Multitemporal RapidEye-data analyses of semi arid natural vegetation in the Negev, Israel to assess and monitor the land use changes

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1. Motivation

- Detection of land use changes is one of the most important issues in remote sensing data based monitoring

- Natural vegetation in arid and semi arid environment is heavily sensitiv to climate change

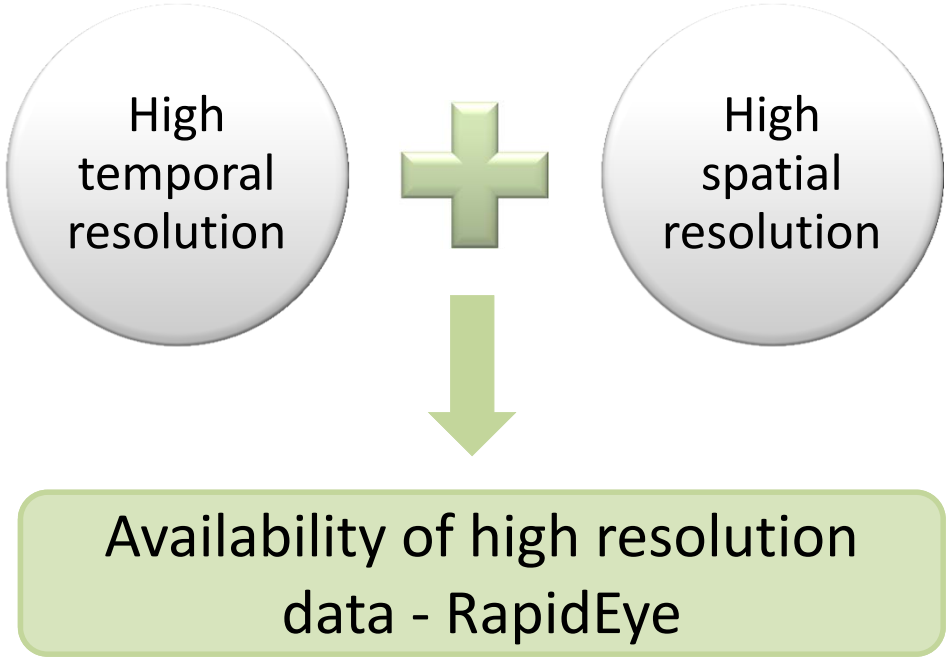
- Differentiation between seasonal variabiliy and climate change requires robust information

- Integration of phenological information from multitemporal satellite data sets are required

1. Motivation

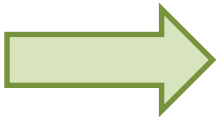
- Test site with high spatial and temporal variability of precipitation and sparse vegetation cover

- Requirements on remotely sensed data for phenological studies in these heterogeneous areas:



2. Objectives

- Detection of sparse natural vegetation using time series of Rapid Eye data
- Detection of time windows in years with different precipitation
- Development of a workflow integrating seasonal aspects

