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Office for Outer Space Affairs



Ministry of I.C.T
IRANIAN SPACE AGENCY

United Nations/Islamic Republic of Iran Workshop on the

Space Technology Applications for **Drought**, **Flood** and **Water** **Resources Management**

9-11 August 2021, Tehran, Iran

**Geospatial-based information for
agricultural drought monitoring
in the sandy soil of the Eastern
Netherlands**

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AgriWatch BV
the Netherlands

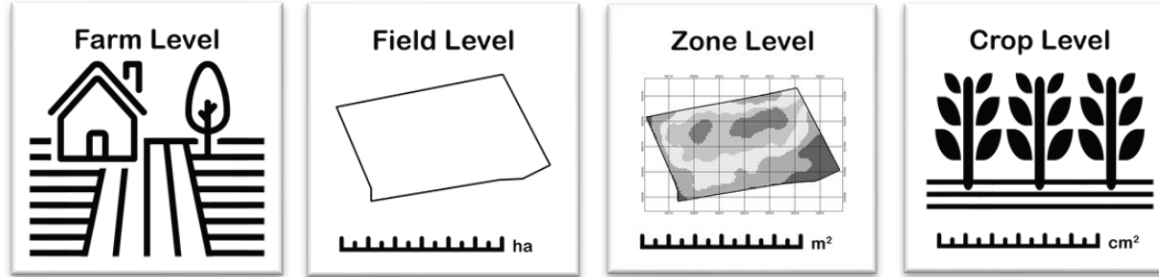


Who are we?

**AgriWatch BV is formed
as an ITC/University of
Twente alumni startup**



Precision Agriculture (PA) is a concept of using the new technologies and collected **farm/field/zone/plant** information, doing the **right thing**, in the **right place**, at the **right time**.

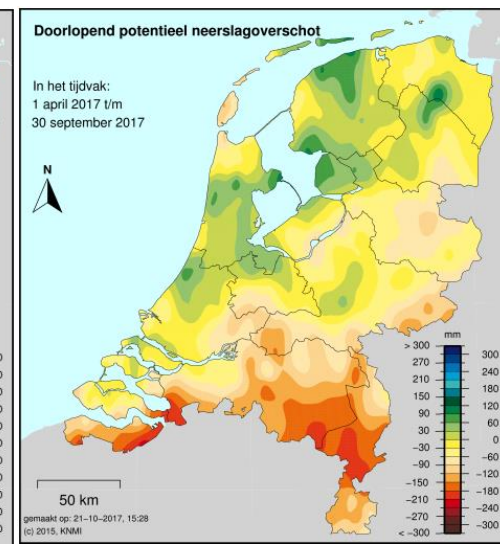
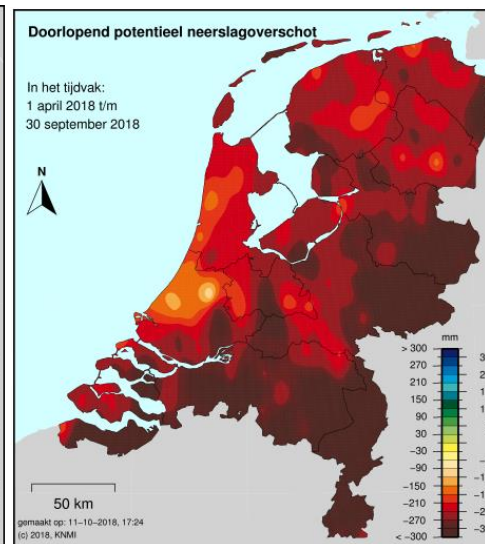
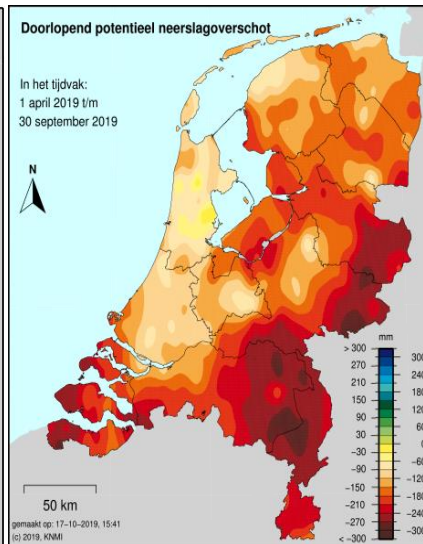
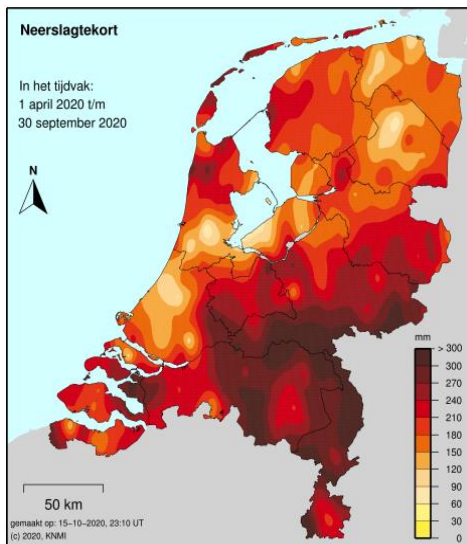


1. AW offers GeoSpatial Services for PA with emphasis on effects of climate change resulting in drought and other extreme climatic conditions.
2. Focuses on affordable RS data acquisition and monitoring services by integrating RS data (satellite, airborne, drone platforms), GIS (maps) data and expert knowledge.
3. Market segment: Remote and Local Sensing for collecting high spatial-spectral data, and monitoring including predictive modelling.
4. AW engages with farmers to manage site-specific crop issues.

