SATHELI

Synergy of VHR satellite and multicopter UAV for the spatio-temporal characterisation of small water body dynamics

Project

Belspo project

Research programme for Earth Observation “STEREO II”

23 months (Feb 2012 – Dec 2013)

Innovative project

Contract NR SR/00/155

Belgian Science Policy Office

belspo

Partners

Laboratory of Forest Management and
Spatial Information Techniques (FORSIT)
Faculty of Bioscience Engineering, Ghent University, Belgium

Staff
Prof Dr Robert De Wulf
Dr Frieke Van Coillie
Dr Els De Roeck

Expertise Object based remote sensing, GIS, spatial analysis, image segmentation and classification

Coordinator in charge of the remote sensing component

Partners

Laboratory of Parasitology (VETPAR)
Faculty of Veterinary Medicine, Ghent University, Belgium

Staff Prof Dr Jozef Vercruysse
Dr Johannes Charlier
Karen Soenen

Expertise Diagnosis, epidemiology, economics and control of helminth infections in ruminants

Partner in charge of the parasitology component

Partners

Agriculture and Veterinary Information and Analysis (Avia-GIS)
Belgium (consultancy company)

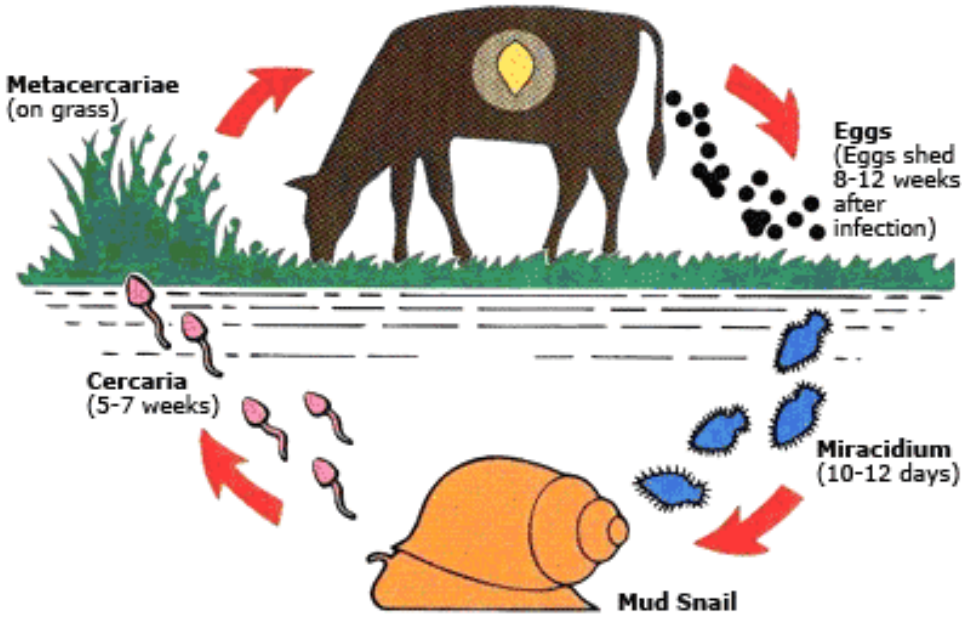
Staff Dr Guy Hendrickx
Dr Els Ducheyne
Wouter Hantson

Expertise Collection, processing and analysis of spatial information
Development of space-time information systems
Vector-borne diseases, zoonoses and emerging diseases

Initiating partner in charge of the UAV component

Rationale

- Common liver fluke disease caused by *Fasciola hepatica*, carried by mud snails
- High economic impact: in Flemish dairy sector alone cost/yr of € 8.2 million
- Snail host lives in small water bodies (SWB) in pastures

