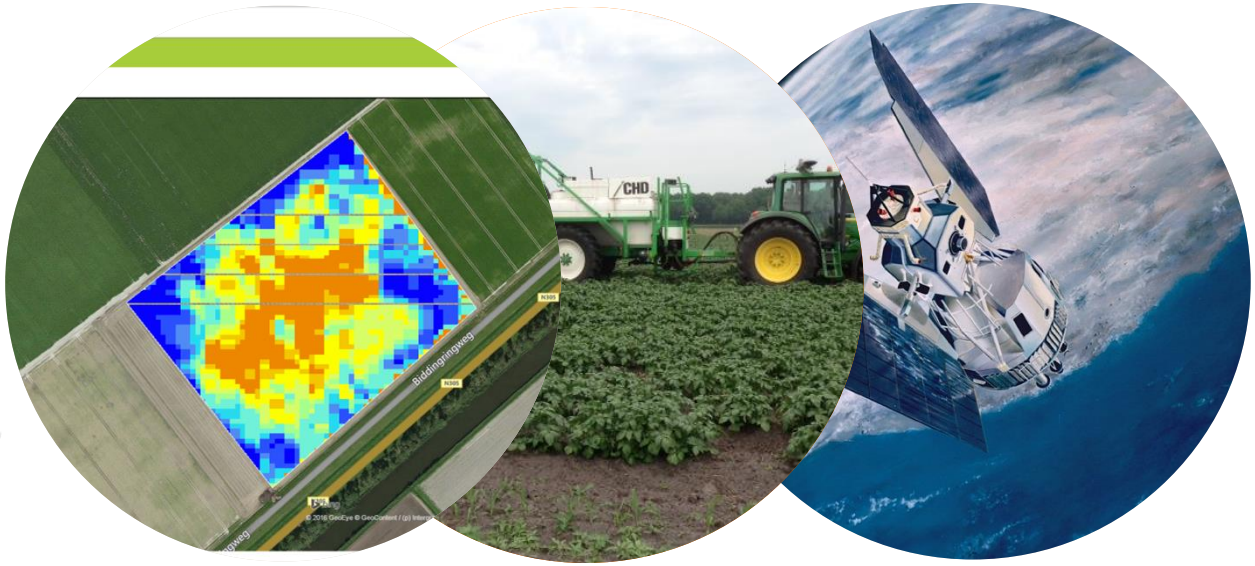
Use of GIS-platform in potato crop management

Corné Kempenaar et al.

Potato GAP workshop, Zhangjiakou, 15 July 2016



WAGENINGEN UR
For quality of life

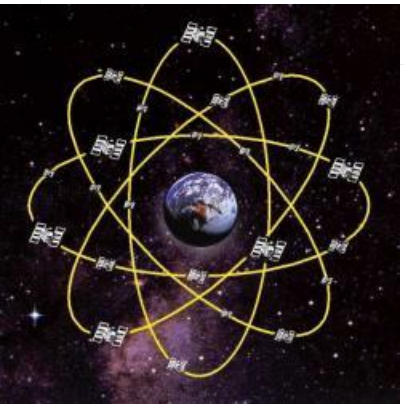
CAH Vilentum Hogeschool

Precision farming

- Precision farming is whole farm management concept based on measuring and responding to temporal and/or spatial variability in crops and livestock.
- Benefits: higher yields, better quality, less inputs, less environmental pressure, less tiring work, new business opportunities

- Enabling technologies are available
  - ICT, FMIS, GNSS, many sensors, data, implements, robotics
  - Smart implementation

GNSS on farms




Akkerweb Satellite
Test wisentweg
subsoyl

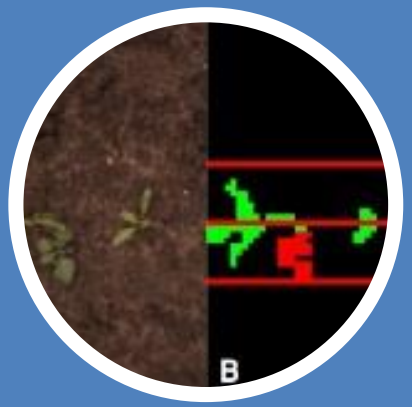
Precision farming and scale of precision

Grid

- In practice

Plant

- On station research



Leaf

- On institute research

Disease

- On institute and university research

Connecting DSS in PF applications

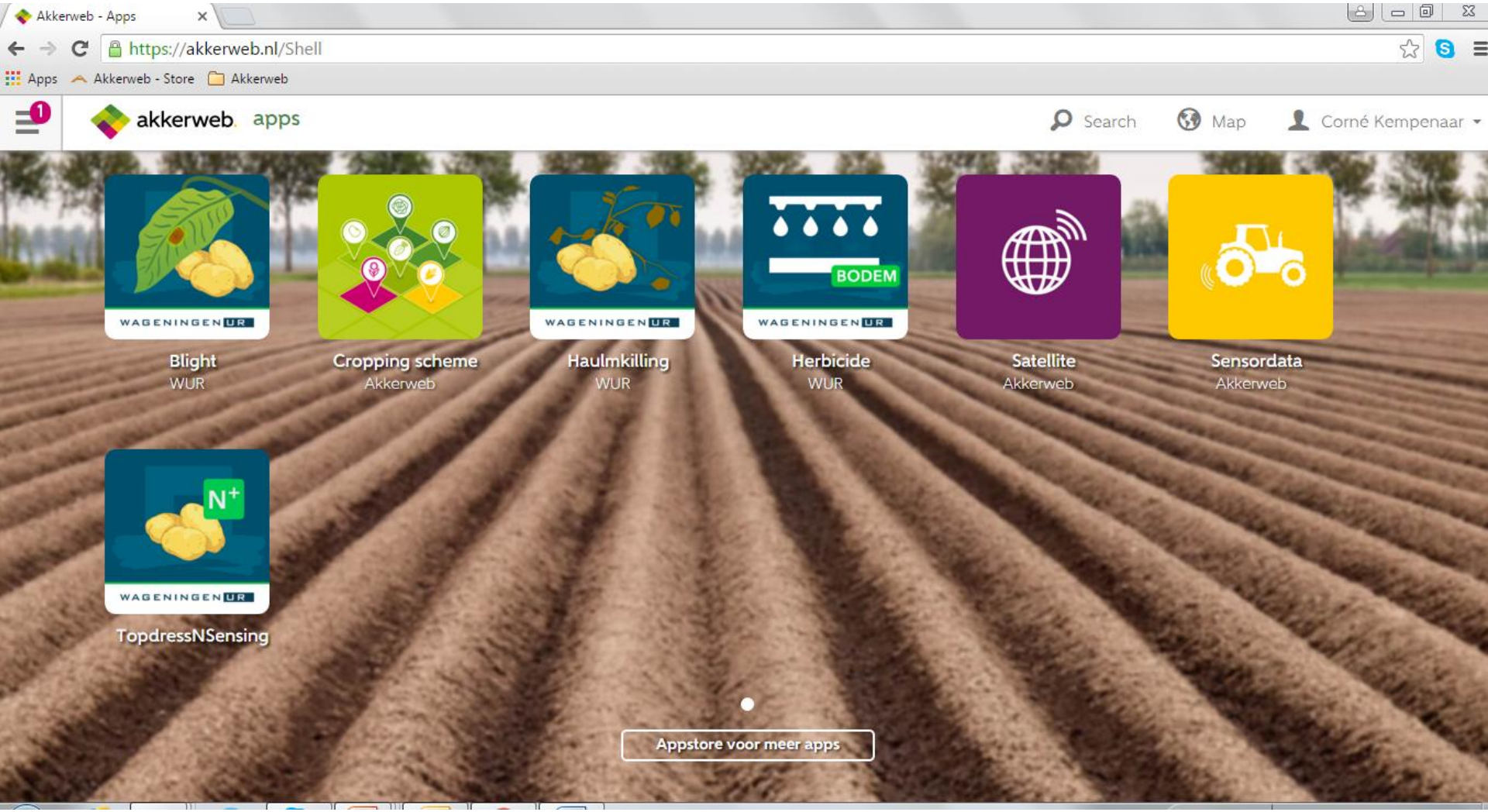
- Examples of variable rate application (VRA)
  - **Haulm killing potato**
  - Lime application
  - **Topdress Nitrogen potato**
  - **Soil herbicides**
  - Fuel use monitoring
  - Nematode management and granulate task maps
  - Late blight control (Geert Kessel presentation)

akkerweb.