Agri Drought Monitoring

EO and drone images for Drought effects
monitoring
case of non-irrigated crops in the Eastern part
of the Netherlands





Agricultural Drought Monitoring

The drought has had a significant impact on the growth of most arable crops in the Eastern part of the Netherlands in the past few years. Satellite and drone images can be used to monitor the state of drought and drought-affected grassland/maize.



Maize has done well --> yield?
Not under new climate conditions
(LessEffectiveRain, increasing Drought spells)

Climate change is a total game changer where farmers cannot anymore fully rely on their knowledge gained from generations.



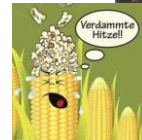
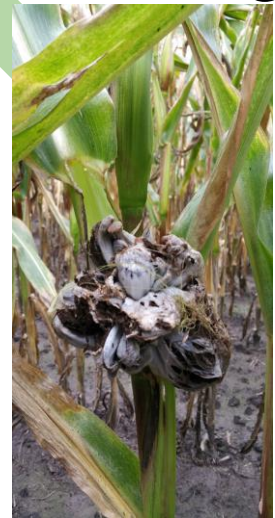
Climate Change and Remote&Local Sensing

It can help to understand challenges and scale solutions to larger areas, as well as gain a better regional understanding of challenges/solutions.

- SandySoil, LessRain, LessInsects, BirdsAttack, Weeds, Fungi, Heat/WaterStress, MissingPlants.

- Export, limits feed quantity and quality.
- UncertainInfo.
- ResponsibleAgriTech.
- SocialEngagementStrategies.

Define new information requirements under new climate conditions!

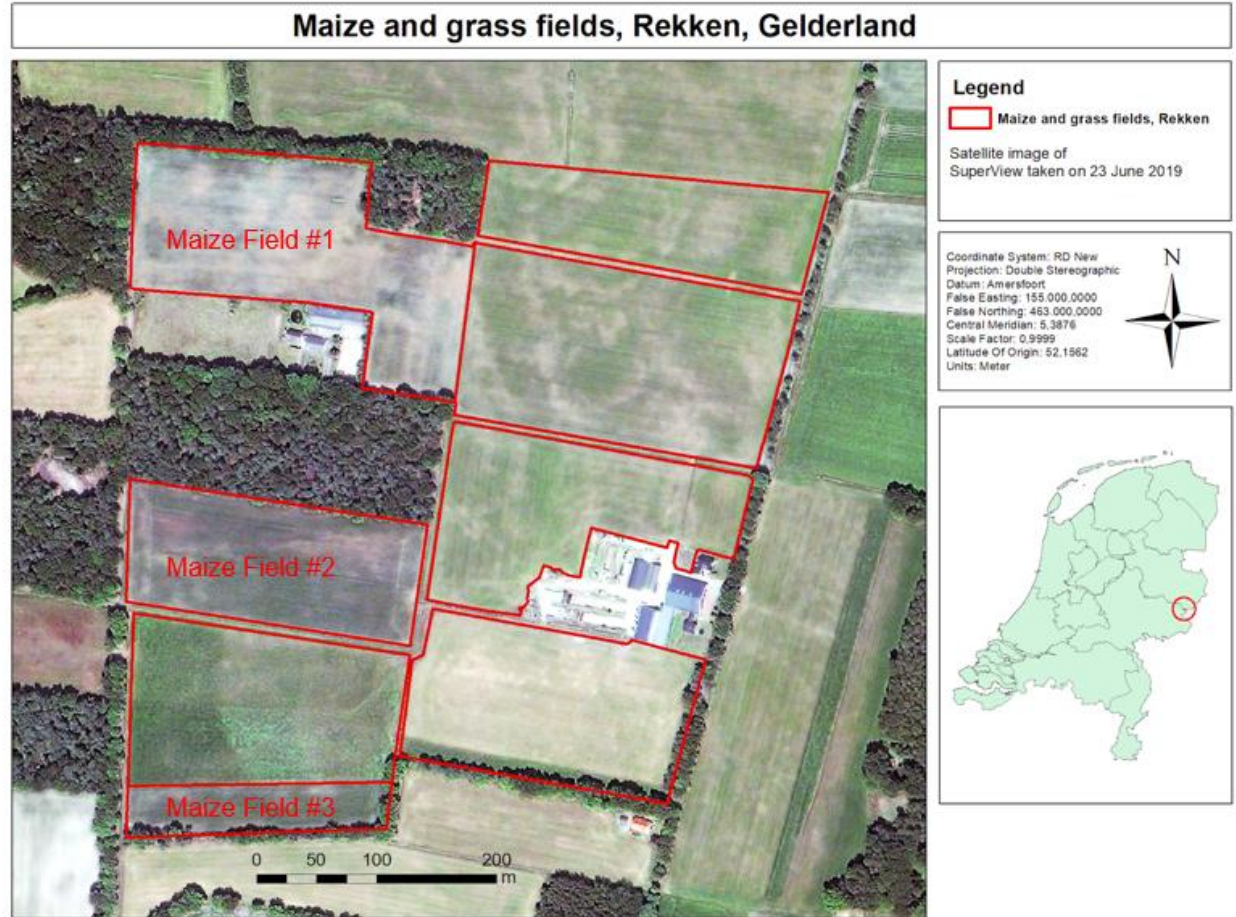


Study Area

Krakeelsweg 9a,
7157CE Rekken,
Gelderland

Crop Calendar:

Maize field number	Planting Date
#1	May 2nd, 2019
#2	May 2nd, 2019
#3	April 23rd, 2019





Rode lijn klopt niet 10:57

Q: Where/which parcel?

kun je tekenen waar het niet klopt

11:02 ✓✓

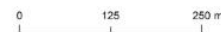


An aerial photograph of a rural landscape. A white polygon is drawn on the image, highlighting a specific area of interest. The area within the polygon appears to be a field or a small forest. Surrounding the polygon are various other features, including roads, buildings, and other fields. The image is labeled 'Gras' in the top left corner and '11:50' in the top right corner.



Nu gras was 3 jaar hennep daarvoor 2 jaar mais

12:00



No	GWS_GEAS	Part	Area	Total Area per part (sq m)	Total Area per part (ha)
1	Grasland, blijvend	1	52723.60156		
2	Grasland, blijvend	1	39864.19922		
3	Grasland, tijdelijk	1	35640.60156		
4	Grasland, tijdelijk	1	38321.80078		
5	Mais, snijl	1	29877.5		
6	Grasland, tijdelijk	1	4864.790039	367867.792	36.7867792
7	Grasland, blijvend	1	29148.30078		
8	Grasland, tijdelijk	1	24589		
9	Grasland, blijvend	1	20925.59961		
10	Grasland, blijvend	1	26016.5		
11	Mais, snijl	1	37124.69922		
12	Grasland, blijvend	1	26371.19922		
13	Grasland, tijdelijk	1	28929.09961		
14	Mais, snijl	2	14030.7998	61744.89941	6.174489941
15	Grasland, tijdelijk	2	17905		
16	Grasland, blijvend	3	9748.049805	24228.9502	2.42289502
17	Grasland, blijvend	3	14490.90039		
18	Grasland, blijvend	4	5863.160156	5863.160156	0.586316016
19	Hennep, vezel-	5	9102.700195	9102.700195	0.91027002
TOTAL AREA OF HENK'S FARM				468807.502	46.8807502
GEWAS		Area (sq m)	Area (ha)		
Mais		81032.99902	8.103299902		
Grasland		378671.8027	37.86718027		
Hennep		9102.700195	0.91027002		
Total Area		468807.502	46.8807502		

Bovenste perceel niet

15:29

- communication with the farmer to get his farm/nr of parcels info (also his plan for corn plantation in 2021).

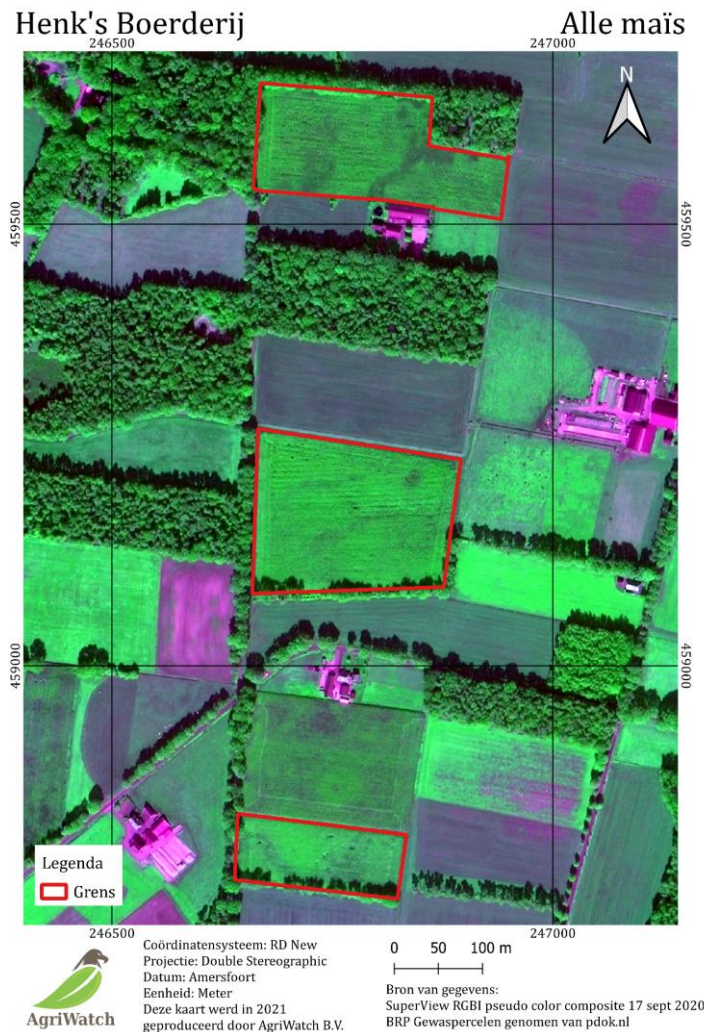
Q: how much corn/grass (replacement) had to be purchased externally?

Q: Where, when and how did the shortages arise?

AW: show expected drought damage (maps, images, link index to estimated loss in mass and quality).

AW: build link to provided images and maps connected to farmers.

