GRS capita selecta
“GIS in Practice”

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Soil Cares Research B.V.

Wageningen, 11th June 2014

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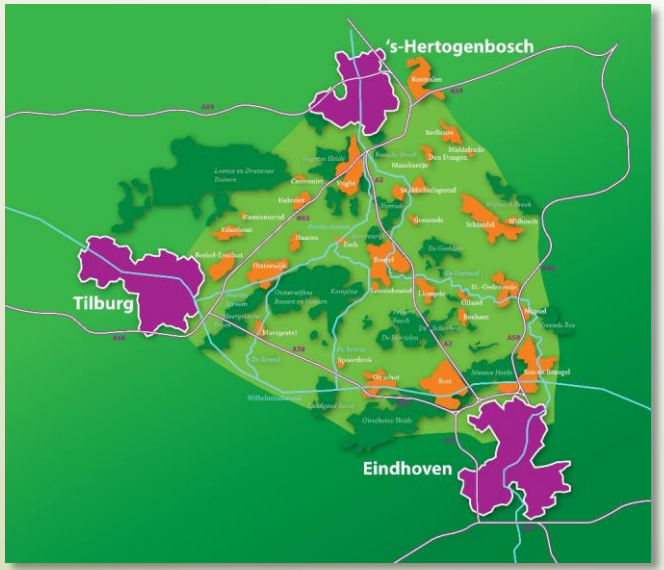
My Career So Far…

Background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NORTH SEA
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Den Helder
NORTH HOLLAND
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AMSTERDAM
Almere
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Keukenhof
Apeldoorn
Enschede
Hilversum
Katwijk
Leiden
Amersfoort
The Hague / 's-Gravenhage
SOUTH HOLLAND
UTRECHT
GELDERLAND
Gouda
Arnhem
IJssel
Lek
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Delft
Rotterdam
Haringvliet
Merwede
Waal
Nijmegen
Dordrecht
Meuse
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Rhine
Eastern Scheldt
Veere
Middelburg
Flushing
ZEALAND
Western Scheldt
NORTH BRABANT
Breda
Tilburg
Eindhoven
Venlo
LIMBURG
Antwerp
Scheldt
Lier
Ghent
Mechelen
BELGIUM
Meuse
Aalst
Hasselt
BRUSSELS
Leuven
Maastricht
Heerlen
Tienen
Aachen
Tongeren
GERMANY
Clickable cities in red ;
Yellow losanges show Dutch provincial capitals

Background

- Industrial Design, TU Eindhoven (2005)
- BSc Forest and Nature Conservation, WUR (2006-2009)
- Msc Geo-Information Science (2010-2011)

TU/e Technische Universiteit Eindhoven University of Technology

WAGENINGEN UNIVERSITY
WAGENINGEN UR

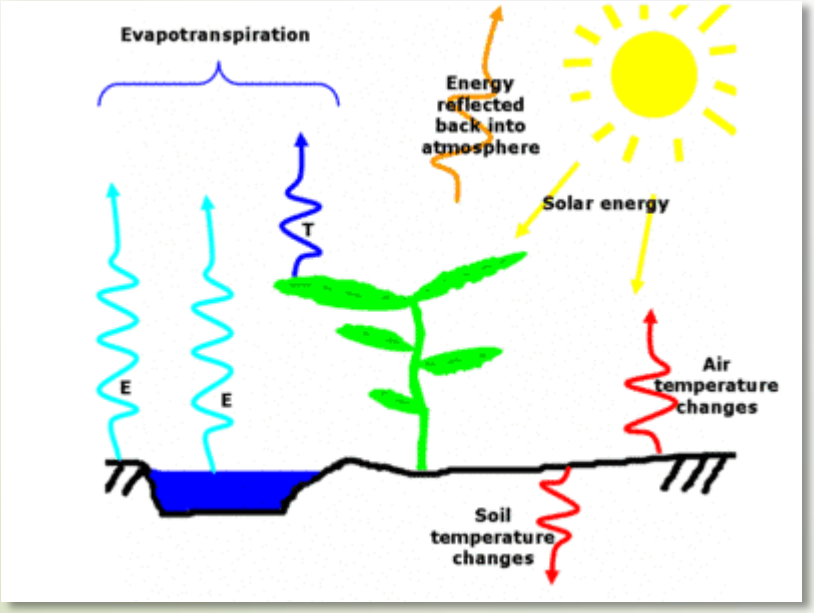
MGI Programme

- Courses:
  - Remote Sensing
  - Geo-information Tools
  - Spatial Data Infrastructures
  - Remote Sensing & GIS Integration
  - Data Management
  - Earth System Modelling
  - Physical Aspects of Land Management
  - Advanced Forest Ecology and Management
  - …

- MSc Thesis:
  - "Satellite-Born Monitoring of Gross Primary Productivity in a Temperate Coniferous Forest by using MODIS Data and the Photochemical Reflectance Index"
- Internship: WaterWatch B.V.
  - "Inferring Leaf Area Index from RADARSAT-2 C-band data for agricultural crops in Flevoland, The Netherlands"
  - Crop monitoring Flevoland/Gelderland (Cropscan, LAI-2000, Minolta SPAD-meter)
- Research assistant CGI
  - Potato monitoring Van Den Borne, Reusel, Noord-Brabant

WaterWatch B.V.

- Internship → 1st Job
- Scientific consultancy firm
- Drainage and irrigation advice, watershed management, etc.
- +- 15 fte
- Projects in +30 countries
- Est. 2000
- Founded by prof. dr. Wim Bastiaanssen
- Surface Energy Balance Algorithm for Land (SEBAL)
- In: low (1km) and high (30m) resolution satellite data (visible, NIR, thermal) + meteorological data
- Out: maps of evapotranspiration, soil moisture, crop water deficit, biomass growth, etc.



WaterWatch B.V.

- “Cloud problem”
- Radar (SAR) is weather independent
- Need for SAR models
- PhD TU Delft (0,6 fte)
  - Literature research
  - Regression analysis on existing data (~800K records)
  - Field sampling Randwijk

WaterWatch B.V.

- Other projects (0,4 fte)
  - Crop monitoring
    - Flevoland/Gelderland
    - Cropscan, LAI-2000, Minolta SPAD-meter
    - Data analysis of hand-held sensors vs. DMC imagery
  - MijnPeilvak
    - Evapotranspiration maps for the Dutch water boards
    - MODIS + meteorological data
    - Daily delivery
    - Batch processing
  - SmartICT-Africa
    - Internet research / feasibility study
    - Visualisation of demo data
    - Website design
    - www.SmartICT-Africa.com

WaterWatch B.V.

- 2012: Fusion
- Economic crisis
- Investors pull out
- Loss of jobs
- No option for extension of my contract
- PhD… on hold
- Paper in press

“In between jobs”

- Unsolicited application!
- 2,5 Months of job searching – Not bad ☺

Soil Cares Research B.V.

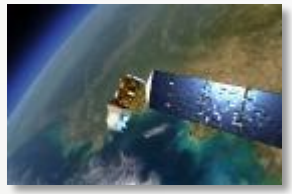
- BLGG AgroXpertus B.V.
  - Soil testing laboratory
  - Chemical & spectroscopy
  - +80 Years of experience
  - ½ Million soil samples/year
  - #1 In the Netherlands
- 2012: BLGG Research B.V.
- 2014: Soil Cares Research B.V.
  - +- 15 fte
  - Experts in soil chemistry, soil biology, agronomy, spectroscopy, data mining
  - Part of Dutch Sprouts (+- 40 fte)

Soil Cares Research B.V.

