The potential of VHR remote sensing for fine-scale risk mapping of *Fasciola hepatica*

BEO day - Lier - 20.11.2014

Project partners

Laboratory of Forest Management and Spatial Information Techniques

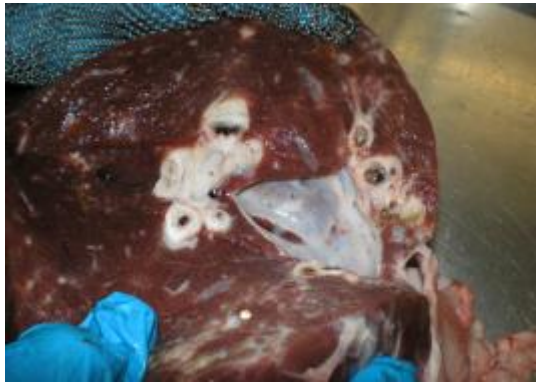
Laboratory of Parasitology

Problem

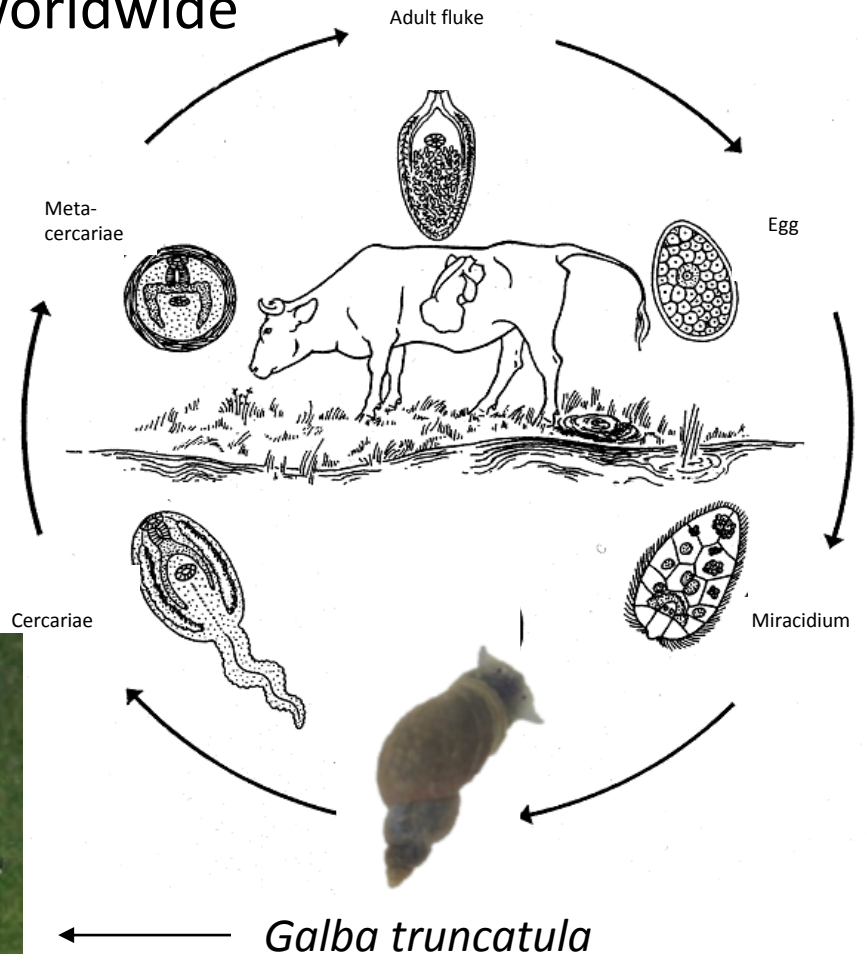
Liver fluke disease causes important economical losses worldwide