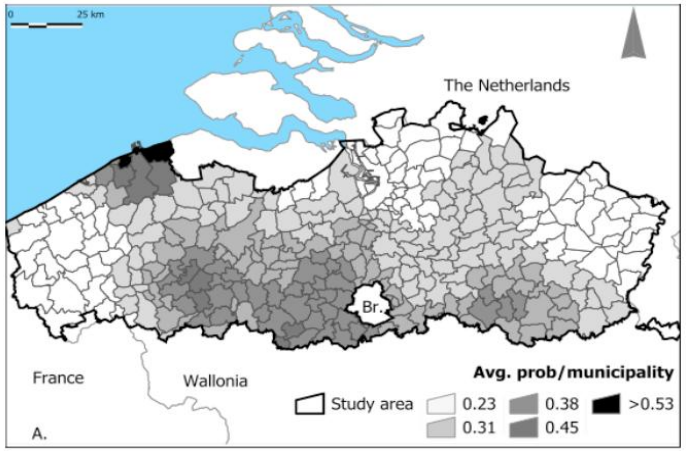


SWB definition

- Pond
- Ditch
- Trench
- Furrow
- Moist / trampled areas

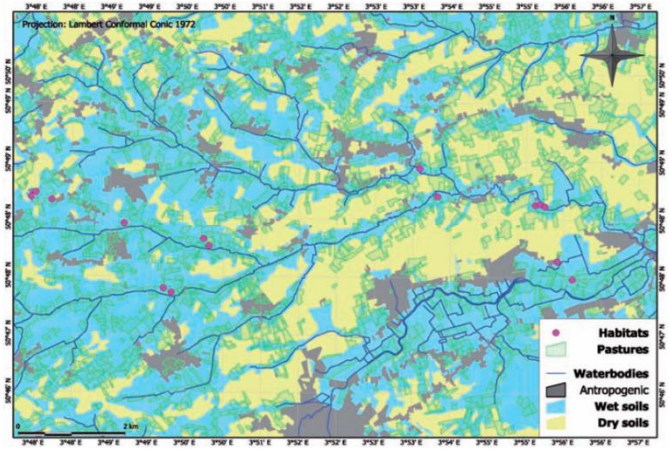
Rationale

Large scale studies liver fluke infection
RS-based



Bennema et al, 2010

Fine scale studies liver fluke infection
GIS-based



Charlier et al, 2011

Previous studies: Low resolution sat/ environmental data /management
↔ Without fine scale data regarding vector habitat

SATHELI: Integration RS component : fine scale data vector habitat
→ Improved risk model
→ Improved disease management

Rationale

Large scale studies

- \- Low spatial resolution
- \+ Large area
- \+ Temporal resolution
- \- No inclusion vector habitats

Useful at regional scale

VHR SAT imagery

- \+ Higher spatial resolution
- \- Smaller area
- \- Temporal resolution (cloud coverage)
- \+ Inclusion vector habitats (detailed: few m)

Useful at landscape scale

HELI imagery

- \+ Very high spatial resolution
- \- Very small area
- \+ Can be taken anytime
- \- Intensive for larger areas
- \+ Inclusion vector habitats (detailed: submeter)

