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The relationship between the morphological status of the urban stream and the floodplain biodiversity – case study of the Leskava Stream in Brno

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Linking floodplain and river pattern

- **floodplain** - the flat area adjacent to river, formed by the present river channel in the present climate, frequently subjected to inundation (*Leopold et al., 1964*)
- the area with dominant occurrence of hydromorphic soils on fluvial sediments
- **river landscape** (riverine landscape, riverscape) – current river ecosystem together with surrounding ecosystems, created or influenced by the river (*Štěrba et al., 2008*)
- **morphological properties of riverbed** as an indicator of natural and anthropogenic processes in the landscape
- concept of „hydroecology“, resp. **„ecohydrology“** (*Zalewski & Naiman, 1985*)
- → **„ecohydromorphology“** (*Clarke et al., 2003*)

Linking floodplain and river pattern

- **main objectives:**
  - to understand and quantify the relationships between hydromorphology and river system ecology

    → basis of the effective watershed management (*Vaughan et al., 2009*)
  - to identify direct and indirect human impact on the character of relationships between terrestrial and fluvial part of river landscape

The Leskava Stream catchment

- small urban stream catchment in the southwestern part of Brno
- tributary of the Svratka River
- stream length 10.04 km, drainage area 21.20 km^2, floodplain area 1.95 km^2
- Brno-Bosonohy, Bohunice, Starý Lískovec, Ostopovice, Dolní Heršpice
- flood in the recent past (01/2004) → flood control measures, …

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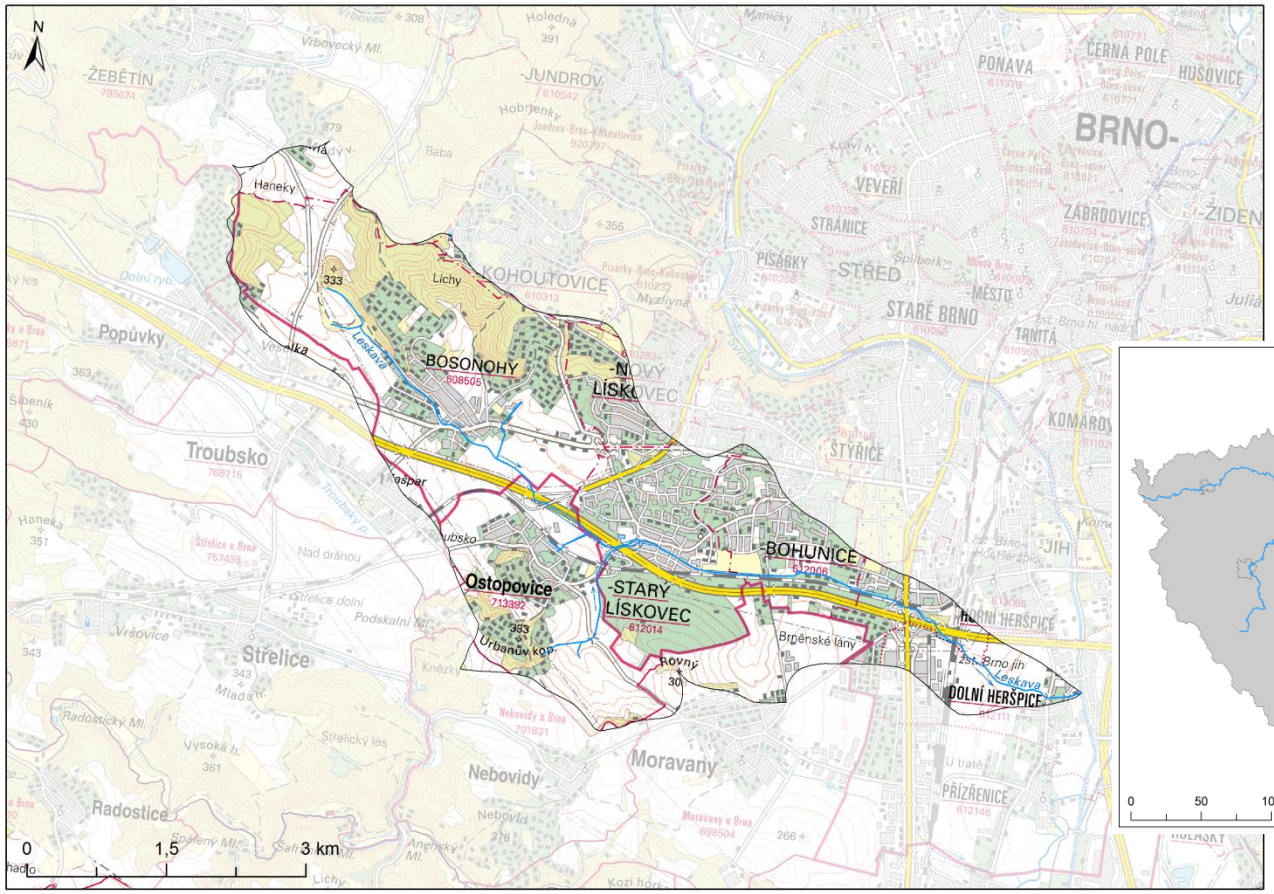
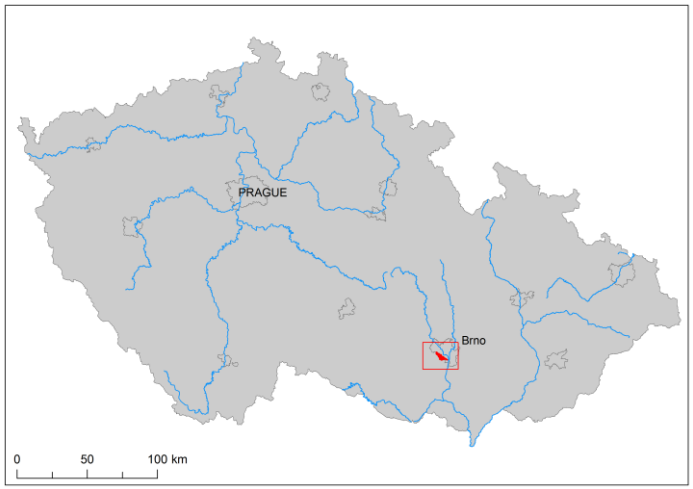
The Leskava Stream catchment