Fasciola hepatica: parasite living in ruminants

- Liver damage
- Growth
- Milk yield
- Fertility



Small Water Bodies



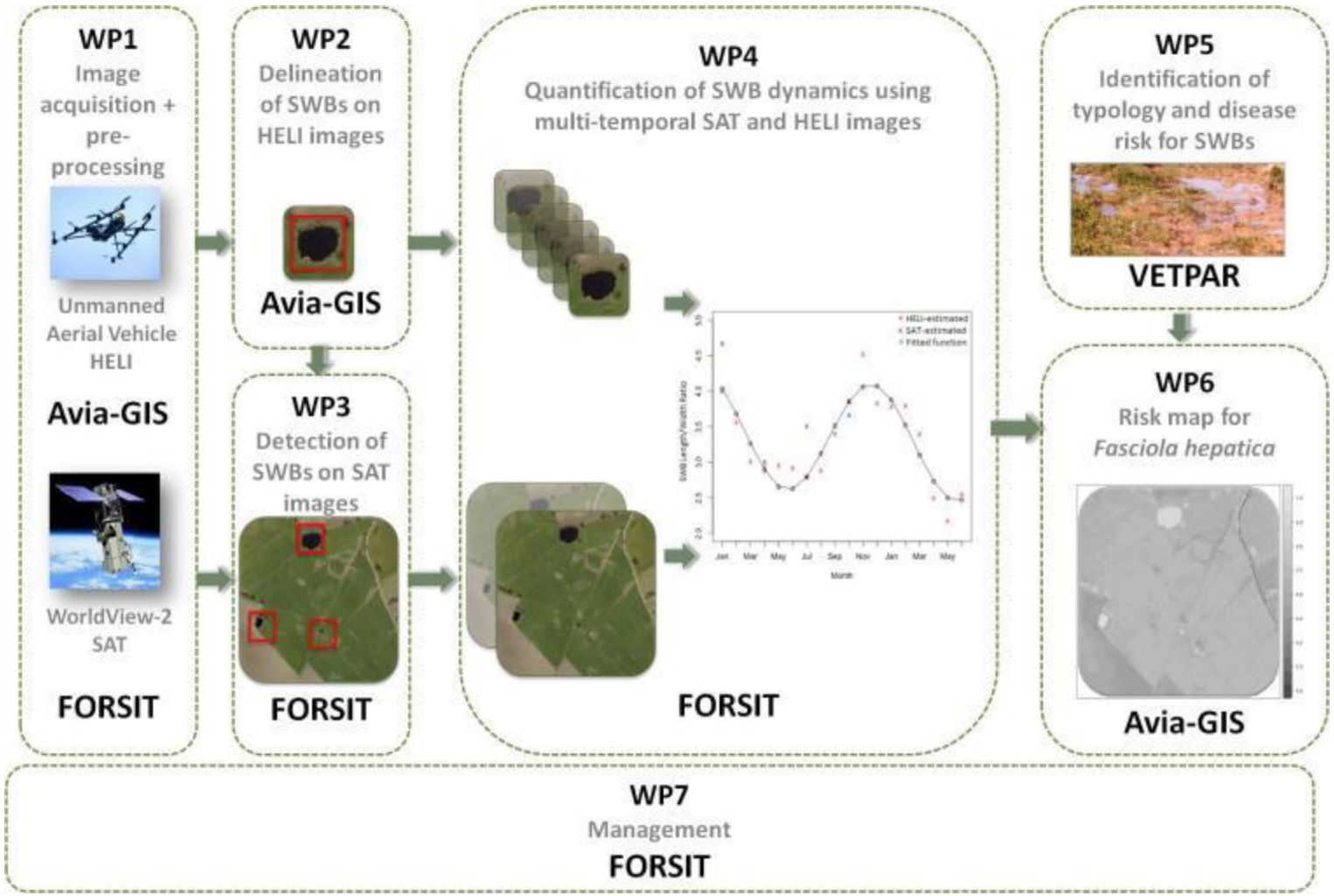
Galba truncatula

Project objective

Design of multi-platform system for SWB detection and monitoring

- Current spatial distribution models do not provide sufficient detail
- Farm-specific control strategies
- Need for technology to assess spatial distribution of snail habitat