RSIA –
an
example



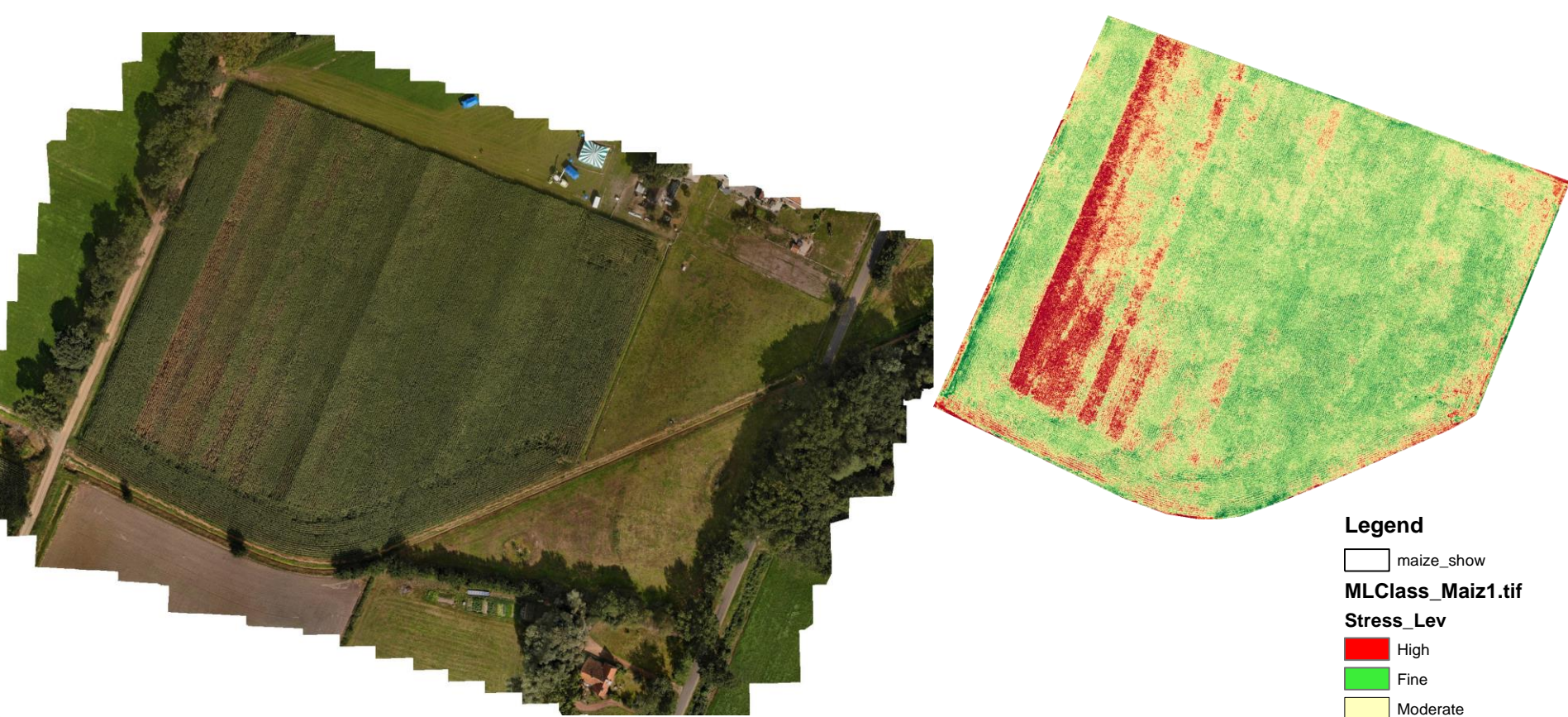
Why, what & how we will use the Smart Drone

We use the Smart Drone to produce qualified information based on collecting and analysing crop conditions (e.g., health, disease and stress) when 'detailed information' is needed or there is 'satellite data gap'

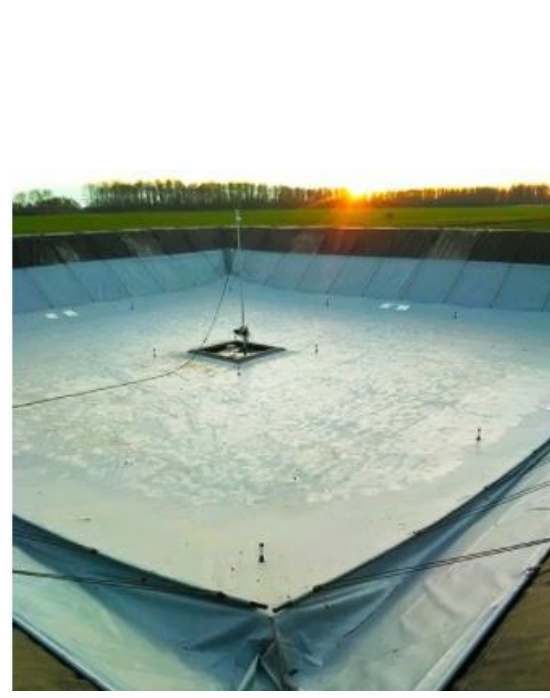
Expected cost/benefit of solutions!

AgriWatch aims to supplement, calibrate and refine that (satellite) data using UAVs and ground sensors in order to derive reliable and practical information from the sensors/data





Orthomosaic drone data captured on 13 September 2020 from the Maize trial field and Grassland, trees and bare soil. The Maize plants were under stress after a number of sweltering days in the first two weeks of August 2020 in Achterhoek.



