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# **2002-2003 Belgian activities in Earth Observation :**

From basis research to technology transfer

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Presented at Namur

May 9, 2003

# What is new under the sun?



## **Since the last workshop in May 2002, a lot of activities have succeeded**

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- Continuation of the poles of expertise
- 4 calls for proposals in 2002 launched 15 new projects
- 3 calls for proposals in 2003 in the process of being evaluated

## **The objective of the meeting is threefold:**

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- Presentation of the current state of the programs STEREO (*SR*) and VEGETATION (*VG*)
- Presentation of the new selected projects
- Presentation of the progress of the on-going projects

# Structure

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- Action lines of the current EO programs *SR* and *VG*
- Calls and projects in 2001, 2002 and 2003
- User support and valorisation
- Announcements for 2003-2004
- Short presentations of four new partnerships
- Conclusion

## Since 2001, OSTC supports two research programs in Earth Observation

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- **VG:** Scientific support for the exploitation of the VEGETATION instruments on board SPOT4 and SPOT5
- **SR:** Support to the Exploitation and Research of Earth Observation data
- Total budget: 14 MEUR

## SR and VG have two **common** action lines

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The programs aim at fostering:

- **Fundamental research** by developing poles of expertise
- **Development of products and operational services for both public and private sectors** by developing partnerships
- User support (SR)
- Valorisation and promotion (SR)

# SR and VG support three types of projects

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## Basic research

**1. Poles of expertise:** network of research teams

Duration: 3-5 years

## Development of products and operational services

**2. Partnerships OSTC - Belgian administrations**

**3. Partnerships industry - research**

Duration: maximum 3 years

Participation of the private or public partner: 25% of the total budget



## SR and VG focus on six topics

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- Global vegetation - land processes **VG**
- Local vegetation - agriculture **SR**
- Cartography - land management **SR**
- Study of coastal regions **SR**
- New technologies – innovation **SR**
- Exploitation of hyperspectrometers aboard aircraft  
(APEX - ESA) **SR**

## In 2001, the programs launched the poles of expertise

<i>Line of action</i>	2001	2002	2003	2004	2005
<b>Building of expertise</b>					
Global vegetation	VG				
Local vegetation	SR				
Cartography - land management	SR				
Coastal regions	SR				
Innovation	SR		SR		
APEX exploitation		SR	PRODEX	SR	SR
<b>Market development</b>					
Private research		SR / VG	SR		
Public research	SR	SR	SR		

# Six poles of expertise are currently granted

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## Global vegetation - land processes

**1. GLOVEG:** Expertise centre for monitoring changes in terrestrial ecosystems via earth observation (VITO, KUL, UCL)

## Local vegetation - agriculture

**2. STEREO-CROP:** Modelling crop growth based on hydrology and assimilation of remotely sensed data (UCL, RUG, CSL)

# Six poles of expertise are currently granted

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## Cartography - land management

**3. SPIDER:** Improving SPatial Information extraction for local and regional DEcision makers using Remotely sensed data (VUB, RUG, ULG, ULB)

## Study of coastal regions

**4. BELCOLOUR:** Optical remote detection of coastal waters (MUMM, ULB, VITO)

# Six poles of expertise are currently granted

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## New technologies - innovation

**5. ASAR-TECH:** Advanced methods for SAR remote-detection processing (CSL, ERM, RUG, UCL)

**6. HYPERCRUNCH:** Data analysis in hyperspectral remote sensing (VITO, KUL, UA)

The poles of expertise are followed by a **Steering Committee** on an annual basis: **scientific experts, end users and OSTC**

**In 2002, SR granted the CASI-SWIR flight campaign  
SR and VG developed first partnerships**

<i>Line of action</i>	2001	2002	2003	2004	2005
<b>Building of expertise</b>					
Global vegetation	VG				
Local vegetation	SR				
Cartography - land management	SR				
Coastal regions	SR				
Innovation	SR		SR		
APEX exploitation		SR	PRODEX	SR	SR
<b>Market development</b>					
Private research		SR / VG	SR		
Public research	SR	SR	SR		

# **In September 2002, OSTC and VITO organized the first CASI-SWIR flight campaign**

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- APEX (Airborne Prism Experiment) is developed by Belgo-Swiss consortium under ESA's Prodex programme
- Future exploitation of APEX by VITO from 2004
- OSTC familiarises Belgian scientists with hyperspectral data: CASI campaigns in 2002 and 2003
- CASI-SWIR: up to 488 channels from 400 nm to 2500 nm
- 2002 SR budget: 124 kEUR
- Presentation of the results: 4 September 2003, VITO