Project methodology



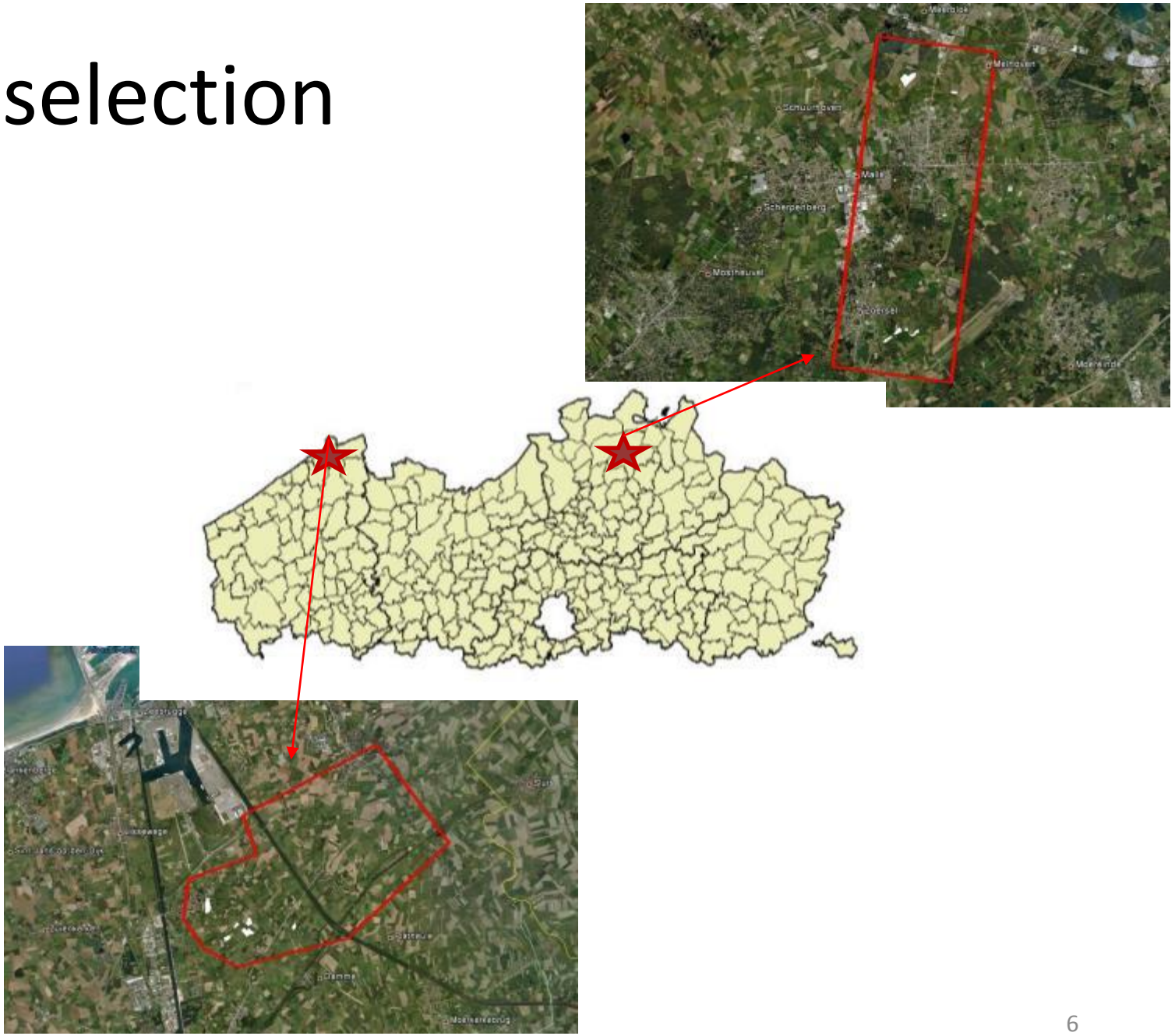
Study site selection

Criteria

- Dairy cattle
- Liver fluke infection
- SWBs
- Owner collaboration
- Flight permission
- Soil conditions: clay/sand

→ Bruges (clay)

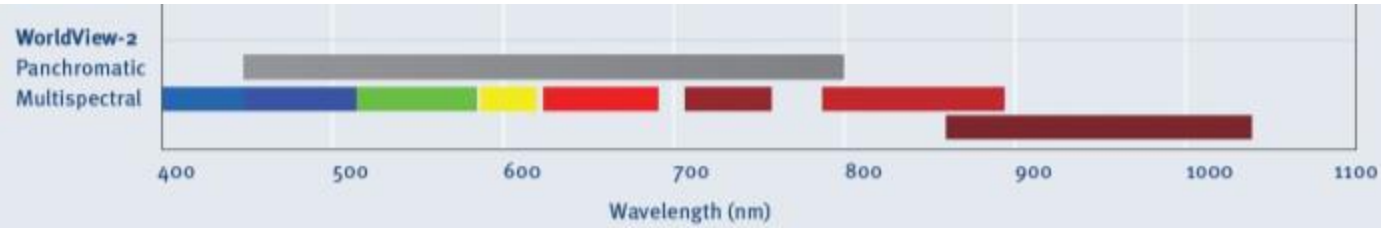
→ Zoersel (sand)

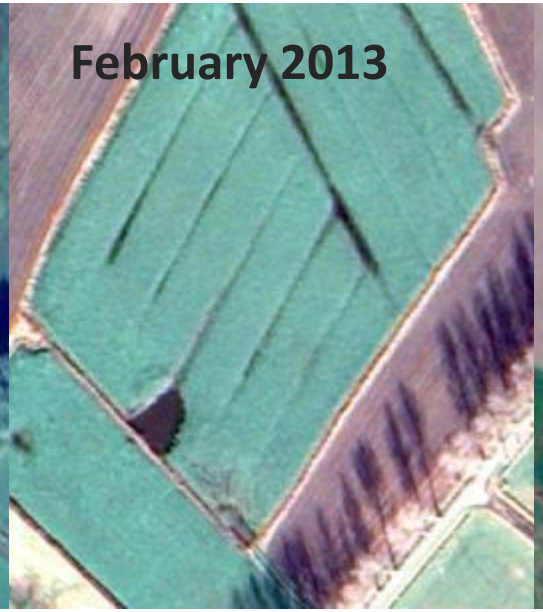


SAT data

WorldView-2

- 8 bands
- Spatial resolution 0.5m (PAN), 2m (MS)
- Seasonal acquisition (4x)





HELI data

Falcon-8

- RGB camera
- Spatial resolution 7cm (PAN)
- Monthly acquisition (10x)

