Monitoring and assessment of NBSs' environmental impact in Poznań.

Iwona Zwierzchowska, Piotr Lupa, Lidia Poniży, Katarzyna Fagiewicz,
Łukasz Mikuła, Andrzej Mizgajski, Tomasz Szeląg, Dawid Gałęza

Department of Integrated Geography
Faculty of Human Geography and Planning
Adam Mickiewicz University in Poznań

Connecting Nature Impact Summit
Genk, 29th April 2022

Bringing cities to life, **Bringing life into cities.**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730222

NBS Monitoring Plan for Poznań

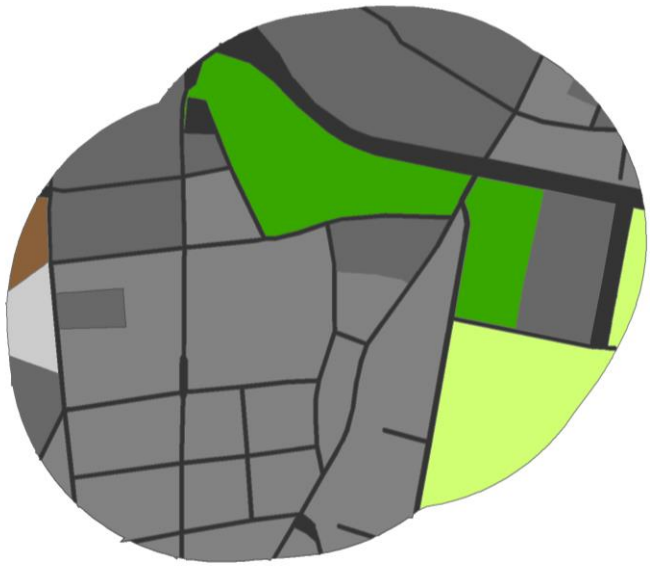
- ✓ **NBSs in Poznań: Nature-oriented playgrounds at preschools, open garden and pocket parks**
- ✓ **The Nature-Based Solutions Monitoring Plan for Poznań covers the environmental, social & health and economic indicators**
- ✓ **NBSs Impact Monitoring and Assessment were conducted at three scales:**
  - ✓ **local scale (selected case studies)**
  - ✓ **intermediate scale (neighborhood, all preschool gardens)**
  - ✓ **city scale (long-term assessment of urban transition).**

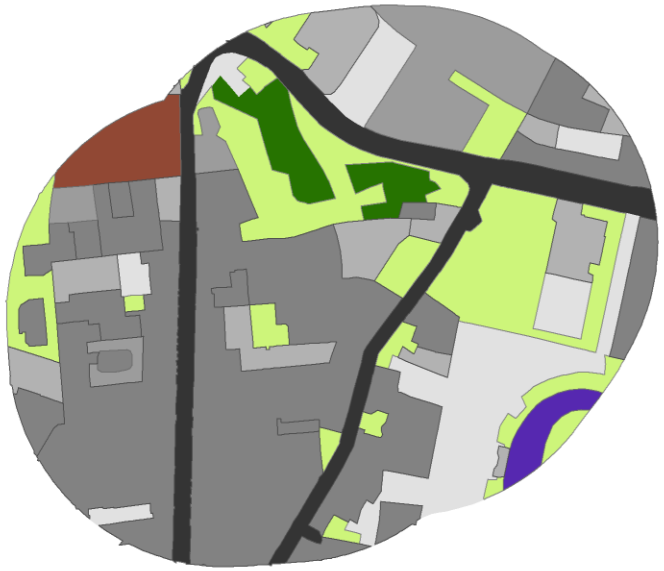
Connecting Nature

Green space area and its ditribution

City scale

Site scale





Urban Atlas

Geometric resolution 1:10 000
Minimum surface area of unit 0,25 ha

Polish Official Database of Topographical Objects (BDOT10k)

Geometric resolution 1:10 000
Minimum surface area of unit 0,1 ha*

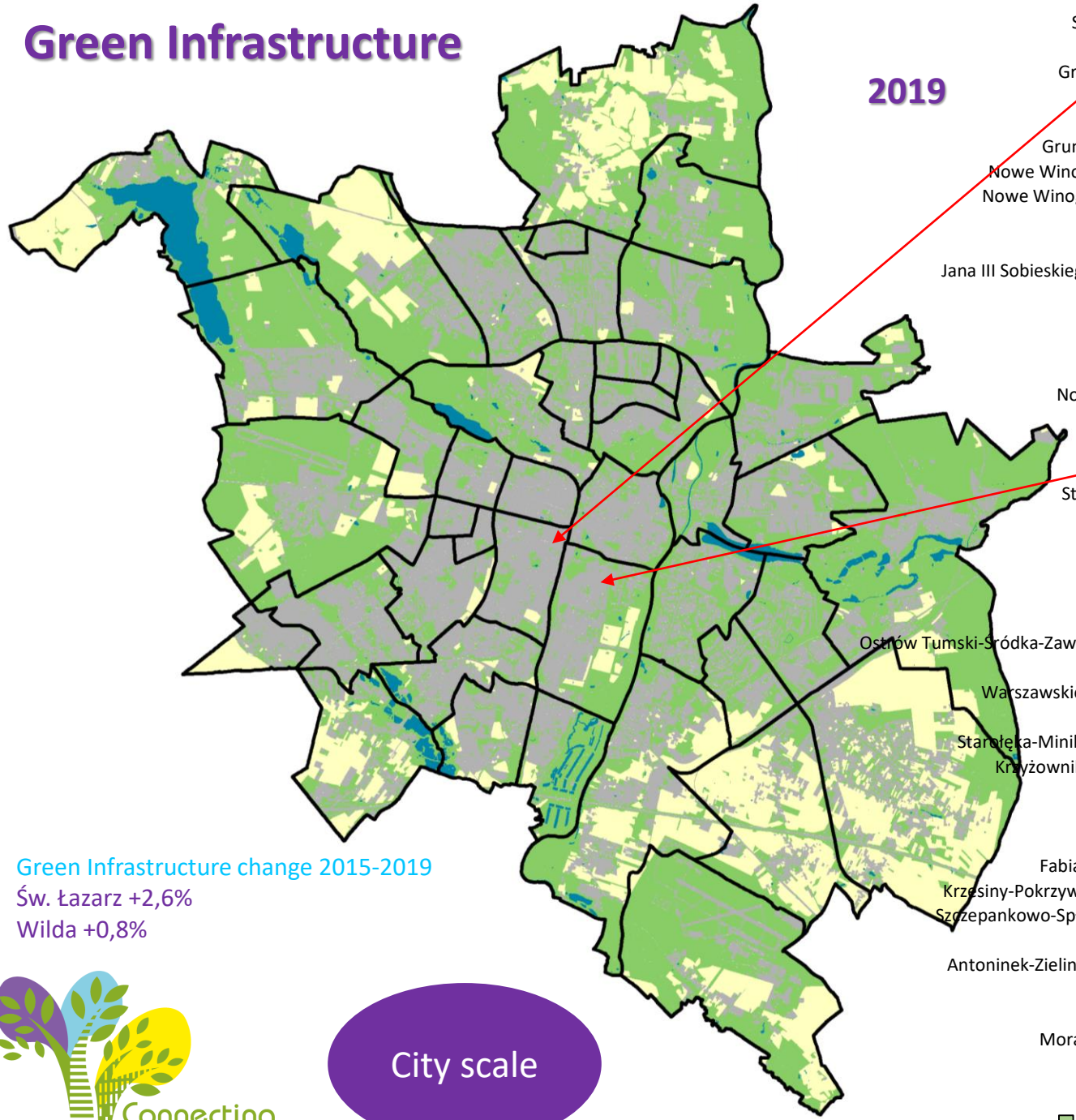
* unless the specific rules provide otherwise

