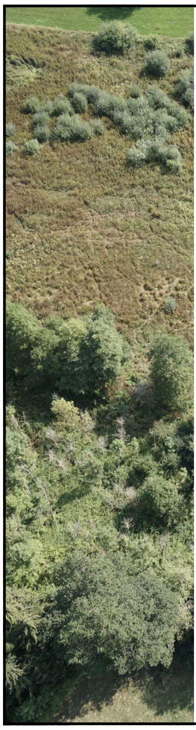

LIÈGE université Gembloux Agro-Bio Tech — UNIVERSITÉ RENNES 2 — cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY — CONVERGES European Riparian Ecosystems

# REVIEW OF THE USE OF REMOTE SENSING FOR THE STUDY AND MANAGEMENT OF RIPARIAN VEGETATION

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Pruhonice, 4 april 2019 – MC comitee of COST CONVERGES
Contact : Leo.Huylenbroeck@uliege.be

## CONTEXT

- **Riparian vegetation : crucial component of river systems, management issues are central**
- **Remote sensing of riparian vegetation is boosted by technological advances**
- **Specific considerations:**
  - Issues of riparian vegetation are unique
  - Riparian vegetation has a singular structure
- **Systematic review structured according to 2 questions :**
  - What technology for what use?
  - What is the contribution to management?

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# ARTICLE SELECTION AND ANALYSIS GRID

- **Request in Scopus database**

  Riparian vegetation & Remote sensing

$$\left[\begin{pmatrix} riparian \\ alluvial \\ floodplain \\ riverine \end{pmatrix} \text{within 5 words of} \begin{pmatrix} vegetation \\ forest \\ wood \\ species \\ tree \end{pmatrix}\right] AND \left[\begin{pmatrix} remote\ sensing \\ multispectral \\ hyperspectral \\ hyperspatial \\ SAR \\ radar \\ LiDAR \\ UAV \\ UAS \\ drone \\ photogrammetry \end{pmatrix} OR \left(\begin{pmatrix} imag* \\ photo* \\ data \\ sensor \end{pmatrix} \text{within 5 words of} \begin{pmatrix} satellite \\ thermal \\ aerial \\ spaceborne \\ airborne \end{pmatrix}\right)\right]$$

- **791 articles -> 423 articles after filtering**
- **Gathering of specific information :**
  - Type of imagery (vector & sensor)
  - Extent of study area
  - Feature of riparian vegetation that is studied
  - Multi-temporal character

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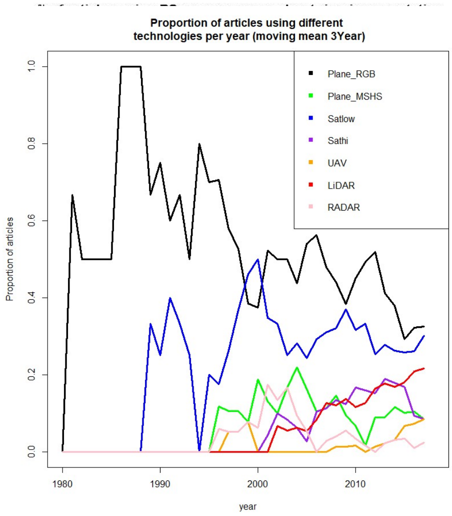
# MAIN RESULTS




- Increase in the proportion of studies, especially *circa* 2000
- Circa 2000 : **LiDAR**, RADAR, high res. satellite images, multispectral aerial images…
- 2010 : UAV
- Temporal series : 53% of studies, mostly aerial images

