Urban ecosystem accounting for Oslo – policy motivations

David N. Barton
with contributions from Zofie Cimburova Frank Hanssen, Megan Nowell, Olav Skarpaas, Graciela Rusch

Norwegian Institute for Nature Research

Break out session #2, Group #5 Urban Ecosystems

Forum of Experts in SEEA Experimental Ecosystem Accounting
18. June 2018, Glen Cove, NY

NINA
Norsk institutt for naturforskning

Session discussion points

Key policy issues and indicators

Defining the relevant spatial units

Measuring condition

Describing the key ecosystem services and valuation options

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Defining the relevant spatial units

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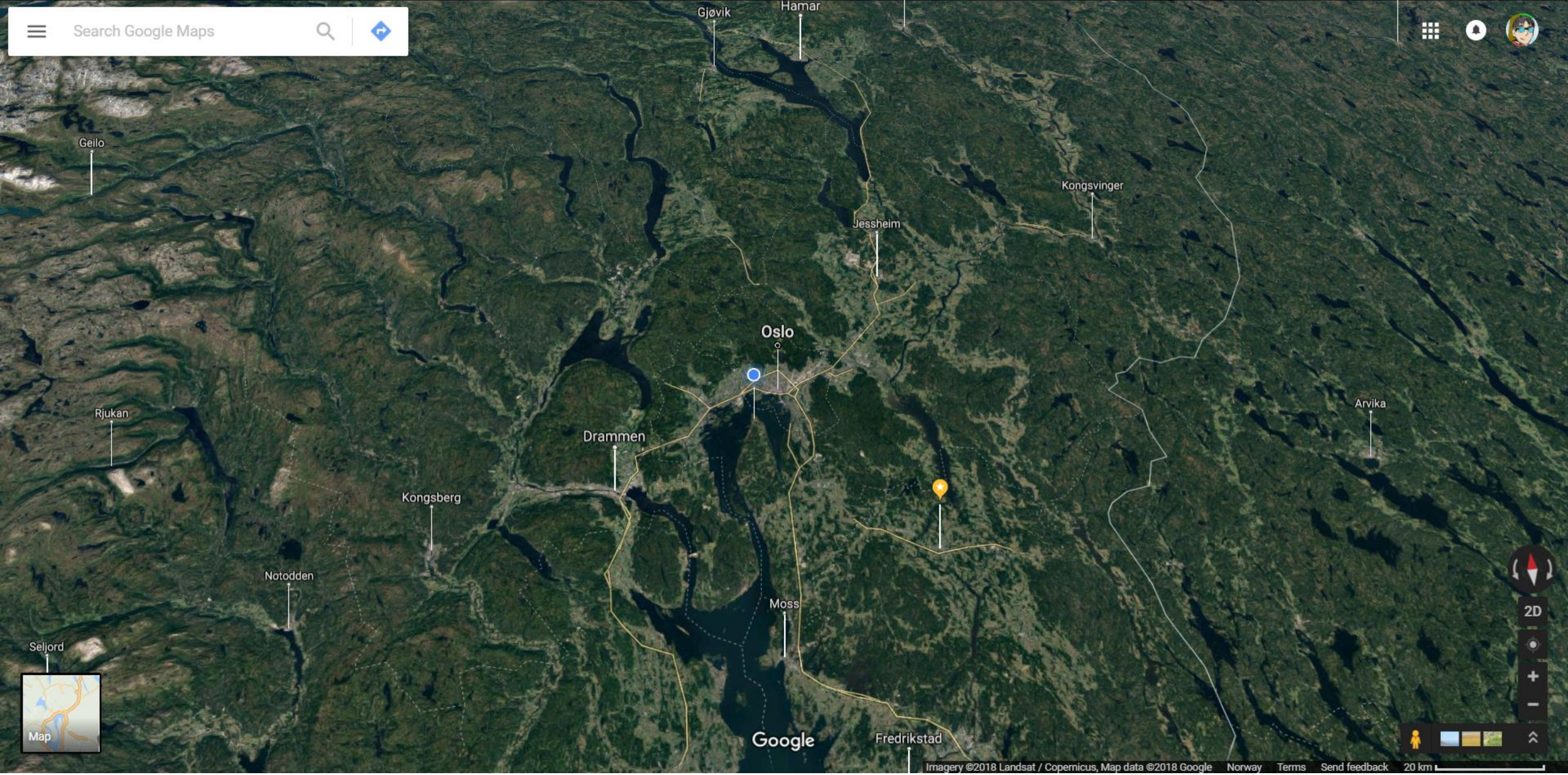
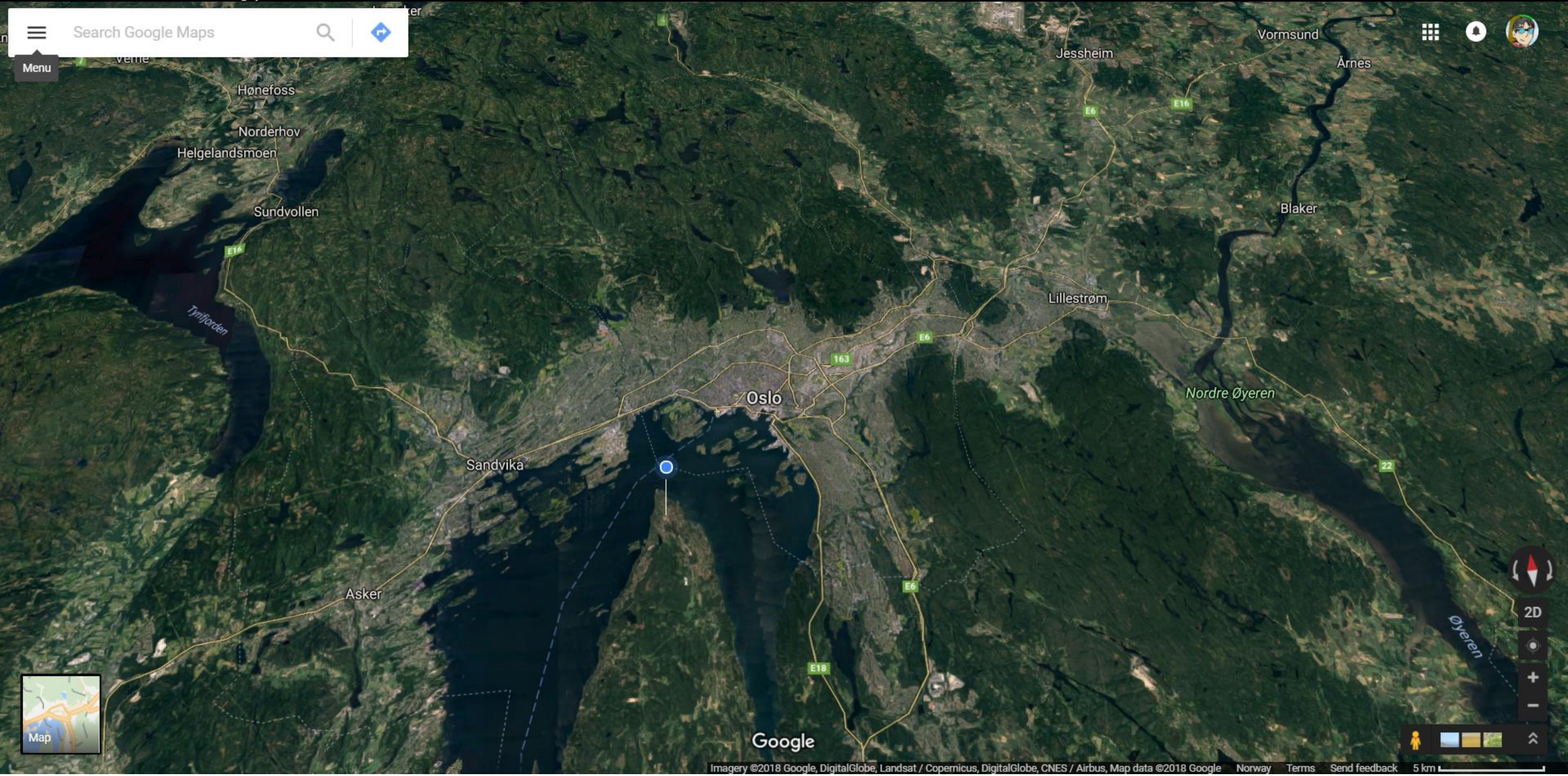
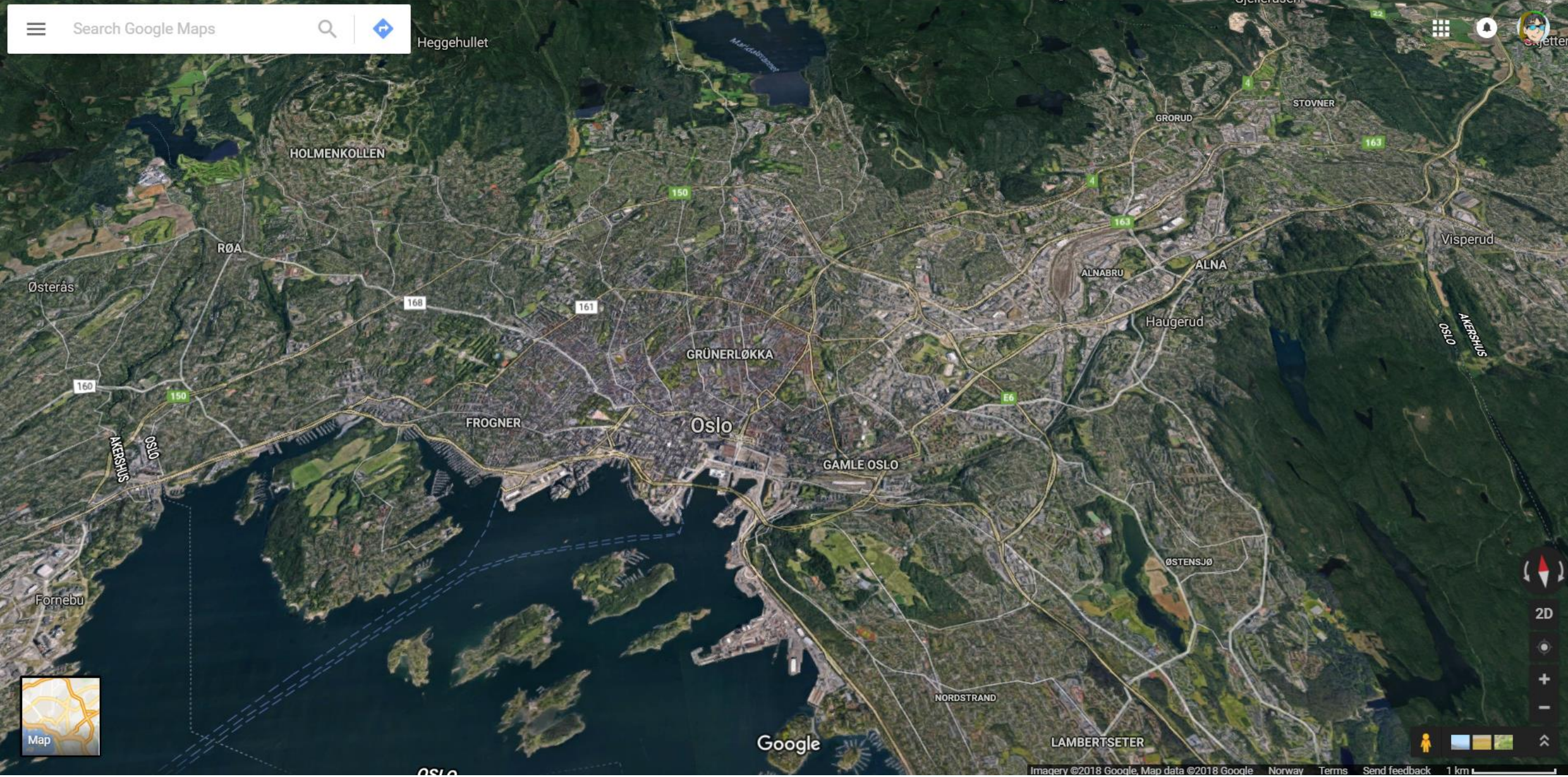
Describing the key ecosystem services and valuation options



Oslo Region – trends in urban extent – sprawl?



Oslo Municipality – trends land use composition (built, forest, agriculture)



Oslo built zone - zoning of development, restoration

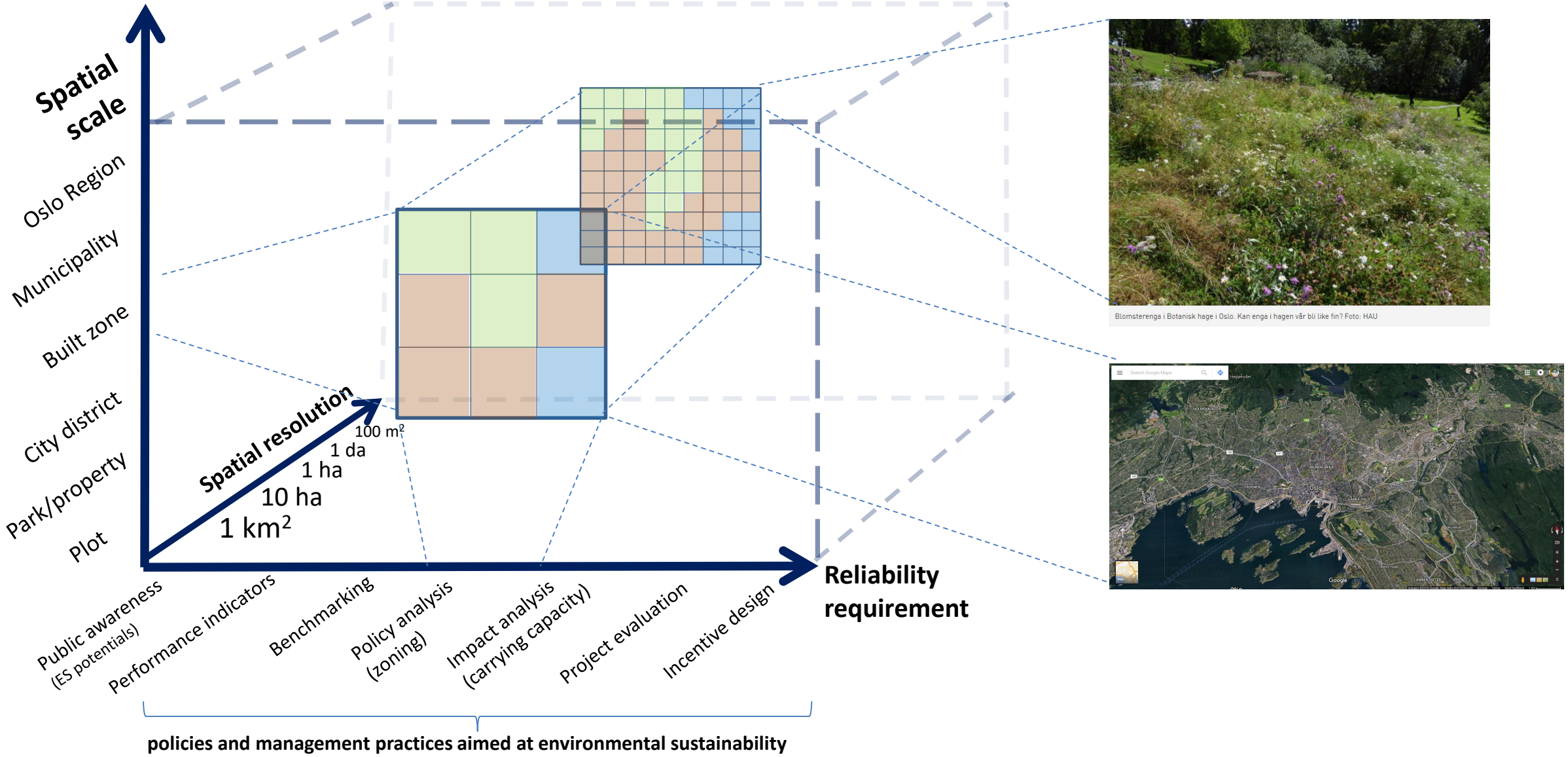
City district - accessibility to services

City park – landuse management

Blomsterenga i Botanisk hage i Oslo. Kan enga i hagen vår bli like fin? Foto: HAU

Lawn or meadow - land use practice

Policy purposes and ecosystem services mapping and assessment



Blomsterenga i Botanisk hage i Oslo. Kan enga i hagen vår bli like fin? Foto: HAU

Source: D.N. Barton adapted from Zulian, G. et al. (2017) Practical application of spatial ecosystem service models to aid decision support (in press) Ecosystem Services