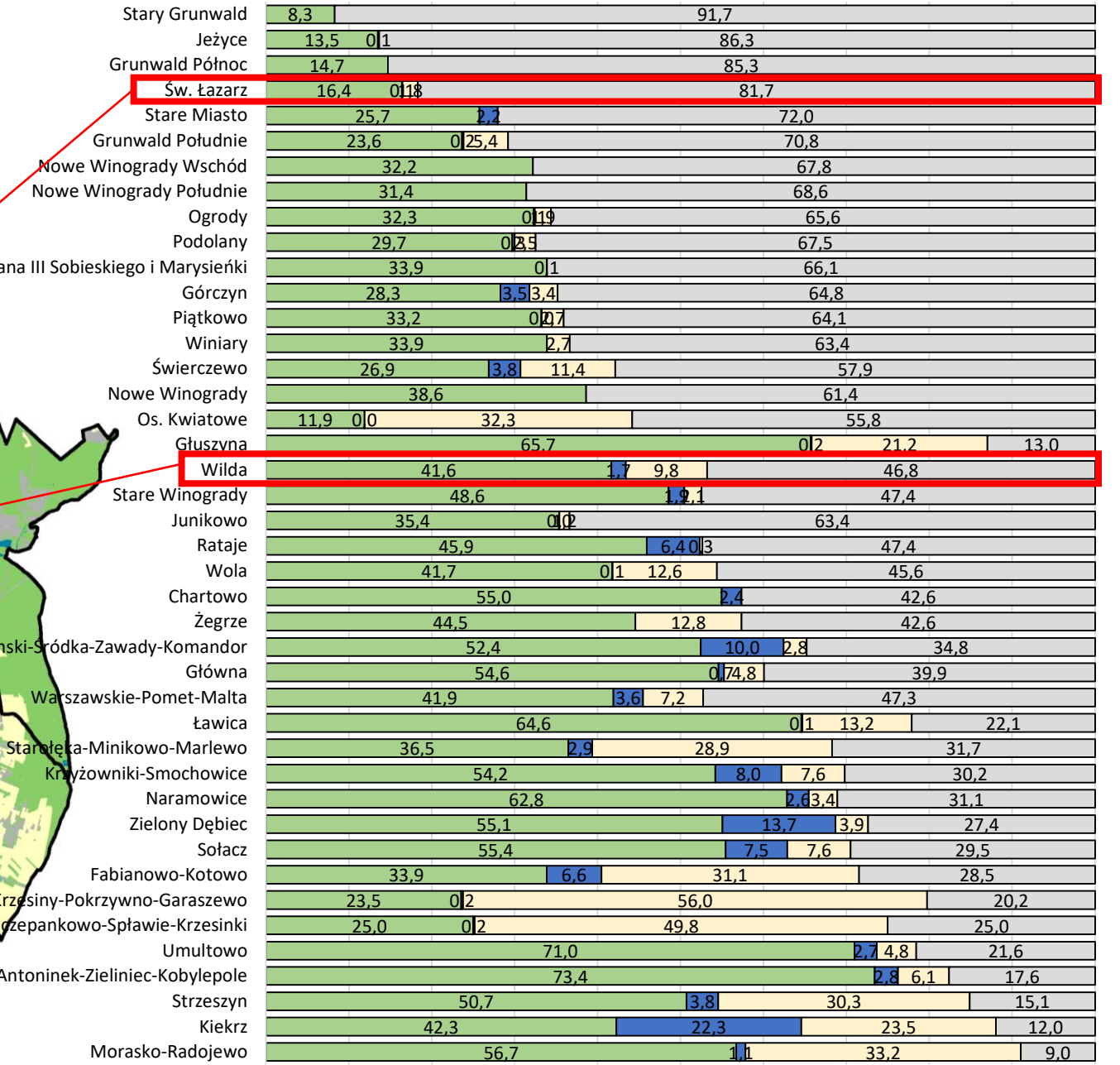
Land cover field mapping

Minimum surface area of unit 1m^2

Green Infrastructure

2019





Green Infrastructure change 2015-2019

Św. Łazarz +2,6%

Wilda +0,8%

City scale

Connecting Nature

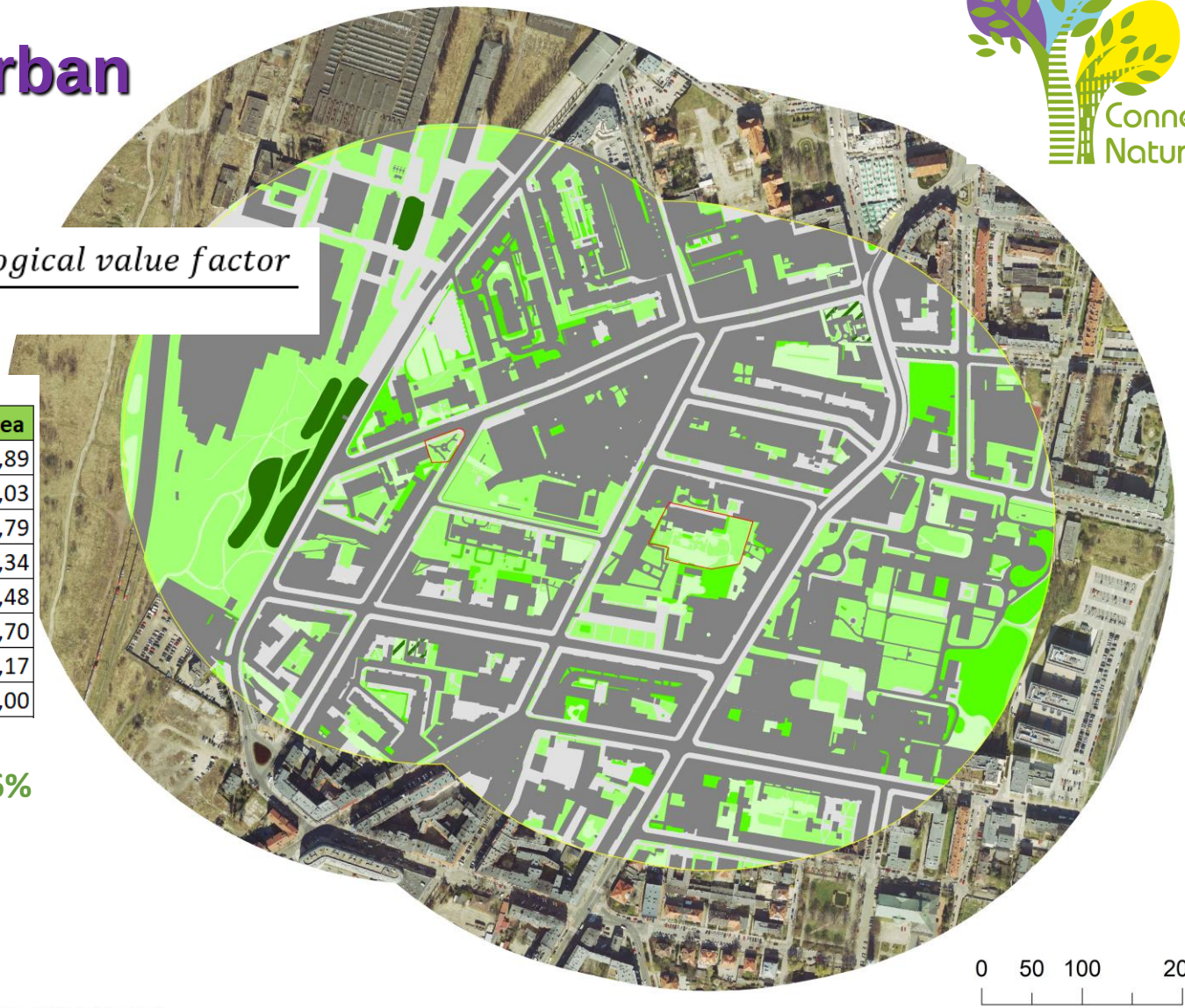
Mapping green space with Urban Greening Factor (UGF)

$$UGF = \frac{Area\ of\ land\ cover\ type\ with\ tree\ crown\ cover * ecological\ value\ factor}{Total\ area}$$

Current state (with NBSs impact)

LC/LU classess	UGF_value	Area (m2)	UGF x Area
semi-natural vegetation	1,00	7436,89	7436,89
hedges	0,60	2255,05	1353,03
groundcover planting including long grass and her*	0,50	19041,59	9520,79
grass (lawns)	0,40	104693,36	41877,34
extensive green roofs (thin substrate)	0,30	921,61	276,48
bare ground	0,25	21050,81	5262,70
permeable paving	0,10	82101,73	8210,17
sealed surfaces	0,00	283818,24	0,00

- ✓ Share of green area in the NBS and its neighborhood is 26%
- ✓ NBS (preschool garden) is 2% of green area
- ✓ UGF (without tree canopy) = 0,14!
- ✓ UGF (with tree canopy) = 0,26!



Intermediate scale

Urban Green Factor – NBS intervention of Preschool 42

$$UGF = \frac{Area\ of\ land\ cover\ type\ with\ tree\ crown\ cover * \ ecological\ value\ factor}{Total\ area}$$

