

DRONES & AGRICULTURE



CENTRE
D'INNOVATION
DRONES
NORMANDIE



SECTEUR

Agriculture numérique

Agriculture technologique

Agriculture connectée

AgTech

Agritech

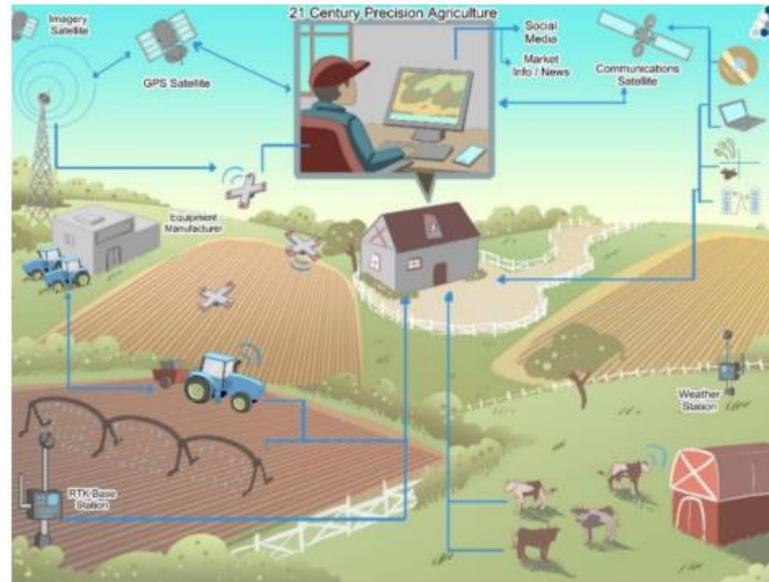
Agriculture connectée

Smartfarming

ÉVOLUTION HISTORIQUE

Agriculture 4.0

Agriculture 3.0



DONNÉES

Big Data

Deep learning

Machine learning

Deeptech

Intelligence Artificielle

Agriculture de précision



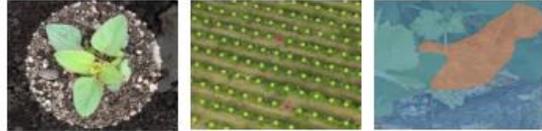


UTILISATIONS

RGB



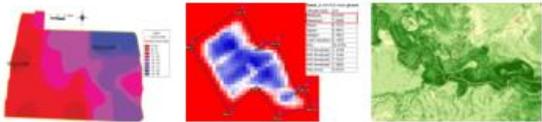
- Identification adventice
- Comptage de plante / pieds
- Dégâts de nuisibles (ex: gibiers)
- Biomasse, risque de verse
- Taux de couverture verte
- Développement foliaire



Multispectral



- **Pilotage de la fertilisation azotée**
- Stress hydrique
- Développement
- Statut azoté/chlorophylle



Infrarouge



- Température de surface
- Stress hydrique
- Pilotage de l'irrigation

Lidar Spectromètre



Proof of concept (R&D Prototypes)

