# EO 4 Ecosystem Accounting 2022

# Introduction
# Urban ecosystems
# Thematic accounts
# Session 4

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30 November 2022

# Session Overview

Introduction to Urban ecosystem accounts – examples from Oslo, Norway,
David N. Barton (Norwegian Institute for Nature Research (NINA)

Understanding the human footprint from space – the World Settlement Footprint,
Mattia Marconcini (German Aerospace Center)

Improving Urban Ecosystem Accounts in the United States Through Hyper-parameterized Machine Learning
Lucila Marie Corro (United States Geological Survey)

The Use of EO Data for Urban Ecosystem Extent and Condition Accounting in Canada
Nicholas Lantz (Statistics Canada)

Remote Sensing To Monitor Air Quality At 1-Kilometer Resolution,
Fabien Castel (Murmuration)

# Introduction to urban ecosystem accounts – examples from Oslo, Norway

David N. Barton (NINA)

# Recognise differences in national and urban ecosystem accounting purposes and data needs

**USERS:**

International agencies

National governments

Finance sector

Inudstrial sectors

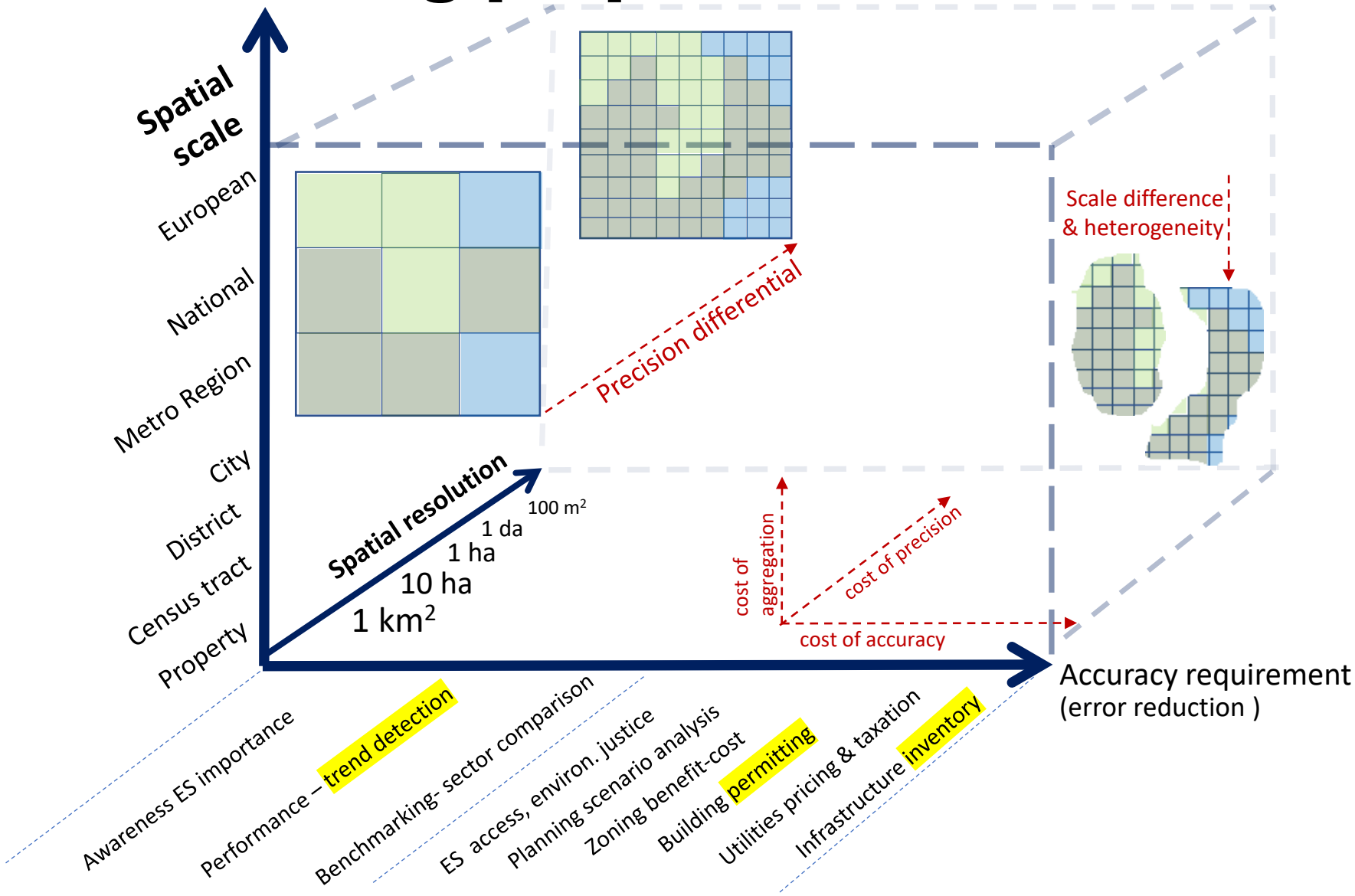
Land & water authorities

**Local governments**

**Producers & utilities**

**Civil society -managers**

**Landowners - residential**



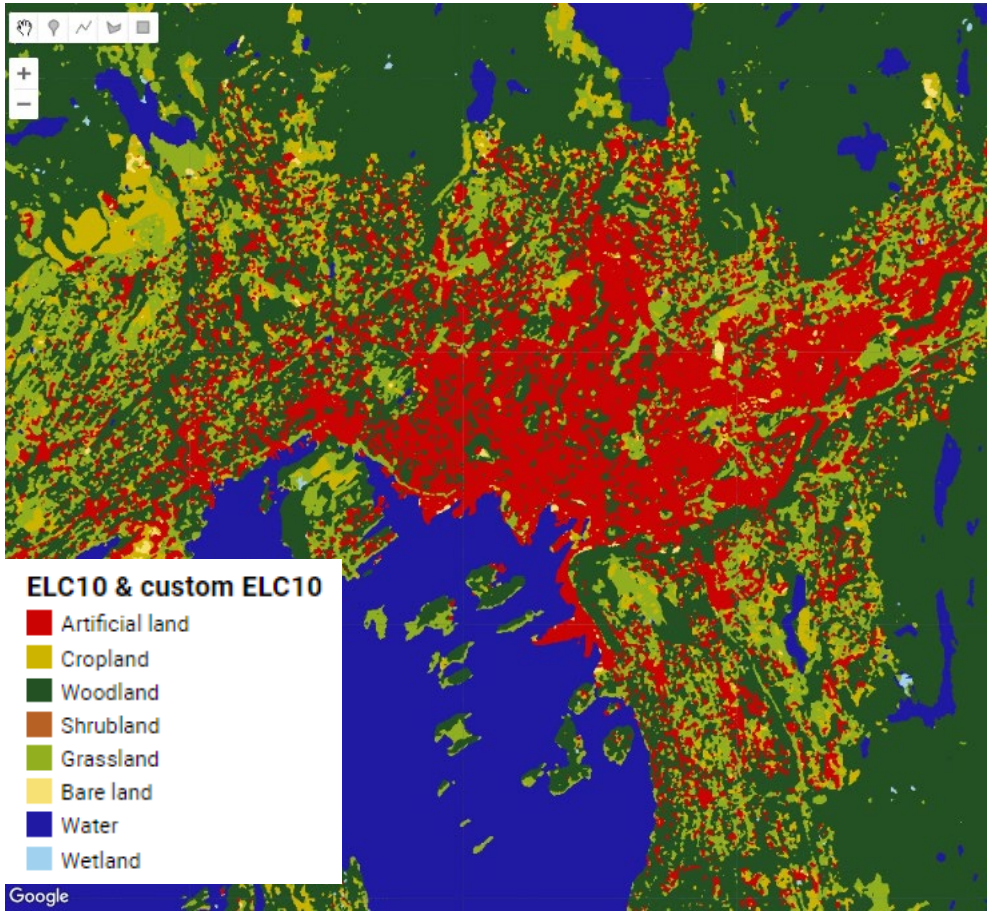

**PURPOSES:**

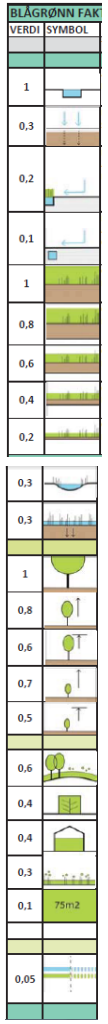
**National accounts** **Urban accounts**

Source: adapted from Zulian, G. et al. (2017)