Source: City of Poznań

Source: City of Poznań

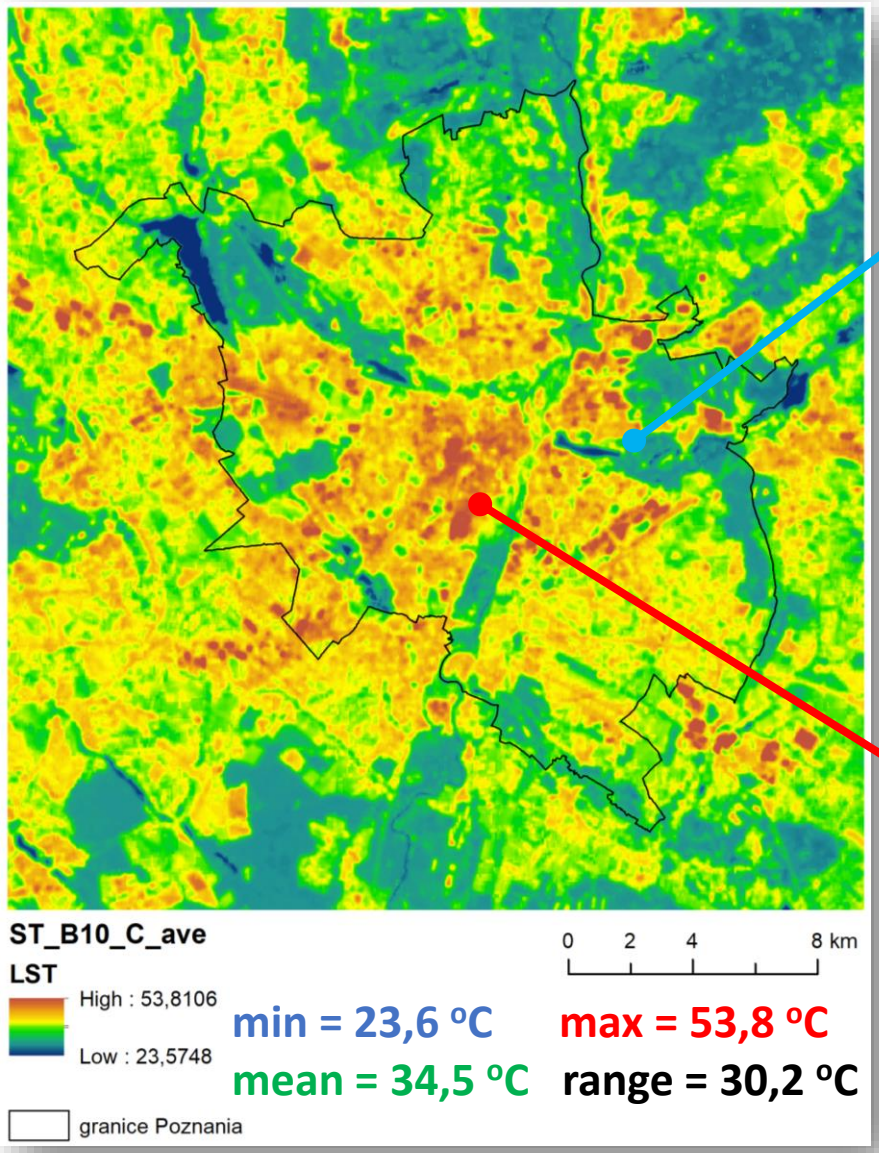
Land cover and tree canopy cover in Preschool no. 42

- ✓ **Concrete surface reduce from 921 m² to 39 m²**
- ✓ **Share of concrete surface reduced from 24% to 1%**
- ✓ **Decrease of concrete surface 96 %**
- ✓ **UGF (without tree canopy) increased from 0.27 to 0.32**
- ✓ **UGF (including tree canopy) increased from 0.63 to 0.73**

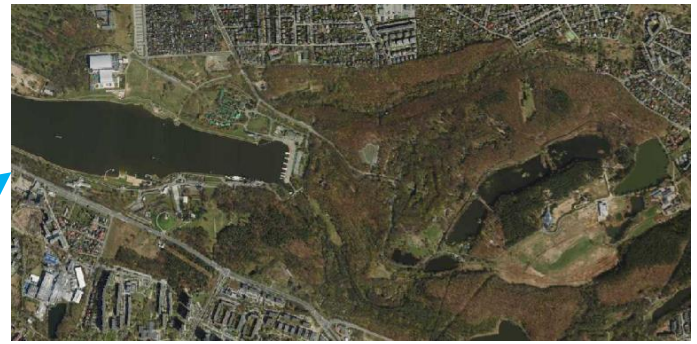
Site scale

Average land surface temperature
City scale

Landsat 8 thermal satelite images
5 scenes (2018-2020)

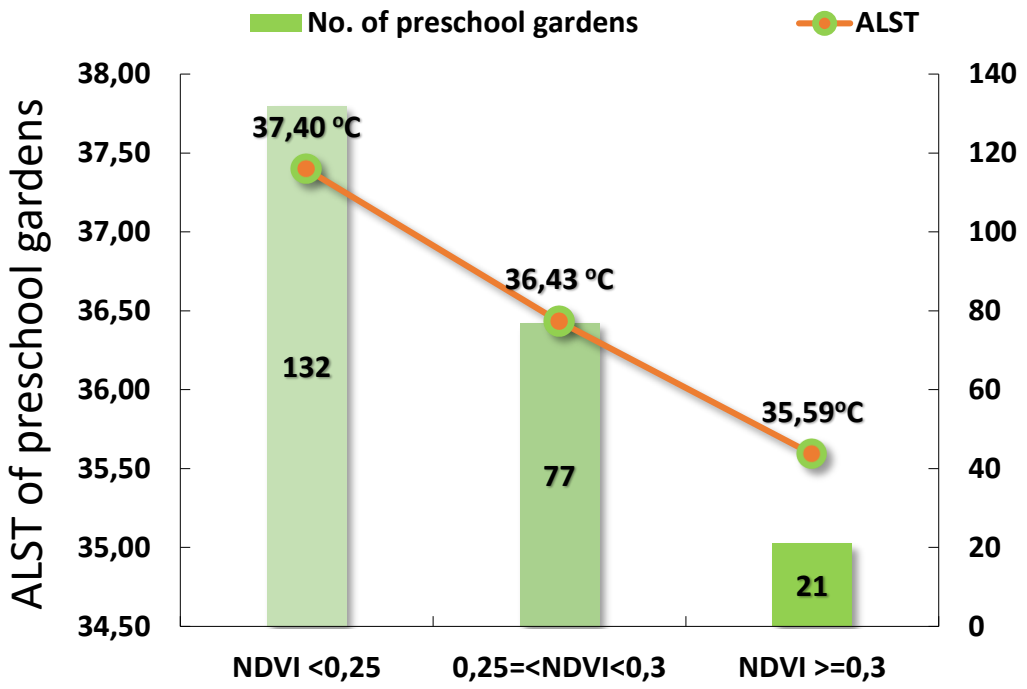


Mapping average land surface temperature (ALST)

