CHARACTERIZATION OF RIPARIAN ZONES IN WALLONIA (BE)

FROM LOCAL TO REGIONAL SCALE USING AERIAL LIDAR DATA AND PHOTOGRAMMETRIC DSM

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34TH EARSEL SYMPOSIUM 2014 - FLUVIAL REMOTE SENSING SESSION

Context: Riparian zone in Wallonia

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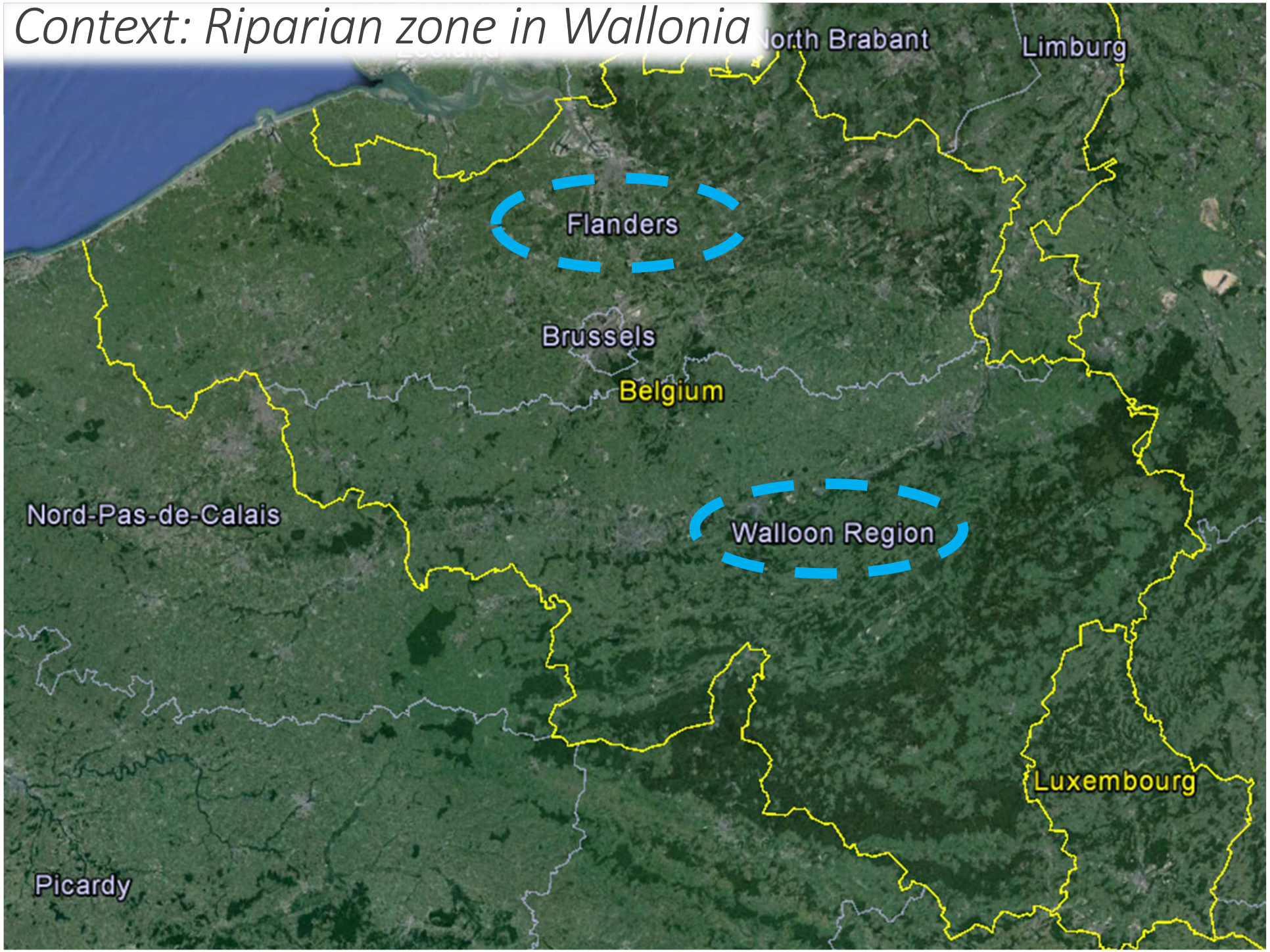
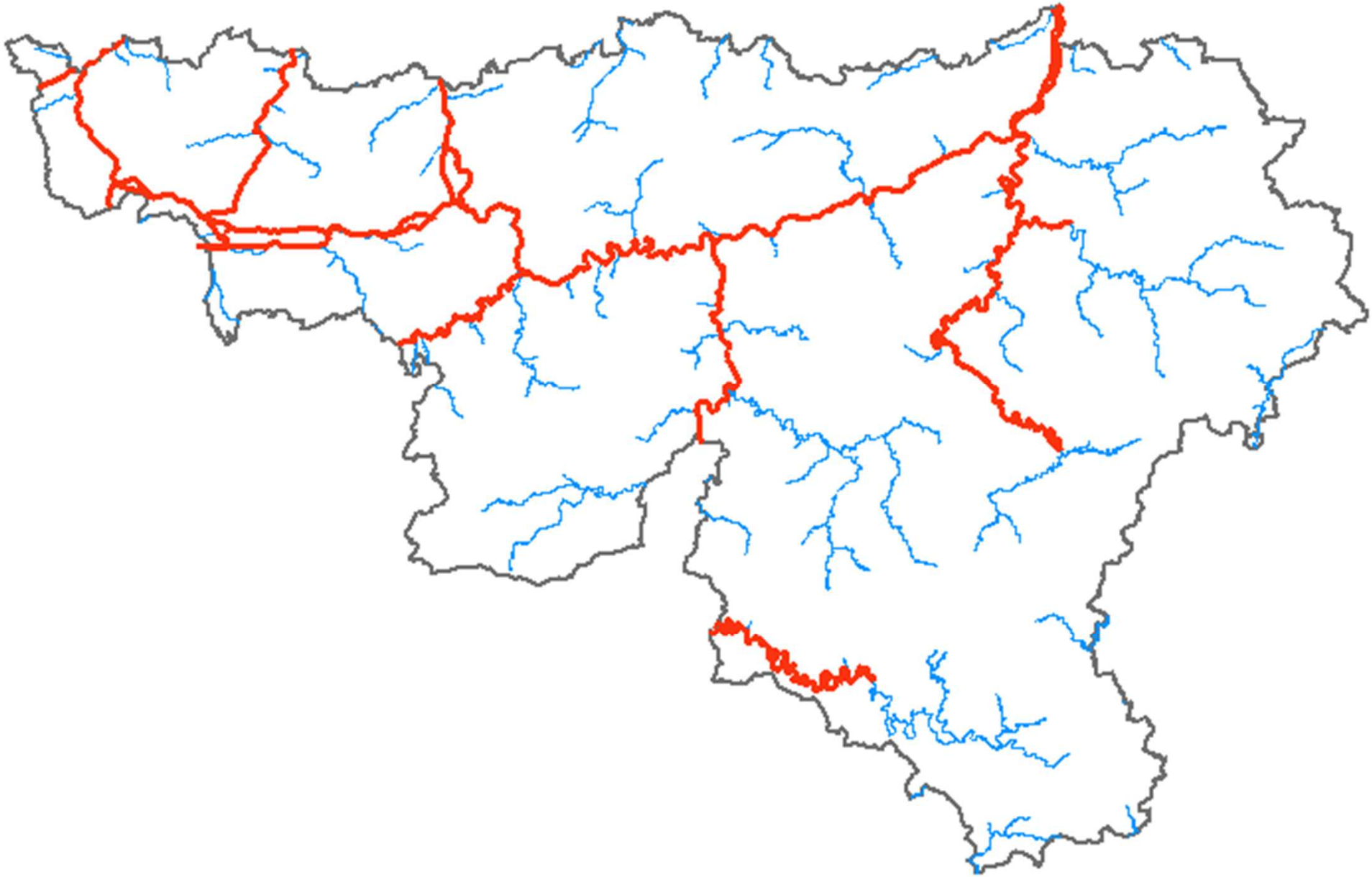
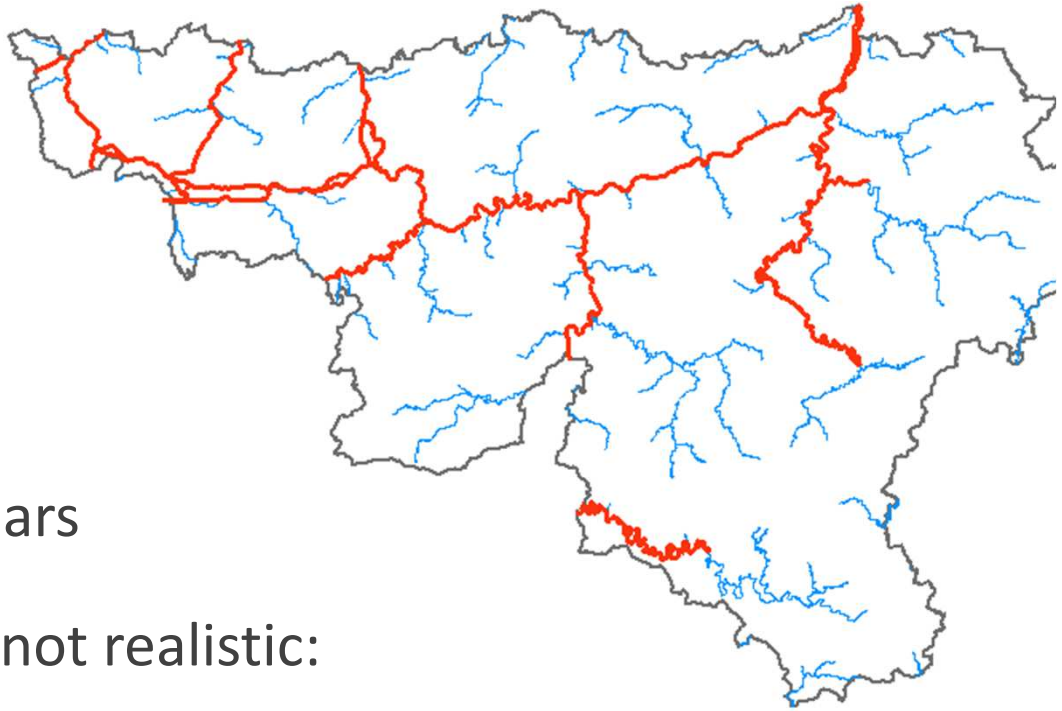


