LARGE- AND SMALL-SCALE CROPLAND CLASSIFICATION ON THE FOOTHILLS OF MT. KENYA BASED ON SPOT5 TAKE5 DATA TIME SERIES

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Study area

- Laikipia County – west of Mt. Kenya
- Large rainfall gradient (y. rainfall 350mm – 1100mm)
- Agricultural production concentrated in the semi-arid zone (y. rainfall 500-900mm)
- Fertile soils
- 2 rainy seasons (April-May (80% of rains), October-November)
- Water scarcity a conflict issue
- Massive land use changes (large scale ranching -> small-scale subsistence farming -> intense horticulture/flower production for export markets)
Motivation

• 2 Projects: Impacts of large agricultural investments (intensive horticulture and flower farms producing for export markets) in Laikipia on
  – small-scale farming livelihoods
  – food security
  – the environment (focus on water* and soil)

• Spot5Take5 great opportunity of getting a high resolution time series data set to generate baseline data

Objectives

• Capture ALL cropland areas
• Differentiate it from natural savannah grass- and shrublands
• More importantly: assess rainfed as well as irrigated cropland
• Analyze the potential to differentiate crop types
Data

- 29 scenes
- Level 2A product
- Start: 14.4.15
- End: 11.9.15
Input data sets

- All Bands
- 29 NDVI
- PCA of 9 cloudless NDVI data sets
- NDVI time series statistics
  - (max, min, mean, std, sum)
- (temporal NDVI features)
Workflow

29 Spot5 scenes
Preprocessing
Segmentation
Cropland landscape units

Bands
NDVI
PCA
NDVI statistics
Random Forest classification
Classification results
Accuracy assessment
Results – Cropland classification
## Results – Cropland classification

<table>
<thead>
<tr>
<th>Input data set</th>
<th>Overall Accuracy [%]</th>
<th>Kappa Accuracy [%]</th>
<th>Avg. F1 Accuracy [%]</th>
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<tr>
<td>Bands</td>
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<td>NDVI</td>
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<td>89.58</td>
<td>76.75</td>
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<td>PC</td>
<td>90.03</td>
<td>86.53</td>
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<td>NDVIstat</td>
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<td>91.97</td>
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Cropland classification

- 29 Spot5 scenes
- Preprocessing
  - Segmentation
  - Cropland landscape units
- Bands
- NDVI
- PCA
- NDVI statistics
- Random Forest classification
- Classification results
- Accuracy assessment
NDVI analysis crop types
Preliminary results – Crop type classification

Legend
- Rainfed cropland
- Maize
- Bare soil
- Water
- Irrigated cropland
- Savannah
- Irrigated grassland
- Beans
- Forest
- Potato
- Urban or bare
- Greenhouse
- Wheat

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## Preliminary results – Crop type classification

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<th>Class</th>
<th>Accuracies [%]</th>
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<td>Producer's</td>
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<td>Maize</td>
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<td>100.00</td>
<td>100.00</td>
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<td>Beans</td>
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<td>Wheat</td>
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</table>

Only few verification samples available and thus to be interpreted with caution!
Conclusions

• Differentiation between rainfed and irrigated cropland **successful** and with good accuracies

• With Sentinel-2 in orbit it could become a **valuable product** for our **local partner** institution CETRAD

• **Misclassification** between savannah and cropland

• **Bands** achieved **highest accuracies**

• First analysis of **crop type specific NDVI time series promising**

• **Crop type classification on plots** <1 ha still challenging

• **Mixed crops** plots classification **challenging**

• Much **more** crop type **samples required**
Thank you!

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