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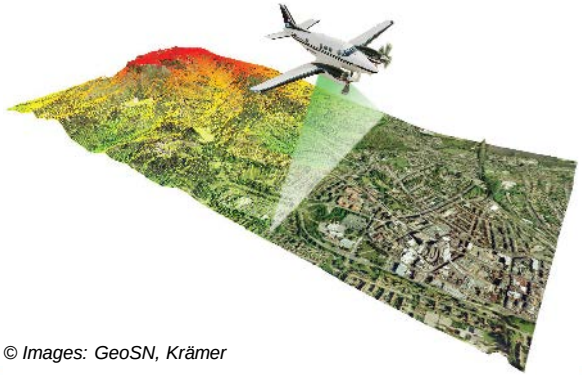
Deutsches Zentrum für integrative Biodiversitätsforschung (iDiv) Halle-Jena-Leipzig

Multi-sensor approach to monitor the urban landscape – refined mapping of urban structure types and vegetation patterns by means of DOP, LiDAR and UAV data



Roland Krämer (UFZ & iDiv Leipzig) & Ellen Banzhaf (UFZ Leipzig)

Workshop Landschaftsprozessmonitoring mittels Multisensordaten, 29.09.2016, Halle (Saale)

HELMHOLTZ ZENTRUM FÜR UMWELTFORSCHUNG UFZ

The urban landscape – human-induced environment

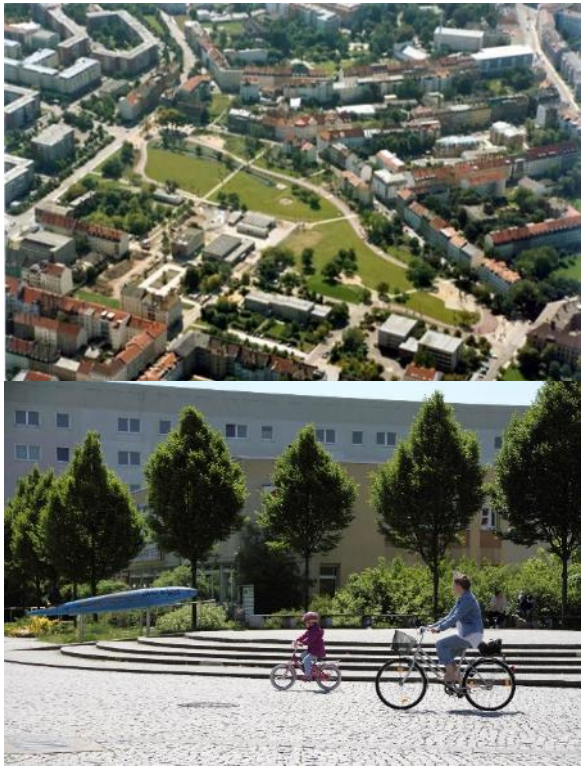
Quantifying the complex urban environment

- Nature-related, built, social environment
- Social, technical and natural sciences
- Fine scale surveys & data in time and space

Challenges for Remote Sensing (RS)

- High heterogeneity of patterns and processes (high variability – small patches / objects)
- High spatial and temporal dynamics
- Strongly intertwined structures (grey, green, and blue)

