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

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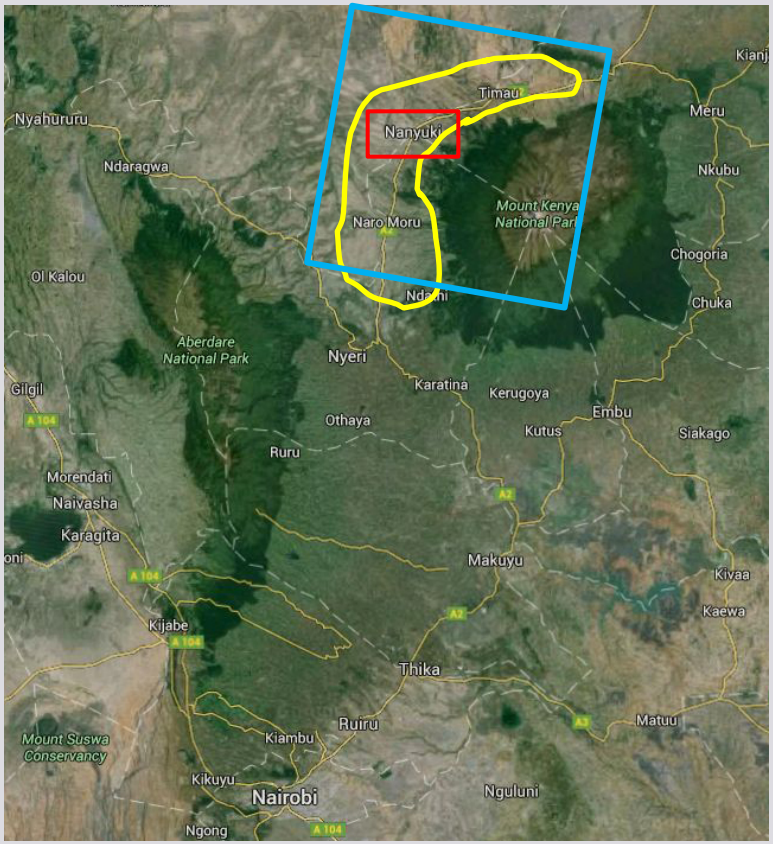
European Space Agency

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)



Cropland
Subset area
SPOT 5 scene

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

*Lanari N, Liniger HP, Kiteme BP. 2016. Commercial Horticulture in Kenya: Adapting to Water Scarcity.CDE Policy Brief, No. 8. Bern, Switzerland: CDE. Peer-reviewed publication submitted.