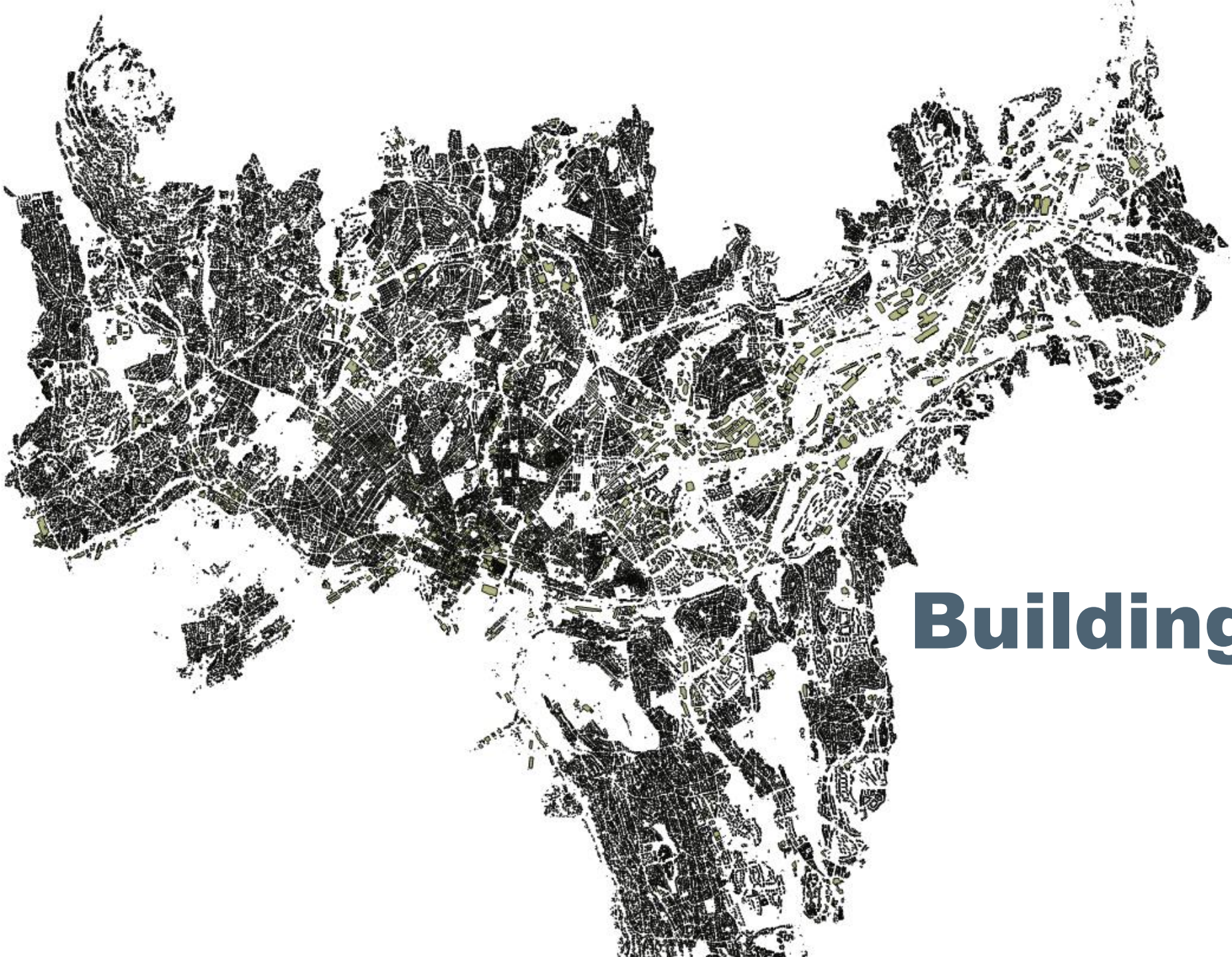
Key policy issues and indicators

Defining the relevant spatial units

Measuring condition & biodiversity

Describing the key ecosystem services and valuation options

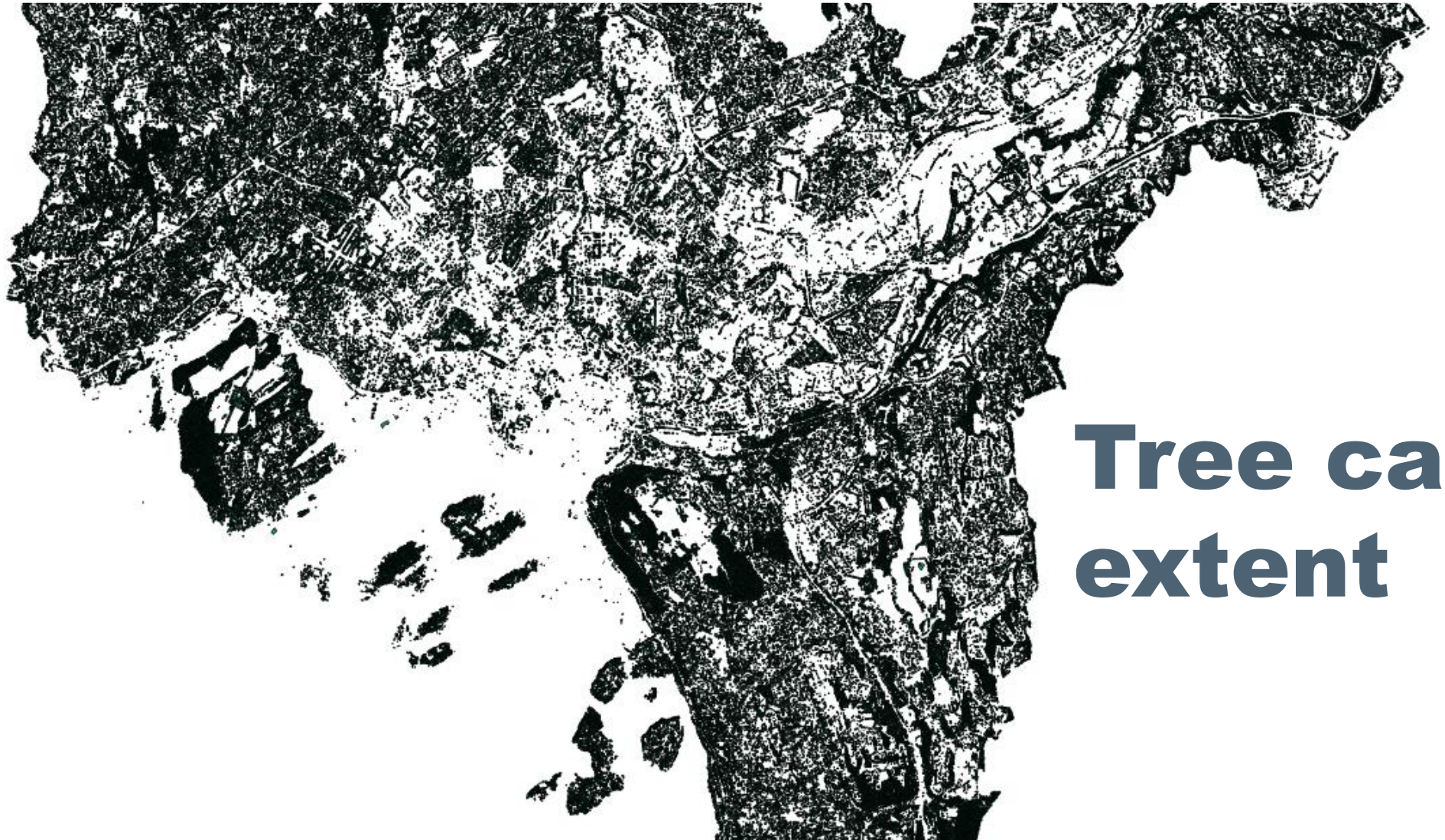
??????? extent



Building extent

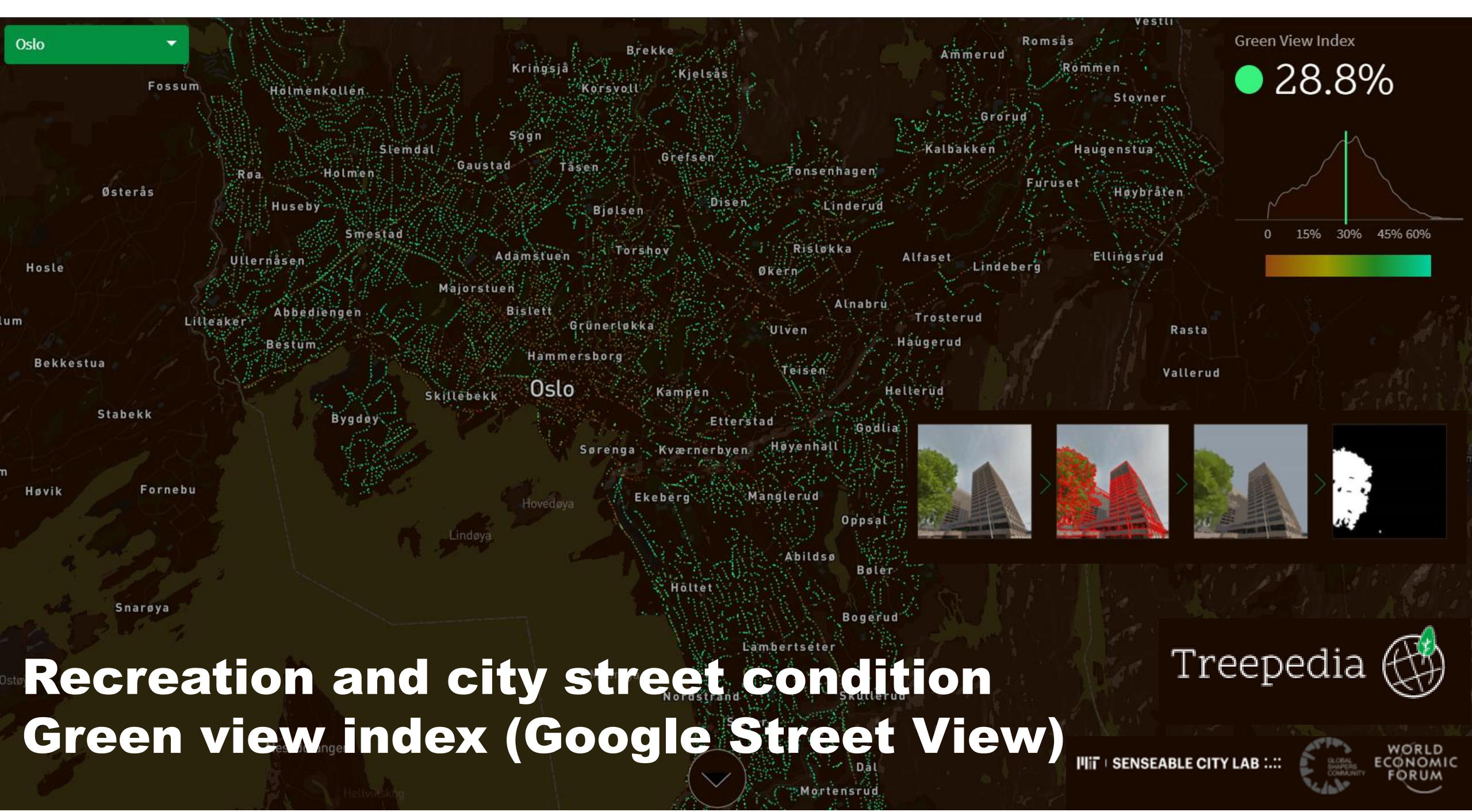
???? ??????
extent

	Inner city (within ring road 2)	Total of Oslo's built zone
Total building area (ha)	410 has	2244 has
Total tree canopy area (ha)	512 has	5031 has



Tree canopy extent

Lidar detected Tree canopy

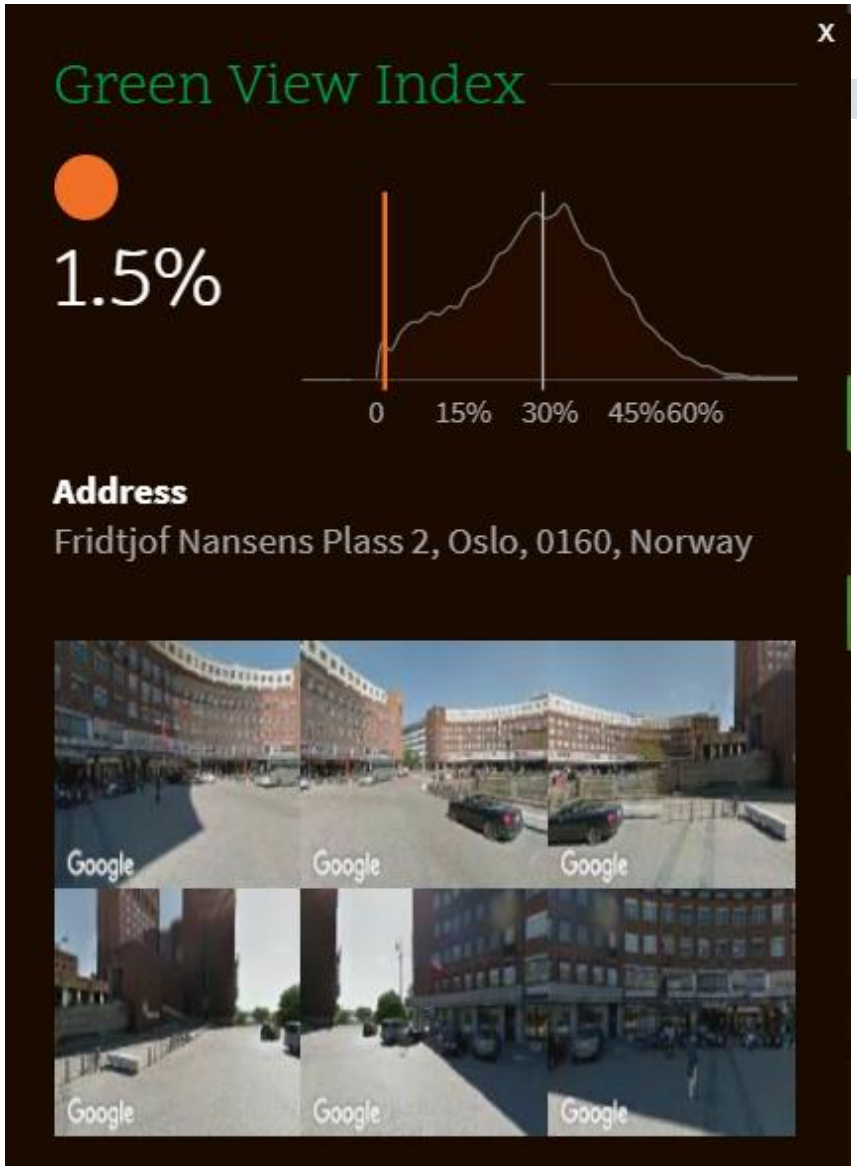


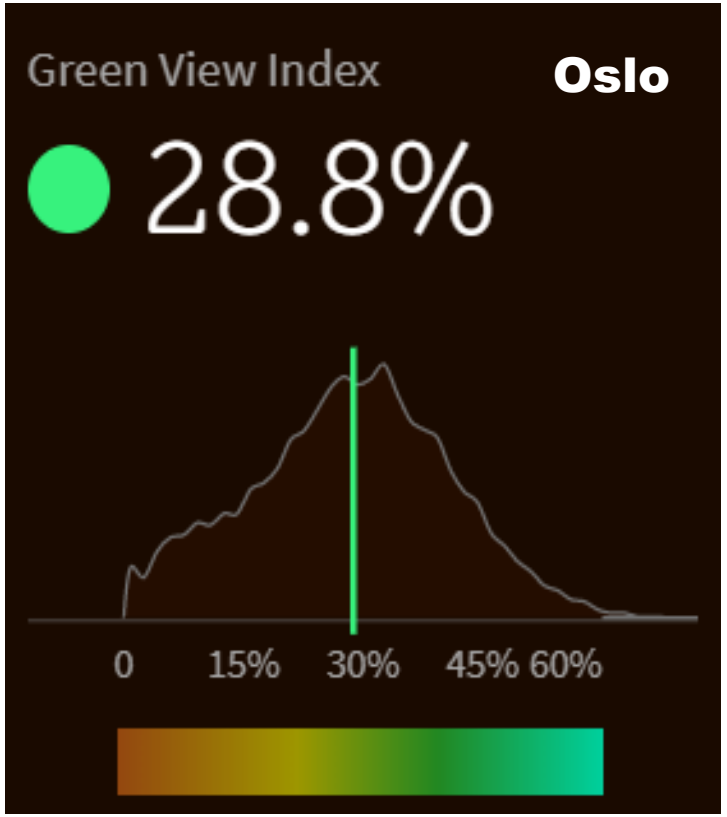
Recreation and city street condition
Green view index (Google Street View)

Estetikk

Index of condition for recreation in city streets?