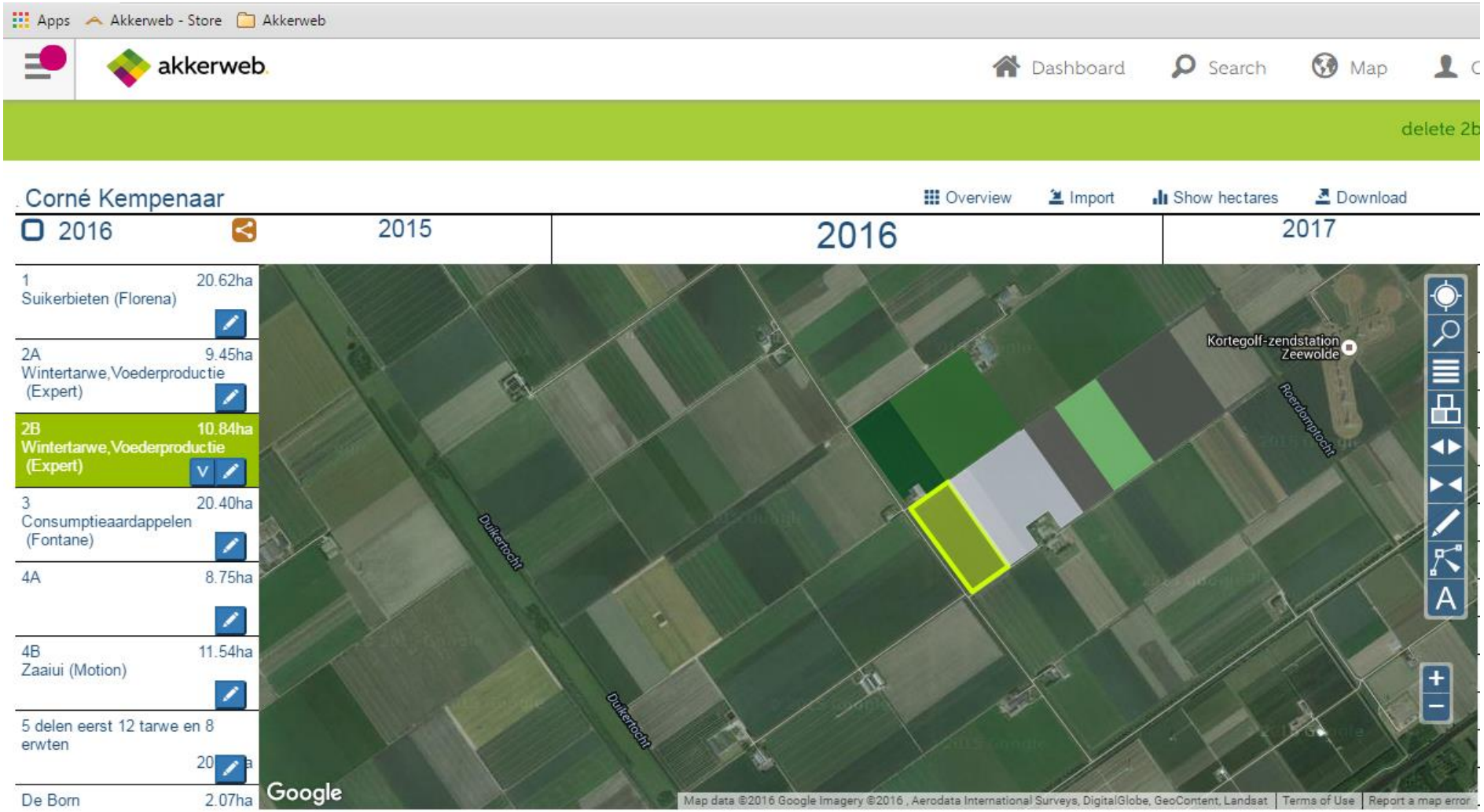
- An internet GEO-platform used by farmers and farm advisors to implement precision farming
  - Started in 2012
- A Public Private initiative of Wageningen UR, Agrifirm and DOBS
- Data ownership policy
- Basic Apps for free, other Apps for sale in store
- Status
  - > 20 Apps
  - Ca.30.000 Dutch fields in Akkerweb 2015

WAGENINGEN UR
For quality of life

My Akkerweb

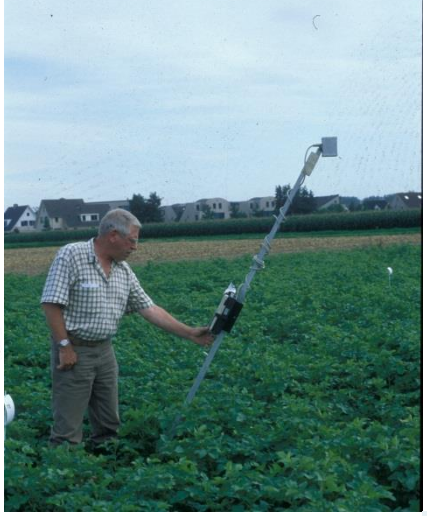

Akkerweb - Apps
https://akkerweb.nl/Shell
Apps
Akkerweb - Store
Akkerweb
akkerweb apps
Search
Map
Corné Kempenaar
WAGENINGEN UR
Blight
WUR
Cropping scheme
Akkerweb
Haulmkilling
WUR
BODEM
Herbicide
WUR
Satellite
Akkerweb
Sensordata
Akkerweb
N+
TopdressNSensing
Appstore voor meer apps

Akkerweb GEO-platform



WAGENINGEN UR
For quality of life

Biomass sensing



Remote sensing,

e.g. Worldview-2 Sensing with UAS and manned airplane

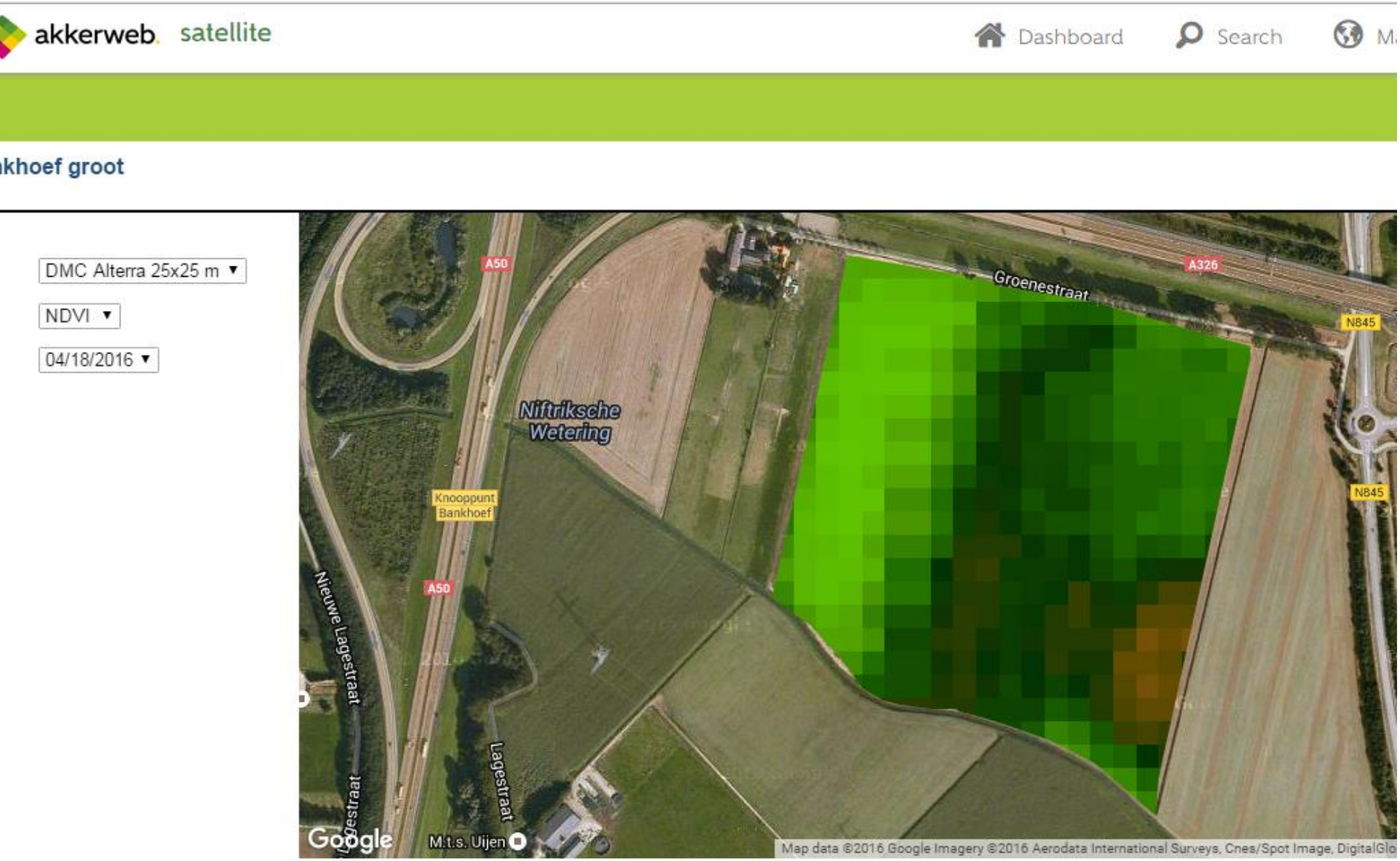
Overview of biomass indices

Index	Name	Formula	Authors (year)
NDVI	Normalized Difference Vegetation Index	$(R_{nir}-R_{red})/(R_{nir}+R_{red})$	(Rouse et al. (1974)
RVI	Ratio Vegetation Index	R_{nir}/R_{red}	Jordan (1969)
$WDVI_r$	$WDVI_r$, with red light reflection in formula	$R_{810}-(R_{810}-R_{560})xR_{560}$	Clevers (1989)
$WDVI_g$	$WDVI_g$, with green light reflection in formula	$R_{810}-(R_{810}-R_{660})xR_{660}$	Bouwman (1992)
REP-LI	Red Edge Position: Linear Interpolation method	$700+40x(Rre-R_{700})/(R_{740}-R_{700})$; and $Rre = (R_{670}+R_{780})/2$	Guyot et al. (1988)
MTCI	Meris Terrestrial Chlorophyll Index	$(R_{754}-R_{708})/(R_{708}-R_{680})$	Dash, Curran (2008)
TCARI	Transformed Chlorophyll Absorption in Reflectance Index	$3x((R_{700}-R_{670})-0.2x(R_{700}-R_{550})x(R_{700}/R_{670}))$	Haboudane et al. (2002)
TCARI/ OSAVI	TCARI with Optimized Soil-Adjusted Vegetation Index	$1.16x(R_{800}-R_{670})/(R_{800}+R_{670}+0.16)$	Haboudane et al. (2002)
MCARI	Modified Chlorophyll Absorption Index	$(R_{700}-R_{670})-(0.2x(R_{700}-R_{550})x(R_{700}/R_{670}))$	Daughtry et al. (2000)
DCNI	Double-peak Canopy Nitrogen Index	$((R_{720}-R_{700})/(R_{700}-R_{670})/ (R_{720}-R_{670}+0.03))$	Chen et al. (2010)
NDRE	Normalized Difference Red Edge index	$(R_{780}-R_{720})/(R_{780}+R_{720})$	Eitel et al. (2010)