RainWaterHarvesting in Twente



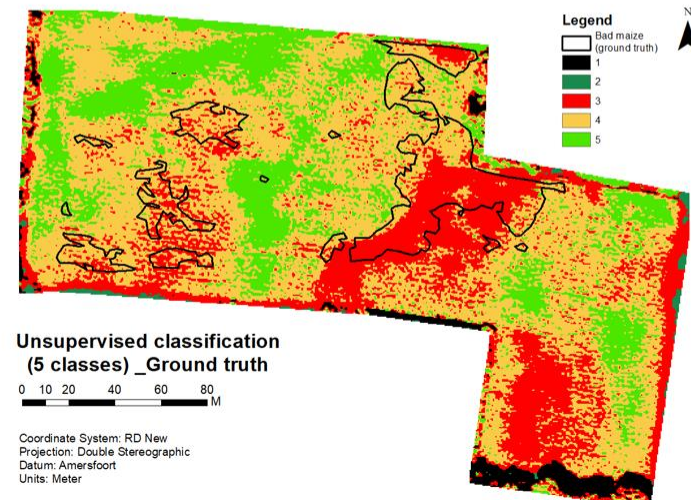
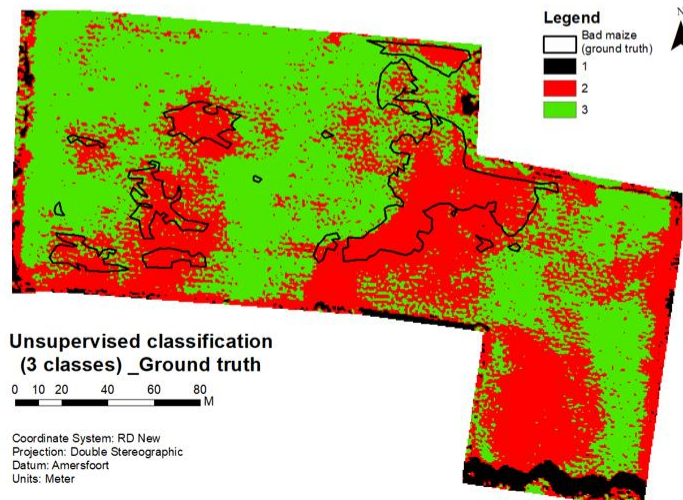
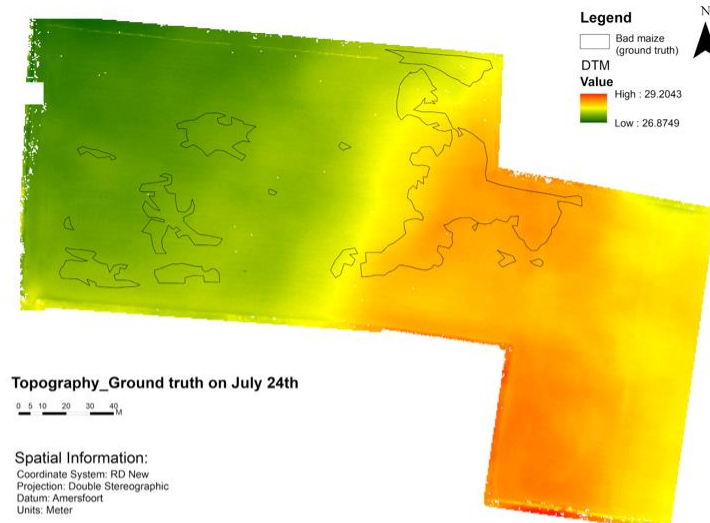
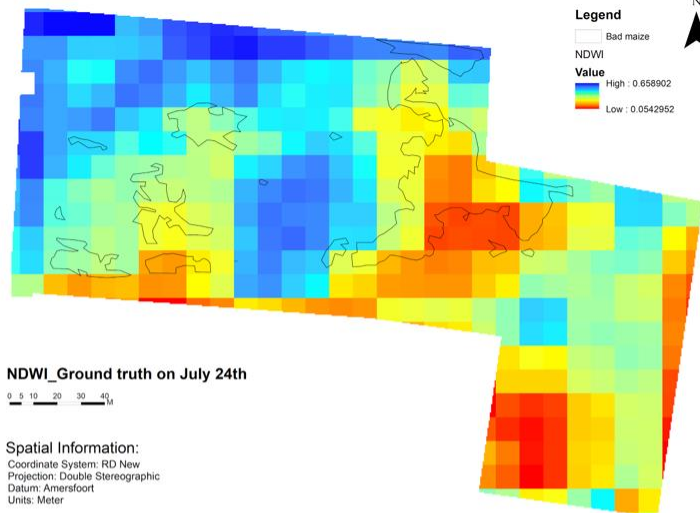
**Satellite images
cross check with
ground truth
polygons**
(visual interpretation)