→ ***Need for a hybrid RS approach***



Photos: UFZ & Stumpe

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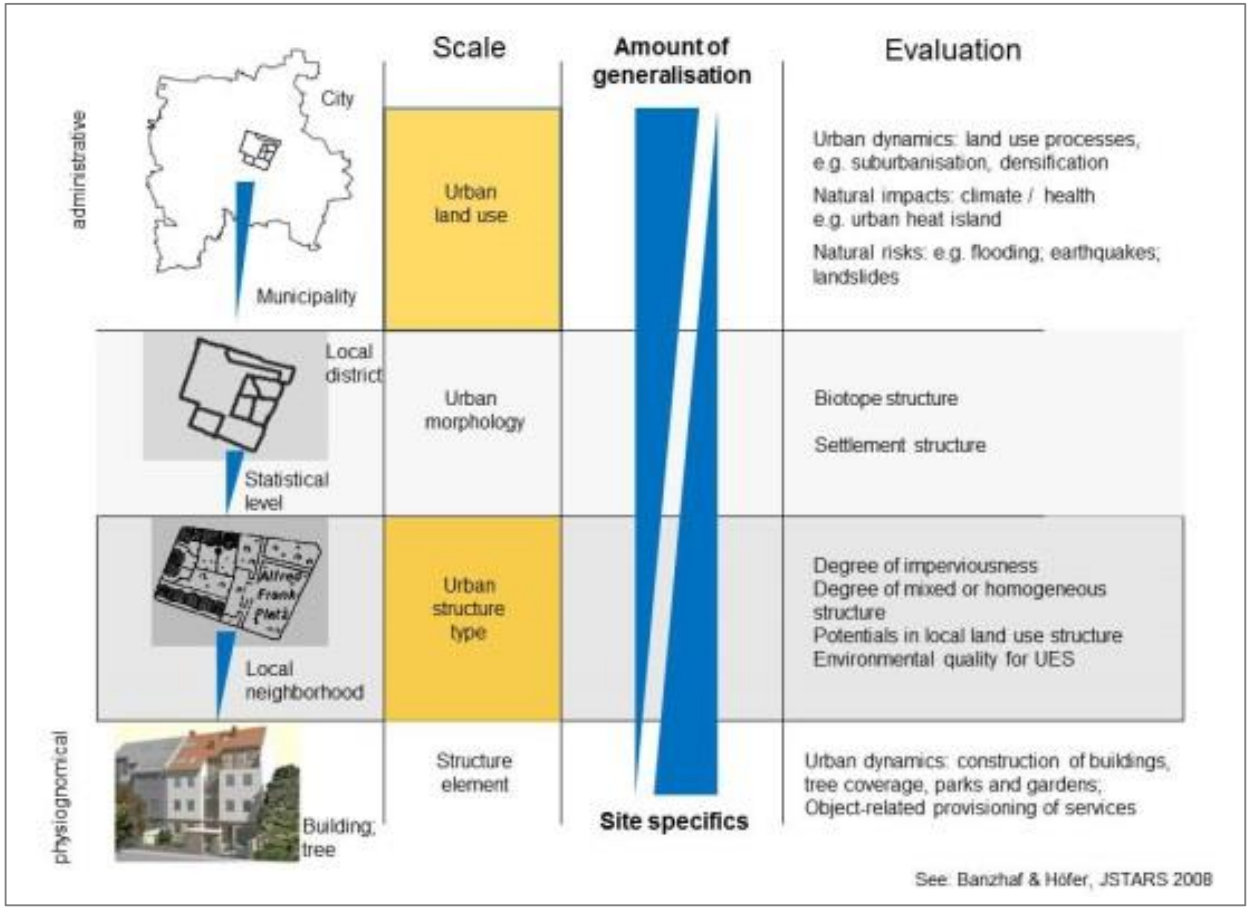
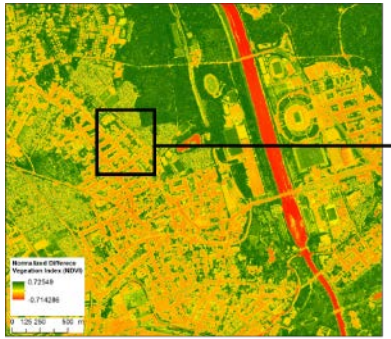
Scale-dependent analysis