SWB reference data collection

- Fixed measurement strategy
- Location hang up on network of fixed points (differential GPS)

Environmental conditions

Weather factors

- Daily minimum, maximum and mean temperature
- Hourly precipitation
- Hourly soil, surface and air temperature

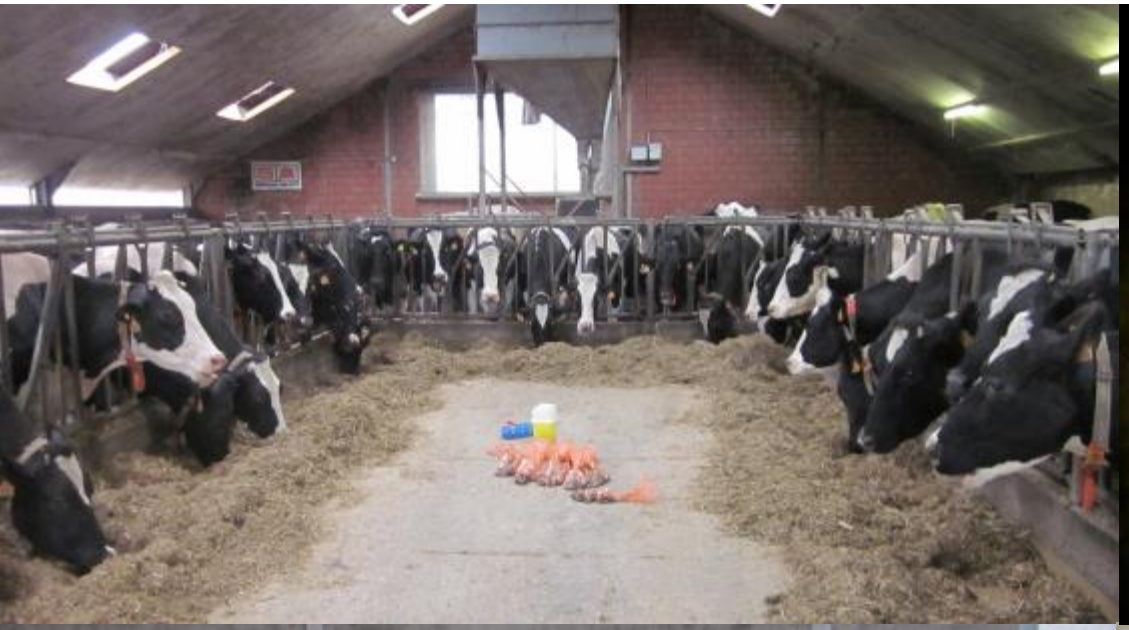
SWB characteristics

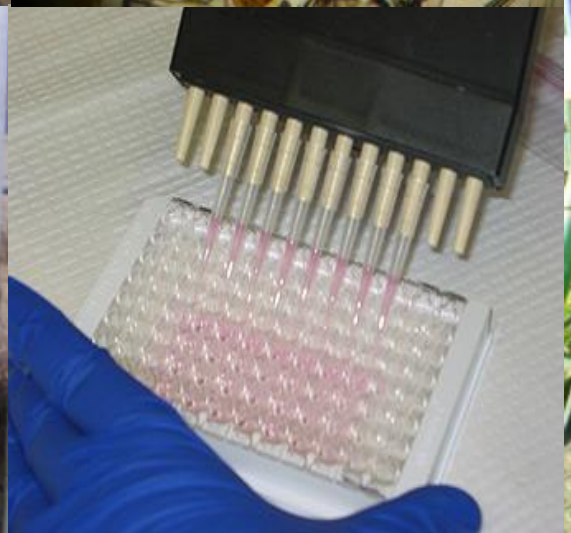
- Management factors (fenced, mowed, …)
- Micro-environmental factors (water flow (yes/no), trampled soil (yes/no), water and soil pH, occurrence of potential indicator plants)

