

URBANEARS - URBAN ECOSYSTEM ANALYSIS SUPPORTED BY REMOTE SENSING

BELGIAN EARTH OBSERVATION DAY 2016





PARTNERSHIP



KU LEUVEN

Division Forest, Nature
& Landscape



Department of Geography

Department of Hydrology
and Hydraulic Engineering



Laboratory of Forest Management
and Spatial Information Techniques



Geography Department
Geomatics Lab

PARTNERSHIP



Department of Geography

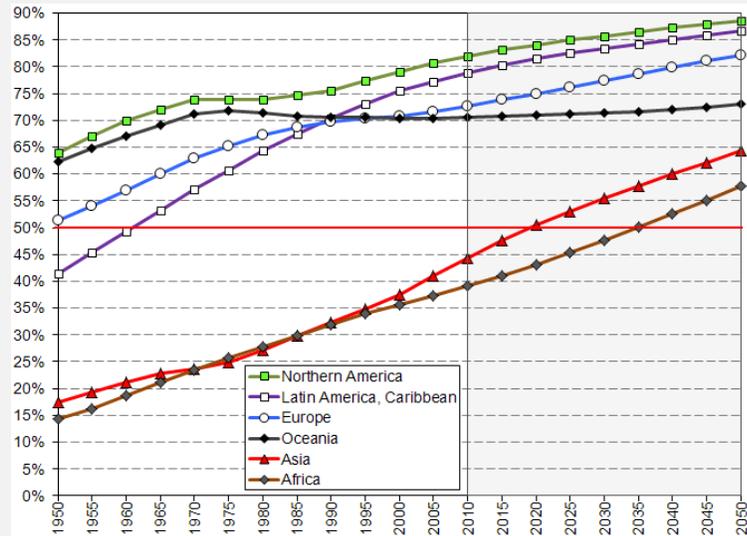


Building, Architecture and Town
Planning Department, Université
Libre Bruxelles

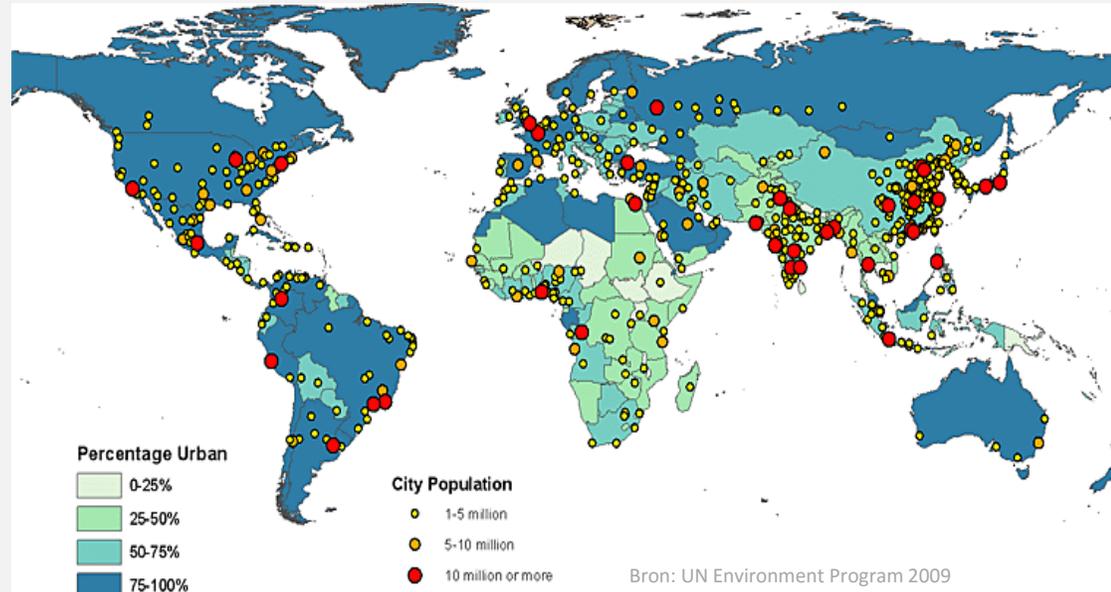


Unit Environmental Modeling

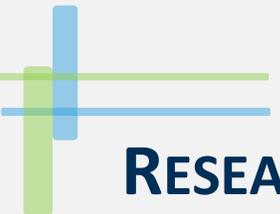
RESEARCH TOPIC



% URBAN POPULATION (UN ESTIMATION)



http://www.youtube.com/watch?v=mPi4zwEpswE&feature=player_embedded



RESEARCH TOPIC

urban heating

Urban Heat Island Effect

1. Paved surfaces and concrete capture about the Sun's rays and produce heat.
2. Chemicals emitted by cars, industrial facilities, and even trees affect sunshine in different ways, often trapping it and creating more heat.
3. The warm air rising from a city may collide with moist air from a nearby body of water, raising precipitation downwind of the city.
4. The warm air and precipitation can affect winds for hundreds of miles.

air pollution

CO₂ emissions

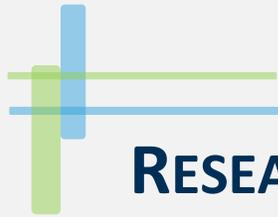
noise pollution

flooding

Effects of urbanization on volume and rates of surface water runoff

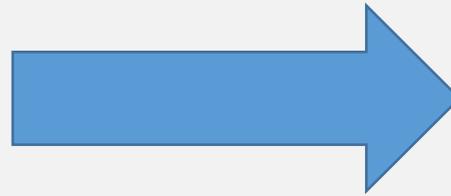
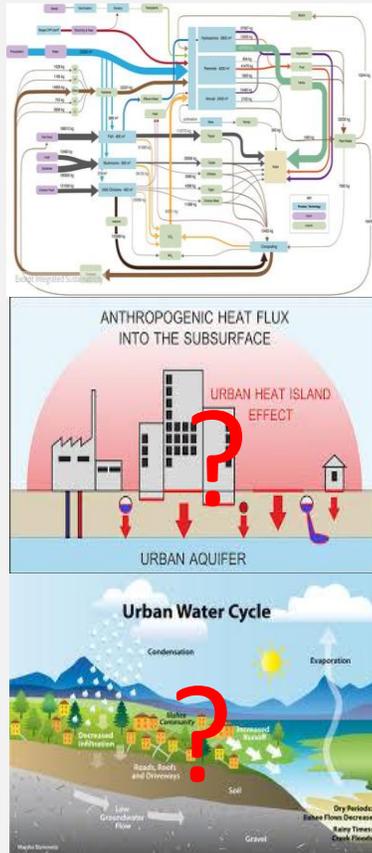
Urbanization increases peak flows and runoff volumes (the area under the curves)