R_{nir} = reflection at near-infrared wavelengths, R_{red} at red light wavelengths, other reflections at specified wavelengths.

Satellite image of potato crop (Aug. 2015)

Sat. image April ’16 (wheat crop)



Haulm killing DSS

Herbicide data

Weather data, forecast, soil moisture

FMIS: Crop management data

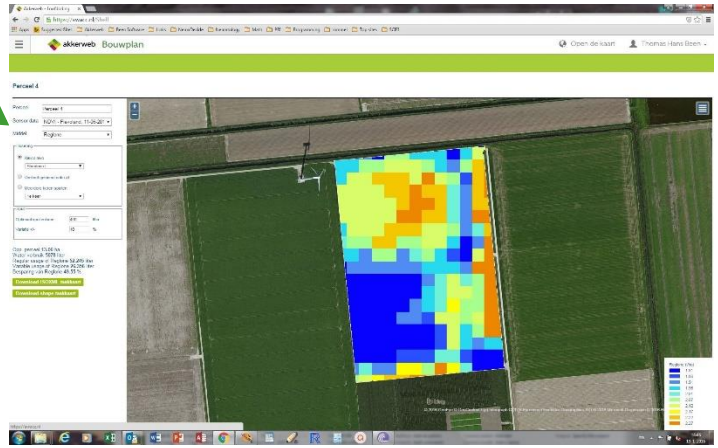
Variety data

WUR minimum effective dose model

Crop biomass data (NDVI, WDVI, S1)

WUR PHK VRA App op Akkerweb

Others, e.g. weeds on field



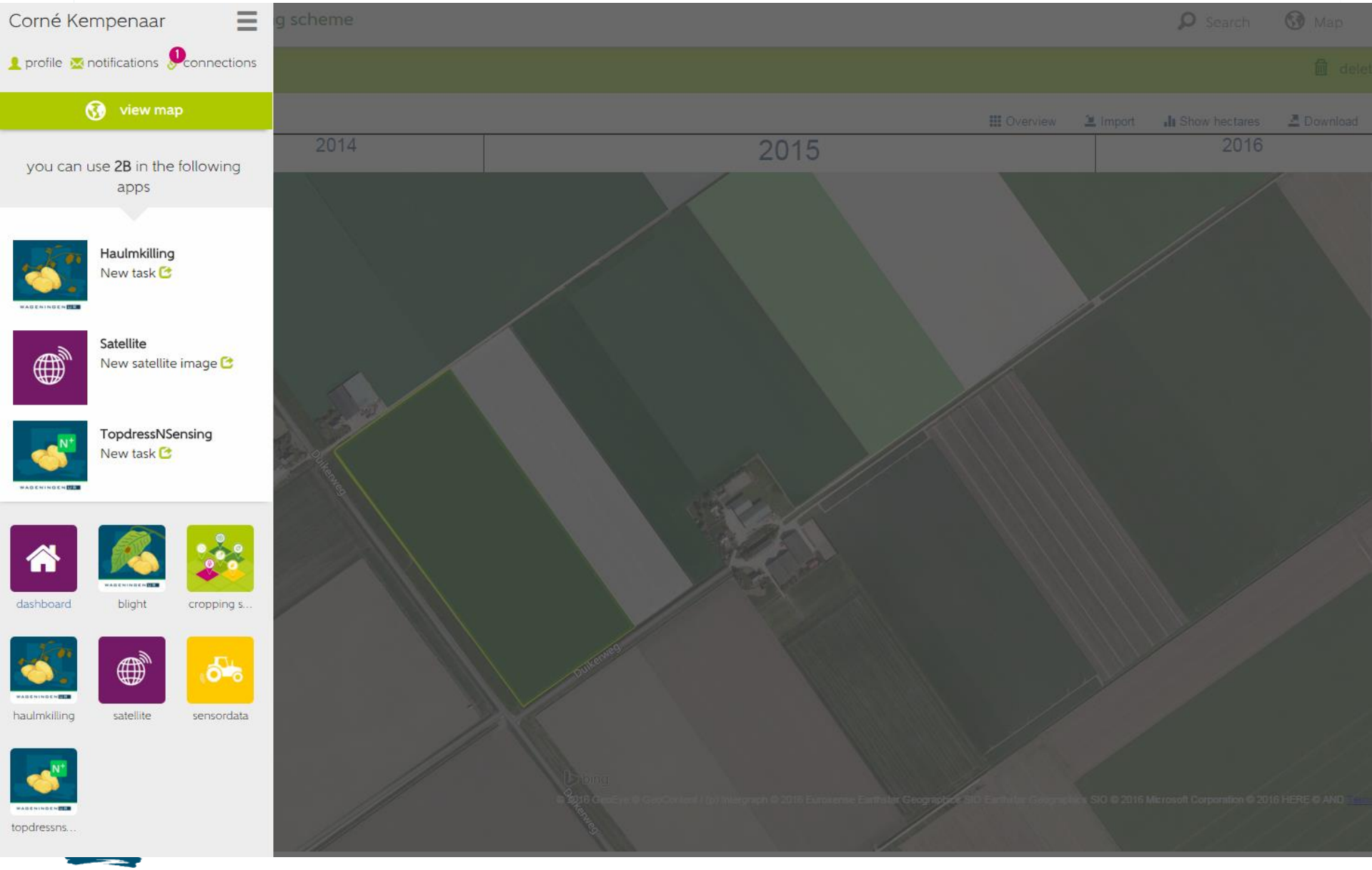
WAGENINGEN UR
For quality of life

VRA Potato haulm killing App.

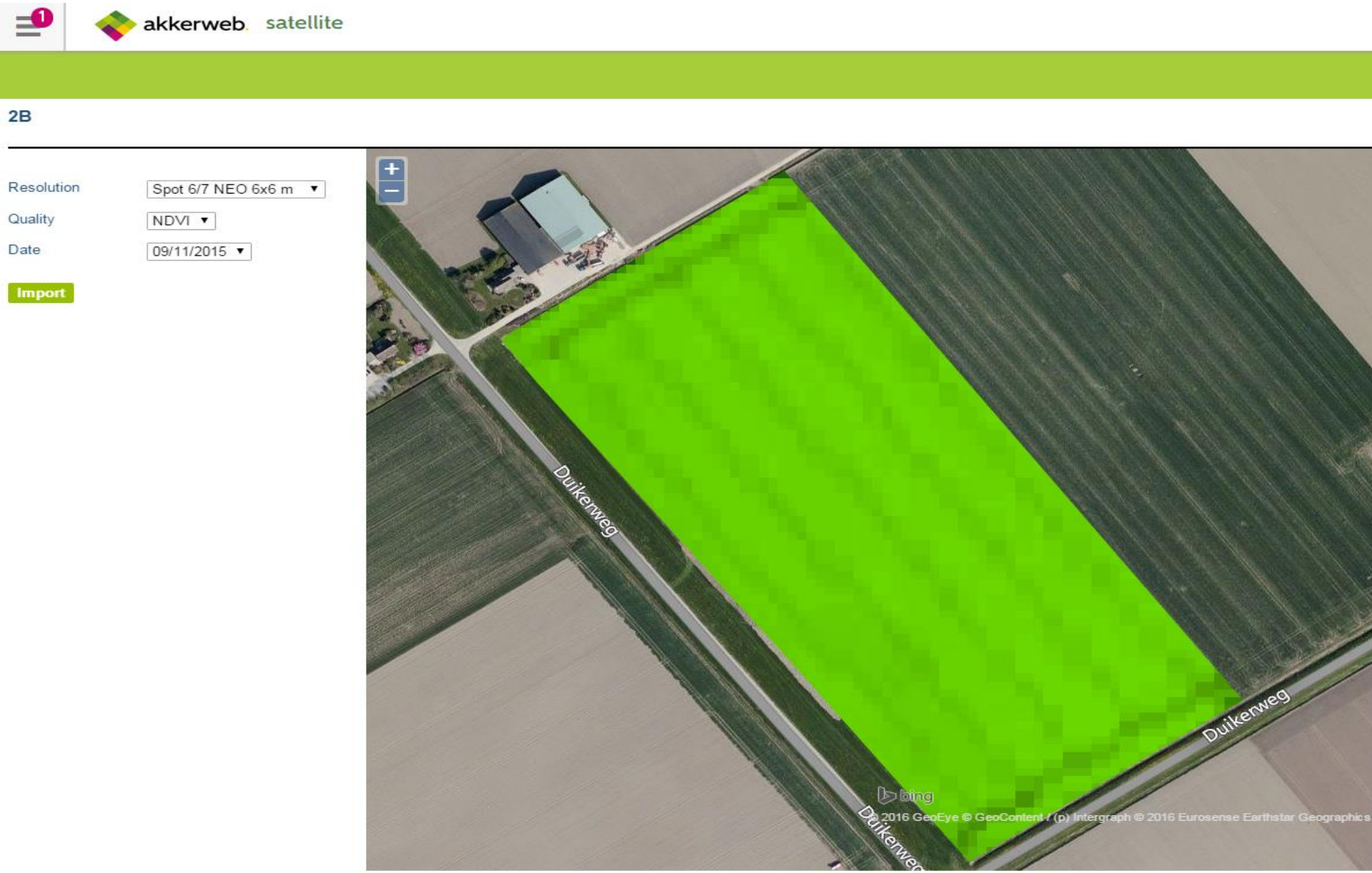
- VRA of potato haulm killing herbicides on basis of variation in crop biomass on the field
- Apps on Akkerweb
- Access to crop biomass data
    - Satellite, drone, proximal sensors