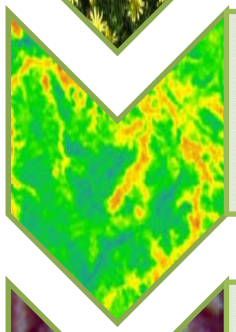


Mapping of distribution of vegetation

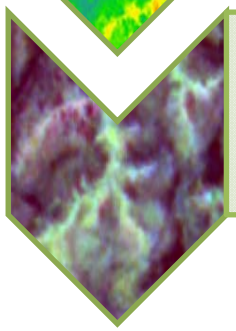
2. Objectives

two time-series of temporal and spatial high resolution RapidEye data

- Analysis of natural vegetation phenology for two growing seasons

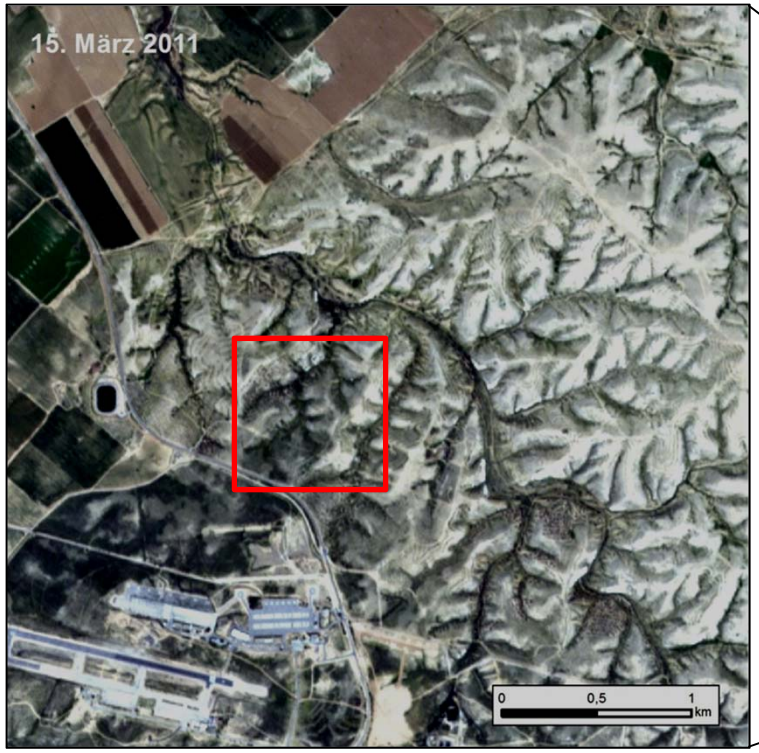


- Multitemporal profiles of selected vegetation indices



- Analysis of the spatial distribution on the basis of false-colour composites

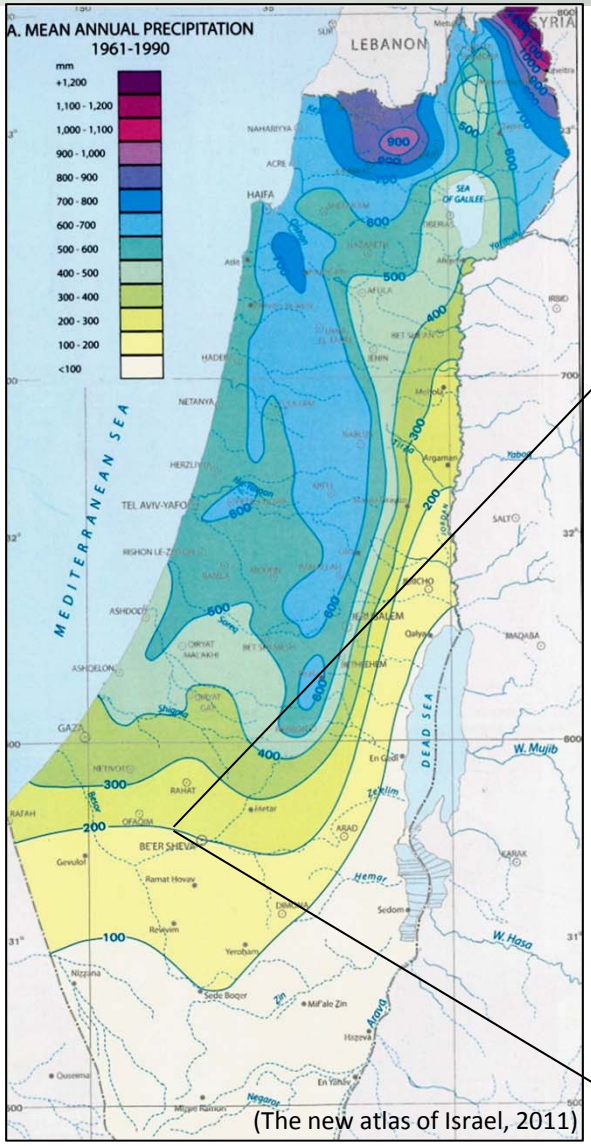
3. Study area – Sayaret Shaked Park



(RapidEye image from 15-March-2011)

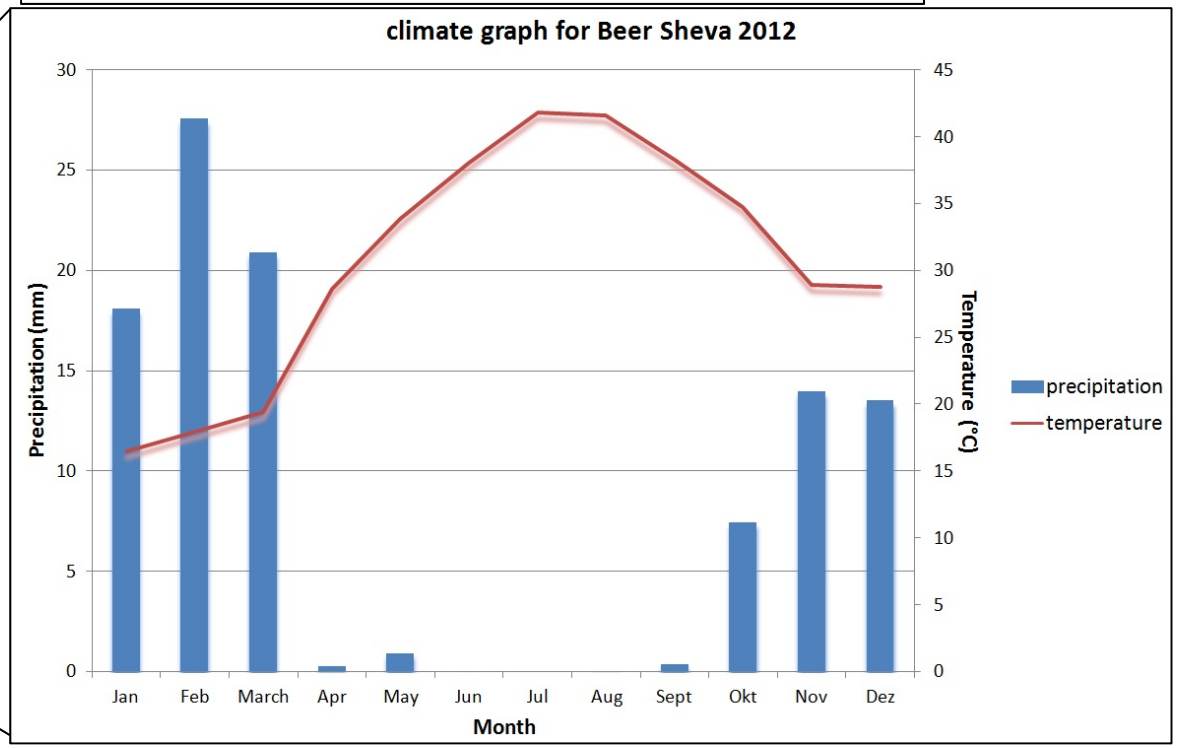
- Heterogeneous landscape
- Long Term Ecological Research Site (LTER)
- ExpEER Ecosystem Research

3. Shaked Park – climatic conditions



(The new atlas of Israel, 2011)

- semi-arid climate
- 200 mm precipitation per year
- precipitation predominantly in winter



3. Shaked Park – natural vegetation

- Composition of cyanobacteria, algae, mosses and lichens, annuals and perennials
- Large variety and heterogenity in spatial distribution and cover density
- Very sensitive response to moisture condition