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

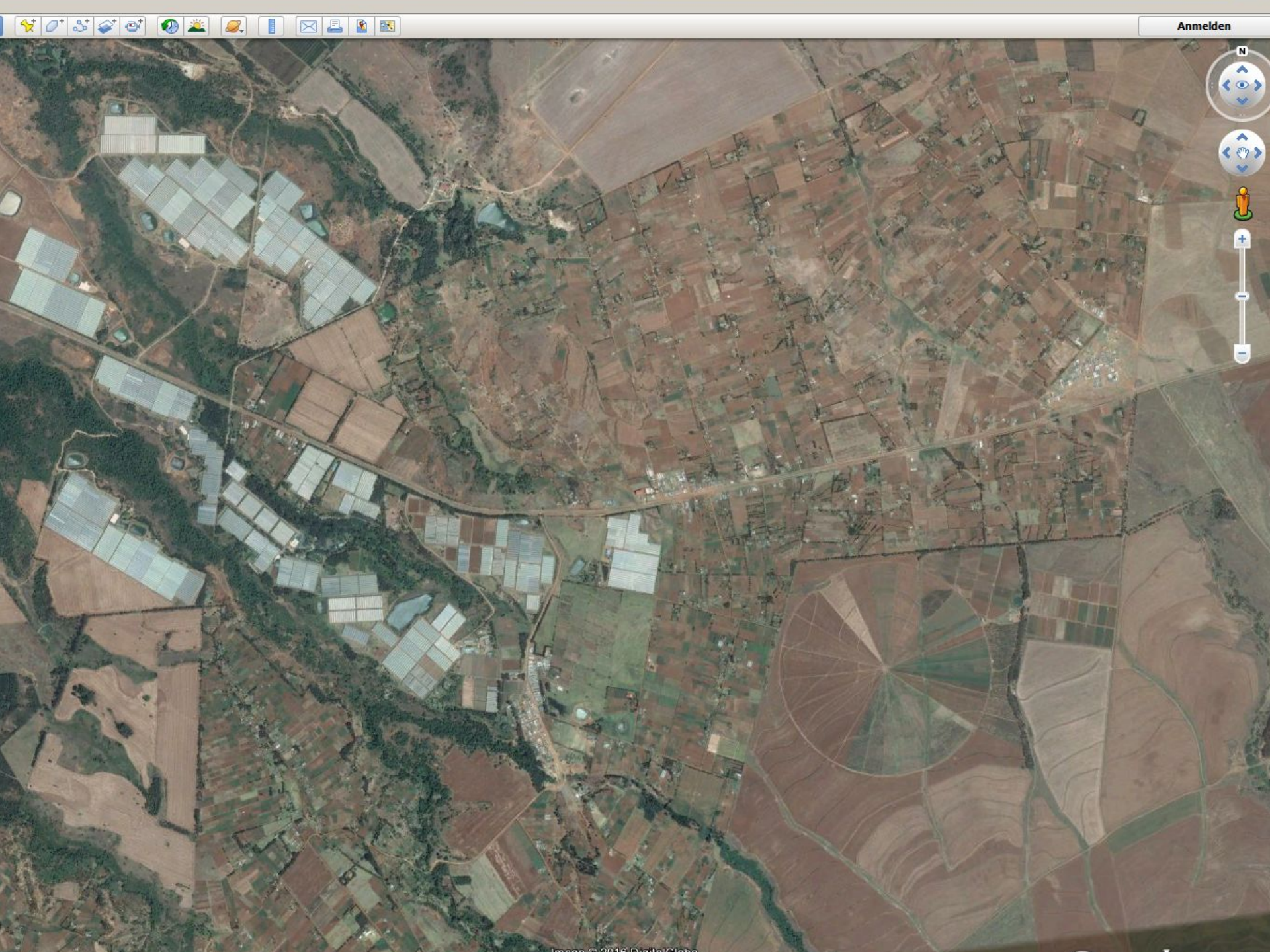