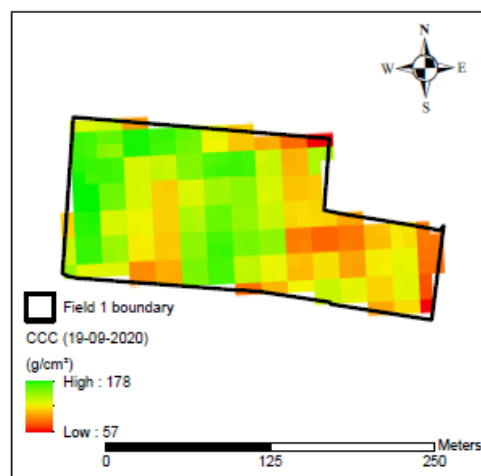
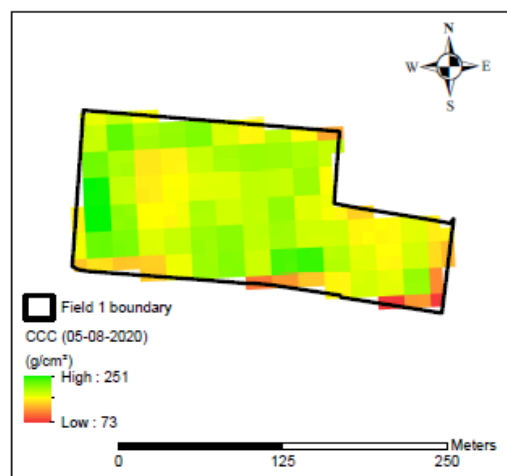
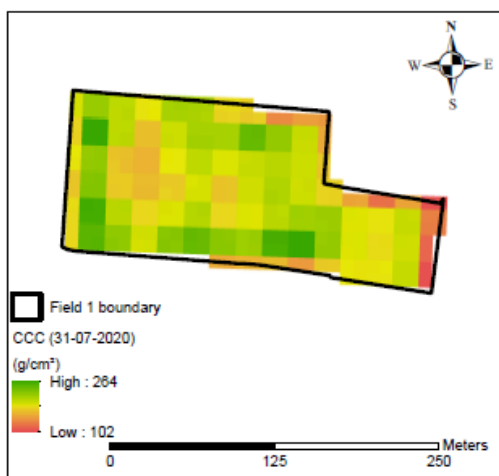
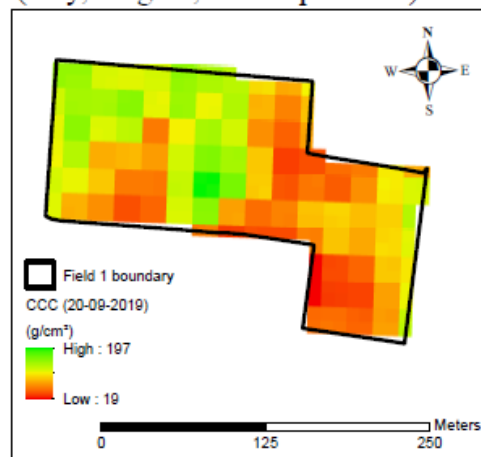
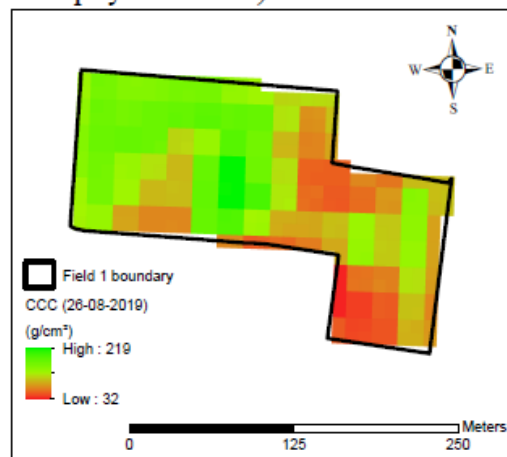
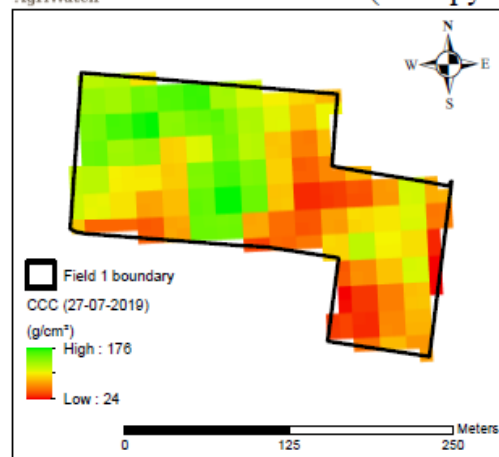
Date: July 24th