Early Semi Commercial Trials

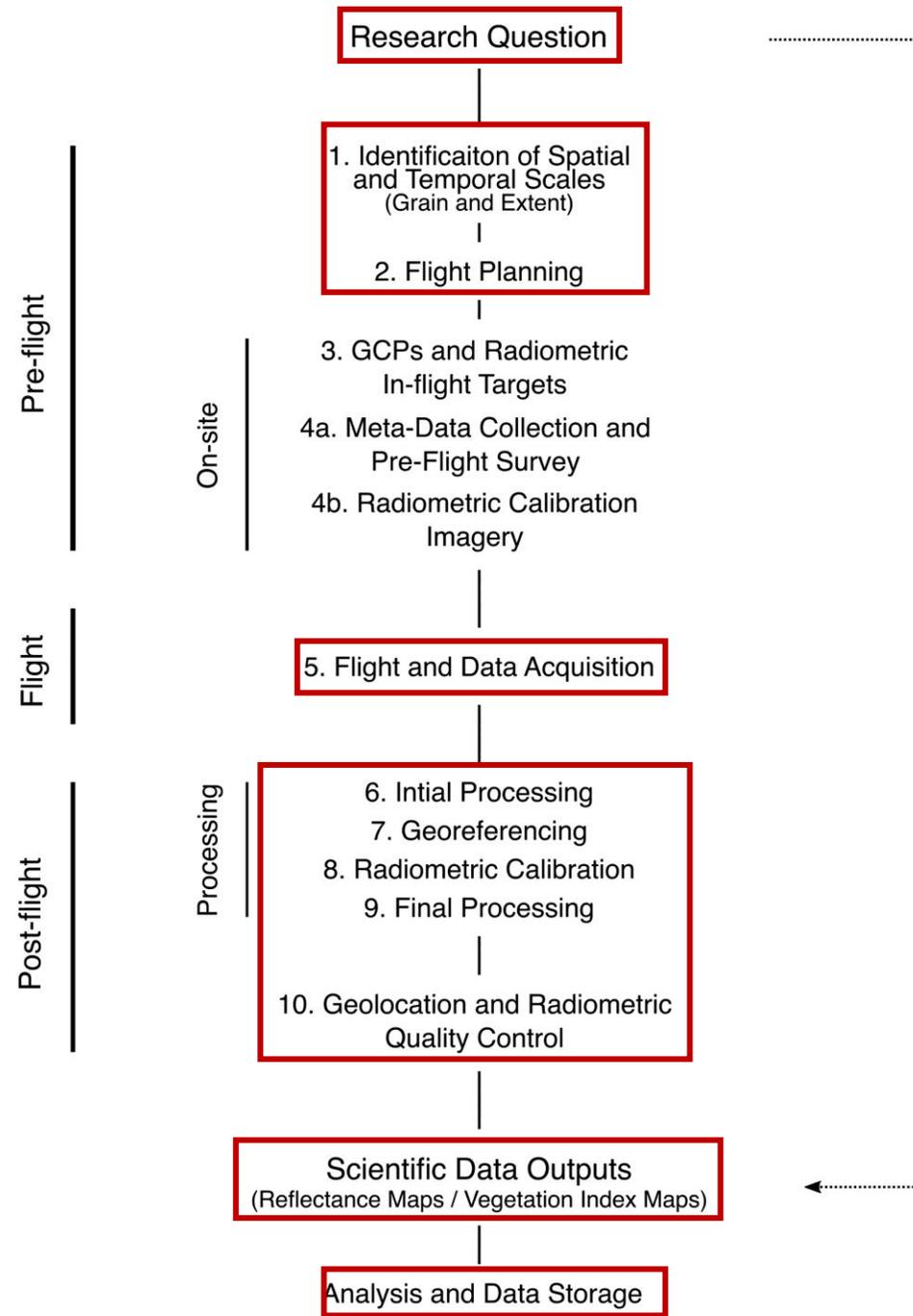
Early Commercial sales

Market Penetration

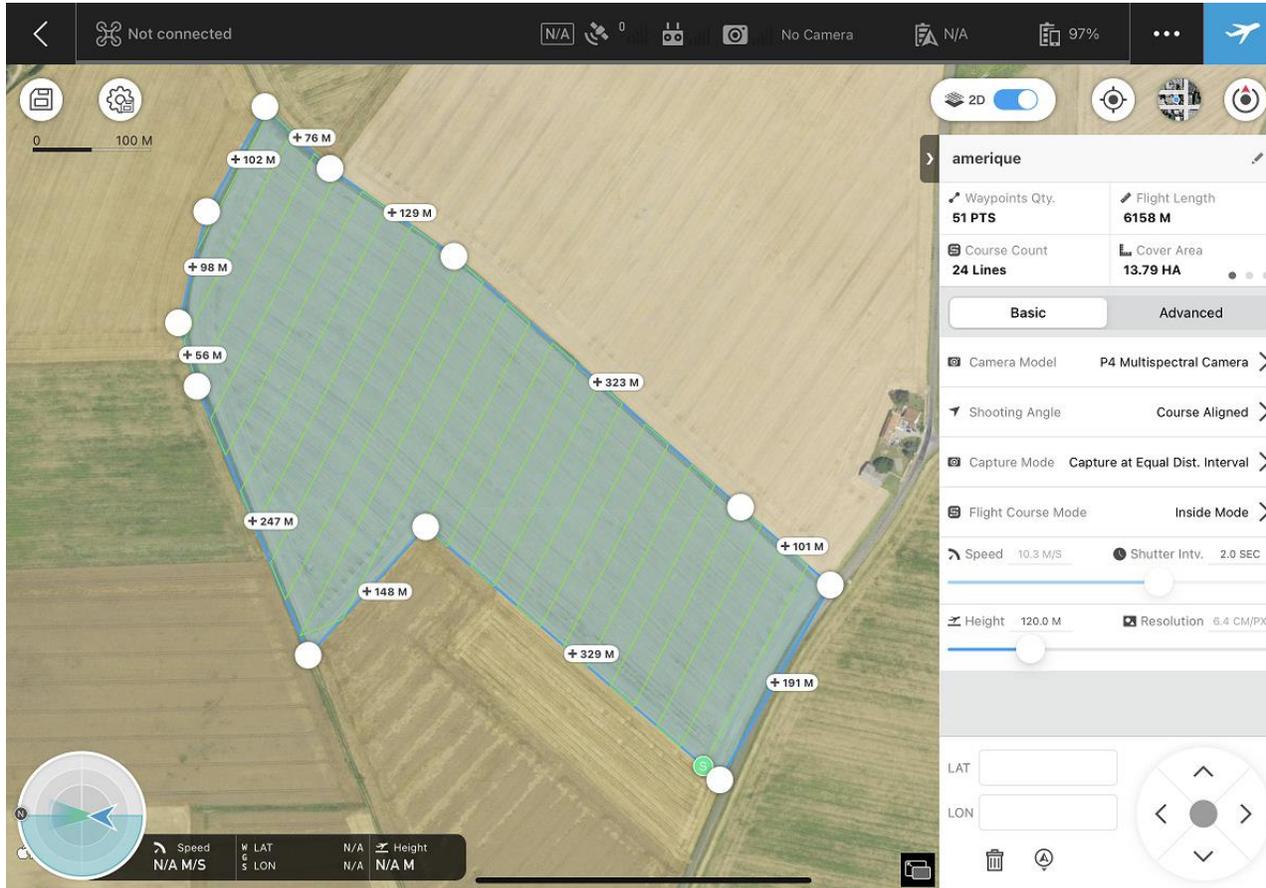
Maturity



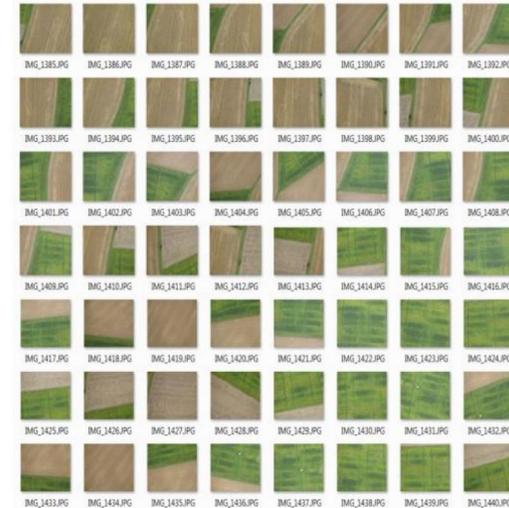
WORKFLOW



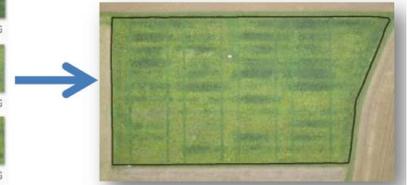
ACQUISITION



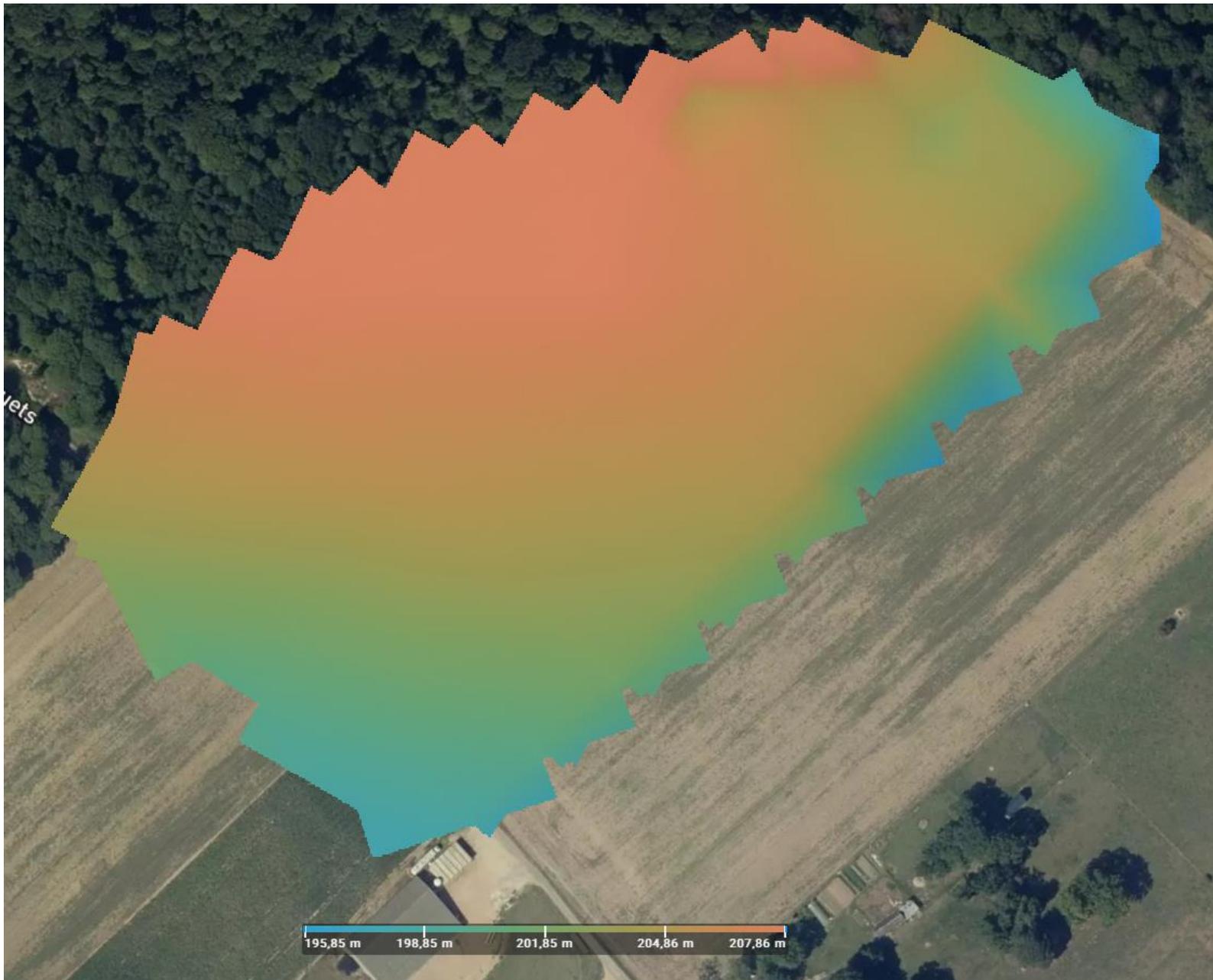
200 photos



Orthophoto parcel entière
mosaïque



SORTIES