Research methodology

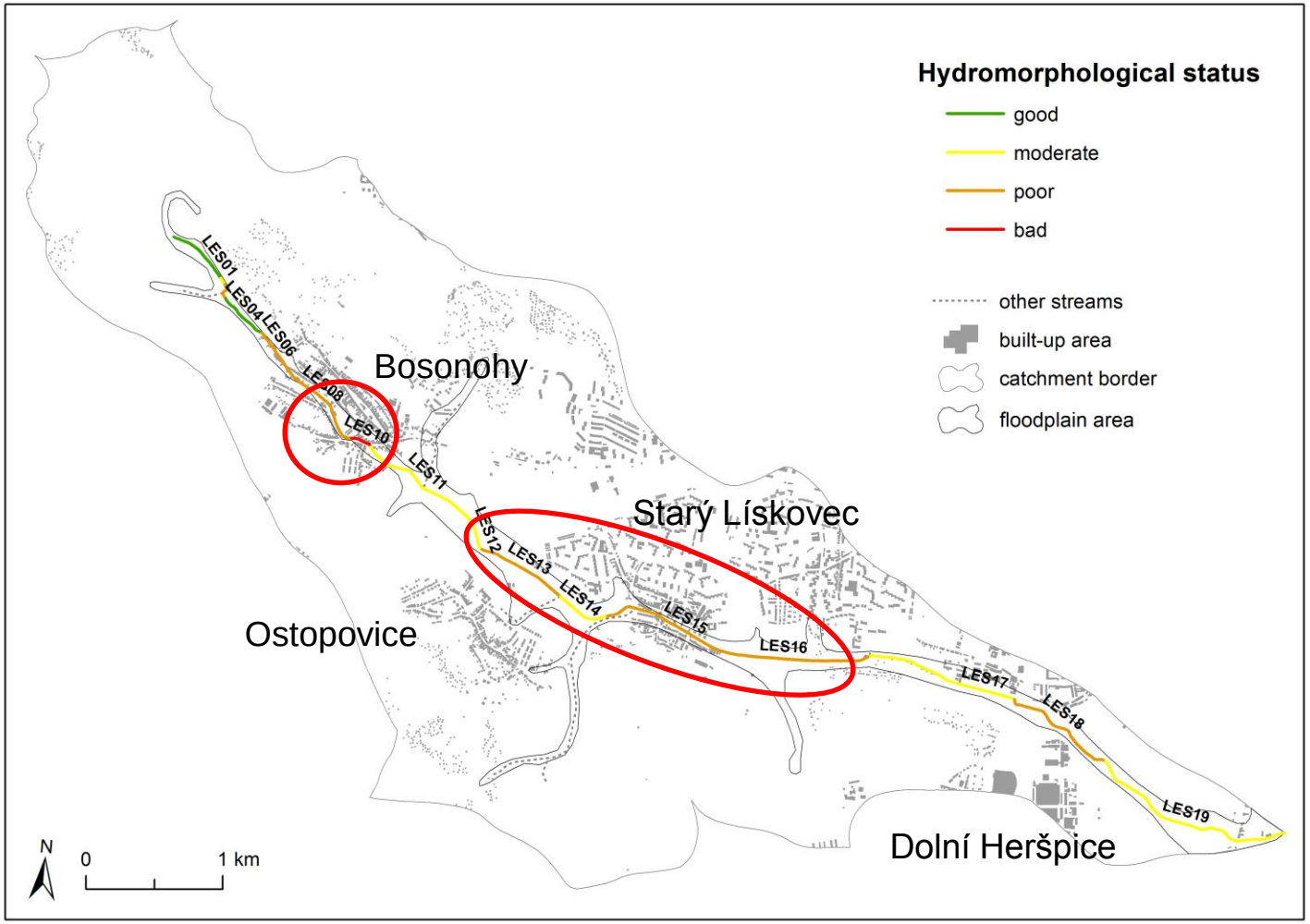
- **floodplain delineation**
  - based on soil and geological maps
  - field research
  - 19 stream segments (+ adjacent floodplain areas)

- **assessment of hydromorphological status**
  - HEM methodology (*Langhammer, 2007-2014*)
  - hydromorphological quality of stream segments
  - classification of final hydromorphological status according to WFD (*EC, 2000*) – 5 quality levels