Biological soil crusts

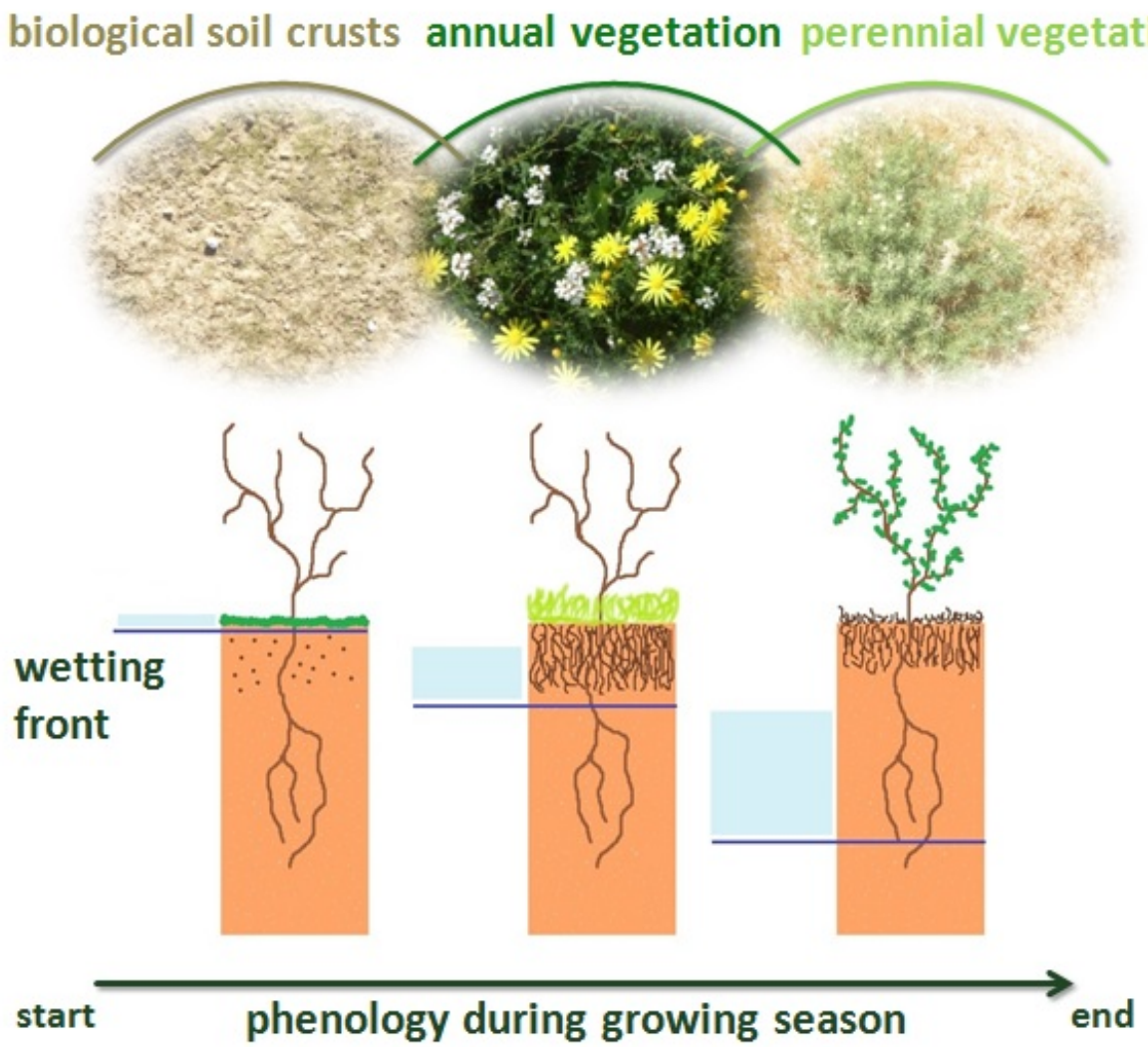
(Elste, 20-Feb-2013)

Annual vegetation

Perennial vegetation

(Elste, 20-March-2013)

3. Shaked Park – seasonal phenology



(after Karnieli, 2003)

(Fotos: Elste, 20-Feb/March-2013)

4. Data – RapidEye satellite images

Spectral resolution

Blue	440-510 nm
Green	520-590 nm
Red	630-685 nm
Red Edge	690-730 nm
NIR	760-850 nm

Data sets

	2010/2011	**2012/2013**
Number of scenes	11	23
Used scenes	9	13
Product	Level 3A	Tasking Level 1B

RapidEye time-series in CIR (5/3/2), spatial resolution: 6.5 m

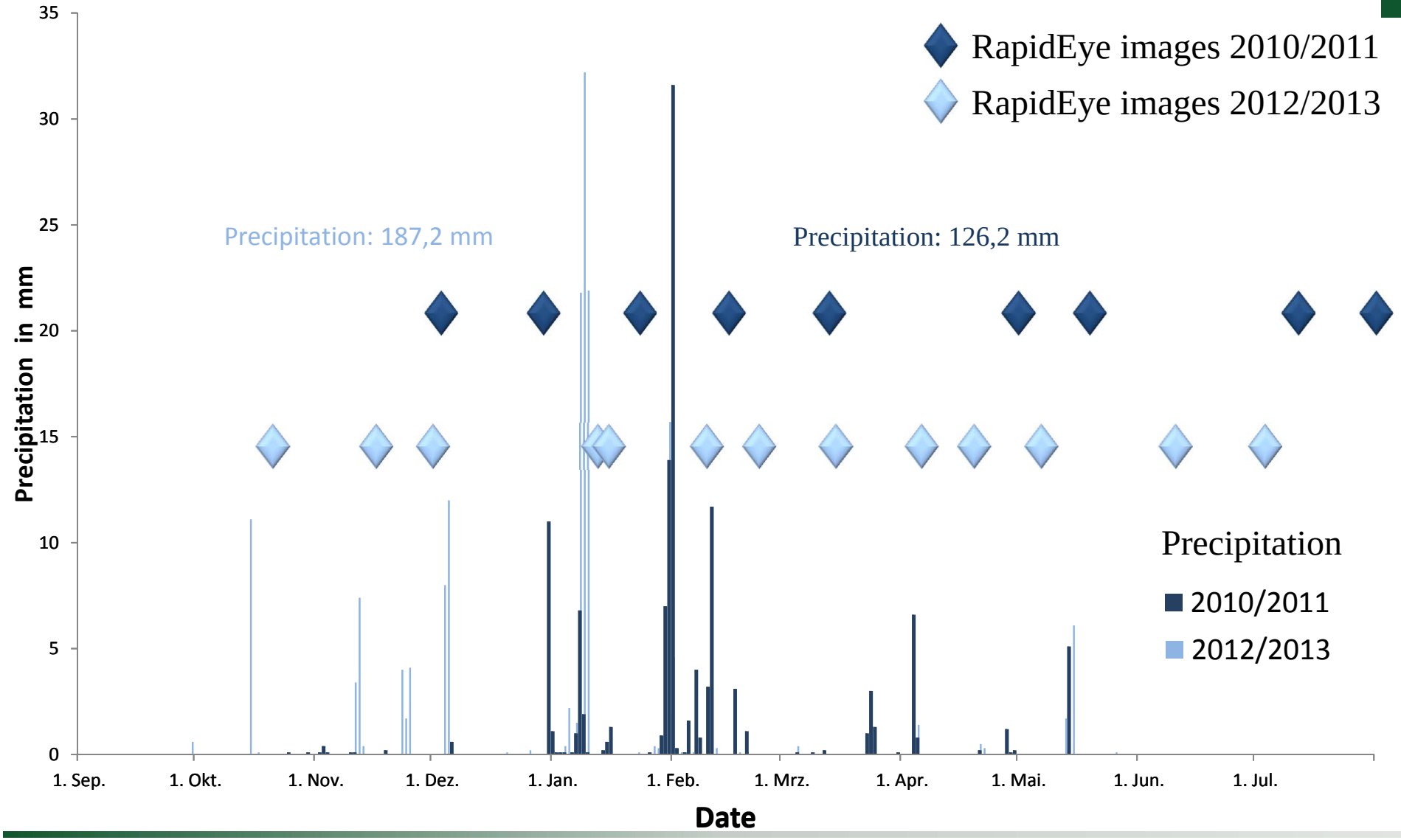
(01-Dec-2012)

