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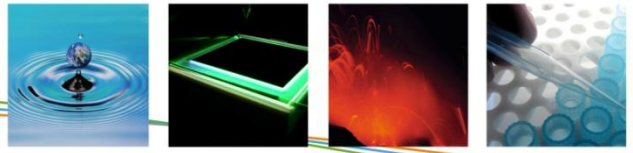

30th EARSeL Symposium:
Remote Sensing for Science, Education and Culture

Crop mapping in Areas with Small-scale Farming

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Outline

- Introduction
- Research questions
- Methodology
- Results
- Discussion

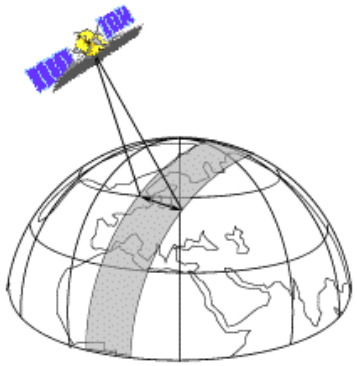
Introduction

RS derived crop type maps:
valuable for annual collection of crop statistics

- Improve crop area estimates.
  - Derive areas from the classification
  - Baseline for field data collection approach
- Input for crop yield models,
  - Taking into account crop specific parameters

- Particularly useful in areas with small scale (subsistence) farming
  - Remote and vast areas

Introduction



New generation high resolution sensors:

wide swath (+/- 600km)

- IRS-P6 AWiFS (56m)
- DMC (32m) a (theoretical)
- Sentinel-2 (10-60m) revisit
- ...

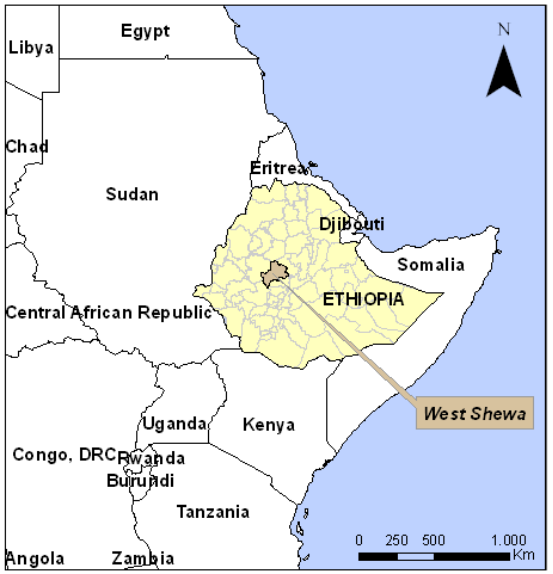
- Succesful for crop mapping with large scale farming:
  - United States AWiFS images are used for operational crop mapping (NASS Cropland Data Layer, 2010).
  - Other examples on the use of AWiFS for crop mapping are found in China (Dong 2008) and India (Patel 2006).

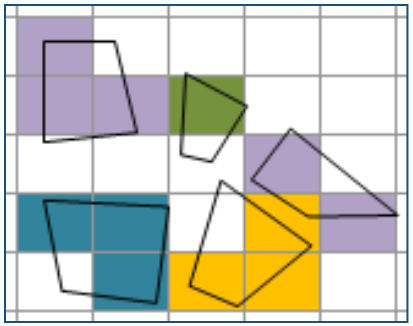
Research Questions

- Can Wide Swath images be advantageous for crop type mapping in areas with small-scale farming?
  - Two major problems arise:
    - 1. Landscapes are dominated by small-scale parcels
    - 2. Landscape heterogeneity induced by geomorphology, climatic variation, etc.
  - How to solve these challenges?

