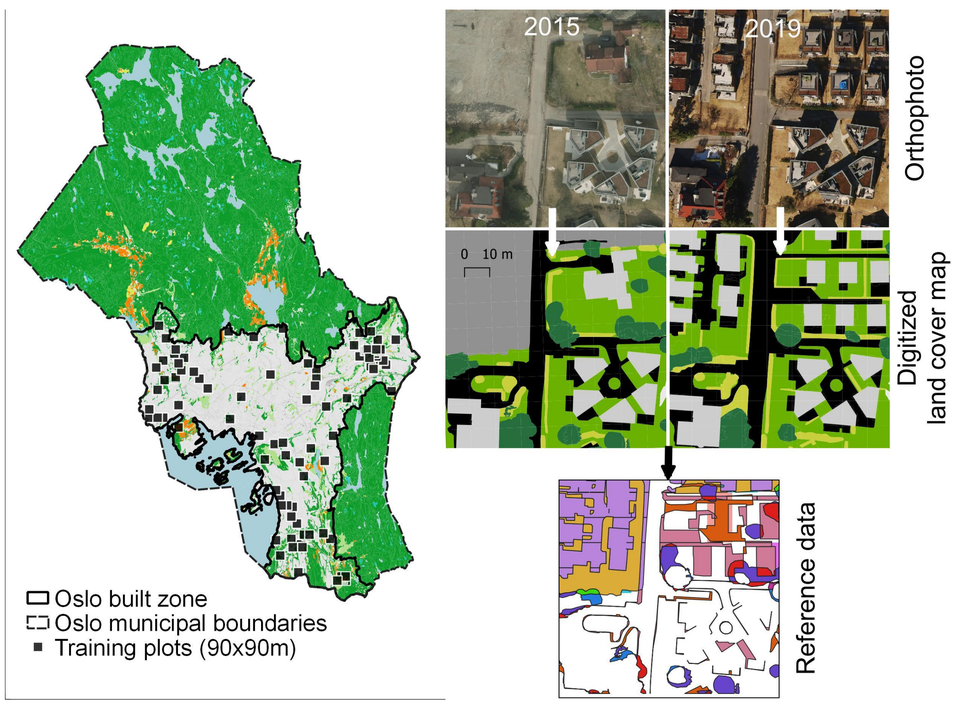
Objectives

- Quantify the accuracy of change detection depending on the type of land cover change
- Assess recommended size of a basic spatial unit and length of accounting period as a function of type of landcover change and the change detection accuracy of the remote sensor