- degree of spatial urban information

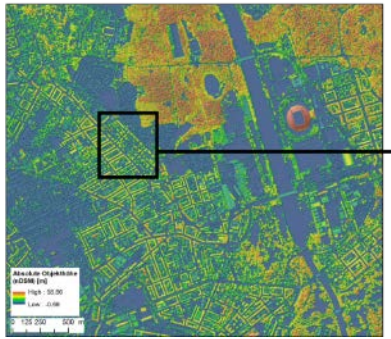
- socio-ecological processes & benefits



Urban tree cover and structure types - Leipzig



Preprocessing incl. NDVI



Preprocessed DOP including absolute height above ground

Material and Methods

- ✓ Digital Orthophotos (DOP) 2012
- ✓ LiDAR derivates (DEM & DSM) in 2012

  => three-dimensional model
- ✓ Object-based image analysis techniques (OBIA)

Source: Banzhaf & Kollai 2015, ISPRS, doi:10.5194/isprsarchives-XL-7-W3-301-2015.

Preliminary results from DOP and LiDAR data

- ✓ Quantifying urban tree cover for the entire city at 60 cm ground resolution
- ✓ Distinguishing mature trees (EEA convention), young trees and bushes, and meadows / lawns
- ✓ Measuring tree cover for different urban districts
- ✓ Structuring residential areas by types of buildings incl. their height to delineate UST
- ❖ Accuracy assessment still to be done!