Selection of field in crop rotation

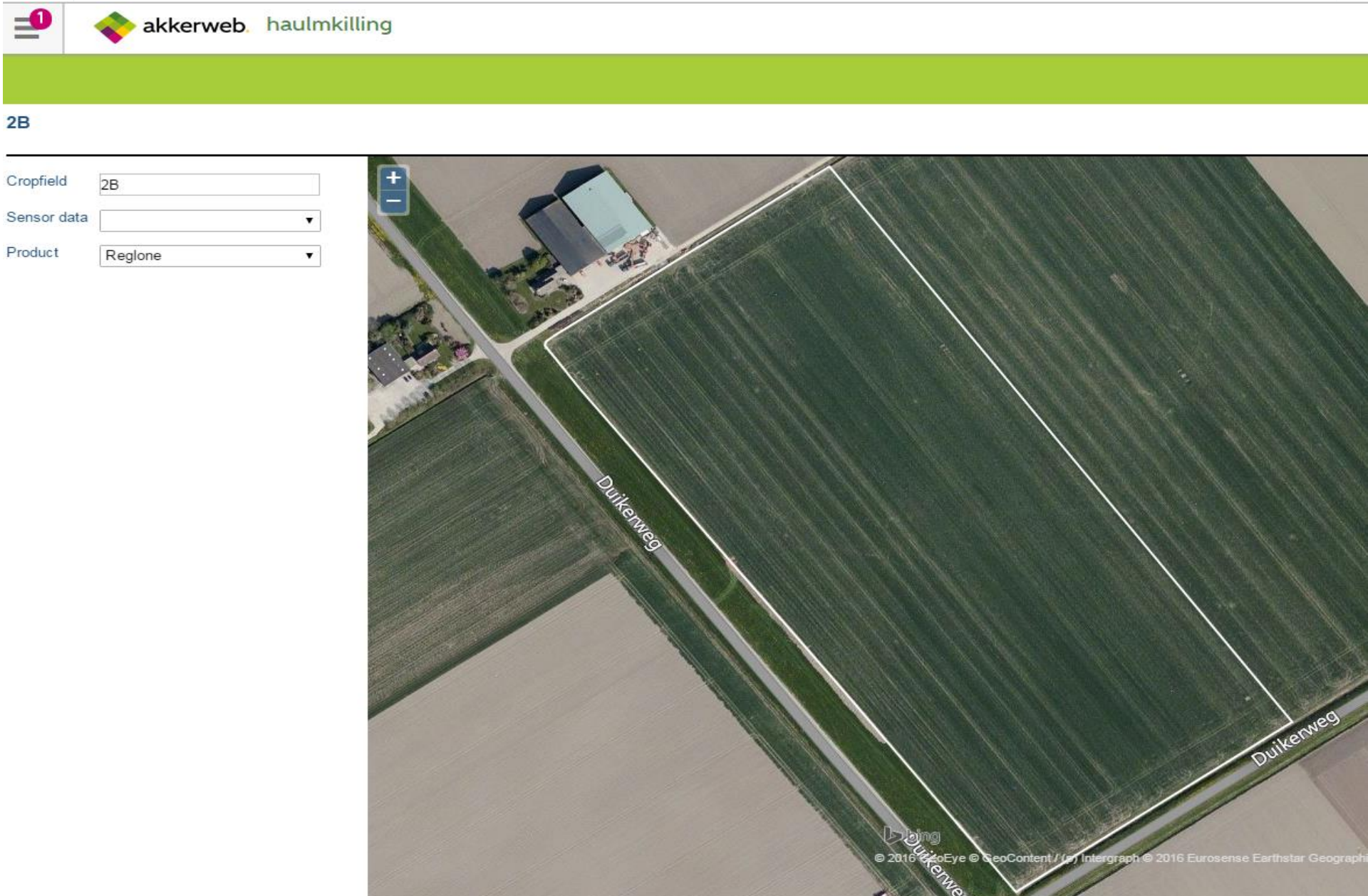
Go to Apps


Corné Kempenaar
profile
notifications
connections
view map
you can use 2B in the following apps
Haulmkilling
New task
Satellite
New satellite image
TopdressNSensing
New task
dashboard
blight
cropping s...
haulmkilling
satellite
sensordata
topdressns...
g scheme
Search
Map
Overview
Import
Show hectares
Download
2014
2015
2016
Dijkenweg