*"Soil Cares Research aims to contribute globally to a sustainable agricultural production by **developing** widely available and **affordable** methods for soil and crop **quality assessment** as well as **management recommendations**"*

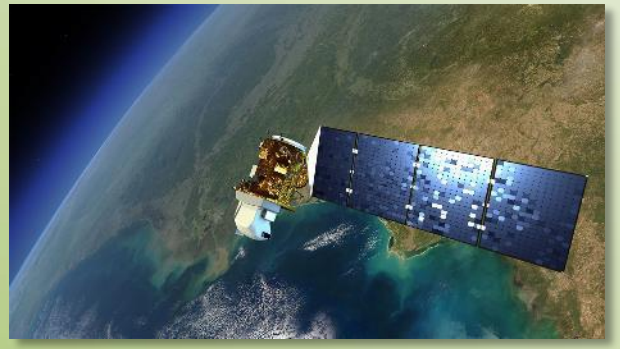
Soil Cares Research B.V.

- Golden Standard Laboratory
- Ijkakker – Soil Sensing
- Virtual Sample
- Kenya Project – Mobile lab
- Water and Nutrient Management
- Many other projects related to soil fertility and soil quality, sensor technology, plant health and data mining/computer learning…



Soil Cares Research B.V.

- My job? Anything spatial…
  - GIS operations & queries
  - GIS visualisations / mapping
  - GIS database management
  - Remote sensing data analysis
  - …



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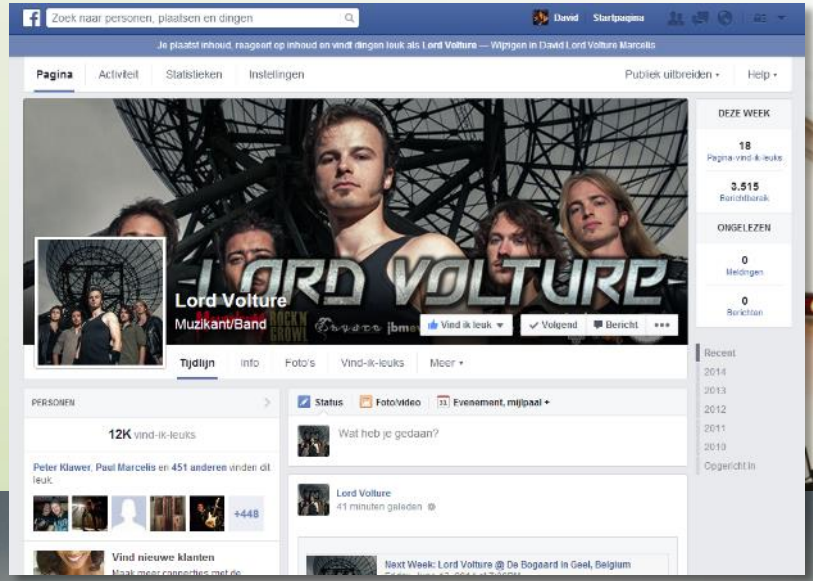
“Sideline Career”



Example of
GIS in Practice

Soil Sampling Site Selection Kenya

Background:

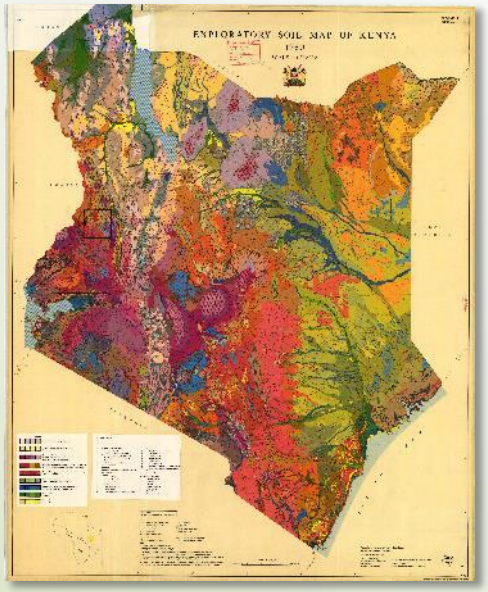
Mobile laboratory / Lab-in-a-bus

Hand-held / Smartphone infrared sensor

- Calibration needed with Golden Standard Laboratory
- Need for huge amount of soil samples

Soil Sampling Site Selection Kenya

- Why Kenya?
  - A lot of in-house knowledge and data on Kenya
  - Large variation of soil types
  - You have to start somewhere…

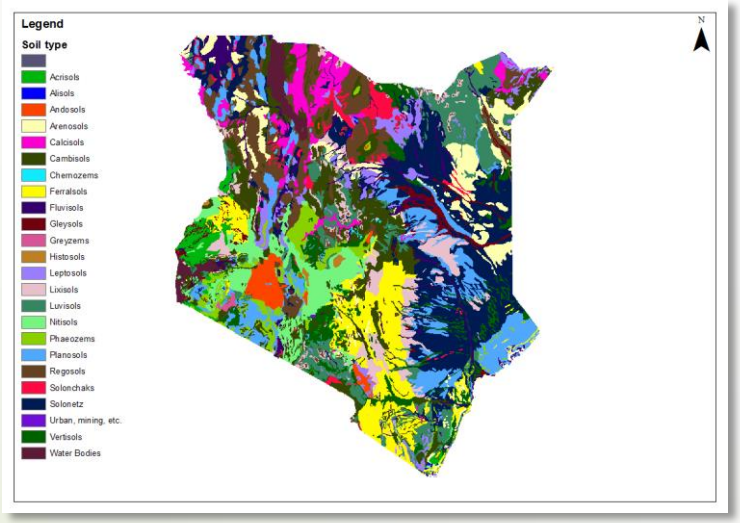


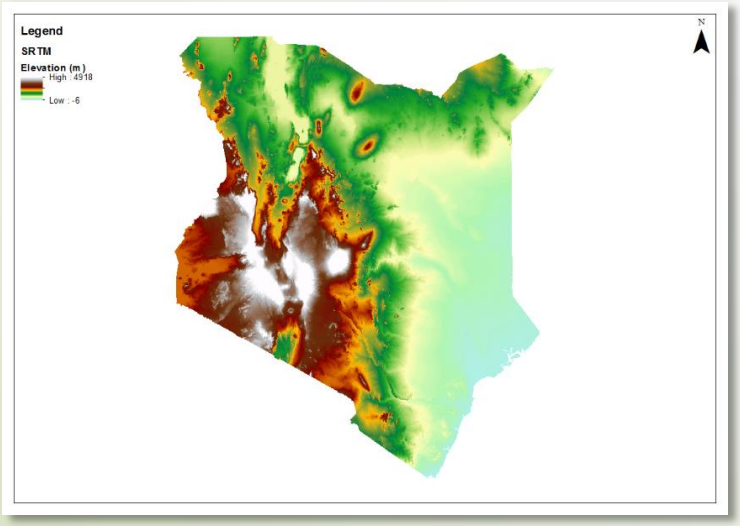
Soil Sampling Site Selection Kenya

- Goal:
  - To select a 1000 soil sampling sites in Kenya
- Criteria:
  - Representativeness
  - Ease of reach
  - Market value

Soil Sampling Site Selection Kenya

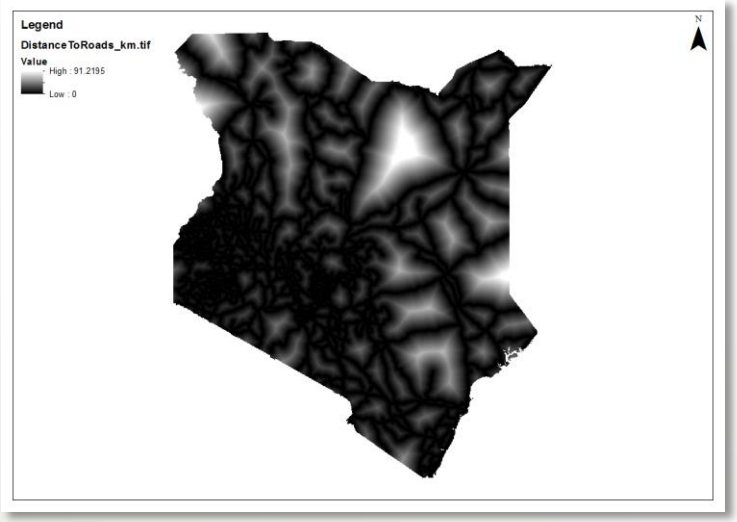
- Representativeness:
  - Soil properties
    - pH
    - Organic carbon
    - Clay
    - CEC
    - etc.
  - Elevation
  - Climate
    - Mean temperature
    - Yearly precipitation
  - Landuse