Snail hunt

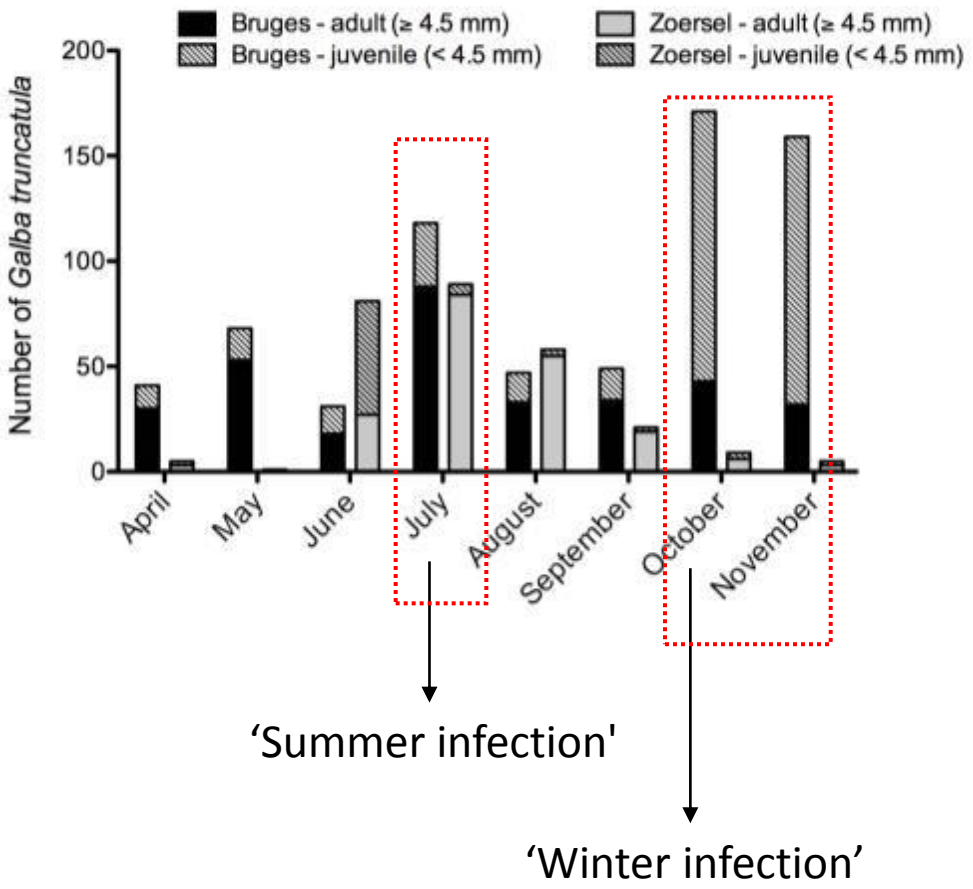
Snail collection and cercarial shedding

Infection status cattle





Longitudinal study



Snail abundance associated

<u>significantly/positively with</u>

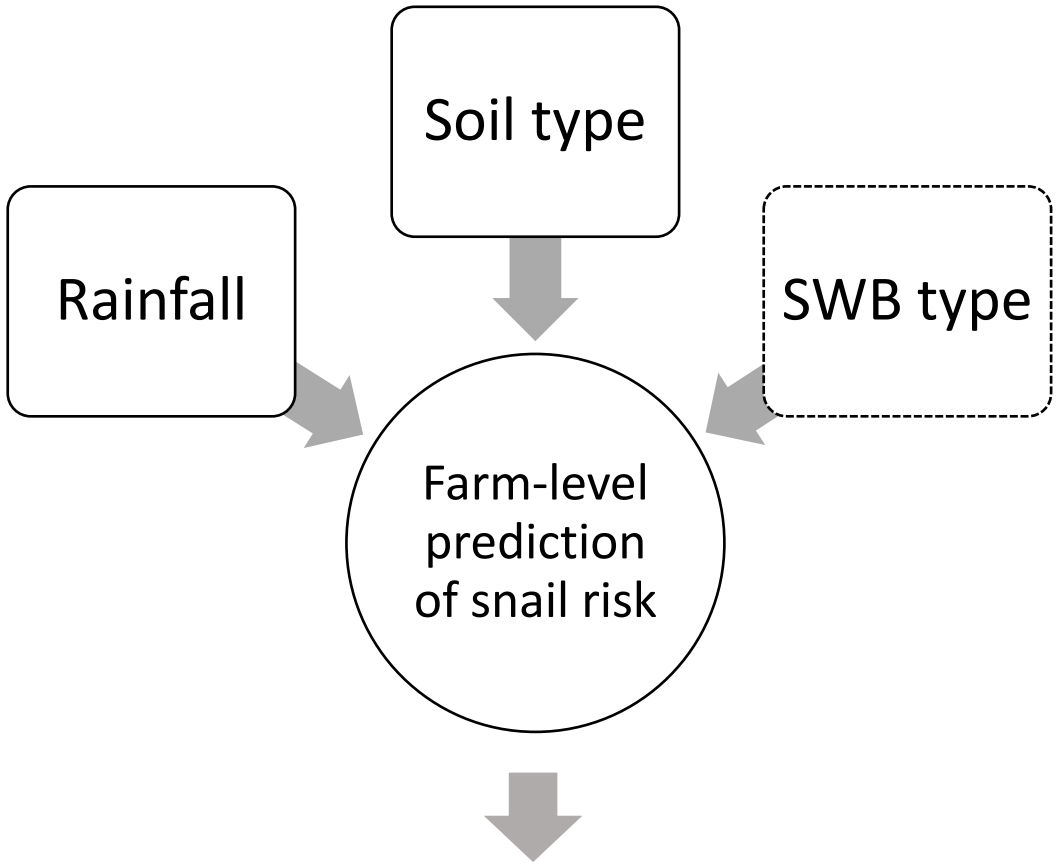
- **SWB type** → trenches
- **Geographic region** → Bruges (soil type)
- **Total monthly precipitation**
- Soil and water PH
- Occurrence of buttercups

