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FEED THE WORLD

Quantitative data on weather and crops

facts from space

30 January 2014

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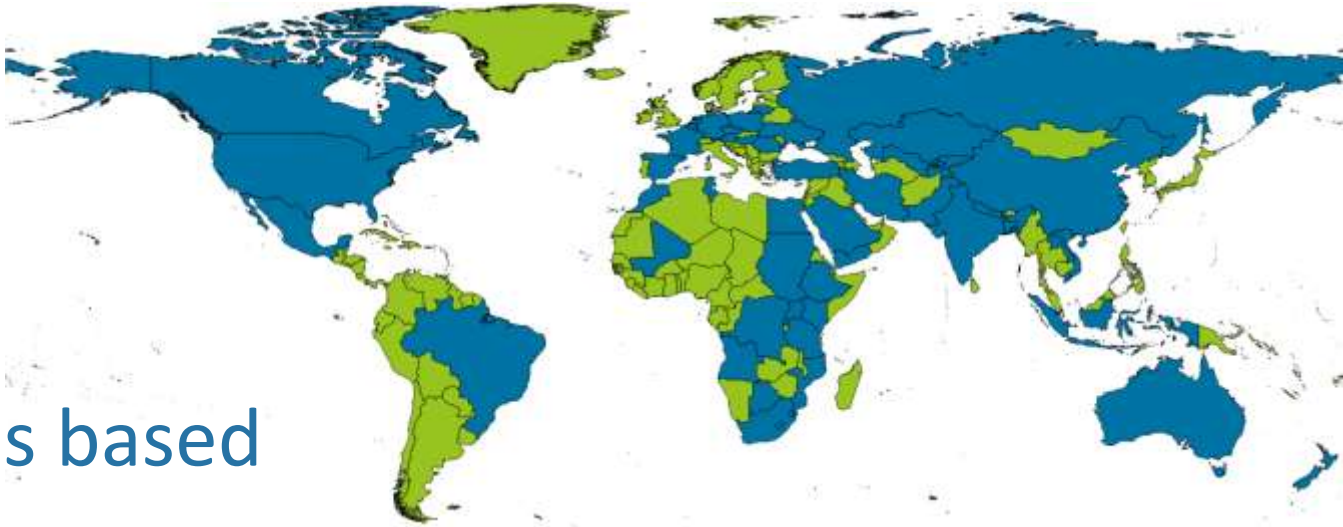
eleaf.com

Introduction



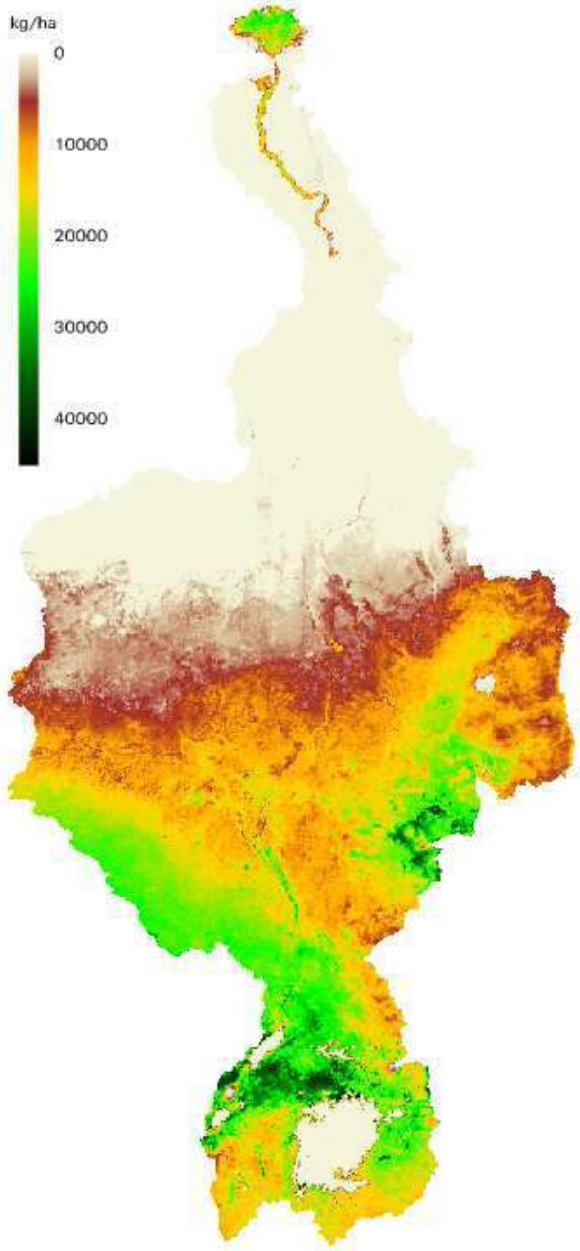
eLEAF

- Since 2000
- Netherlands based
- Global experience
- Consultancy services and data supplier
  - Crop monitoring
  - Weather conditions
  - Agricultural water management
- Quantitative Remote Sensing = PiMapping®

What is PiMapping® ?

Pixel Intelligence Mapping
is a toolbox of algorithms:

- Based on satellite imagery and meteo data
- Resulting in quantative data in mm, kg, °C, etc
- Information on Water, Vegetation & Climate



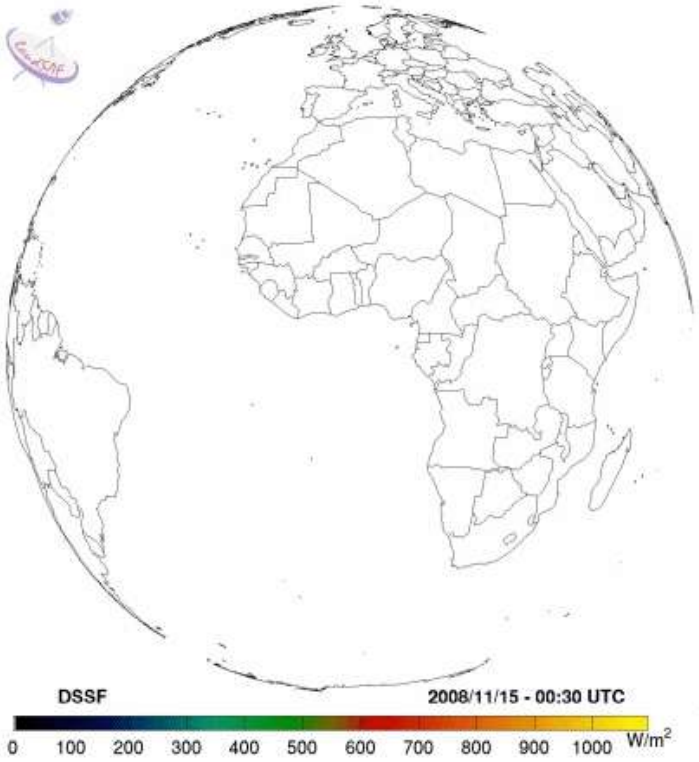
eLEAF's data components

	Data Components
WATER	**Actual Evapotranspiration** (E, T, interception), precipitation, top soil moisture, water stress, storage change reservoirs, storage change aquifers, water productivity, water accounting, **irrigation performance**
VEGETATION	**Actual biomass production**, Land cover, Fractional vegetation cover, Leaf Area Index LAI, fPAR, crop coefficient, crop yield, CO2 flux, sowing date, harvest date
CLIMATE	Surface temperature, air **temperature**, air humidity, wind speed, cloud cover, solar radiation, sensible heat flux (H), latent heat flux (LE)