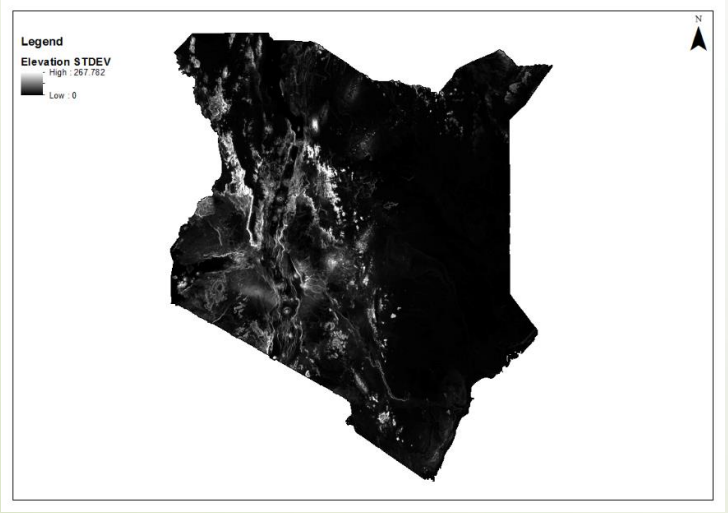




Soil Sampling Site Selection Kenya

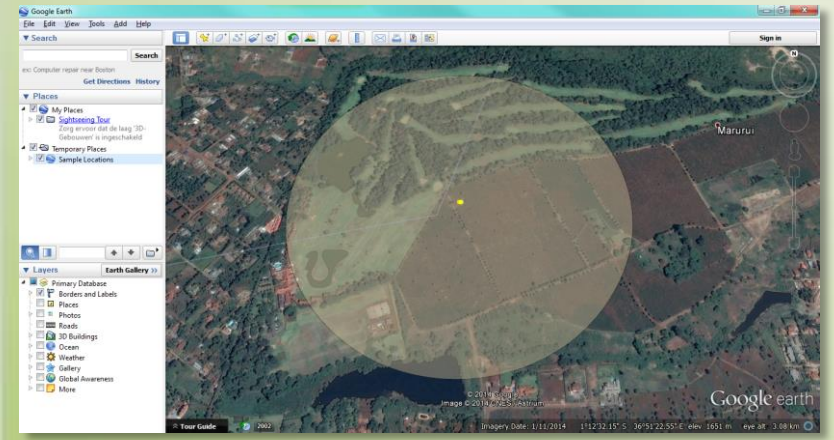
- Ease of Reach:
  - Distance to roads
  - Roughness of terrain:
    - Standard deviation of elevation
    - Land cover friction
- Market value