Context: Riparian zone in Wallonia



Context: Riparian zone in Wallonia

13,000 km of rivers (+ riparian zone) managed by public administration



Effective and regular monitoring needed !

(WFD, Flood Directive, N2000, maintenance work, …)

- Desired frequency: 3 years
- Field based monitoring not realistic:

Remotely sensed approach relevant !

Characterization of riparian zones: methodology

Methodology development for a regional monitoring (13,000 km)

Approach derived from previous work

(see **Michez *et al.*, 2013** for details)

- Extraction of riparian zone attributes to assess ecological integrity
- Based on metrics of High Density LiDAR dataset (> 10 pts/m²)
- River reach < 30 km, watershed: 240 km²

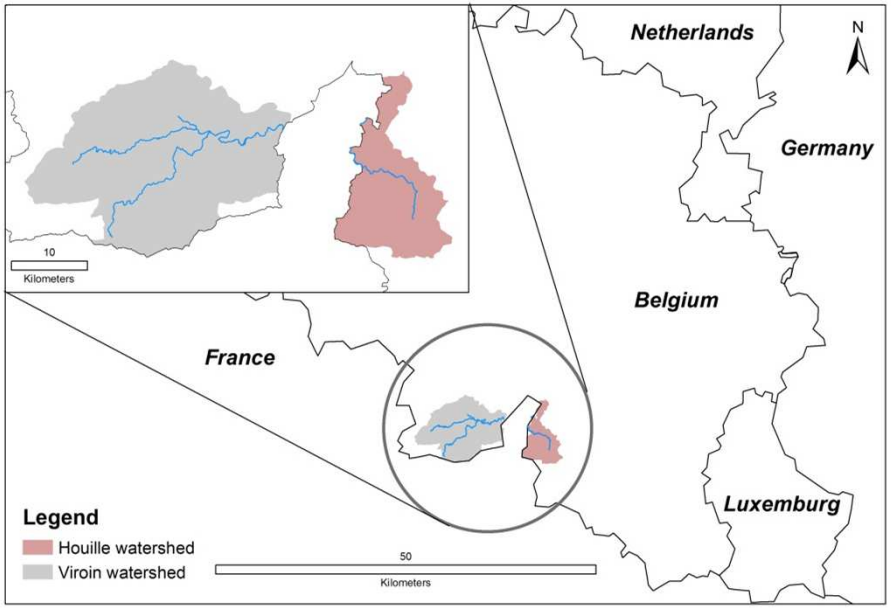
Michez *et al*., *« LiDAR derived ecological integrity indicators for riparian zones: Application to the Houille river in Southern Belgium/Northern France »*, **Ecol. Indic.**, vol. 34, p. 627-640, nov. **2013**

Characterization of riparian zones: *methodology*

Methodology development for a regional monitoring
(13,000 km / 170,000 km²)

First research on study site:

- Two tributaries of the Meuse
- Watersheds: 725 km²
- River network: 487 km
- 192 reaches (ca. 2.3 km)