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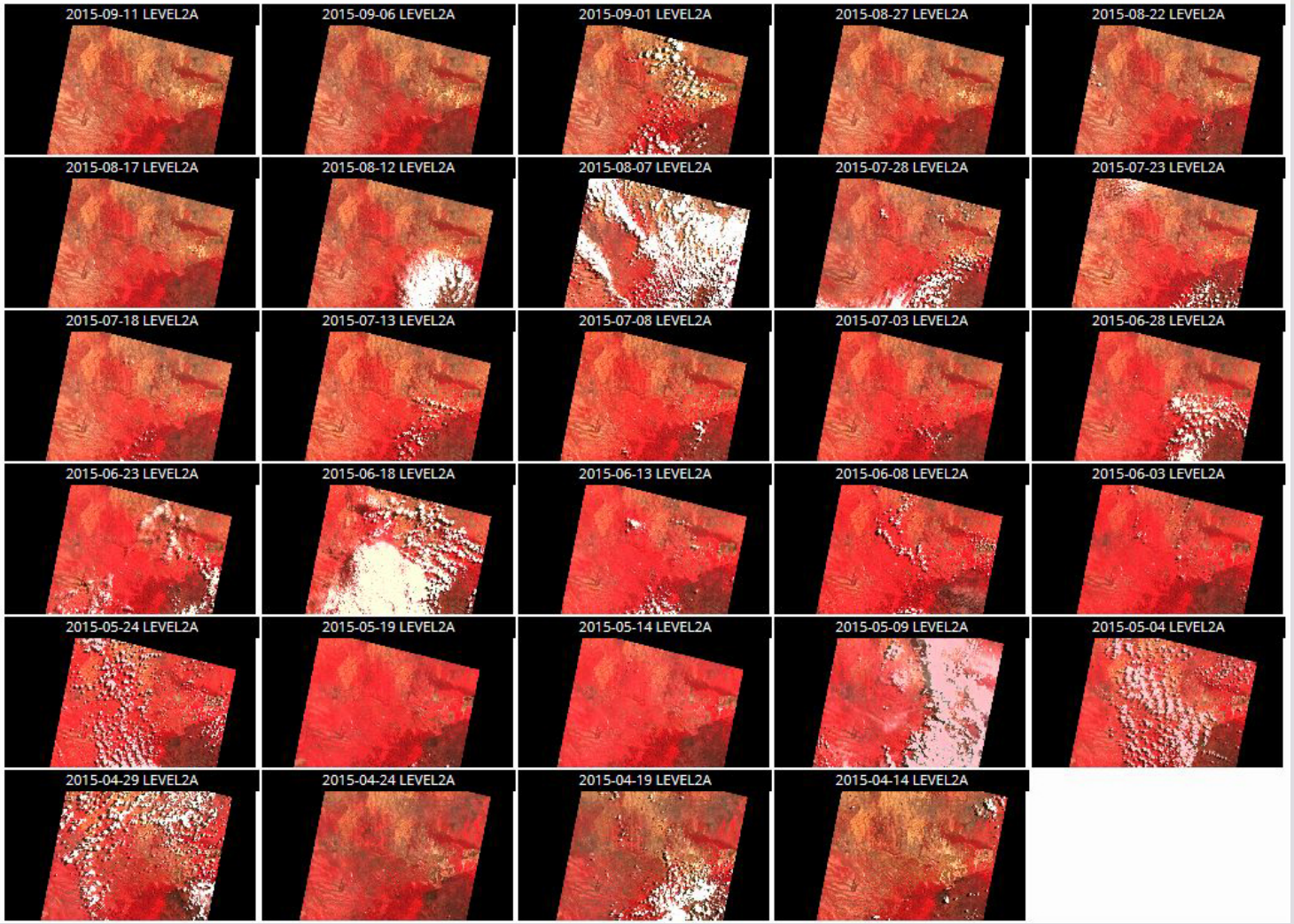
Image © 2016 DigitalGlobe