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BOT
SPÉCIALISTE DRONES PRO



CAPTEUR RGB



Dégâts animalier

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DRONES
NORMANDIE

4BOT
SPÉCIALISTE DRONES PRO



CAPTEUR RGB

81%
Crop Cover

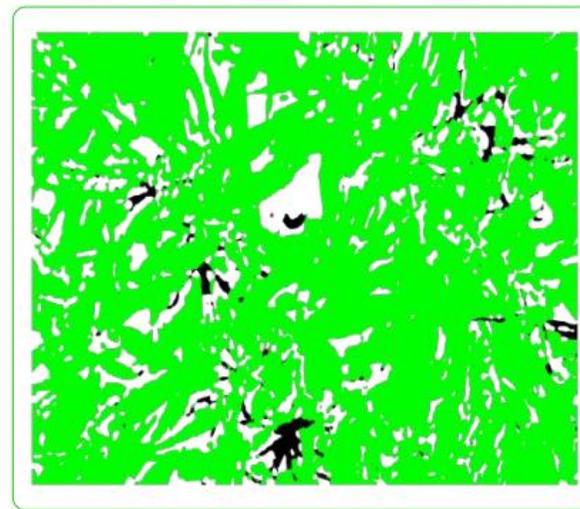
N/A
Field NDVI

0.03%
Weeds

0.00%
Unhealthy Crop



Surveillance cultures



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CAPTEUR RGB