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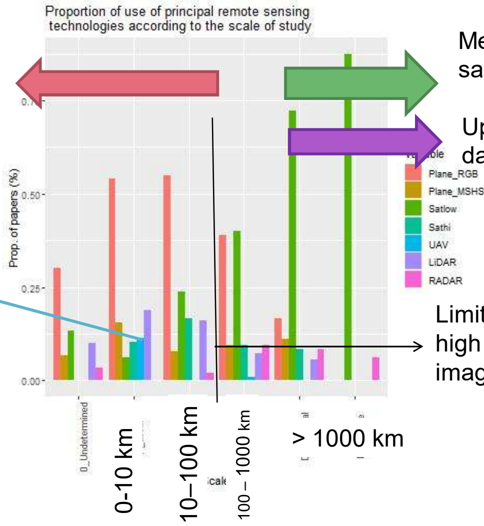
# TECHNOLOGY VS EXTENT

Aerial images and photointerpretation

UAV : < 10 km




Medium resolution satellite images

Upscaling of LiDAR data?

Limited upscaling of high resolution images

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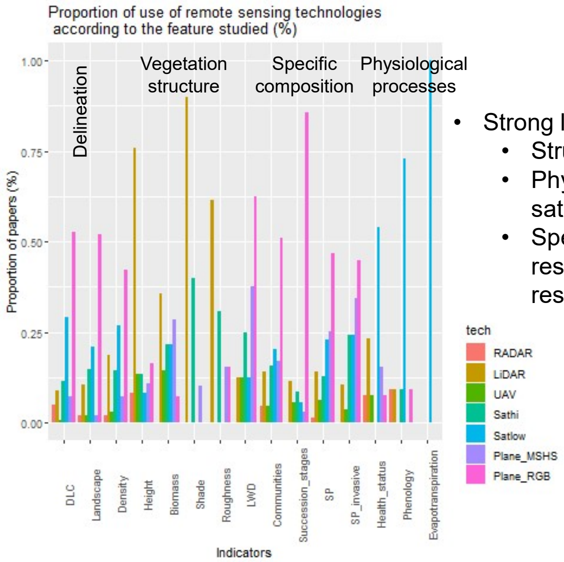
# TECHNOLOGY VS FEATURE STUDIED

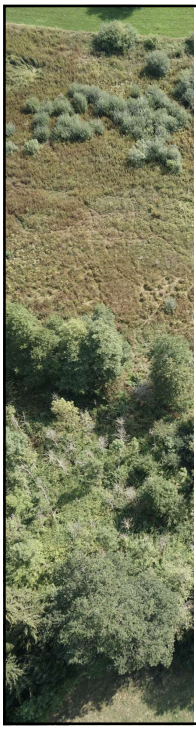



- Strong link technology – feature
  - Structure : LiDAR
  - Physiology : medium resolution satellite imagery
  - Species composition : high resolution multispectral images to resolve most difficult cases

6

# WHAT IS THE CONTRIBUTION TO MANAGEMENT?

7



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# THANK YOU !

Pruhonice, 4 april 2019 – MC comitee of COST CONVERGES
Contact : Leo.Huylenbroeck@uliege.be

# Potential of Copernicus data to assess European riparian zones integrity with landscape metrics.

Case studies applied to Belgium and Portugal.

Ugille Jean-Philippe

(Jean-Philippe Ugille[a], Adrien Michez [a], André Fonseca[b], Patricia Rodriguez-González [b], Maria Rosário Fernandes [b])

[a] University of Liège, Belgium

[b] University of Lisbon, Forest Reserch Centre, Portugal

Presentation at the annual meeting of COST CONVERGES Action in Pruhonice.

4th of April, 2019

- Presentation

- Master 2 bioingeneering student in management of forest and natural areas in Gembloux Agro-Bio Tech (Belgium).
- In the framework of my master thesis ; Participated to a STSM from the COST CONVERGES Action in the forestry research center of Lisbon.
- Non-funded project between the University of Liège (Belgium) and the Instituto Superior d'Agronomia (Ulisboa, Portugal), borned thanks to the COST CONVERGES Action.

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# Table of contents



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# 1. Objectives

1. Characterize the Riparian Ecological Integrity across European bioclimatic regions using a Landscape Metrics approach.