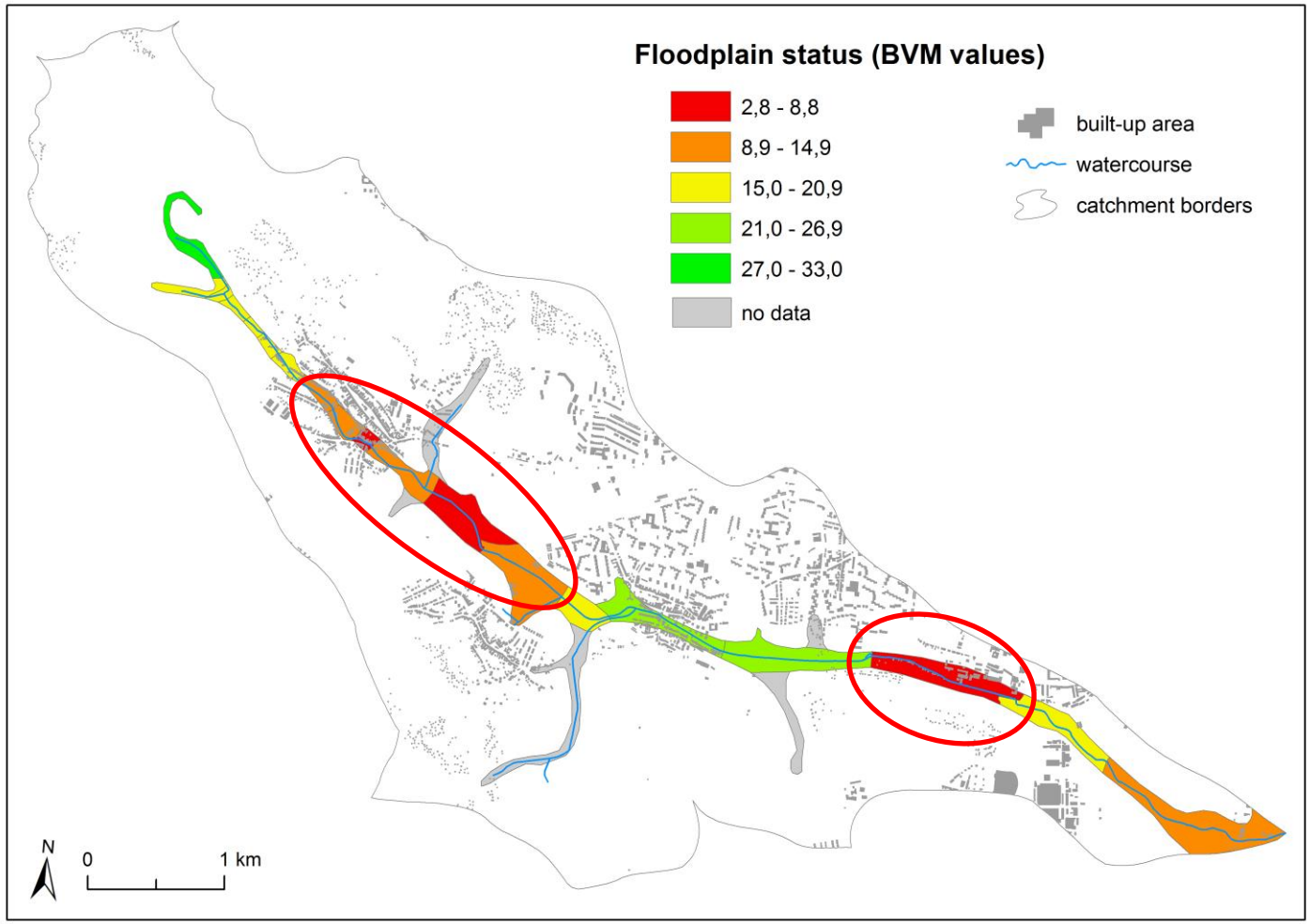
Research methodology

- **assessment of environmental status of floodplain**
  - BVM methodology (*Seják et al., 2003*)
  - interdisciplinary evaluation of all habitat types
  - habitat point value obtained on the basis of an evaluation of eight environmental and economic characteristics:
    - maturity and naturalness of habitat type
    - structure diversity of habitat type
    - species diversity of habitat type
    - rareness of habitat type
    - species rareness of habitat type
    - sensitivity of habitat type
    - endangering of habitat type