# SR grants 7 small study contracts of 8 months

<i>Application field</i>	<i>Topic</i>	<i>Test site</i>
Coastal monitoring	Biogeochemistry of Scheldt estuary and plume	Scheldt estuary <b>RMA, ULg, ULB, RUG</b>
Hydrology	Detection of soil moisture gradients	Dijle Valley <b>VUB</b>
Forestry	Vitality of perennial plants	Limburg <b>KUL</b>
Pollution monitoring	Detection of heavy metals in plants and solid matrices	Campine <b>VITO, LUC</b>
Agriculture	Characterisation of permanent grassland canopy	Lorraine <b>CRAGx</b>
	Estimation of soil organic matter content	Lorraine <b>FUL</b>
Urban studies	Spatial information extraction for urban areas	Ghent <b>RUG, VUB, ULg, ULB</b>



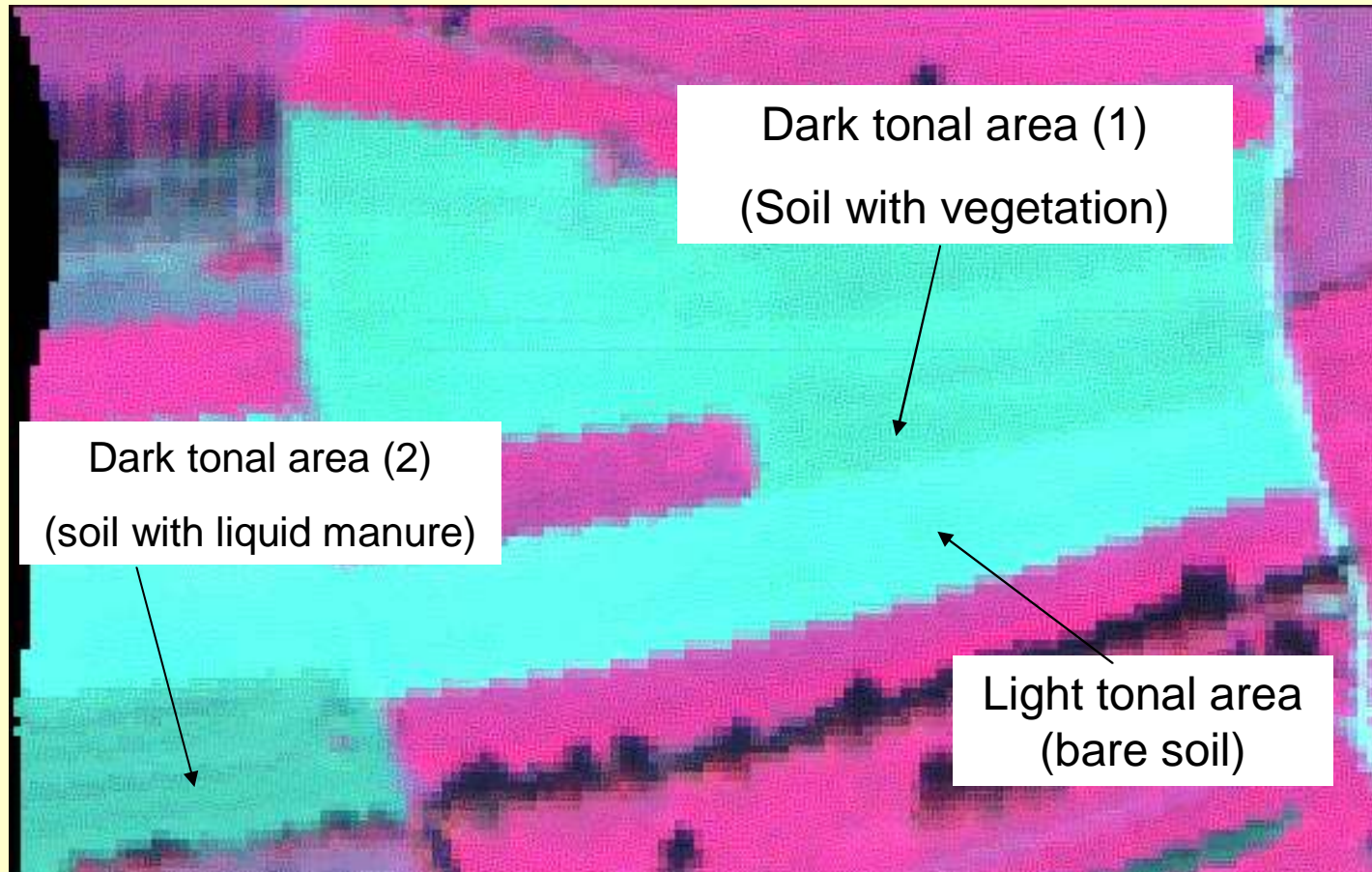
# The flight campaign flew 6 test sites

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# Estimation of soil organic matter content