# FROM MAPPING URBAN ECOSYSTEM LANDCOVERS TO BLUE-GREEN INFRASTRUCTURE ASSETS (1/2)

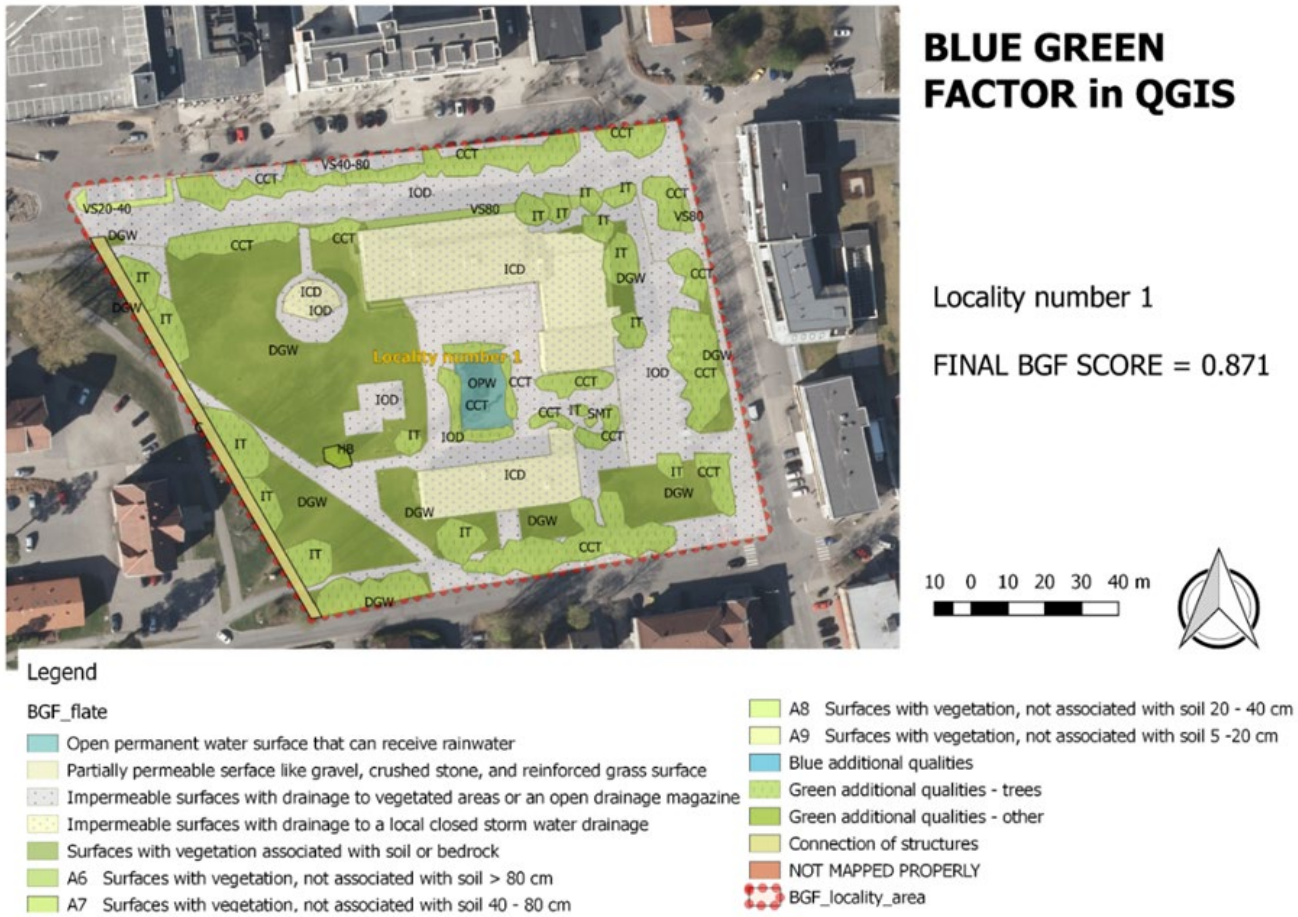
## LANDCOVERS OF URBAN ECOSYSTEM AT CITY SCALE



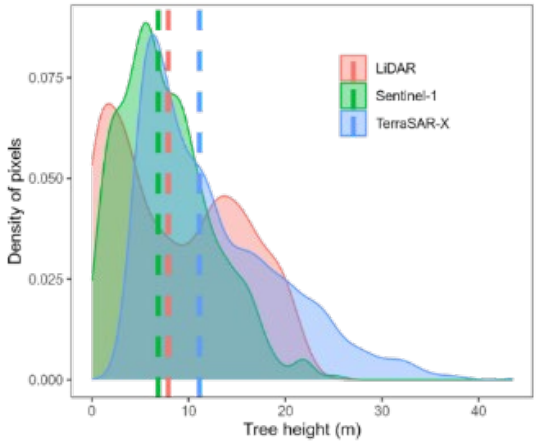

Source: https://nina.earthengine.app/view/landcover-compare
Venter, Z.S., Sydenham, M.A.K., 2021. Continental-Scale Land Cover Mapping at 10 m Resolution Over Europe (ELC10). Remote Sensing 13, 2301. https://doi.org/10.3390/rs13122301