biodiversity loss



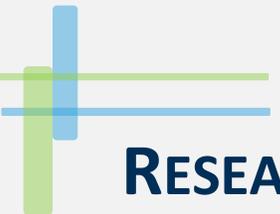
RESEARCH TOPIC

URBAN BIOPHYSICAL MODELS



SUSTAINABLE URBAN PLANNING





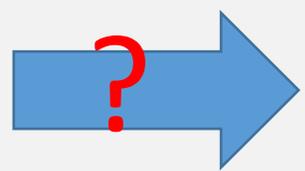
RESEARCH TOPIC

URBAN INFRASTRUCTURE

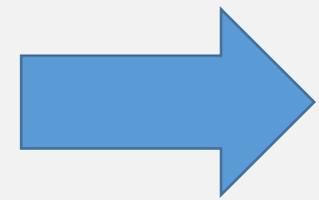
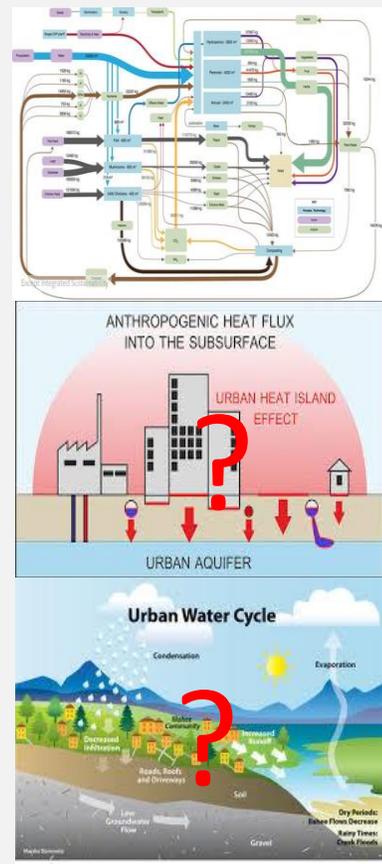
- type of material
- height of buildings
- roof exposition
- etc,

PLANT & ECOSYSTEM PROPERTIES

- LAI
- moisture content
- chl-a concentration
- species diversity
- habitat Quality
- vegetation Height
- etc.



URBAN BIOPHYSICAL MODELS

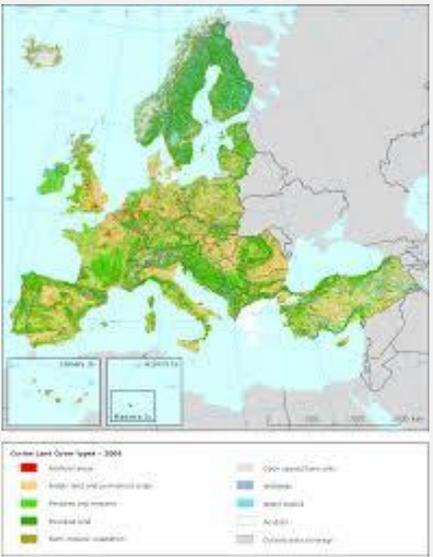


SUSTAINABLE URBAN PLANNING

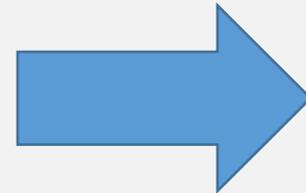
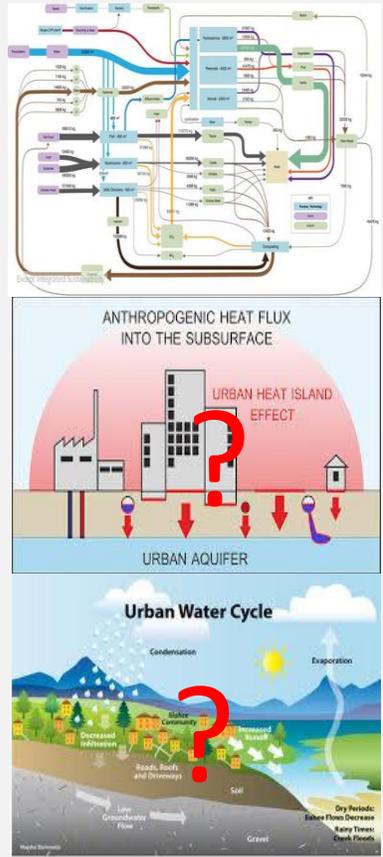
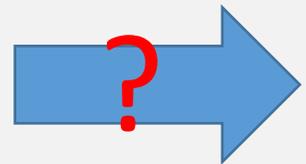




RESEARCH TOPIC



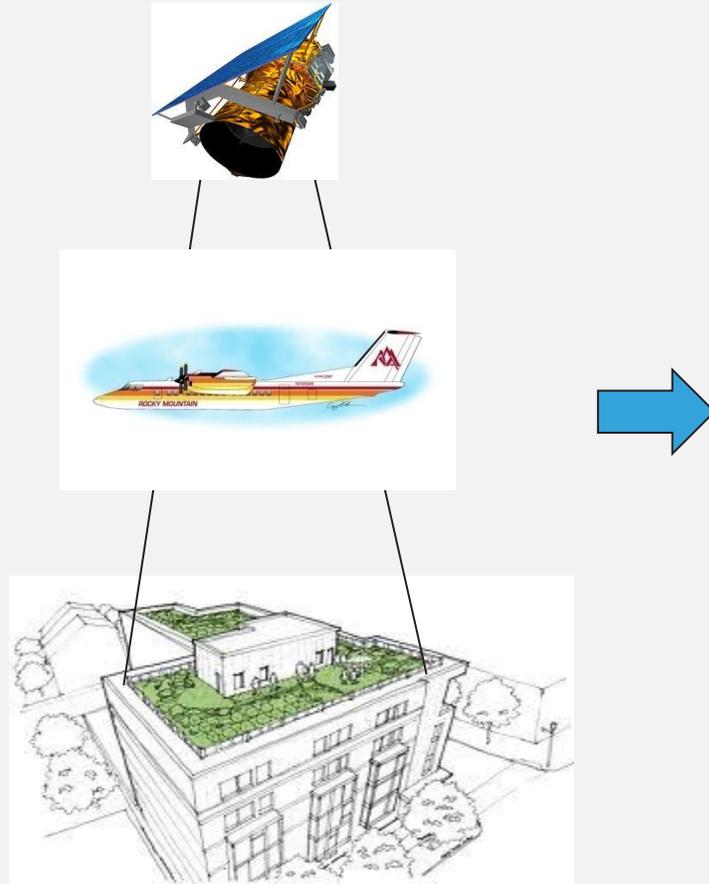
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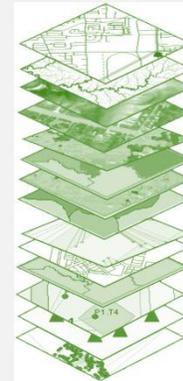
URBAN REMOTE SENSING?



A BIRD'S EYE VIEW ON THE CITY

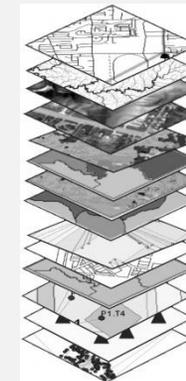
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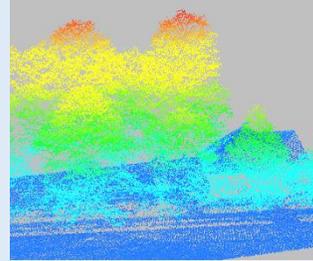
- type of material
- height of buildings
- roof exposition
- etc,



URBAN REMOTE SENSING?