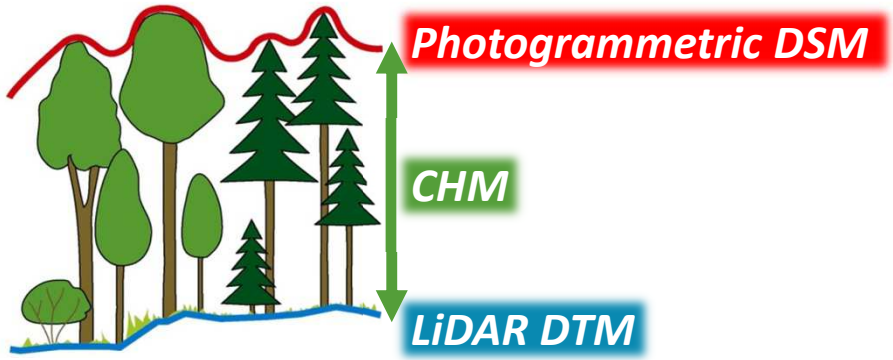
Characterization of riparian zones: *methodology*

Use of data available at the regional scale (170,000 km²):

- Aerial LiDAR
  - Low density (0.8 pts / m²) small footprint dataset (captured on April 2013)
- Photogrammetric Digital Surface Model
  - DSM (0.5m GSD) derived from raw images of orthophoto coverage (may 2013)

"Hybrid" Canopy Height Model

DSM – DTM = CHM



Characterization of riparian zones: *methodology*

Two classes of attributes

- Physical settings (LiDAR dataset)
  - Relative water level, channel extent/width/sinuosity, floodplain width
- Riparian forest attributes (hybrid CHM)
  - Relative water level, Longitudinal continuity, Tree height, Mean Core Area Index (CAI), Mean Fractal Dimension Index (FDI)

Characterization of riparian zones: *methodology*

Physical settings (LiDAR dataset)

- Channel extent (width/sinuosity)
  - Extracted from LiDAR-metrics
    - OBIA for main rivers (watershed > 10 km²)

Characterization of riparian zones: *methodology*

Physical settings (LiDAR dataset)

- Channel extent (width/sinuosity)
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    - OBIA for main rivers (watershed > 10 km²)

Characterization of riparian zones: *methodology*

Physical settings (LiDAR dataset)

- Channel extent (width/sinuosity)
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OBIA approach

Segmentation

Characterization of riparian zones: *methodology*

Physical settings (LiDAR dataset)

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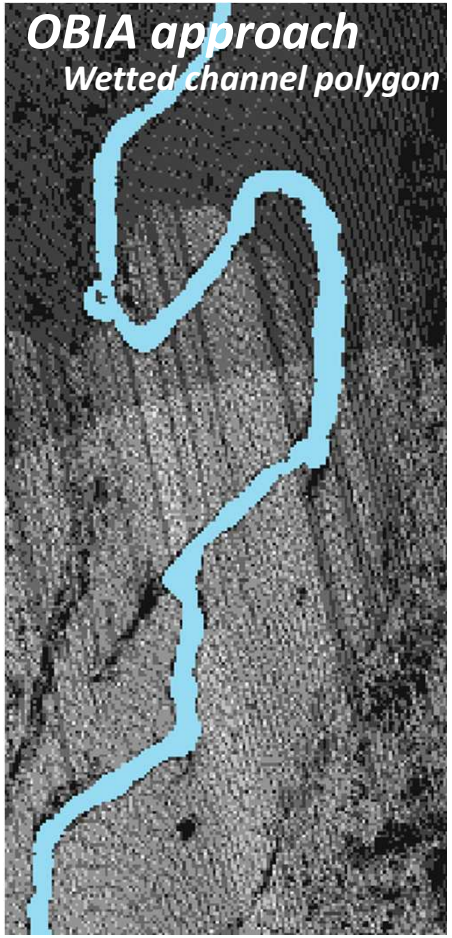


Characterization of riparian zones: *methodology*

Physical settings (LiDAR dataset)

- Channel extent (width/sinuosity)
  - Extracted from LiDAR-metrics
    - OBIA for main rivers (watershed > 10 km²)

Characterization of riparian zones: *methodology*

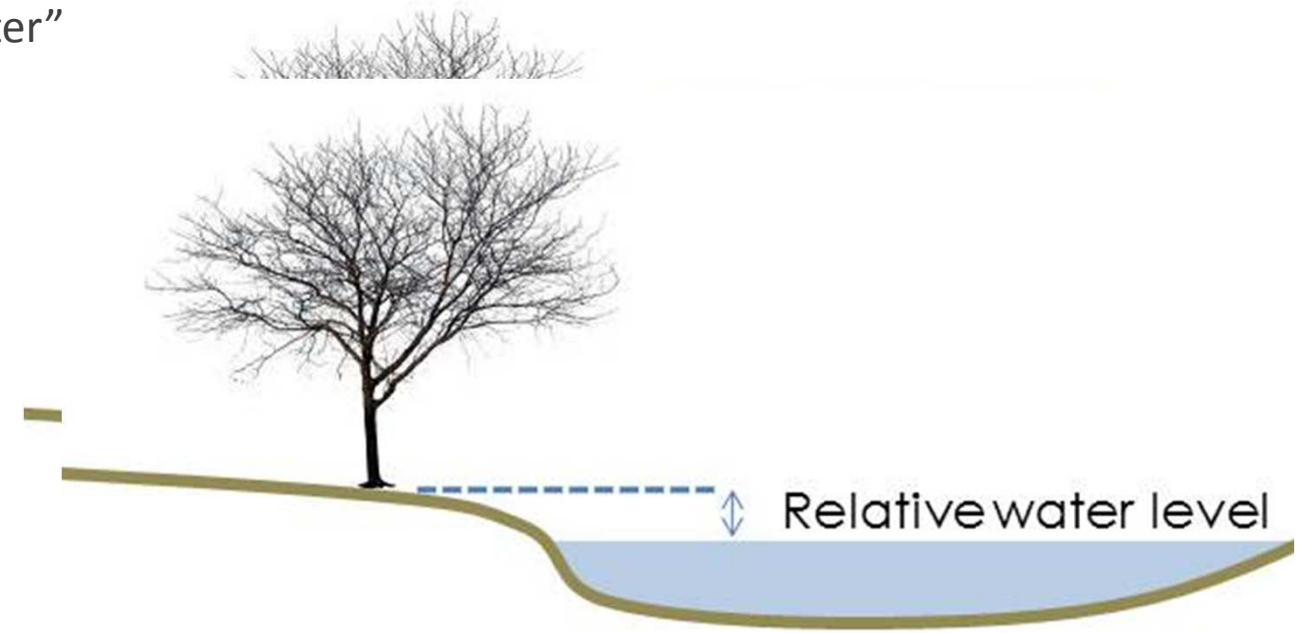
Physical settings (LiDAR dataset)

- Channel extent (width/sinuosity)
  - Extracted from LiDAR-metrics
    - OBIA for main rivers (watershed > 10 km²)
    - Channel axis derived from DTM (1m GSD)