S.Touré and B.Tychon (FUL)

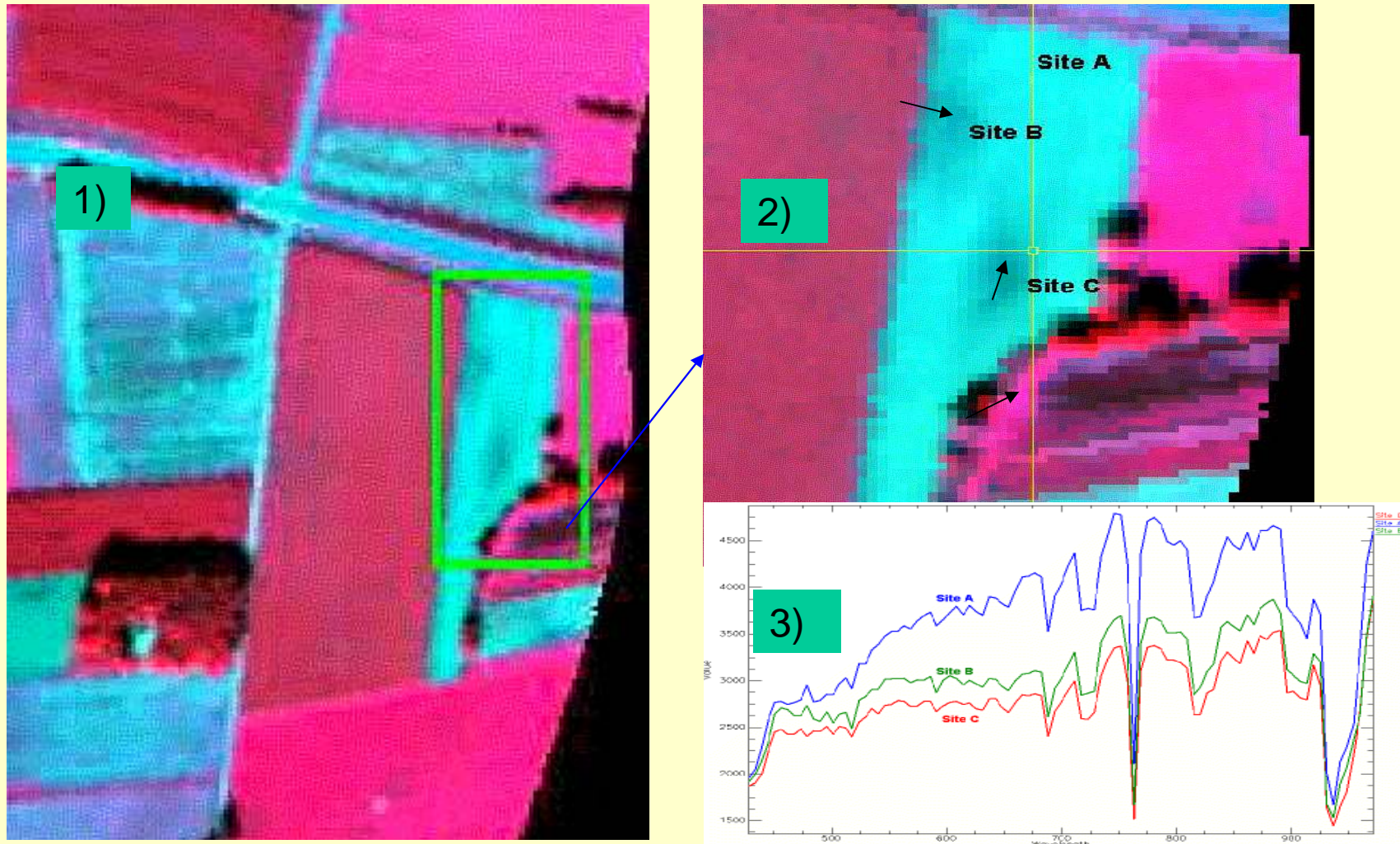


Use of low altitude CASI-SWIR sensors for identifying soil surface characteristics