<u>not/negatively with</u>

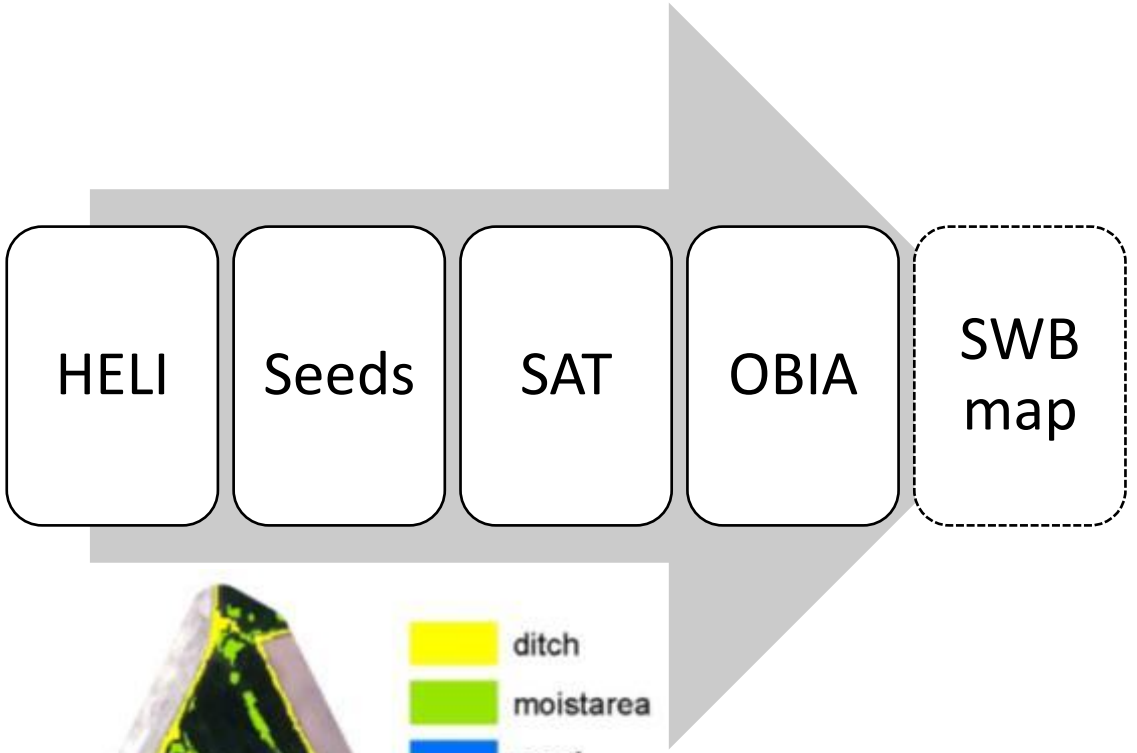
- Monthly temperature
- Mowed pastures
- Water temperature
- Presence of reed-like plant species

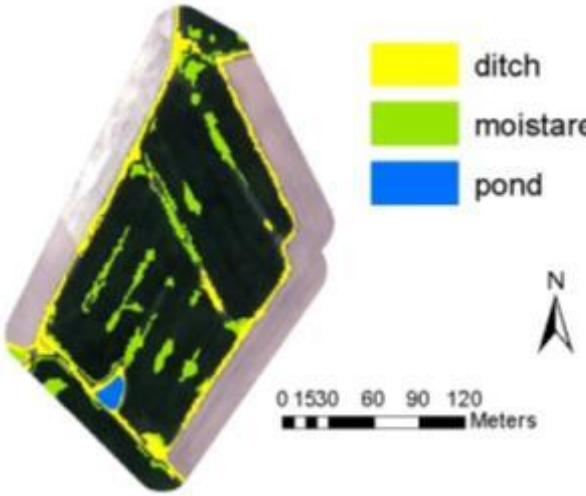
No comparable differences in *F. hepatica* prevalence in cattle

