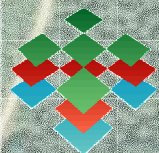


ForeCAST :

Use of VHR satellite data for forest cartography

I-MAGE
CONSULT



I-MAGE
CONSULT

UCL- Dpt Sciences du Milieu et
de l'Aménagement du Territoire



Description of the partnership

I-MAGE Consult

Private partner



Team of engineers, geographers
and computer scientists

Cartography

Satellite remote sensing

Development of Geographical
Information Systems

Inventory and census production
using (D)GPS



UCL- Dpt of
Environmental Sciences
and Land Use Planning

Scientific partner

Geomatics unit

Forest remote sensing activities

Specific expertise on the VHR
images processing for forest
applications (ICRAFOL)

Forestry unit

Integration of remote sensing
information into systems
necessary for the improvement of
forest policies, forest planning or
management



Foresters are within the first remote sensors

- ◆ Forests need to be described BUT
 - Covers large area
 - Hardly accessible
- ◆ Different products have been developed
 - Scouting map (Landsat...)
 - Stand map from aerial photography



Very high resolution satellites bring new opportunities

- ◆ Spatial resolution decreases
 - Eros, Ikonos, Orbview-3, Quickbird
- ◆ Spatial coherence over wide areas
- ◆ Color and near-infrared channels
- ◆ Spectral description in 11 bits
- ◆ Lesser parallax than airborne sensors



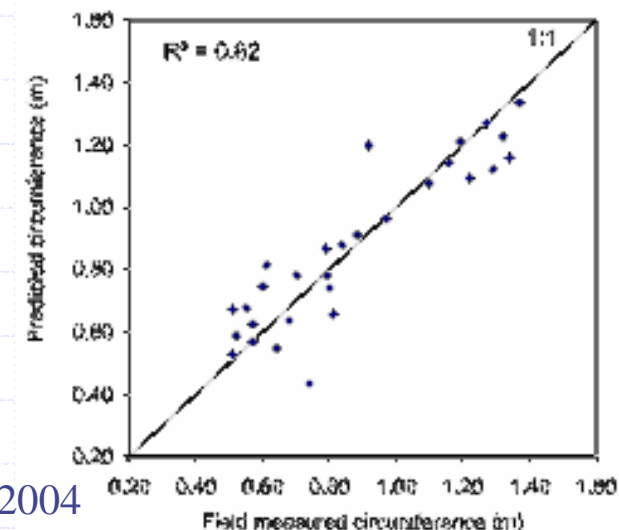
Evaluation of stand parameters from the textural information

◆ Use of the grey level co-occurrence matrix

	Age (years)	Density (N ha ⁻¹)	Height (m)	Circumference (m)	Basal area (m ² ha ⁻¹)
Absolute error	10	276	2.2	0.13	7.1
Relative error (%)	18	29	10	15	16

◆ Not fully operational

- Coniferous only
- No slopes
- Low sun angles

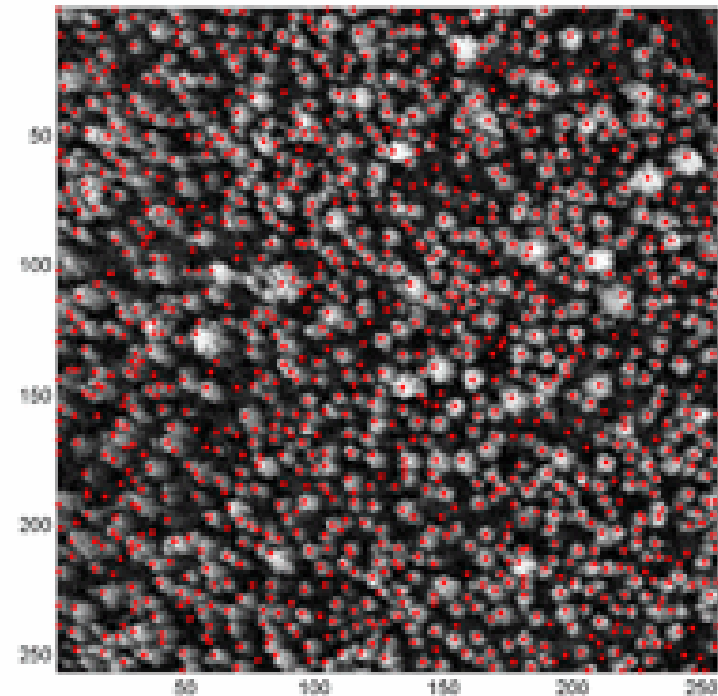


Kayikaire, Hamel & Defourny RSE 2004



Individual tree delineation and identification

- ◆ Local minima following algorithm
- ◆ Object classification
- ◆ Boreal forests
 - Lesser slopes
 - Slim trees
 - Open stands



Le Wang, Peng Gong and Gregory S. Biging ; Gougeon



Can satellite imagery fullfill foresters needs ?