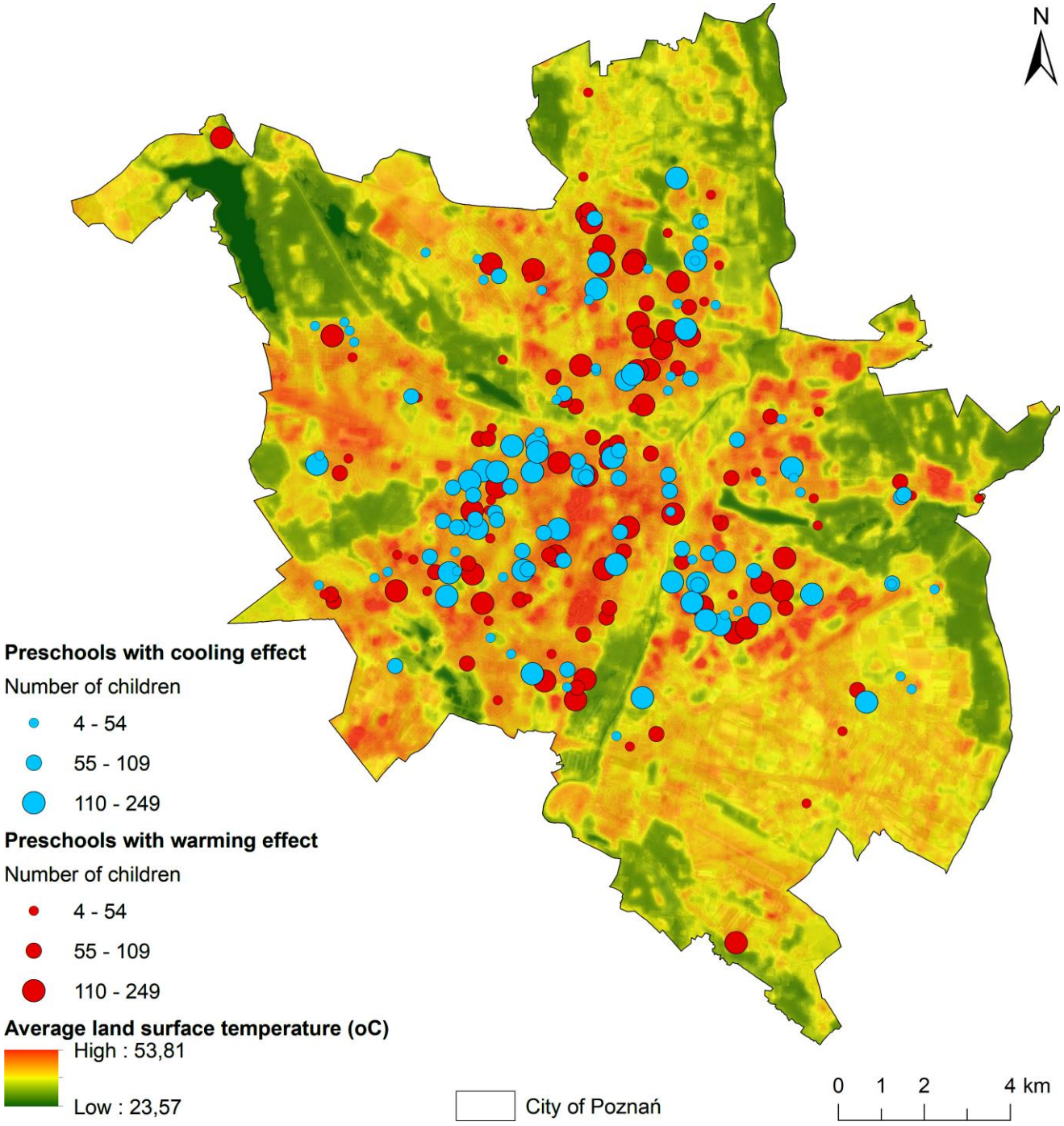


Identification of hot and cold-spots

Preschool gardens cooling effect

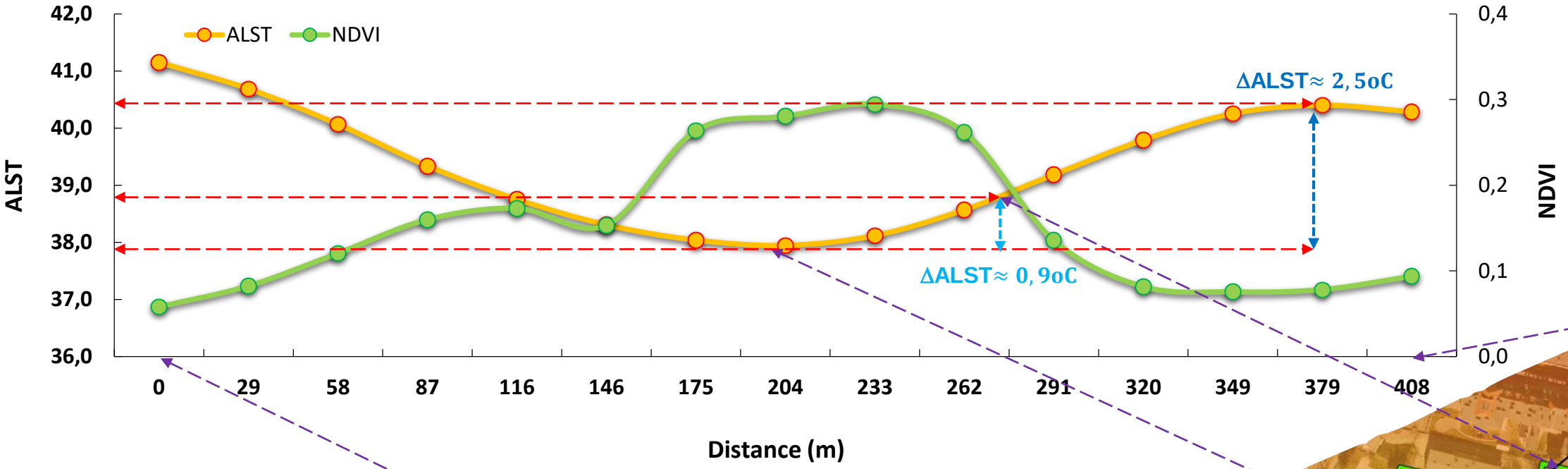


Preschool garden cooling effect in the neighborhood
Lower ALST (mean 0,15 °C; max 0,51 °C)