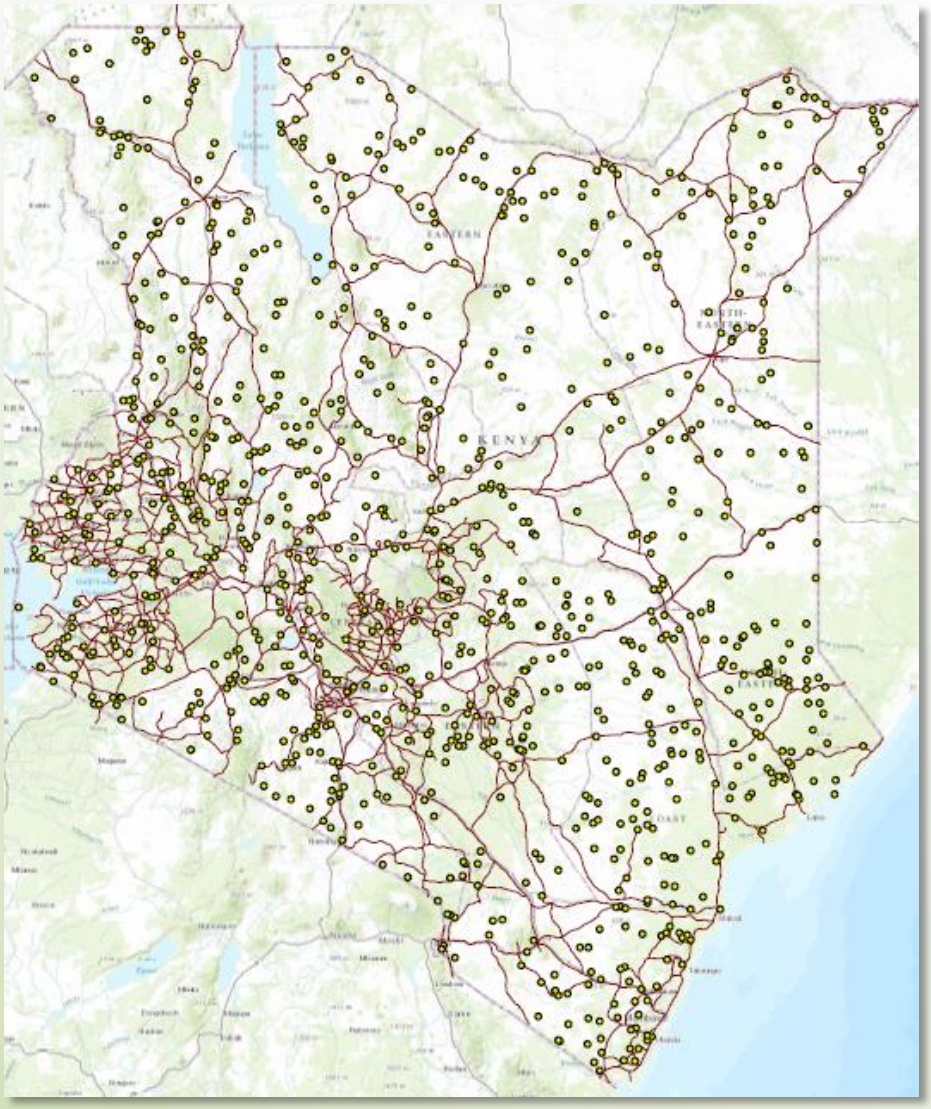




Soil Sampling Site Selection Kenya

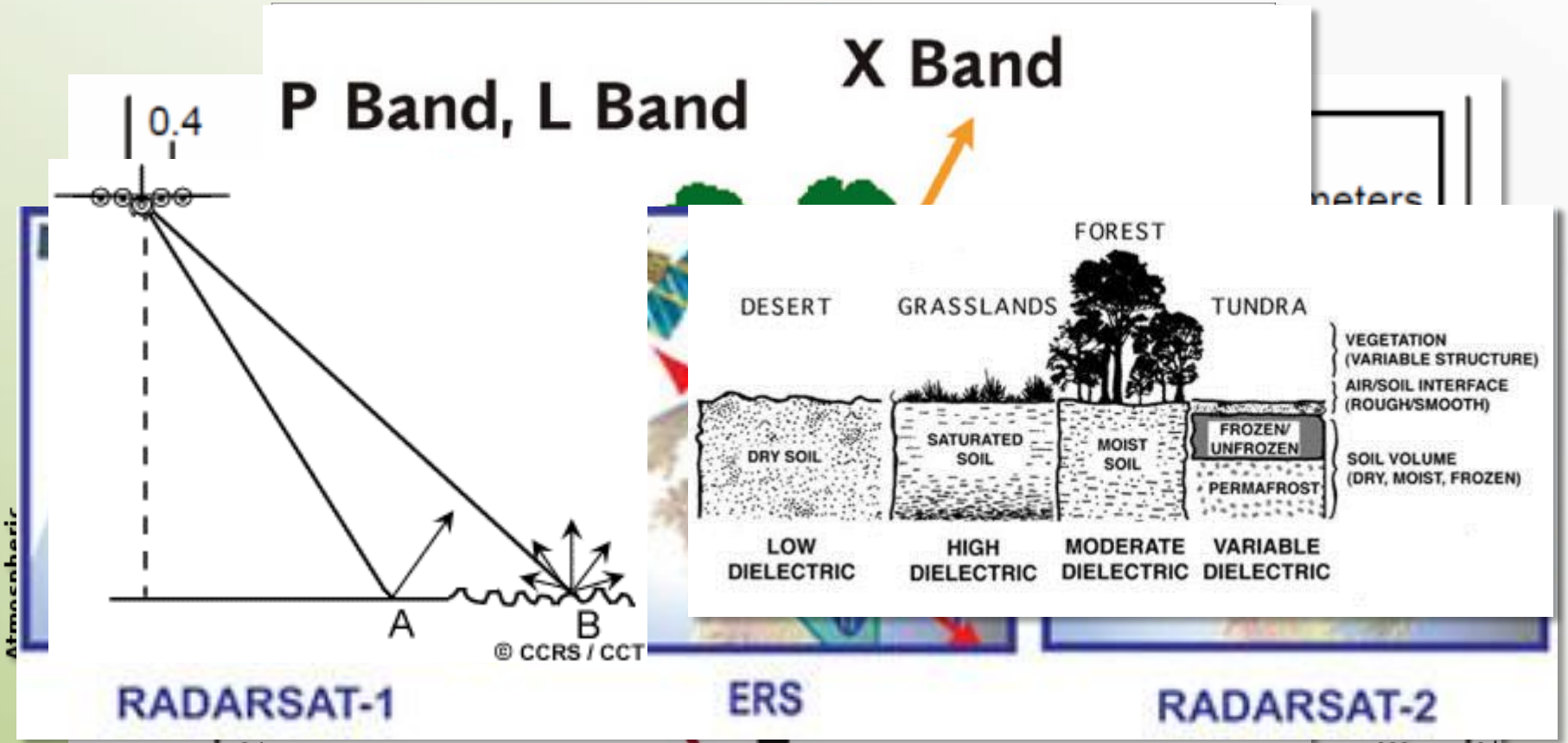
- Result:
  - 1000 sites
  - 500 m buffer (radius)
  - Esri Collector App to monitor progress





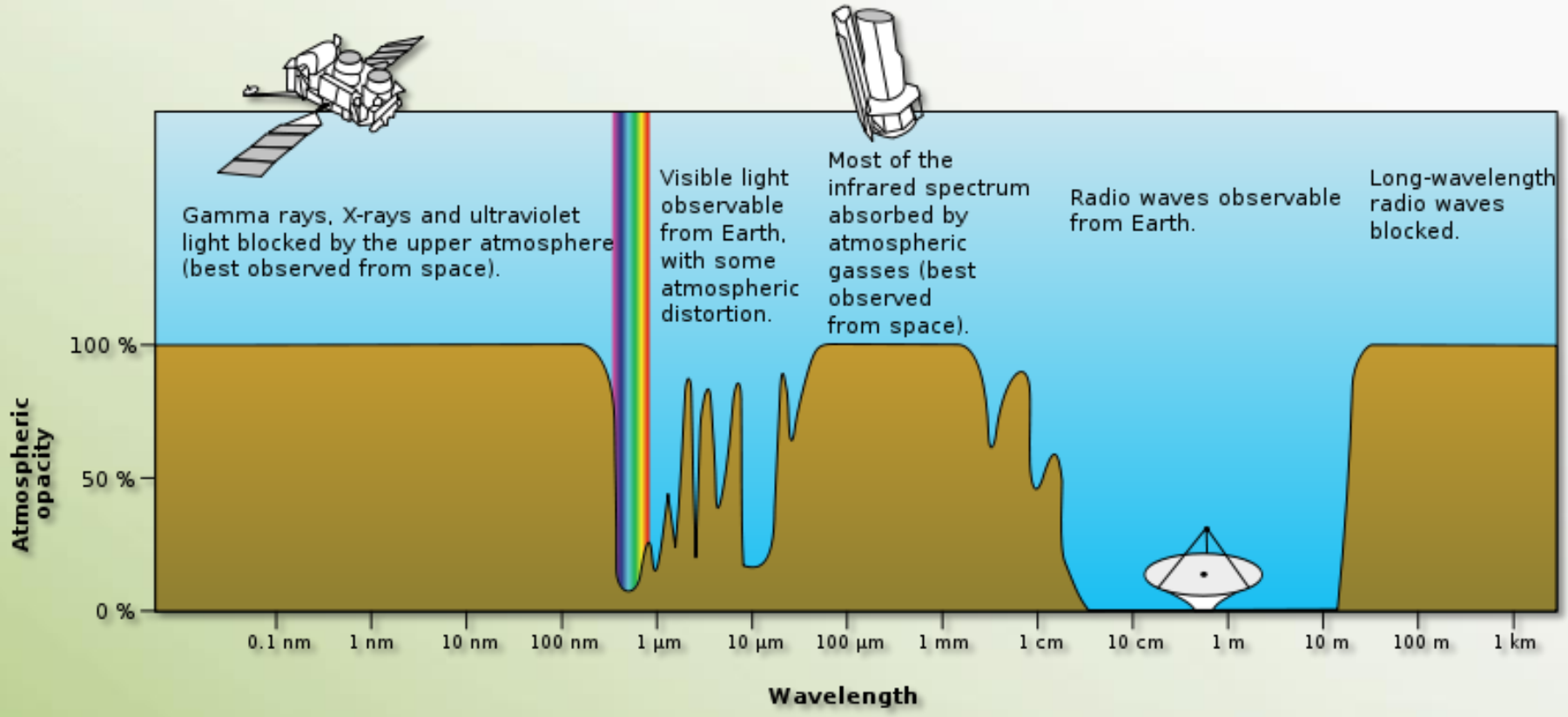
A View on the Future of SAR for Precision Agriculture