LiDAR



Hyperspectral
Airborne (2 m)

2-5 meter resolution
>200 bands



*multi-source
multi-resolution
approach*

Enmap/Hyspirci



Sentinel-2/Landsat

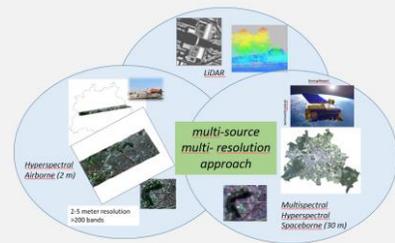


Multispectral
Hyperspectral
Spaceborne (30 m)





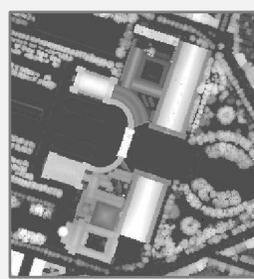
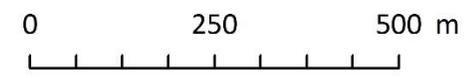
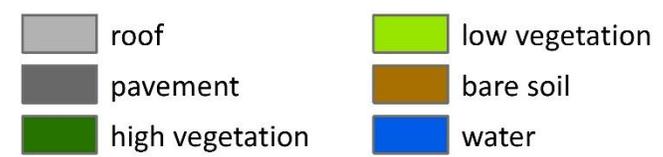
URBAN REMOTE SENSING?



APEX

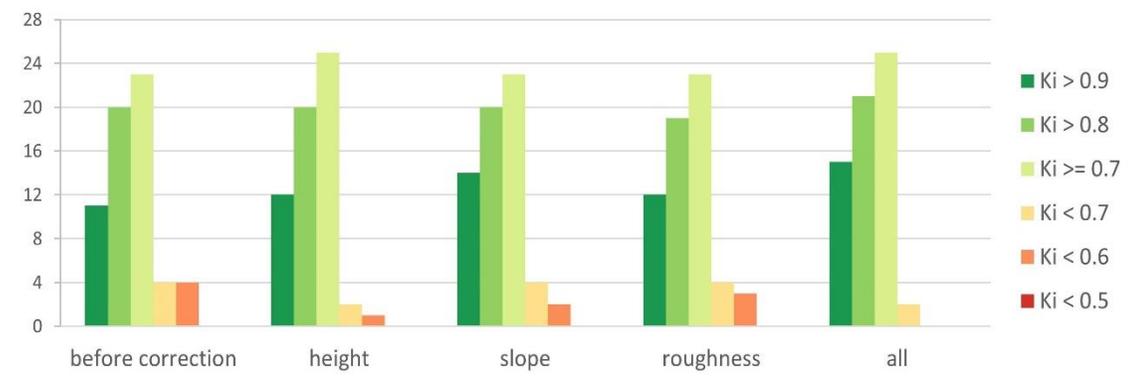


Land cover after correction



LiDAR

Cumulative class wise kappa histograms

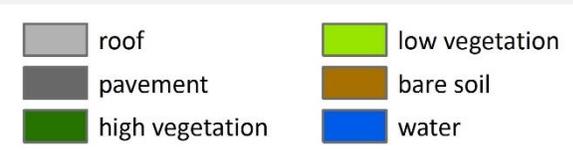
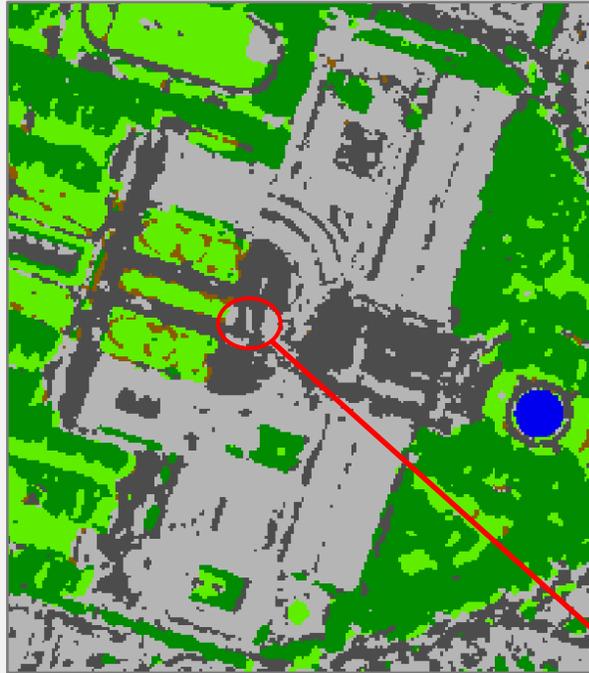


Overall kappa before correction = 0.80
 Overall kappa after correction = 0.87

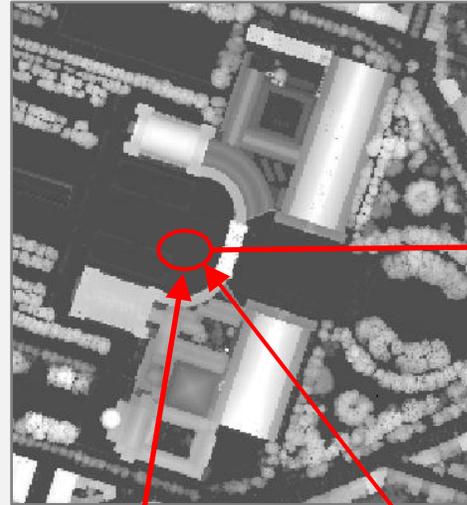
Priem F. & Canters F., *Synergistic use of LiDAR and APEX hyperspectral data for high-resolution urban land cover mapping*, Remote Sensing, 2016, 8(10), 787; doi:10.3390/rs8100787

URBAN REMOTE SENSING?

Land cover

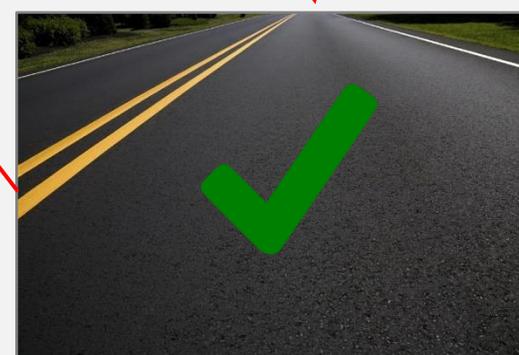
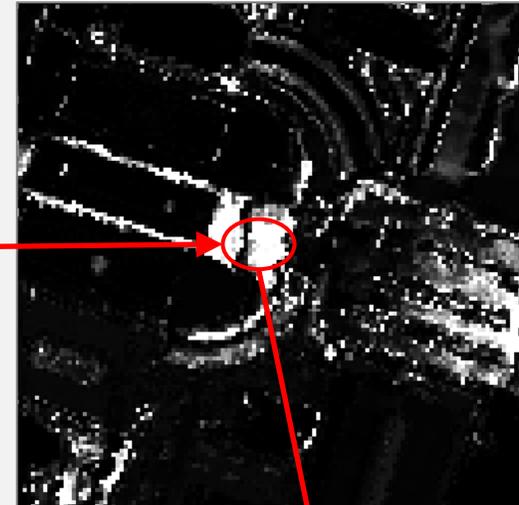


Geometry check

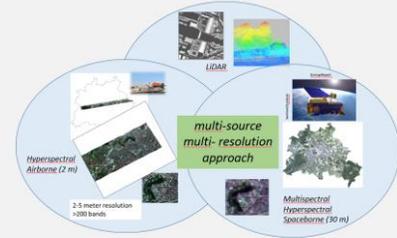


Bitumen

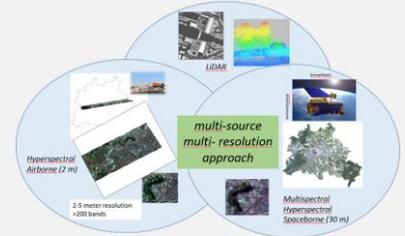
If wrong: next best class
(SVC class probabilities)