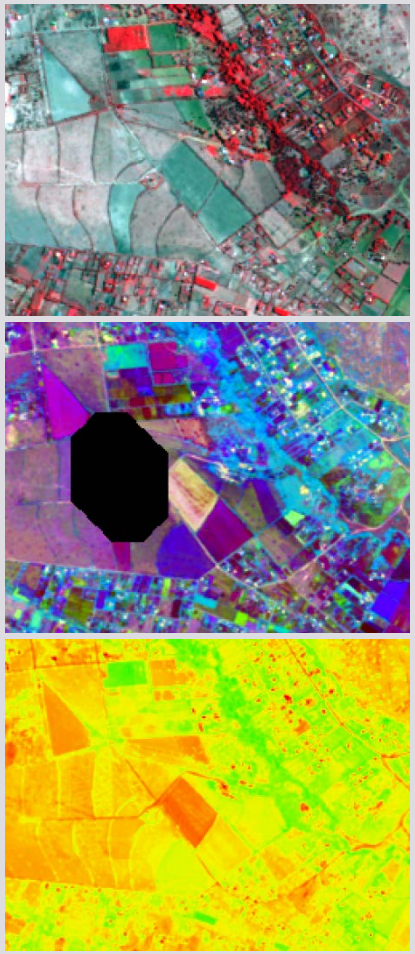
Data

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

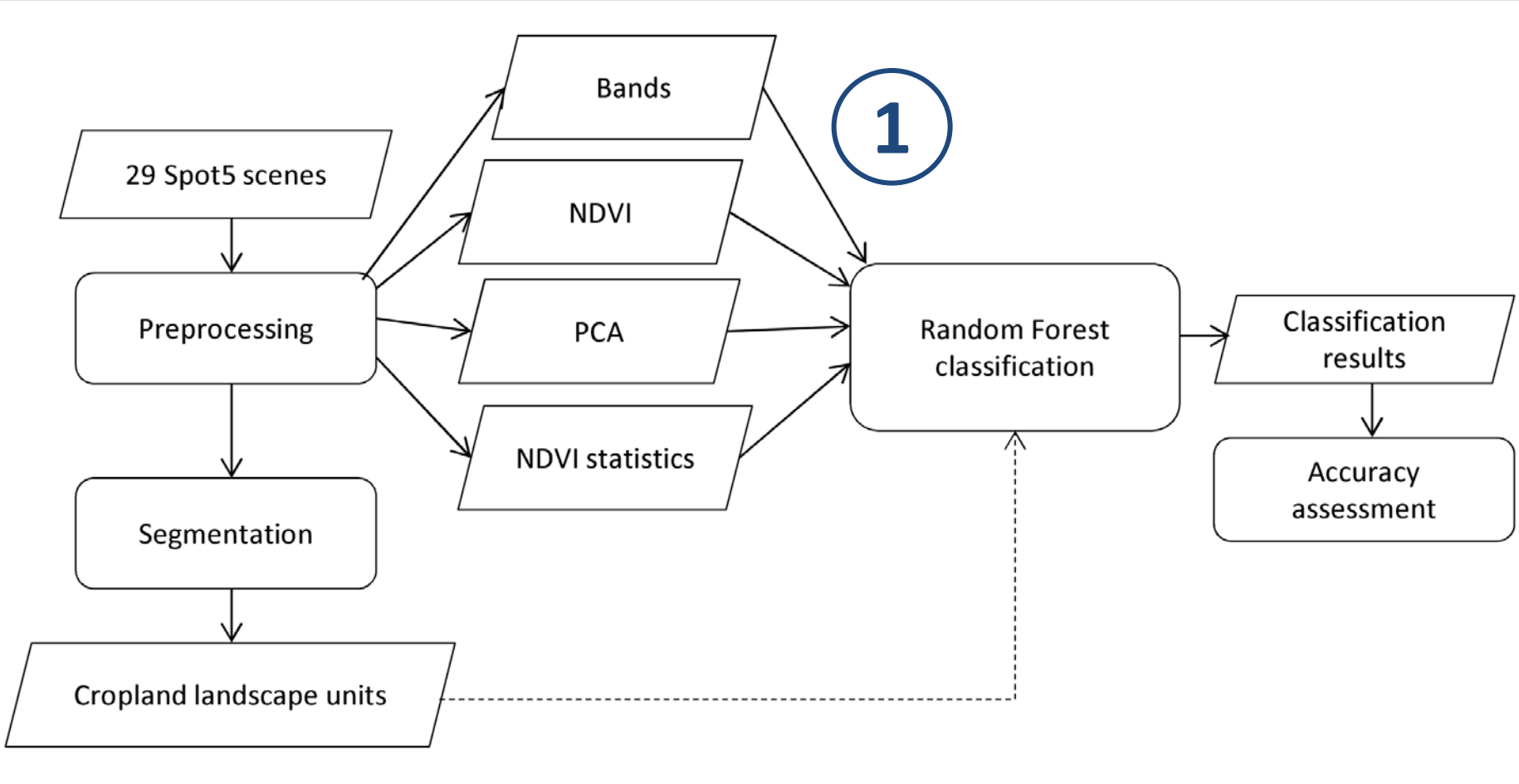


Input data sets

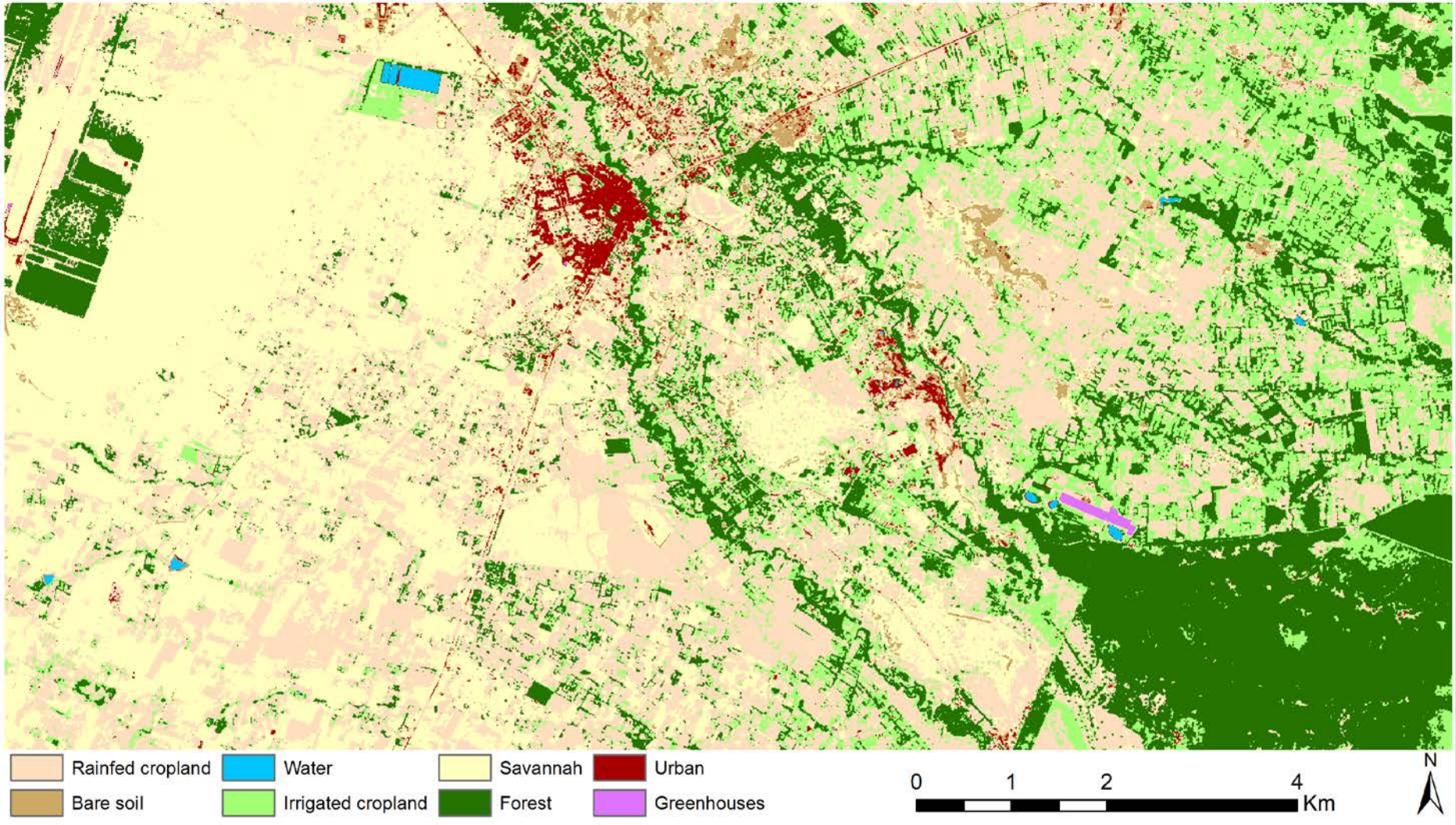
- All Bands
- 29 NDVI
- PCA of 9 cloudless NDVI data sets
- NDVI time series statistics
  - (max, min, mean, std, sum)
- (temporal NDVI features)



Workflow


Bands
1
29 Spot5 scenes
NDVI
Preprocessing
PCA
Random Forest classification
Classification results
NDVI statistics
Accuracy assessment
Segmentation
Cropland landscape units