   *Case studies: Portugal (Tagus basin) and Wallonia (Meuse and Escaut basin)*

2. Identify the most important drivers of riparian change : proximal or catchment scale-drivers ?

3. Develop an image-based method for the assessment and monitoring of the riparian ecological status for different river types in Europe.

   *What do we loose seeing riparian systems from above? Based on field reference data*

4. Assess the sensitivity of the method concerning image spatial resolution.

   *Very High Resolution (ESRI layer) VS Copernicus riparian layer (satellite imagery)*

4

f3

# 2. Introduction

## What we know:

1. Riparian structural and functional attributes may be derived using a combination of landscape metrics, from different categories (Aguiar et al., 2011; 2016; Fernandes et al., 2011).

2. Structural connectivity, shape configuration and area-edge numerical indicators may be used to describe the dynamics and the ecological processes in riparian systems (Fernandes et al., 2011).

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# 2. Introduction

Usually well preserved riparian galleries exhibit large woody patches, highly connected, with complex shape configurations (Fernandes et al., 2011; 2016; Magdaleno and Fernández-Yuste, 2013).

THUS : The Riparian Ecological Integrity may be derived using a **landscape metrics approach.**

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**Diapositive 5**

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**f3** I I added two slides concerning the scientific background to support and contextualize the work.
fp; 03/04/2019

# 3. Material and methods

## 3.1 Study area

Mediterranean hydroregion → Tagus basin (Portugal) 38 sampling points

Central Baltic hydroregion → Escaut and Meuse basins (Belgium) 40 sampling points

Criteria for selection:
- Intersection with the Copernicus Riparian Layer ;
- Minimum 1km distance between points (to avoid spatial autocorrelation) ;
- Field information (e.g. floristic composition) for validation



## 3.2 Drivers of change at catchment scale

1. LAND-USE

Analysis at sub-basin scale

(Sub-basins delimited with the CCM dataset)

- CLC 2012 layer (Corine Land Cover) for the soil occupation.
- CLC c[illegible] 6 new land uses classes.

| New land uses |
|---|
| Artificial surfaces |
| Intensive agriculture |
| Managed forest |
| Extensive agriculture |
| Unmanaged |
| Unclassified |

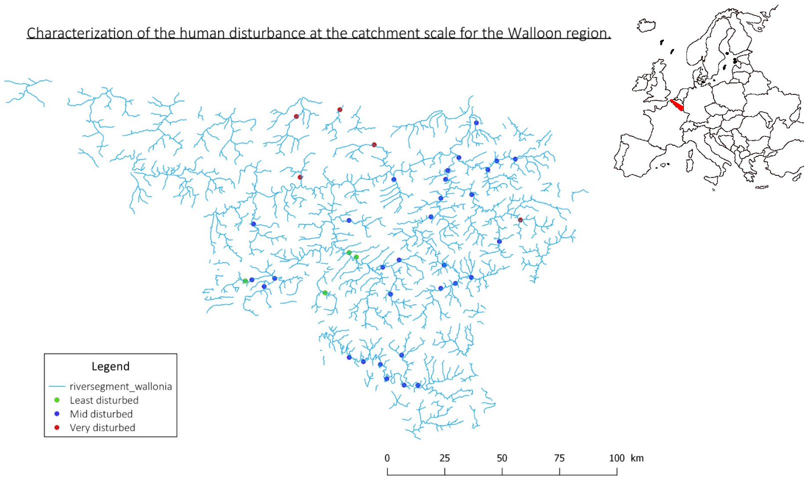
Gradient of human disturbance →
- Least disturbed : E.A + Un. > 70%
- Very disturbed : I.A + M.F > 70%
- Mid disturbed

2. HYDROMORPHOLOGY

- Number of dams in the sub-basins (georeferenced using ICOLD database)
- Reservoir capacity

Characterization of the human disturbance at the catchment scale for the Walloon region.