Pseudo-color image, 750, 650, and 550-nm in RGB classes

# Estimation of soil organic matter content

S.Touré and B.Tychon (FUL)



Hyperspectral measurements with CASI-SWIR sensors (spatial resolution : 2m; 200 bands in the visible and the NIR )

# Three partnerships with public departments are currently granted by SR

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## Local vegetation – agriculture

**1. SAGRIWATEL:** Monitoring of Walloon agriculture based on remote sensing (Ministère de l'Agriculture de la Région wallonne, FUL, CRAGX, UCL, FUSAGX)

## Cartography and land management

**2. FLOODMAP:** Development of an operational monitoring system in the context of floods (OC-GIS Vlaanderen, ERM)

**3. ETATS:** Evaluation system of actualisation status of topographic data by remote sensing (NGI, ERM)

**Under VG, one partnership with private companies has started in January 2003**

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**Global vegetation - land processes**

**GEO-SUCCESS:** Global earth observation in support of climate change and environmental security studies (GIM, TRASYS, VITO)

# **Under SR, four partnerships with private companies will start very soon**

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## **Local vegetation – agriculture**

1. Remote sensing and risk assessment of vector transmitted diseases. Bluetongue in Australia.

(Avia-GIS, ITG)

2. Remote sensing in evaluating the environmental impact of rangeland management (Avia-GIS, RUG)

# Under SR, four partnerships with private companies will start very soon

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## Cartography - land management

**3. SUGRES:** Services for Urban Green monitoring using Remote Sensing (GIM, VUB, ULB, UCL, RUG)

**4. GIS problem detector:** Automated quality assessment of databases with very-high resolution satellite images (TELEATLAS, RUG)

## In 2003, OSTC has launched calls for new poles of expertise in innovation and new partnerships

<i>Line of action</i>	2001	2002	2003	2004	2005
<b>Building of expertise</b>					
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## **In March 2003, OSTC launched a SR call for new poles of expertise in innovation**

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- Budget: 500 kEUR
- 4 proposals are now under evaluation
- The Guidance committee of the STEREO program will meet in June 2003
- Proposed selection to Minister of Scientific Research in July 2003
- Start of contracts in autumn 2003

## **In May 2003, OSTC is going to launch a call for new partnerships “Industry-research”**

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- Budget: 600 kEUR
- Deadline: 4 July 2003
- Guidance committee of the STEREO program will meet at the beginning of October 2003
- Proposed selection to Minister of Scientific Research in November 2003
- Start of contracts in January 2004

# The ESA's Prodex program supports the CASI-ATM campaign of 2003

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- 2003 Prodex Budget: 87 kEUR
- CASI: up to 288 channels from 400 nm to 950 nm
- ATM: 1 TIR band from 8,5 to 13  $\mu\text{m}$
- Flight windows:  
**2nd fortnight of June 2003 and in October 2003**
- Workshop in 2004

# Evaluators renewed 3 projects of 2002 and selected 4 new projects

<i>Application field</i>	<i>Topic</i>	<i>Test site</i>
Coastal monitoring	The Yzer estuary	Yzer estuary <b>KUL, RUG, VLM</b>
Geology	Detection of changes induced by active faults	Roer Graben <b>MRAC, OMA</b>
Soil	Dynamics of soil organic Carbon	Ardennes <b>UCL</b>
Forestry	Monitoring of stress vegetation and water quality	Sonian Forest <b>VUB, KMI</b>
Agriculture	Characterisation of permanent grassland canopy	Lorraine <b>CRAGx</b>
	Estimation of soil organic matter content	Lorraine <b>FUL</b>
Hydrology	Water and energy fluxes in a Riparian wetland	Dijle Valley <b>VUB</b>

## At the end of 2003, all the projects will have started

<i>Line of action</i>	2001	2002	2003	2004	2005
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# EODesk provides user support and valorisation actions

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- Image acquiring and archiving:
  - Sammy Dalewyn: [dale@belspo.be](mailto:dale@belspo.be)**
  - Martine Stélandre: [stel@belspo.be](mailto:stel@belspo.be)**
- **EOEdu** <http://telsat.belspo.be/beo> offers
  - an on-line access to theoretical information contained in CD-Rom BEO
  - topical links
  - a teacher's corner with educational announcements and resources
- EODesk took part in the realization of the demo website :  
**'Remote Sensing and GIS in Support of World Heritage Conservation'** <http://telsat.belspo.be/whp/>