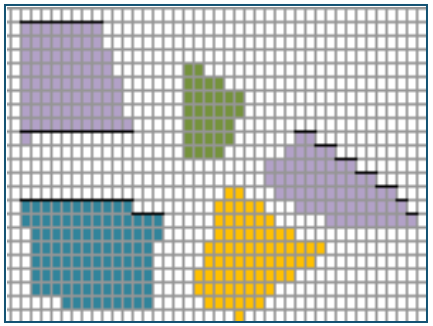
Method

- Study site: West Shewa (Central Ethiopia)
  - Parcel size 0.2 – 0.5 ha
    - ➡ Integrate very high resolution images



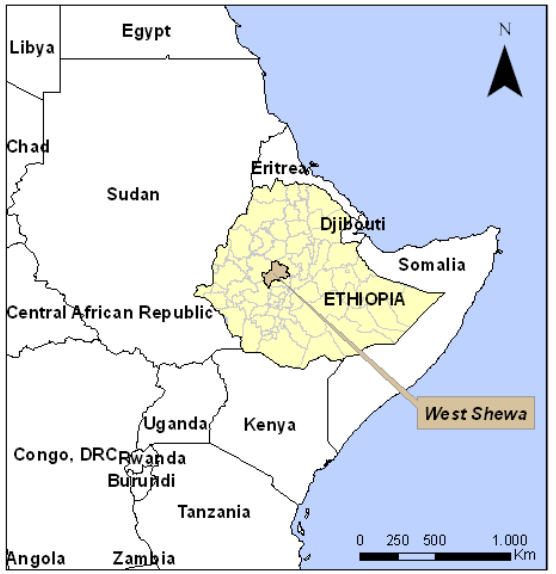


30m resolution

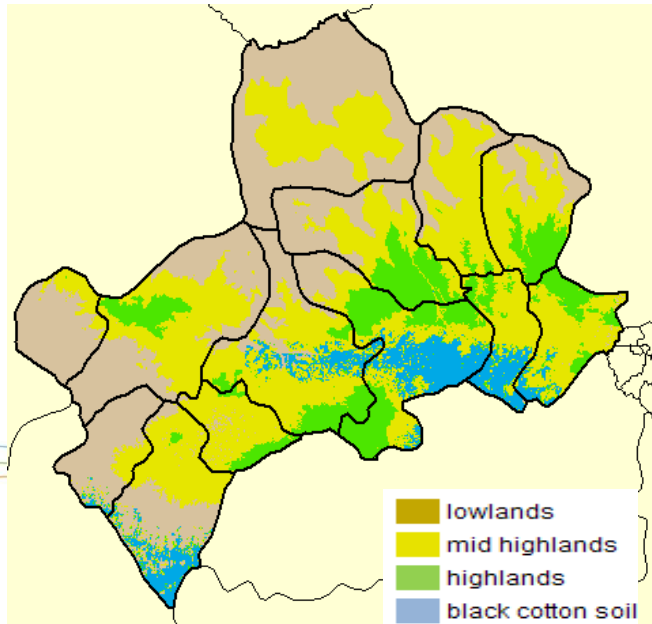


4m resolution

Method



- Study site: West Shewa (Central Ethiopia)
  - Parcel size 0.2 – 0.5 ha
    - ➡ Integrate very high resolution images
  - Heterogeneity
    - Mountain ranges and plateaus (1200m – 3500m)
      - Variations in rainfall and temperature
      - Alternation of hard and soft rocks
    - 'Belg' & 'Meher' season
    - ➡ Stratification