Characterization of riparian zones: *methodology*

Physical settings (LiDAR dataset)

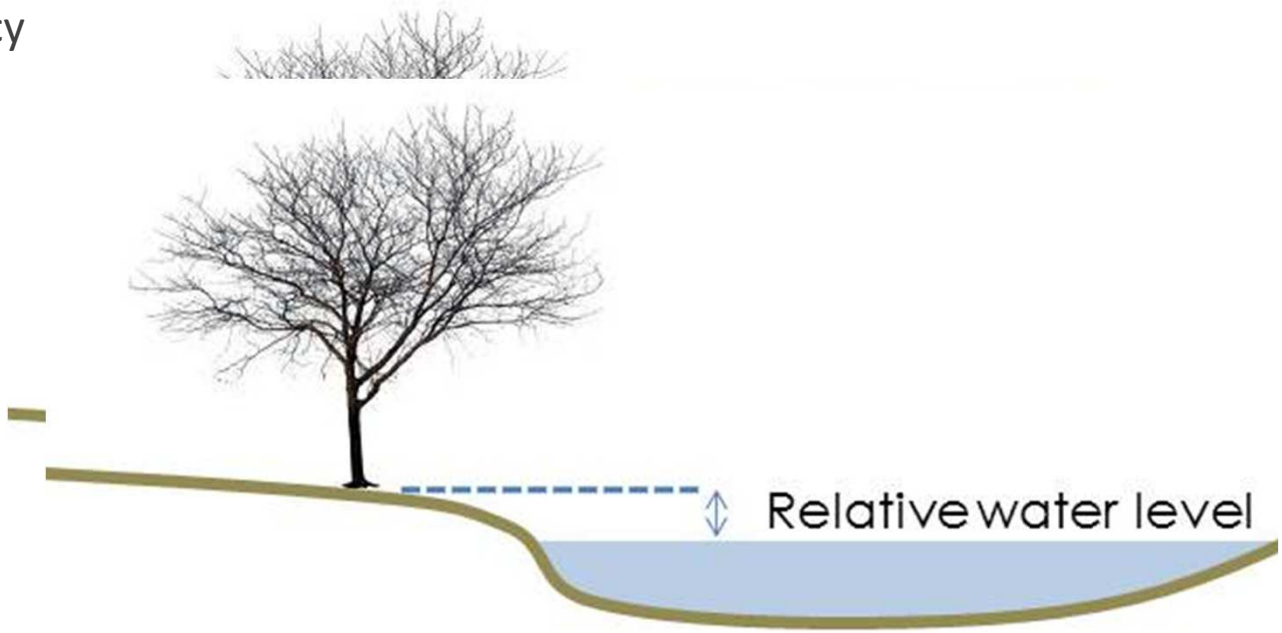
- Relative water level
  - “Nearness to water”
  - Terrestrialization
  - Anthropization



Characterization of riparian zones: *methodology*

Riparian forest attributes

- Relative water level
  - Flooding frequency
  - Terrestrialization



Characterization of riparian zones: *methodology*

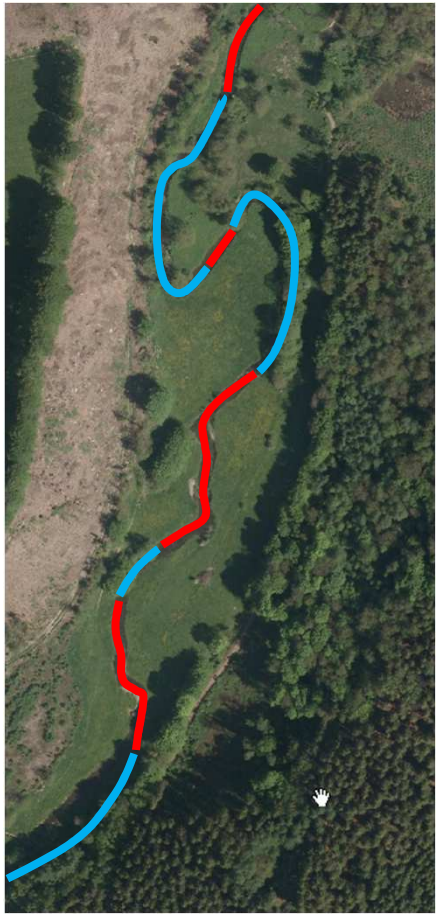
Riparian forest attributes

Ecological integrity indicators

- Longitudinal continuity
  - Continuity of the presence of riparian forest
- Core Area Index (CAI) / Fractal Dimension Index (FDI)
  - Fragstat landscape metrics (McGarigal et al., 2002)

Management indicator

- Tree/forest height



McGarigal, K., S. A. Cushman, M. C. Neel, and E. Ene. 2002. FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps. Computer software program produced by the authors at the University of Massachusetts, Amherst