Only with land-use information.






## 3.3 Drivers of change at local scale

1. LAND-USE

- Land-Cover/ Land-Cover layer from **Copernicus** data

→ European dataset, open-access

Spatial resolution : 10m
MAES level 4 nomenclature

- CLC codes reclassified into 6 new land uses classes.

Analysis at segment/buffer scale

Buffer = area delimited by PRZ

(Strahler - order dependent)

2. HYDROMORPHOLOGY

- Local morphological changes (Presence of local barriers, channel reductions, elimination of meanders, river linearizations, etc)
- Data from WFD and visual observation in aerial imageries

**Diapositive 9**

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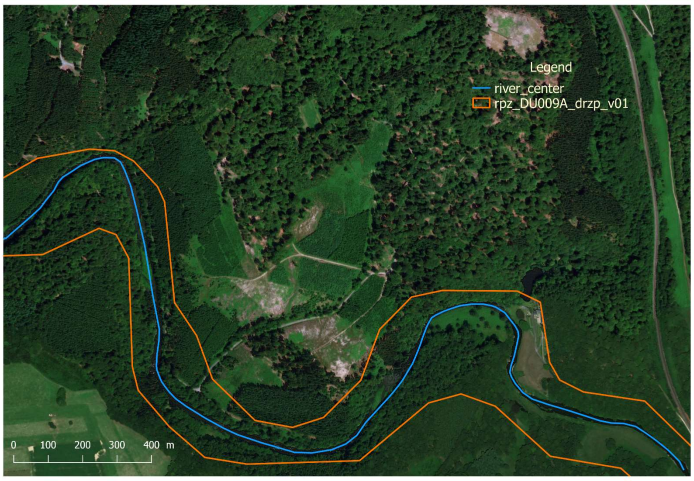
**f4** Add that this level of disturbance was established using only land-use infromation..
fp; 03/04/2019




PRZ based on ;

- terrain topography
- Soil properties
- Flood zones
- LULC class « water »
- Object based image analysis approach



## 3.3 Drivers of change at local scale

1. LAND-USE

- Land-Cover/ Land-Cover layer from **Copernicus** data

→ European dataset, open-access

- CLC codes (MAES level 4) reclassified into 6 new land uses classes.

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2. HYDROMORPHOLOGY

- Local morphological changes (Presence of local barriers, channel reductions, elimination of meanders, river linearizations, etc)
- Data from WFD and visual observation in aerial imageries

## 3.3 Riparian structural connectivity and landscape metrics analysis.

Riparian data

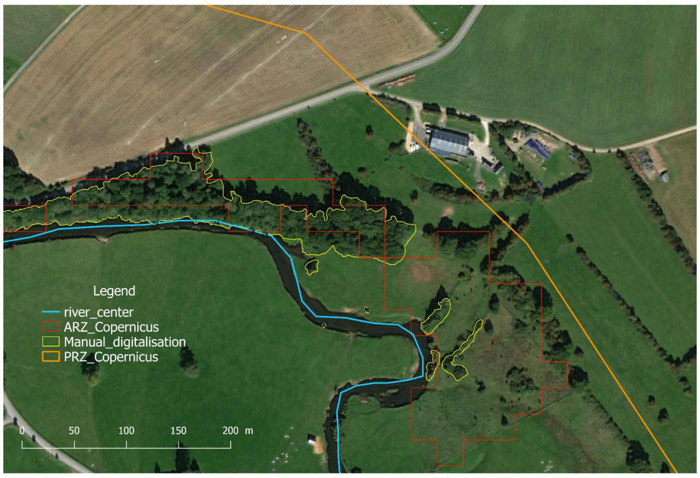
Analysis at segment scale:

Riparian woody patches:

1- Actual Riparian Zone (RZA)- Copernicus layer,  Coarse spatial resolution (30m)