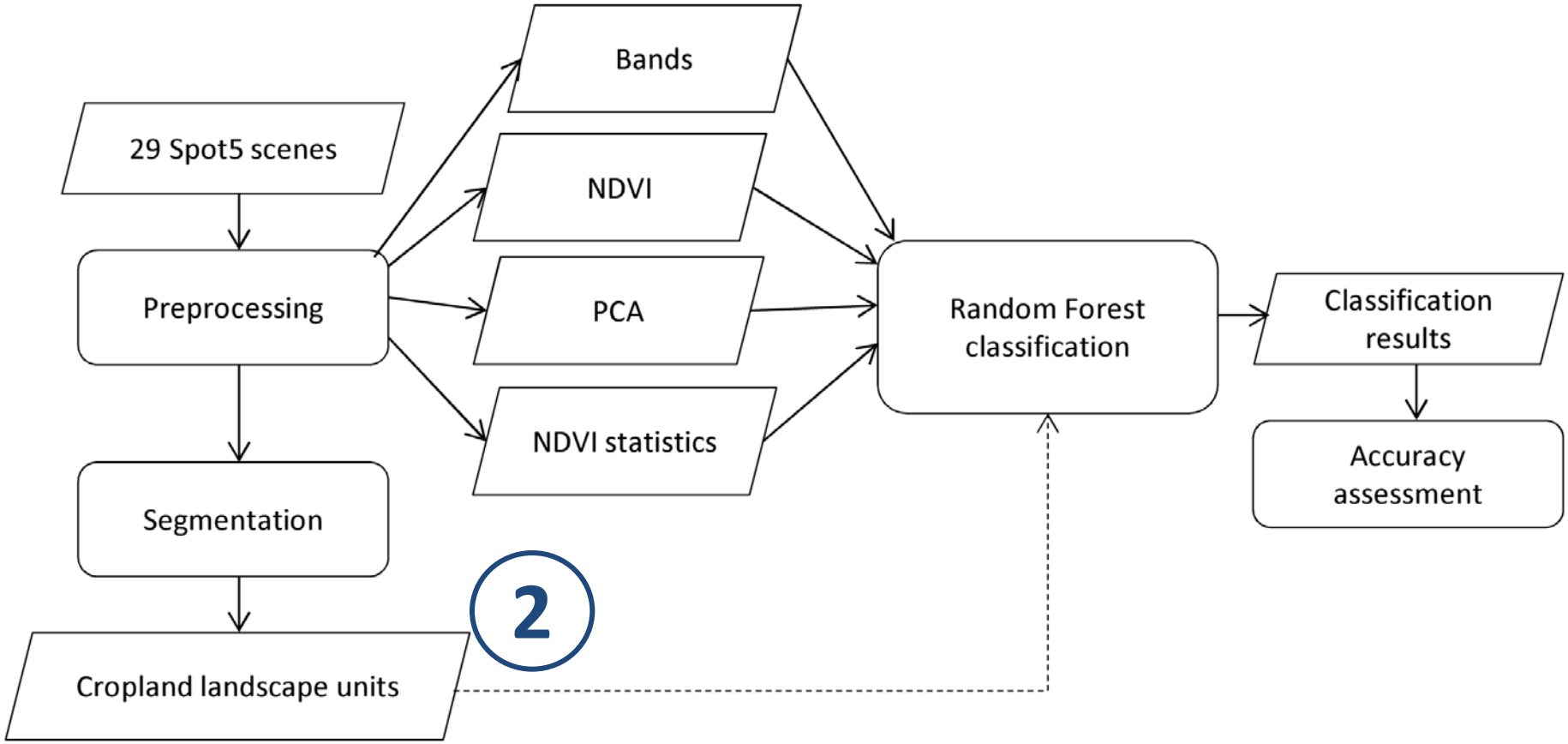
Results – Cropland classification



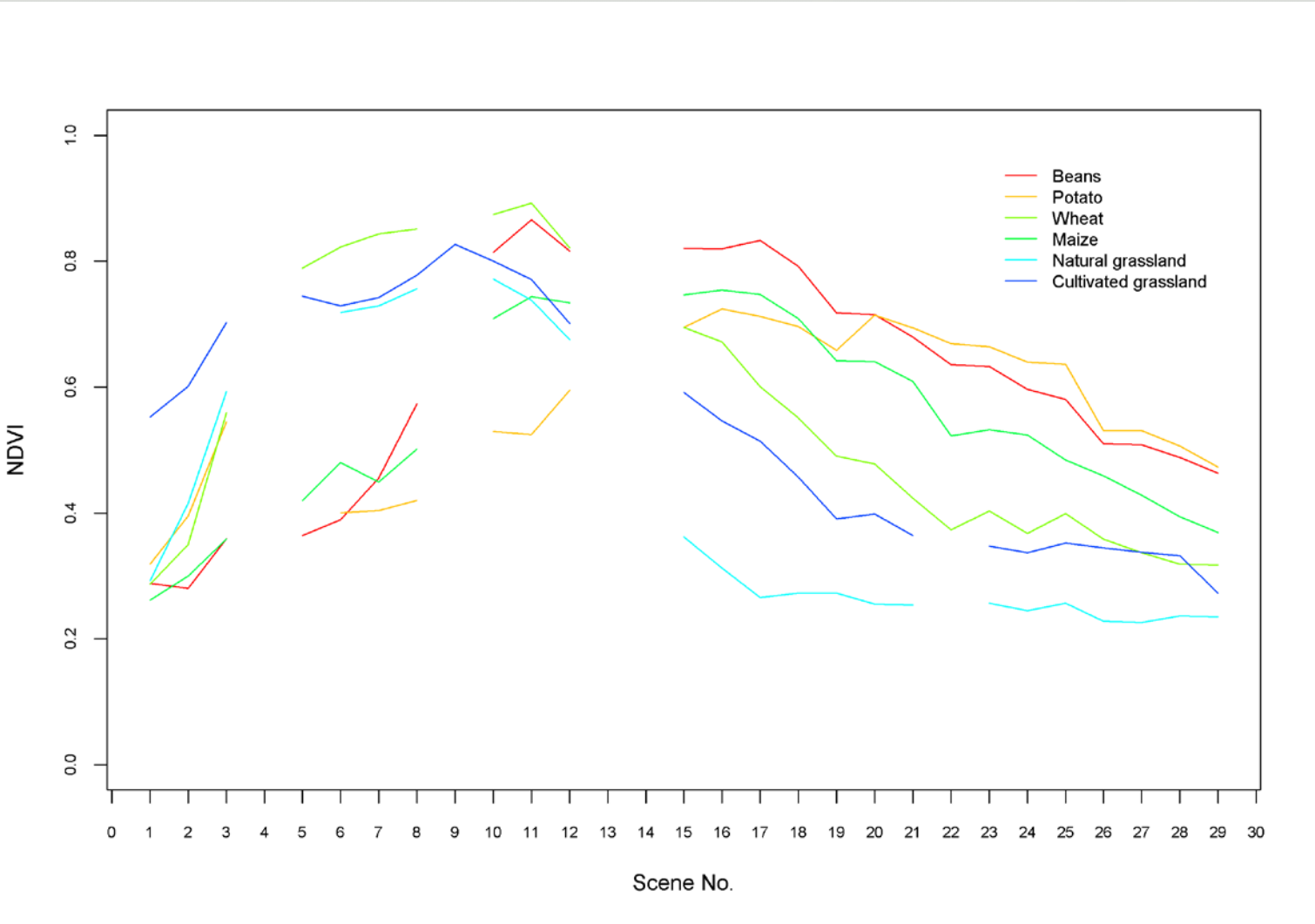
Results – Cropland classification

Input data set	Overall Accuracy [%]	Kappa Accuracy [%]	Avg. F1 Accuracy [%]
Bands	96.18	94.78	93.15
NDVI	92.36	89.58	76.75
PC	90.03	86.53	64.69
NDVIstat	**84.23**	**78.78**	**64.38**
Bands+NDVI	96.16	94.74	91.97
Bands+PC	96.39	95.07	93.59
Bands+NDVIstat	96.37	95.03	93.43
NDVI+NDVIstat	92.74	90.09	74.86
PC+NDVIstat	89.58	86.04	68.19
Bands+NDVI+NDVIstat	96.25	94.87	92.12
Bands+PC+NDVIstat	**96.65**	**95.42**	**93.73**