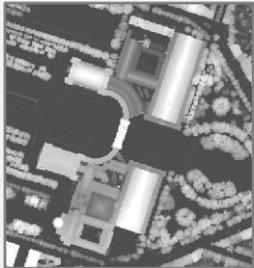
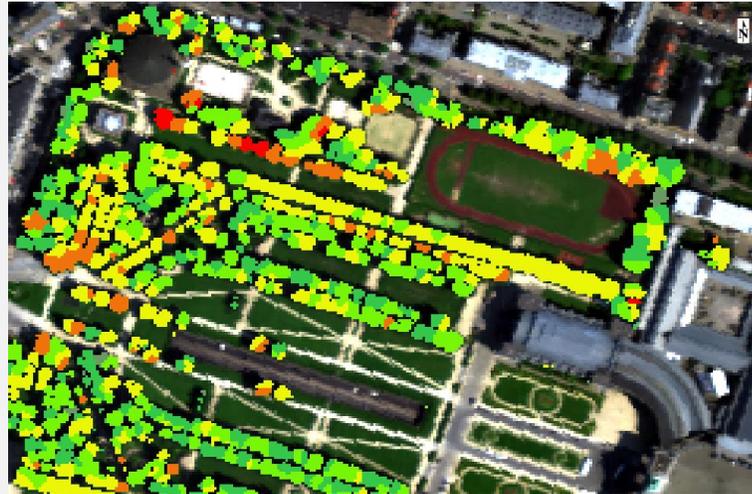
Asphalt



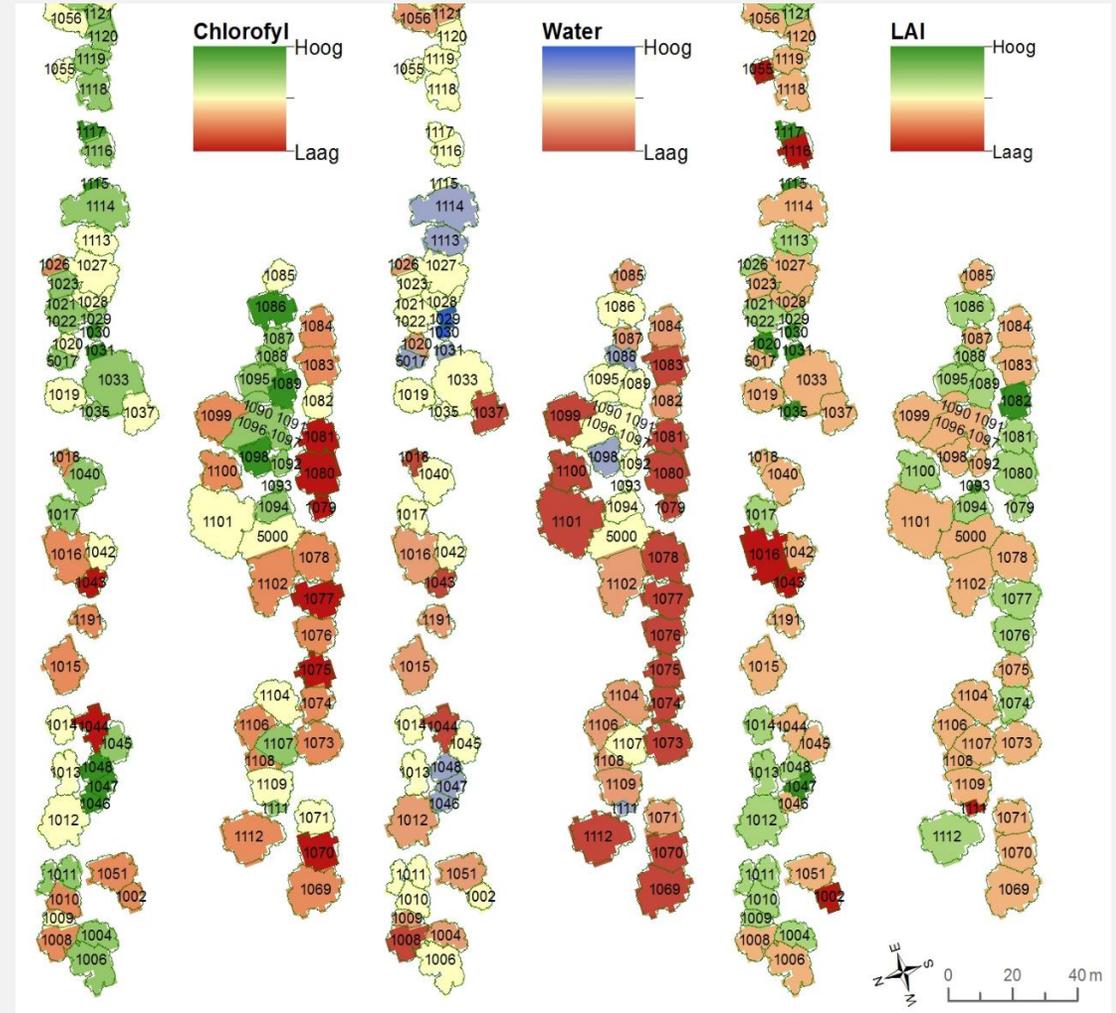
URBAN REMOTE SENSING?



APEX

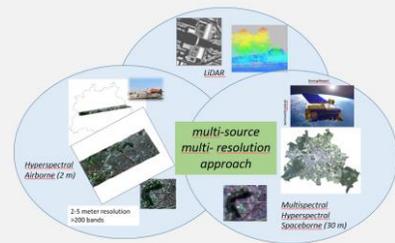


LIDAR

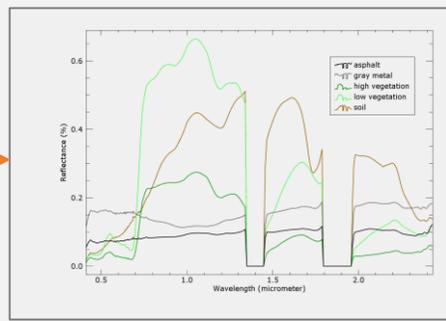




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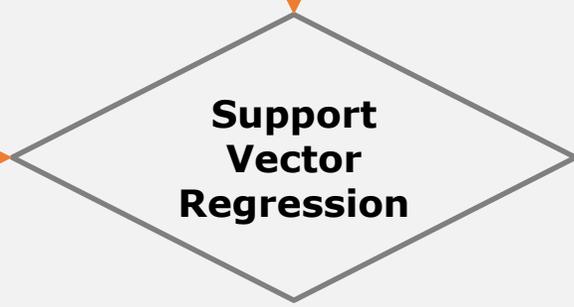
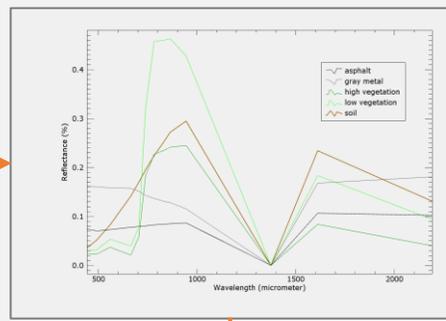