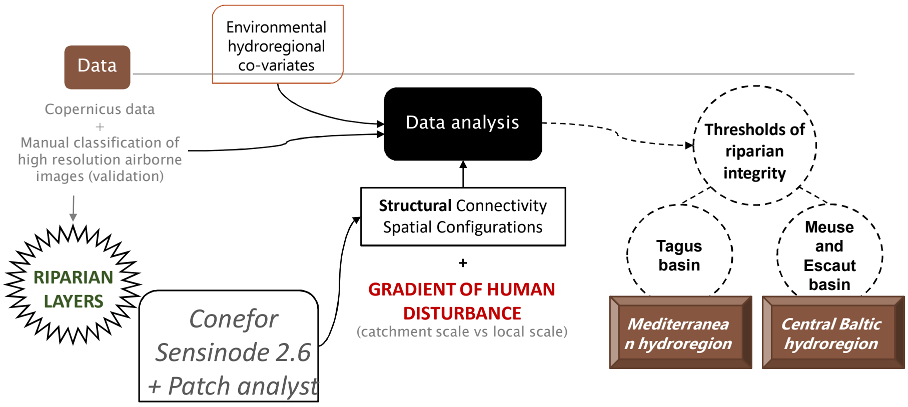
2- Manual digitalization – ArcGis World Imagery, High spatial resolution (30, 50 cm)






ARZ ;

- Probability to encounter riparian zones on ground
- Based on satellite images




## 3.4 Structural connectivity and landscape metrics.

1. Structural connectivity (*Conefor Sensinode 2.6*)

- - integral index of connectivity (IIC)
- - Patches divided by river segment and in both margins
- - Minimum Map Unit (MMU): 200 m²

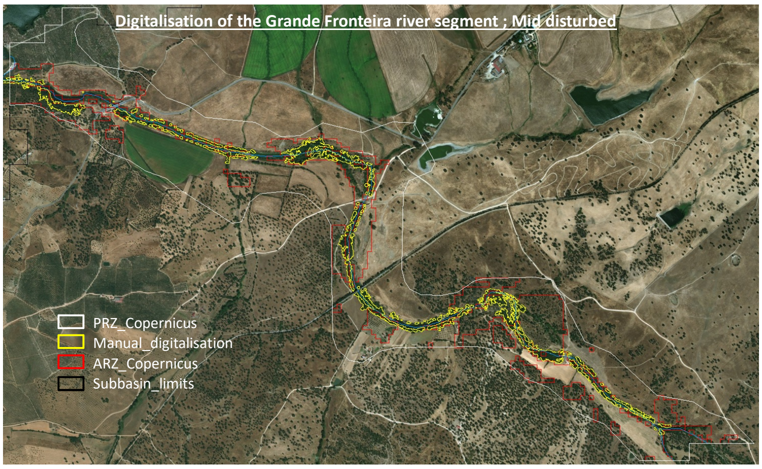
→ Connectivity analysis for the 2 margins **separately** and **together**.

2. Landscape metrics. *(Patch analyst)*

- Number of patches
- Average area
- $^{p}/_{\sqrt{a}}$
- Fractal dimension


Example of digitalisation of woody patches for a mid-disturbed river segment in the Walloon region.
Legend
Manual_digitalisation
PRZ_limits
ARZ_limits
Subbasin_limits
River_center
Arcgis W.I 30cm
0
250
500
750
1000 m

17


Digitalisation of the Grande Fronteira river segment ; Mid disturbed
PRZ_Copernicus
Manual_digitalisation
ARZ_Copernicus
Subbasin_limits

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## 4. Questions

- **Main challenges**

- Harmonization of the methodology

Manual digitalization of the riparian patches, delimitation of the external limits of riparian areas for the two hydroregions

- Data availability concerning the land-use and hydromorphological data for the two hydroregions

- ……

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Thank you for your attention !

Thank you to the COST CONVERGES Action for making this project possible and for giving me the opportunity to do a STMS.

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