# **EODesk maintains the website, TELSAT Guide**

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- To add a new project in the TELSAT Guide:  
<http://telsat.belspo.be> (Select Data Entry/Maintenance)
- To update your project data in the TELSAT Guide,  
please contact EODesk:

**[eodesk@belspo.be](mailto:eodesk@belspo.be)**

# Future activities

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## 2003

- 23rd EARSeL annual symposium, Ghent, 2-7 June 2003 is sponsored by OSTC:

[http://www.earsel.org/earsel\\_events/index.html](http://www.earsel.org/earsel_events/index.html)

- CASI-2002 workshop: 4 September 2003
- Autumn: all steering committees

## 2004

- CASI-2003 workshop
- Mid-course SR & VG workshop (2 days)
- Campaign APEX 2004



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**Short presentations of new partnerships  
‘Industry-research’**

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## Avia-GIS OSTC STEREO projects

Avia  
GIS



Agriculture and Veterinary Intelligence and Analysis  
[www.avia-gis.com](http://www.avia-gis.com)

- (a) Remote sensing and risk assessment of vector transmitted diseases. (Bluetongue in Australia)**
- (b) Remote sensing in evaluating the environmental impact of rangeland management.**

## Project Partnership

### **Prime: Avia-GIS ([www.avia-gis.com](http://www.avia-gis.com))**

Mission: to assist the design of agricultural, veterinary and environmental sustainable management practices through consultancy, specific training and projects. Since these objectives largely depend on spatial land evaluation and modeling, GIS and end-user customized software development are key tools in Avia's methodology.

### **Scientific partners:**

- Bluetongue:  
Institute of Tropical Medicine (ITM, Antwerp),  
Dept. Veterinary Medicine (Dr. R. De Deken)
- Rangeland management:  
Ghent University  
Dept. Forest and Water Management (Prof. R. De Wulf)

### **Core end users:**

- The Austrex-CPC-GRM livestock export group
- Governmental Institutes having the mandate to monitor and control disease spread and other environmental issues (e.g. use of vegetation resources)

## End User Information Needs

Contact with GRM-Austrex-CPC (April 2002), livestock management and export company in Australia, owning 35,000km<sup>2</sup> ranches scattered over the Australian continent.



Interest in Remote Sensing (RS) based decision making:

- (a) Vector transmitted disease spread prediction (e.g. Bluetongue),
- (b) Quantitative pasture management evaluation tools.

Intention to outsource upper issues. However, there exist NO decent precursor services regarding these topics. Current precursor services are highly fragmented and still demanding highly trained personnel to answer upper interests.