Characterization of riparian zones: *methodology*

River network segmentation

- Use of the administrative segmentation

Management unit < Water bodies (WFD) < Sub-Watershed

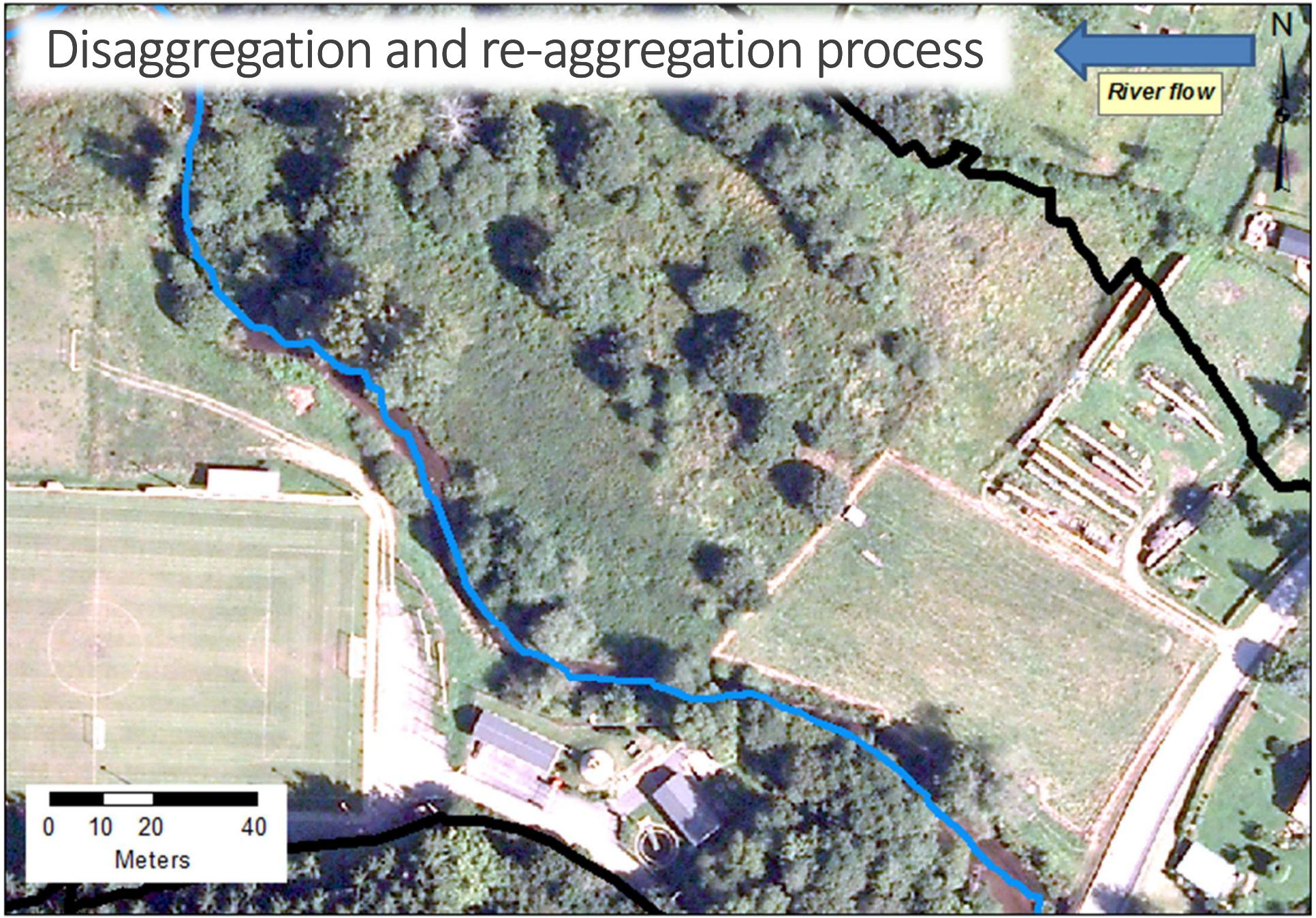
homogenous river reaches defined by expert operator (previous research project)

Disaggregation and re-aggregation process

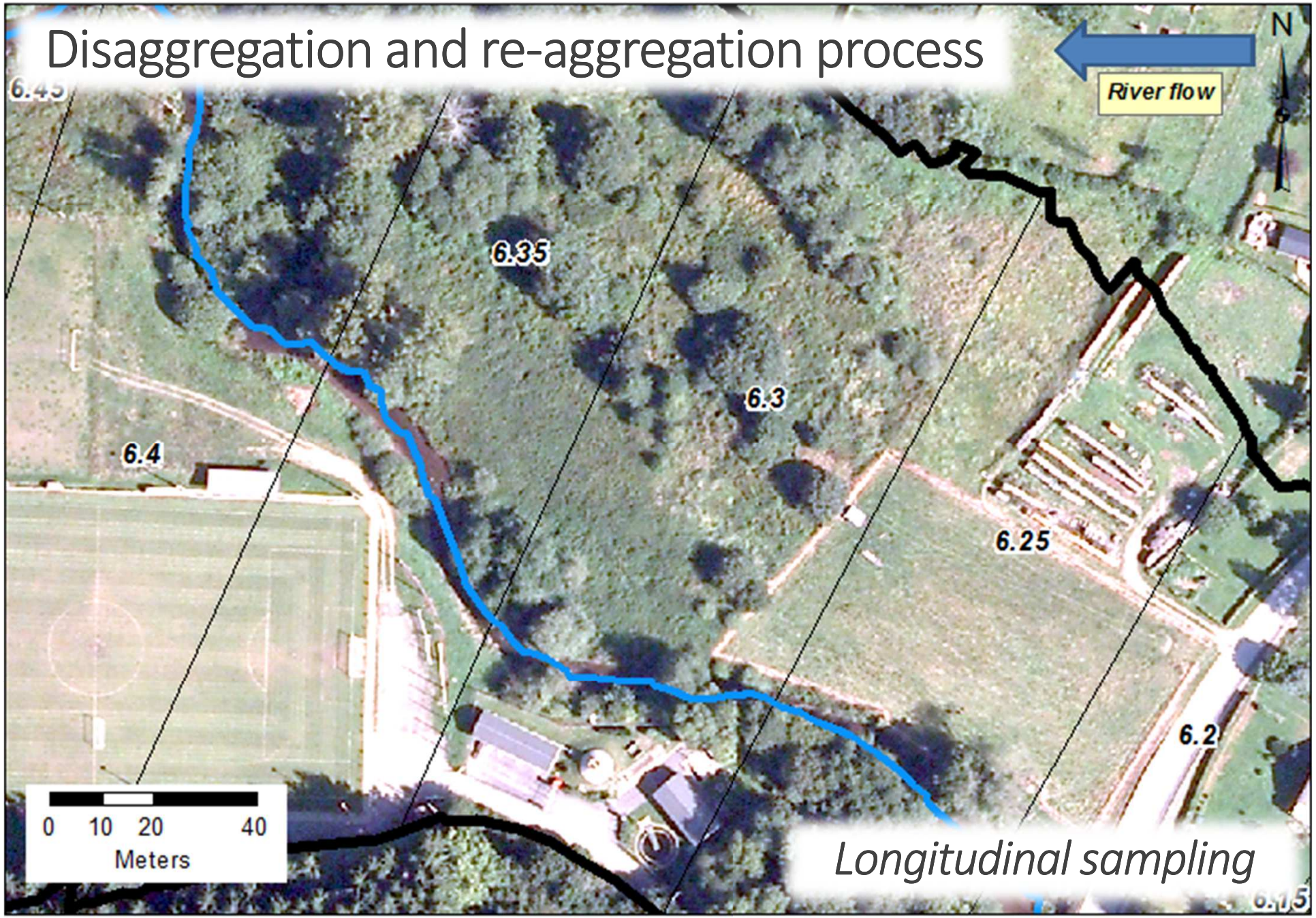
- Based on the work of Alber and Piégay (2011)
- Variation of attributes from upstream to downstream

A. Alber et H. Piégay, « Spatial disaggregation and aggregation procedures for characterizing fluvial features at the network-scale: Application to the Rhône basin (France) », Geomorphology, vol. 125, no 3, p. 343-360, févr. 2011