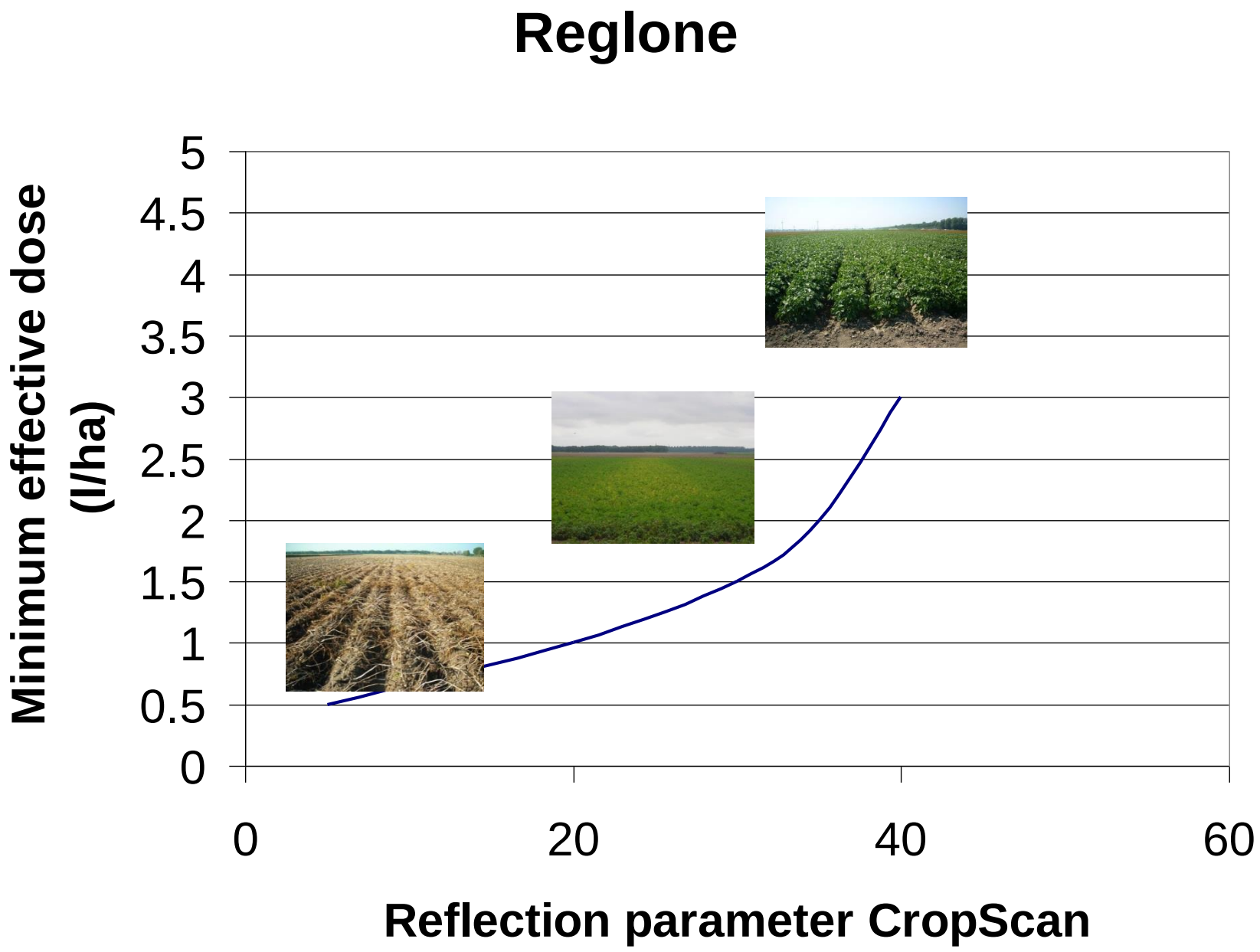
Processed satellite image download



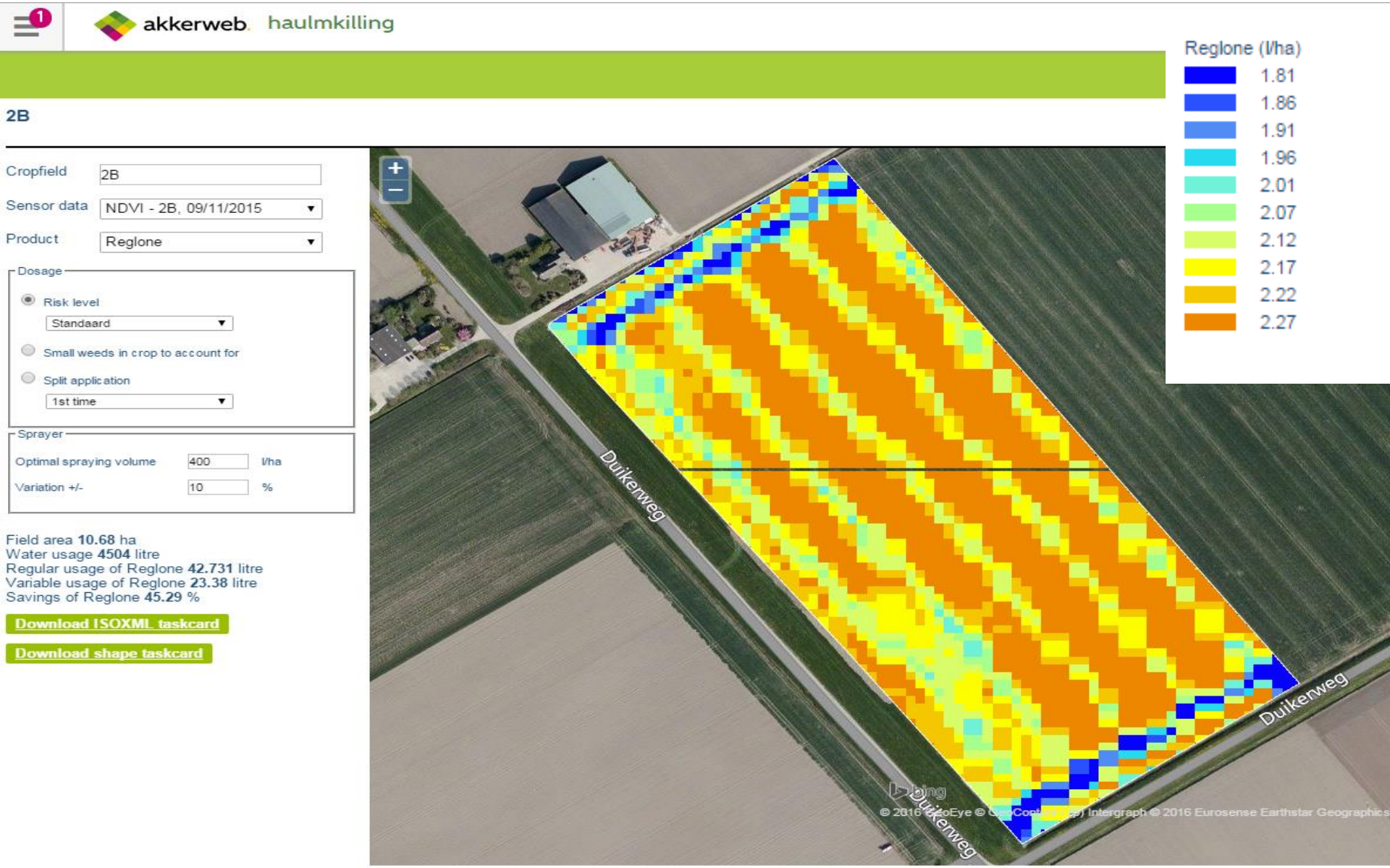
Select sensor data



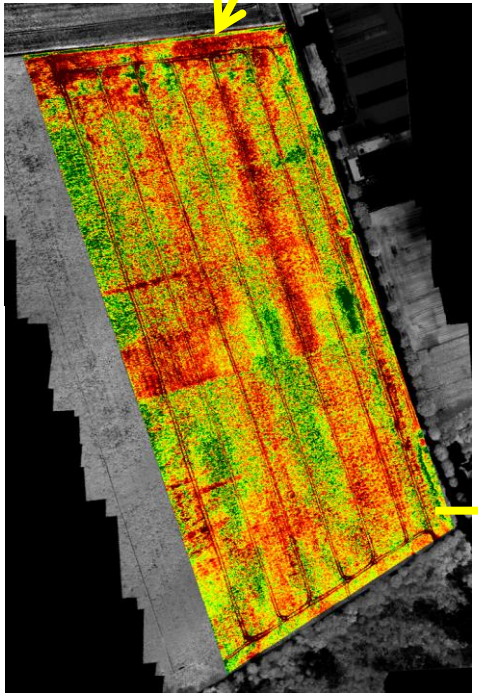
Decision support algorithm

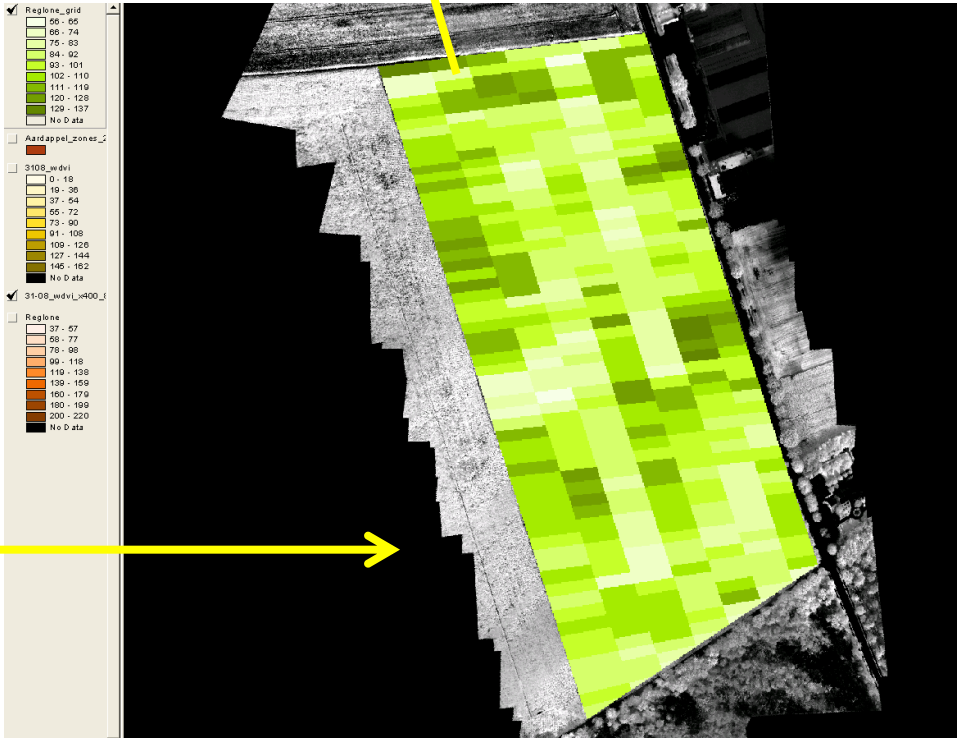


Calculate apply map



Biomass map from UAS,
DSS gives task map (2012)





Acknowledgement: TerraSphere, Vd Borne

SensiSpray: variable rate application on the go

WAGENINGEN UR
For quality of life

VRA Topdress N in potato App

- VRA of nitrogen based on site specific N-content of the aboveground biomass, and crop growth and nitrogen uptake models
- Apps on Akkerweb
- Access to N-content data