Rekreasjon, mental og fysisk helse





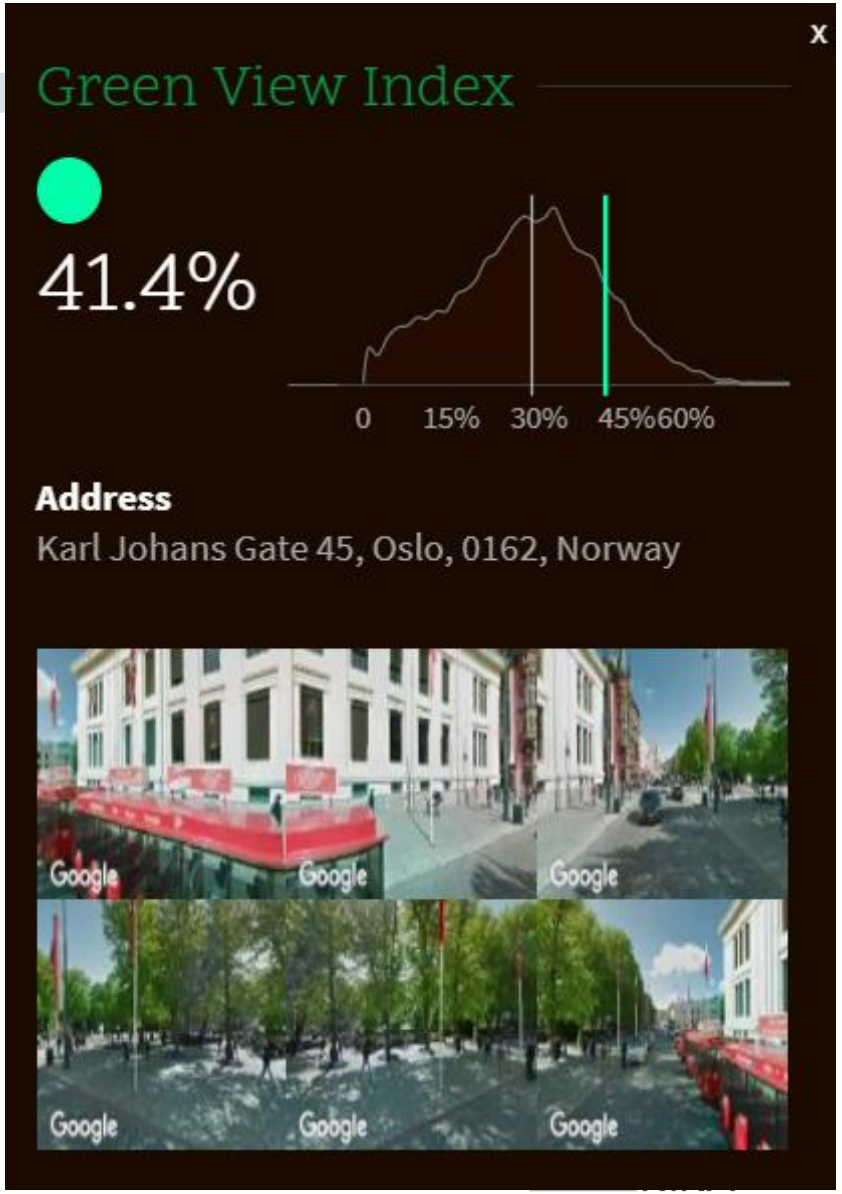
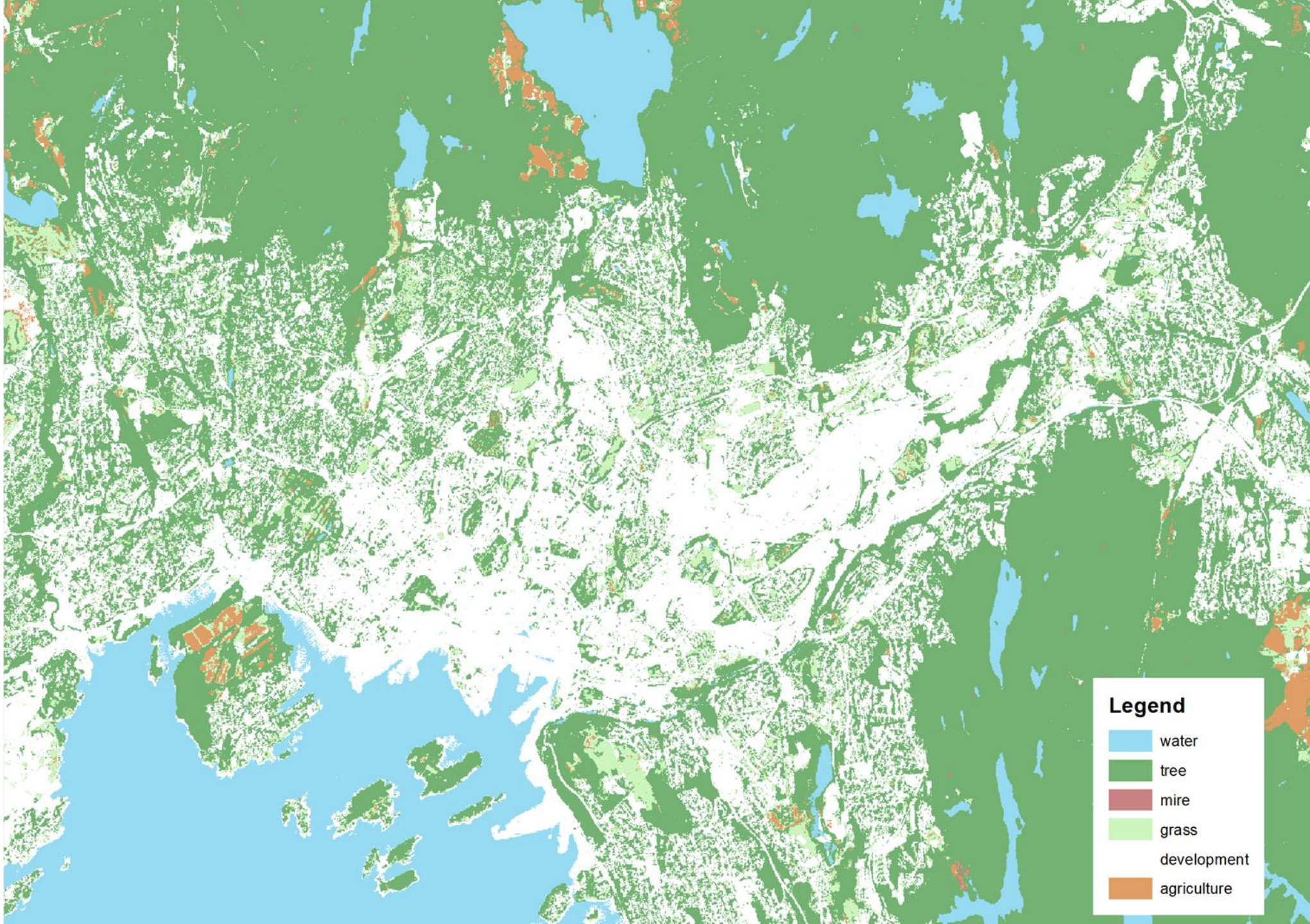


Foto: Vegard Gundersen

www.nina.no



Marka Wilderness

Marka interior

Entry points Marka

Natural areas in built zone

Parks & cemetaries

Built area with trees

Total hours on-site/yr

Total visits/yr.

- Millions 10 20 30

Legend

water

tree

mire

grass

development

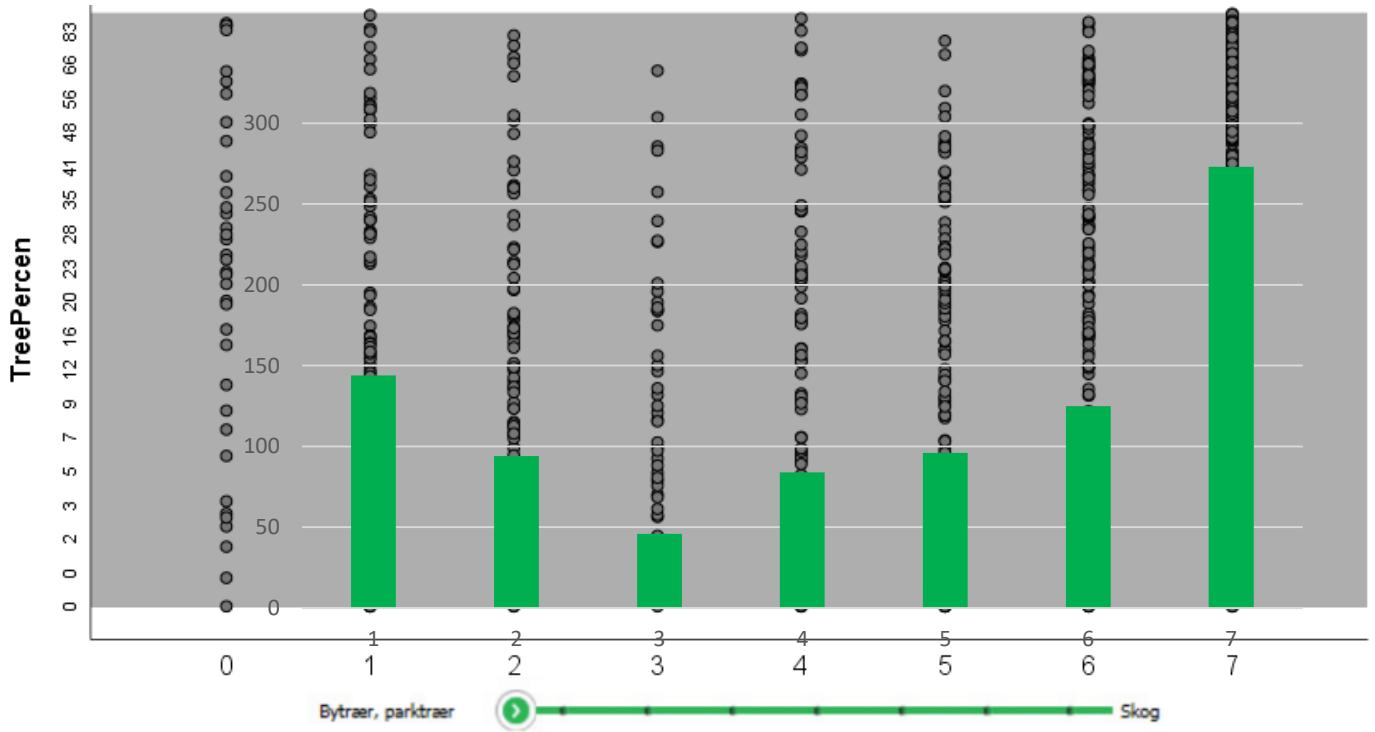
agriculture

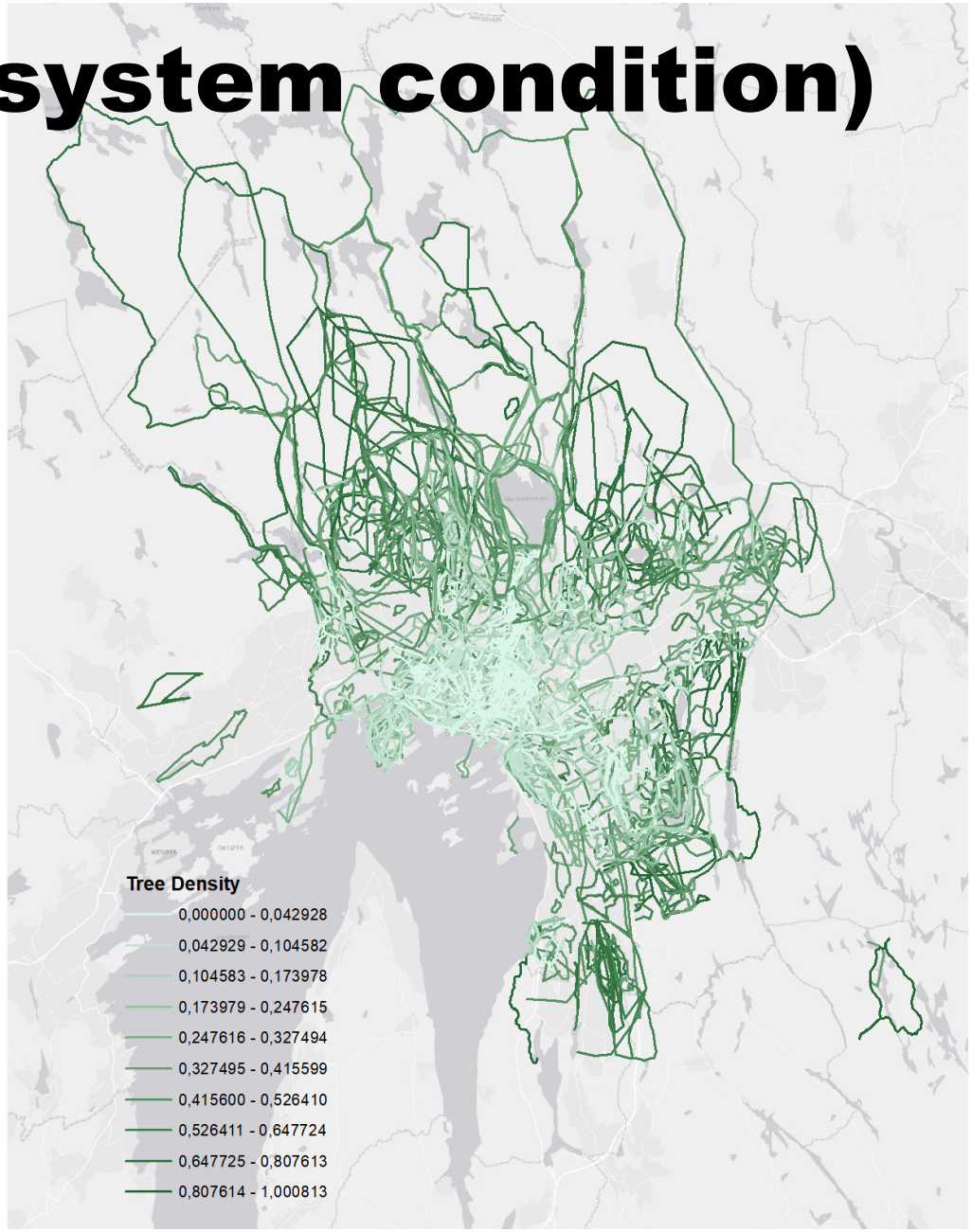
Data: Q9_2OSLOpenNESS web-survey 2016

Foto: Vegard Gundersen

Recreation service = f(ecosystem condition)

Inhabitants favourite recreational walks are significantly correlated with self-reported preference for tree canopy density