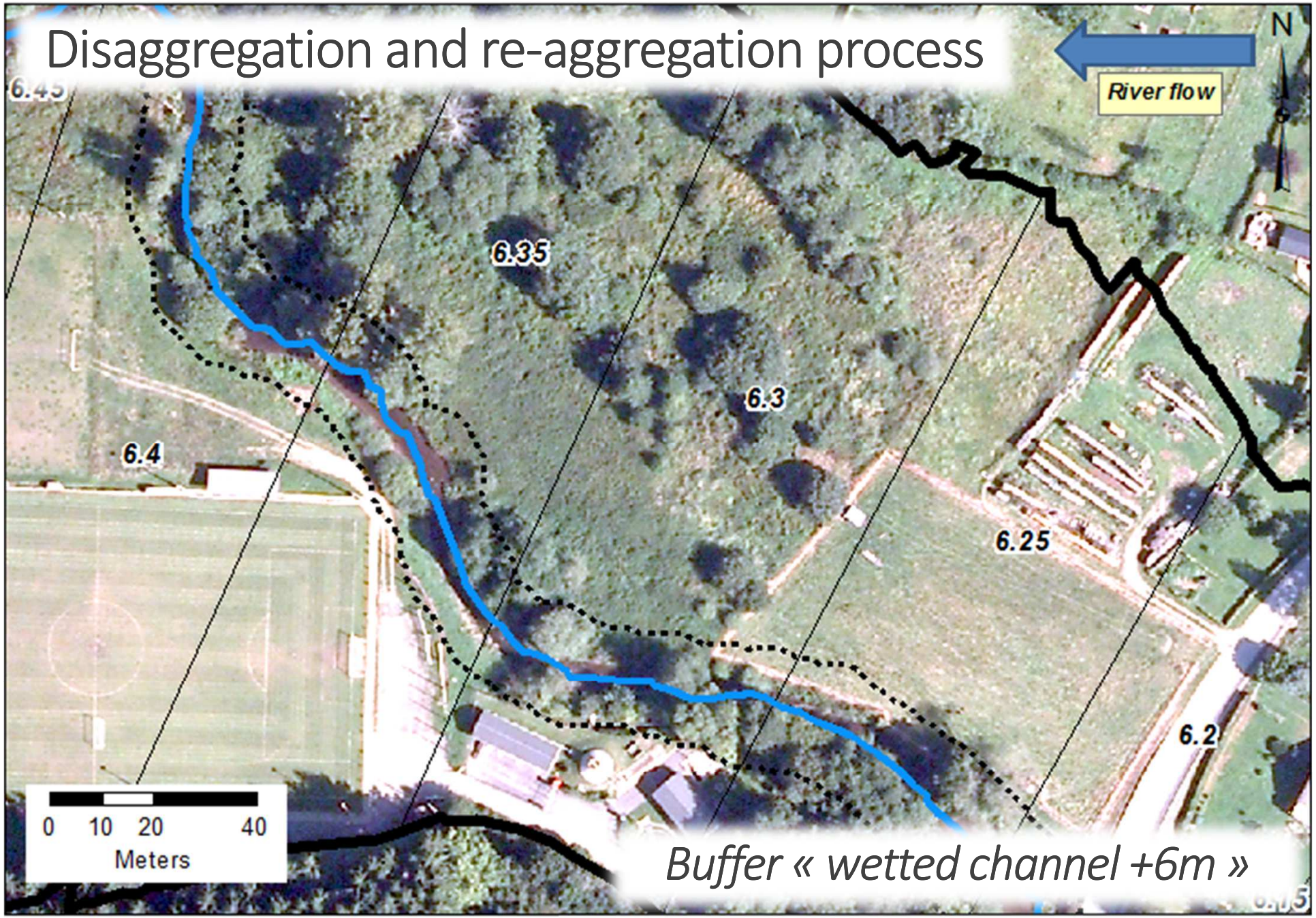
Disaggregation and re-aggregation process



Disaggregation and re-aggregation process

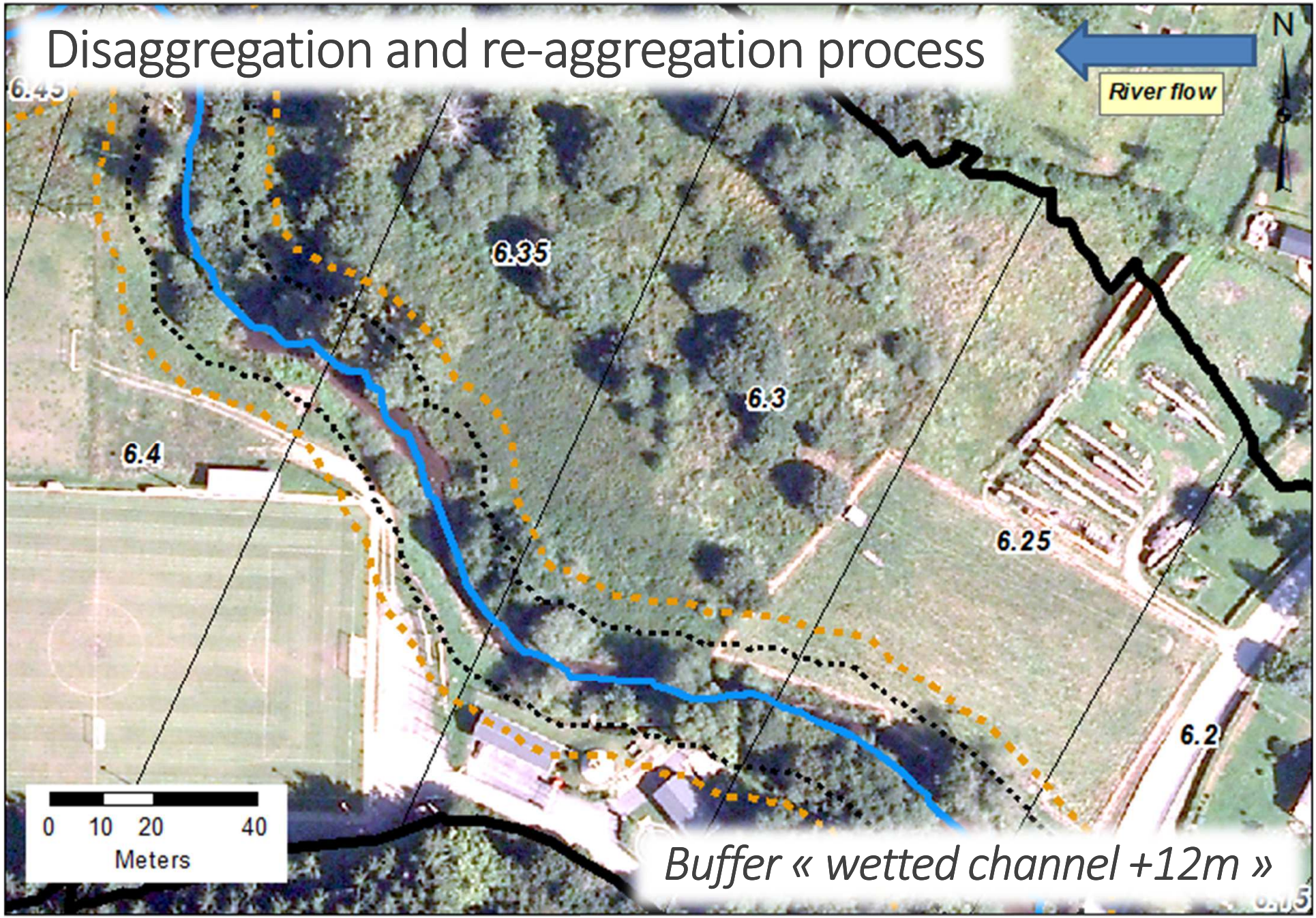


Disaggregation and re-aggregation process



Buffer « wetted channel +6m »