(17-Jan-2013)

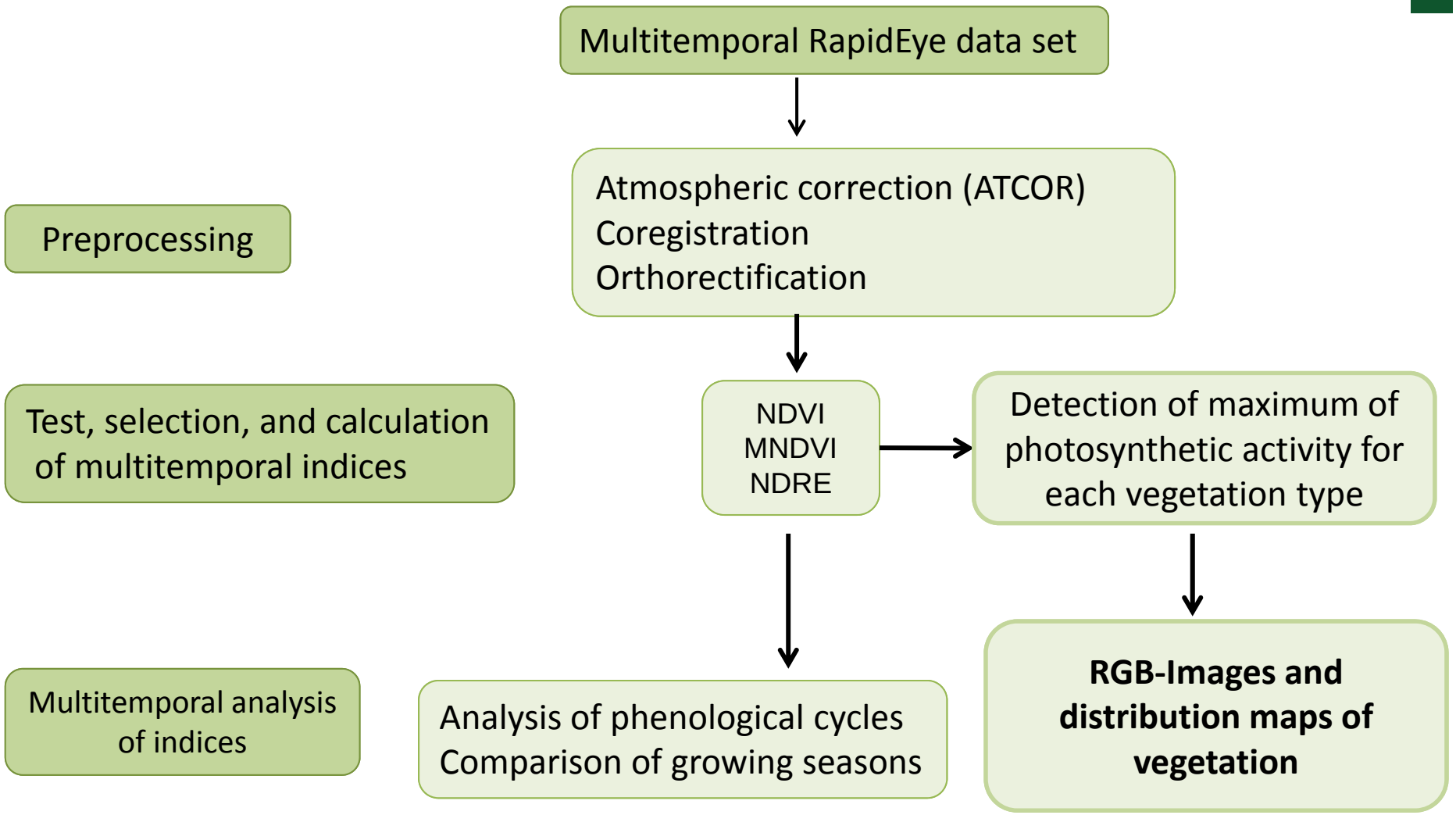
(26-Feb-2013)

(23-Apr-2013)