Topdress N potato DSS

Weather data and prediction

N mineralization prediction and N soil data

FMIS: Farm and crop management data

Crop and variety data

WUR potato growth and NUE models

N in crop biomass data and prediction

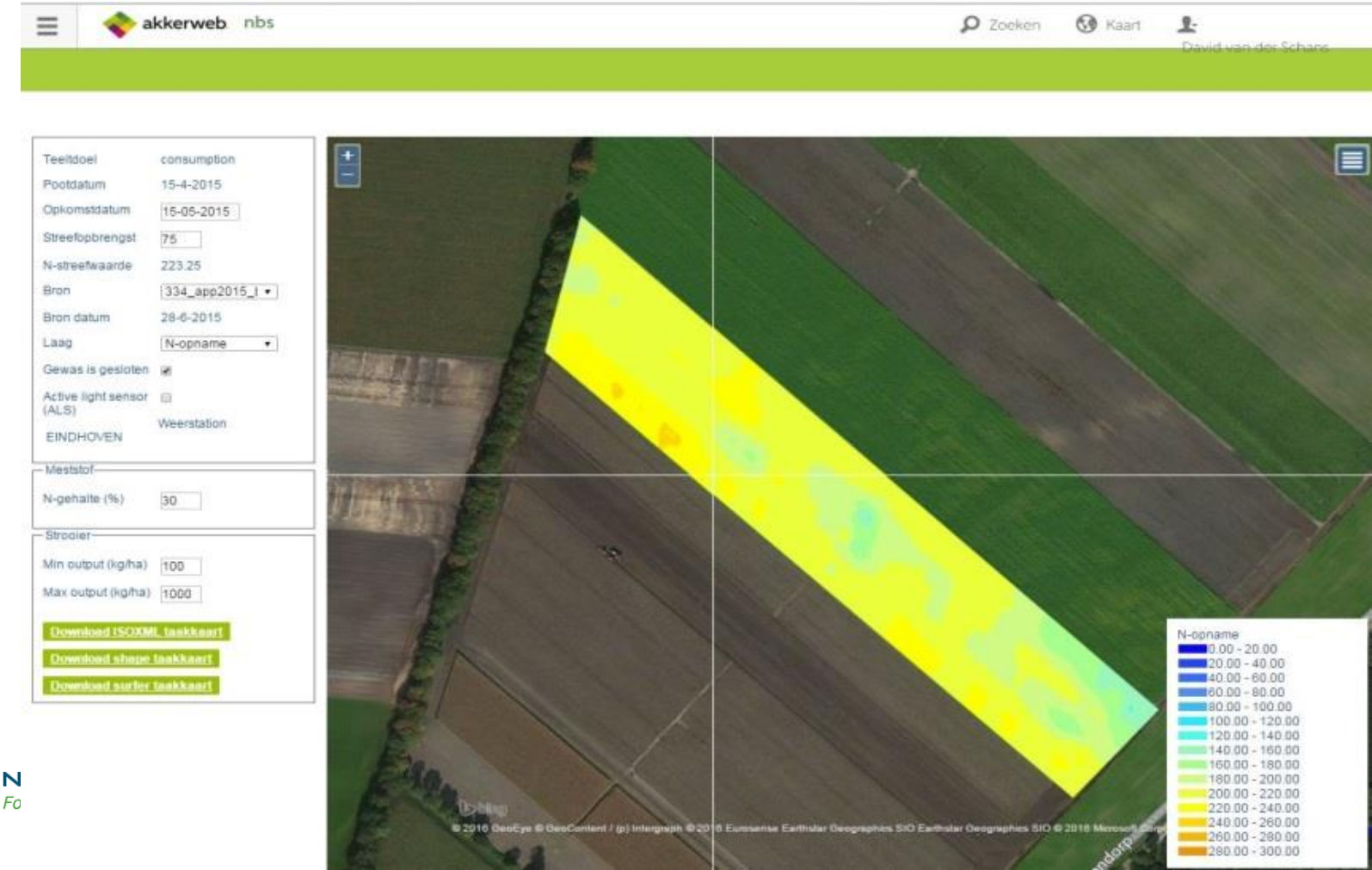
WUR N topdress App on Akkerweb

Others, expected yield data and fertilizer data

WAGENINGEN UR
For quality of life

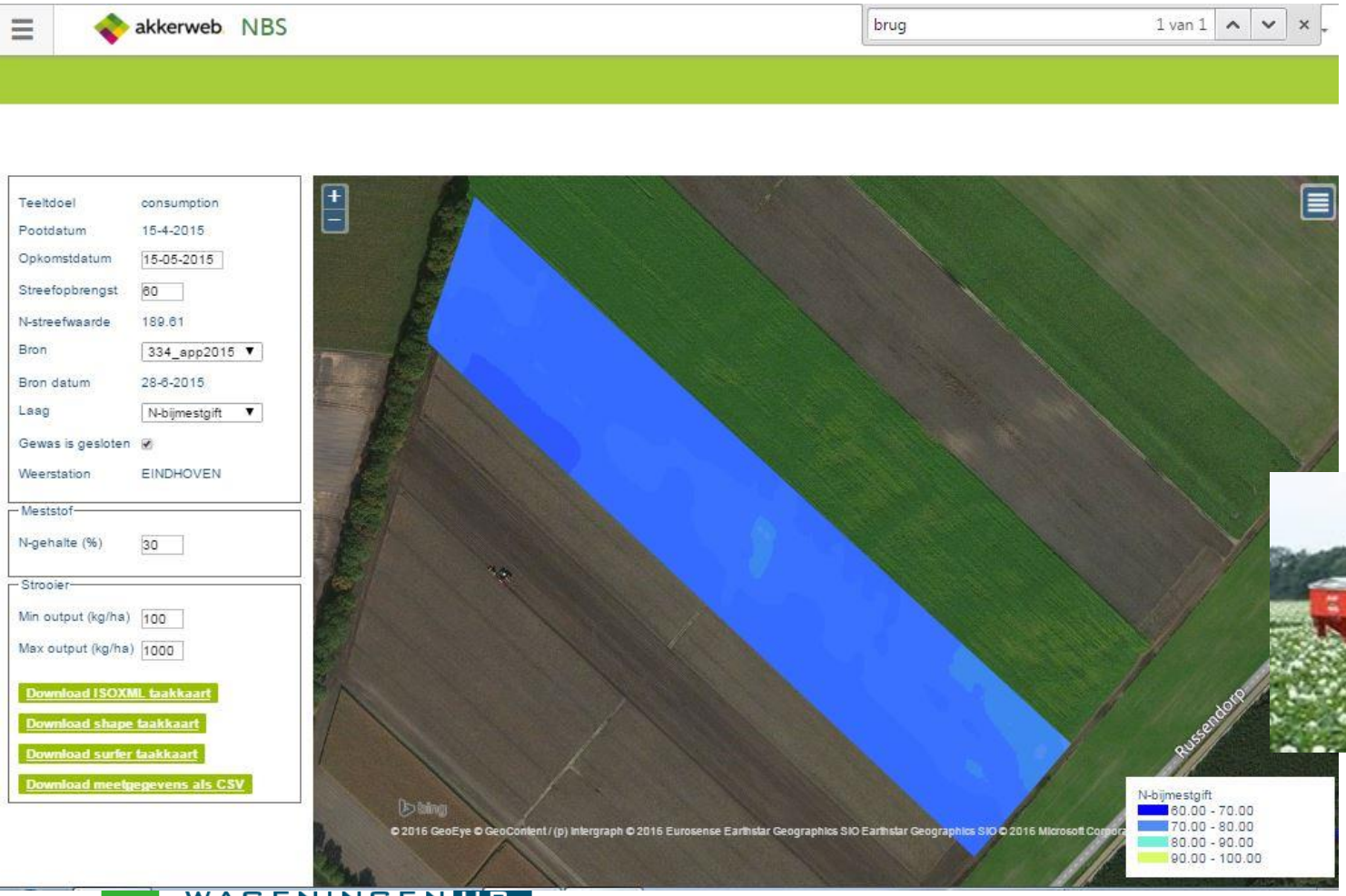
Step 1

Crop sensing and Calculation of N-uptake from proximal sensor(in kg N/ha)



Step 2

Calculation of task map N-rate in kg N/ha and application



WAGENINGEN UR
For quality of life

VRA Soil herbicides App.

- VRA of herbicides based on site specific variation in soil properties
- Apps on Akkerweb
- Access to soil maps and other data

Soil herbicide DSS

Herbicide data

Weather data and prediction;
Soil moisture

FMIS: Farm and crop management data

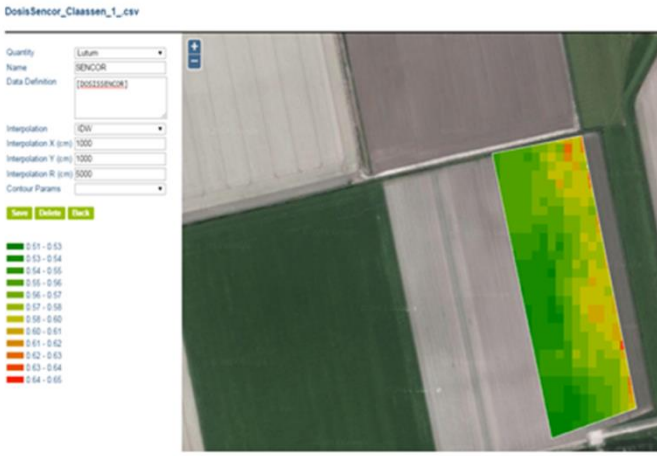
Crop and variety data

WUR minimum effective dose models

Soil data and maps **(clay, o.m. and/or pH**)