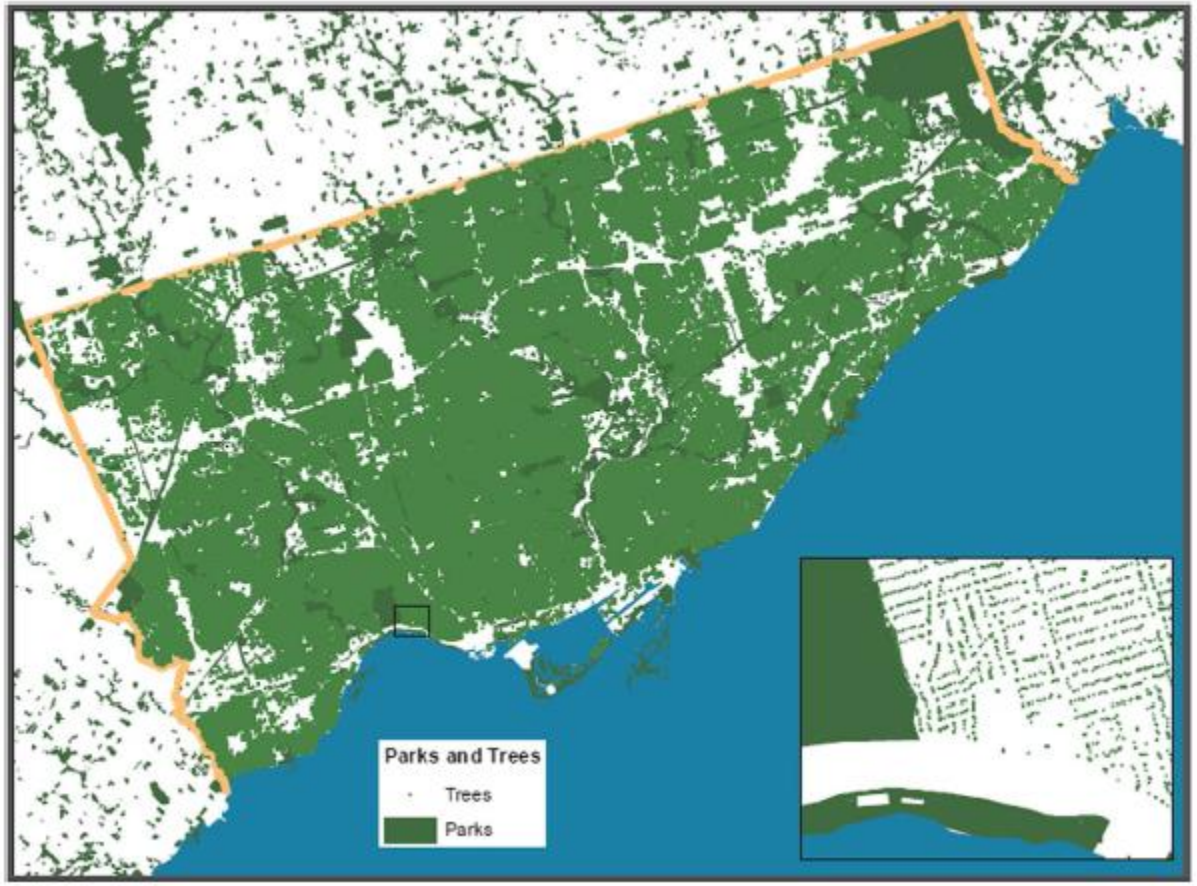


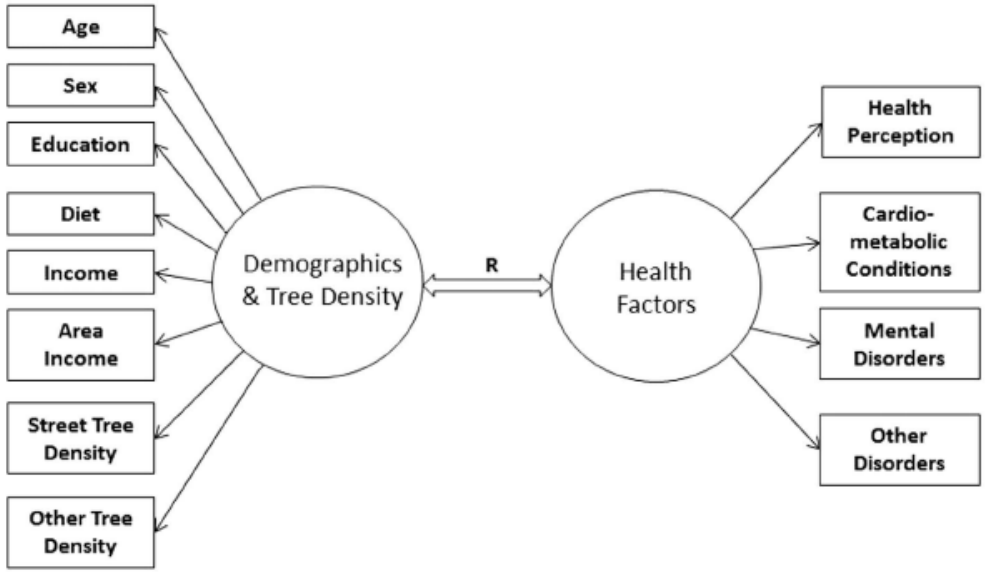


Analysis: Megan Nowell, NINA. Data: Q9_2OSLOpenNESS web-survey 2016

Rekreasjon, mental og fysisk helse

Health effects of urban tree canopy





SCIENTIFIC REPORTS

OPEN

Neighborhood greenspace and health in a large urban center

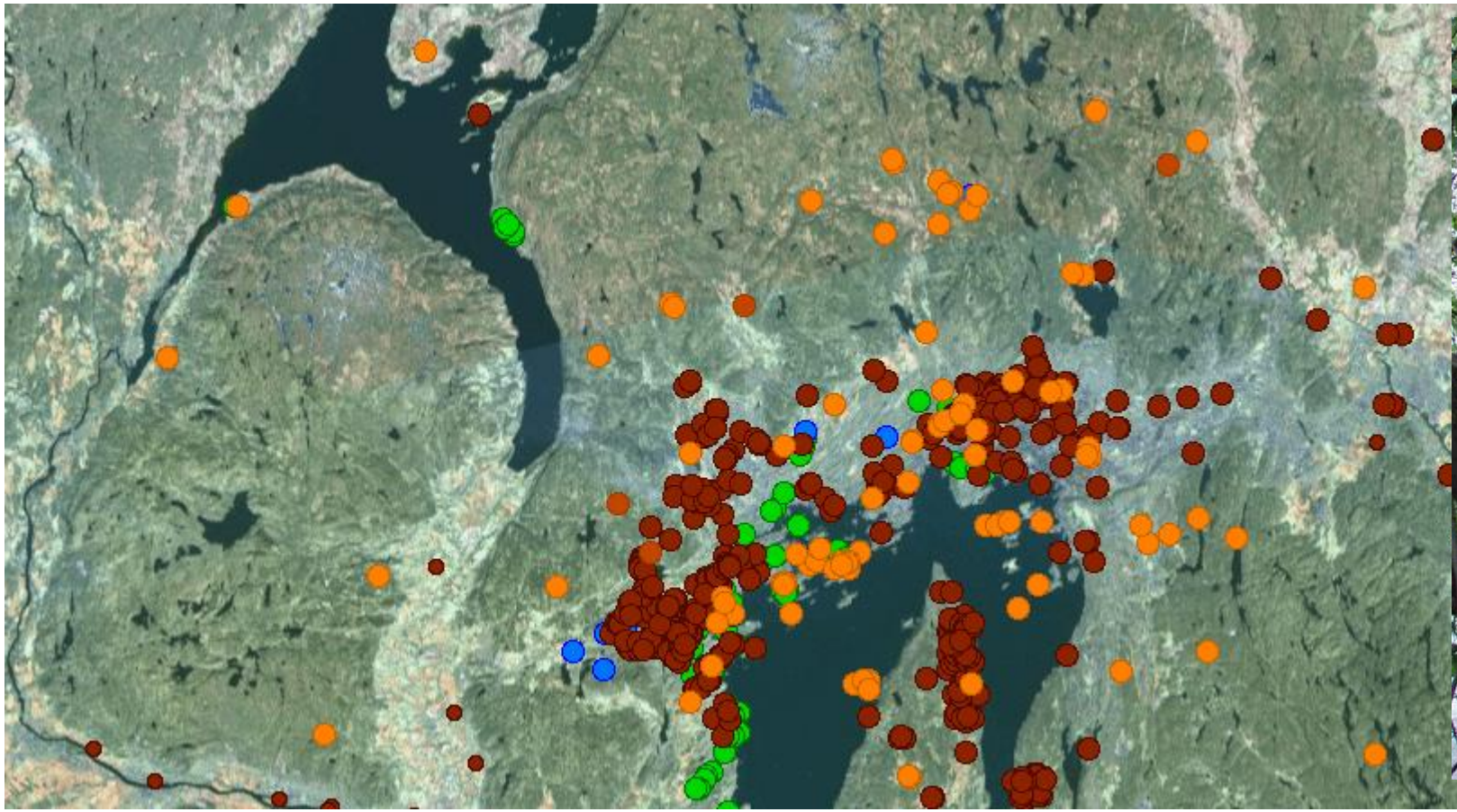
Omid Kardan[1], Peter Gozdyra[2], Bratislav Misic[3], Faisal Moola[4], Lyle J. Palmer[5], Tomáš Paus[6] & Marc G. Berman[1,7]

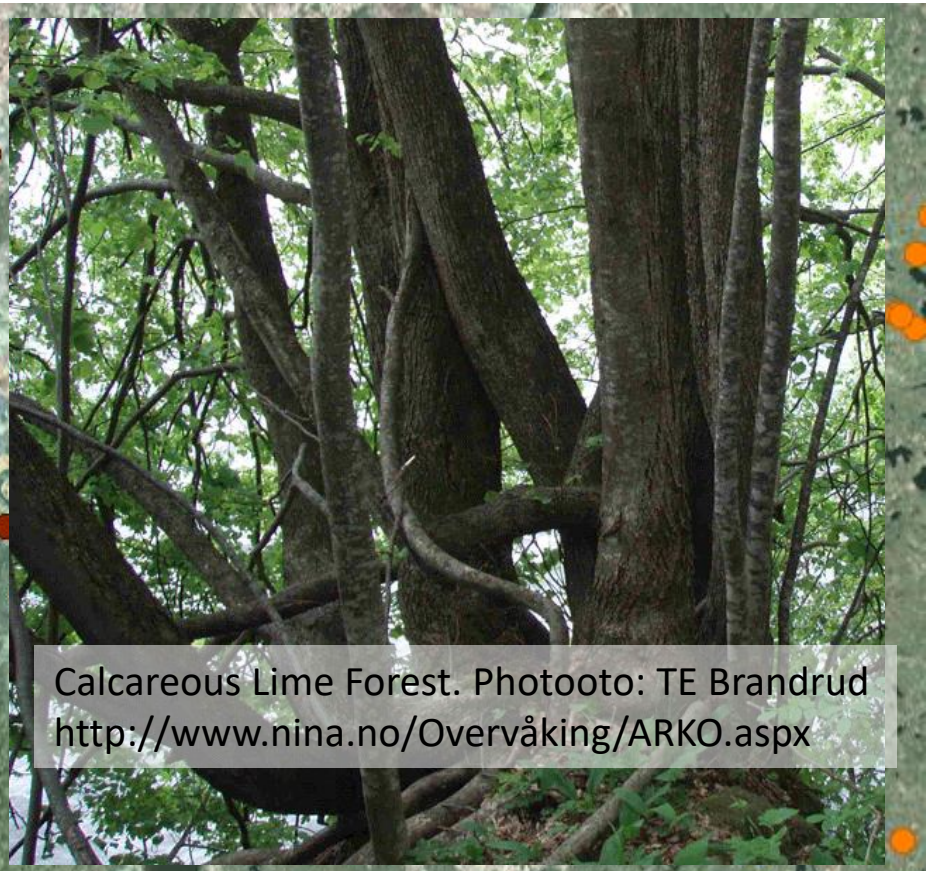
Vancouver

10 more trees/city block on average improve perceived health equivalent to a **7 year younger person.**

11 more trees/city block, on average, reduces **chardiometabolic illness** comparable to a **1.4 year younger person**

Protected nature types in Oslo





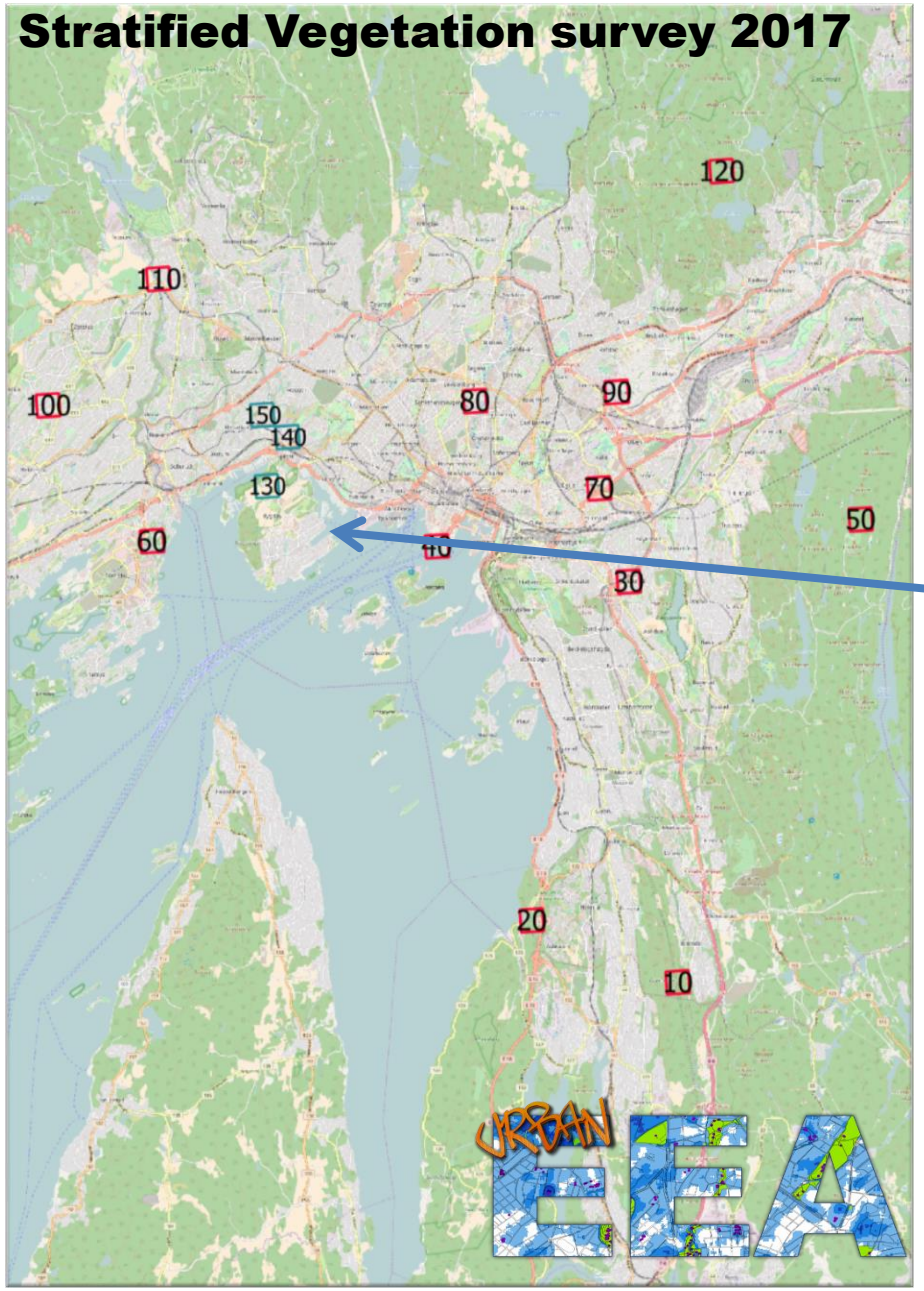
Calcareous Lime Forest. Photooto: TE Brandrud
http://www.nina.no/Overvåking/ARKO.aspx

Protected Nature Types Naturbase: http://kart.naturbase.no/.

Slide: Olav Skarpaas

Artsdatabanken: 11554 species, 1186 red listed species

Higher biodiversity in the built zone than in the peri-urban forest!



3 biologists

40 minutes

70 plant species

10x10m plot

Bygdøy 11. May 2017

Slide: Olav Skarpaas

Pollinator diversity in the urban built zone

Urban SIS

Pollinators in Oslo's built zone
Species group diversity





Honey bees	Bumble bees	Solitary wild bees	Flower flies	Sum specimens trapped
331	294	342	276	1 243

Bumble bees: 15 species, almost ½ of Norway's species (35)

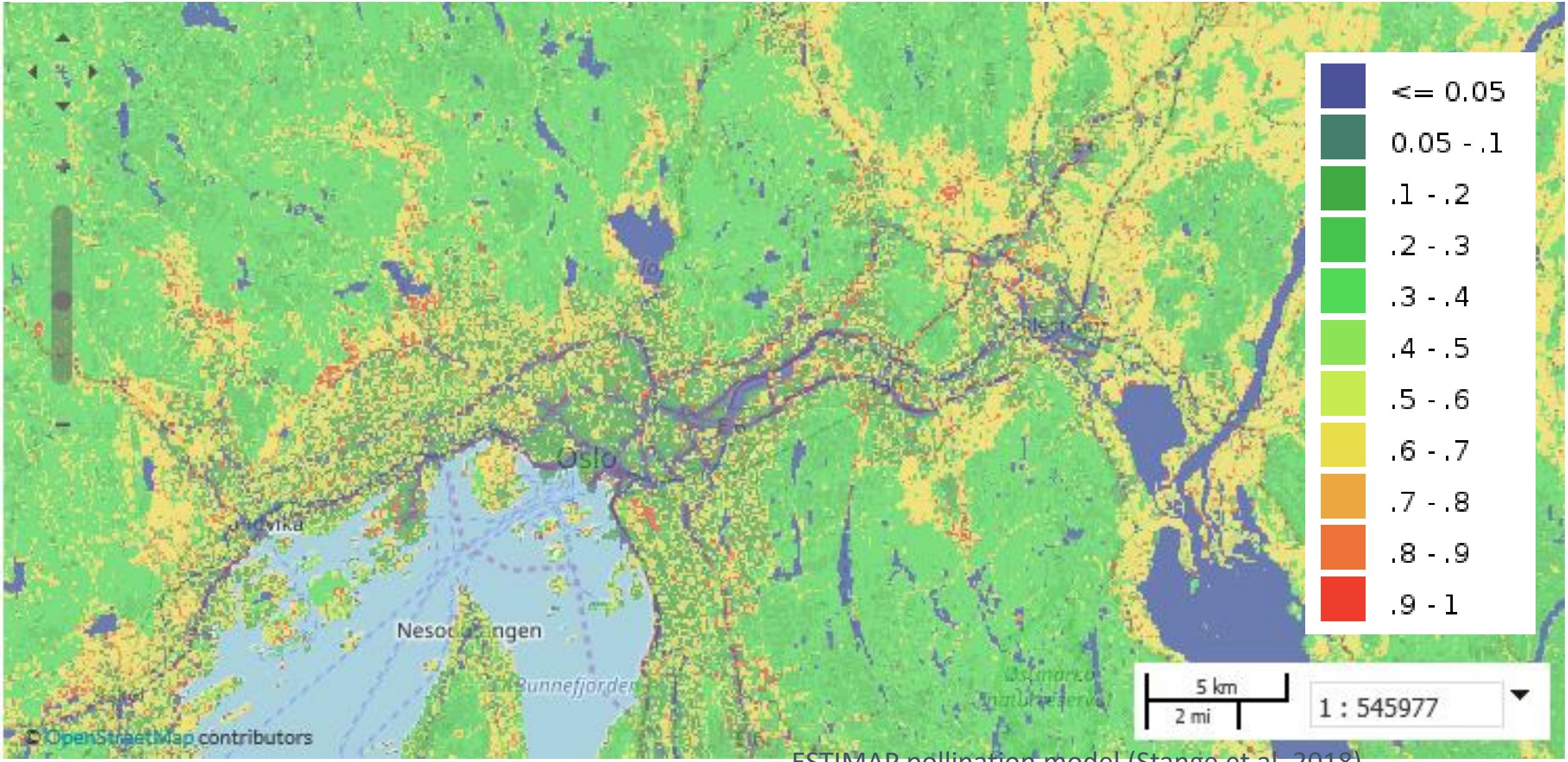
Wild solitary bees: Solitary bees, 32 species