Hyperspectral library

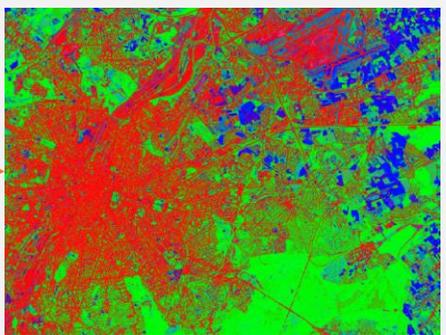


resample

Multispectral library

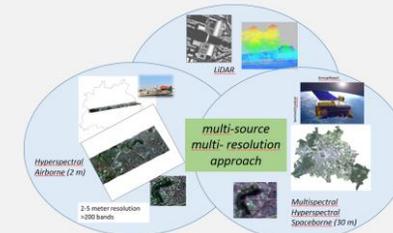


Vegetation – Impervious - Soil fraction maps

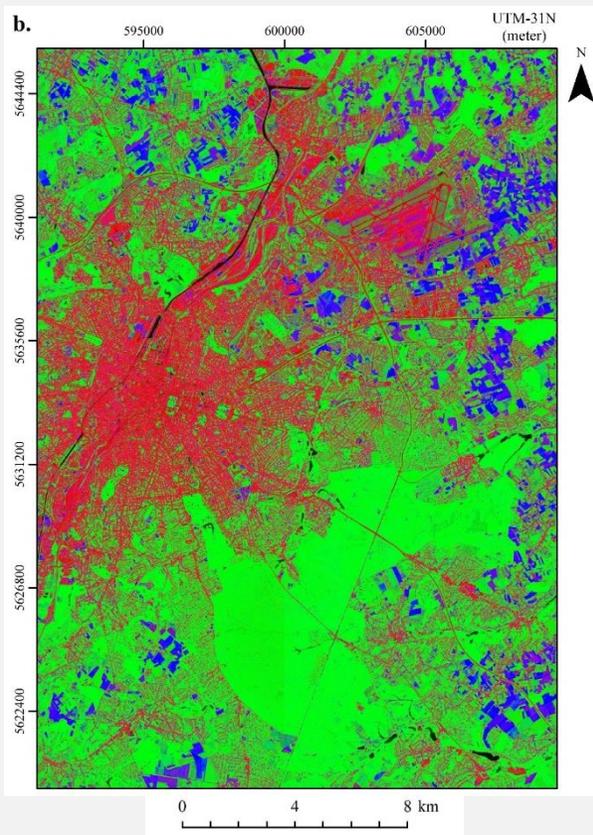




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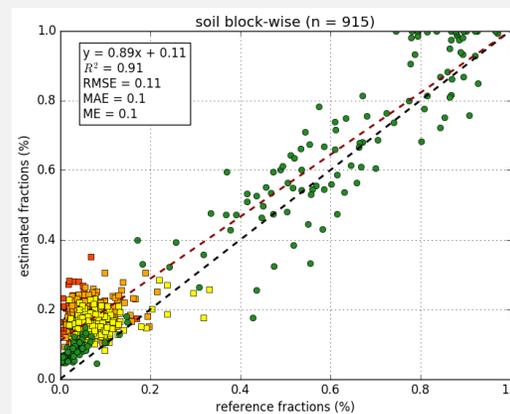
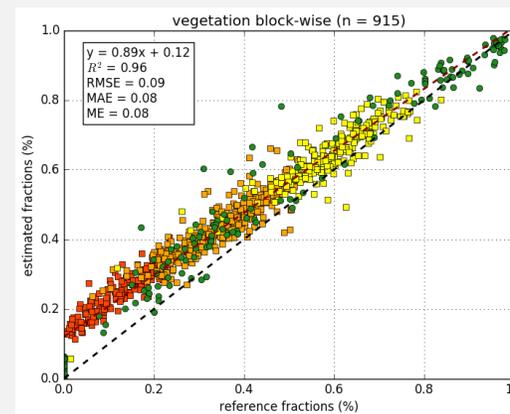
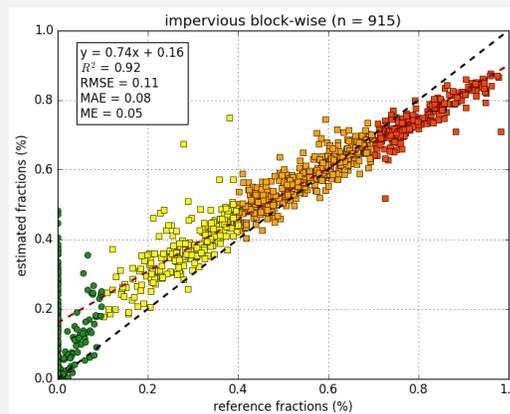


VIS fractions map

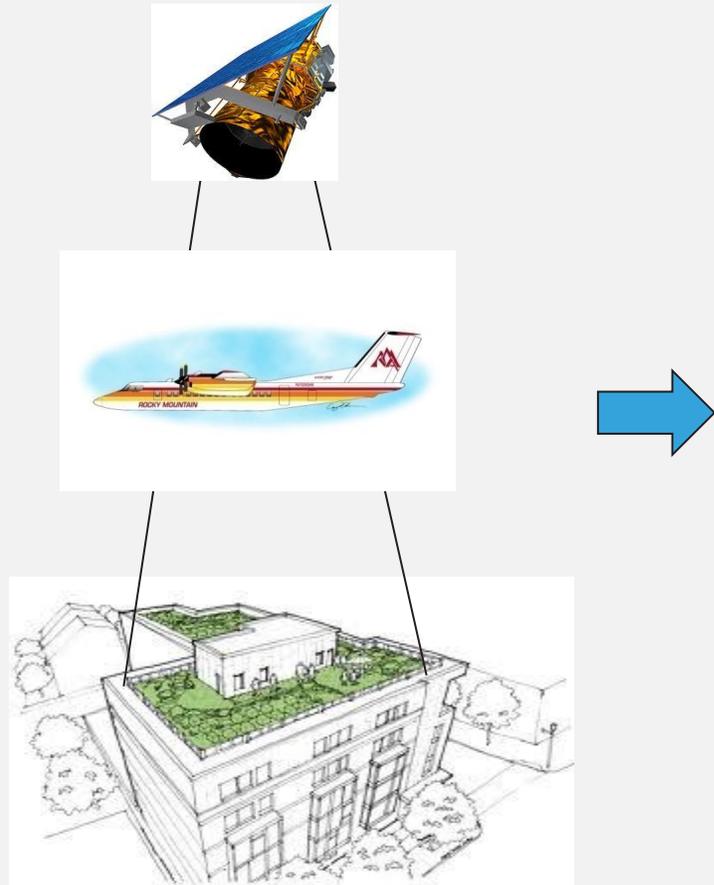


Red = Impervious
Green = Vegetation
Blue = Soil

Validation on block level



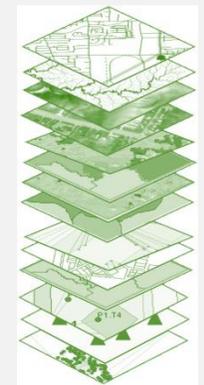
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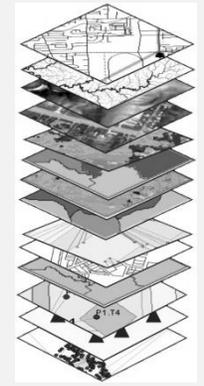
PLANT & ECOSYSTEM PROPERTIES

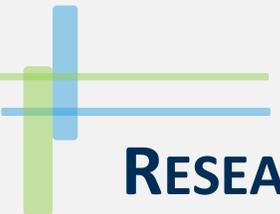
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URBAN INFRASTRUCTURE