WUR herbicide App on Akkerweb

Others, e.g. weed (prediction) data



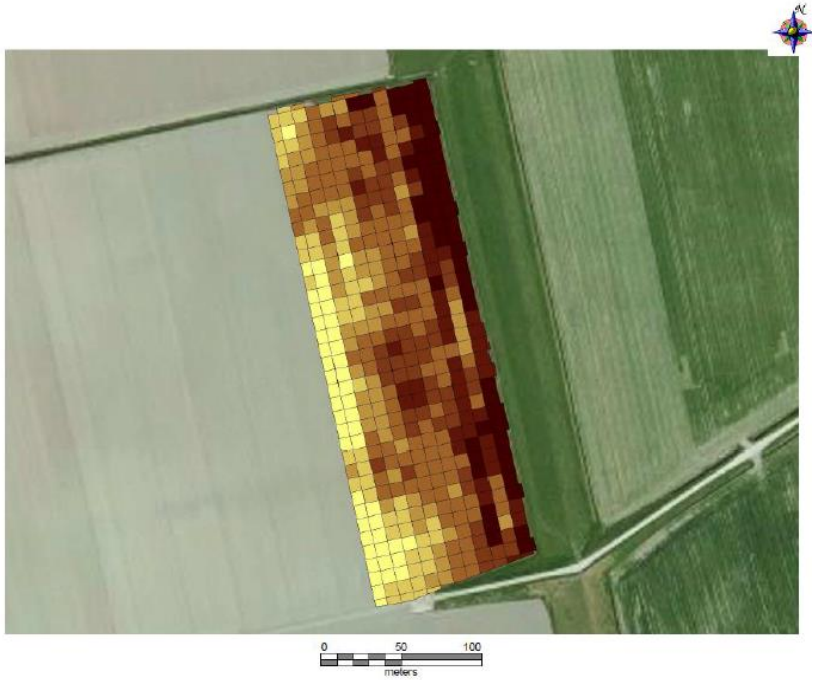
WAGENINGEN UR
For quality of life

Soil sensors systems in practice

WAGENINGEN UR
For quality of life

Soil maps organic matter and clay content (Veris sensor)

VERIS ORGANISCHE STOF KAART



Klant: claasen
Bedrijf: 2015 21jan
Perceel: laauwersmeer
Naam: ph hg ec - 9.00 m
Min: 1,3 %
Max: 4,8 %
Gem: 2,7 %

3,5 - 4,8 %	0,45 ha	
3,2 - 3,4 %	0,36 ha	
2,9 - 3,1 %	0,50 ha	
2,5 - 2,8 %	0,96 ha	
2,2 - 2,4 %	0,50 ha	
1,9 - 2,1 %	0,36 ha	
1,3 - 1,8 %	0,35 ha	

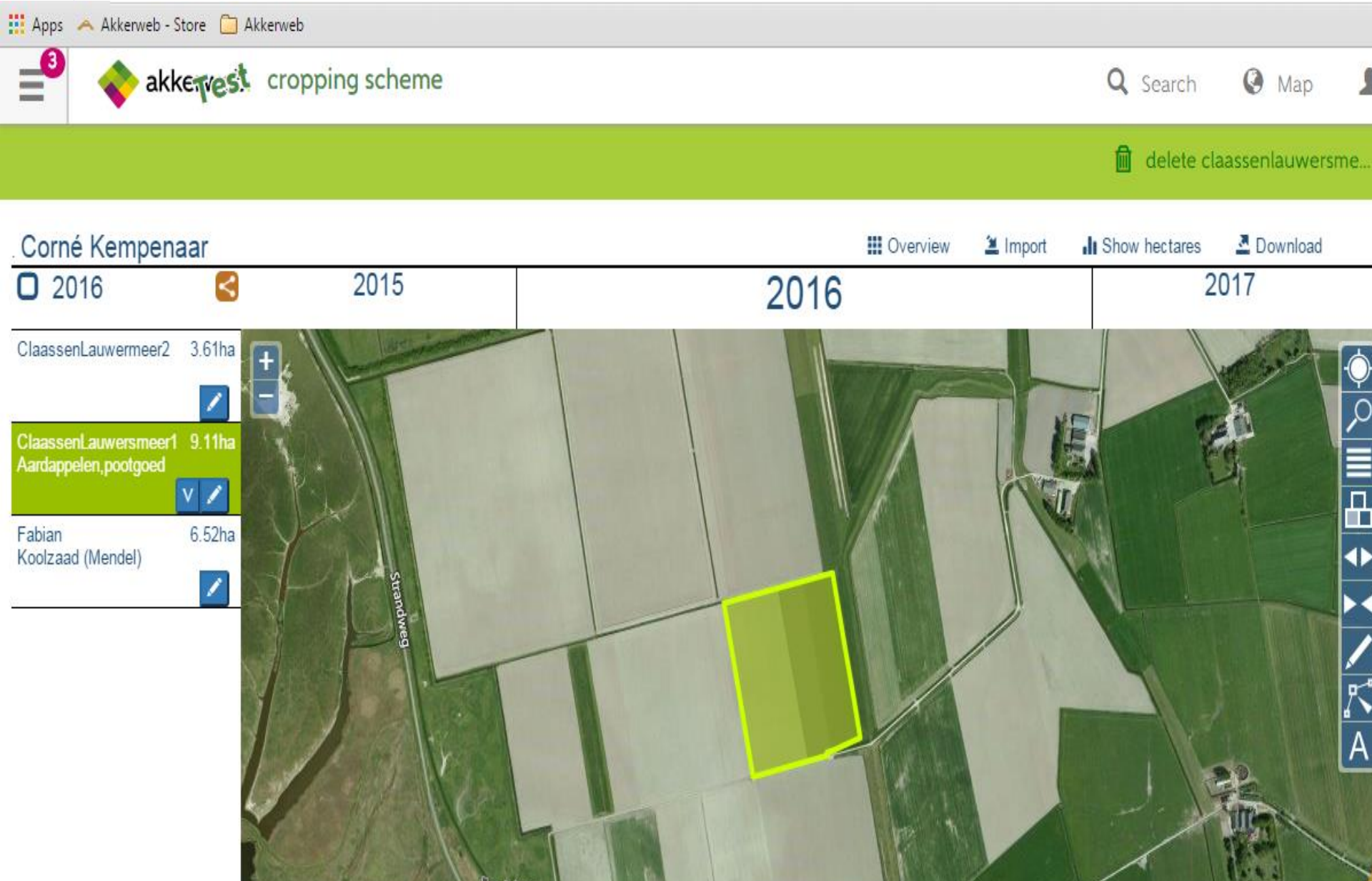
laauwersmeer
Lutum

Klant: claasen
Bedrijf: 2015 21jan
Perceel: laauwersmeer
Naam: lu ph hg ec - 9.00 m
Min: 6,0 %
Max: 18,4 %
Gem: 11,5 %

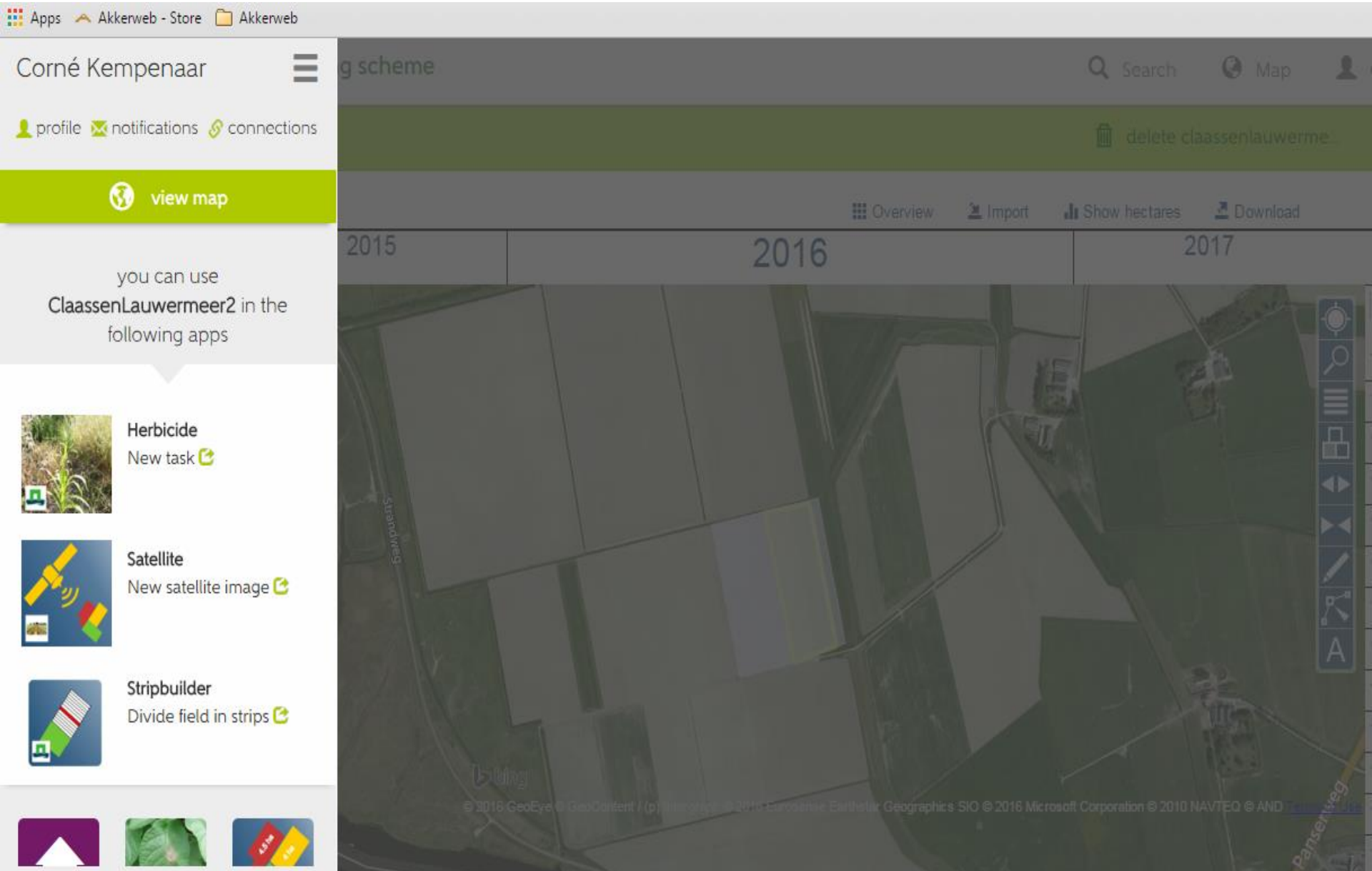
14,6 - 18,4 %	0,42 ha	
13,4 - 14,5 %	0,34 ha	
12,1 - 13,3 %	0,56 ha	
10,8 - 12,0 %	0,76 ha	
9,6 - 10,7 %	0,63 ha	
8,3 - 9,5 %	0,36 ha	
6,0 - 8,2 %	0,39 ha	