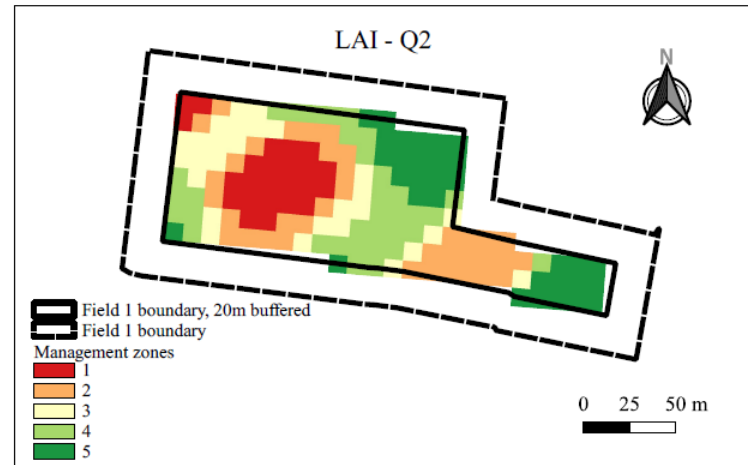
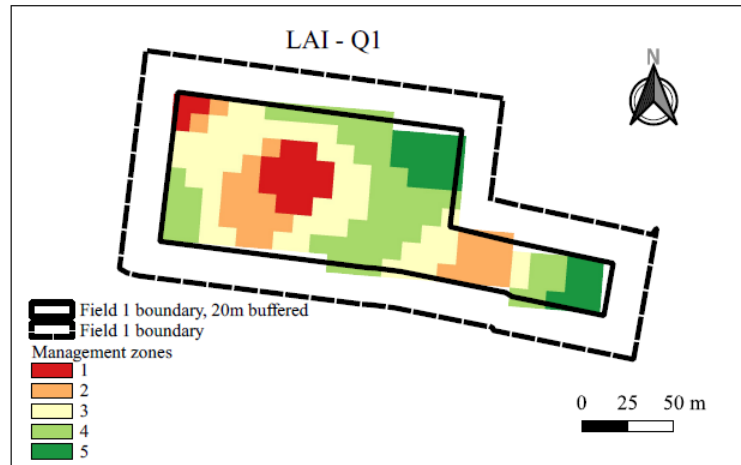
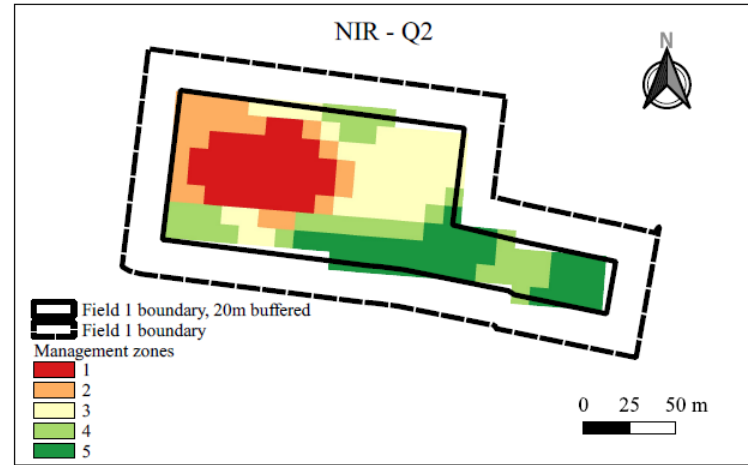
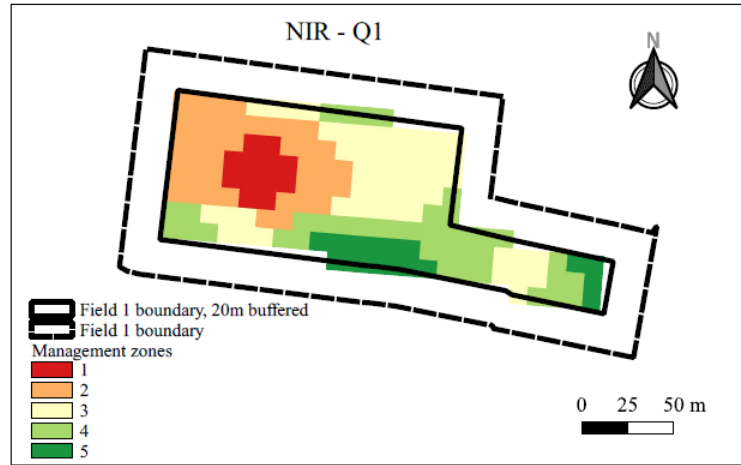


	TCC	FCC	PTCC
R	B3	B4	B3
G	B2	B3	B4
B	B1	B2	B2
B1: Blue B2: Green B3: Red B4: NIR			

Table: Band combination









Coördinaatsysteem: RD New
Projectie: Double Stereographic
Datum: Amersfoort
Eenheden: Meter
Deze kaart werd in 2021
geproduceerd door AgriWatch B.V.

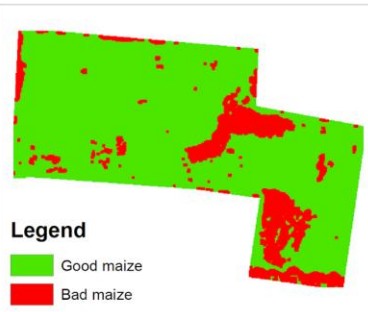
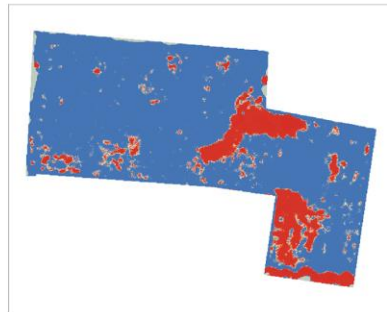
0 50 100 m
Basis van gegevens:
SuperView RGB Rbt RD Geklaar 0.5m, 17 sept 2020
BIP Gewaspercelen genomen van pldok.nl



Temporal maize field #1 from Superview satellite images



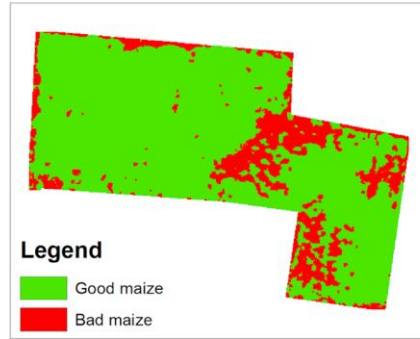
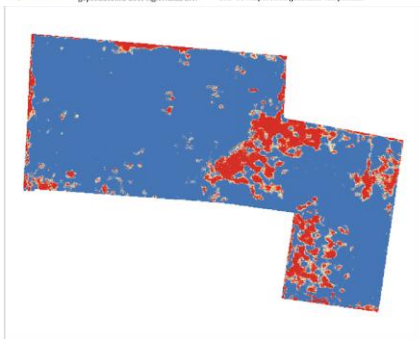
May 25th, soil reference map