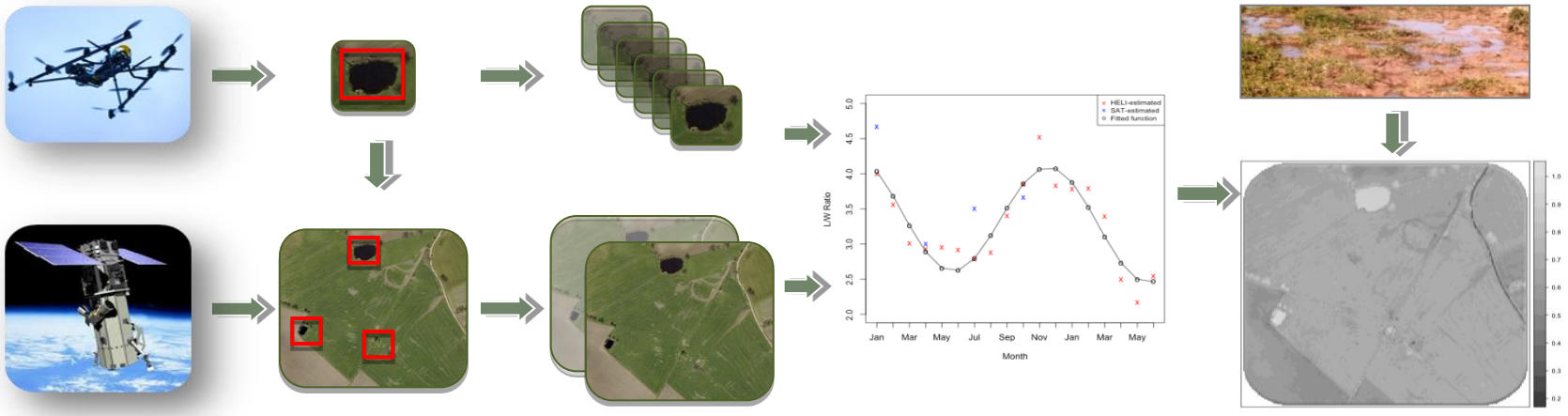
Useful at field scale

Objectives

Multi-platform SWB monitoring system using HELI & SAT

+ Monitoring local climate, environment, snails & infection cattle

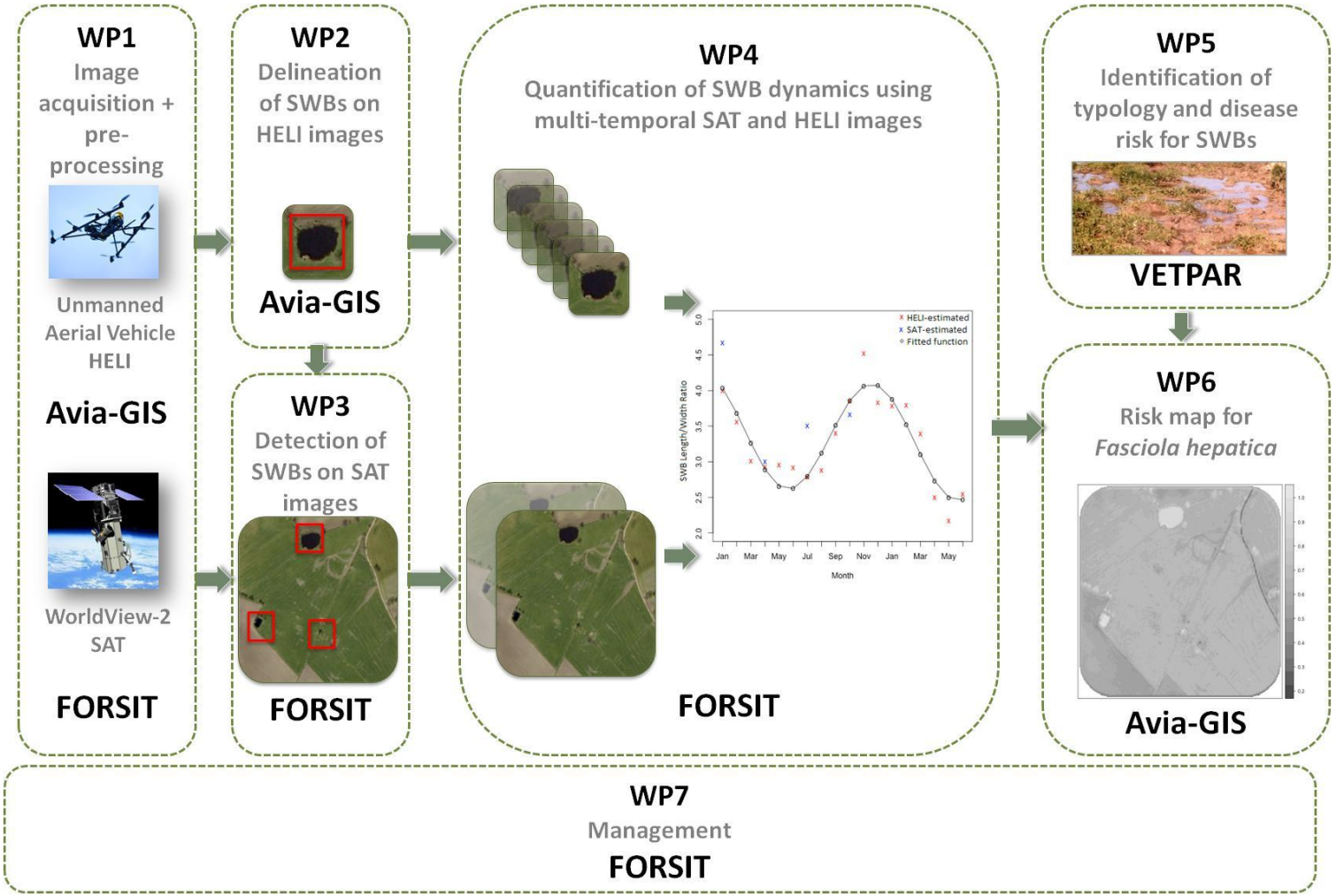
→ Infection risk map liver fluke



Research questions

1. How to identify SWBs on HELI imagery?
2. How to incorporate HELI-derived SWBs to delineate SWBs on SAT imagery using OBIA (Object Based Image Analysis)?
3. How to quantitatively characterise SWB dynamics?
4. How to optimise temporal sampling of SAT imagery using multi-temporal HELI images?
5. How to apply multi-platform approach to quantify disease transmission risk of *F. hepatica*?

Methodology



Expected outcome

1. Processing chain to delineate SWBs on HELI images
2. OBIA algorithm to capture SWBs on SAT images
3. Tool for SWB dynamics analysis
4. Best time frame to reliably characterize SWB dynamics on SAT images
5. Framework to assess disease transmission risk of *F. hepatica*

Selection study sites

Criteria:

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

→ 2 farms close to Bruges (clay)

→ 2 farms close to Zoersel (sand)

Data

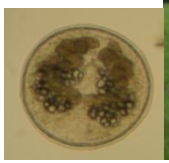
Transmission risk

- Vector habitats (SWBs)
  (HELI / SAT / field data)
- Environmental factors
- Weather conditions
- Snail abundance
- Snail infection

Infection dynamics herd

- Herd sampling
- Farm management

Infection risk model



Preliminary results

HELI Falcon 8 imagery:

First flights: August 2012 (flight permissions ok)

RGB imagery

Preliminary analyses:

- stitching imagery,
  correction lens distortion,
  orthorectification,
  georeferencing

Preliminary results

SAT WorldView2 imagery:

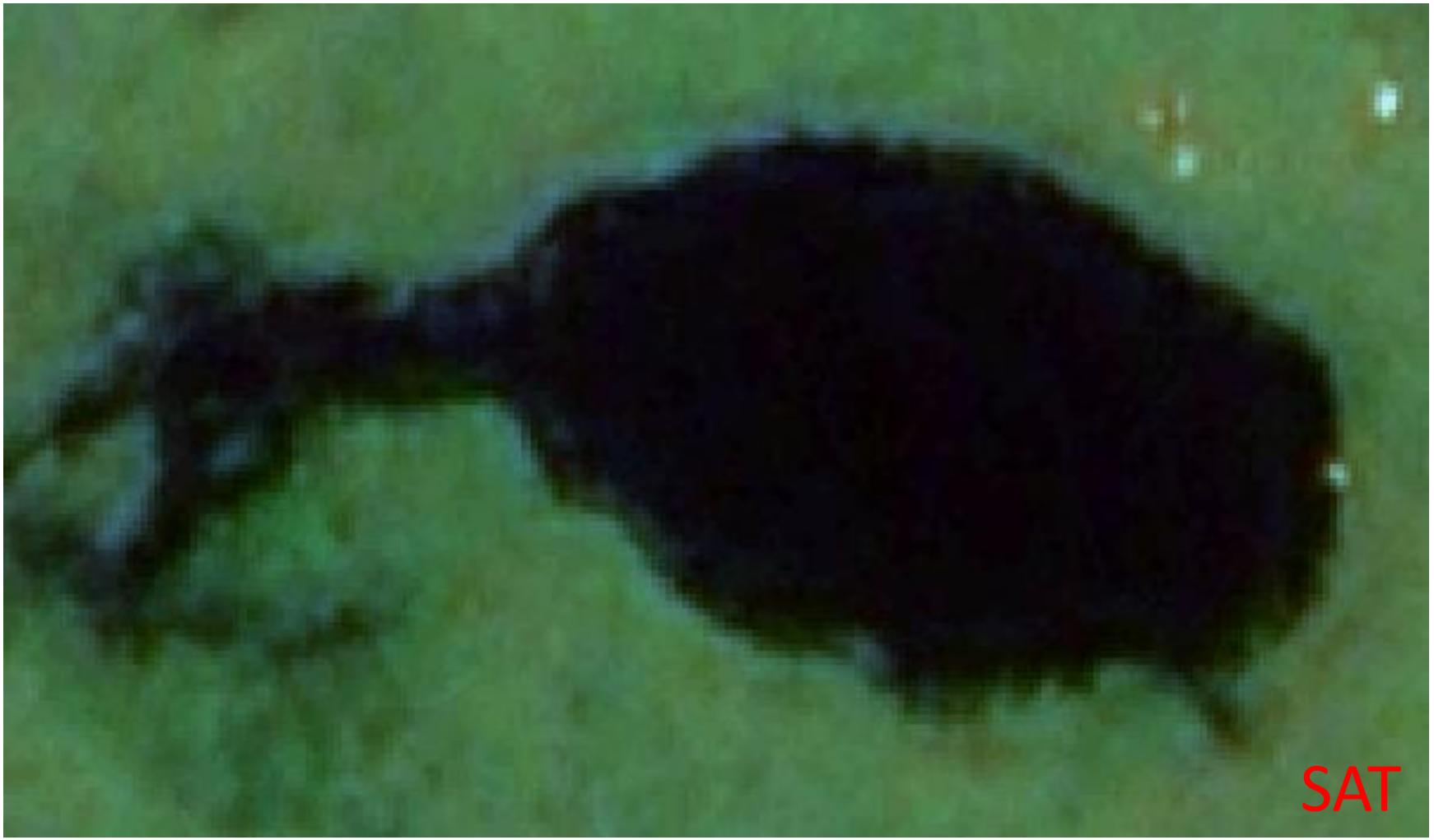
23 July 2012: Bruges & Zoersel

Field data – ground truth

PAN + 8 MS bands

Preliminary RS analyses: orthorectification, pansharpening, creation of indices, segmentation, …

Preliminary results



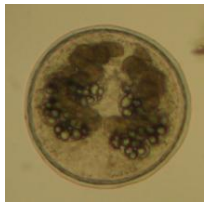
Preliminary results

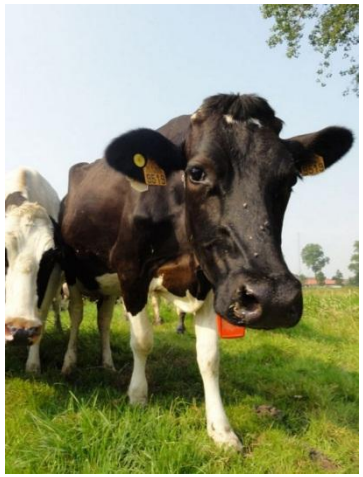
Preliminary results

Field data snails and infection cattle:

From April 2012 onwards

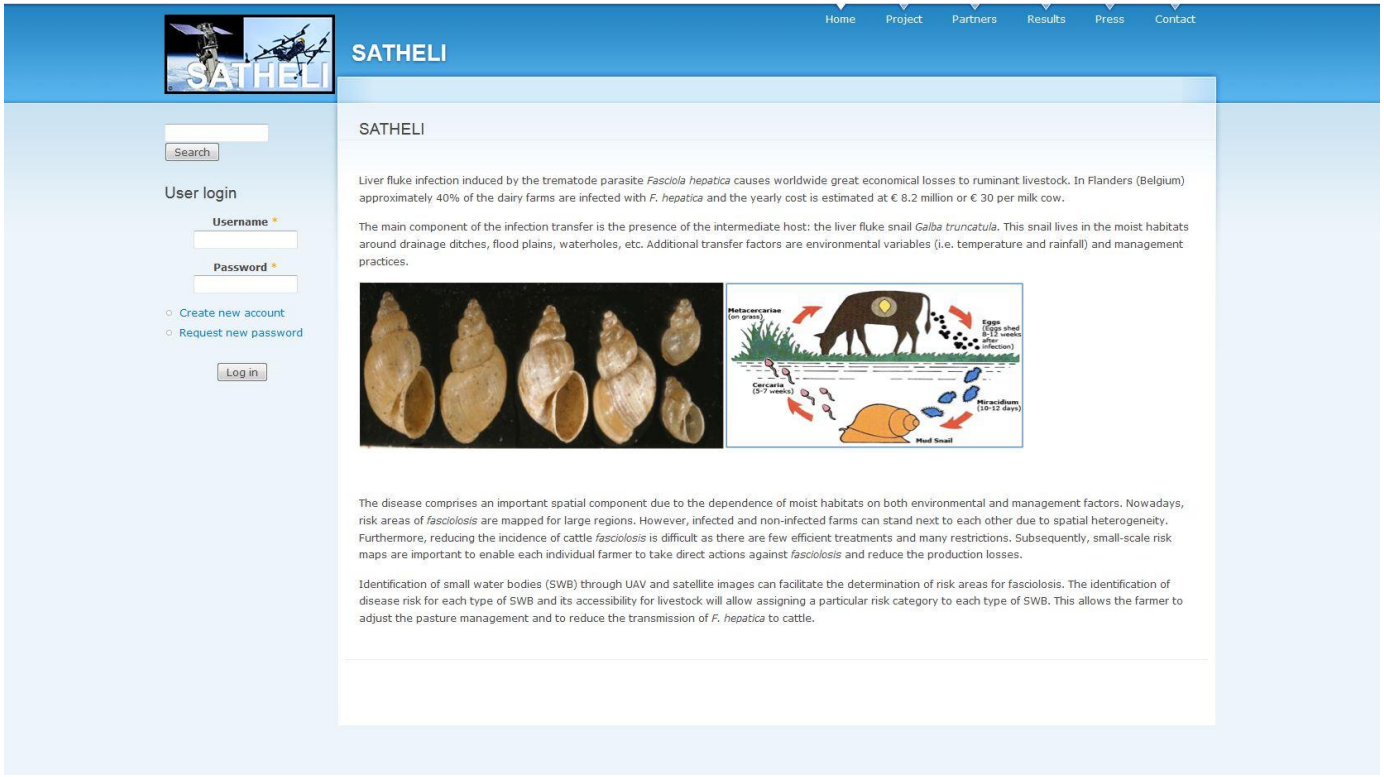
- Monthly data snail abundance
- Monthly data environmental variables
- Monitoring acquisition of infection during grazing period





Climatological data:

From April 2012 onwards

Website

www.satheli.be