METEOLOOK:
EVERY 250 METER
A WEATHER STATION

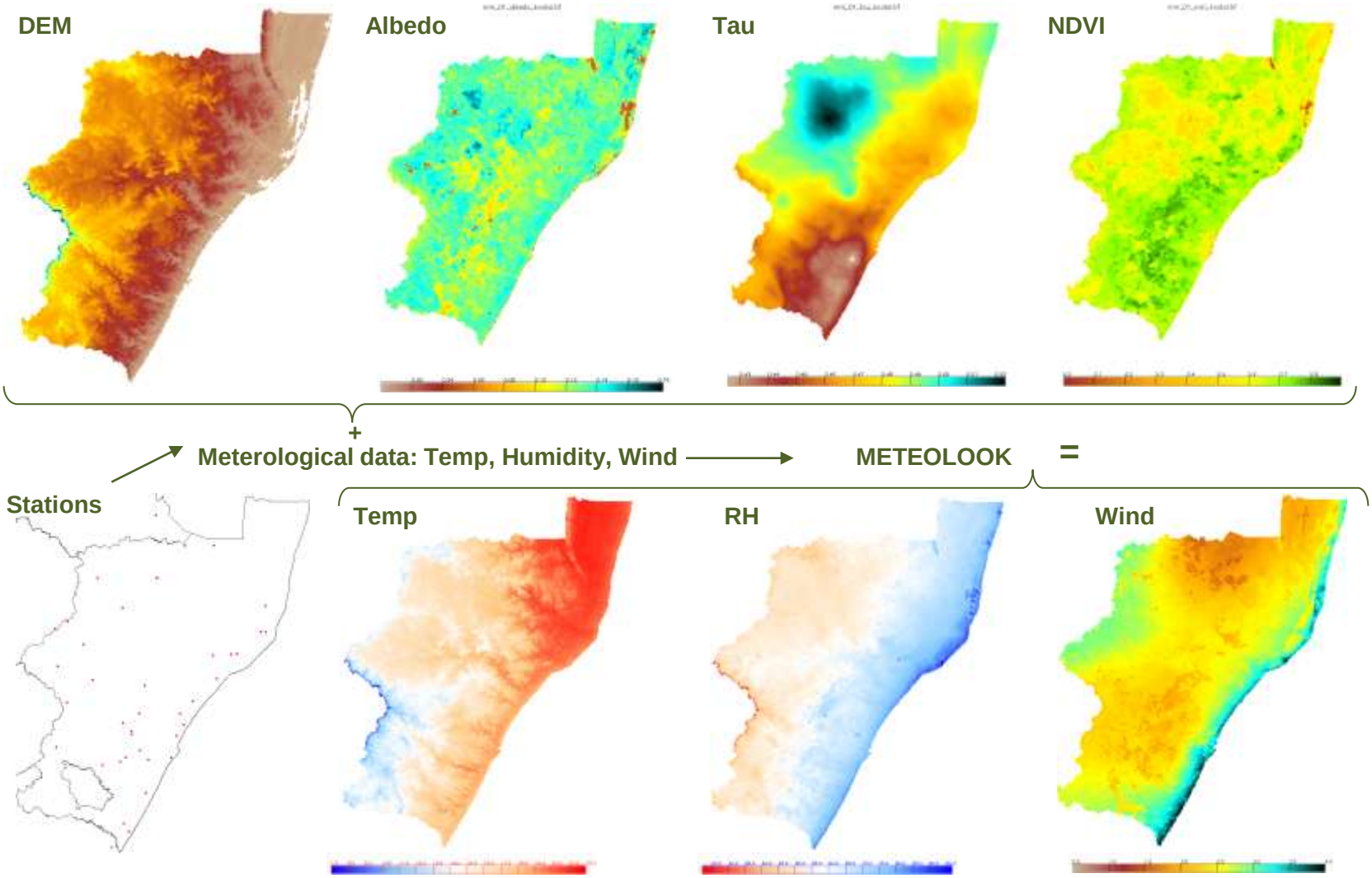
MeteoLook

- Transfers local point measurements of air temperature, wind speed and relative humidity to a regular grid



- Physical basis:
  - Surface characteristics
  - Soil wetness
  - Available radiation
  - Orography

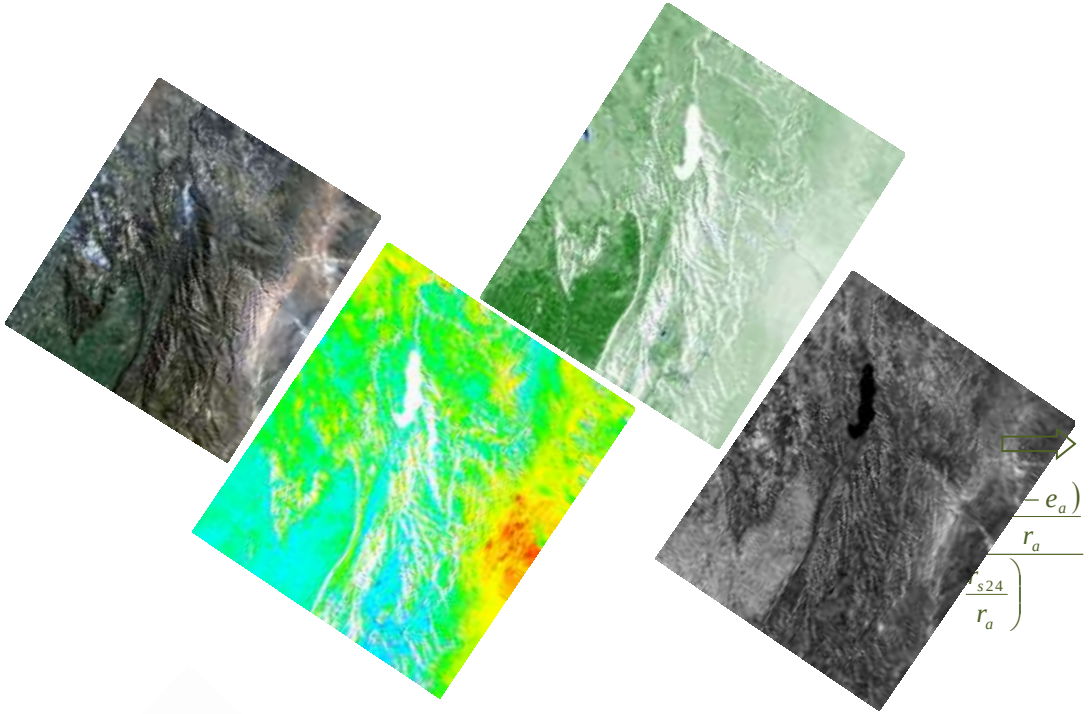
MeteoLook: Kwazulu Natal



ENERGY BALANCE ALGORITHMS: QUANTIFIED CROP PRODUCTION

SEBAL

vegetation index, albedo, temperature, cloud cover

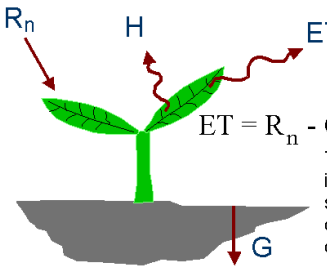


$$\frac{(e_s - e_a)}{r_a}$$

$$\left(1 + \frac{r_{s24}}{r_a}\right)$$

Weather station data

ET is calculated as a "residual" of the energy balance



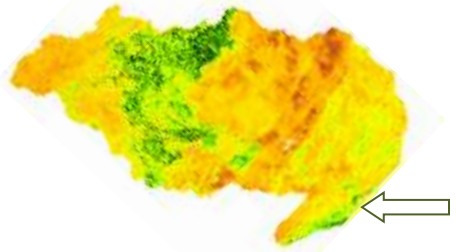
$$ET = R_n - G - H$$

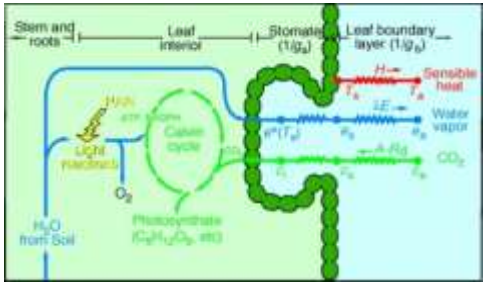
The energy balance includes all major sources (R_n) and consumers (ET, G, H) of energy

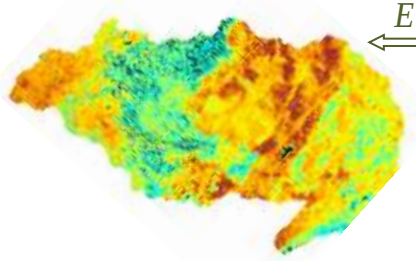
Actual water use

$$Bio = \int APAR'$$

Biomass production and yield







$$ET = \frac{\Delta(R_n - G) + \rho c_p \dfrac{(e_s - e_a)}{r_a}}{\Delta + \gamma\left(1 + \dfrac{r_{s24}}{r_a}\right)}$$