Slide: Graciela Rusch, NINA

Urban SIS

Pollinering og frøspredning

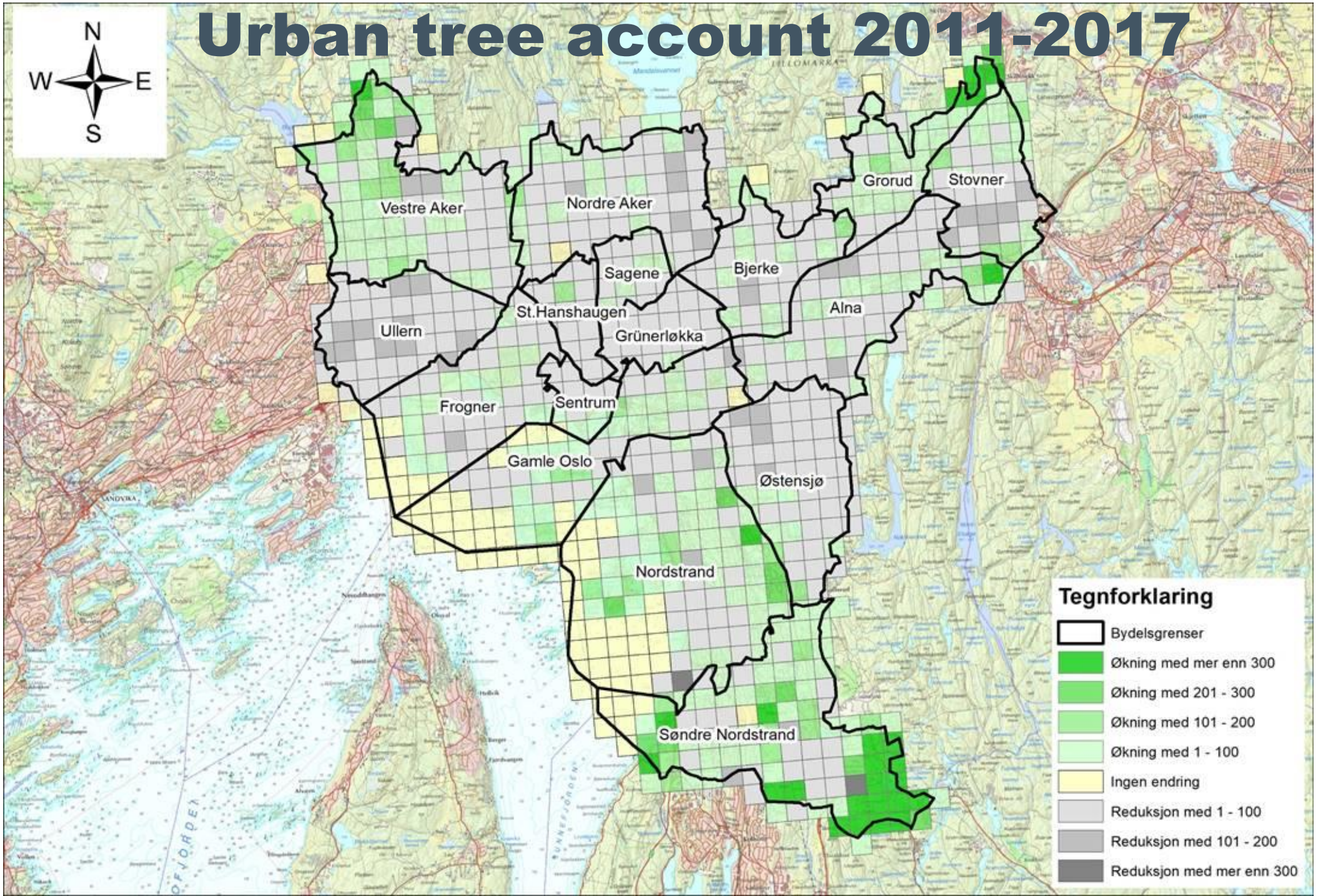
Pollinator habitat suitability



ESTIMAP pollination model (Stange et al. 2018)

Recap: Policy motivations for accounting for urban ecosystems at high spatial resolution

Urban tree account 2011-2017



Source: Frank Hanssen

Foto: David N. Barton

Forskningsrådet

biodiversa

SEVENTH FRAMEWORK PROGRAMME

OSLOpenNESS

URBAN EEA

ENABLE

New Water Ways

SUSTAINABLE URBAN WATER MANAGEMENT

Urban SIS

Kontakt: david.barton@nina.no

NINA

Discussion questions

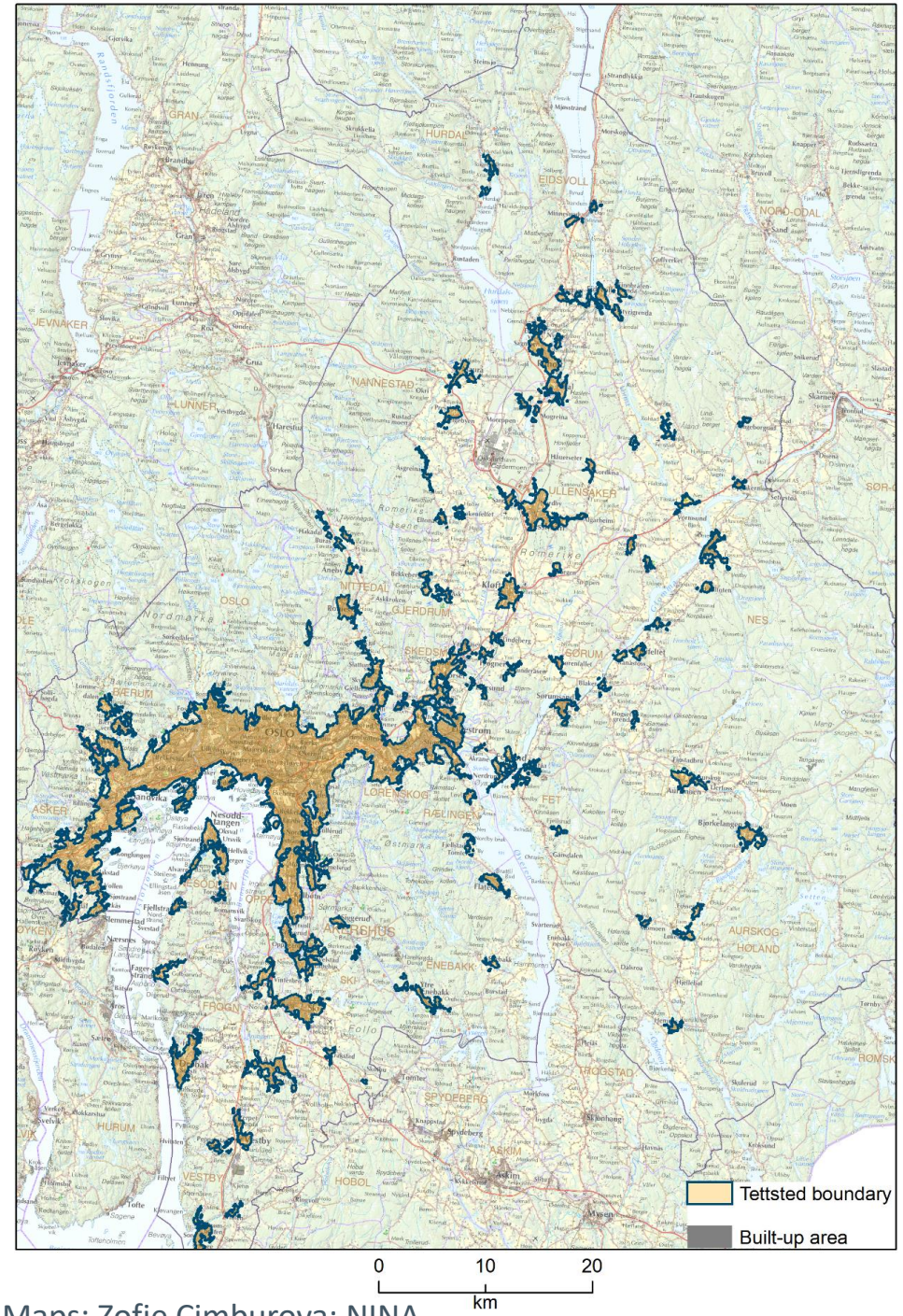
- What is an urban ecosystem?
- Why urban ecosystem accounting?
  - Urban as lab for testing ecosystem accounts.
  - Scarcity of green, high demand, high context richness

- Challenge: Mapping ecosystem extent or condition?

- Selecting monetary valuation methods? Policy relevance vs accounting consistency. Examples: Hedonic property pricing, Travel cost, Avvoided, Life years lost.

What is an urban ecosystem?

What is an urban ecosystem?



Maps: Zofie Cimburova; NINA

Figure 1 Urban ecosystem boundary derived from Statistics Norway "densely built land"

Urban ecosystem boundary of Greater Oslo

(EFTEC 2017 UK buffer approach)

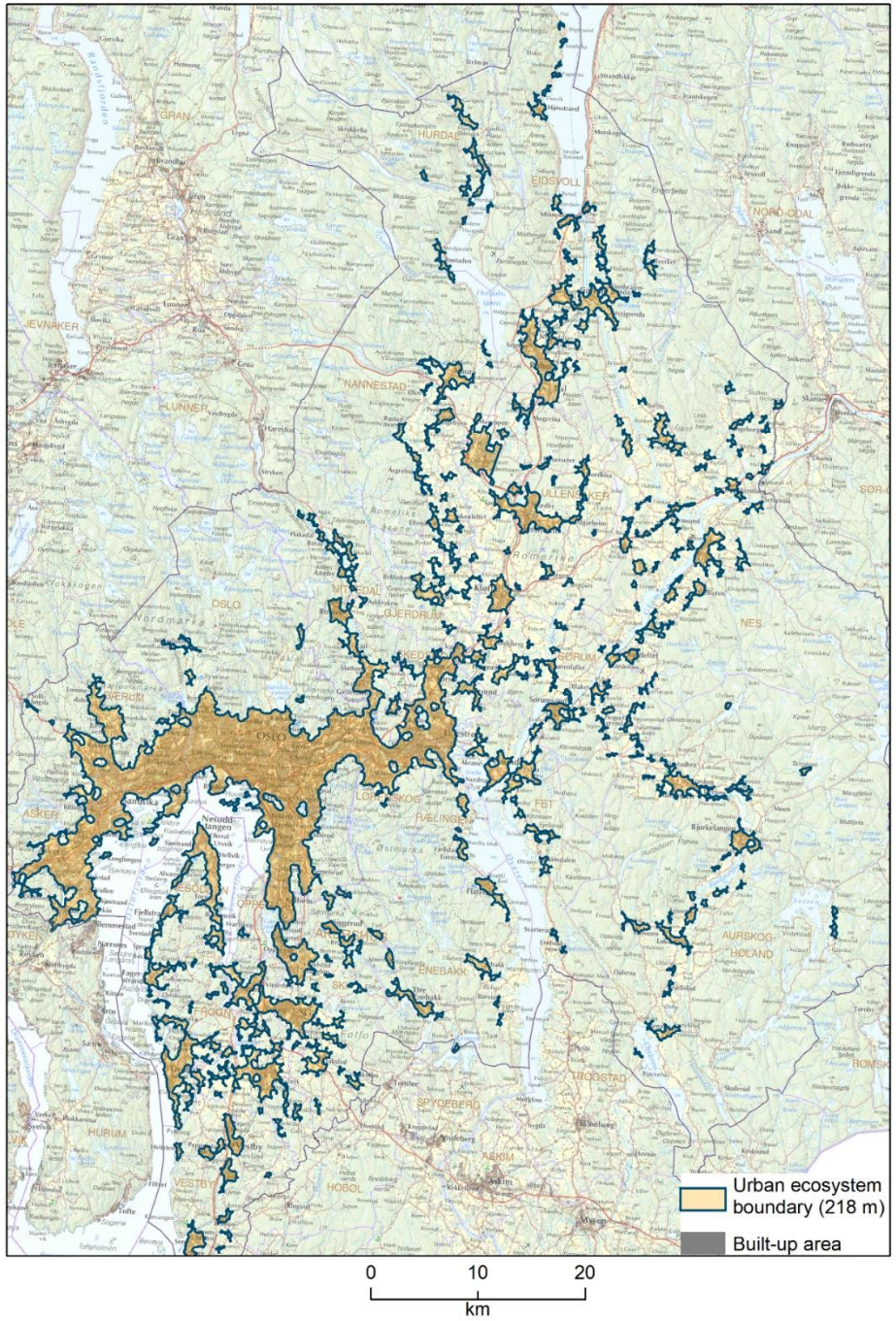


Figure 2 Urban ecosystem boundary computed by EFTEC method, distance = 218 m

Maps: Zofie Cimburova; NINA

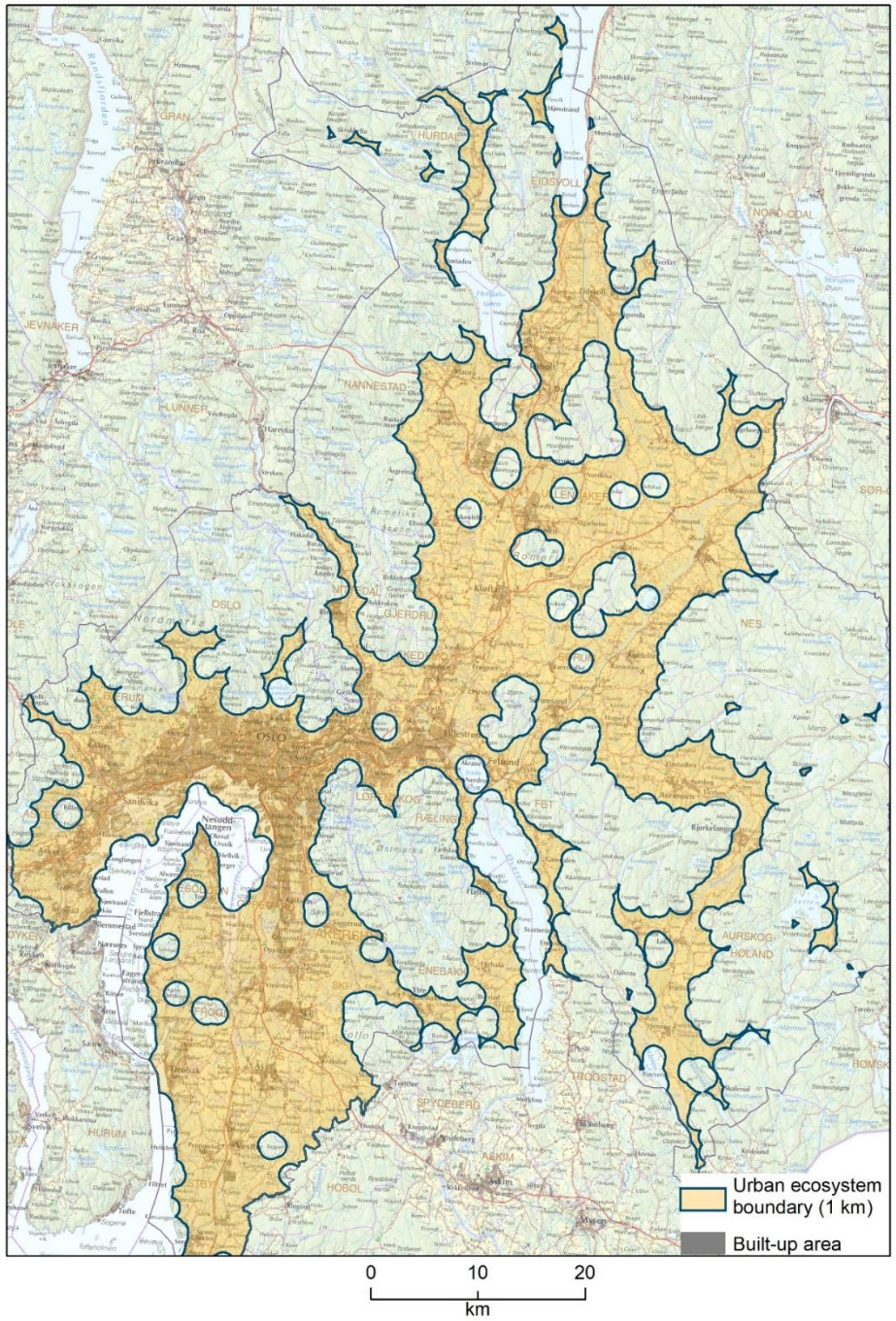
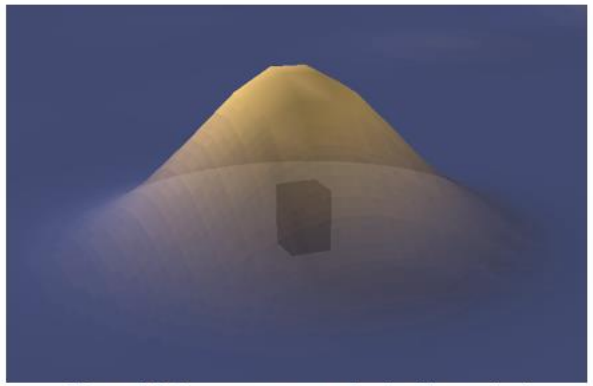
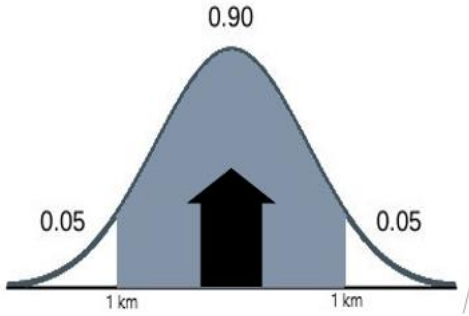