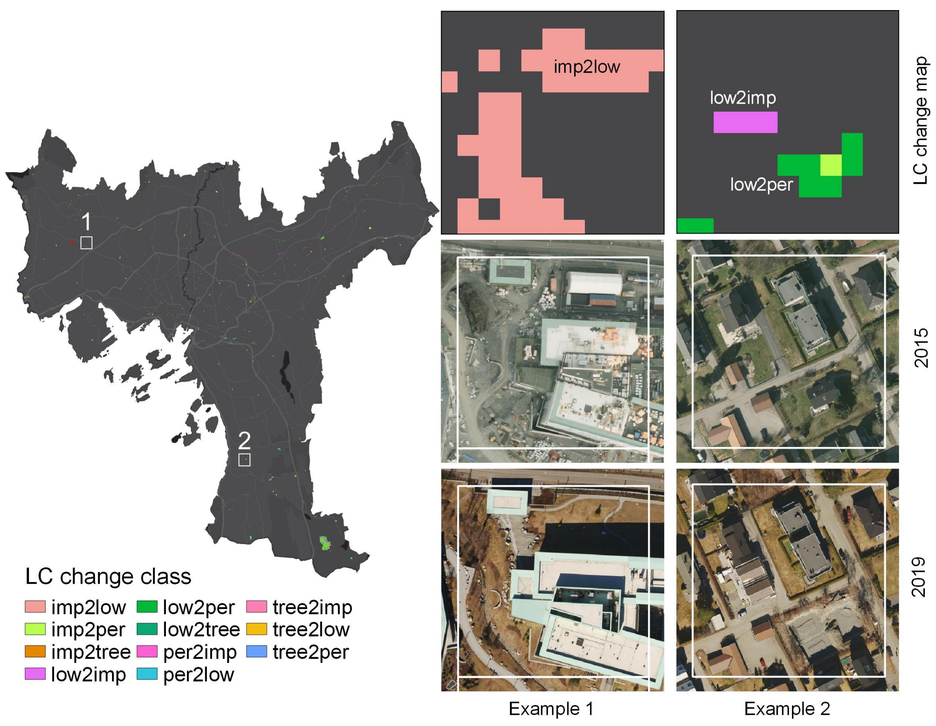
Methods

1. manual delineation of land cover change polygons 2015-2019 for a sample of 93 square plots in Oslo, Norway.
2. train random forest classifiers iteratively by reducing the sample size based on a minimum area threshold (5 – 100 m2)
3. calculate the overall and class-specific producer's accuracy.
4. produce a wall-to-wall map of land cover type change for the entire municipality using the classifier trained using all change patch sizes > 50 m2

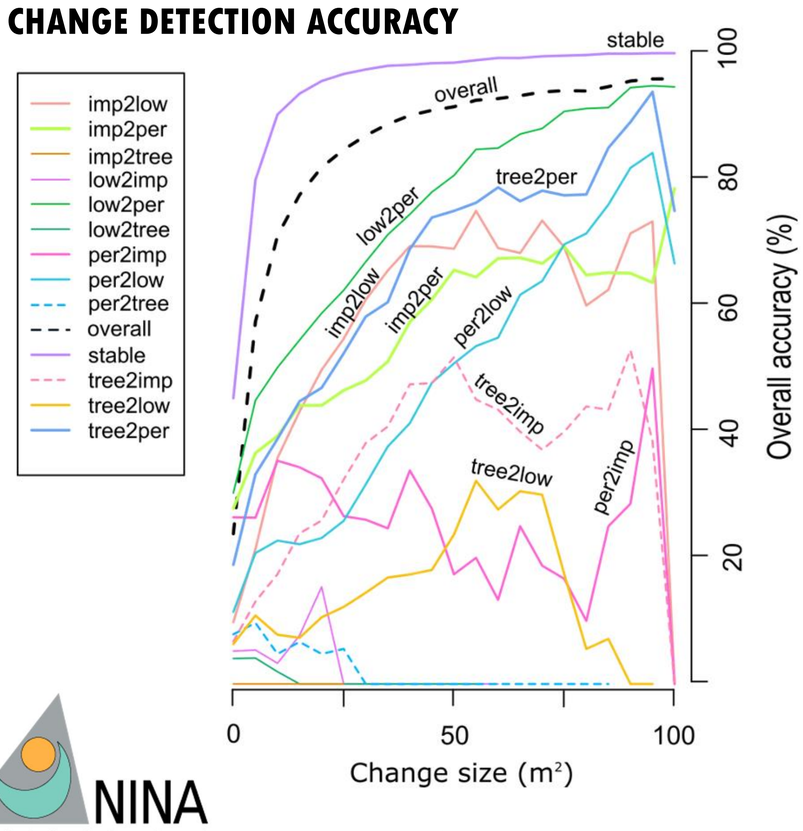
GROUND TRUTHING



CHANGE MAPPING



CHANGE DETECTION ACCURACY



LANDCOVER CHANGE ACCOUNT

Change type	Area of change (ha)	95% CI (ha)
imp2low	39.85	17.21
imp2per	27.51	14.2
imp2tree	0.01	0
low2imp	105.95	29.73
low2per	81.85	21.92
low2tree	2.22	4.31
per2imp	49.60	20.17
per2low	39.08	17.74
tree2imp	63.29	21.92
tree3low	124.54	31.81
tree2per	34.72	14.92
stable	13944.45	64.70

NINA
Norwegian Institute for Nature Research

Source: Nowell et al. (forthcoming) Direct change mapping of urban land cover: how remote sensing can inform ecosystem accounting

Results

- Change patches of 50 m2 (i.e. half of the size of the Sentinel-2 pixel) allowed detection of changes smaller than the pixel size and maximized the number of classes with producer's accuracy > 50%.
- Different accuracy levels are associated with different land cover change types due to different frequencies of occurrence in the area, average size of the patches, and different spectral signal.
- A four year accounting period was sufficient to detect significant trends in almost all land cover changes

Implications for ecosystem accounting

- Direct land cover change classification allows for greater trend detection accuracy than classifying opening and closing landcover extents
- Detection of trends in ecosystem extent and condition can have higher spatial resolution than ecosystem service and asset accounting based on opening extents.

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