Next steps – integrating selective VHR+ data

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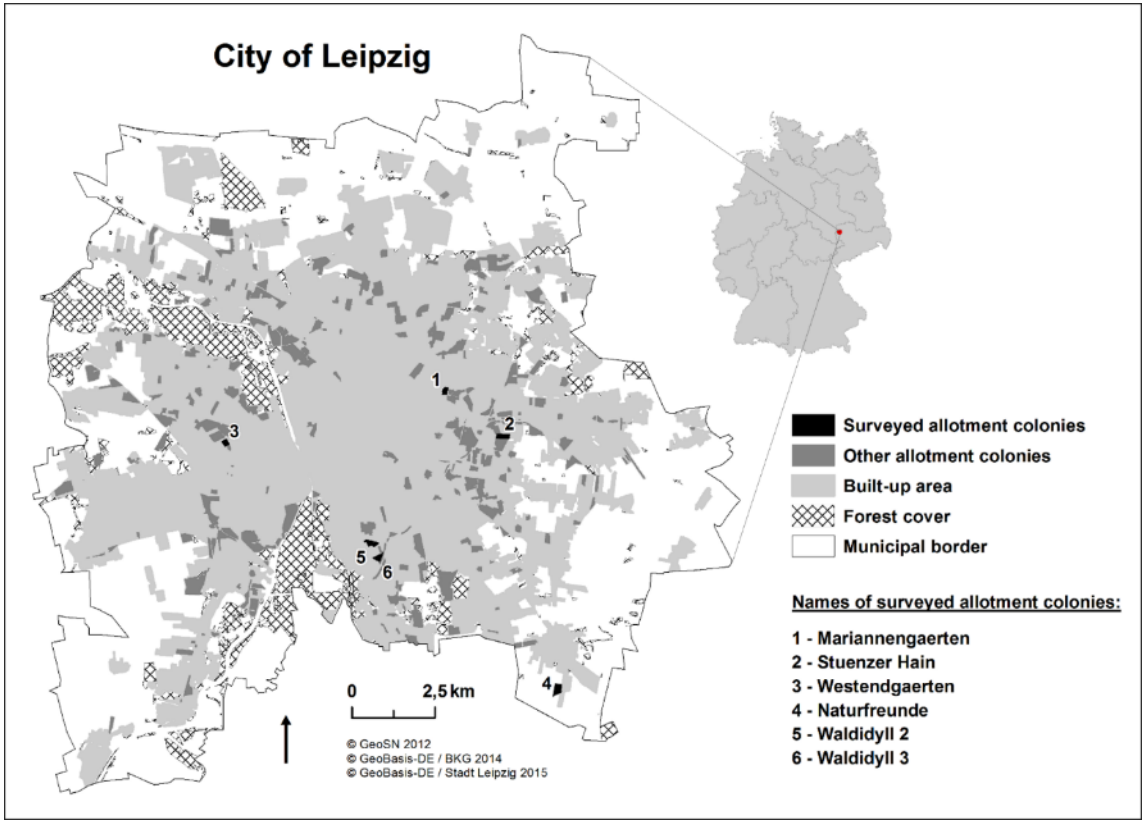
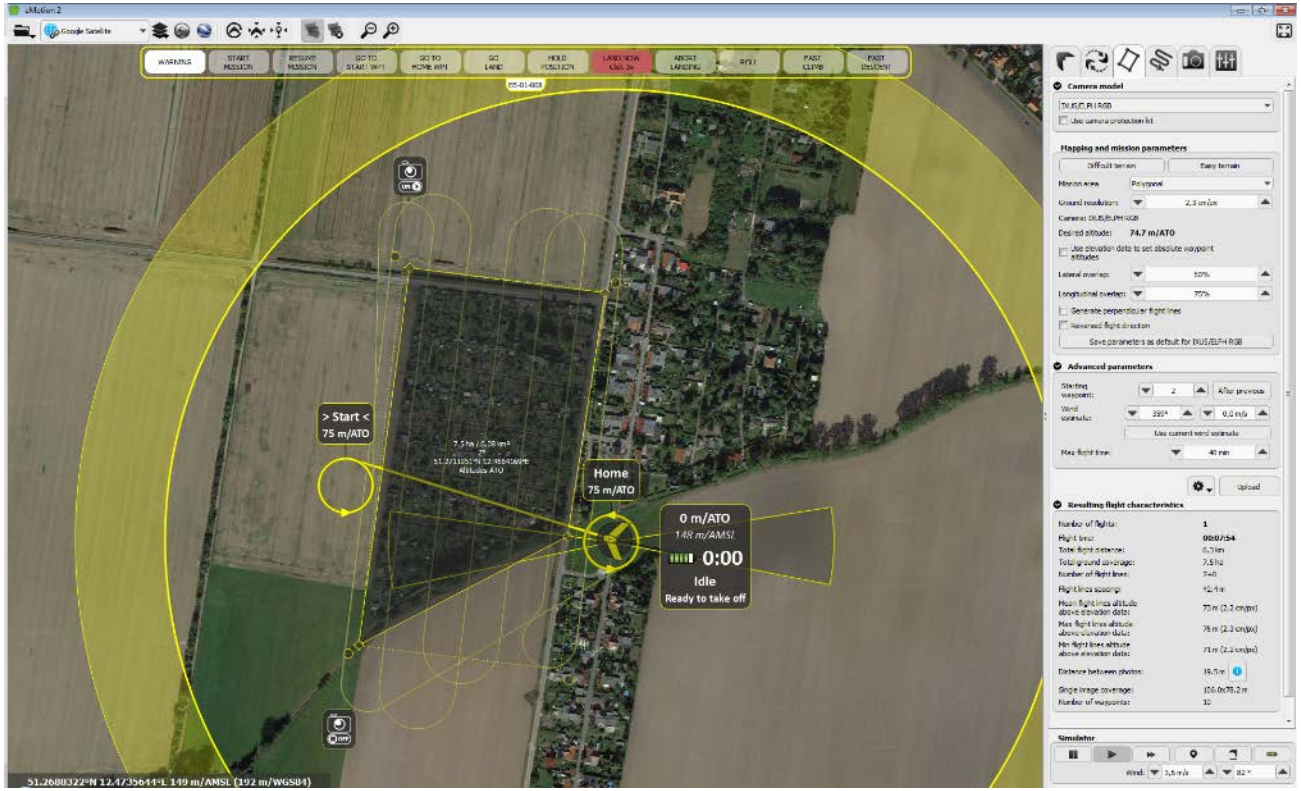
Project on Urban Gardens in Leipzig



Cabral et al. 2016 *Urban Forestry & Urban Greening*, *in review*

- 275 allotment colonies (843 ha; 9% of built-up area)
- 15 m^2 of gardening area per capita
- Colonies´ age from 50 – 150 years