WAGENINGEN UR
For quality of life

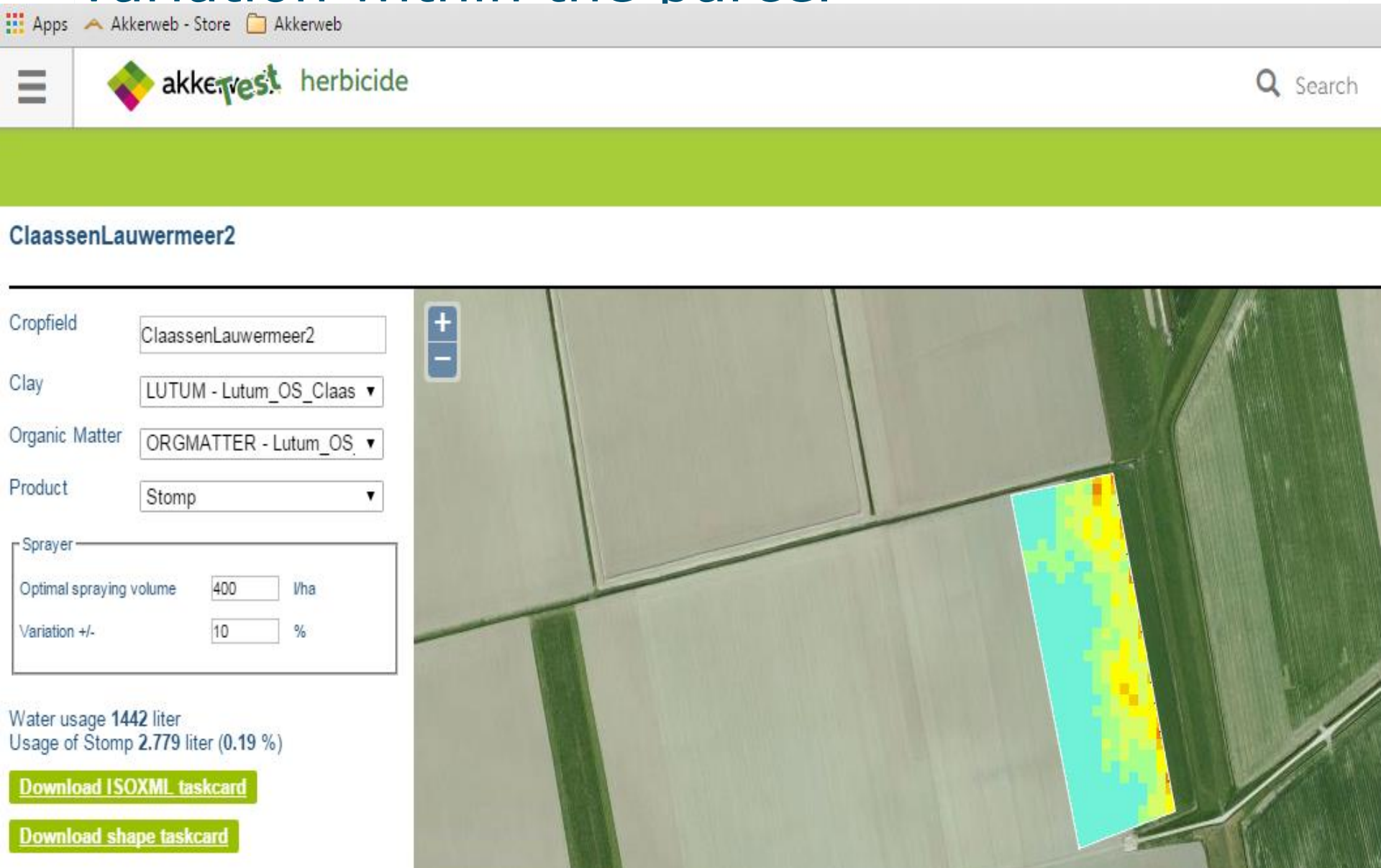
Select parcel



Select soil **Herbicide** App



Task map Stomp based on O.M. and clay variation within the parcel

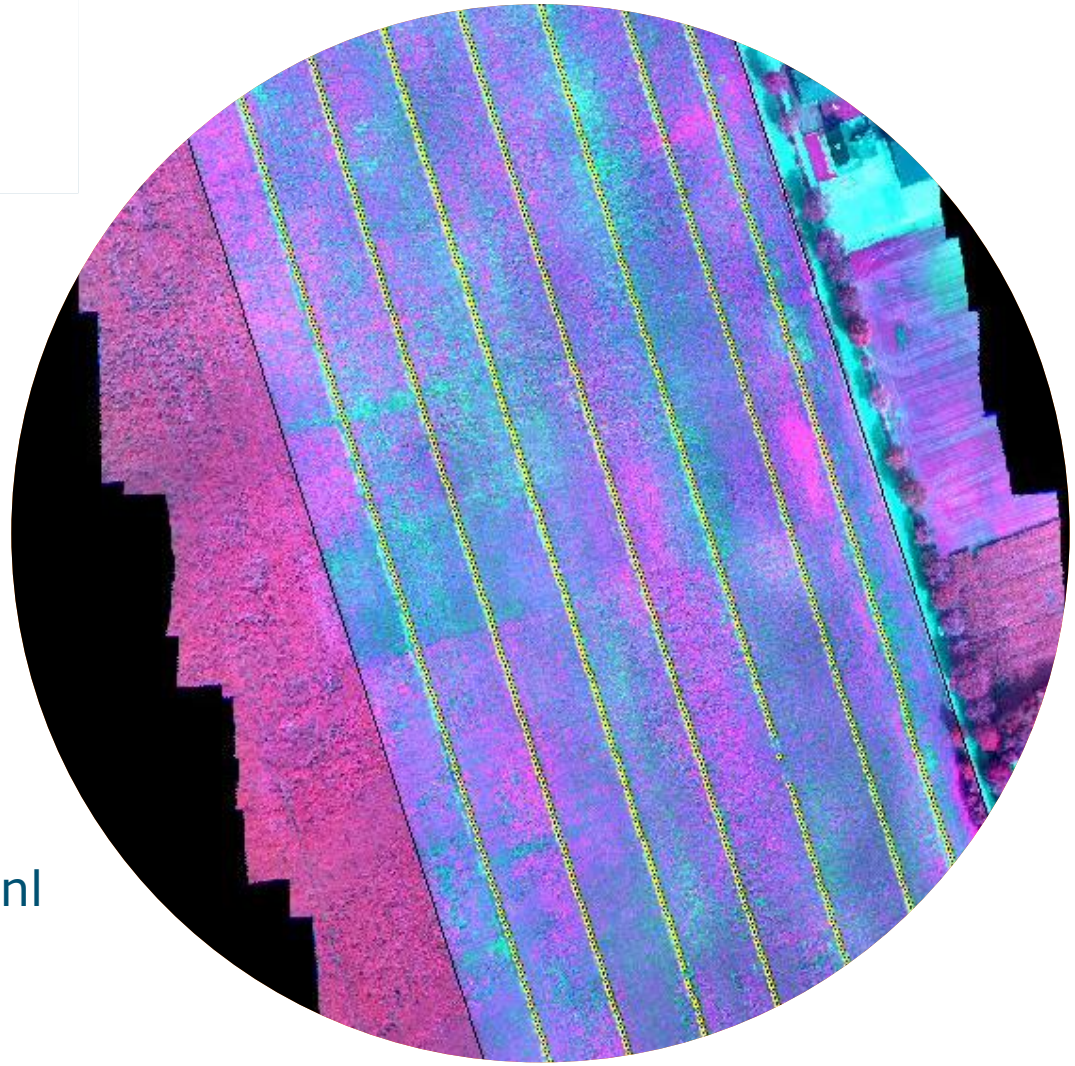


Boxer task map, FF, Abbenes, 20 May 2016

Concluding remarks

- Akkerweb is a new platform for use of spatial and temporal data in crop management
- Several Apps for potato crop management have been developed and tested successfully
- The new precision farming applications will contribute to more sustainable production

Thanks for your attention



www.precisielandbouw.eu

www.akkerweb.nl

corne.kempenaar@wur.nl

c.kempenaar@cahvilentum.nl

Tel. (+31) 317 480498

Skype: corne.kempenaar

WAGENINGEN UR
For quality of life

CAH Vilentum Hogeschool