## Project Objectives

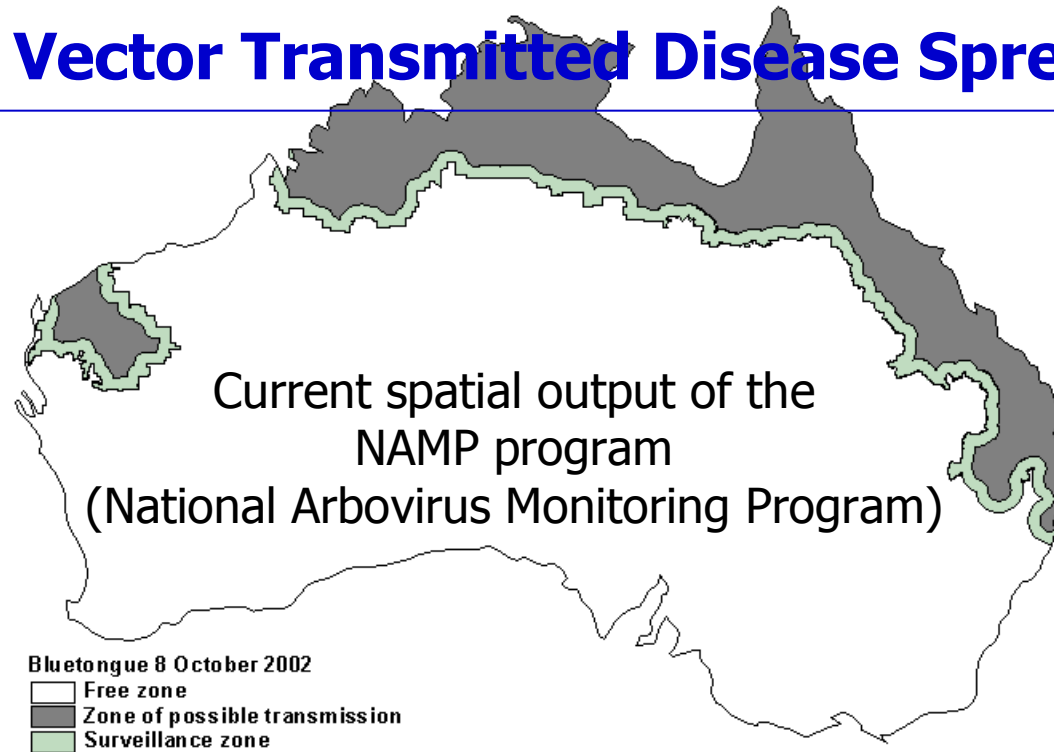
### **Project objectives:**

End-user customized and continuous disease and rangeland management integrated information services based on spatio-temporal RS data (NOAA, MODIS(?), Spot-Vgt(?), MeteoSat (?),...) co-variables.

### **Avia-GIS RS based precursor info-services:**

Easy to use software package regarding NOAA AVHRR LAC/GAC Level 1b image processing. GIS/RS literates can build their own 100% custom vegetation and climate related cloudfree time series, perform advanced time series analysis (Fourier transformation), habitat mapping, etc...

# Vector Transmitted Disease Spread



**Problem:** Current governmental online info-services are too crude.

**Objective:** More detailed information in the « zone of possible transmission »

**Boundary conditions:**

- Methodology must be applicable on other vector transmitted diseases (e.g. Trypanosomosis, Malaria, Old World Screw Wurm, ...)
- Integrate the government (through NAMP) within the development cycle
- End user customized (directly useable by GIS/RS literates)

# Vector Transmitted Disease Spread

## **Methodology:**

- Understanding vector/disease patterns: Geostatistical techniques to analyse vector/serology data
- Biological and epidemiological processes, such as disease prevalence, abundance and distribution of living organisms are influenced in time and space by a number of biotic (e.g. vegetation) and abiotic (e.g. temperature, humidity...) parameters → covariables delivered by low resolution remote sensing (1 km)
- Disease spread (space-time domain): cellular automata technique with environmental covariables
- risk assessment: stochastic uncertainty modeling (Monte Carlo or Latin Hypercube or ...)

# Rangeland Management



**Auvergne Station (site 3), Northern Territory  
(4142 sq km, 600 mm rainfall)**

**Problem:** Objective and quantitative assessment of region specific and time dependent optimal vegetation resources management strategies.

**Objective:** (a) Determining carrying capacity; (b) discriminating anthropogenic from physical environment impact; (c) developing management scenarios