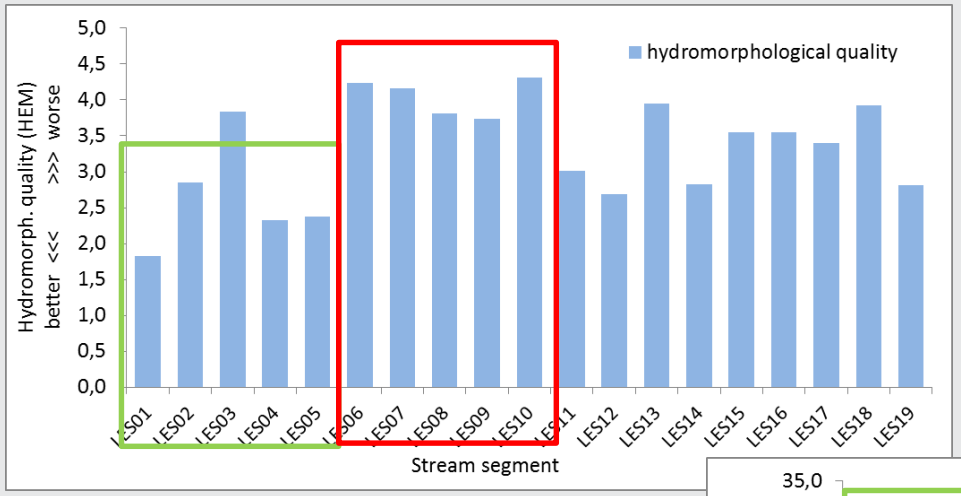
Results

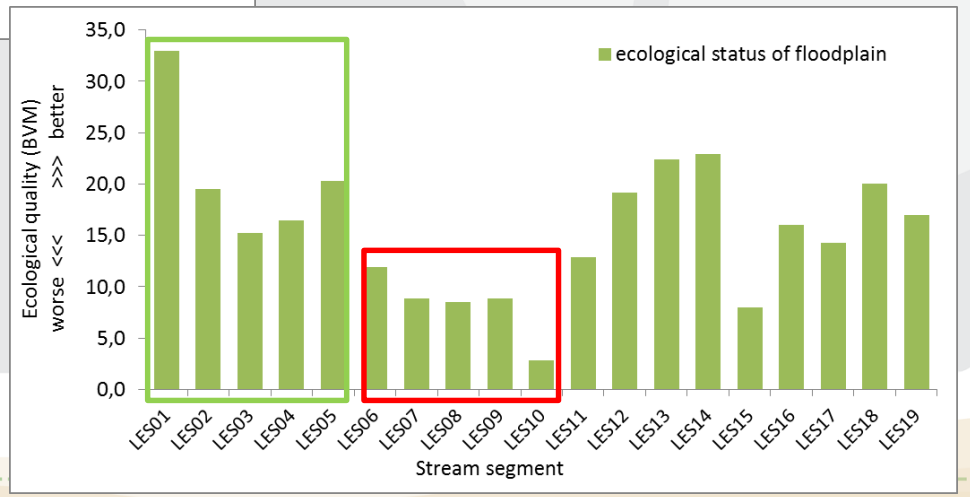

Hydromorphological status
good
moderate
poor
bad
other streams
built-up area
catchment border
floodplain area
Bosonohy
Starý Lískovec
Ostopovice
Dolní Heršpice
LES01
LES04
LES06
LES08
LES10
LES11
LES12
LES13
LES14
LES15
LES16
LES17
LES18
LES19
N
0
1 km

Results


Floodplain status (BVM values)
2,8 - 8,8
8,9 - 14,9
15,0 - 20,9
21,0 - 26,9
27,0 - 33,0
no data
built-up area
watercourse
catchment borders
N
0
1 km

Results


hydromorphological quality
Hydromorph. quality (HEM)
better <<< >>> worse
5,0
4,5
4,0
3,5
3,0
2,5
2,0
1,5
1,0
0,5
0,0
LES01 LES02 LES03 LES04 LES05 LES06 LES07 LES08 LES09 LES10 LES11 LES12 LES13 LES14 LES15 LES16 LES17 LES18 LES19
Stream segment


ecological status of floodplain
Ecological quality (BVM)
worse <<< >>> better
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
LES01 LES02 LES03 LES04 LES05 LES06 LES07 LES08 LES09 LES10 LES11 LES12 LES13 LES14 LES15 LES16 LES17 LES18 LES19
Stream segment

Results

- most degraded segments: LES06-LES10 (Bosonohy)
  - significant riverbed incision
  - stream bottom and banks fortification
  - channelized („pipelined“) stream
  - urban stream syndrome (*Walsh et al., 2005*)

- segments in the best overall conditions: LES01, LES02, LES04, LES05
  - headwater area (polder)
  - suburban stream in the agricultural / forest landscape
  - concrete channel covered by sediment deposition

Conclusion

- the relationship between morphological status of the river network and environmental state of the floodplain is significantly influenced by anthropogenic activities
- loss of contact between terrestrial and fluvial part of the river landscape - esp. in built-up areas
- the quantity and quality of interactions between the stream and floodplain is affected esp. by two factors:
  - the degree of riverbed incision
  - riverbed-forming material
  - → key evaluation criteria for identification of segments with limited potential to the occurrence of natural alluvial habitats

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Thank you for attention.

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