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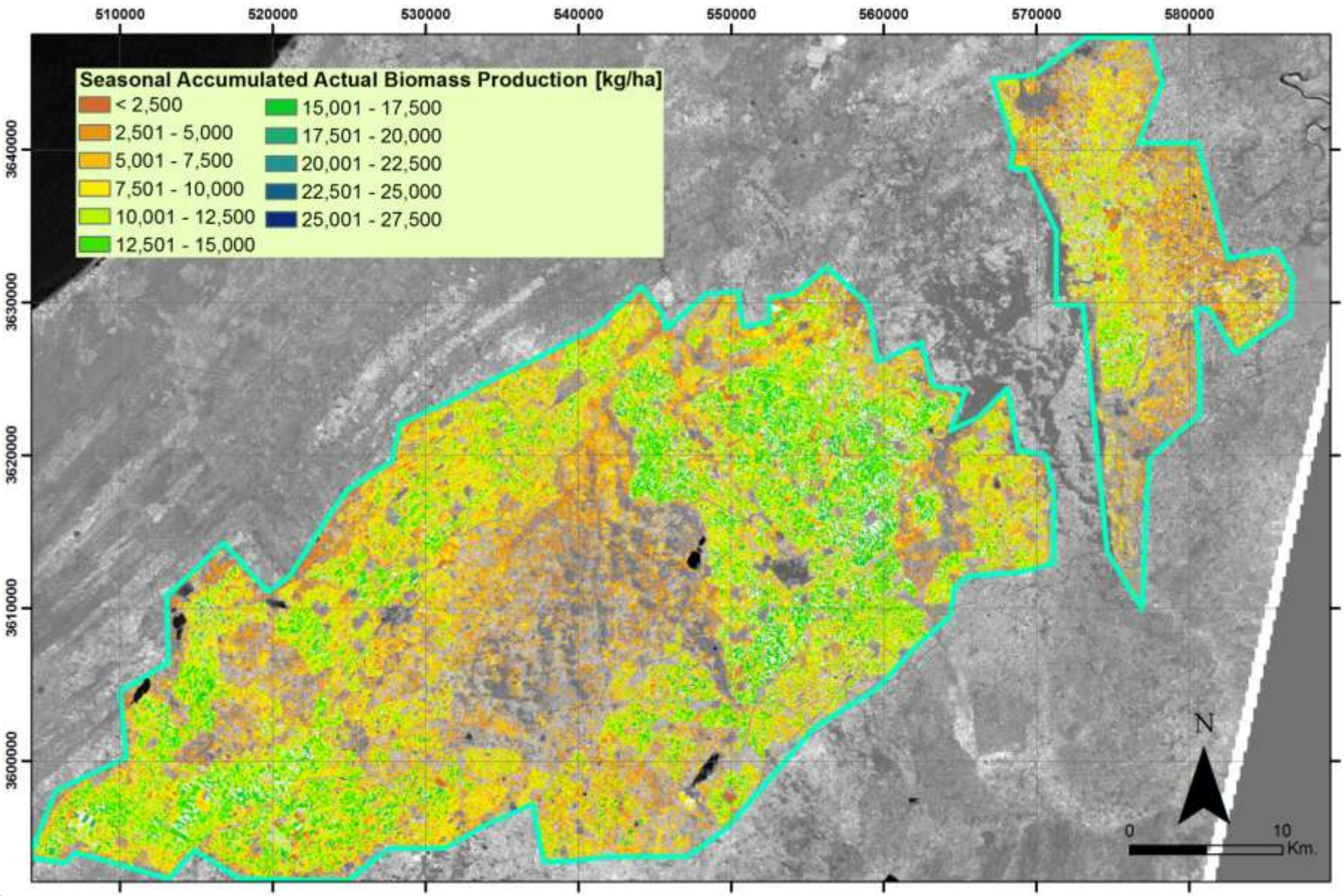
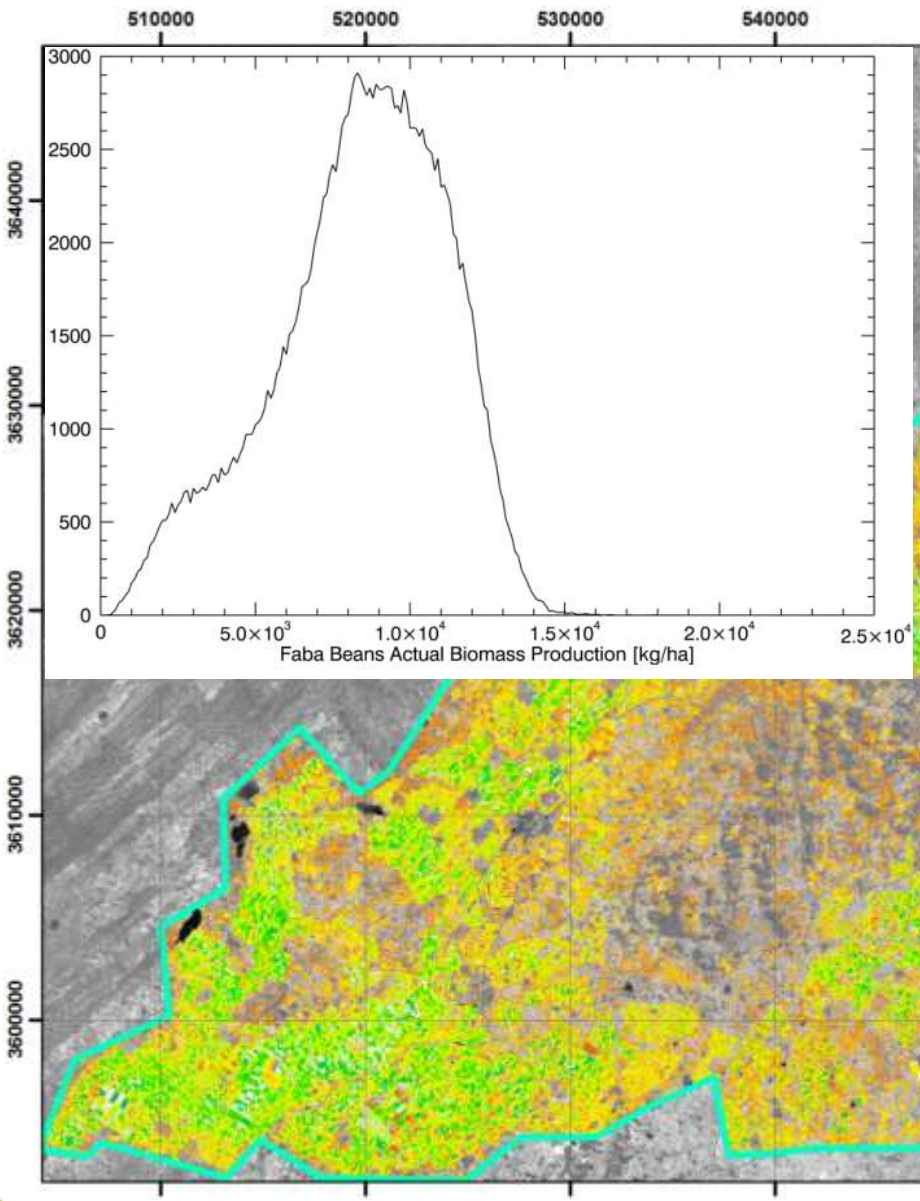
Doukkala