4. Temporal resolution of RapidEye data in relation to precipitation



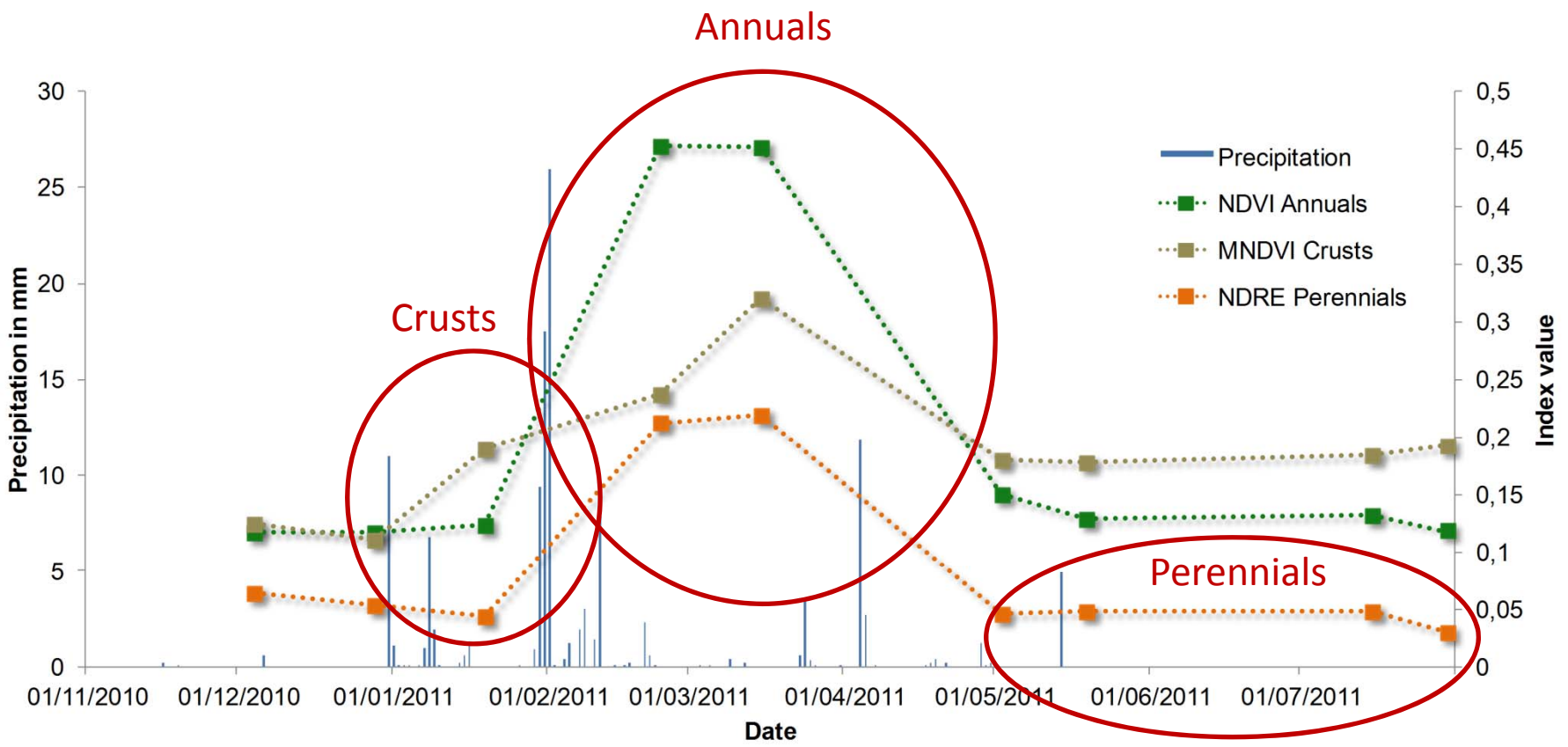
5. Methodology - Workflow



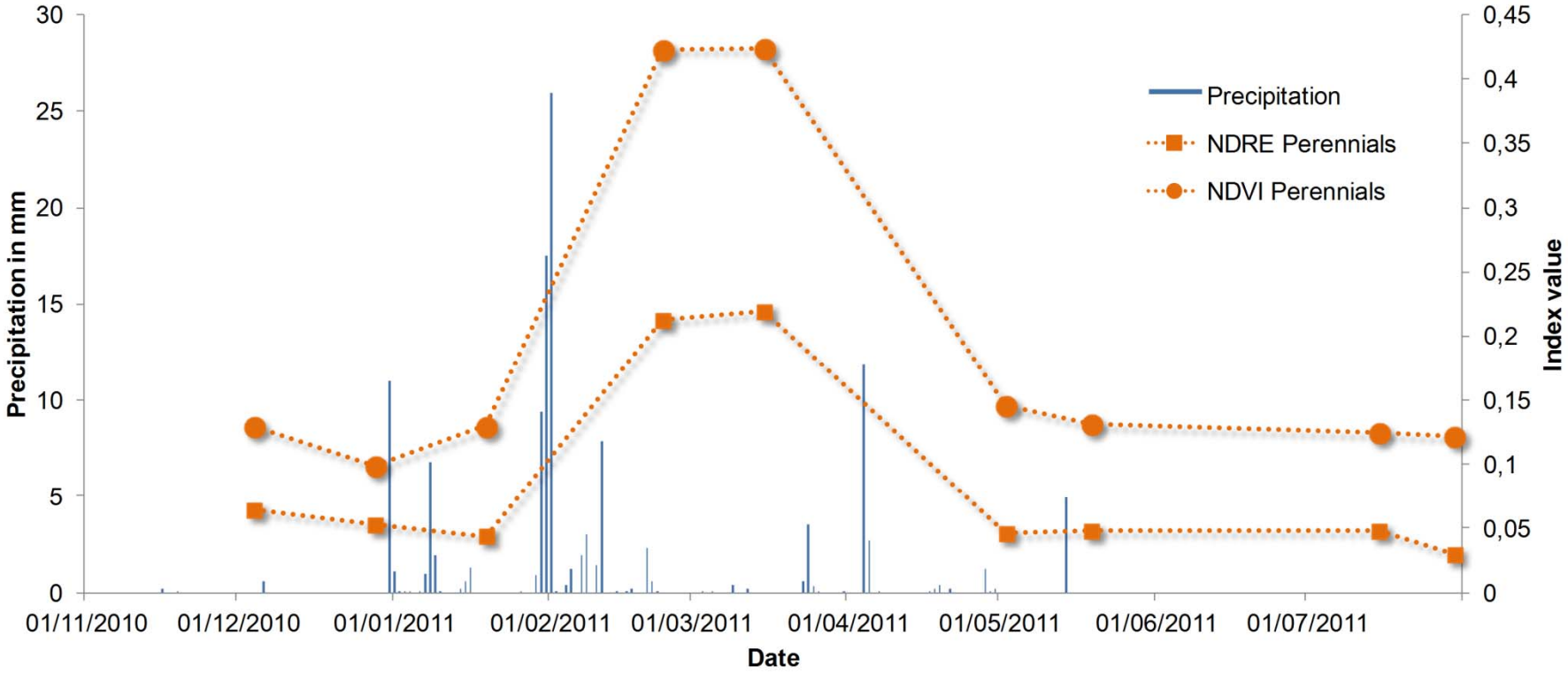
5. Methodology – selected indices

Index	Formula	Application	Reference
NDVI ***Annuals***	$NDVI = \frac{NIR - Red}{NIR + Red}$	Analysis and monitoring of vegetation	ROUSE, 1974
NDRE ***Perennials***	$NDRE = \frac{RE - Red}{RE + Red}$	NDVI modification with red edge spectral band	BARNES et al., 2000
MNDVI ***Crusts***	$MNDVI = \frac{NIR - Red}{NIR - Red - 2Blue}$	Analysis of pigment concentration in leaves	SIMS & GAMON, 2002