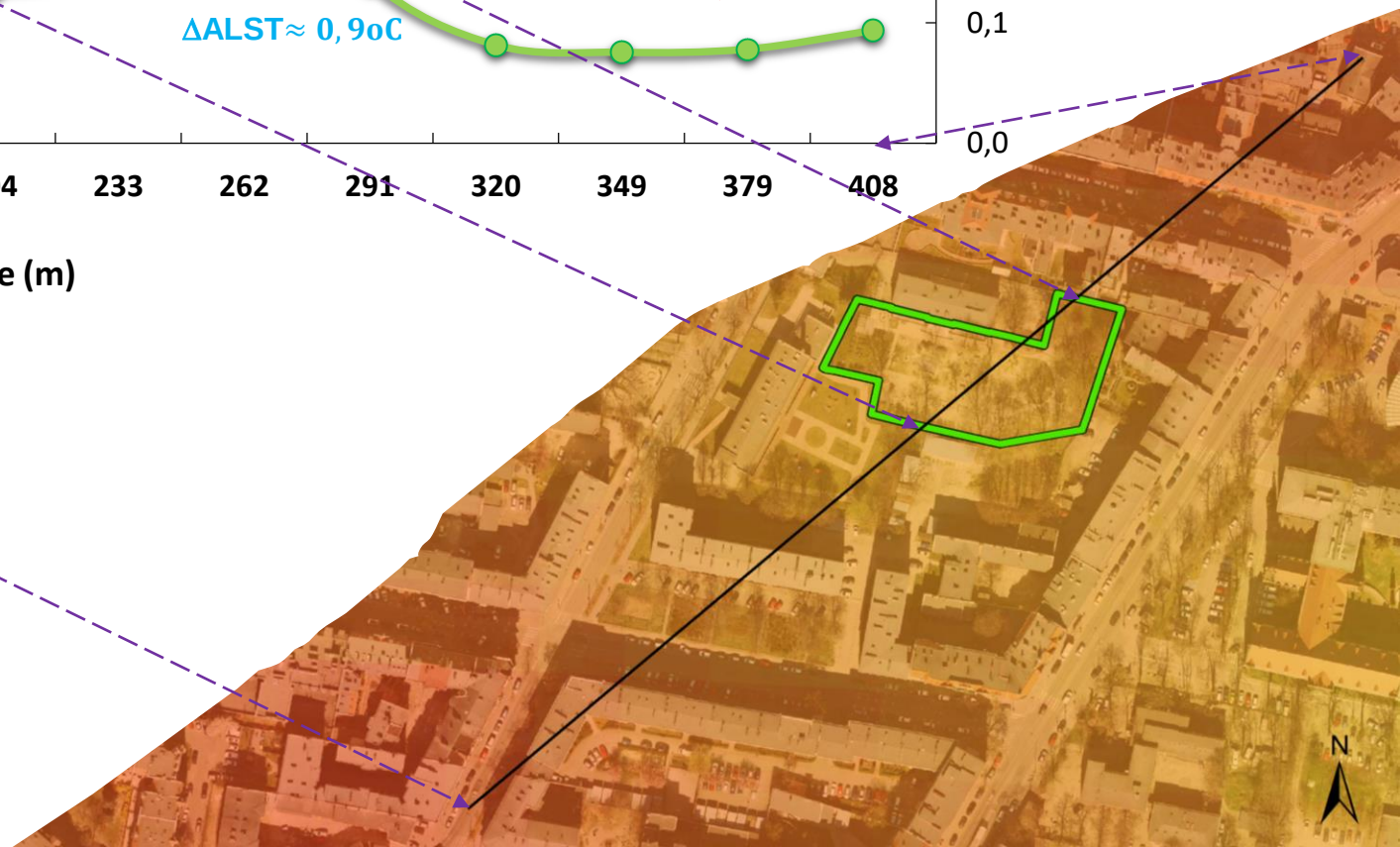


NDVI – Normalized Difference Vegetation Index
ALST – Average Land Surface Temperature

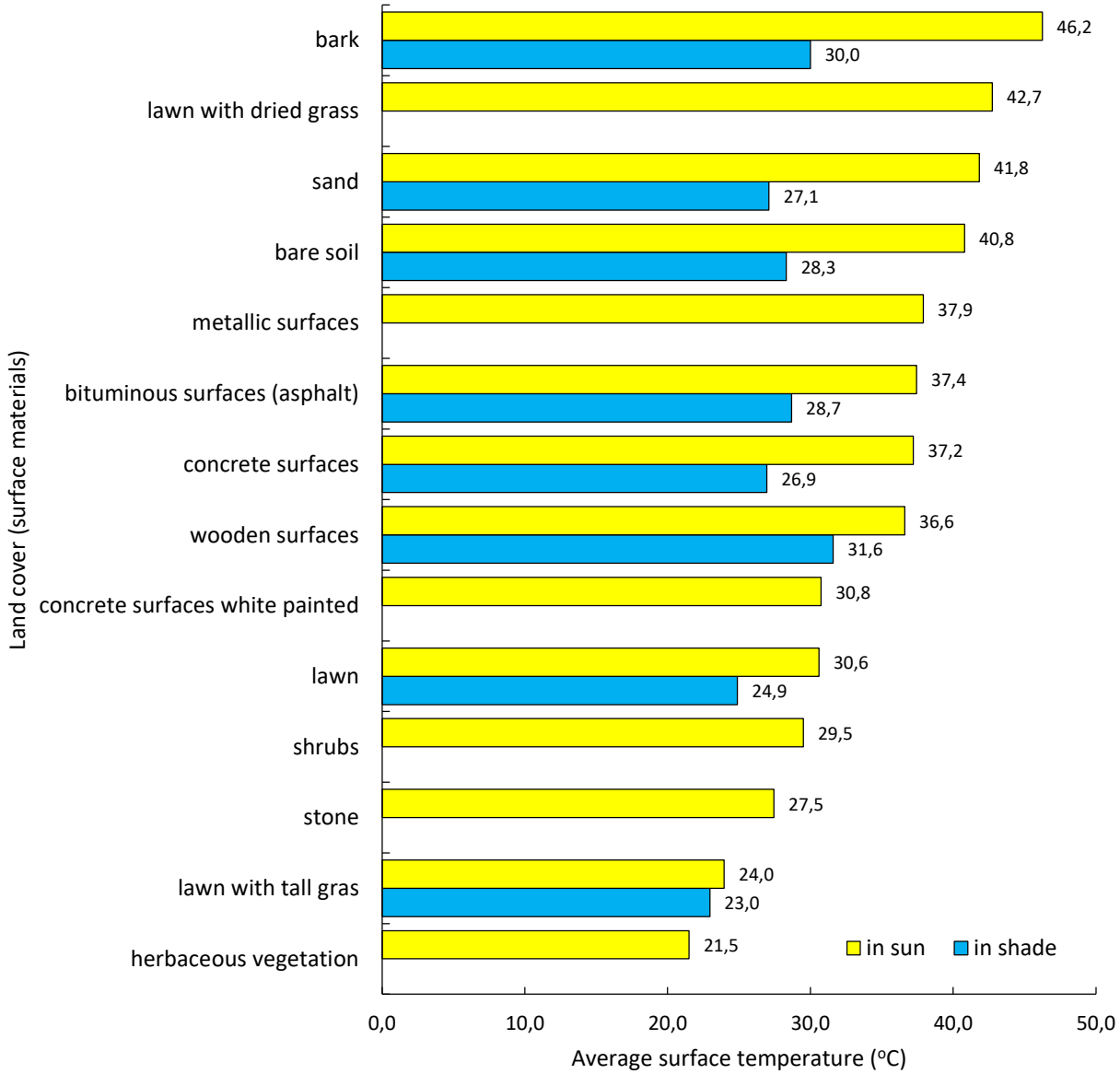
Case study of Preschool No. 42 – thermal profile