Disaggregation and re-aggregation process



Buffer « wetted channel +12m »

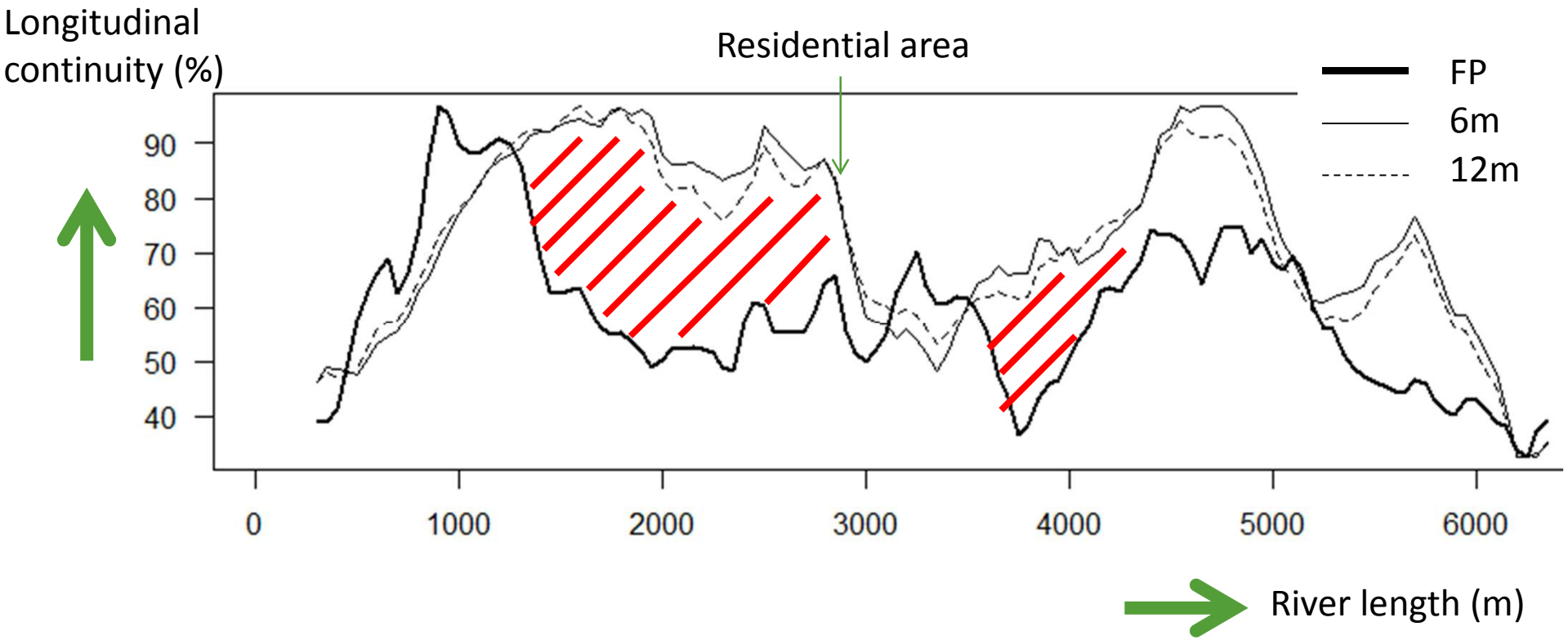
Characterization of riparian zones: *Results*

Preliminary results !

- First case study … before the regional monitoring (mid 2015)
- 192 river reaches characterized (ca. 500 km)