Figure 3 Urban ecosystem boundary computed by EFTEC method, distance = 1 km

Urban ecosystem boundary of Greater Oslo Zone of influence approach



Figur 1 Influence zone of a built-up pixel



Figur 2 Influence zone shape and size

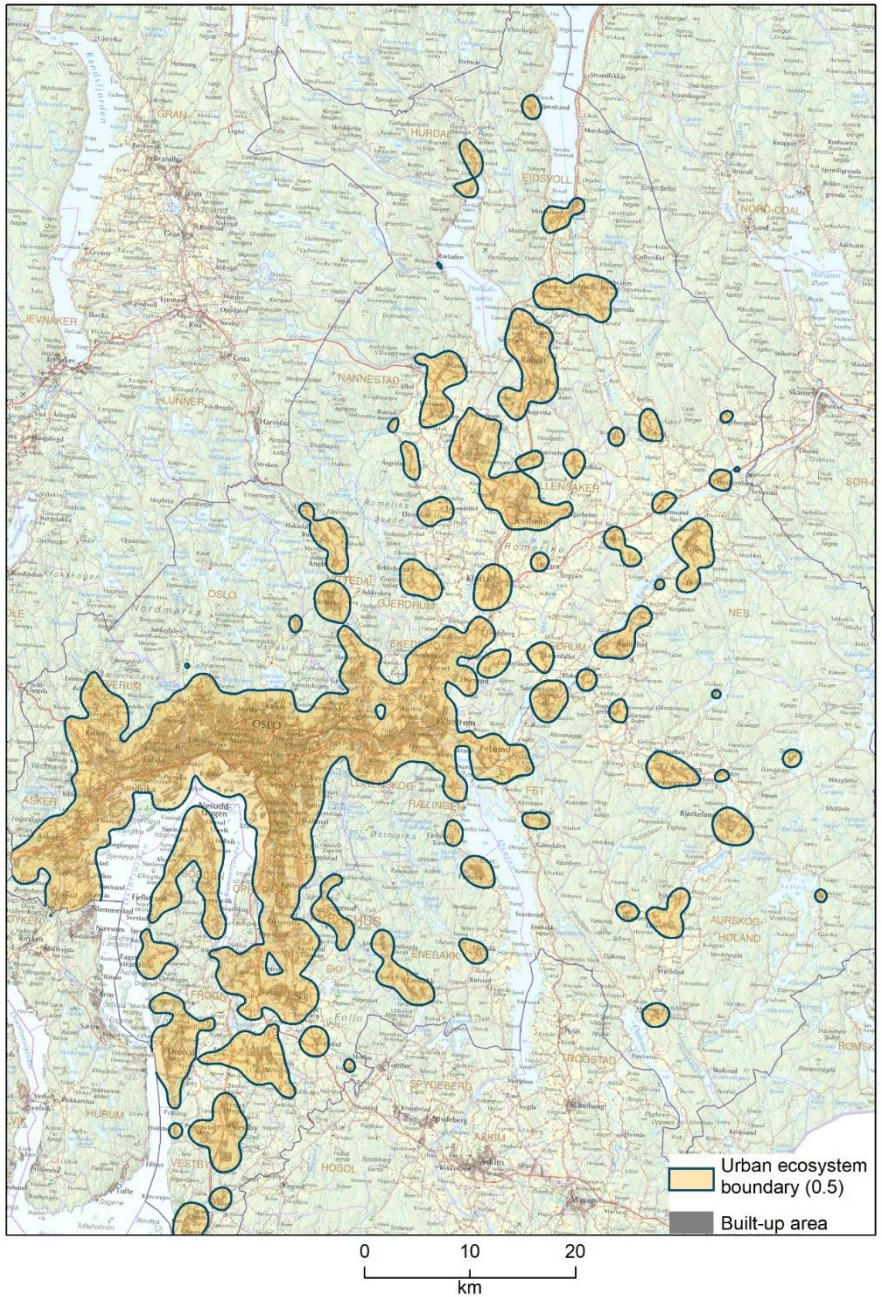


Figure 4 Urban ecosystem boundary computed by influence zone method, threshold at 0.5

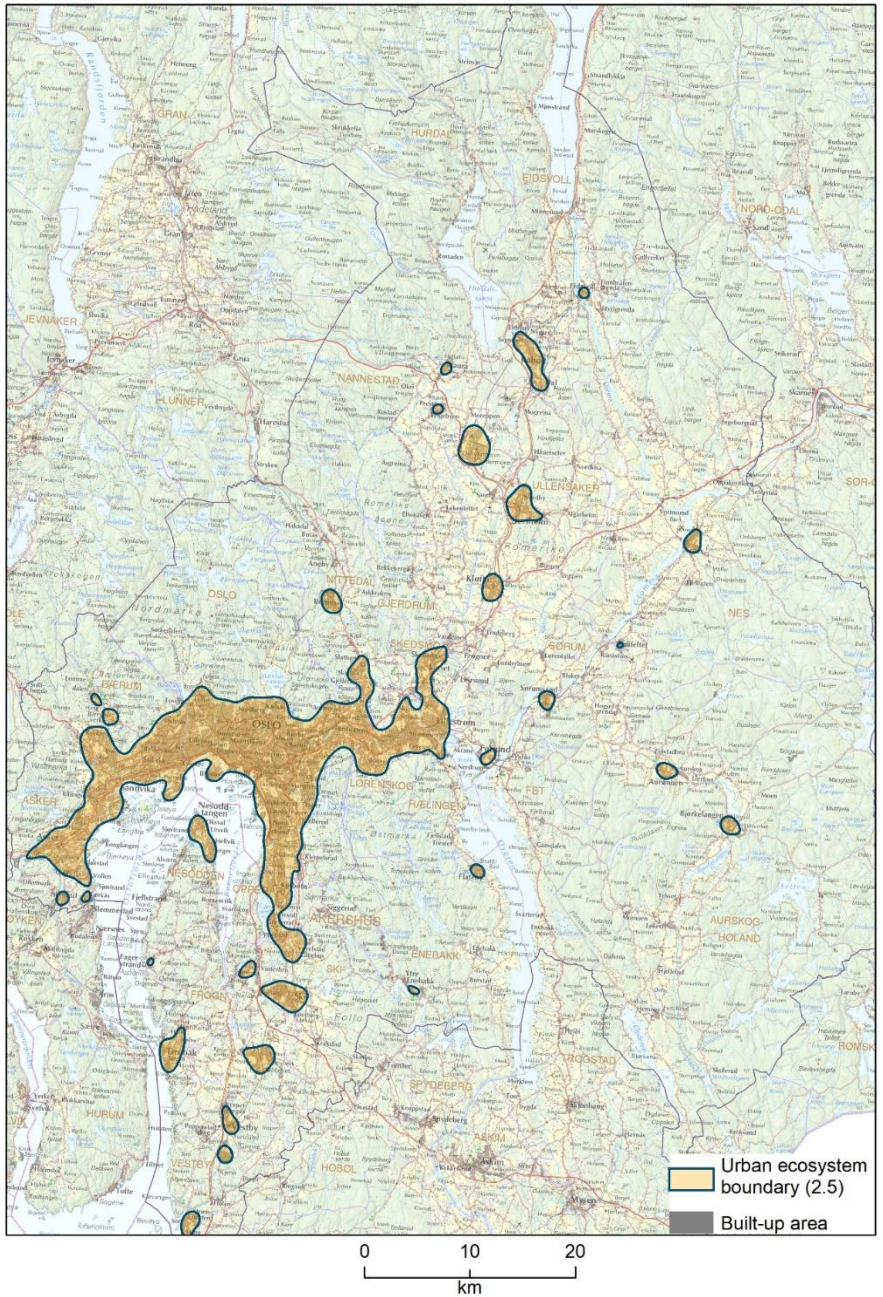
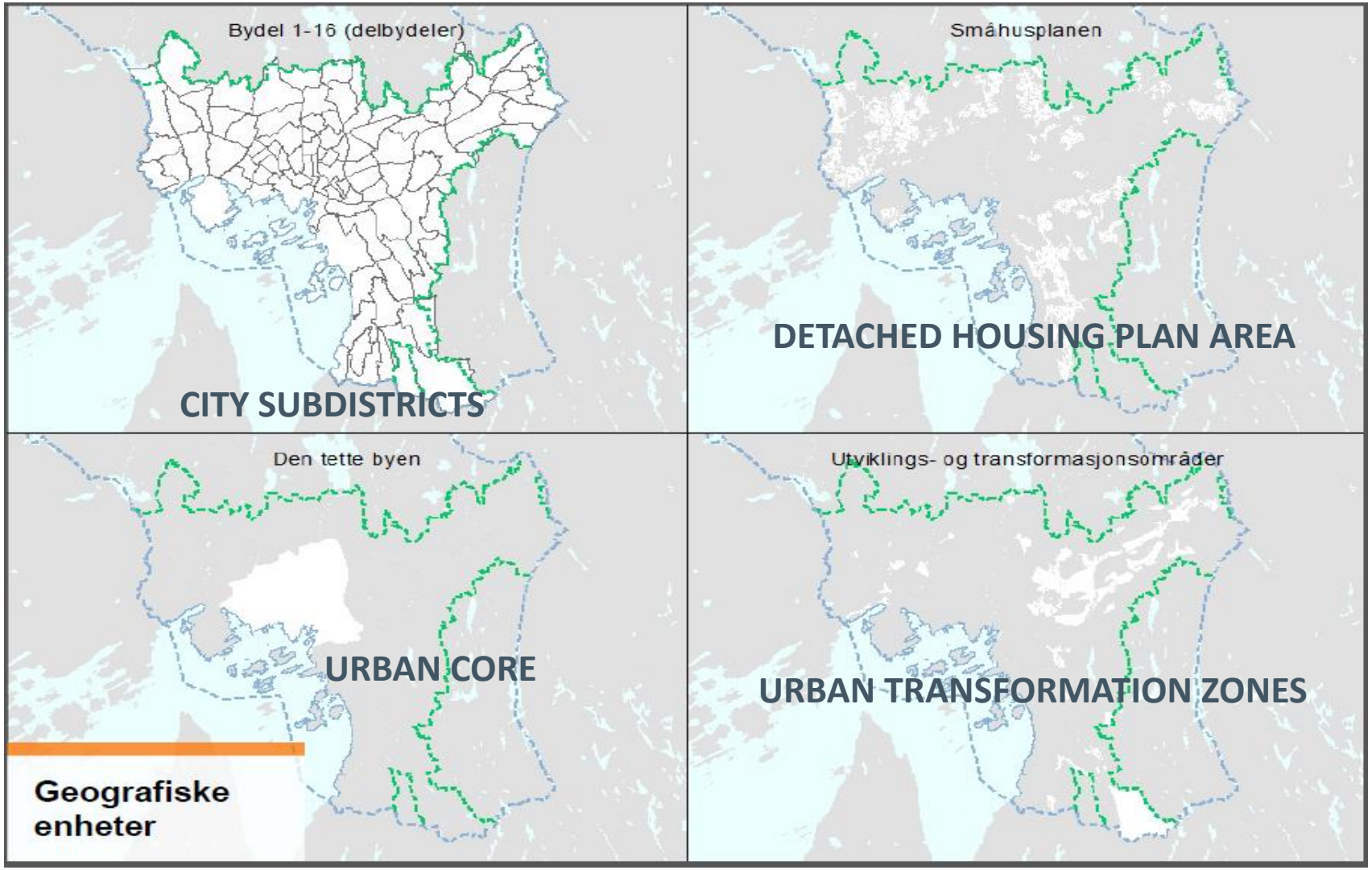


Figure 5 Urban ecosystem boundary computed by influence zone method, threshold at 2.5

Source: Zofie Cimburova; NINA

Statistical reporting units for Oslo «green cover accounts»



Basic spatial units (I)

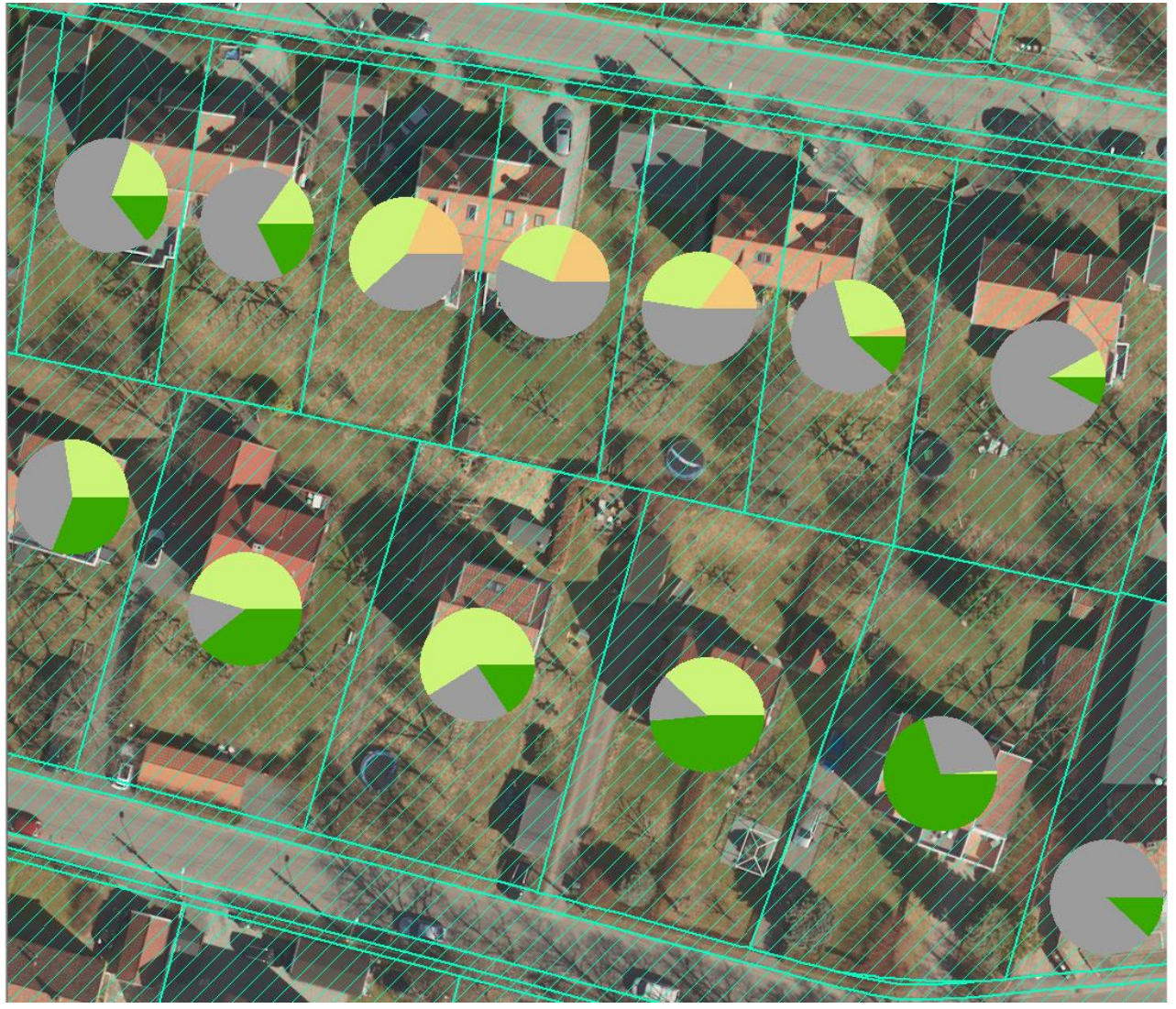
- Sentinel-2 landcover
  - Agriculture
  - Grass
  - Built-up
  - Tree
  - Water

Basic spatial units (II)

- SSB areas
  (*SSB Arealbruk 2015,*
  SSB Arealbruk 2017,
  A2_Arealformal_Ubebygd_StrFordelt,
  B2_Oplareal_Ubebygd_StrFordelt,
  Arealbruk_NyttFra2016til2017)

Smallest statistical reporting unit (plot)

- Proportion of Sentinel-2 class in SSB areas (cartodiagram)
  - Agriculture
  - Grass
  - Built-up
  - Tree
  - Water



Smallest statistical reporting unit – pixel averaging

- Proportion of Sentinel-2 class in SSB areas (choropleth)

GREEN INFRASTRUCTURE TYPOLOGY (GIT)

Conceptual matrix
V.11

Ground surfaces (GS)

Terrestrial surfaces (TS)

Impervious surfaces

- Artificial (Hard surfaces & pavements)
- Natural (Bare rock)

Bare surfaces

- Porous pavements
- Bare soils, sands & perennial snow

Vegetated surfaces

- Non-irrigated
- Irrigated

Aquatic surfaces (AS)

Vegetated

- Wetland (marsh, swamps, mangroves)

Non-vegetated

- Open water (lakes, rivers, oceans)

Building structures (BS)

Roof structures (RS)