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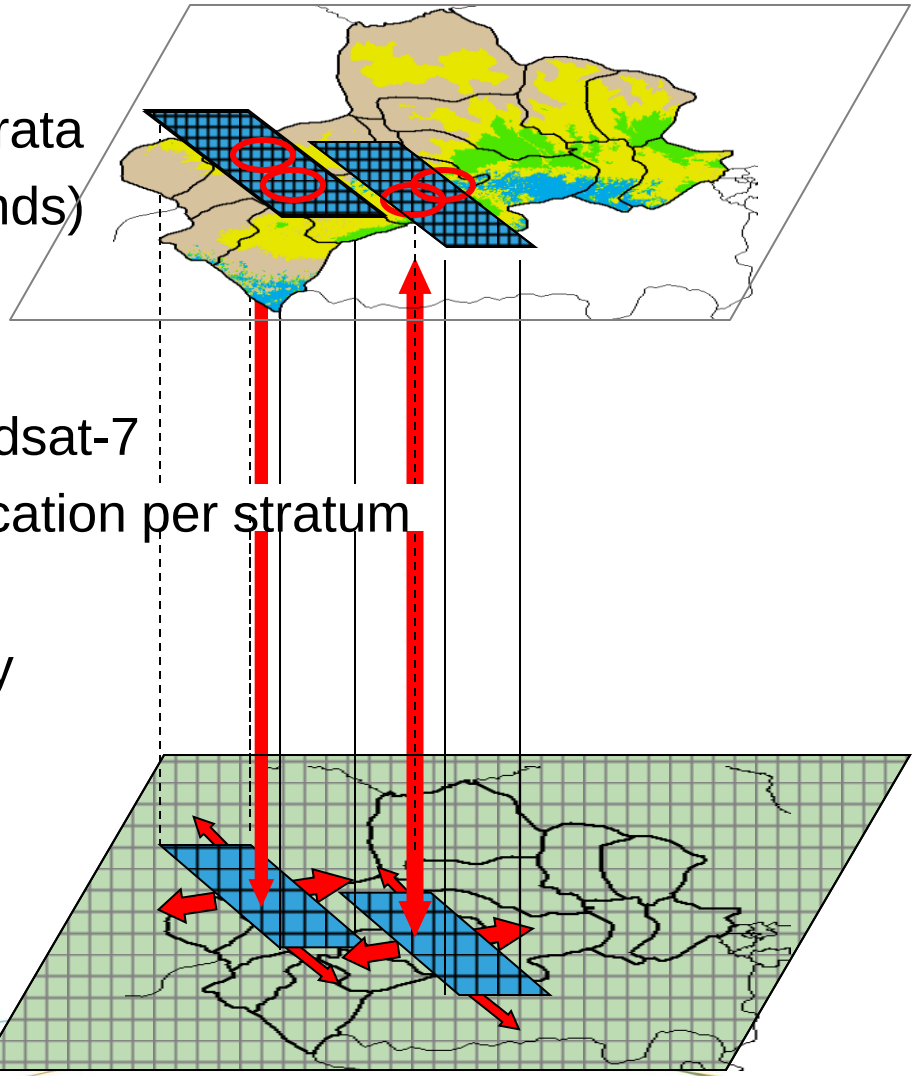
Method

- Kompsat (4m) distributed over strata
- Fieldwork in strata (except lowlands)
- Maximum likelihood Kompsat
- DMC timeseries simulation:
  - DMC supplemented with Landsat-7
- Neural network sub-pixel classification per stratum
- Mosaic result
- Validation with statistics ministery



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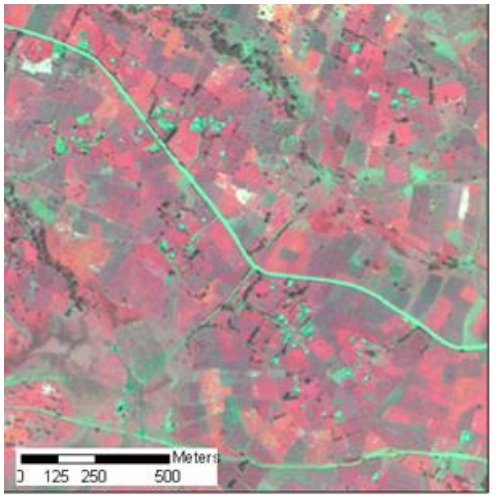
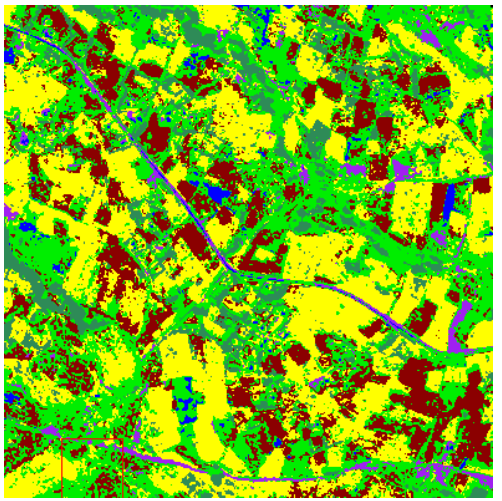
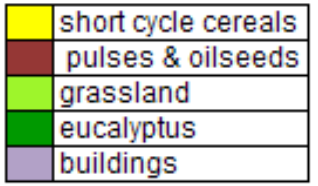
Results

