RiReMo project: operational monitoring of riparian zones in Wallonia

BEODAY 2018 - BEERSEL
BELSPO STEREO III PROGRAMME (SR/00/347)
Central objective:

- Develop cost effective tools (based on remote sensing approach) to monitor 12000 km of riparian area

Target audience:

- River (and riparian) managers from public administrations of Wallonia
“Development of application” project - STEREO III program

Coordination
- The directorate of non-navigable watercourses

Scientific partner
- Gembloux Agro-Bio Tech, University of Liège
- BIOSE research unit - Forest management research group
- Based on previous research projects on regional characterization of riparian area
- Employees of project: 1 post-doc researcher and 1 technician (6 months)

Timetable
- Start in February 2017
- End of project: by the end of 2019
More specifically:

- Development of management indicators (river managers)
  - Regional scale (entire river network and riparian area)
  - Cost effective approach (repeatability):
    - Data free-of-charges / already acquired on a regular basis (LiDAR, orthophoto surveys)

- Integration of main outputs (decision making tools) in online platform for river managers

- Training of the administration staff
  - Familiarization with RS techniques deployed (photogrammetry / LiDAR)
  - Update of the identified indicators after the project
Important ongoing reform: PARIS actions program

◦ Gather all actions of public administrations related to river ("physical") management
  → Official launch in 2021

◦ Duration: 6 years

◦ Monitoring wanted at start / middle / end of the programs
  ◦ > 12000 km of rivers targeted

◦ Field based monitoring not realistic

Interest for RS approach!
Scientific support needed to develop remotely sensed decision-making tools to monitor riparian area at a regional scale

→ Rationale behind the RiReMo project

PARIS online platform developed by SPW:

- Decision-making tools
- Management actions encoding

→ Medium of project output!
WP1: canopy height model (CHM) generation

WP2: extraction of quality and management indicators of riparian area

WP3: integration of indicators in an online platform

WP4: User requirements - Organization of transfer and exchange with the administration
WP1: CHM generation
Photogrammetric DSM  LiDAR DTM
CHM computation

WP2: extraction of indicators
3D + Sentinel-2 data: classification of riparian vegetation
3D indicators: evolution of riparian forest
Management indicators

WP3: transfer of results
Indicators available on online platform
CHM available on “géoportail”

Integrated tools for the monitoring of the PARIS actions program

WP4: User requirements
Information session for skills transfer (yearly basis)
Exchange session (6 months basis)
Methods

- Characterization of riparian vegetation
- Based on photogrammetric DSM and LiDAR DTM
- Photogrammetric DSM
  - Structure From Motion photogrammetry with raw images from regional ortho surveys
  - DSM already available for 2012 and 2009
  - Computation for 2015 and 2016
- LiDAR DTM
  - Low density regional survey: ca. 1 pt/m²
  - Terrain considered as constant along time series
- CHM validation
  - Based on
    - Reference database of tree height measurement (Walloon Permanent Forest Resources Inventory)
Results

° WP almost finished
  ° Production of DSM and CHM for 2015 spw ortho survey
    ° > 90 % surveyed in April 2015
    ° (Very) bad 3D reconstruction of deciduous trees in leaf-off condition
  → Poor quality of CHM in riparian forest for CHM 2015
Results

◦ WP almost finished
  ◦ ... Production of DSM and CHM for 2016 (not planned)
  ◦ Opposite situation: surveys started in June ... But ended Nov. 1st
  ◦ Photointerpretation of phenology of deciduous trees for all the survey dates
Results

- WP almost finished
- Outputs soon available on SPW geoportail (2nd quarter 2018)
- For 2015 and 2016 ortho surveys
  - DSM (50 cm GSD)
  - CHM (50 cm GSD)
  - Leaf-on / Leaf-off condition map (deciduous trees, 4 km² squared tiles)
WP1: CHM generation

Photogrammetric DSM

LiDAR DTM

CHM computation

WP2: extraction of indicators

3D + Sentinel-2 data: classification of riparian vegetation

3D indicators: evolution of riparian forest

Management indicators

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Indicators available on online platform

CHM available on “géoportail”

WP4:
User requirements

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Integrated tools for the monitoring of the PARIS actions program
Riparian Remote Monitoring for river management
WP2: extraction of quality and management indicators

Ongoing task

3D indicators of the riparian forest evolution
  ◦ Adapted from previous work on regional scale
  ◦ Strictly based on height data: time series of CHM
  ◦ Temporal evolution of key indicators: longitudinal continuity, width, ...

Michez et al. (2013). LiDAR derived ecological integrity indicators for riparian areas: Application to the Houille river in Southern Belgium/Northern France. *Ecological indicators*
Michez, A et al. (2017). Multi-temporal monitoring of a regional riparian buffer network (> 12,000 km) with LiDAR and photogrammetric point clouds. *Journal of Env. Management.*

*Michez et al. 2013*
3D + spectral indicators of riparian vegetation

- Segmentation to identify homogenous riparian vegetation object (last CHM coverage)
- Use of spectral information (Sentinel-2 - Pleiades) to improve the characterization of riparian vegetation (species composition, health condition, ...)

*Michel et al. 2013*
Riparian Remote Monitoring for river management
WP2: extraction of quality and management indicators

Riparian area morphology indicators
- Various indicators derived from the highly accurate LiDAR DTM
  - Shape of the valley
  - River and bank geometry
  - Channel-riparian interactions (e.g. through the Emerged channel depth)
Development of management indicators

- Organization of meetings to exchange on project outcomes with river field managers

→ Meeting 1: presentation of the potential of Remote Sensing for river management / identification of needs

→ Meeting 2: presentation of the decision making tools developed by the project / selection of management indicators to be integrated in the webplatform

→ MAY 2018
WP4: User requirements

Information session for skills transfer (yearly basis)
Exchange session (6 months basis)
Integration of indicators in online platform

- Synthesis (maps, graph, diagrams, ...) of collected information
- Decision-making tools, from day-to-day management to regional planning of the riparian area management

Riparian Remote Monitoring for river management
WP3: transfer of results
Exchange meetings
- All along, 6 months basis
- Exchange on project intermediate outcomes
- Adaptation of the approach for the rest of the project

Skills transfer sessions (yearly basis)
- Structure from motion photogrammetry applied to river management
- Aerial LiDAR and river management
- Integrating and updating the RiReMo management indicators for the PARIS webgis platform
Riparian Remote Monitoring for river management

WP4: organization of transfer and exchange

First training session:

- *Sfm* photogrammetry applied to river management (October 2017)
Work on WP1
- Ending the validation of data to be shared
- Data sharing on the geoportail

Work on WP 2
- Development of management indicators
  - Closely with river managers
  - First meetings planned with river and riparian managers
  - Introduction of satellite spectral data (riparian forest typology, species composition, ...)

Work on WP4
- Training session to come
  - Aerial LiDAR and river management (October 2018)
Thanks for your attention!

Questions?