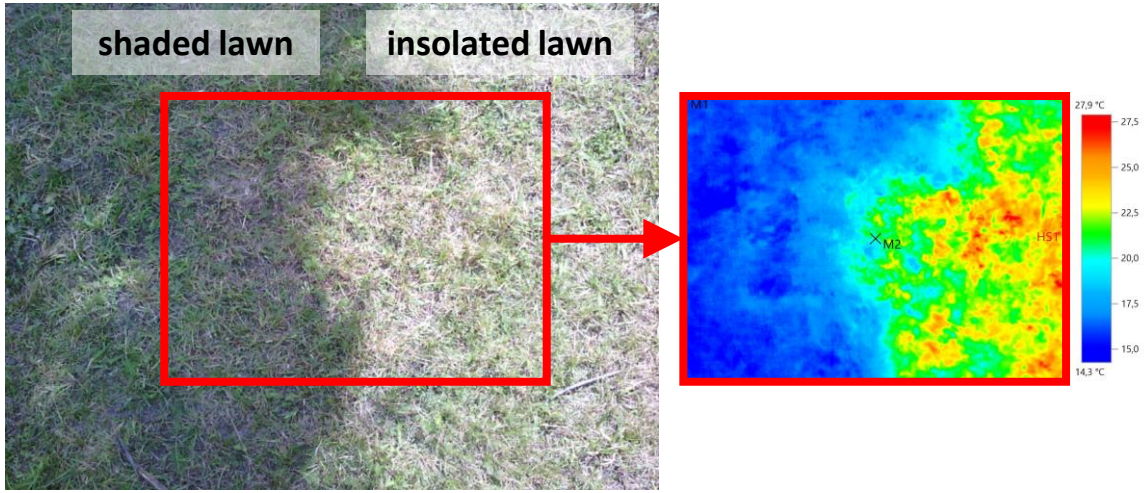


The cooling effect of the preschool garden is **0,9-2,5°C!**



Tree shade for local heat reduction





Testo 871 Thermal Camera

Average temperatures in pocket parks and their surrounding - mean values based on measurements at T_{air}≥25°C

Change in ecosystem service provision

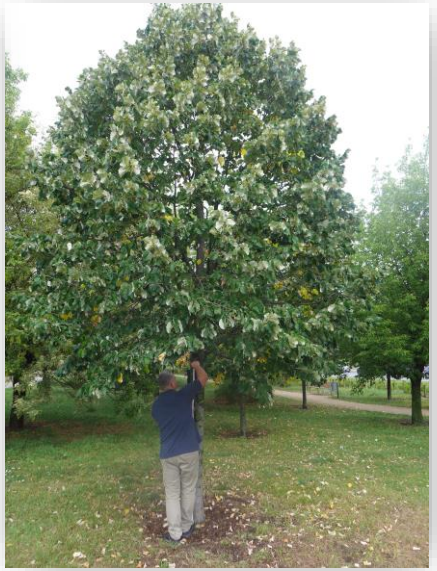
Site scale
Pilot
assessment

Connecting Nature

1. **Measurement of ecosystem services provided by trees in pocket park:**
   - ✓ air pollution removal (CO, NO2, O3, PM2.5, SO2)
   - ✓ carbon storage and sequestration
   - ✓ oxygen production
   - ✓ avoided runoff
2. **i-Tree Eco free software (https://www.itreetools.org/)**
3. **Required input data:**
   - ✓ tree measurement data
   - ✓ precipitation data and air pollution data
4. **Trees measurements using rangefinder and measuring tape**

i-Tree

Tools for Assessing and Managing
Forests & Community Trees



Change in ecosystem service provision: i-Tree results

Number of trees: **108**

Most common species of trees:

- ✓ **Tilia tomentosa,**
- ✓ **Celtis occidentalis,**
- ✓ **Robinia pseudoacacia 'Frisia'**