SAR for Precision Agriculture

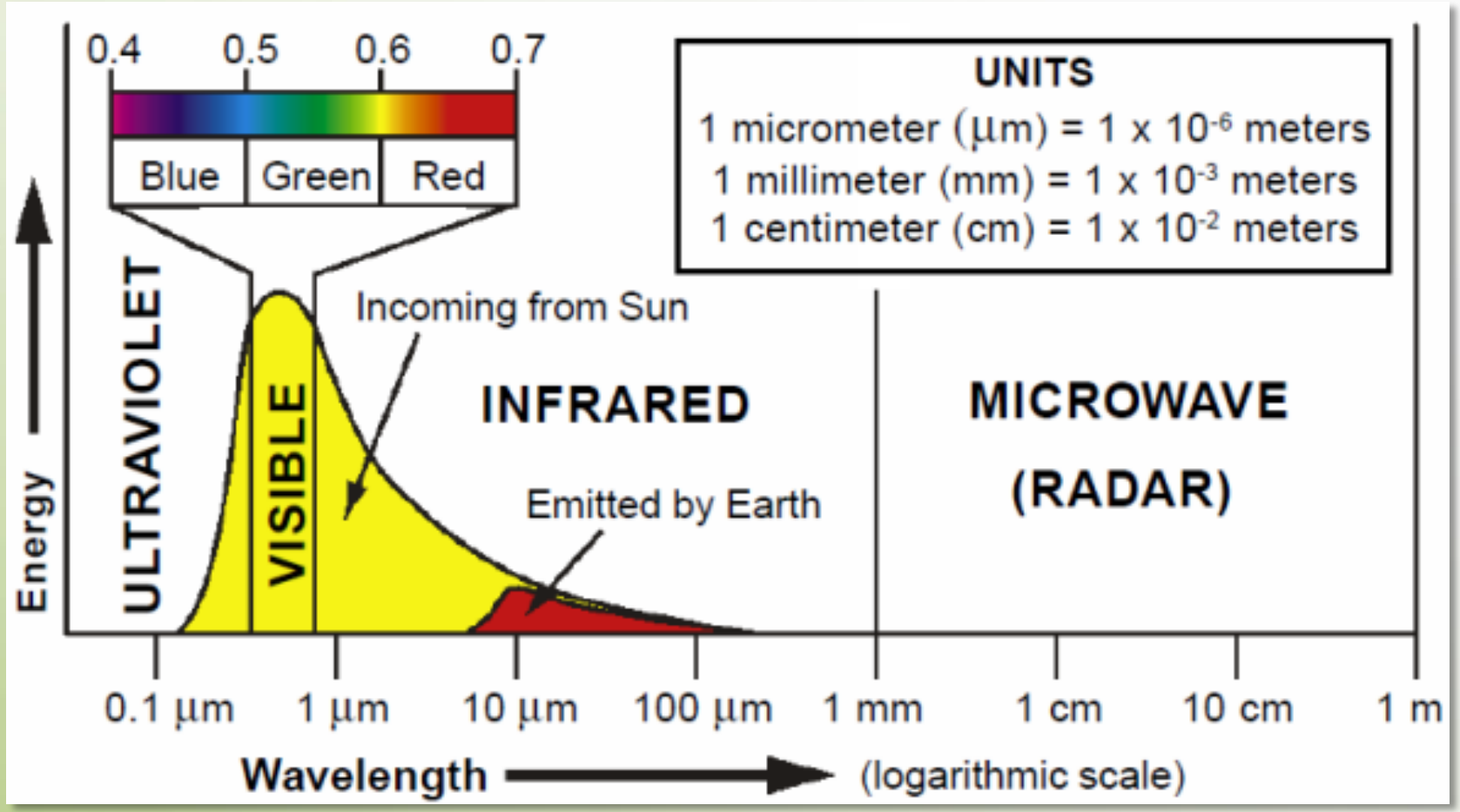


Remote sensing using active sensor system

SAR for Precision Agriculture



SAR for Precision Agriculture



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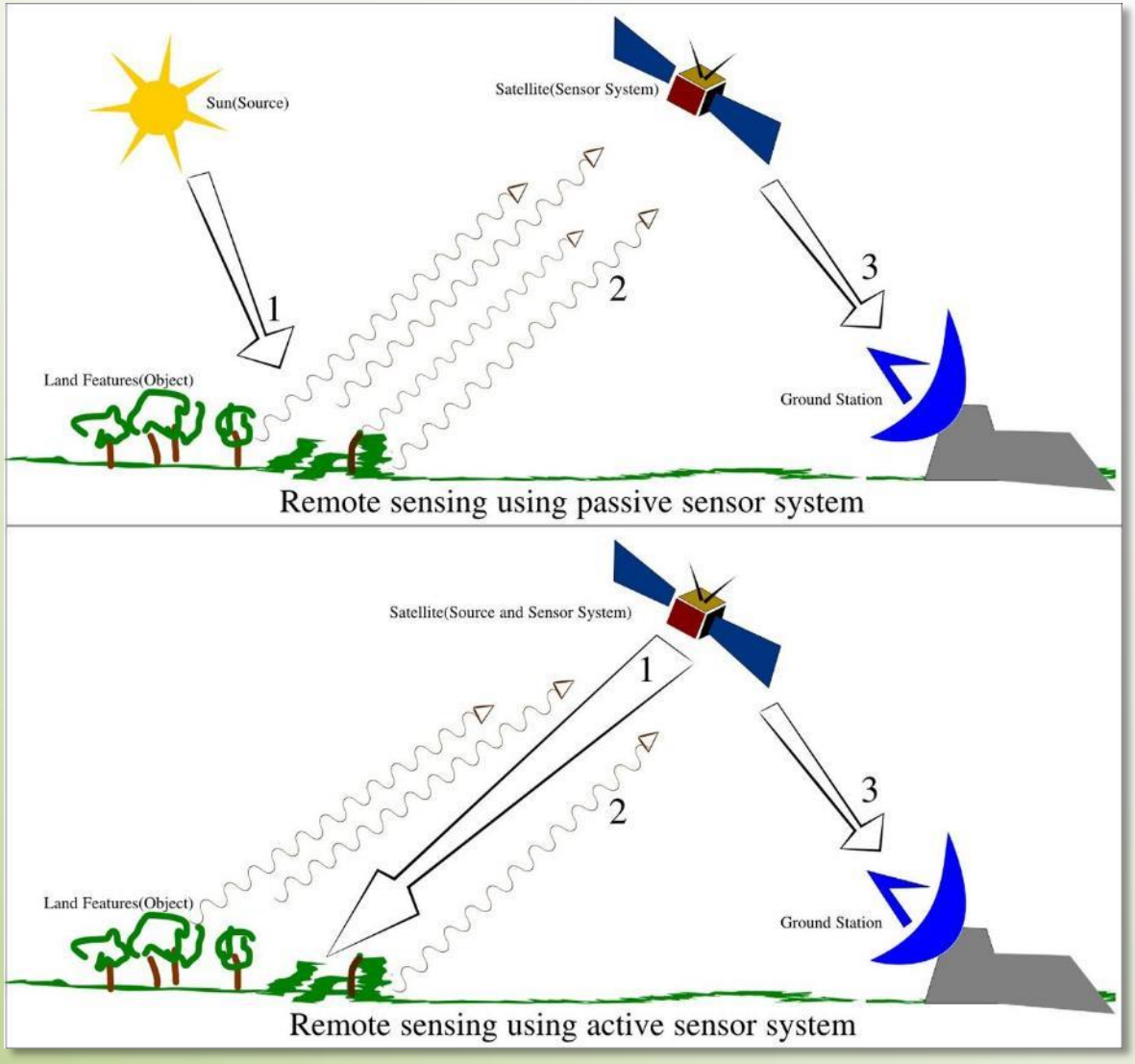