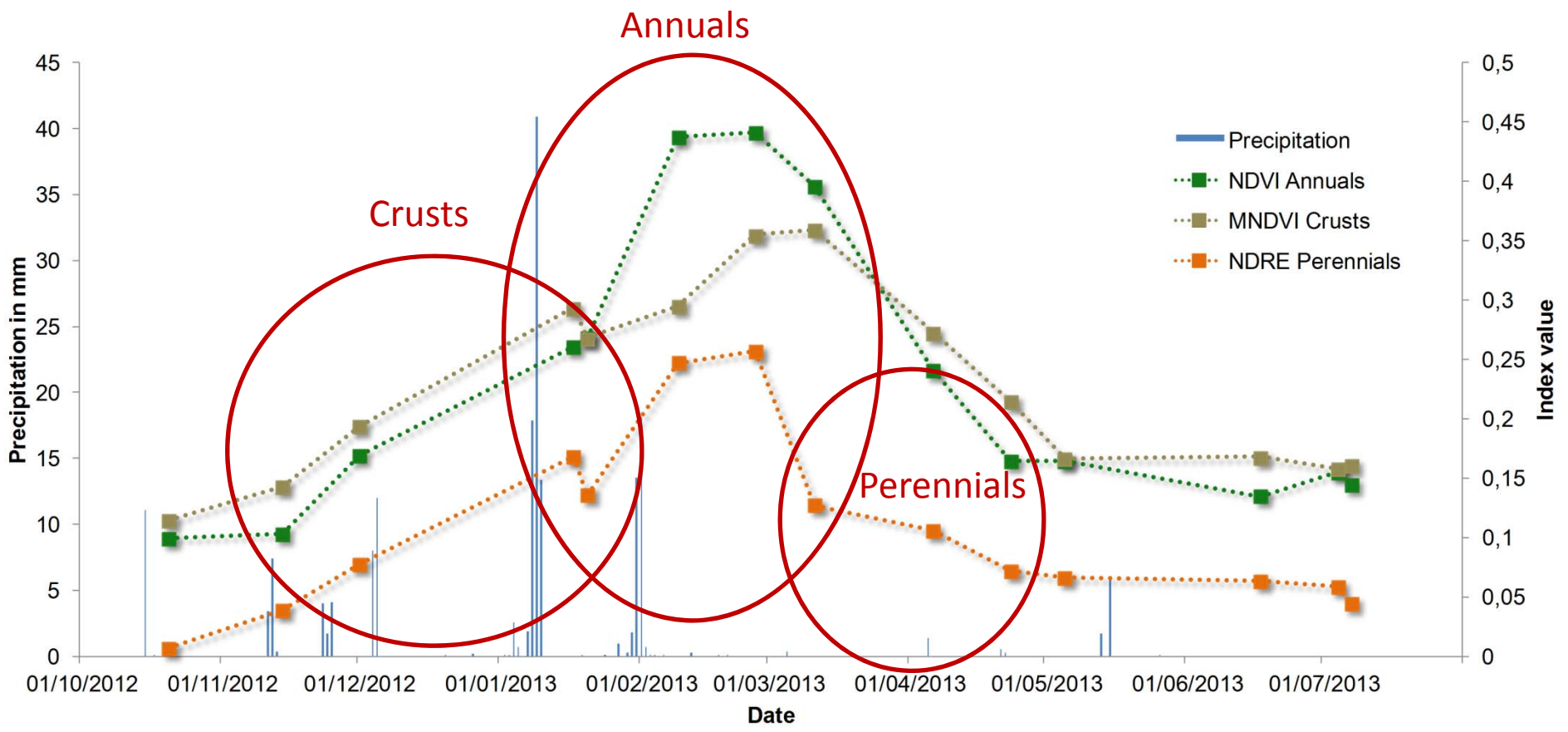
6. Results – Vegetation indices for 2010/2011



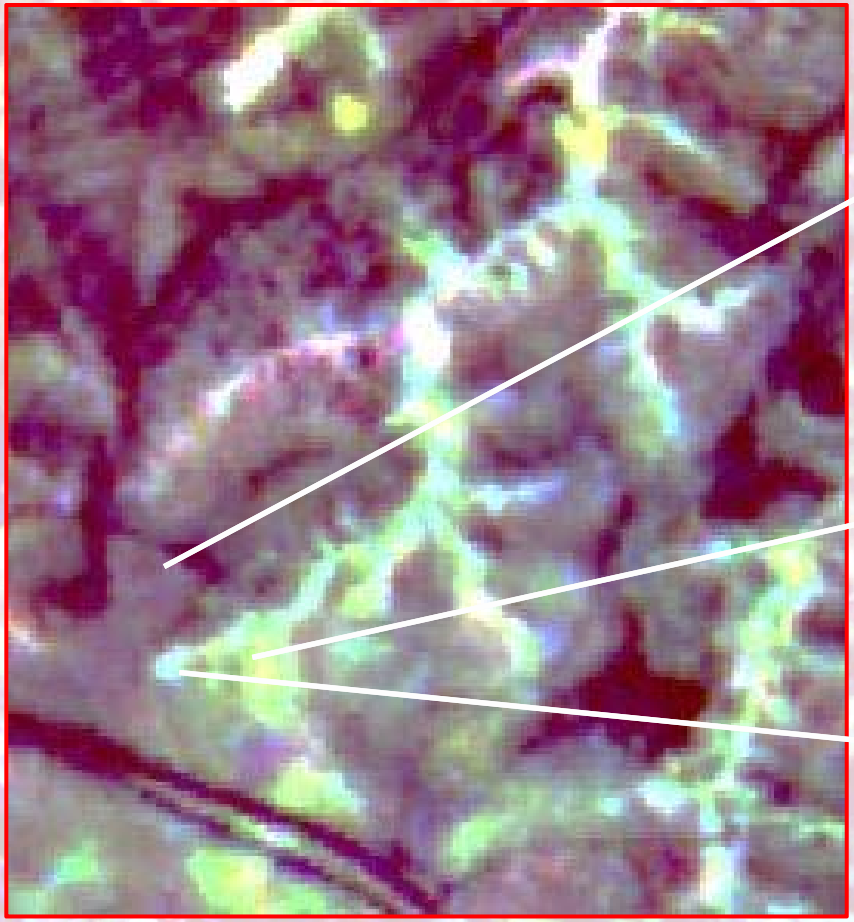
6. Results – NDVI and NDRE for perennials 2010/2011