Selective, local VHR+ Remote Sensing



„eBee“ drone by Sensefly

- 700 g
- RGB, NIR, MultiSpec
- Max. 1.5 cm GSD/res.
- 40-90 km/h cruise speed
- Max. 45 min. flight
- Post-processing software

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Selective, local VHR+ Remote Sensing

Selective, local VHR+ Remote Sensing

Selective, local VHR+ Remote Sensing

Outlook: Integrating remote sensing data → improving all products

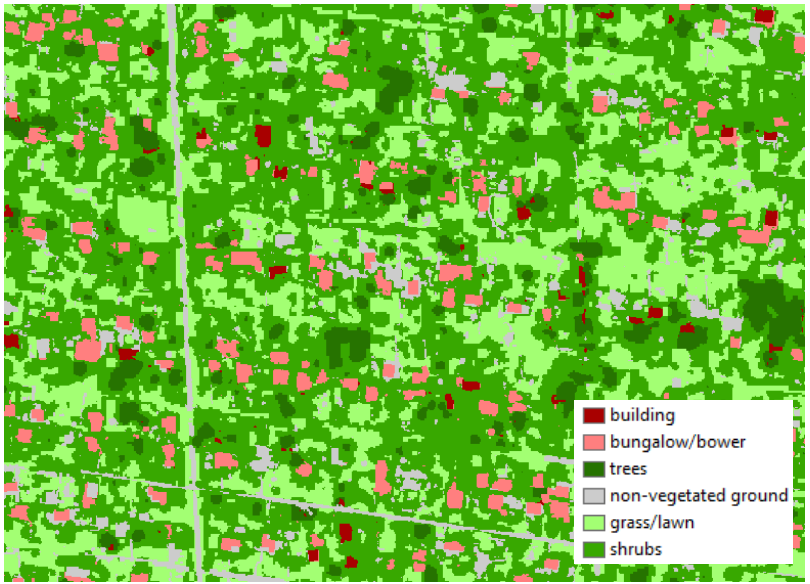
UAV data/products (selective)

?

→

←

Airborne products (DOP & LiDAR), spatially explicit



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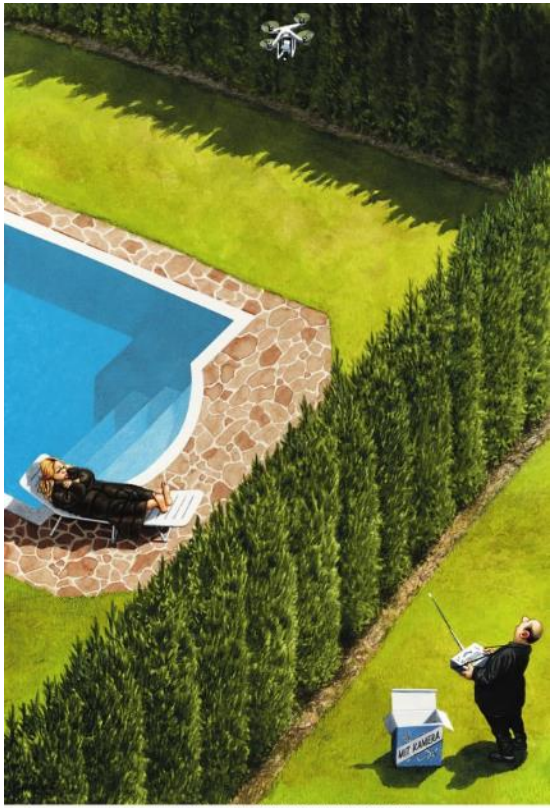
Outlook / Final remarks

- Joining and calibrating **hybrid remote sensing** data needed for urban areas but **challenging**
- **Remote sensing** alone **not sufficient** in coupled natural-built-social system (only a proxy for land-use)
- **Interdisciplinarity** needed: social surveys, (mobile) sensors, environmental (point) data, biological surveys, statistics
- Scientific UAV application still needs big effort (and public acceptance)



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Thank you

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Photos: Stumpe, Krämer