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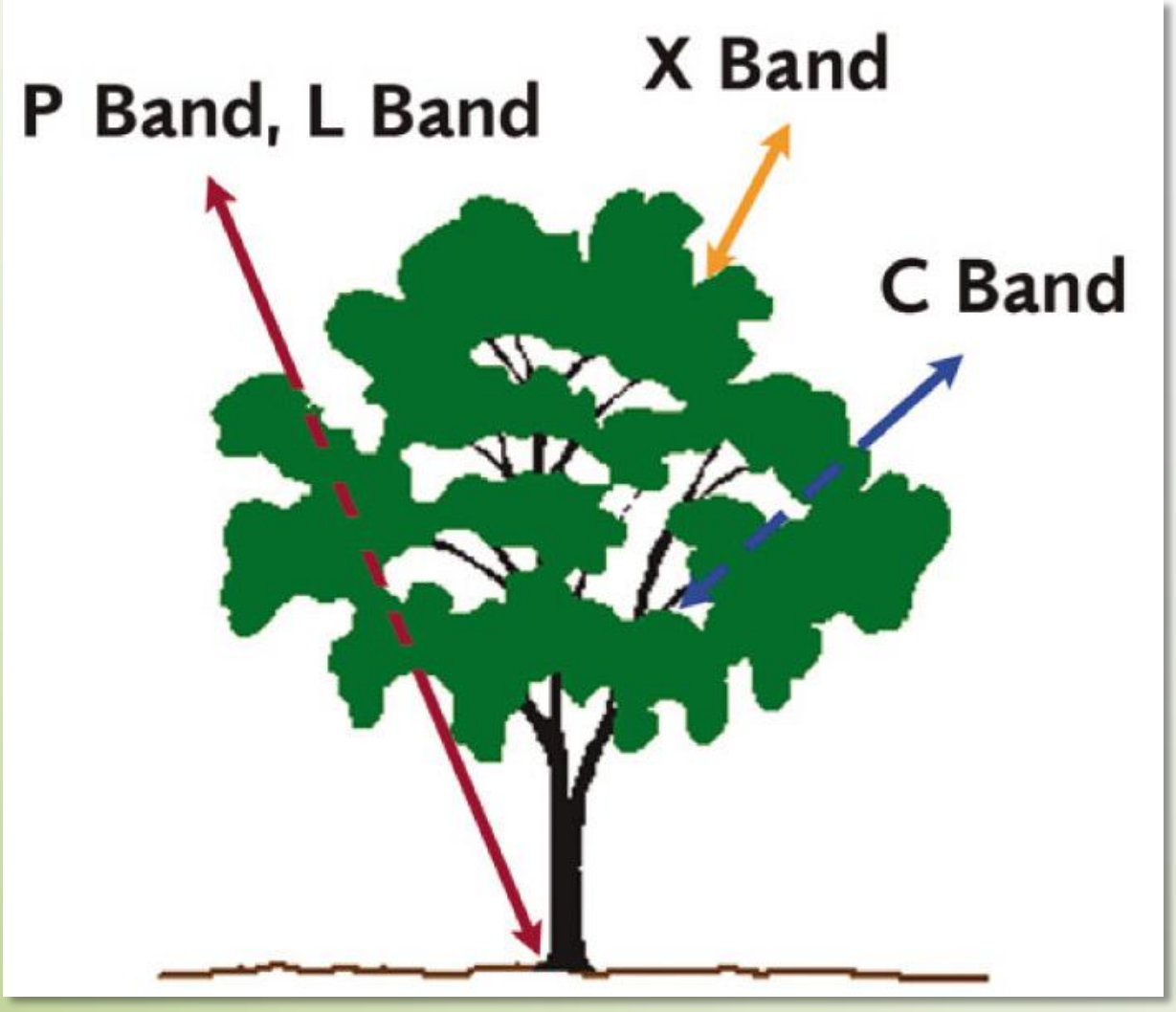
SAR for Precision Agriculture



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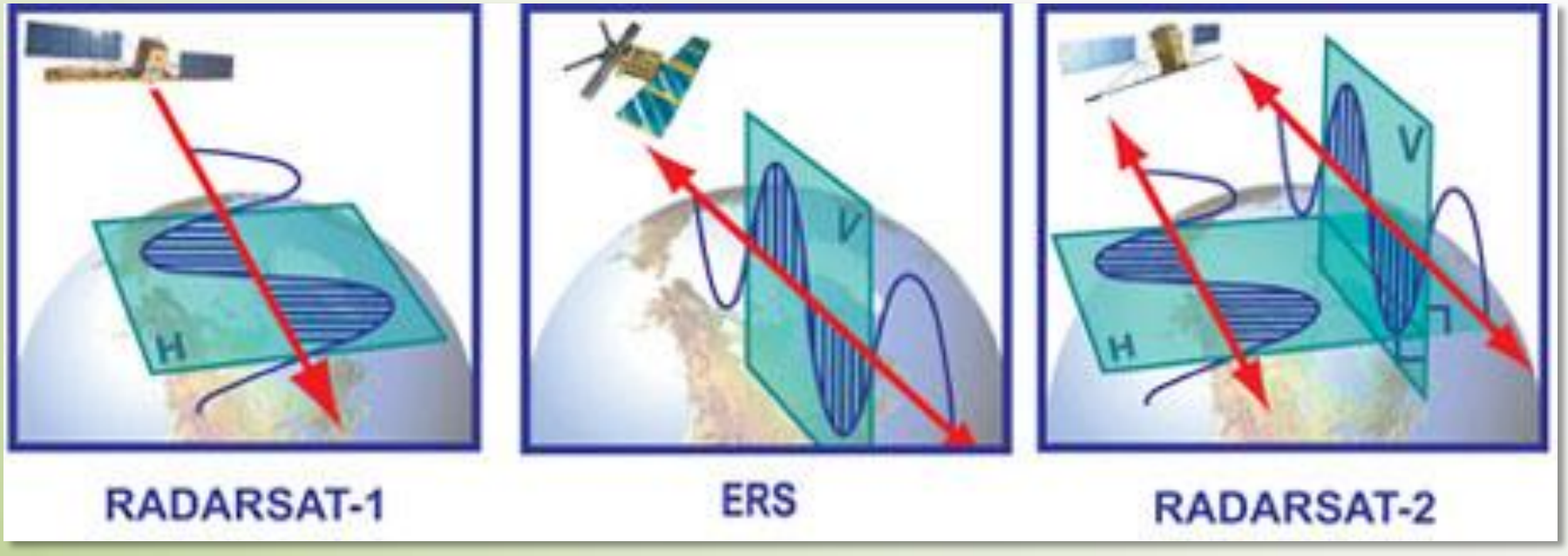

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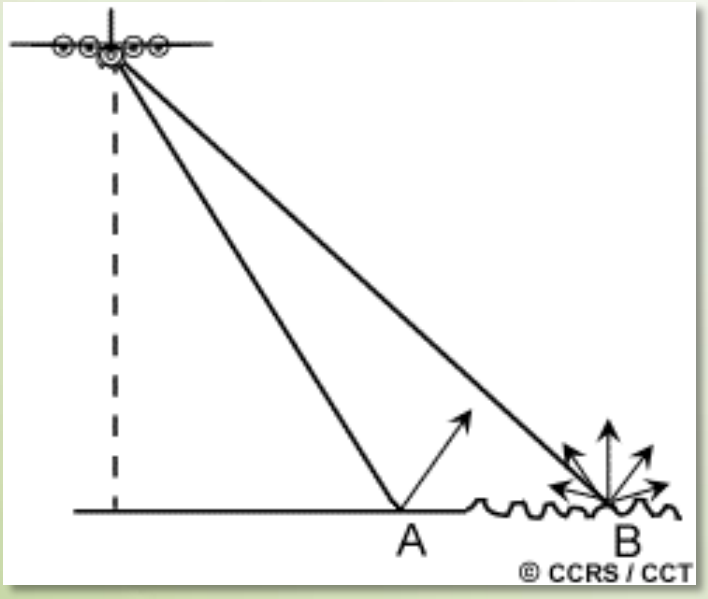
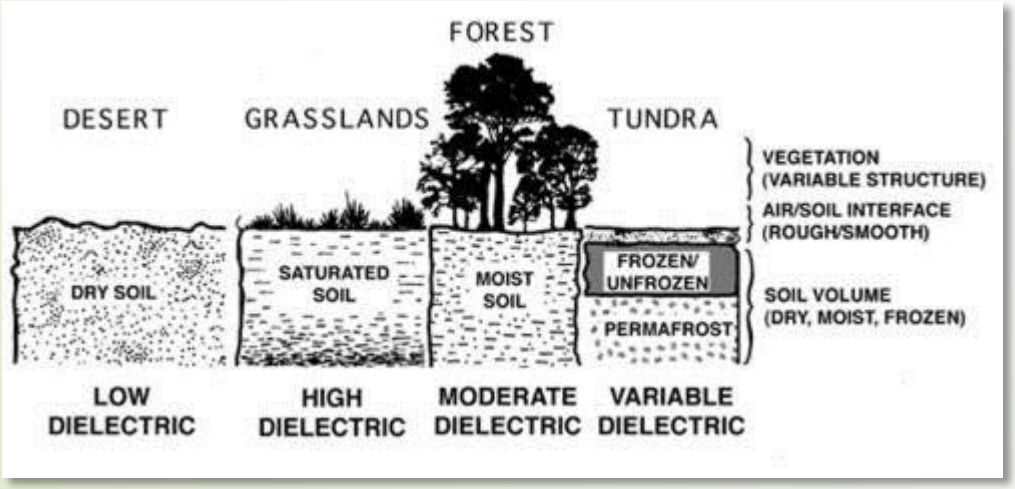
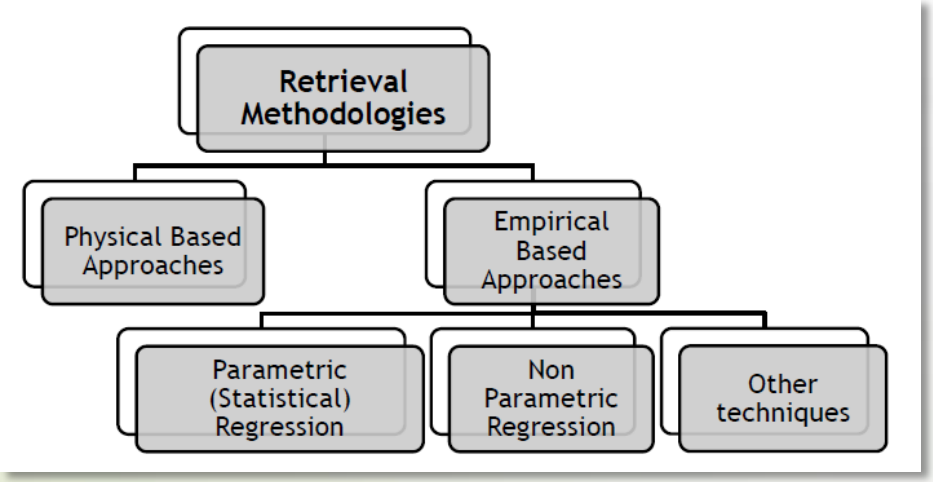