OBIA classification strategy



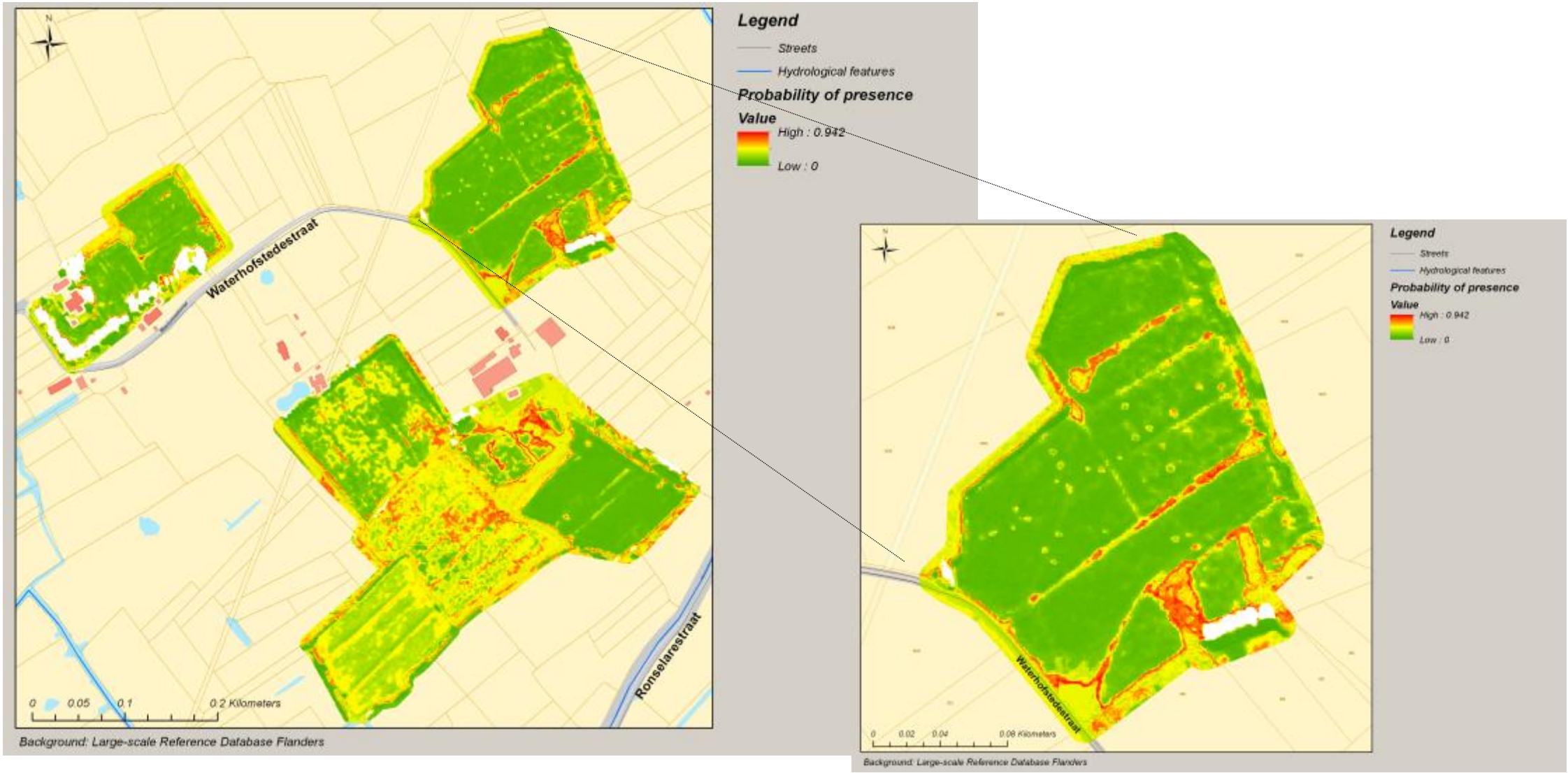
Risk mapping for *F. hepatica* occurrence





Overall SWB detection accuracy reached up to 87%.

Risk mapping for *F. hepatica* occurrence



Project output

D'oleire-Oltmanns, S., Van Coillie, F. M .B., Hantson, W. (20__), UAS mapping in Morocco and Belgium – Evaluation of a fixed-wing and a multicopter UAS (in review)

De Roeck, E., Van Coillie, F., Soenen, K., Charlier, J., Vercruysse, J., Hantson, W., Ducheyne, E., Hendrickx, G., De Wulf, R. (2014). Fine-scale mapping of vector habitats using very high resolution satellite imagery: a case-study on liver fluke, Geospatial Health (in press)

Charlier, J., Soenen, K., Vercruysse, J., Van Coillie, F., De Roeck, E., De Wulf, R., Hantson, W., Ducheyne, E., Hendrickx, G., Longitudinal study on the temporal and micro-spatial distribution of Galba truncatula in four farms in Belgium as a base for small-scale risk mapping of Fasciola hepatica, Parasite and Vectors (in press)

Hantson, W., Ducheyne, E., Soenen, K., Charlier, J., Vercruysse, J., De Roeck, E., Van Coillie, F., De Wulf, R., Hendrickx, G. (20__). Very High Resolution UAV Image processing using Open Source Tools (in preparation)

Charlier, J., Meyns, T., Soenen, K., Vercruysse, J. (2013). Monitoring gastrointestinal nematode and liver fluke infections in Belgium by bulk-tank milk ELISA: Are we making progress in parasite control? Vlaams Diergeneeskundig tijdschrift 82 (1), 17 - 22

Van Coillie, F., De Wulf, R., Soenen, K., Charlier, J., Vercruysse, J., Hantson, W., Ducheyne, E., Hendrickx, G.. A concept for spatio-temporal characterisation of small water bodies. Luxembourg Earth Observation & Integrated Applications Day, Luxemburg, March 2012.