Intensive

- Intensive semi-vegetated
- Intensive vegetated

Semi-intensive

- Semi-intensive semi-vegetated
- Semi-intensive vegetated

Extensive

- Extensive semi-vegetated
- Extensive vegetated

Vertical Structures (VS)

Living walls (*rooted on wall*)

- Modular panel & geo-textiles
- Elevated substrate (box, pot, bag)

Green facades (*rooted on ground*)

- Traditional direct system
- Double-skin indirect system

Vegetation layers (VL)

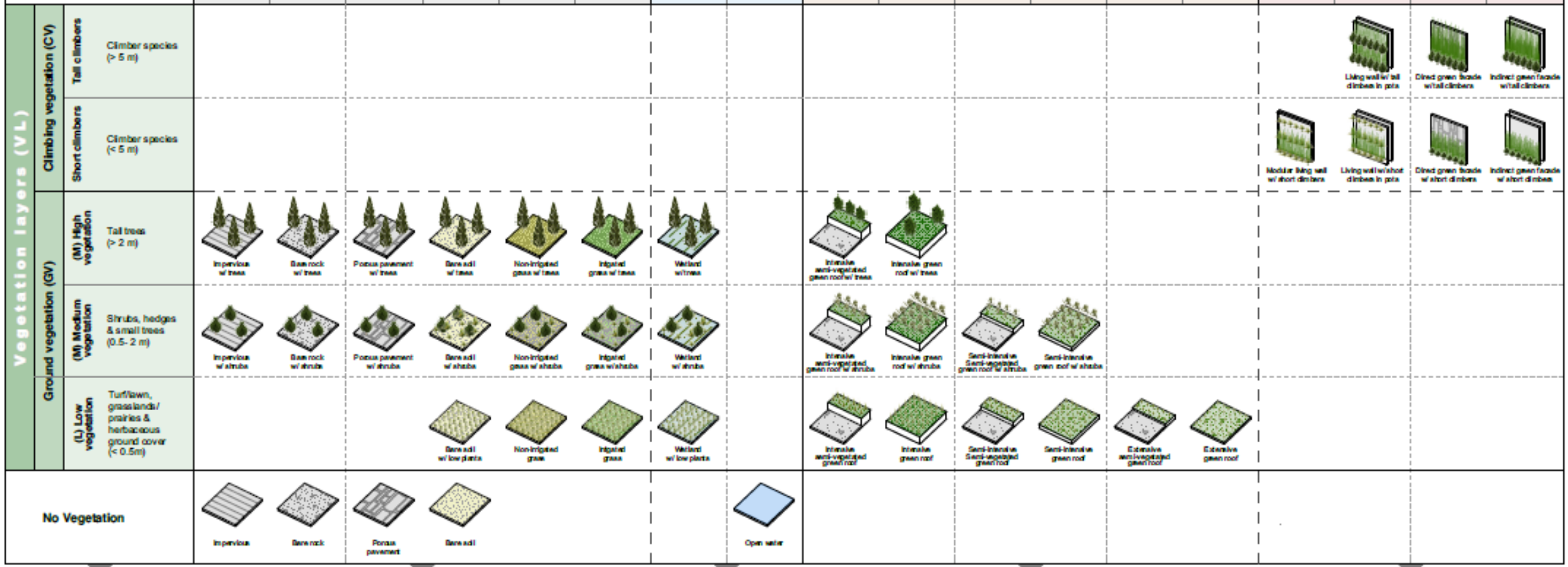
Climbing vegetation (CV)

- Tall climbers: Climber species (> 5 m)
- Short climbers: Climber species (< 5 m)

Ground vegetation (GV)

- (M) High vegetation: Tall trees (> 2 m)
- (M) Medium vegetation: Shrubs, hedges & small trees (0.5- 2 m)
- (L) Low vegetation: Turf/lawn, grasslands/ prairies & herbaceous ground cover (< 0.5m)

No Vegetation



TREE CANOPY (TC) | GREEN OPEN SPACES (GOS) | WATER BODIES (WB) | GREEN ROOFS (GR) | VERTICAL GREENERY SYSTEMS (VGS)

Example of possible combinations

Spatial arrangements

Koc et al. 2017

Challenge: Mapping ecosystem extent or condition?

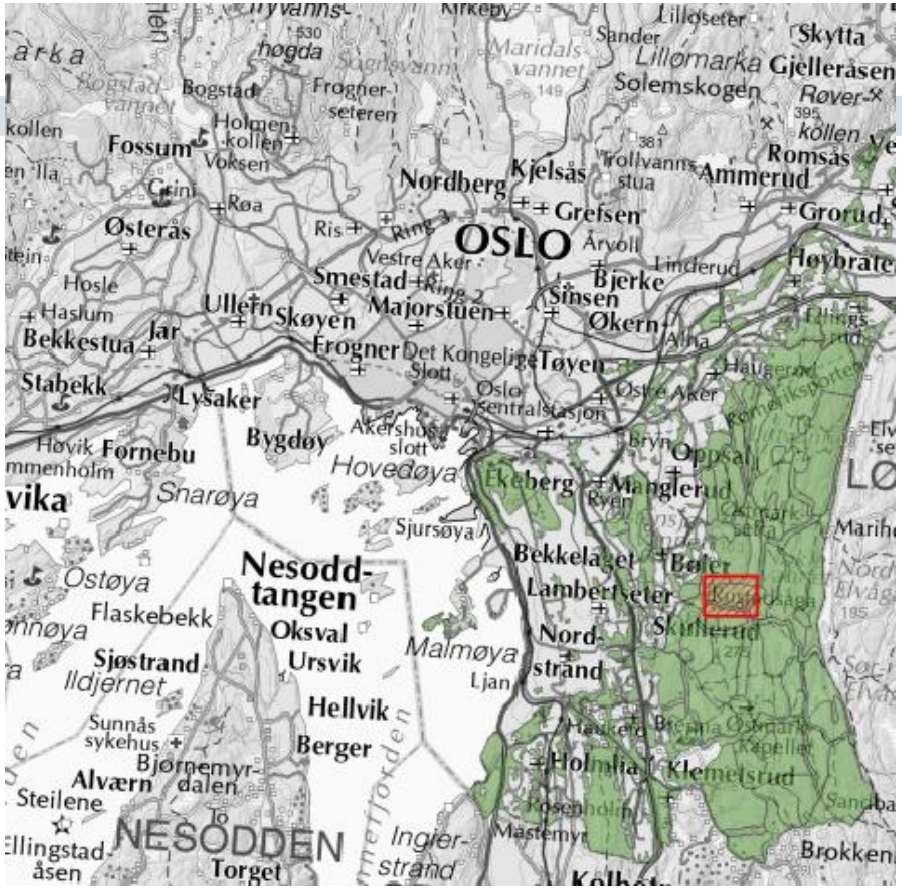
Modifiable area-unit problem in mapping condition/suitability for recreation

em

Point data
(facilities)

Aggregation to zones
(recreation areas)

Different results
depending on
size of zones
delineation of borders



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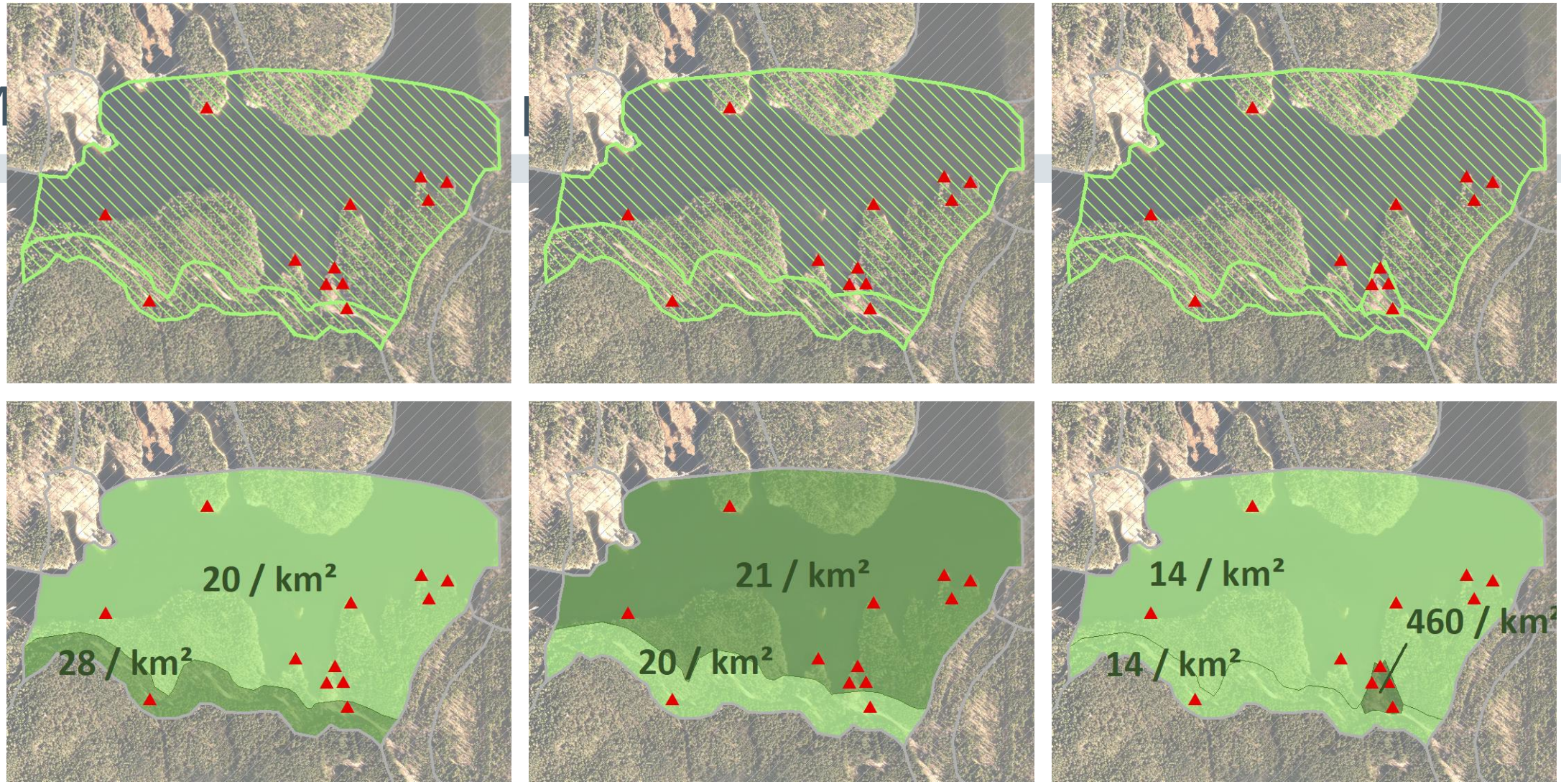
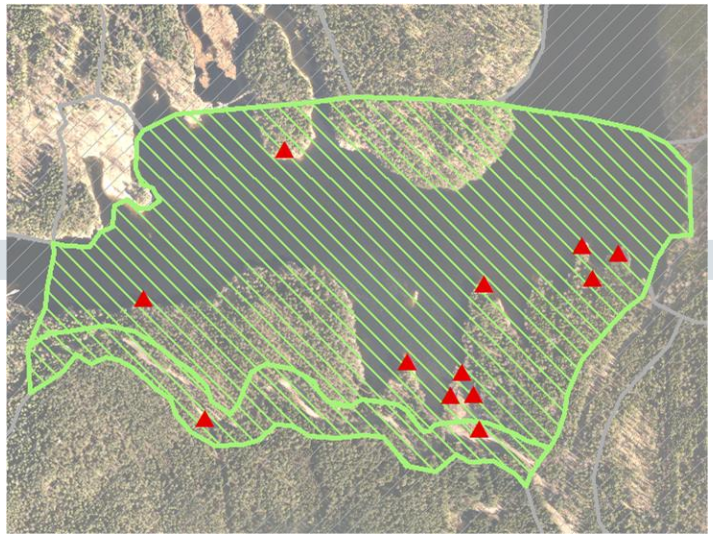

20 / km²
28 / km²
21 / km²
20 / km²
14 / km²
460 / km²
14 / km²
0
250
500
m

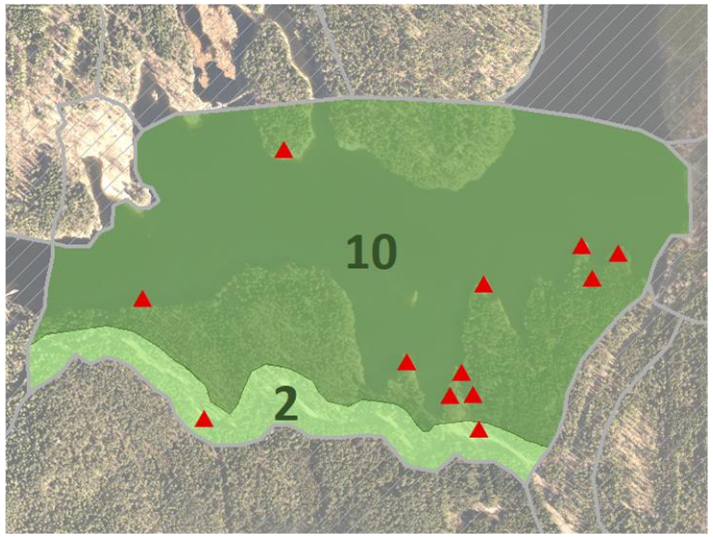
n problem

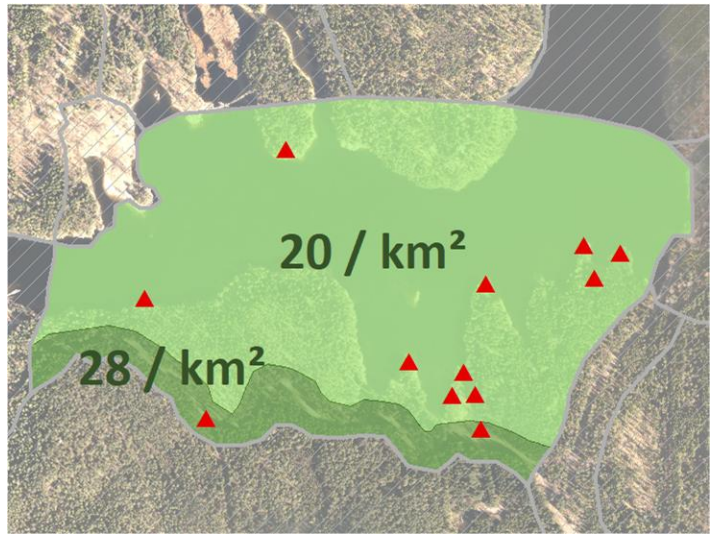
Point data
(facilities)

Aggregation to zones
(recreation areas)