- VHR classification

Stratum	Overall accuracy	Kappa
Black cotton soil	91%	0.84
Mid highland 1	72%	0.73
Mid highland 2	62%	0.40
Highlands	75%	0.61



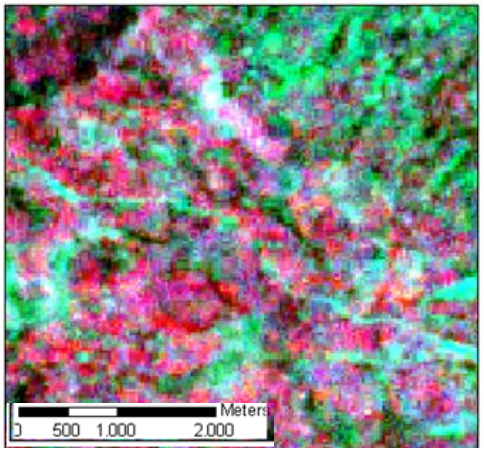


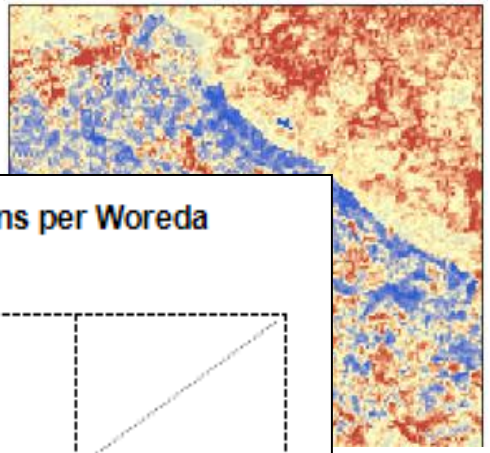


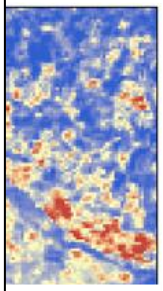
- User and Prod. acc. of crop classes > 70%, except for Highlands (51% user acc. oilseed & pulses)
- Overestimation ~ underestimation

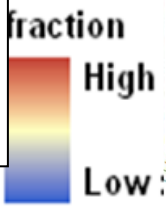
Results

- Sub-pixel classification
- Mosaic
  - assumptions for lowlands (no field data)