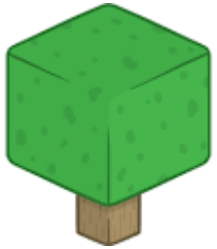
## BLUE-GREEN INFRASTRUCTURE ASSETS AT PROPERTY SCALE



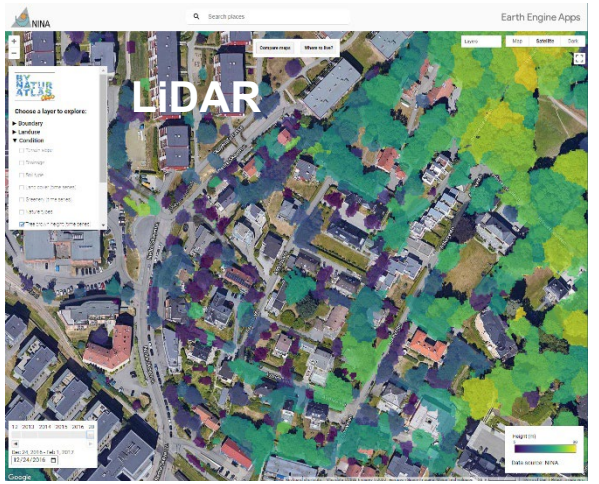

Source: Horvath, P., Barton, D.N., Hauglin, E.A., Ellefsen, H.W., 2017. Blue-Green Factor (BGF) mapping in QGIS. User Guide and Documentation, 47. Norsk institutt for naturforskning (NINA).