**Boundary conditions:**

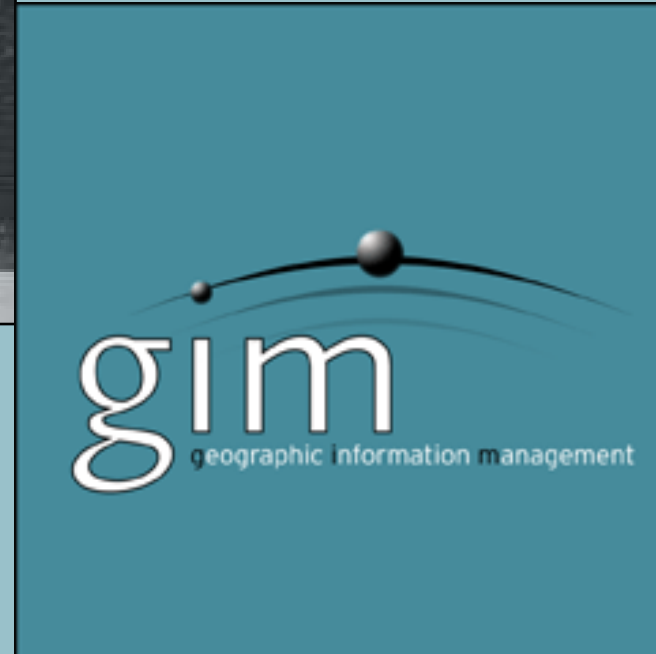
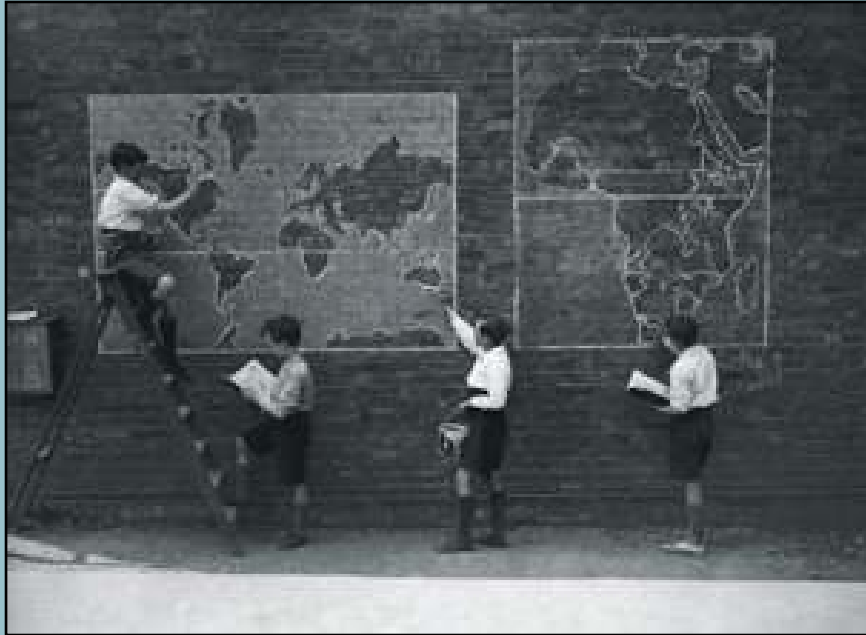
- Methodology must be applicable on extensive rangeland areas in other continents.
- End user customized (directly useable by GIS/RS literates)



# Rangeland Management

## **Methodology:**

- Control areas: areas of minimal human impact
- Rangeland areas and control areas: integrated space (geostatistics) time (Fourier, Wavelet, ...) modeling to assess anthropogenic component in vegetation dynamics using low resolution (1 km) RS data.
- Uncertainty estimation by uncertainty/error propagation (Monte Carlo or Latin Hypercube or ...)



**SUGRES**

Services for Urban Green  
Monitoring using Remote  
Sensing



## SUGRES - Partners

- Private partner
  - GIM - Geographic Information Management NV (Ir. Els Brems)
- Scientific partners
  - ULB - IGEAT (Prof. Eléonore Wolff)
  - VUB - Centre for Cartography and GIS (Prof. Frank Canters)
  - UCL - Unit of Environmetry and Geomatics (Prof. Pierre Defourny)
  - UG - Department of Geography (Prof. Rudi Goossens)

- Development of value-adding products and services for optimising the monitoring of urban green using VHRSI
- Demonstration of the potential of VHRSI for monitoring urban green in an operational context

- Products to be developed (digital/GIS environment)
  - Inventory of green areas, both public and private (update every 2-3 years)
  - Classification of life forms (update every 2-3 years)
  - Health condition of alley trees (yearly update)
  - Change products: inventory of green areas (update every 2-3 years)

## SUGRES - End users

- City administrations responsible for urban green management
  - active involvement from:
    - Gent: Dienst Plantsoenen
    - Brussels: Brussels Instituut voor Milieubeheer (IBGE - BIM), Afdeling Groene Ruimten - Dienst Groen Netwerk
  - to be extended to other cities and communes during project exploitation phase

- Vegetation monitoring (UCL)
- Photogrammetry of EO data (UG)
- Information extraction from Very High Resolution Satellite Images (UG, UCL, ULB, VUB, GIM)
- Change detection (UCL, ULB)
- Urban vegetation (ULB)
- Spatial data quality (VUB)
- GIS integration and service development (GIM)



# The GIS Problem Detector

The aim of this project is  
to **define** and **assess quality**  
from the view of the content provider,  
to increase the efficiency of the production  
process,  
using **VHR satellite images**.