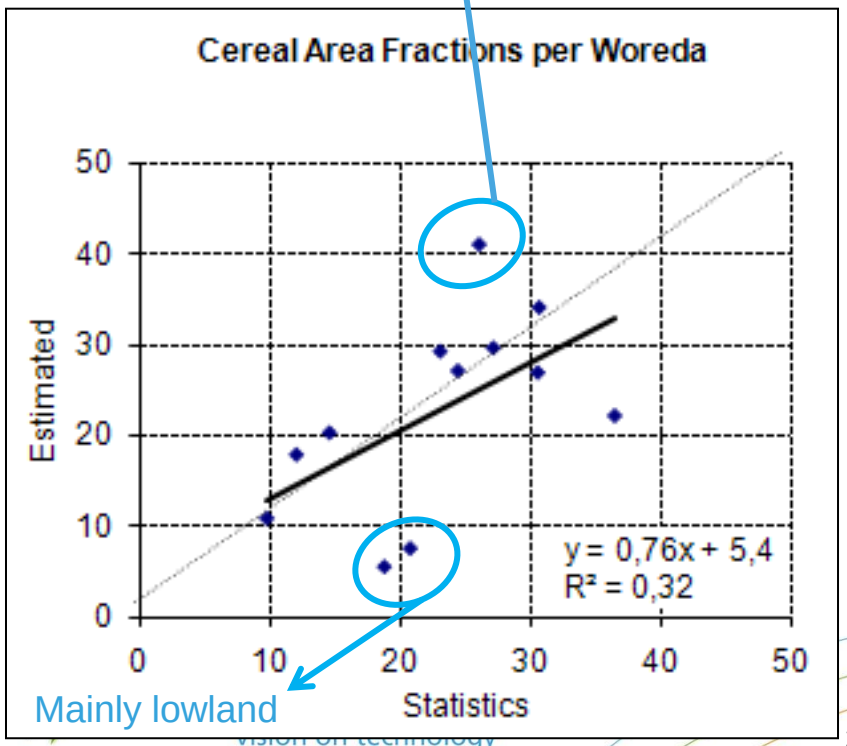




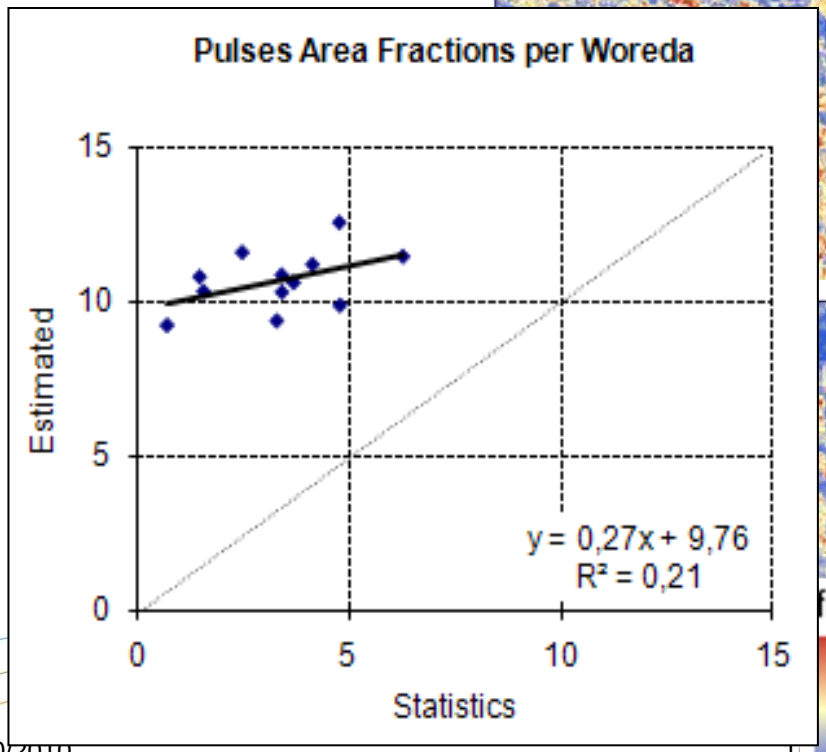




Cash crops



Mainly lowland



Conclusions

- Tackle the problems of mixed pixels and distinct agro-ecological zones, by starting from a VHR classification and applying an agro-ecological stratification.
- Unfortunately, accuracies were not satisfactory, but did demonstrate the potential of this approach.
- Improvements are expected through better input data
  - reference data collected within all strata
  - minimum of 3 VHR and HR images spread evenly along the season

Conclusions

- With better accuracies, the method will be a valuable tool to determine crop distribution on a regular basis with limited costs.
  - With the track survey, sufficient reference data can be collected in short time.
  - The maps can be provided before the end of the season, once the timeseries of images is available.
  - The major expense, the acquisition of VHR images can be kept low by carefully distributing a limited number of frames over the area.


Questions or recommendations?