- type of material
- height of buildings
- roof exposition
- etc,

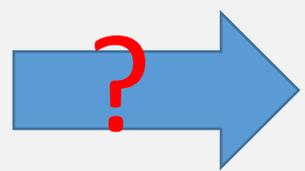
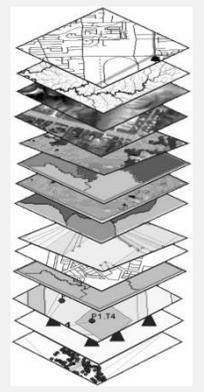




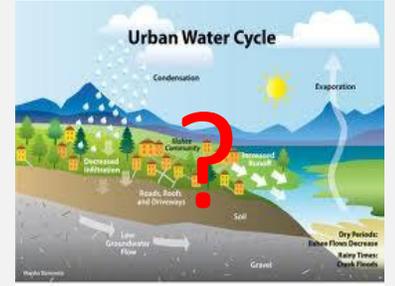
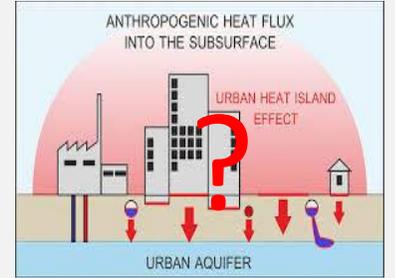
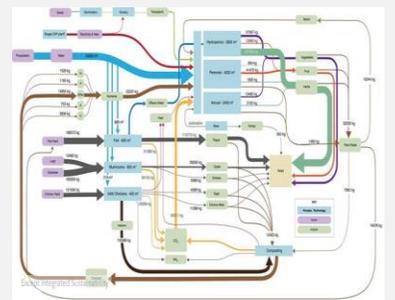
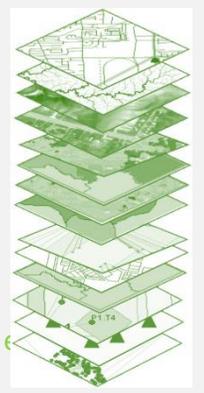
RESEARCH TOPIC

URBAN BIOPHYSICAL MODELS

URBAN INFRASTRUCTURE

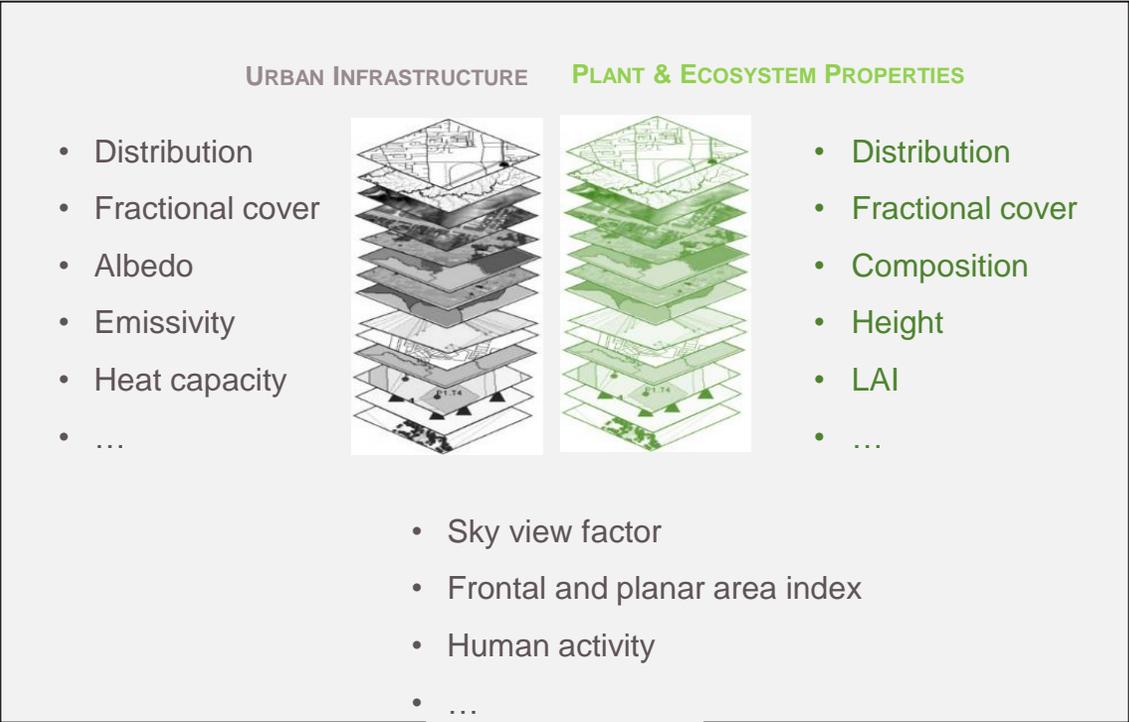


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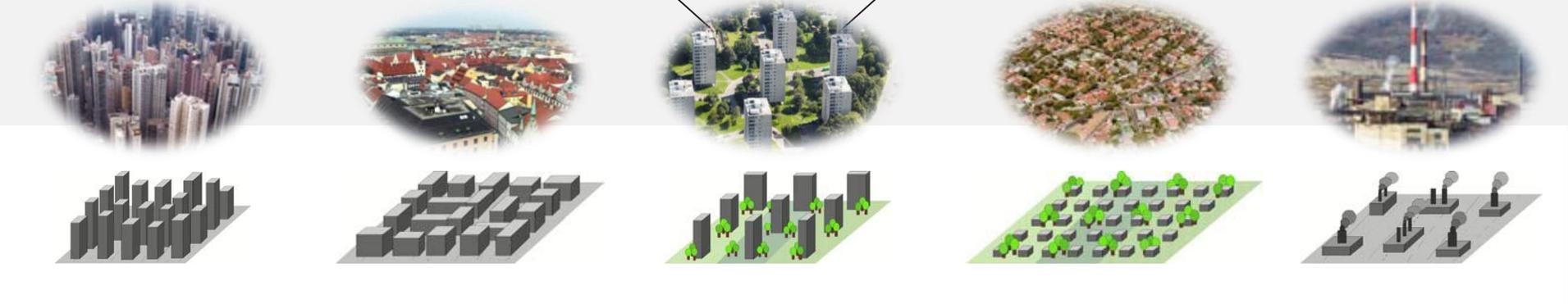


URBAN MODELING?