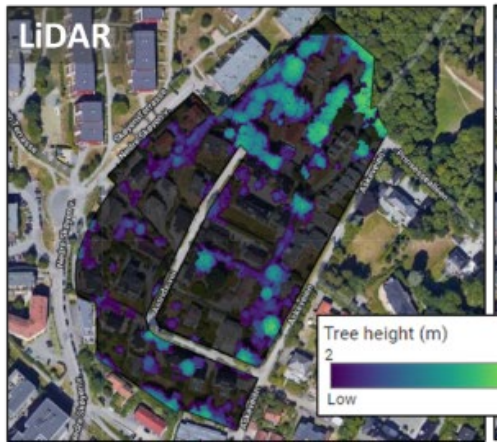
# MAPPING URBAN TREE CANOPY EXTENT AND HEIGHT USING DIFFERENT SENSORS

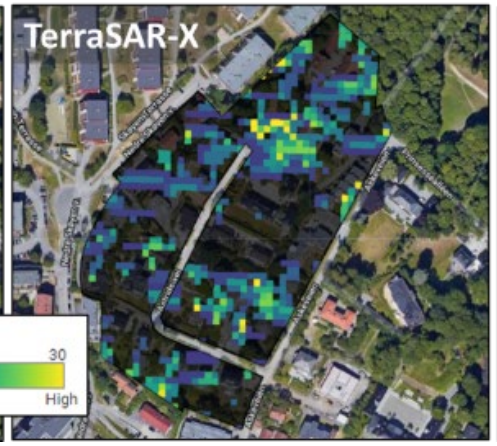


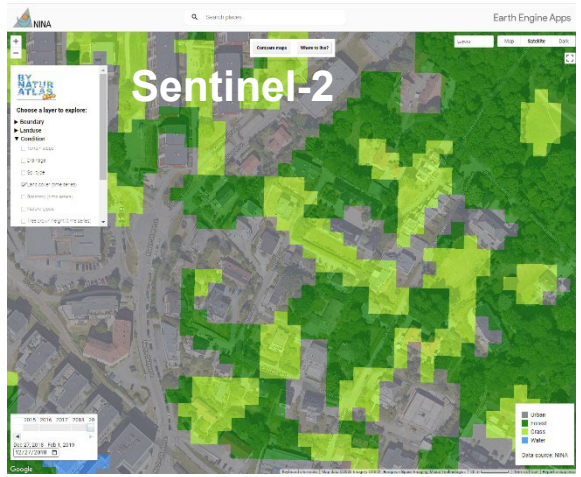
3D «raster» tree





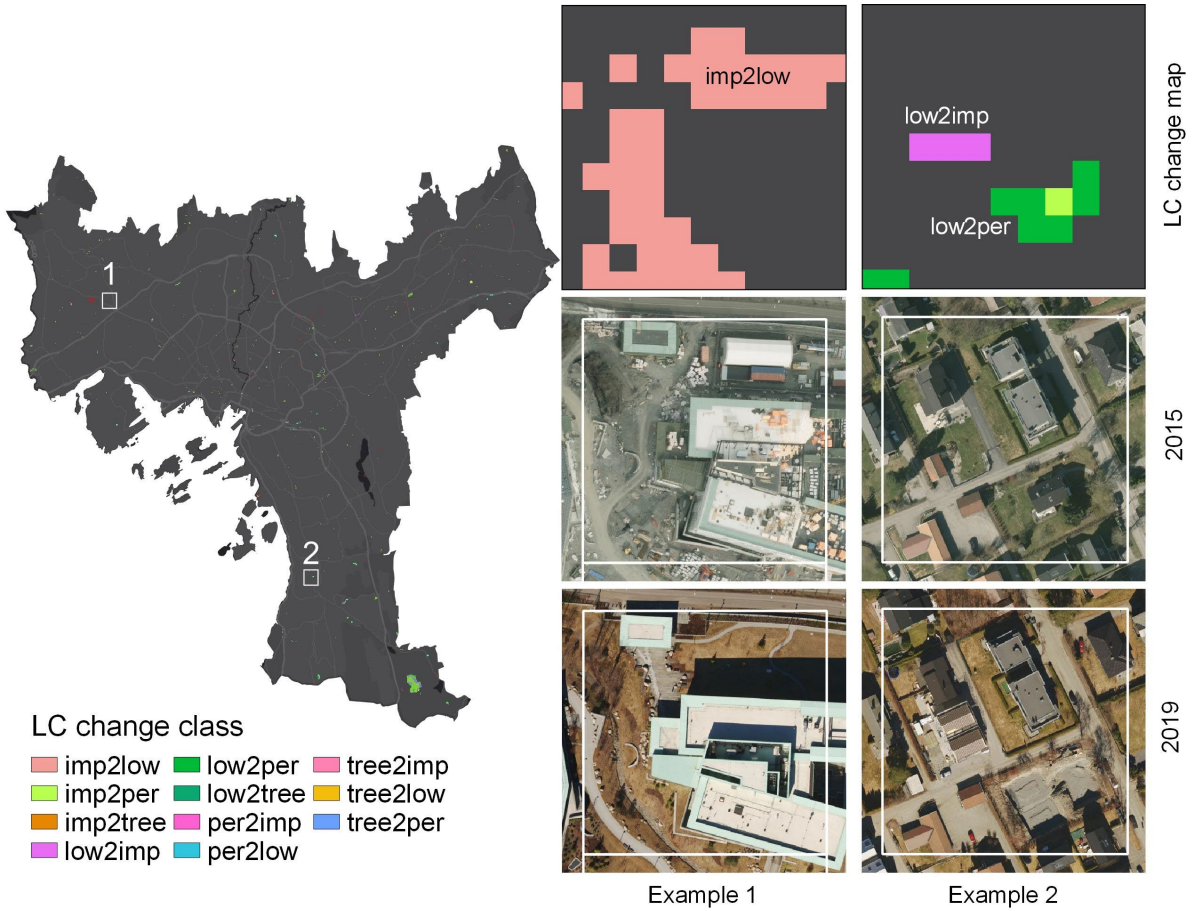



2D «raster tree»