Characterization of riparian zones: *Results*

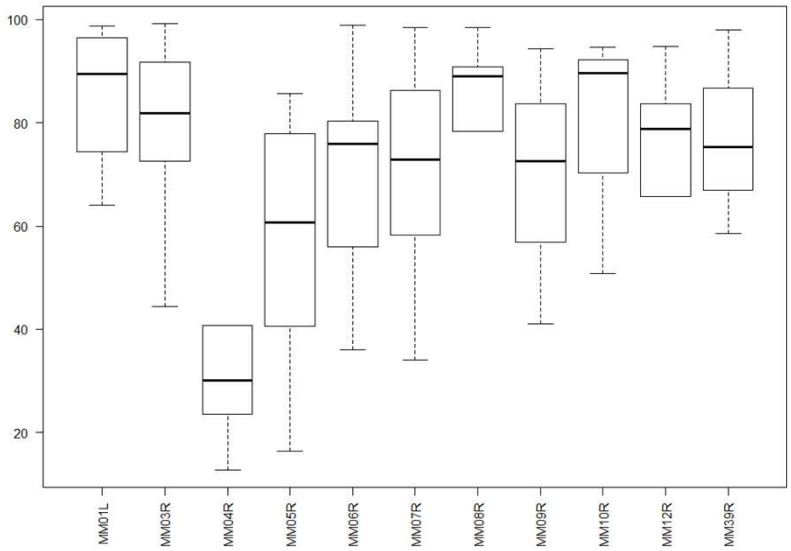
Downstream / Upstream vizualization

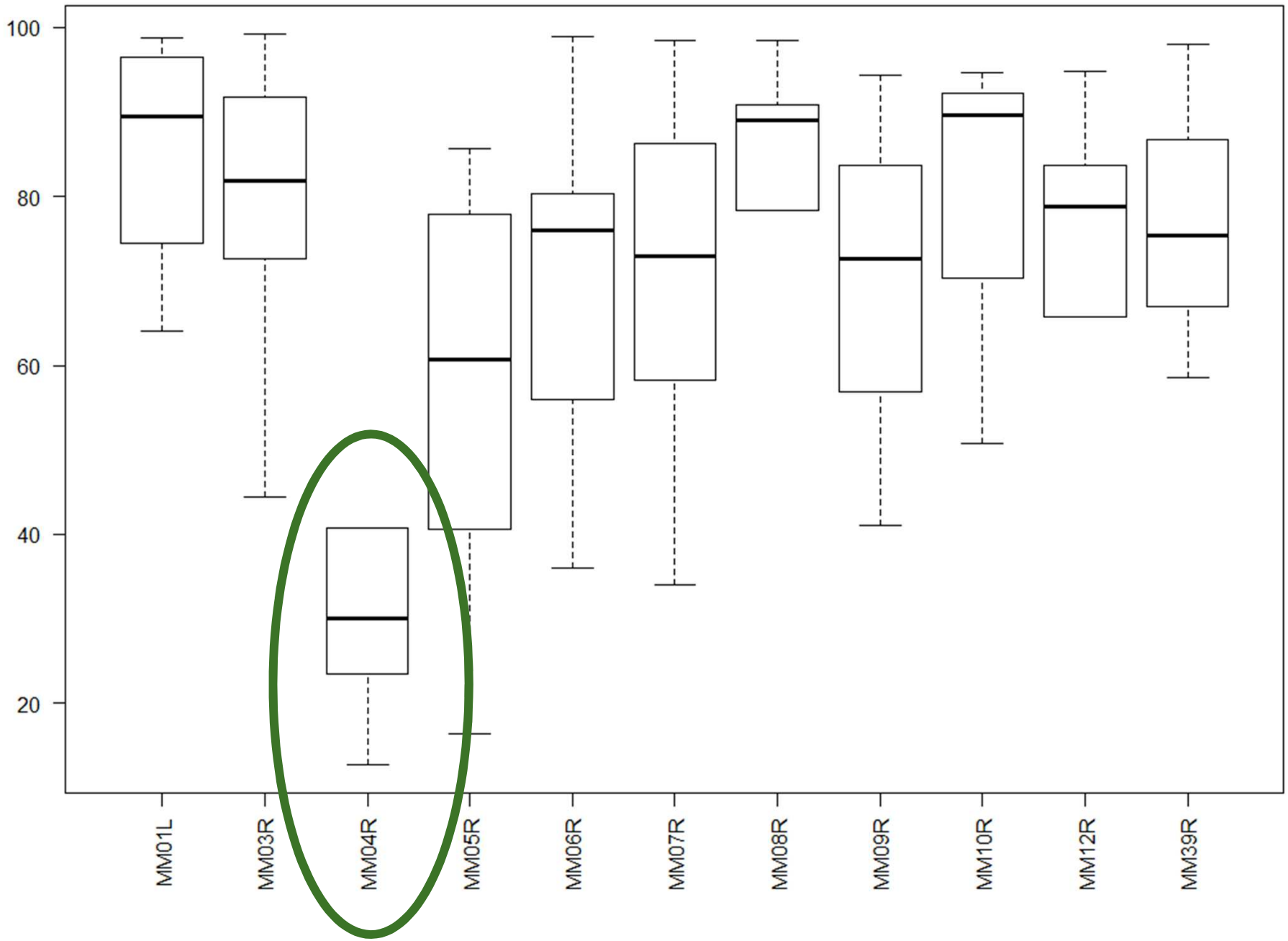


Characterization of riparian zones: *Results*

Re-aggregation exemple

- Water bodies of a watershed
  - Exemple of the longitudinal continuity

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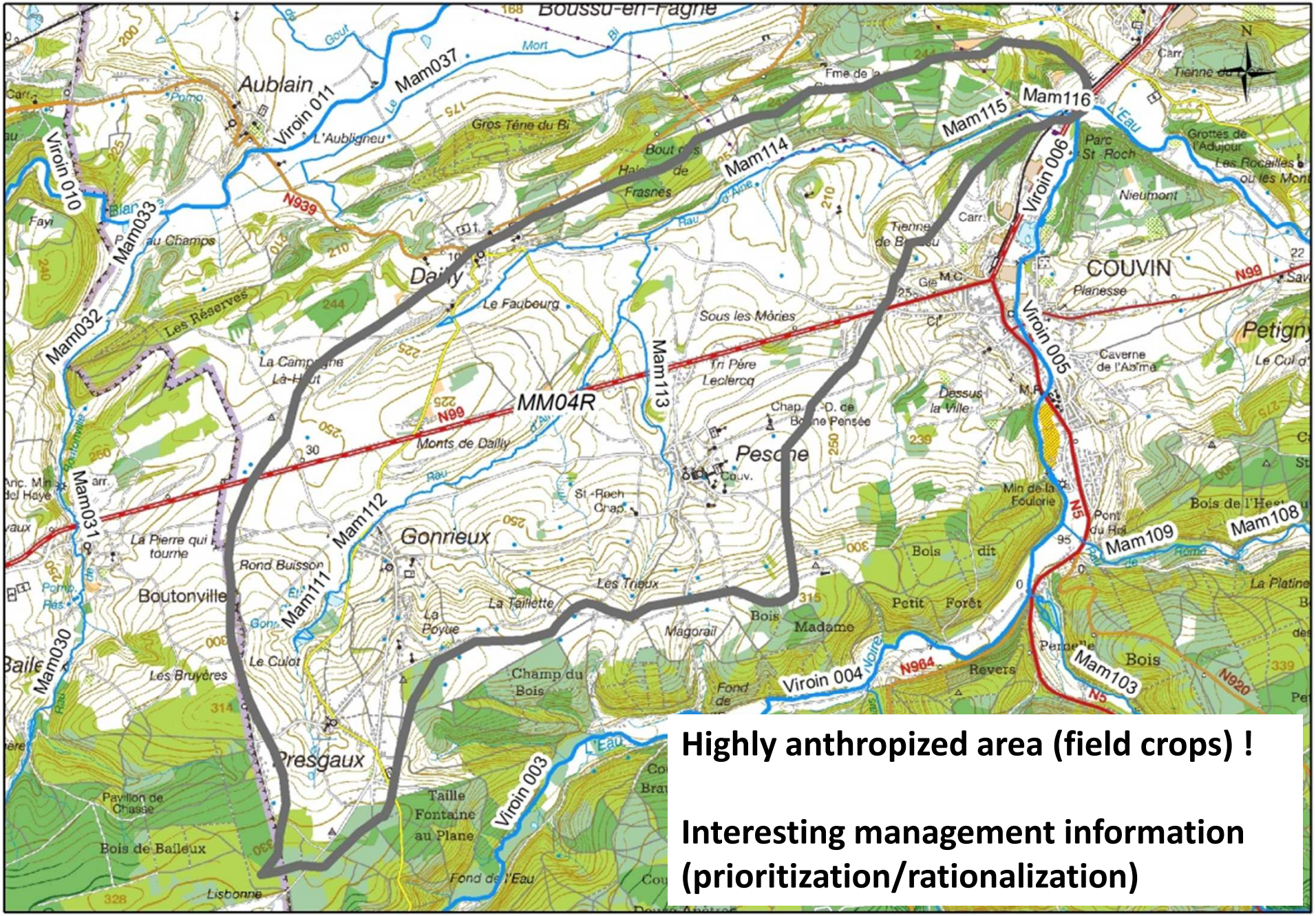

Highly anthropized area (field crops) !

Interesting management information (prioritization/rationalization)

Characterization of riparian zones: *Perspective*

Upscaling to whole Wallonia (mid-2015)

- 500 km → 13,000 km !

Selection of management indicators

- Exchange with field managers

Integration of chronological component

- Computation of historical photogrammetric DSM (2006/2009/2013)

Integration in online platform for day-to-day use of the result by the administration

Thank you for your attention !

? Question ?