SAR for Precision Agriculture

- Modelling: $\sigma^\circ = f(x)$
- x = number of variables
- Physical models
  - Require many parameters
  - Difficult to invert
- Empirical models
  - Need a lot of data for calibration
  - Not easy to generalise



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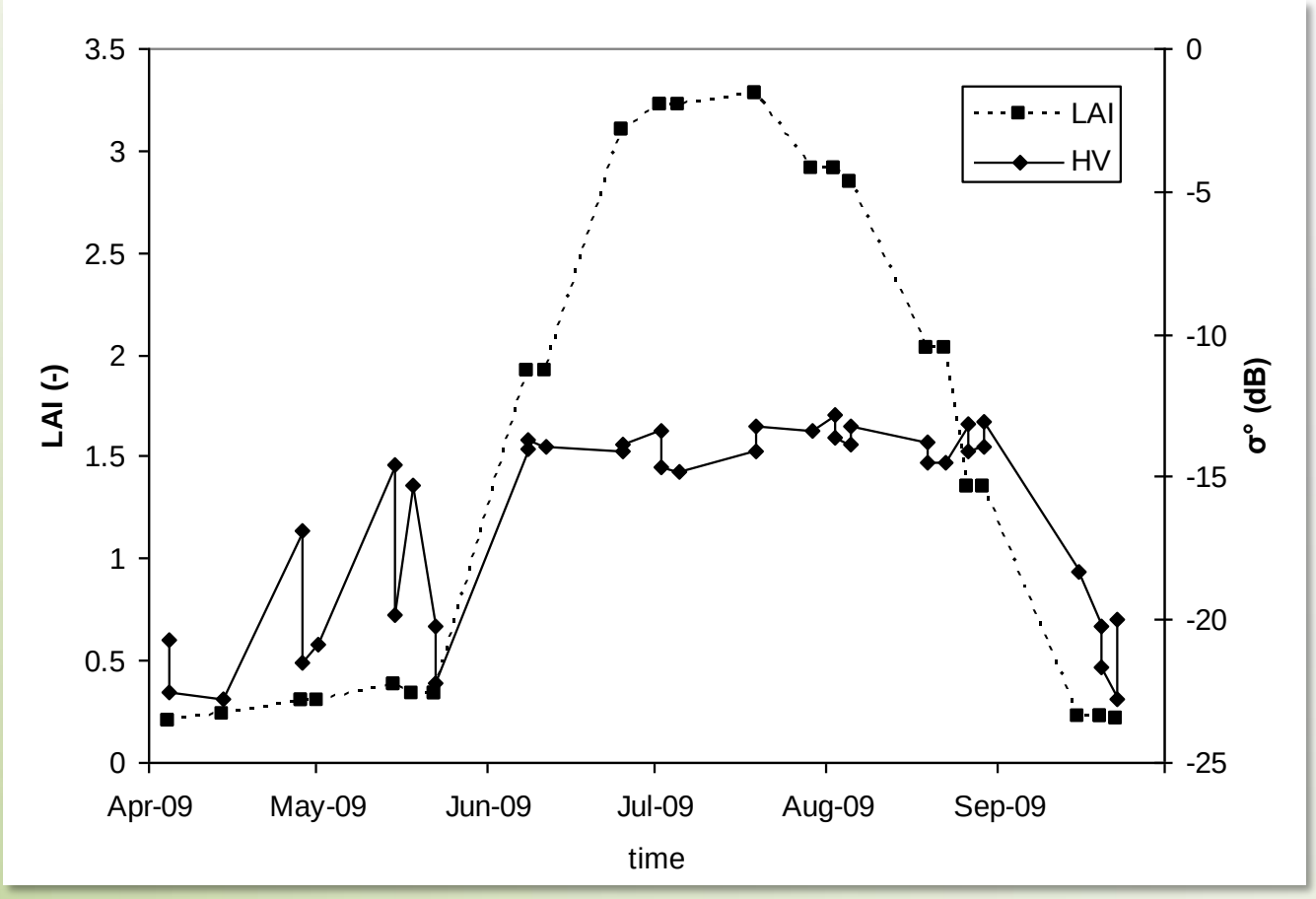

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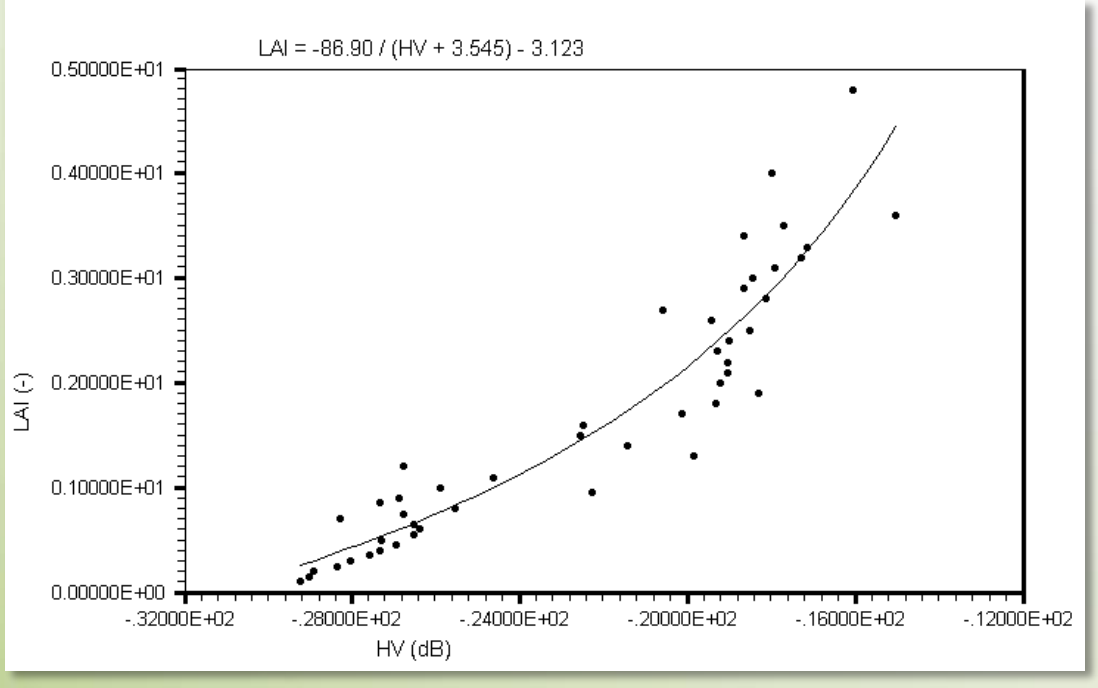