Count of facilities
Density of facilities

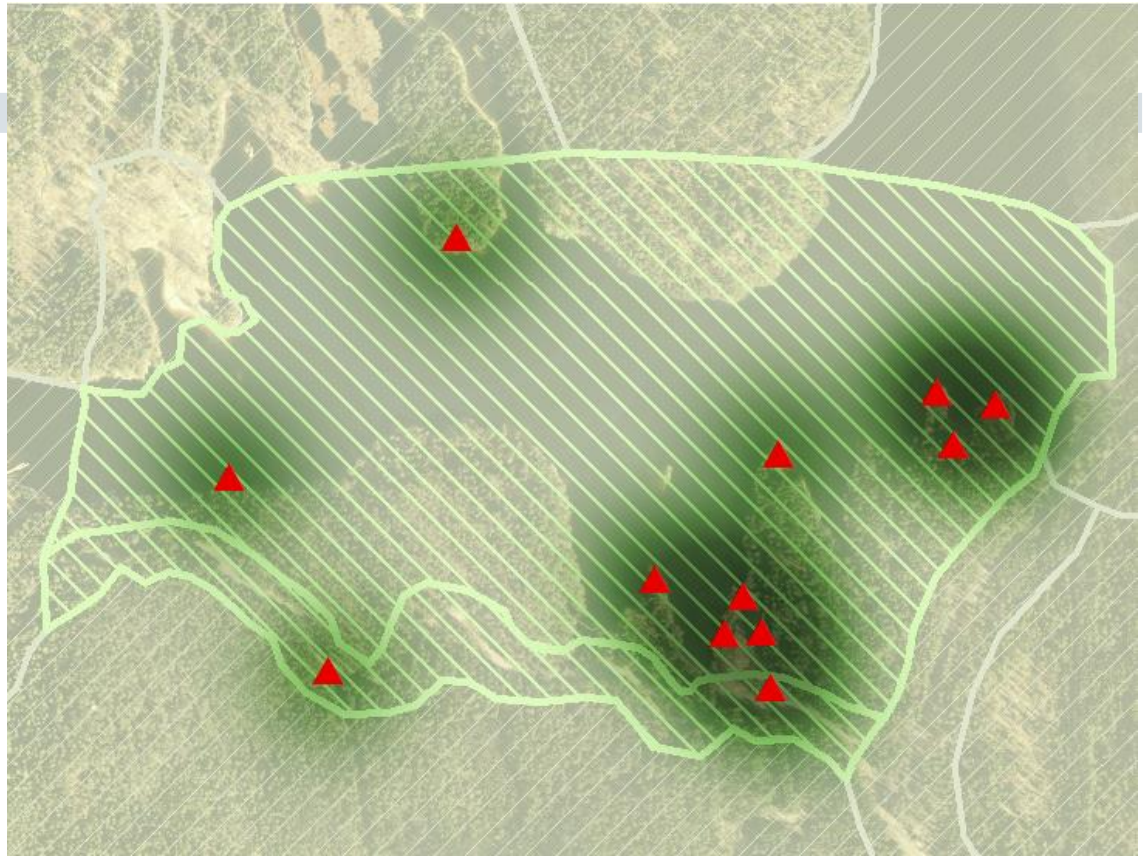






0 250 500
m

NINA



Solution suggestions – zone of influence

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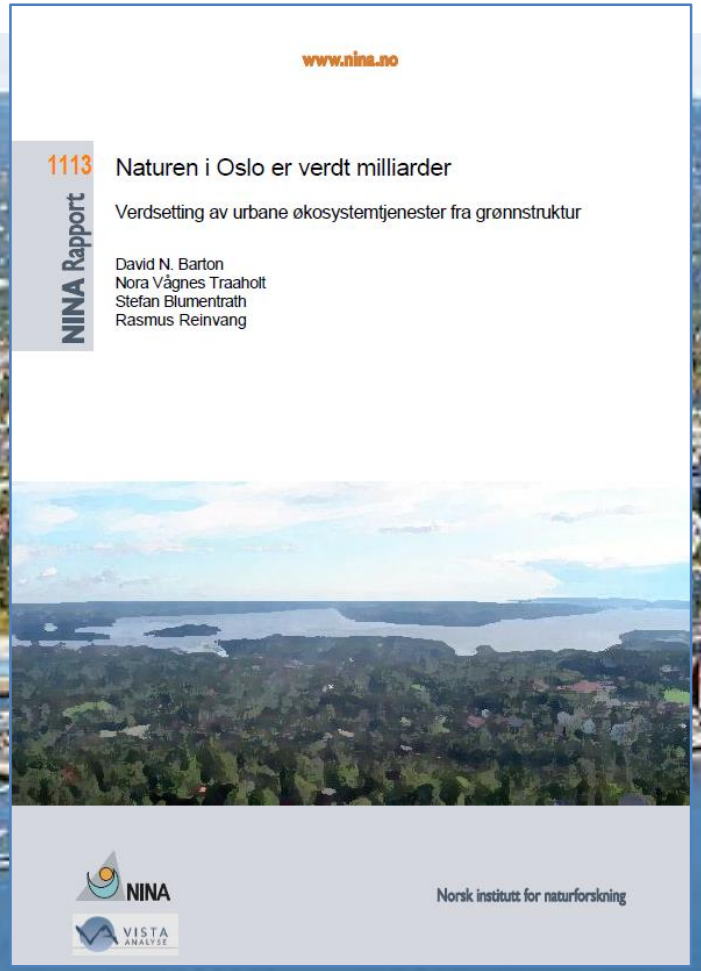
Selecting monetary valuation methods?

Policy relevance vs accounting consistency.

Nature in Oslo is worth billions!

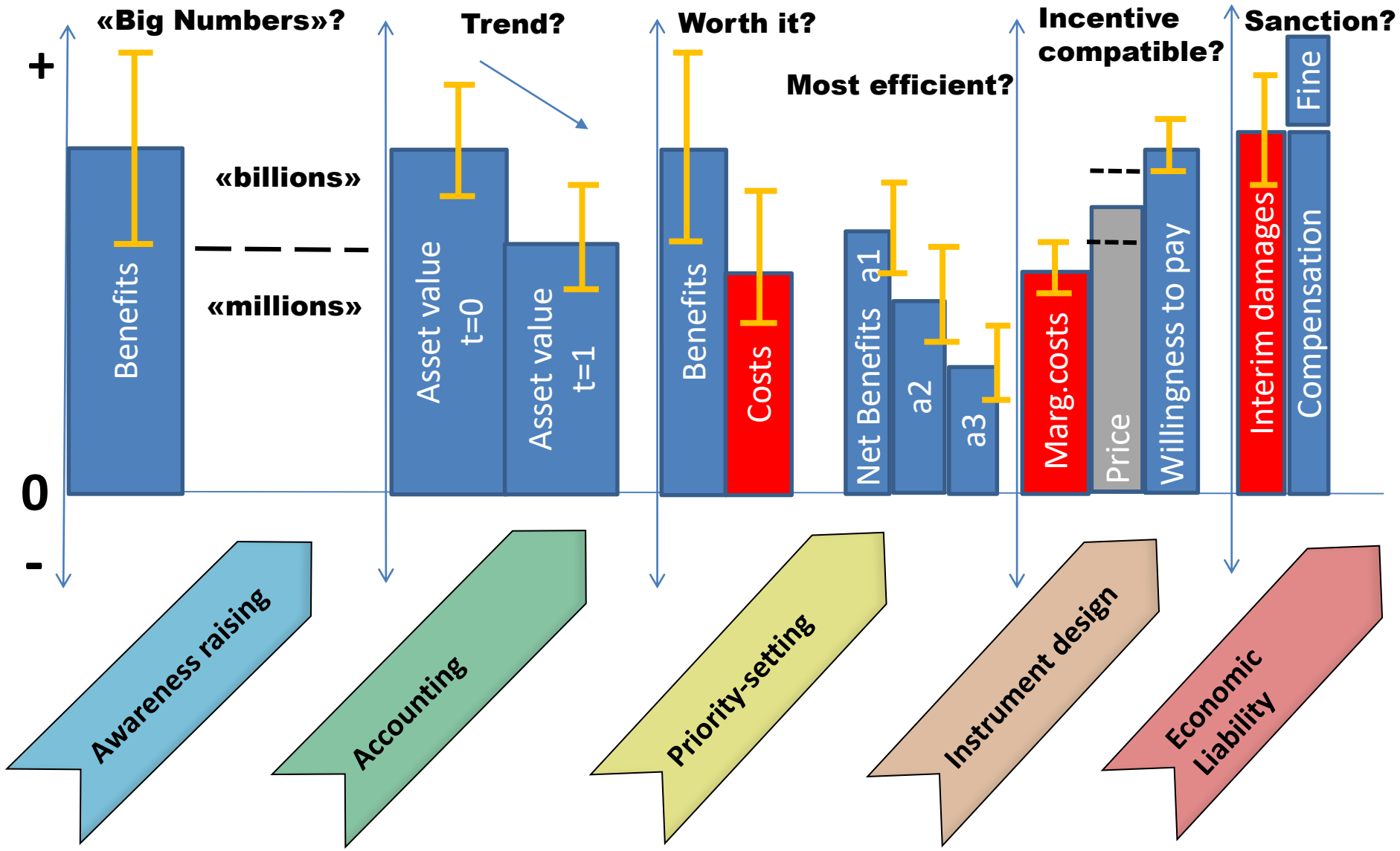



28
Byutvikling
Oslos grønne milliarder
Marka, parkene, trærne, elvene, bekkene og stiene i og rundt Oslo er høyt skattet av byens innbyggere. Forskere ved Norsk institutt for naturforskning satt en pris på verdien av grøntområdene i byen. Oslo kommune innfører nå juridisk vern for mange parker og friområder.
Esben Hoff


osloby
Hva om vi betalte like mye for en time i Marka som en time på SATS?
Oslofolk har en grønn milliardformue
Med tre små hunder kommer venninnene Guri Storeide Christoffersen og Anette Bråthen. – Det er meditativt å gå rundt vannet, sier Bråthen. De to ble kjent for fire år siden, fordi hundene hilste på hverandre på tur rundt vannet. ALLE FOTO: ROLF ØYHAUG
BYUTVIKLING
KJERSTI FLUGSTAD ERIKSEN
Hvor mye betaler vi faktisk ekstra for å bo nærmere grønne lunger? Milliarder av kroner, ifølge Norsk institutt for naturforskning.
Millionbyen Oslo
Oslos befolkning vil trolig passere én million innen 20-25 år.
I en serie artikler vil Osloby se på hvordan vi skal takle befolkningsveksten.
Hvor skal det bygges, hvordan skal det bygges, hvordan skal folk komme seg fra A til B og hva skal til for at vi trives når Oslo blir en millionby?
Brendan Slater holder høyt tempo rundt vannet. – Det gjør noe med sjelen at man kan oppleve fred og ro og at avbrekk fra bylivet, sier Slater.
Bytrær verdt 28 milliarder

Photo: VisitOslo
Illustration: CEEweb

Generic policy purposes of monetary accounting for ecosystem services



EXAMPLE: HEDONIC PROPERTY PRICING METHOD

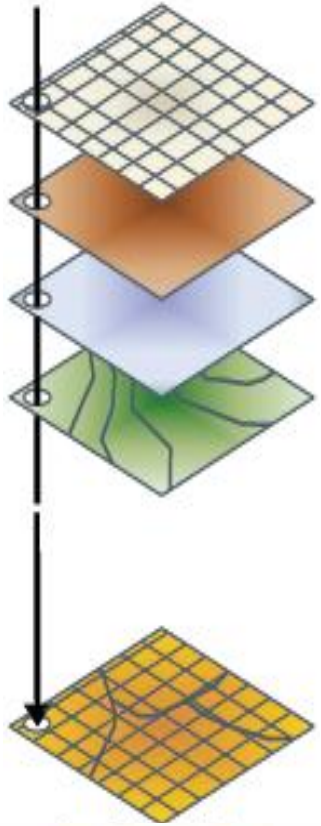


Foto: www.vendanvo.com

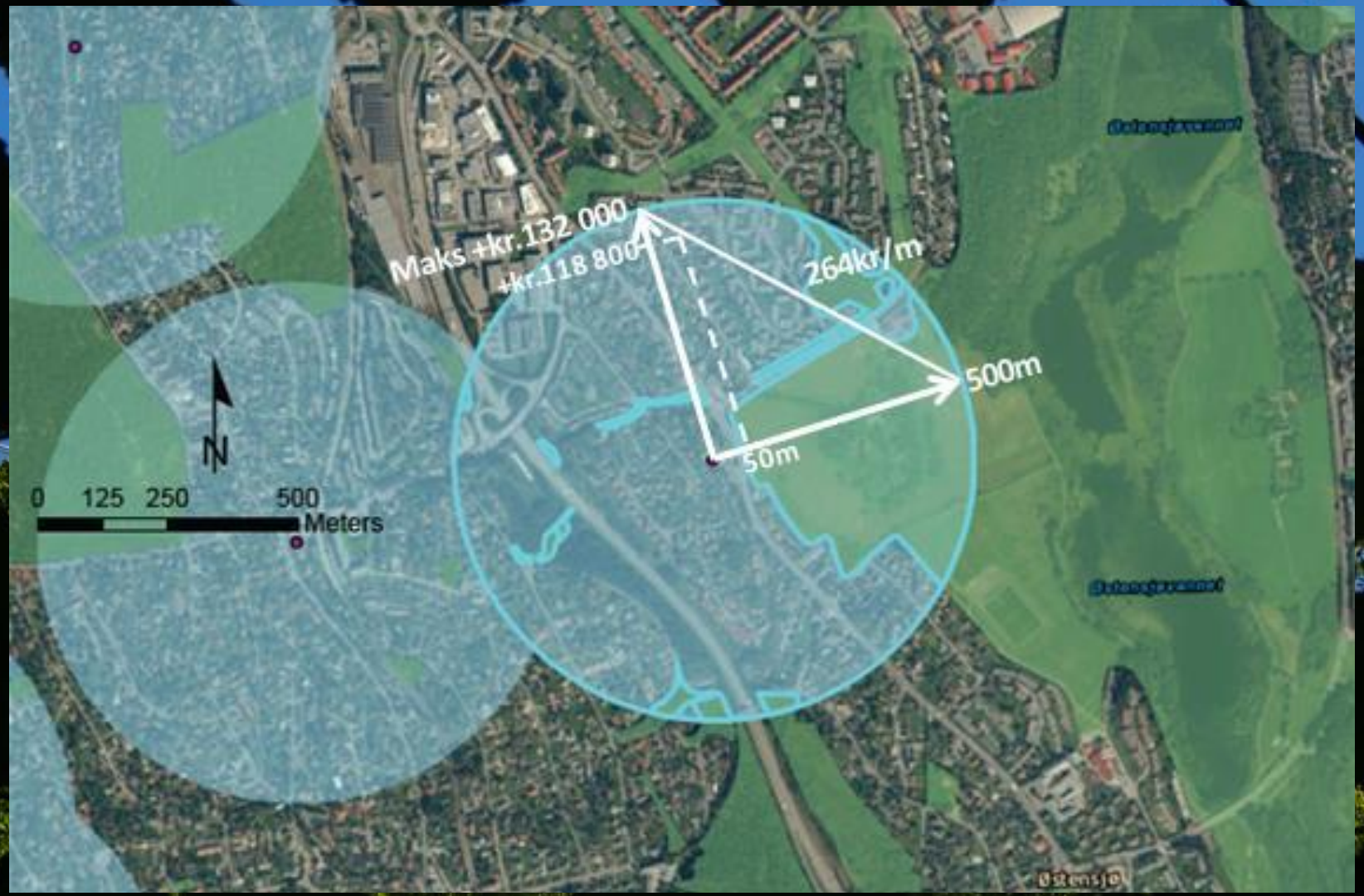


Foto: David N. Barton

Foto: David N. Barton

31147 apartments near 10 large parks >100,000 m2:

0,3-2,3 billion NOK

160 722 apartments within 500m of parks :

8,3-18,9 billion NOK

Public Parks
Parks
Sold Apartments

N

0 1 2 4 Kilometers

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Kart: Traaholt (2014)

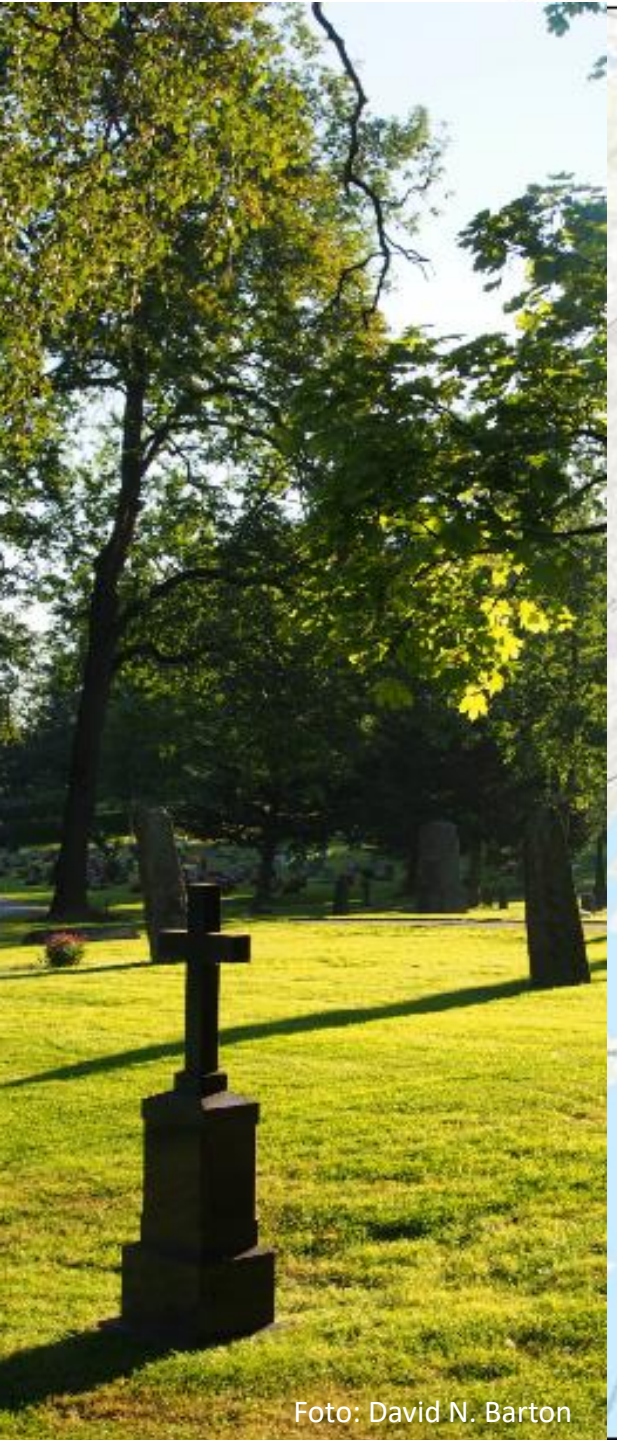


Foto: David N. Barton

45 356
Apartments within
500m of cementaries
2,1-5,0 billion NOK

Graveyards
Graveyards
Sold Apartments

N

0 1 2 4 Kilometers

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Kart: Traaholt (2014)

Foto: David N. Barton

53089 apartments within 200m of green spaces with ater:

2,8-6,6 billion NOK

Public Recreational Areas with Freshwater

Areas with freshwater

Sold Apartments

N

0 1 2 4 Kilometers

Kart: Traaholt (2014)

Foto: David N. Barton

36 310 apartments within 500m of Marka: 0,8-4,1 billion NOK

34 965 aparments within 1000m of coastline: 4,7-7,0 billion NOK

Natural City Limits
- Forest border
- Fjord border
- Sold Apartments

0 1 2 4 Kilometers

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Kart: Traaholt (2014)