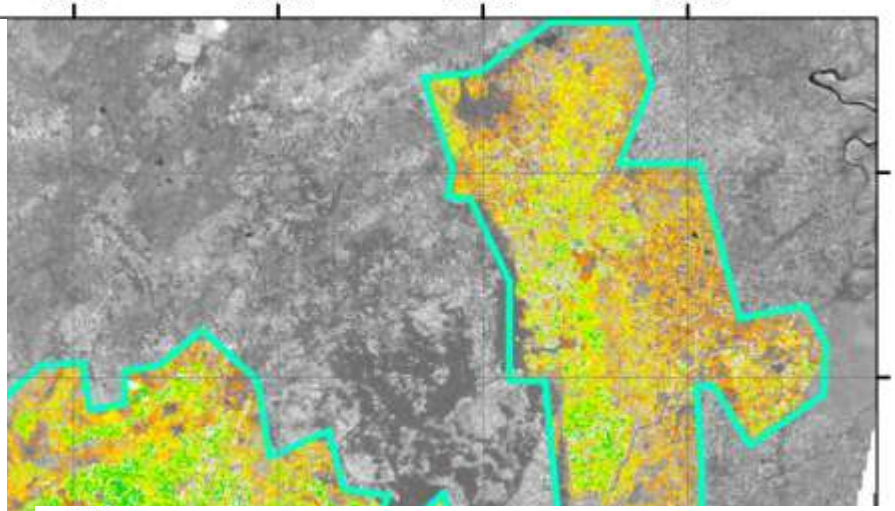

Casablanca
El Jadida
Berrechid
Settat
Safi
Youssoufia
Marrakesh
Tamesloht
Ahmar

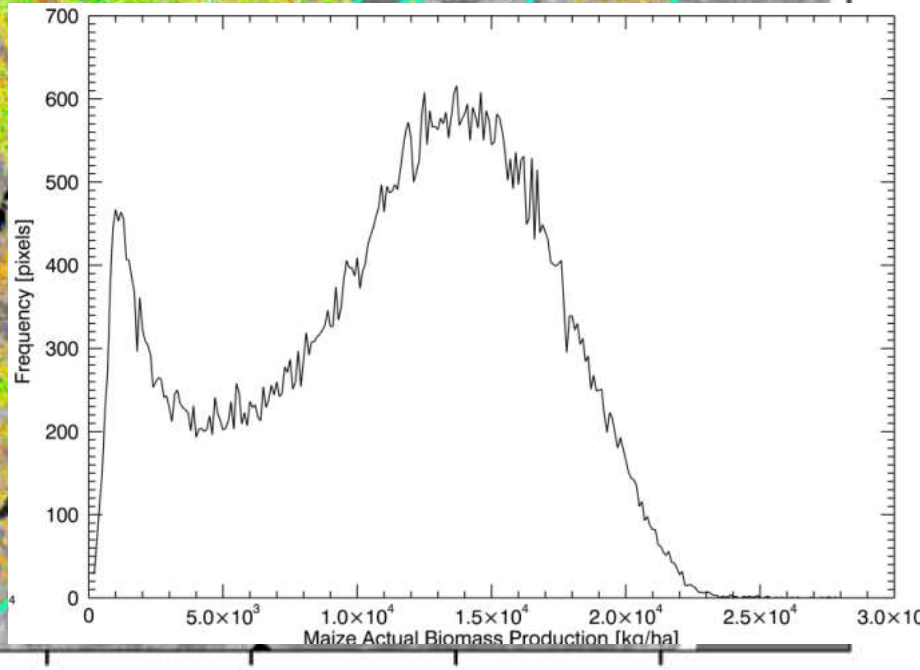
Accumulated biomass production



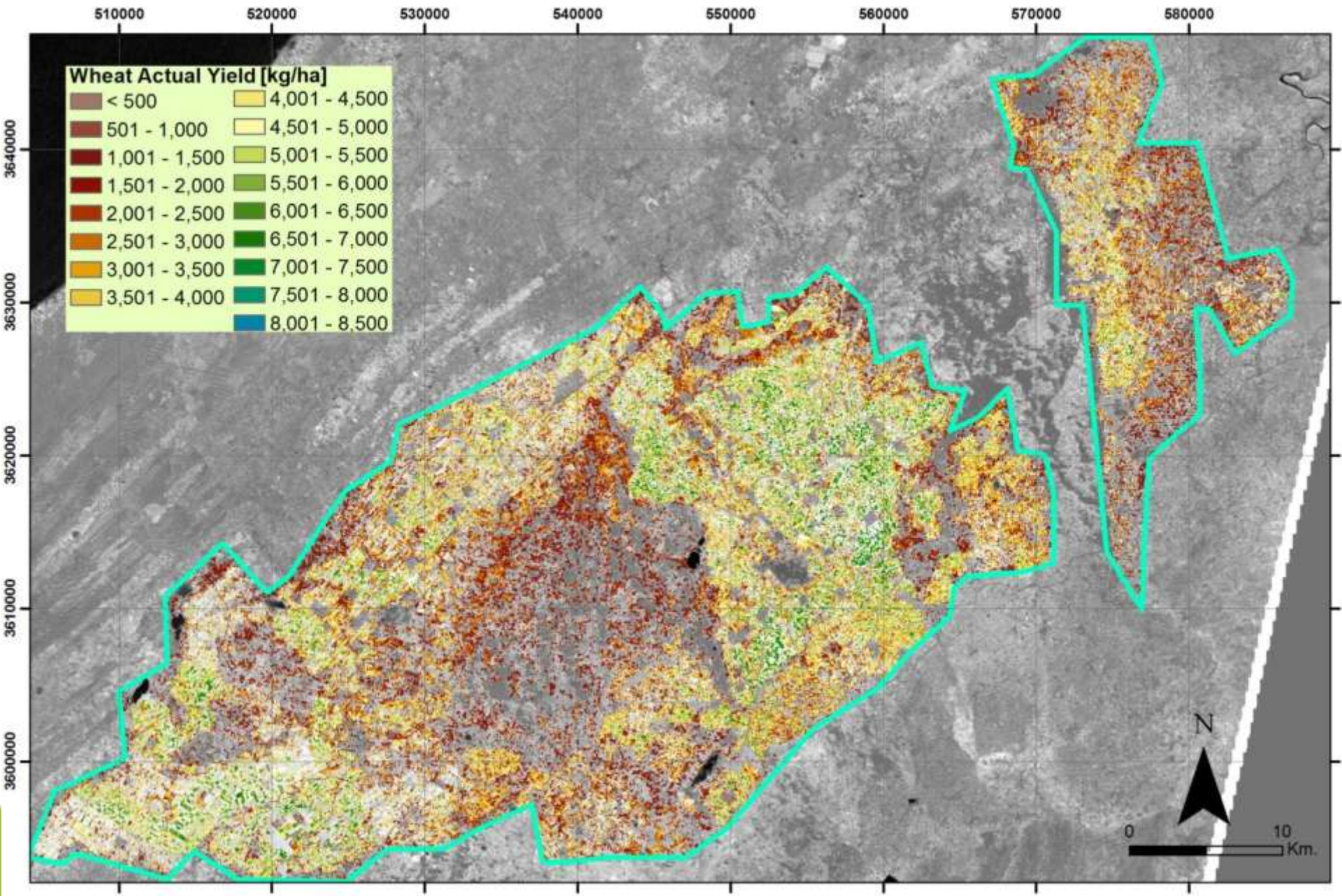
Accumulated biomass production







Wheat: actual crop yield



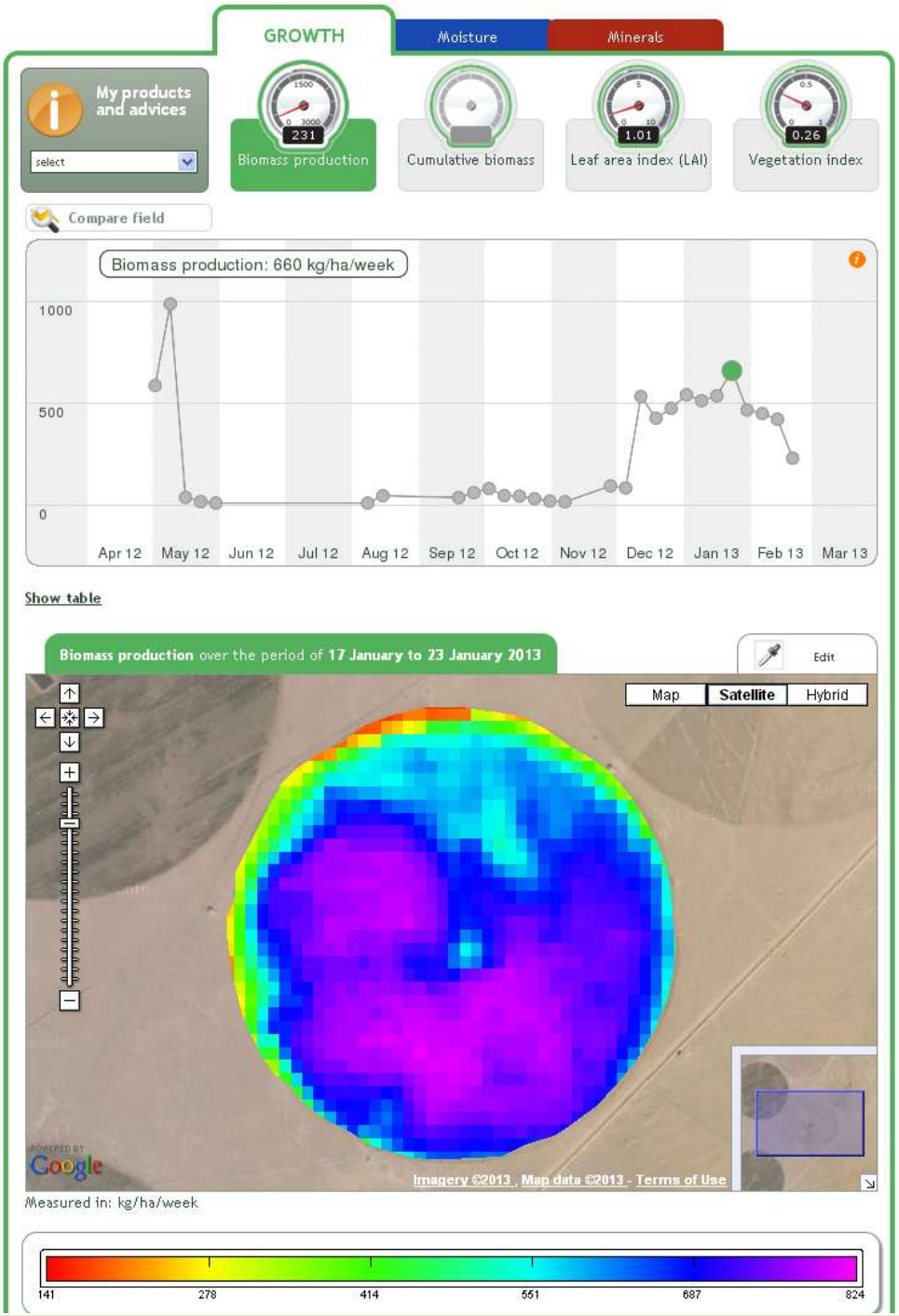
FieldLook.com

Weekly updates:

- Growth
- Moisture
- Minerals
- Returns

Applied in:

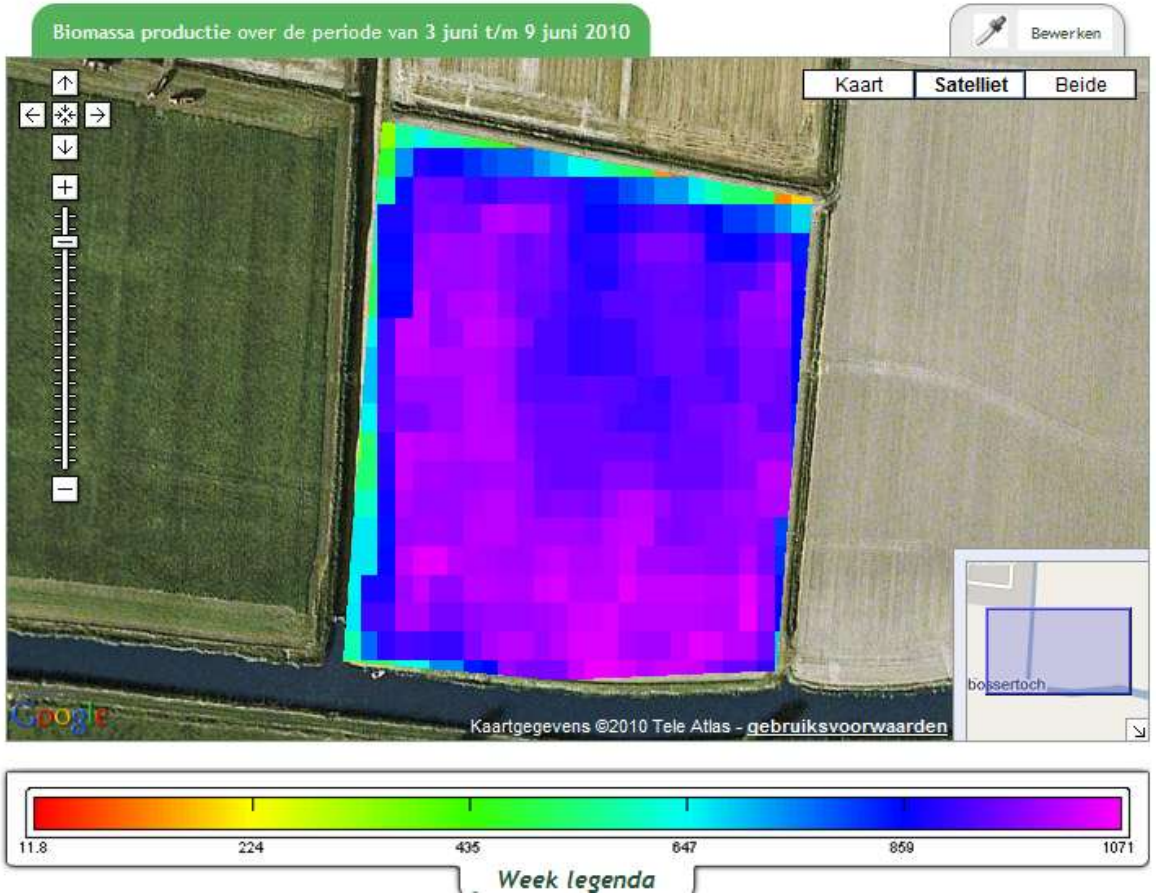
- Egypt, Ethiopia, Sudan, South Africa, Canada, Spain, Russia, Ukraine, Netherlands, Belgium



Mildew in Cereals

Biomass production second week of June:

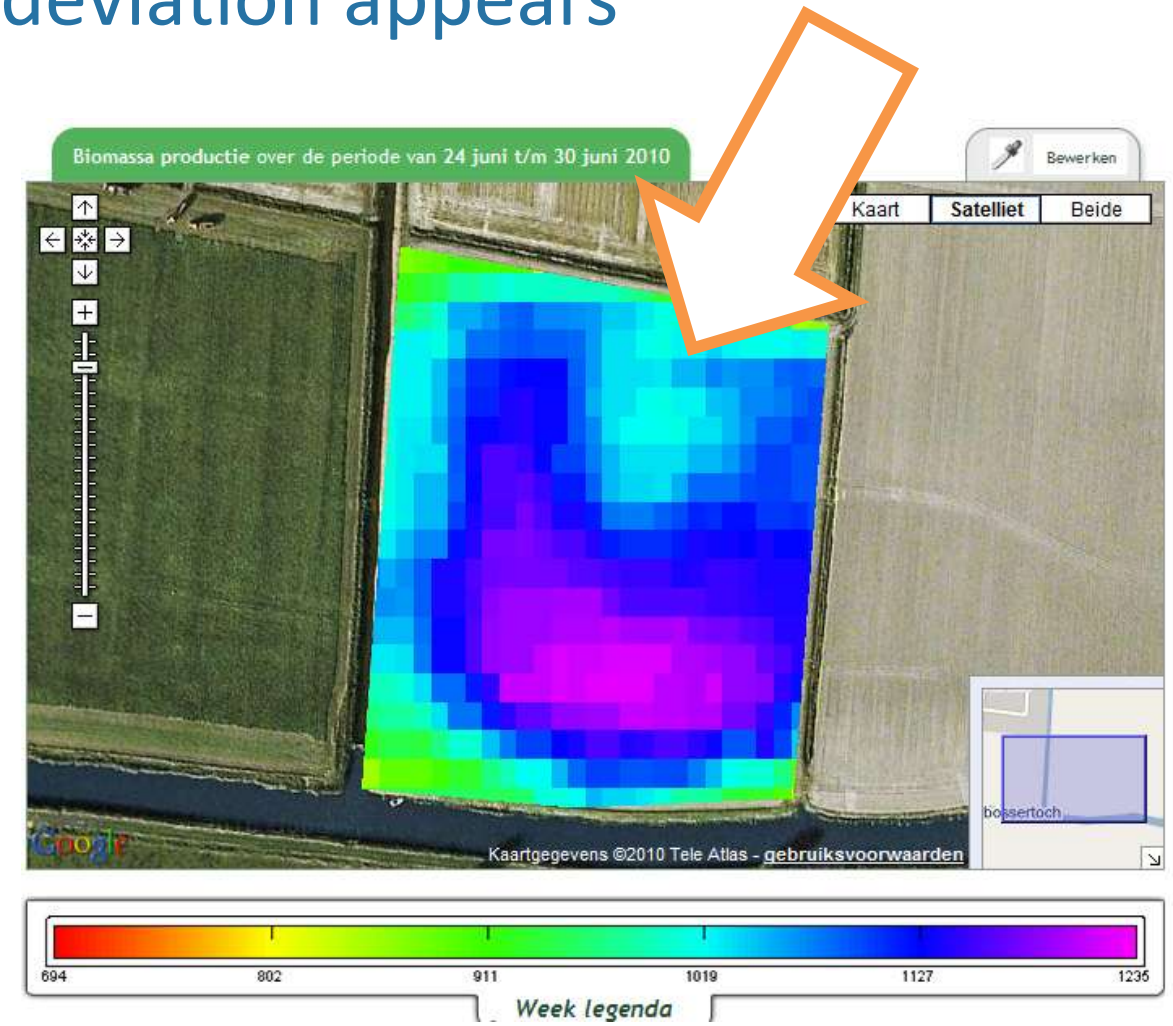
- normal and quit homogeneous



Mildew in Cereals

Biomass production fourth week of June:

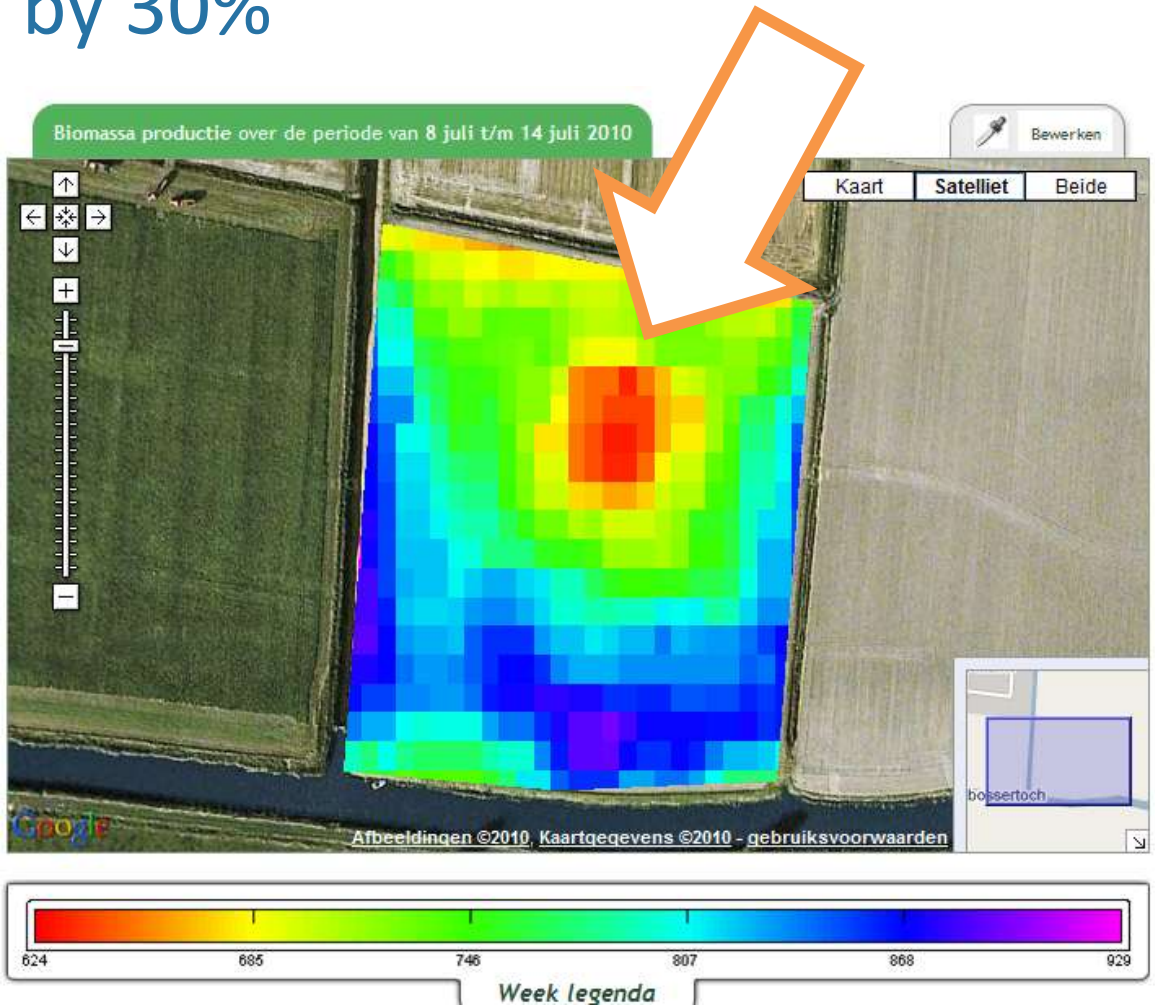
- Pattern deviation appears



Mildew in Cereals

Biomass production third week of July:

- Lagging by 30%

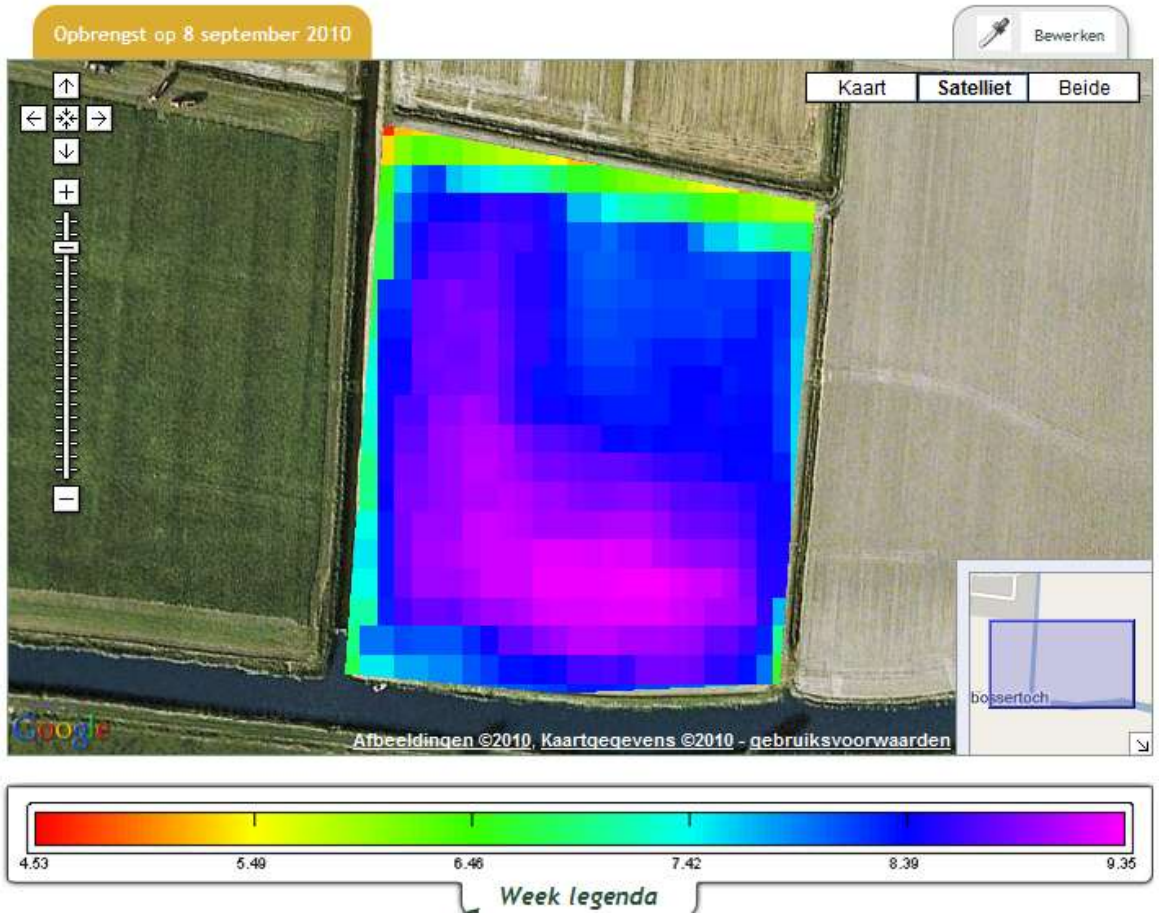


Mildew in Cereals

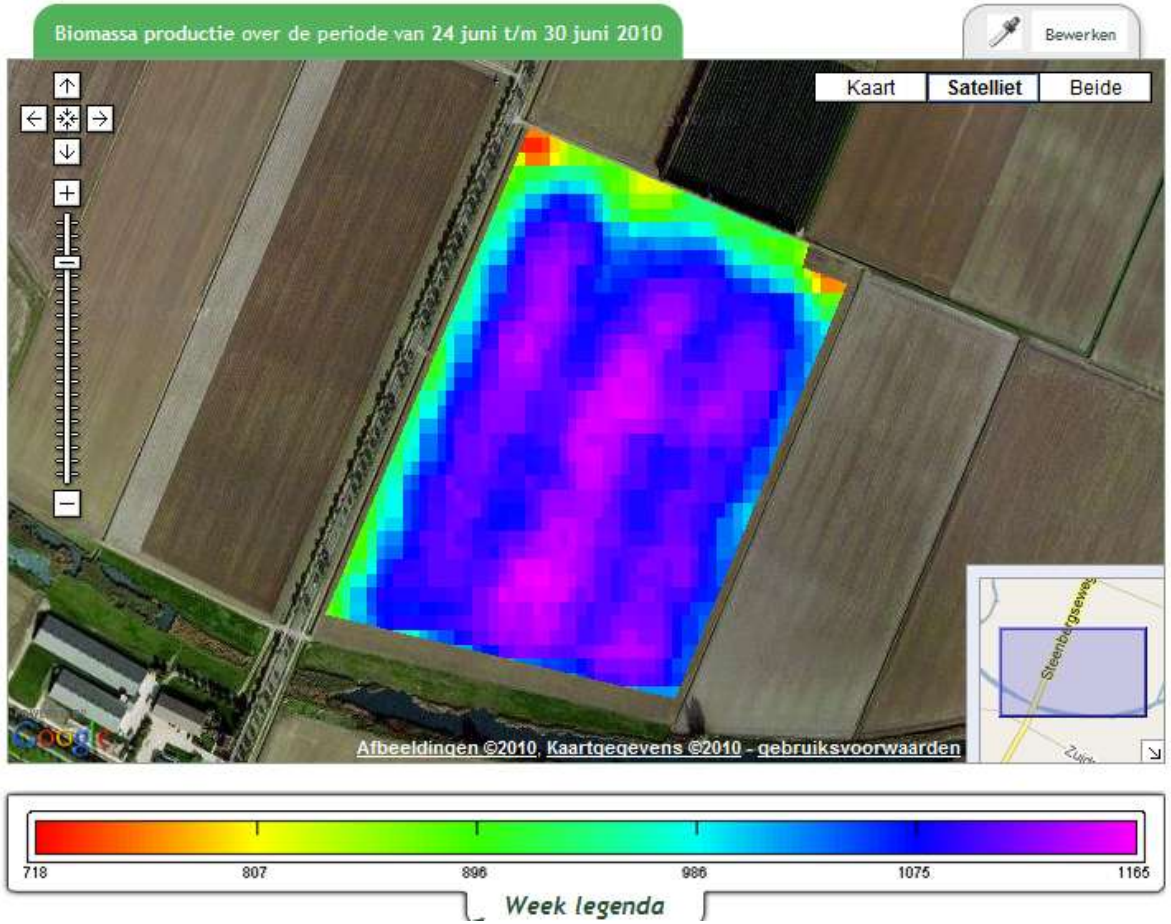
- Second week of August: Harvest
- Affected area yields 7.5 ton/ha instead of 9.5