De Roeck, E., Van Coillie, F., De Wulf, R., Soenen, K., Charlier, J., Vercruysse, J., Hantson, W., Ducheyne, E., Hendrickx, G.. Satheli Spatio-temporal characterisation of small water bodies using very high resolution satellite and helicopter imagery. EPCN 2012: Little things mean a lot - understanding the role of ponds in a changing world, Luxemburg, June 2012.

Project output

Soenen, K., Vercruysse, J., De Roeck, E., Van Coillie, F., De Wulf, R., Hantson, W., Ducheyne, E., Hendrickx, G. & Charlier, J.. Liver fluke infection: characterization and disease risk of small water bodies as a complementary tool for disease control. Belgian Society for Parasitology, Antwerp, Belgium, October 2012.

De Roeck, E., Van Coillie, F., De Wulf, R., Soenen, K., Charlier, J., Vercruysse, J., Hantson, W., Ducheyne, E., Hendrickx, G.. Spatio-temporal characterisation of small water bodies, habitats of liver fluke vectors. Eurisy, Lille, France, October 2012.

Hantson, W., Ducheyne, E., Hendrickx, G., Soenen, K., Charlier, J., Vercruysse, J., De Roeck, E., Van Coillie, F., De Wulf, R.. SATHELI: Spatio-Temporal Characterisation Of Small Water Bodies Using Very High Resolution UAV Imagery, MultiTemp2013, Banff, Canada, June 2013.

De Roeck, E., Van Coillie, F., De Wulf, R., Hantson, W., Ducheyne, E., Hendrickx, G.. Object-based change detection: case study on small water bodies. Poster presentation. MultiTemp2013, Banff, Canada, June 2013.

Hantson, W., Ducheyne, E., Hendrickx, G.. Multi-temporal UAV Image Processing for Habitat Modeling. Poster presentation. MultiTemp2013, Banff, Canada, June 2013.

Soenen, K., Vercruysse, J., De Roeck, E., Van Coillie, F., De Wulf, R., Hantson, W., Ducheyne, E., Hendrickx, G., Charlier, J.. Farm specific risk assessment for *Fasciola hepatica*: Putting the pieces together. World Association for the Advancement of Veterinary Parasitology, Perth, Australia, August 2013.

Soenen, K., Vercruysse, J., Ducheyne, E., Hendrickx, G., Hantson, W., De Roeck, E., Van Coillie, F., De Wulf, R., & Charlier, J.. Small-scale spatial risk assessment for *Fasciola hepatica*: which factors are crucial? Global Network for Geospatial Health, Naples (Italy), September 2013

Project output

Ducheyne, E., Hantson, W., Soenen, K., Vercruysse, J., De Roeck, E., Van Coillie, F., Dewulf, R., Charlier, J., Hendrickx G.. Very high resolution risk model for *Fasciola hepatica*. Global Network for Geospatial Health, Naples (Italy), September 2013

Ducheyne, E., Hantson, W., Soenen, K., Vercruysse, J., De Roeck, E., Van Coillie, F., Dewulf, R., Charlier, J., Hendrickx G.. Very high resolution risk model for *Fasciola hepatica*. Global Network for Geospatial Health, Naples (Italy), September 2013

Hantson, W., Ducheyne, E., De Roeck, E., Van Coillie, F., Dewulf, R., Soenen, K., Charlier, J., Vercruysse, J., Hendrickx, G.. SATHELI: spatio-temporal characterization of small water bodies. Global Network for Geospatial Health, Naples (Italy), September 2013

Soenen, K., Vercruysse, J., Ducheyne, E., Hendrickx, G., Hantson, W., De Roeck, E., Van Coillie, F., De Wulf, R., Charlier, J. (2013). Towards farm-specific risk maps: which factors determine Galba truncatula abundance? Vlaamse Vereniging voor Veterinaire epidemiologie en economie, Drongen (België) 8 November 2013

De Roeck, E., Van Coillie, F., De Wulf, R., Soenen, K., Charlier, J., Vercruysse, J., Hantson, W., Ducheyne, E., Hendrickx, G.. Spatio-Temporal Characterisation of Small Water Bodies Using Very High Resolution Satellite And Helicopter Imagery. BEODay, Bruges, Belgium, September 2012.

Soenen K., Vercruysse J., Charlier J.. Focus op leverbot. Dierengezondheidszorg Vlaanderen, Merelbeke (België). December 2013.

Take home message

- Potential of VHR RS to efficiently and semi-automatically detect SWB habitats
- Fine-scale risk mapping at the farm level
- Improved management advice
- VHR image acquisition tuned to seasonal peaks in snail abundances of adults/juveniles

Thank you!