Legend

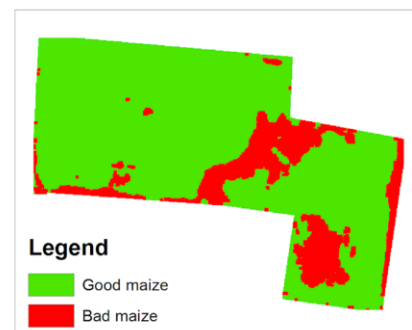
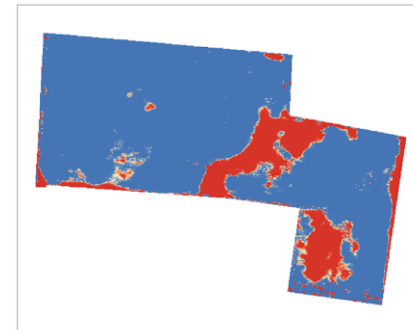
- Good maize
- Bad maize

July 24th, maize field map



Legend

- Good maize
- Bad maize



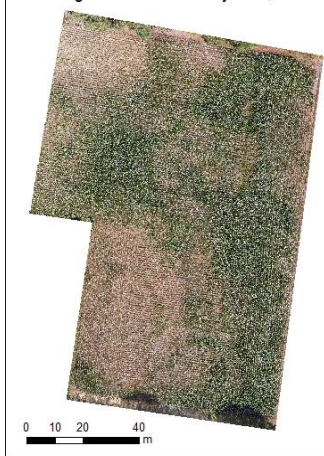
Legend

- Good maize
- Bad maize

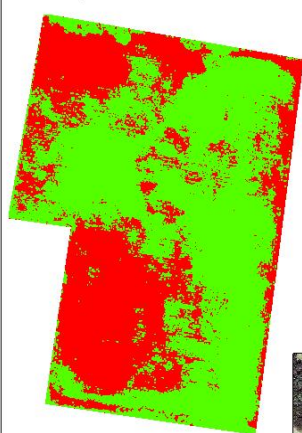


**Orthomosaic drone images of 28 July 2019:
Drought-stressed pattern of Grassland and
Maize**

UAV image was taken on July 28th, 2019



Maize map



Legend

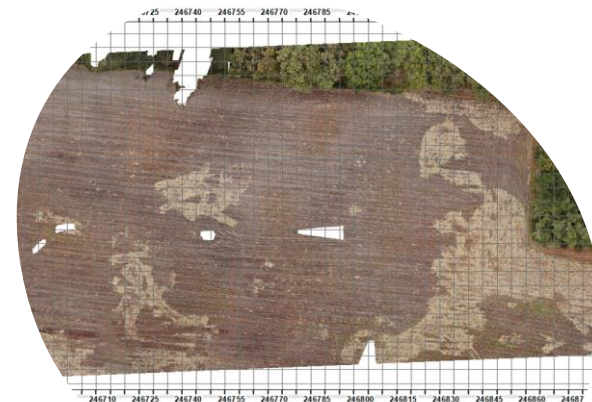


UAV image of 28 July 2019
in eastern part of maize
field

Maize Field
Rekken, Gelderland



Coordinate System: RD New
Projection: Double Stereographic
Datum: Amersfoort
Units: Meter



Oct 16th with 5m grids after georeferencing

**Ground-truth image of
drought-damaged maize field**
Pattern showing drought-
stressed flattened maize by
farmer caused by drought

Aerial view of spatial variability for maize plant health, 12 June, 13 Aug, 9 Sep 2020





The Poor Kernel set in Maize, damaged kernels on exposed end of ear, September 13th, 2019



Way Too Much Damged Stress!, September 25th, 2019



Drought Stress: Leaf rolling + brownish / whiteish cast



Extreme Heat Stress_13aug2020

Fosfaattekort-A P-deficient corn leaf is not photosynthesizing at its maximum rate (in Maize#1)



The coupled effect of both heat and water stress & soil



Weed

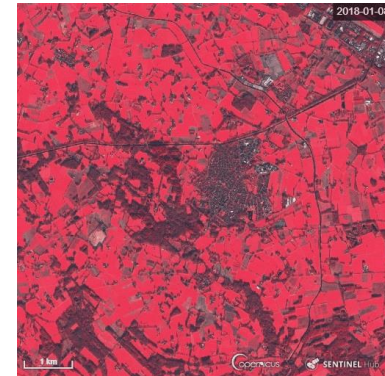


One indicator of heat stress is when corn leaves roll

Drought Stress: Leaf rolling + Weed + Very sparse maize canopy due to bird attack and severe leaf rolling

Conclusions and Recommendations

- We combined different types of platforms and technologies, from satellites to Unmanned Aerial Vehicles (UAVs), for monitoring the occurrence of severe photosynthetic stress (severe drought, extreme heat, severe nutrient deficiency, severe foliar disease).
- By utilizing computer-assisted analysis of satellite and drone data, along with the systematic use of knowledge from application domain experts.
- RainWaterHarvesting, PrecisionIrrigation.
- Alternative crops/varieties or crop Tolerance to HeatStress and DroughtStress.



Thank you for your
attention