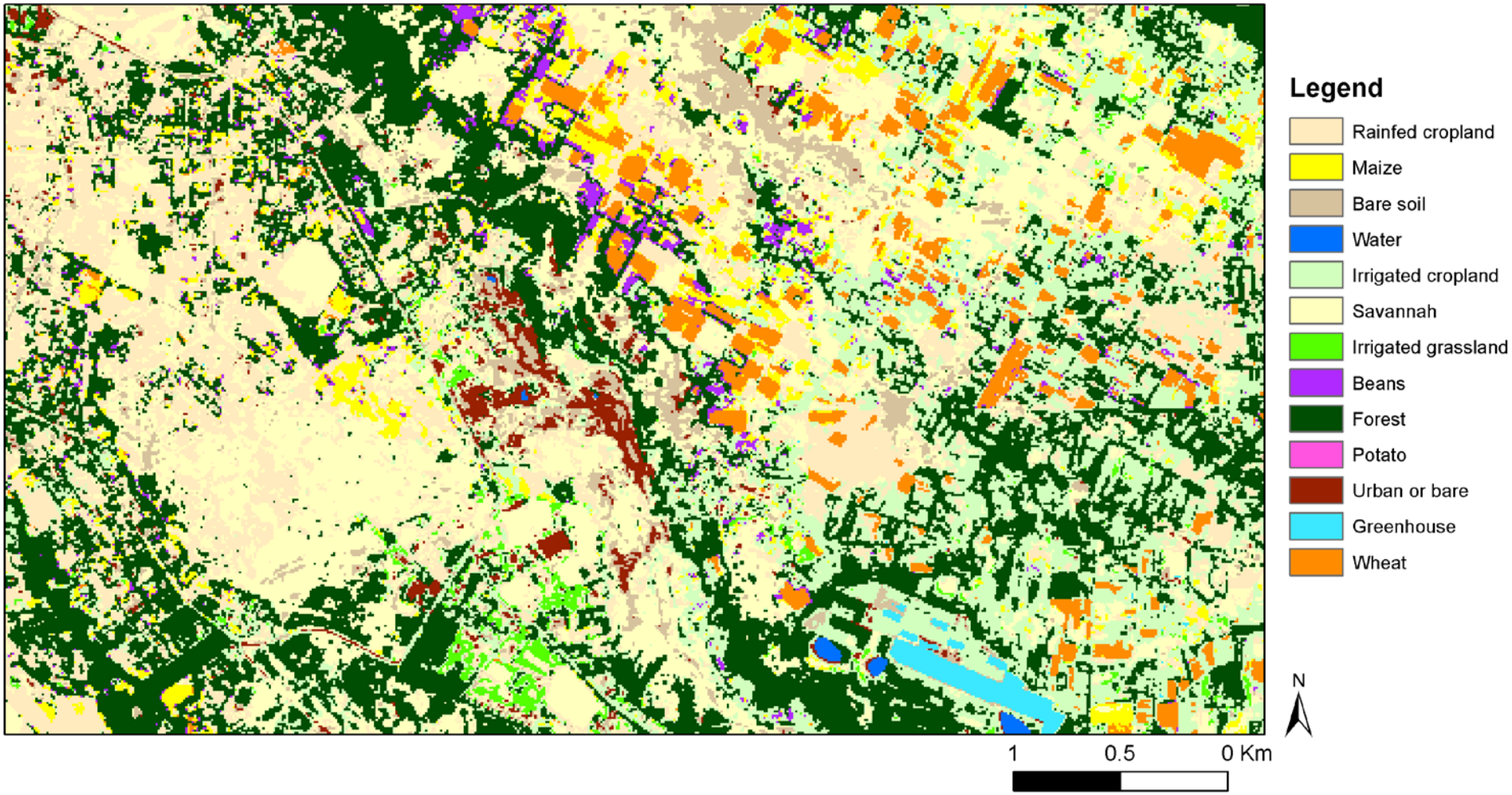
Cropland classification



NDVI analysis crop types



Preliminary results – Crop type classification



Preliminary results – Crop type classification

	Accuracies [%]		
Class	User's	Producer's	F1
Maize	59.02	100.00	74.23
Irrigated grassland	100.00	100.00	100.00
Beans	100.00	38.46	55.56
Potato	55.56	83.33	66.67
Wheat	84.13	77.94	80.92

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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