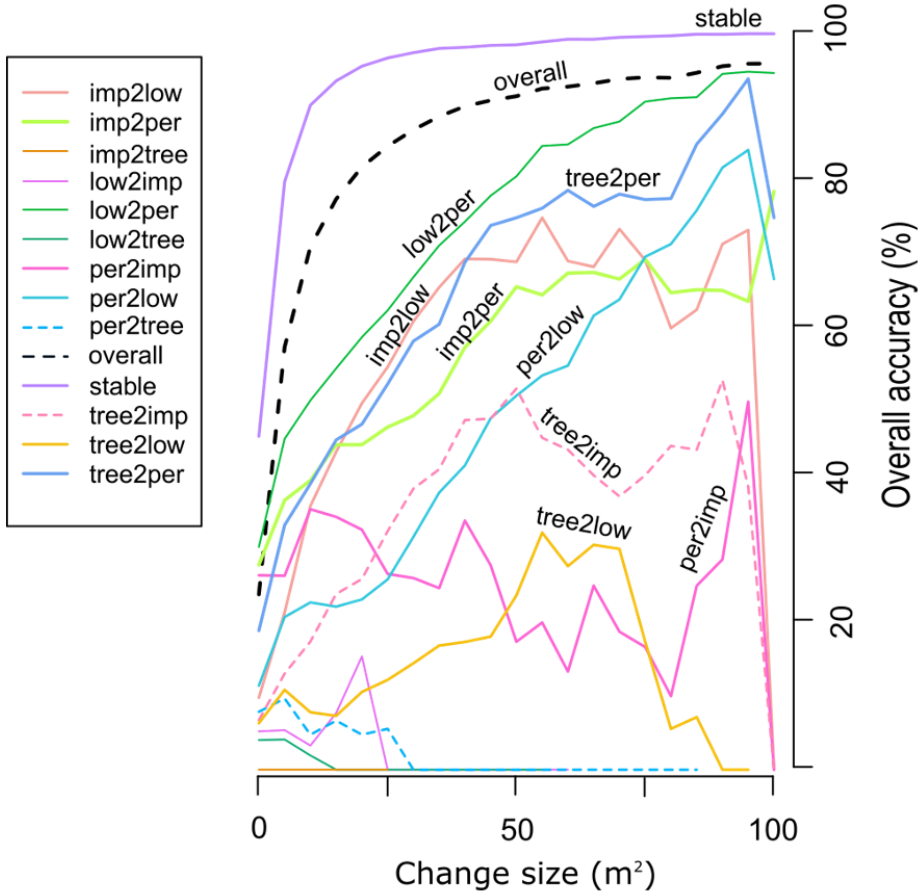
Note: Pixel resolutions of TerraSAR-X (25m2) and Sentinel-1 (25m2), Pixel resolution of Sentinel-2 (10x10m). Lidar (1m2).
Source. Venter et al. (2022)