- Missed earnings

  € 1500

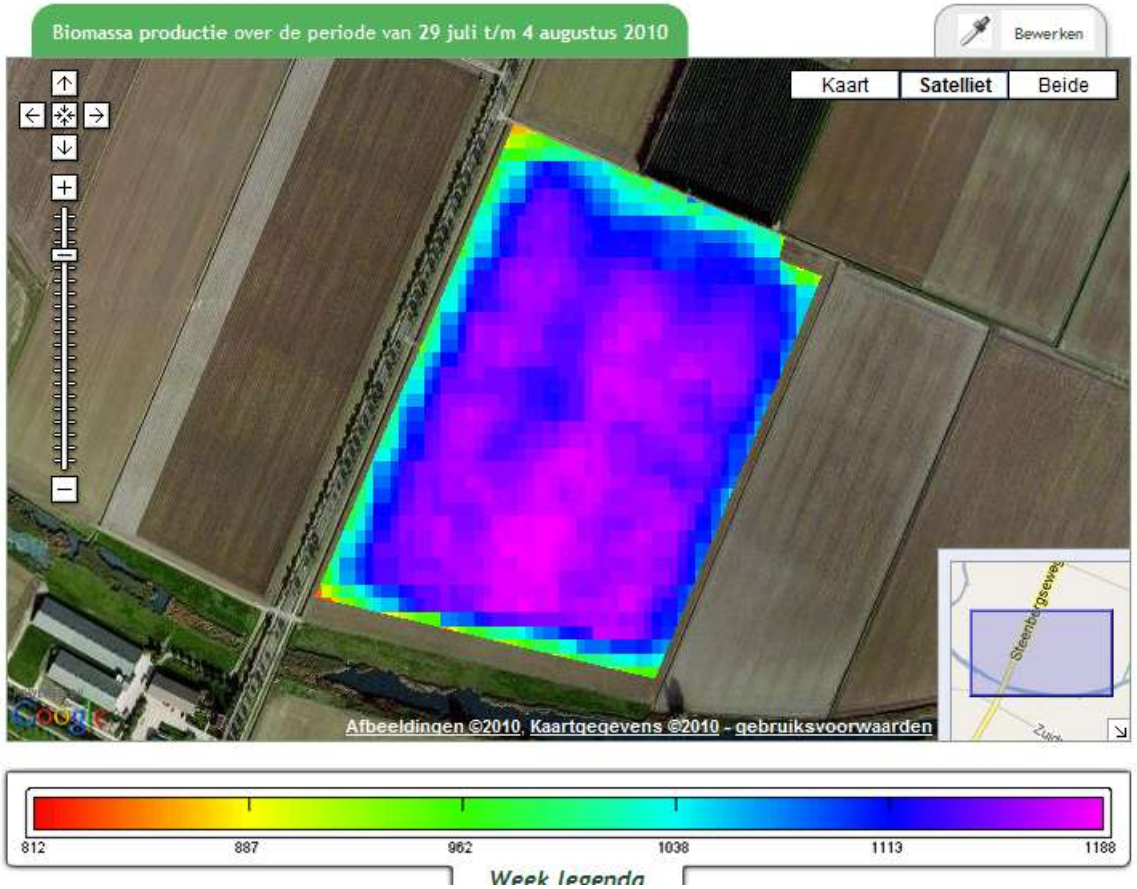


Poor irrigation potatoes



- 18 June: Irrigation in three passes
- One week later: lower biomass production between passes

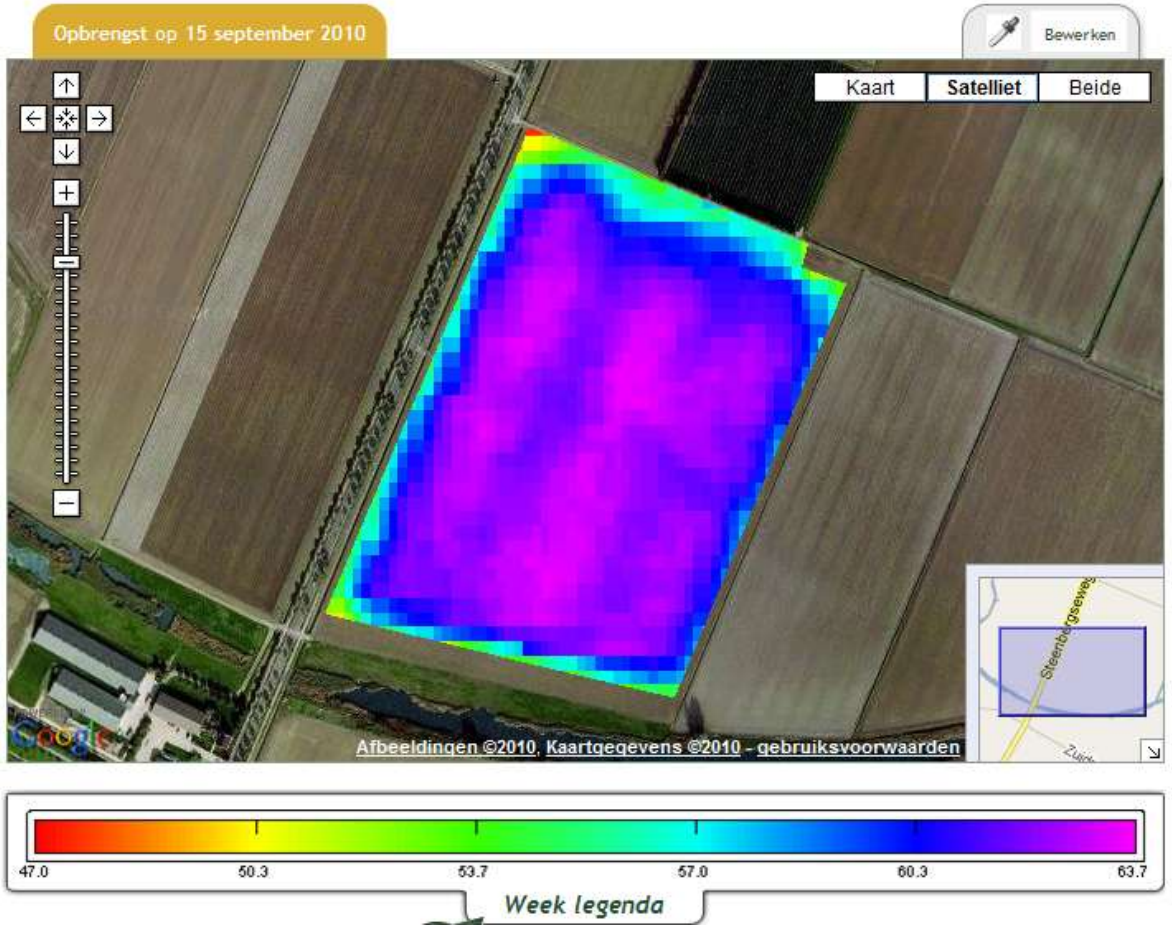
Poor irrigation potatoes



- Four weeks later: despite additional irrigation production keeps lagging.
- Not visible in the field!

Poor irrigation potatoes

- Ten weeks later: harvested
- Well irrigated areas yield 64 ton/ha
- Poor irrigated areas only 60 ton/ha



- Total missed earnings: € 2800

Conclusions

eLEAF provides quantitative pixel data

- Weather conditions up to 250*250 m^2
- Biomass production up to 20*20 m^2
- Actual crop yield for selected crops

- Objective measurements
- Covering large areas at once
- Damage can be quantified

Thank you

How can you benefit from space?