Site scale Pilot assessment

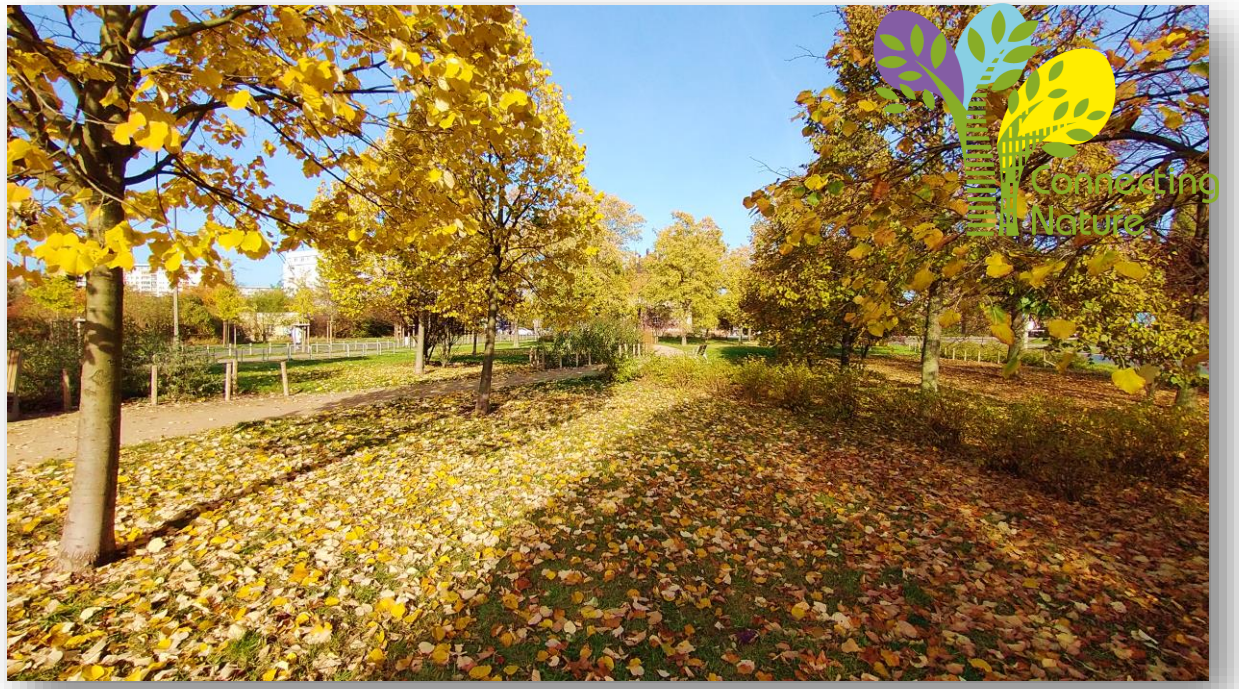
Pollution Removal: **11,31 kg/year**

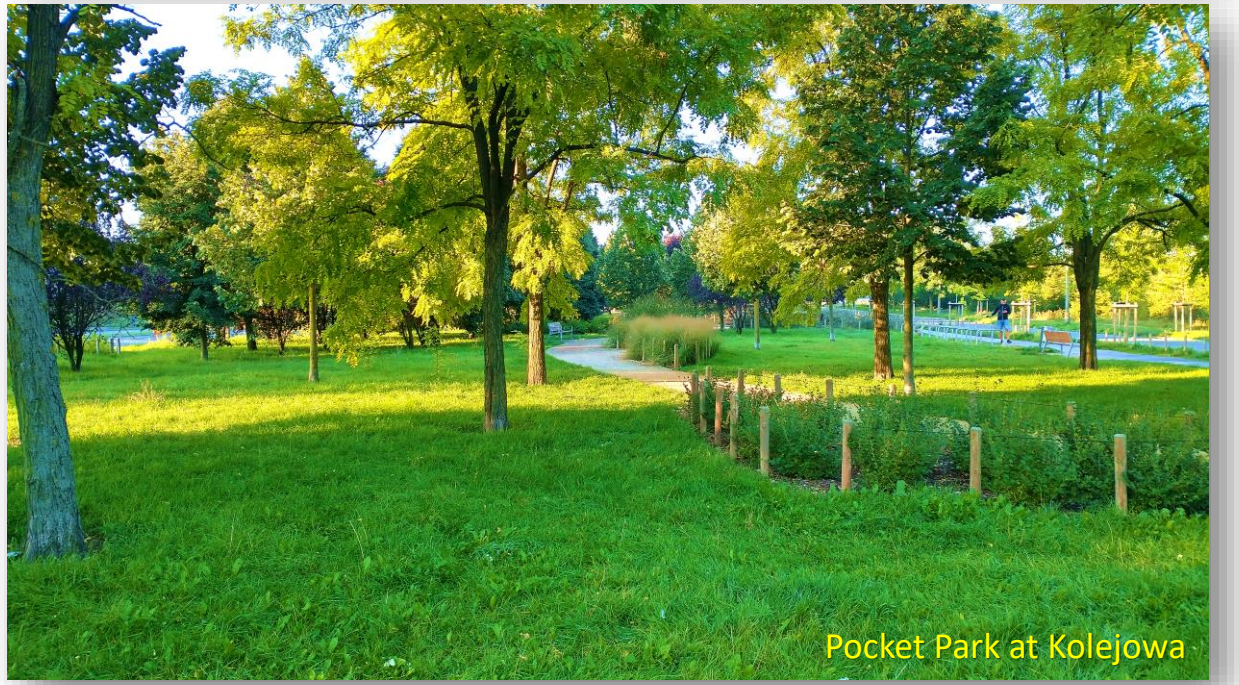
Carbon Storage: **114,8 t**

Carbon Sequestration: **1,661 t/year**

Oxygen Production: **4,43 t/year**

Avoided Runoff: **30,47 m3/year**





Conclusions

- ✓ Monitoring the NBS is fundamental to suport and evaluate decision-making process.
- ✓ Relevant data is a key challenge to monitor the impact of interventions at the site scale.
- ✓ On-site measurements allows for generating a local library of values that can be used as a base for the recommendation of the most appropriate solutions.
- ✓ City-wide monitoring can show the direction of urban transition from a long-term perspective and give evidence for local policy impact.
- ✓ Decision-making is a complex process from a legal and organizational perspective, in which environmental aspects are not always sufficiently captured. We showed how it can be improved.
- ✓ Science-practice interaction supports cities through evidence delivery and translation into feasible indicators.

Connecting Nature

Connecting Nature

Adam Mickiewicz University Poznań

Thank you

Connecting Nature Impact Summit
Genk

Bringing cities to life, **Bringing life into cities.**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730222