# The GIS Problem Detector

People involved:

**Tele Atlas**

Dhr.Pascal Brackman

**UGent - Department TELIN**

Prof.Johan D'Haeyer

Sidharta Gautama, Werner Goeman

**UGent - Department Geography**

Prof.Philippe De Maeyer

Leen De Temmerman



**TELIN & Geography**

**Tele Atlas**



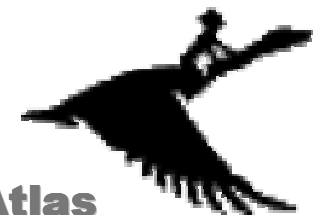
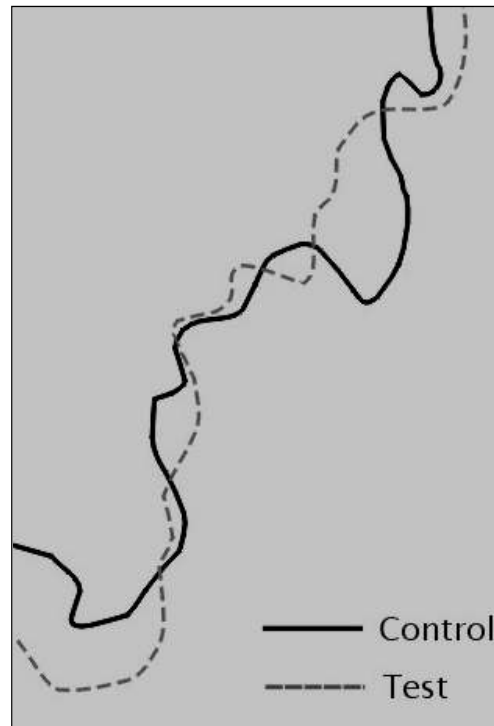
# The GIS Problem Detector

- Need for consistent and reliable automation of quality assessment on high volume data
- Three questions:
  - what is quality of geospatial data?
  - how can we describe image information?
  - how can we achieve robust automatic QA?



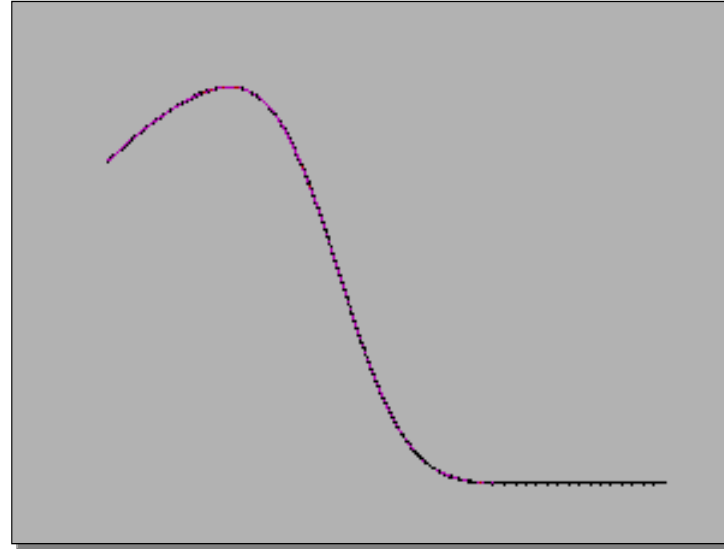
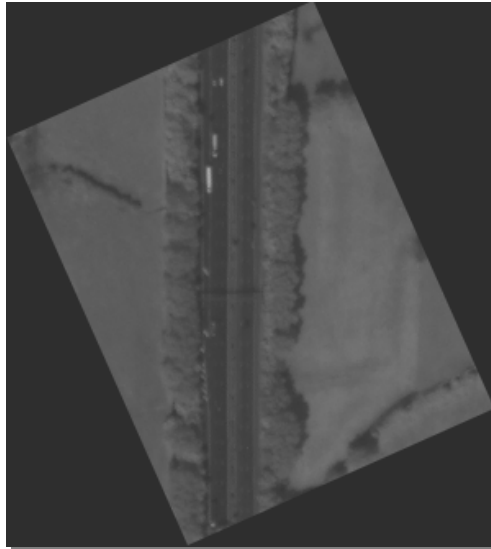
# The GIS Problem Detector

- What is quality of geospatial data?



# The GIS Problem Detector

- How can we describe image information?



# The GIS Problem Detector

- How can we achieve robust automatic QA?



# OSTC expectations

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- Clear, concise and well-written reports, including
  - Report of the Steering Committee
  - Answer of the network to the Committee
- Plan the next meeting of the steering committee
- Develop a **user-oriented** action plan
- Publish the results in well-chosen peer-reviewed journals: **Publish or perish!**

# **Have a good meeting!**

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The presentations will be available on:

**<http://telsat.belspo.be/documents/stereo-vg-2003.html>**