Classification of riparian forest species (individual tree level) using UAV-based Canopy Height Model and multi-temporal orthophotos (Vielsalm, Eastern Belgium)

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I. INTRODUCTION

RIPARIAN FOREST

- Central landscape feature
- Supply ecosystem services
  - water quality and quantity regulation
  - banks protection
  - biodiversity support
- Critically endangered by
  - human pressures
  - natural hazards, e.g. black alder extensive decline (Phytophthora alni)
- Need for tools to assess riparian forest conditions and ability to carry out their functions.

UAV-BASED MONITORING ...

- Low-cost and user-controlled systems
- High temporal and spatial resolutions

... TO CHARACTERIZE

- Riparian forest species (individual tree level)
- Health condition (black alder)

II. UAV PLATFORM

- Gatewing X100
- Off-the-shelf camera (Ricoh GRIII)
- Micro-UAV
  - Weight : 2 kg
  - Flight duration : ca. 40 min
- Limited to rectangular flight
- Typical flight:
  - 100 ha / flight
  - 250 m above ground level
  - 80% overlap

III. METHODS

Aerial survey
- Acquisition of multitemporal datasets
  - 16 datasets, 6 days
  - Mean GSD : 0.03 m
  - Mean Altitude : 140 m
  - 10/08/2012 - 16/11/2012

Field survey
- Individual trees database :
  - ca. 600 trees
  - Accurate localization
  - Species
  - Health condition
  - Height class

Photogrammetric processes
- Digital Surface Model (MicMac suite)
- Orthophoto (Agisoft Photoscan)

Co-registration
- Bare soil areas with National DTM (CloudCompare)

CHM Computation
- Photo-DSM – National DTM

OBIA process
- Tree crown object segmentation
- Spectral metrics computation :
  - Texture indices (Haralick, entropy)
  - Band mean
- Vegetation indices (NDVI, GNDVI)

Classification
- Supervised classification
- "Random Forest" package in R

IV. PRELIMINARY RESULTS

- Relevant accuracies for the identification (82%) and the health condition (77%) of black alders
- Promising results (80% to 70%) for the discrimination of riparian forest species

IV. PERSPECTIVES

- Photogrammetric workflow improvements
  - basic radiometric corrections (mitigation of in-flight changing sunlight conditions)
- CHM improvement through country-scale aerial-LiDAR survey (2013-2014)