www.eleaf.com

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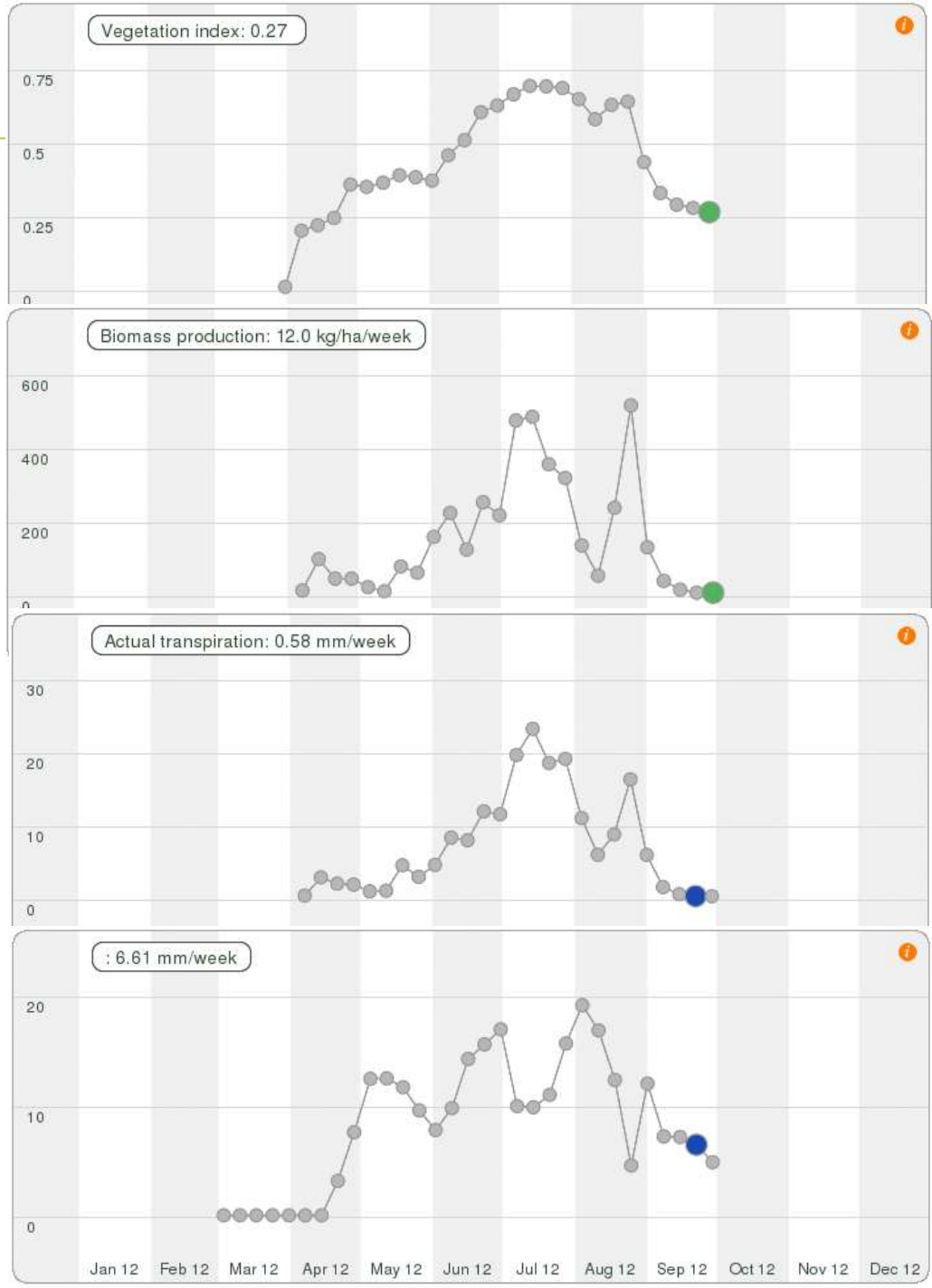
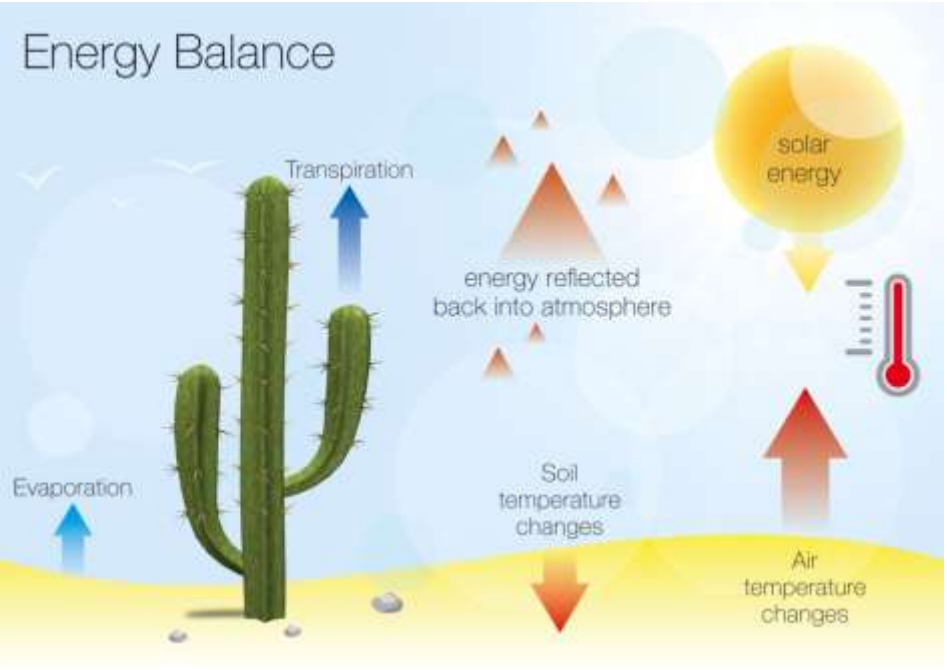
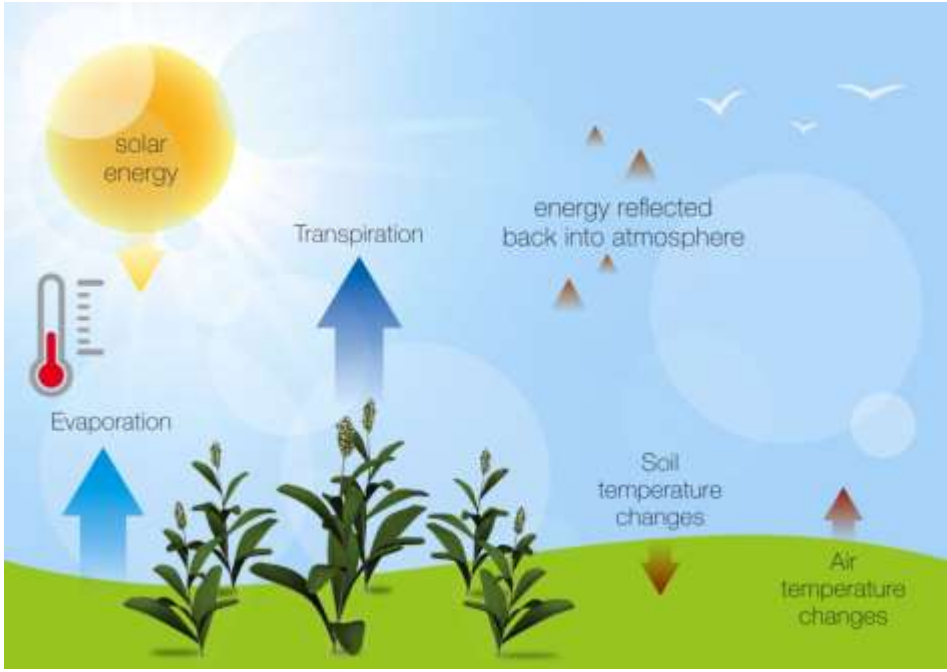
Just NDVI...?

- Smooth NDVI curve
- Biomass production varies from week to week [kg/ha/wk]
- Actual transpiration [mm/wk]
- Transpiration deficit [mm/wk]

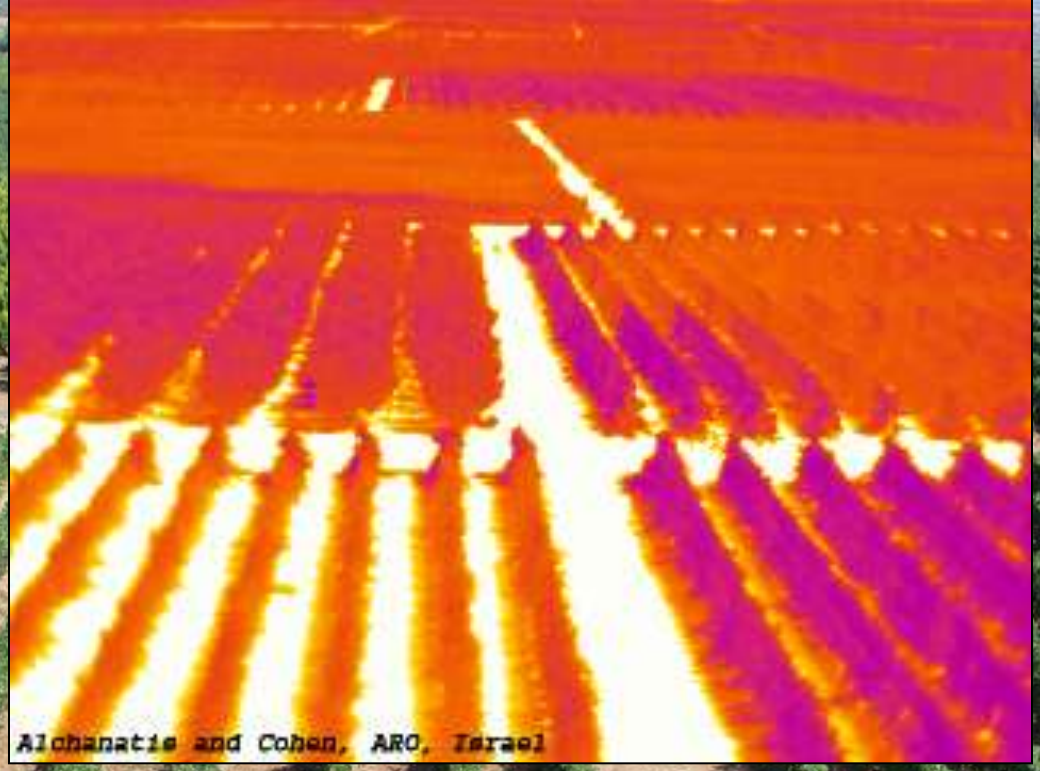


Energy balance





- SEBAL: *Surface Energy Balance Algorithm for Land*
- Successor: ETLook



Alchanatis and Cohen, ARO, Israel