Local Climate Zones

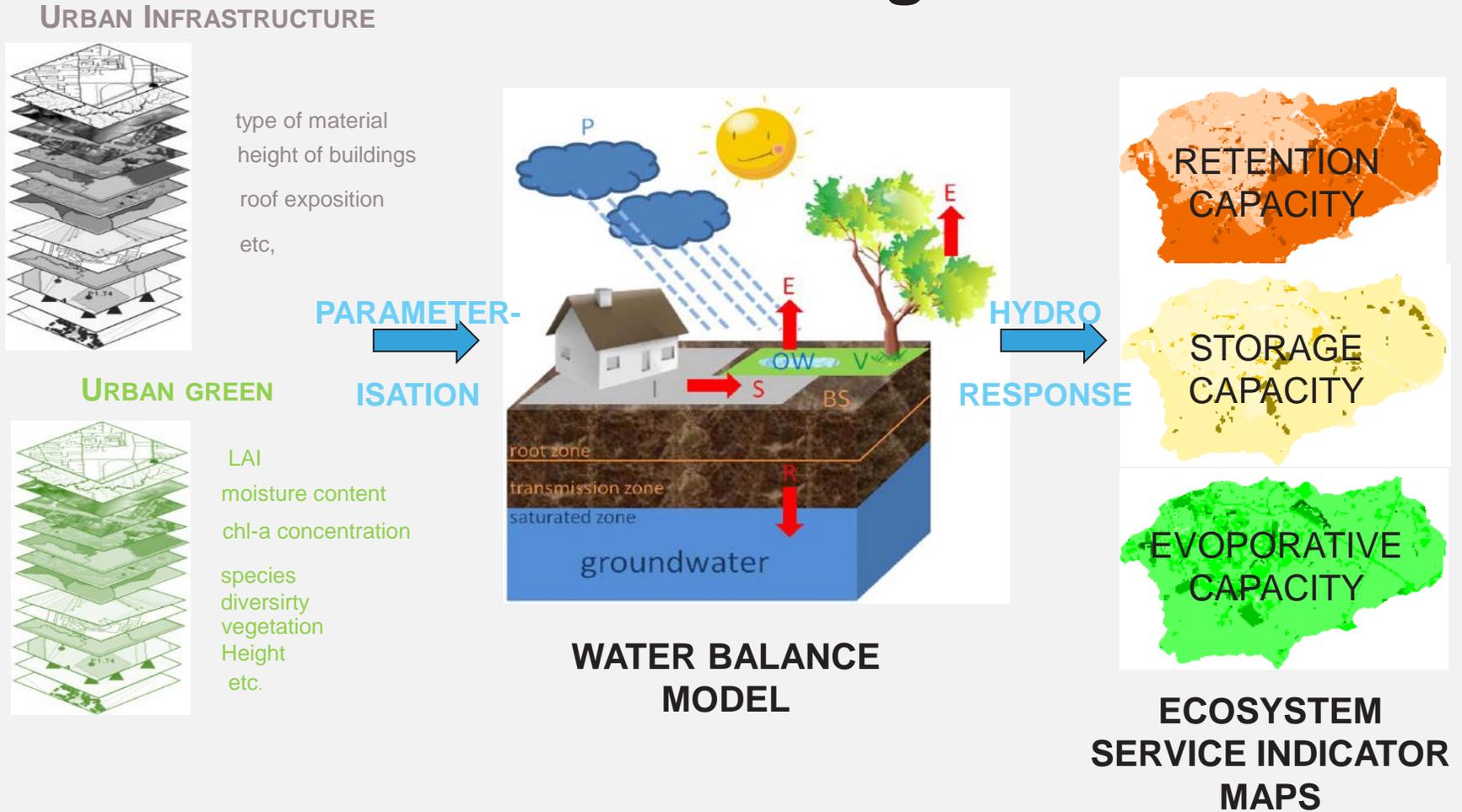
Adapted from Steward & Oke (2012)

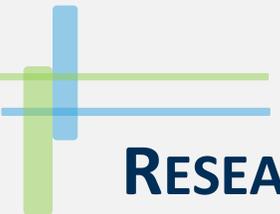




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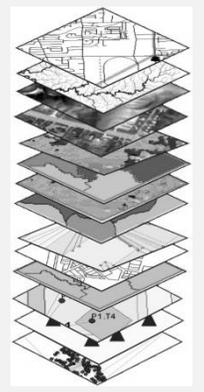
Urban water regulation



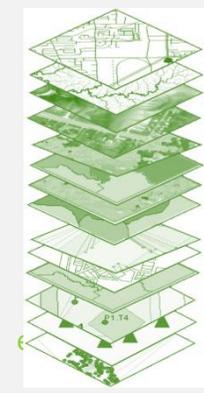


RESEARCH TOPIC

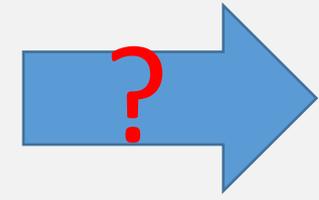
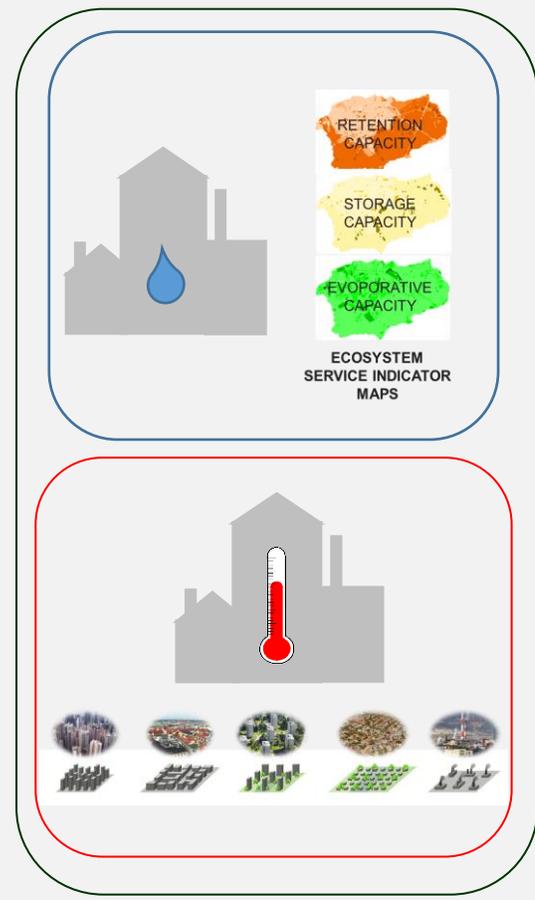
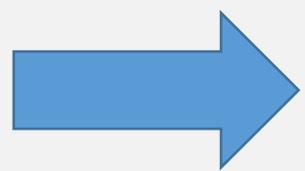
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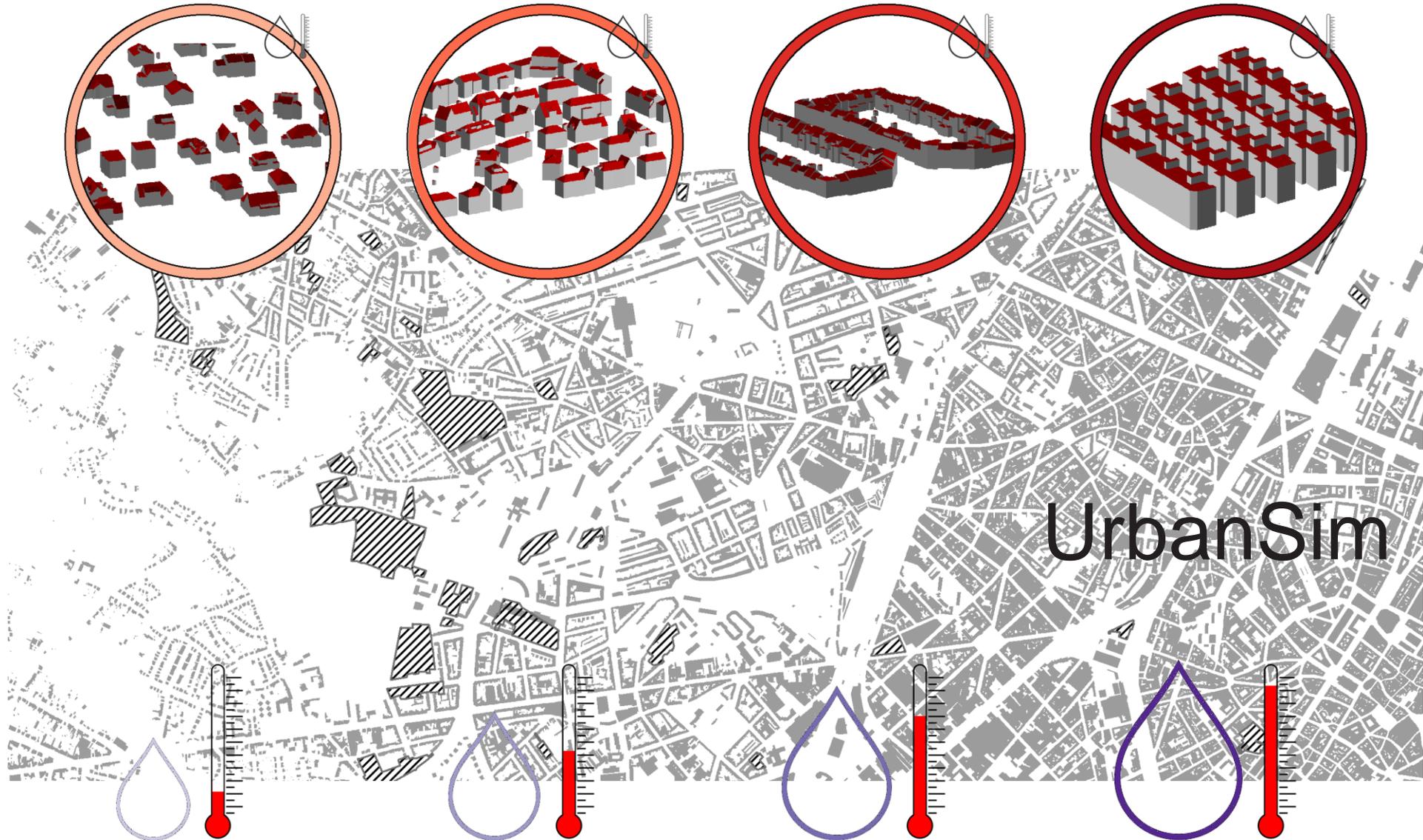
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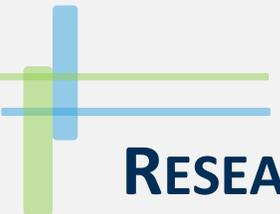
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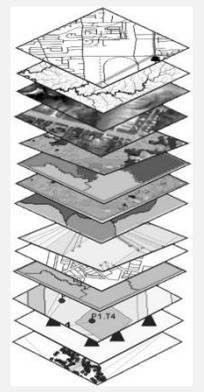