◆ Yes

- Appropriate spatial resolution
- Object-oriented approach are efficient

◆ No

- Species recognition
- Slopes

◆ Anyway

- No comprehensive product without field study



Objectives

- To transfer results obtained in the field of scientific research to the private sector for forestry applications, regarding VHR satellite images processing techniques
- To make operational and validate those techniques and the know-how acquired in the research field
- To design a production workflow for the creation of forest maps meeting a number of needs of the forest managers and administrations





WP 1 : Coordination and promotion of the project

- Synchronization of the tasks, logistic aspects
- Promotion begins the second year

WP 2 : Preliminary works

- Needs assessment and definition of products
 - 3 sites : Belgium, France and Morocco
- State of the art
- Preparation of field works



WP 3 : On site implementation and validation

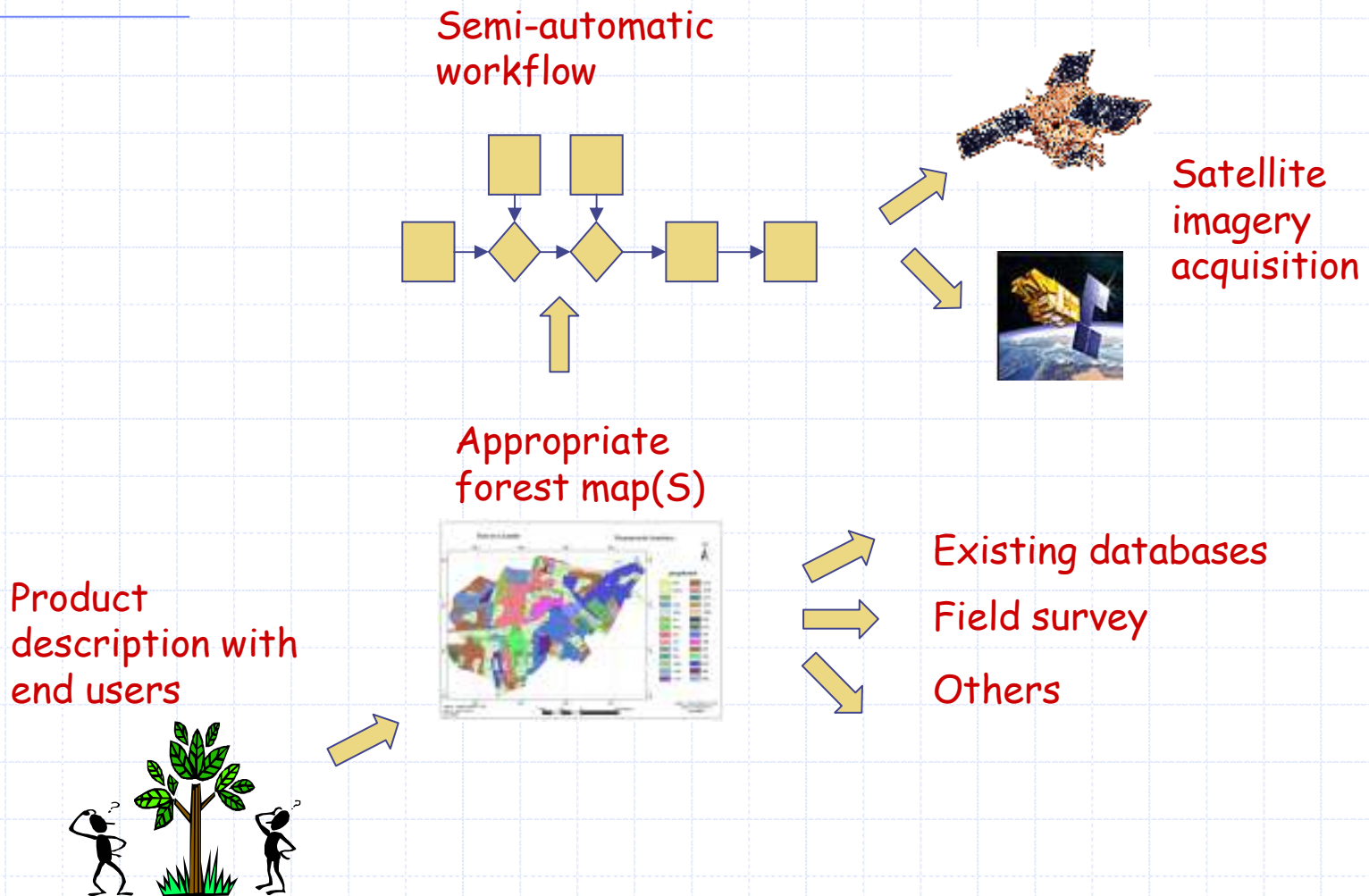
- Acquisition of images, reference data, additionnal data
- Pre-processing and processing of images
- Quality control, output production and reporting