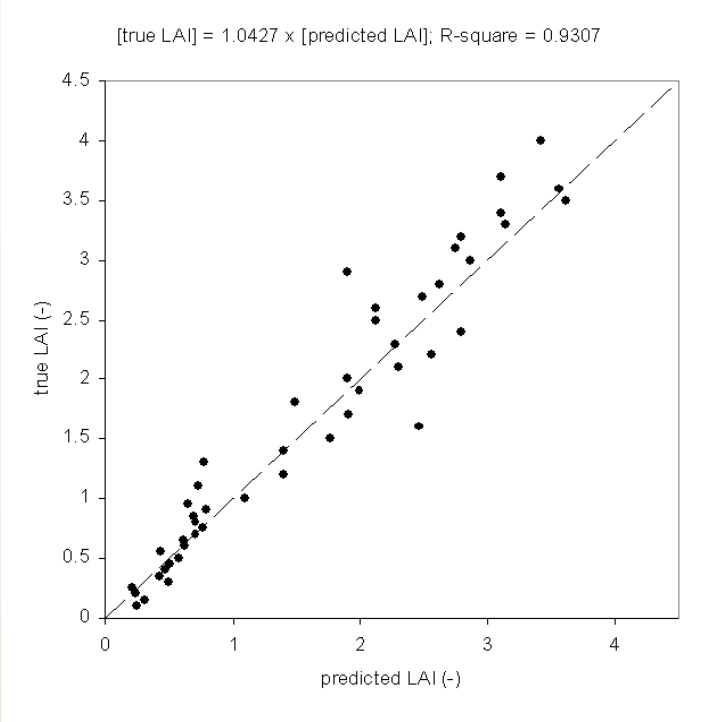

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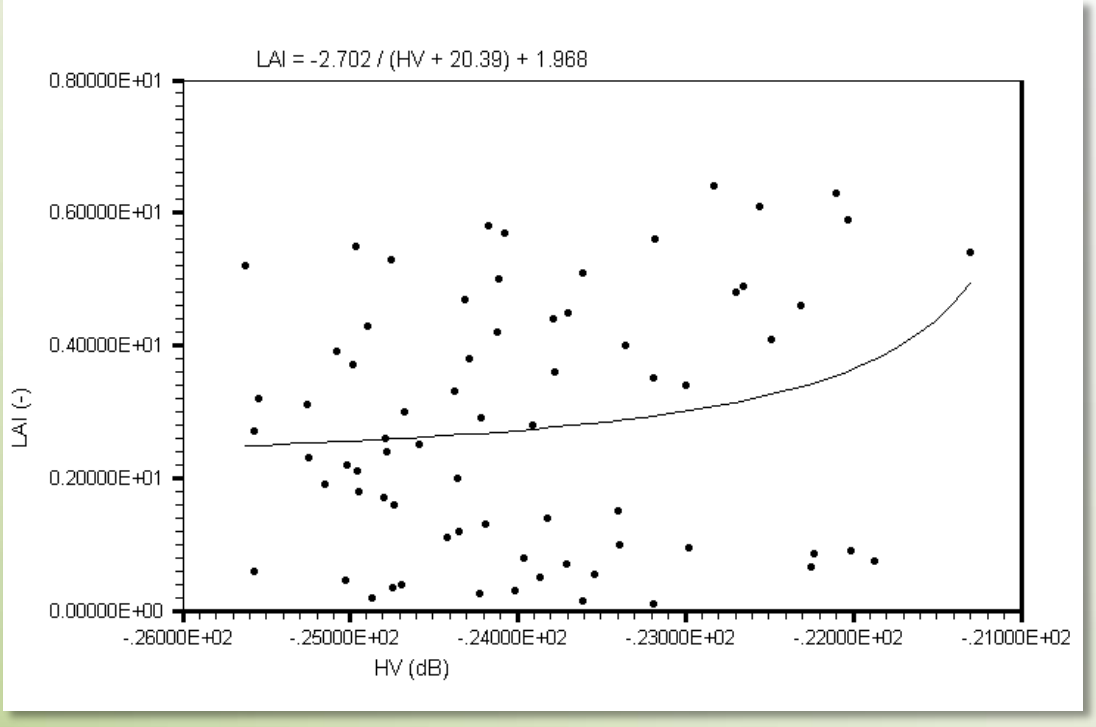

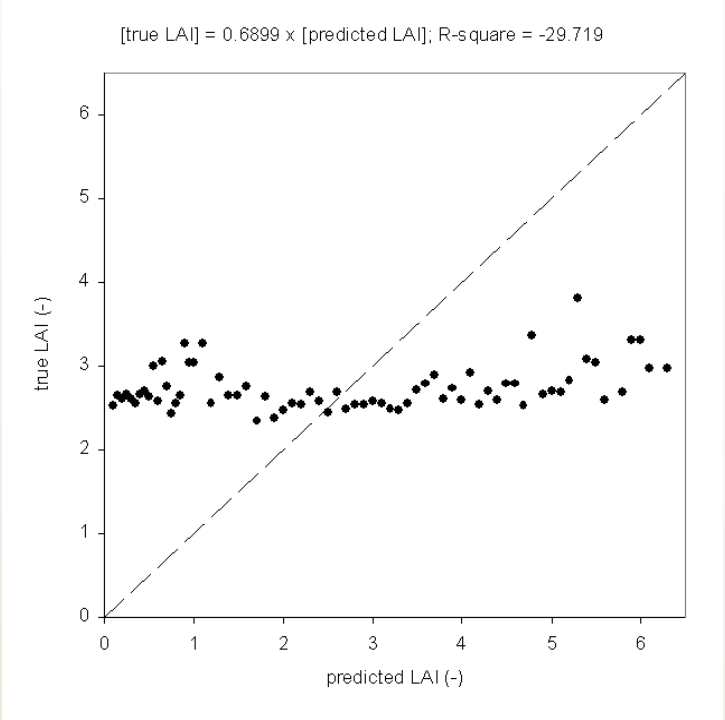

SAR for Precision Agriculture

Future:

- More SAR missions (and EO missions in general) are being launched
- SAR data becomes of higher spatial, spectral, temporal and polarimetric resolution
- Increase in number of publications and inversion models can be expected

Nonetheless… SAR has the highest value when combined with other (RS) data:

- Multispectral VIS+NIR
- Imaging spectroscopy
- Thermal imaging
- UAV's
- Hand-held sensors
- Stationary sensors (e.g. meteorology)
- Farmer data (crop type, crop rotation history, dates of sowing and harvesting, etc.)

Your choice of sensors/data inputs depends on:

- Parameters of interest
- Area of phenomena
- Size of area
- Temporality
- Available time
- Financial budget
- Required reliability

Thank you for your attention

Feel free to contact me:
david.marcelis@soilcaresresearch.com