# ADEQUATE TEMPORAL AND SPATIAL RESOLUTION FOR CHANGE DETECTION

## CHANGE MAPPING



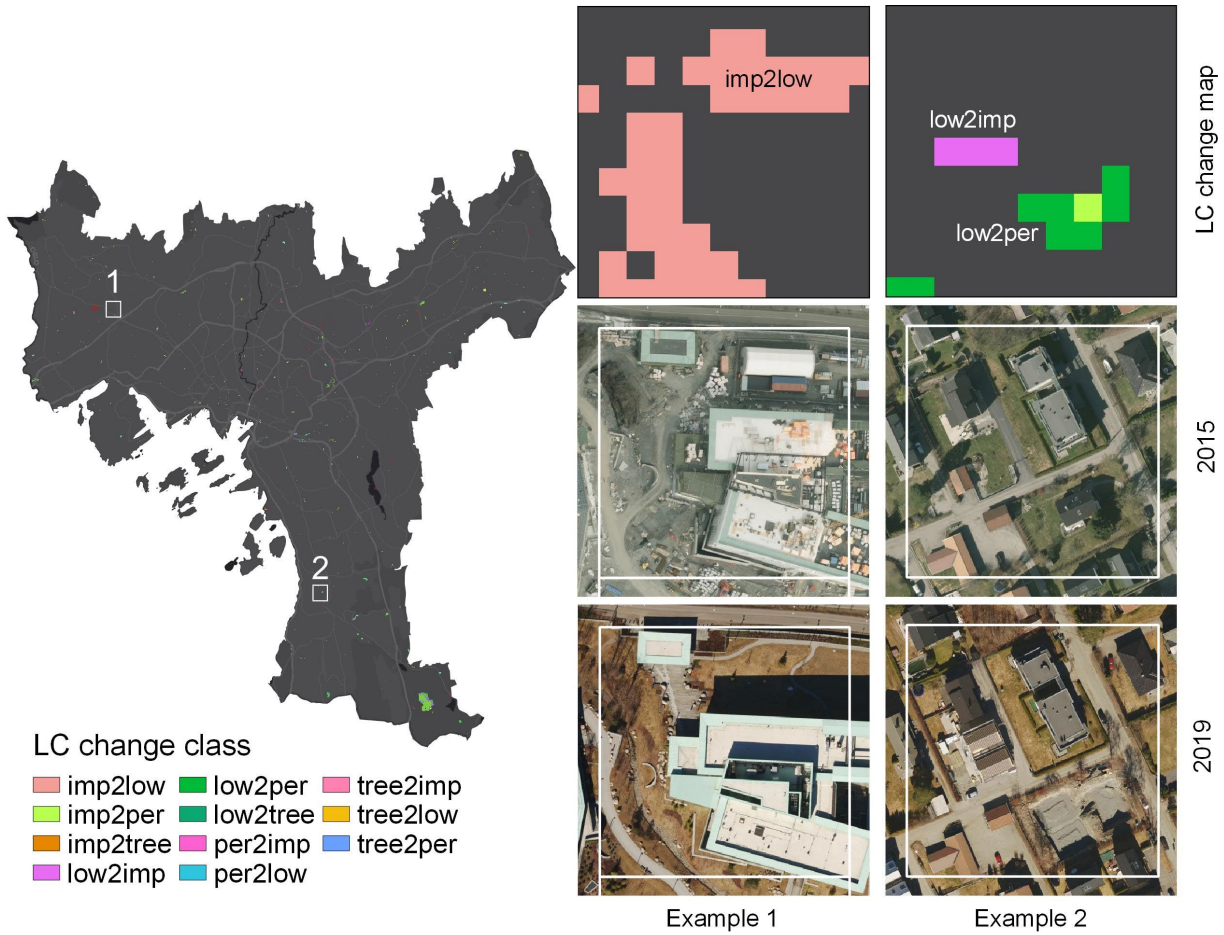

## CHANGE DETECTION ACCURACY BY CHANGE RESOLUTION




Nowell et al. 2022 Assessing the accuracy of remote sensing of land cover change detection in urban ecosystem accounting. Forthcoming

# UNCERTAINTY ESTIMATION FOR CHANGE DETECTION

## CHANGE MAPPING




## CHANGE DETECTION CONFIDENCE

| 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 |

Nowell et al. 2022 Assessing the accuracy of remote sensing of land cover change detection in urban ecosystem accounting. Forthcoming

# CHALLENGES AND OPPORTUNITIES FOR URBAN ECOSYSTEM ACCOUNTING

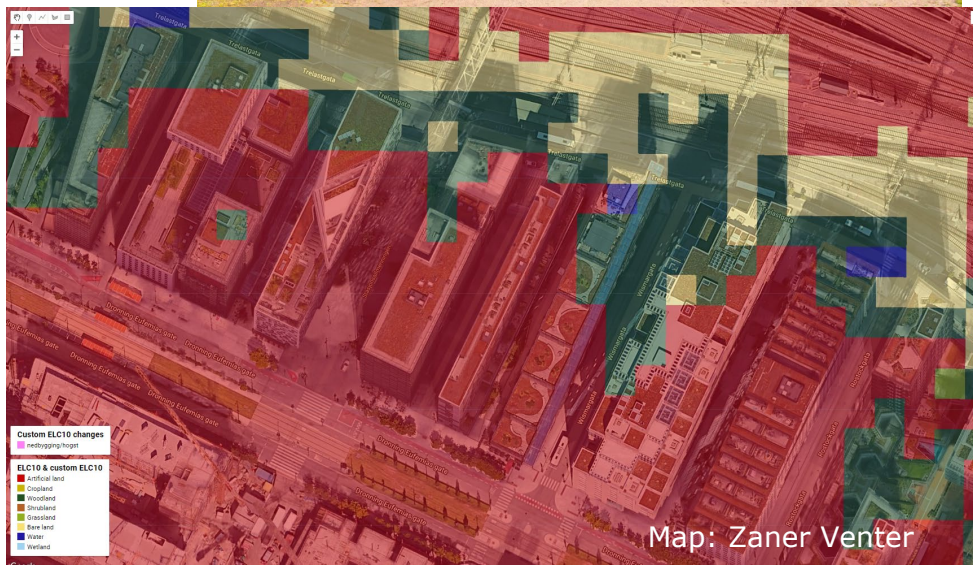
**1. What are the main challenges in the uptake of urban ecosystem accounts for municipal planning and policy purposes (in Oslo)?**

- Urban landcover change detection and accounting
- Combined extent-condition presentations (e.g. tree canopy)
- Identifying blue-green infrastructure assets and their condition
- “Utility-oriented” ecosystem service indicators
- Monetary accounts - zero rent municipal services, open access amenities.

**2. What are the priority actions for the next 5 years in urban ecosystem accounting (in Oslo)?**

- Combining multiple sensors, human-labeled training data and AI to identify blue-green assets
- Bespoke urban accounting typologies for municipal govts. (beyond NSO reporting)
- Linking ES accounts to public health indicators