WP 4 : Design of the production workflow for map creation

- Integration of the procedures in a data processing sequence
- Consolidation of the technology transfer
- Production of a reference document



Bottom-up approach for an appropriate cartography



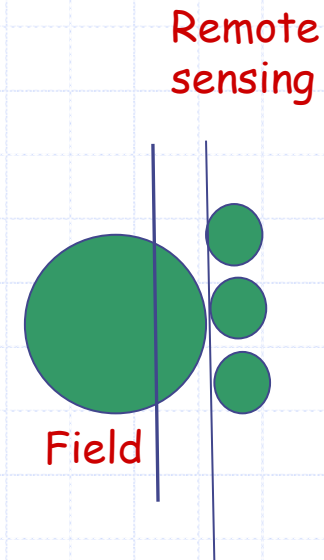
SPOT 5 and Ikonos-2 compared for different products

- ◆ Depends upon product definition on each site
- ◆ Main issues
 - Spatial accuracy
 - Slopes
 - Tree recognition



What is the appropriate spatial accuracy in forest ?

- ◆ Coherence with 1/10000 base maps
- ◆ On field, 1 to 3 meters
- ◆ For remote sensors
 - Crown limits are not soil limits
 - Parallax
- ◆ Satellites
 - For orthorectified Ikonos, spatial accuracy ~ 6 m



How to manage slope ?

◆ Low slopes

- ATCOR 3 , cosine adjusted by Minnaert constant

◆ Steep slopes

- Shade effects are hardly reversible
- Existing methods over-correct



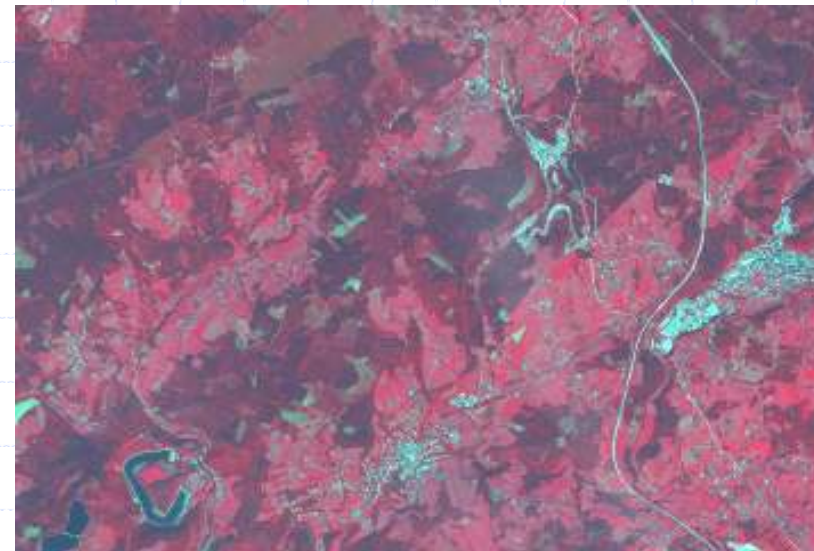
Combining method to recognise trees

- ◆ Important variability within a single species
 - Shape
 - Reflectance
- ◆ Moving forward in textural and object-oriented classification
- ◆ Using ASTER and ALI data



In Belgium, testing spatial accuracy and classification

- ◆ 3 SPOT 5 images
 - April 9th, may 7th and september 14 th
- ◆ 1 Ikonos
 - Planned between mid-may and june
- ◆ 1 stereo pair (if available)
- ◆ Reference
 - TOPO 10 GIS : planimetry
 - DNF : description
 - Field survey with GPS





Thank you for your attention