UrbanSim

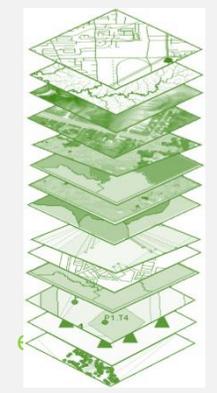


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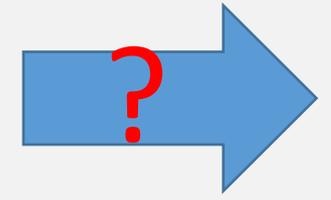
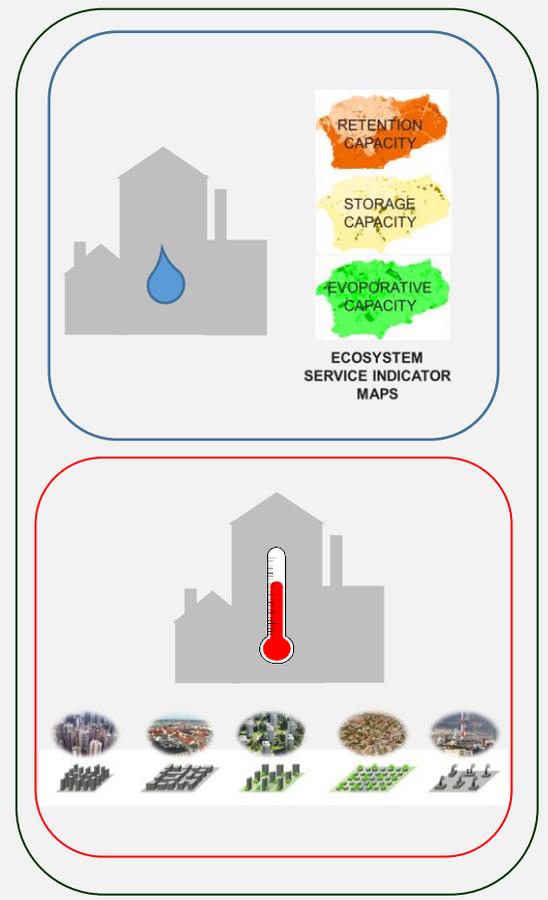
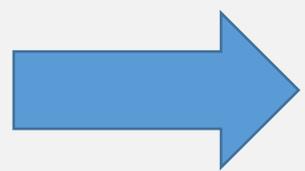
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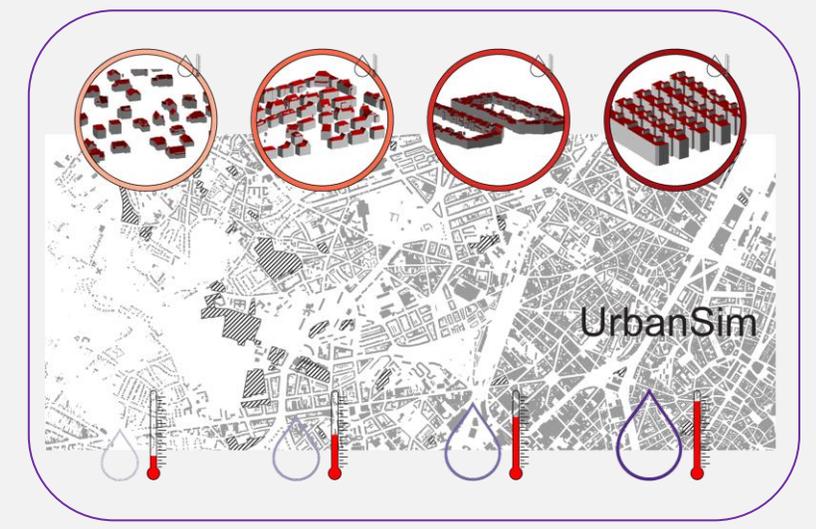
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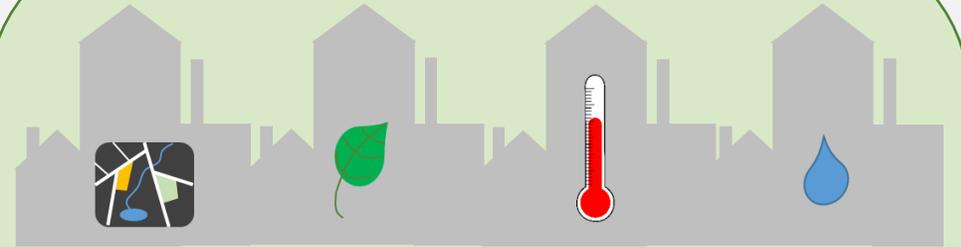


SUSTAINABLE URBAN PLANNING



ACKNOWLEDGEMENTS

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