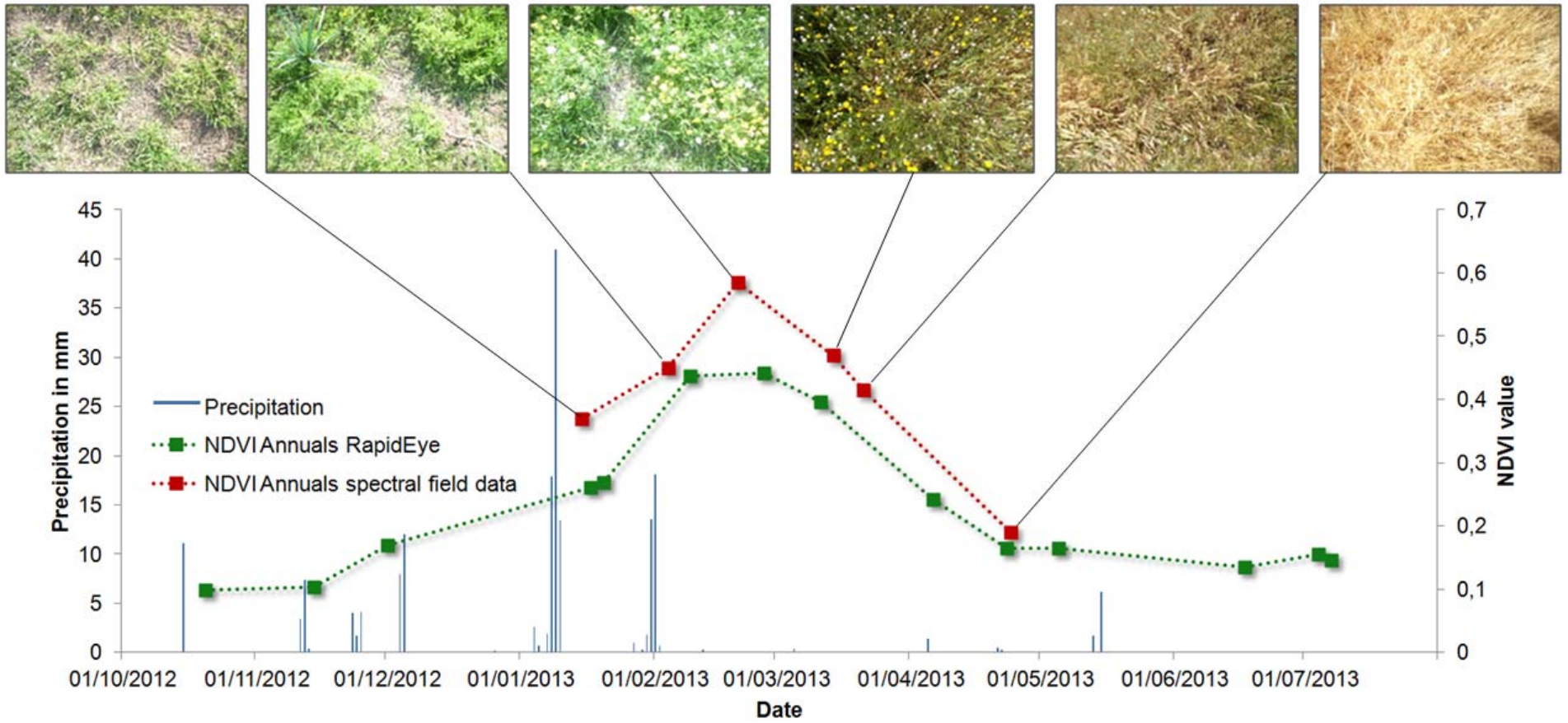
5. Results – Vegetation indices for 2012/2013



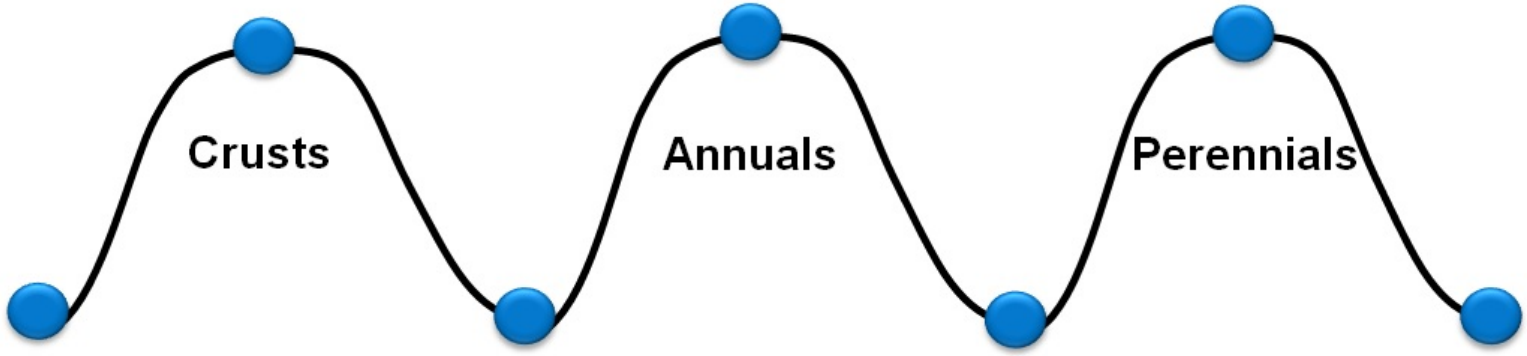
6. Results – Spatial distribution of natural vegetation