Photo: David N. Barton

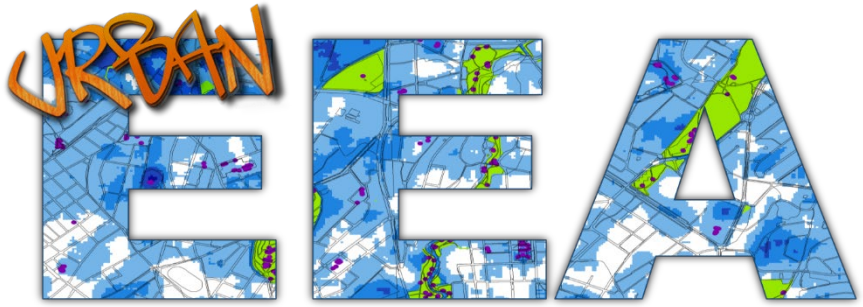



Map: Zaner Venter

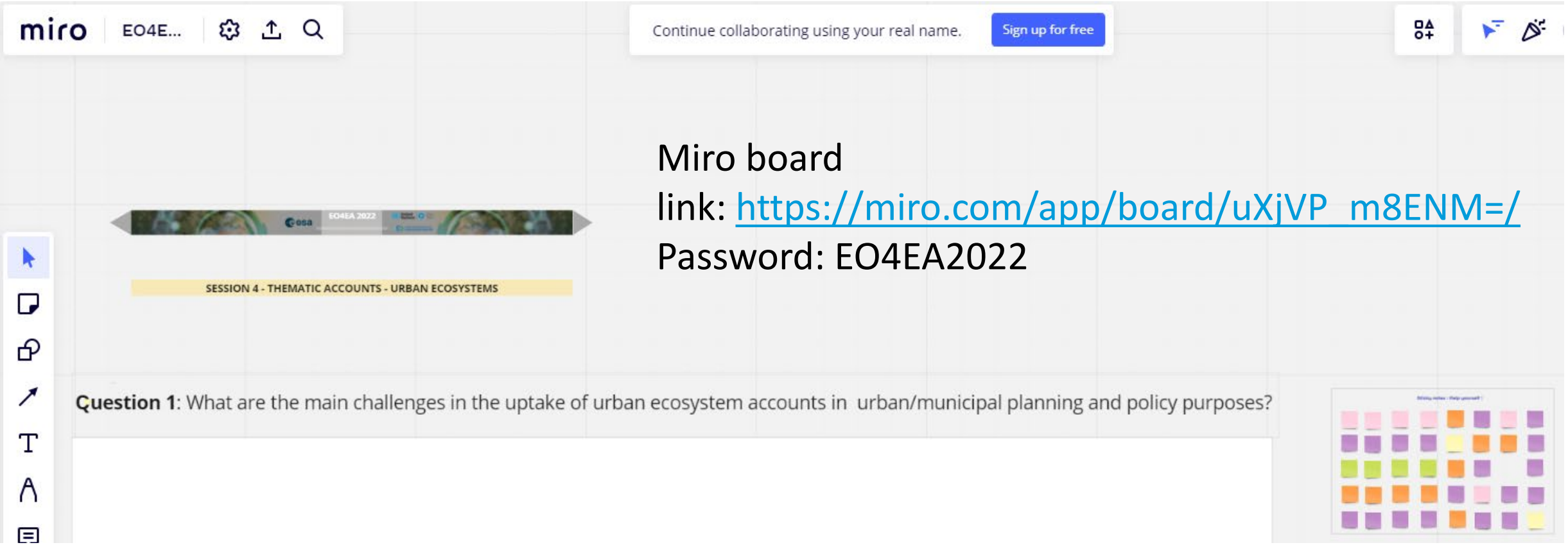
# ACKNOWLEDGEMENTS


URBANECO
Statistics Norway project


MAIA
Mapping and Assessment for Integrated ecosystem Accounting



# DISCUSSION – MIRO BOARD BRAINSTORMING




Miro board
link: https://miro.com/app/board/uXjVP_m8ENM=/
Password: EO4EA2022

**Sticky notes:**

**1. What are the main challenges in the uptake of urban ecosystem accounts for municipal planning and policy purposes?**

**2. What are the priority actions for the next 5 years in urban ecosystem accounting ?**

# Discussion – wrap-up

**1. What are the main challenges in the uptake of urban ecosystem accounts for municipal planning and policy purposes?**

- Understand municipal policy **applications** of urban accounts and their data challenges
- **Diversity** of municipal needs vs. **standardisation** of accounts at national level
- **Sufficient** spatial and temporal **resolution** for municipal purposes
- **Uncertainty** estimation for significant change detection
- Ease of access for municipal purposes (**dashboards**, ad hoc online analytics)
- Complement extent-condition accounts at the national level with **green infrastructure/ asset** accounting at municipal level

**2. What are the priority actions for the next 5 years in urban ecosystem accounting?**

- **Urban boundary definition** and sprawl analysis
- **Differentiate products** for different purposes (change detection, asset valuation)
- '**Super-resolution'** approaches (use of AI for asset identification)
- Integration of EO with big data on **mobility and health**