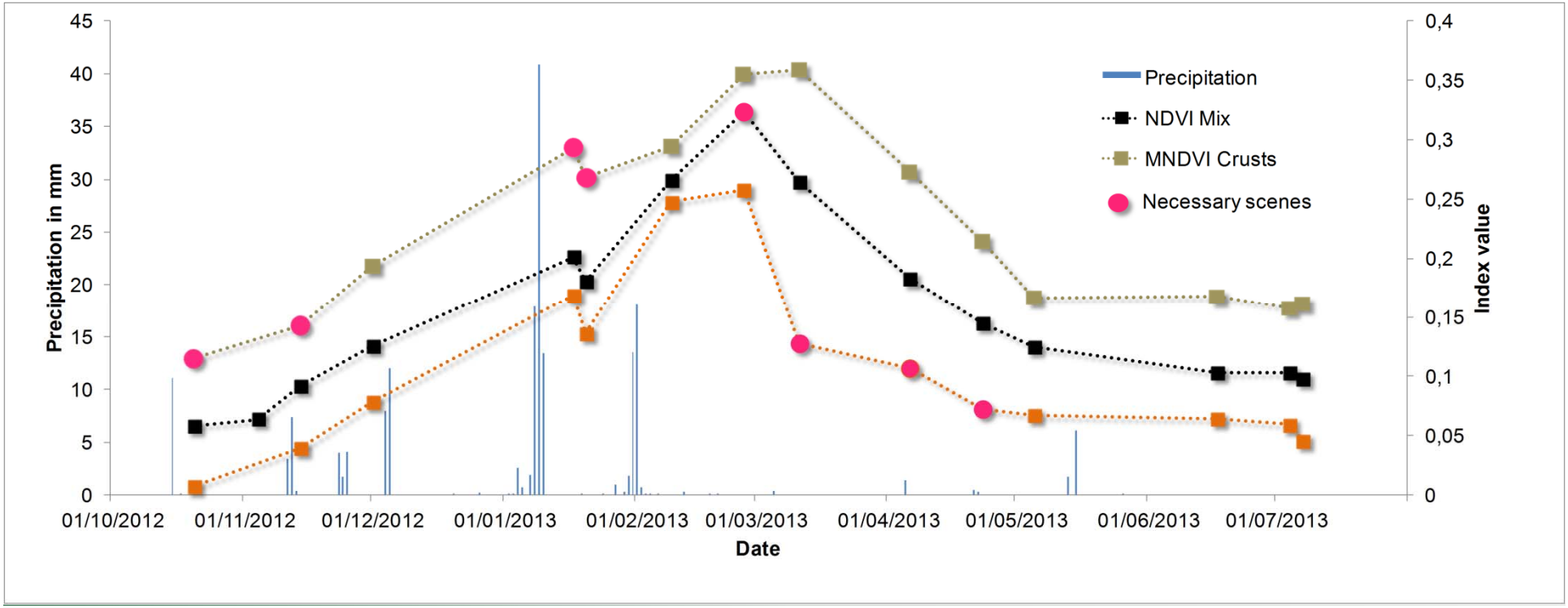


6. Results – Validation with spectral field data and photos



6. RapidEye data sets - for detection of phenological cycle





7. Conclusion and Outlook

- Multitemporal RapidEye data with high spatial and temporal resolution as well as the red edge chanell offers new possibilities of detection of highly heterogenous natural vegetation types

- First time we can detect the typical phenological cycle with
- RapidEye data

- Detection of phenological cycle using different time windows and specific vegetation indices for the different vegetation types

6. Conclusion

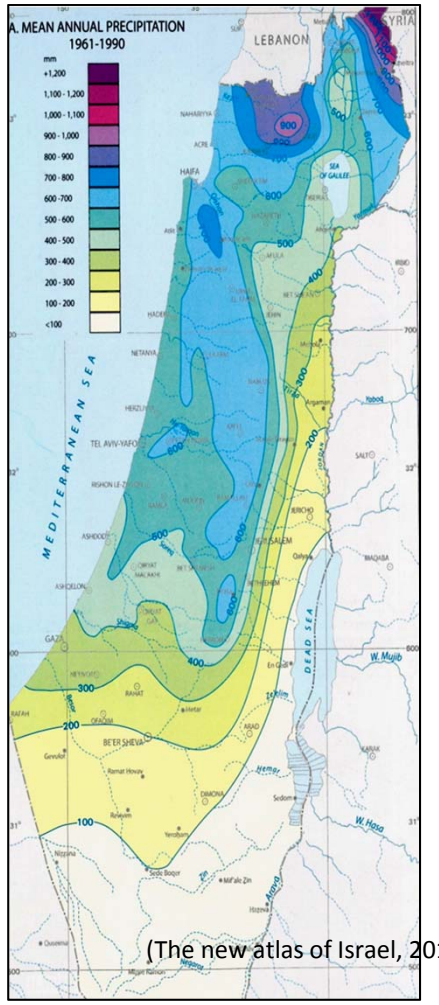
- Workflow is robust in relation to different intensities and distribution of precipitation pattern

- Method is the basic stepstone for long term monitoring of meteorological variabilites and real climatic changes

7. Outlook

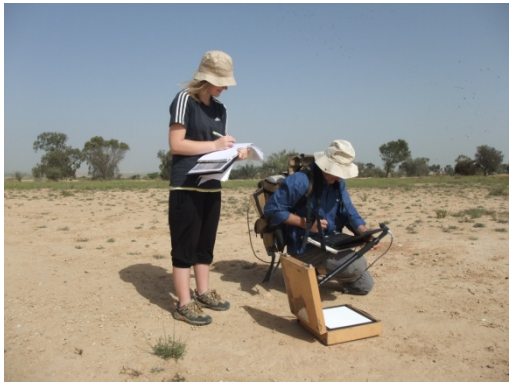
- Integration of RapidEye data 2014- 2017
- Monitoring of the vegetation period 2010 – 2017
- Transformation of the workflow to other parts of Negev, like Nizzana, Southern Negev with 50 mm/a and Israel

(RapidEye image from 11-March-2013)



(The new atlas of Israel, 2011)

Acknowledgement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