The screenshot shows the Solvi software interface with the following elements:

- Navigation:** IMAGERY, ANALYSIS, EXPORT tabs.
- PLANT COUNTS with Plant AI:** A toggle switch is turned on.
- CLASSIFY BY:** A dropdown menu is set to "DIAMETER (M)".
- TOTAL:** 124,396 PLANTS.
- Color Legend:** Three categories are shown: Red (35,224), Yellow (54,068), and Blue (35,104).
- Bar Chart:** A histogram showing the distribution of plant diameters, with a range from 0.47 to 3.59 meters. A slider below the chart is set between 1.51 and 2.55 meters.
- Options:** "Measure areas of interest" (unchecked) and "Show labels" (checked).
- PLANT HEALTH:** A toggle switch is turned off.
- ZONAL STATISTICS:** A toggle switch is turned off.

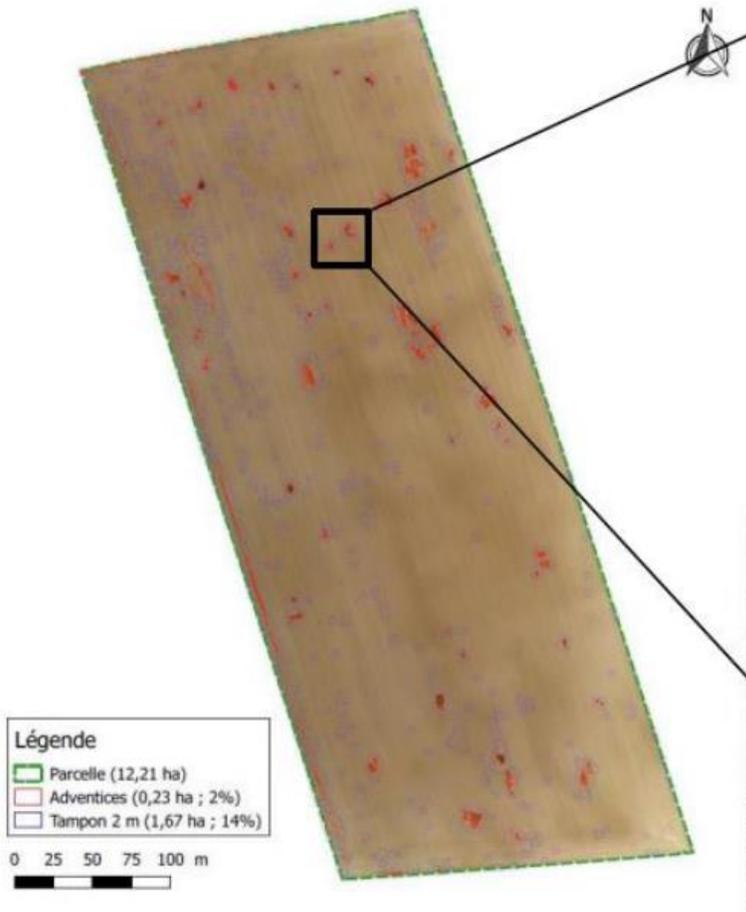


Dénombrement cultures





Identification



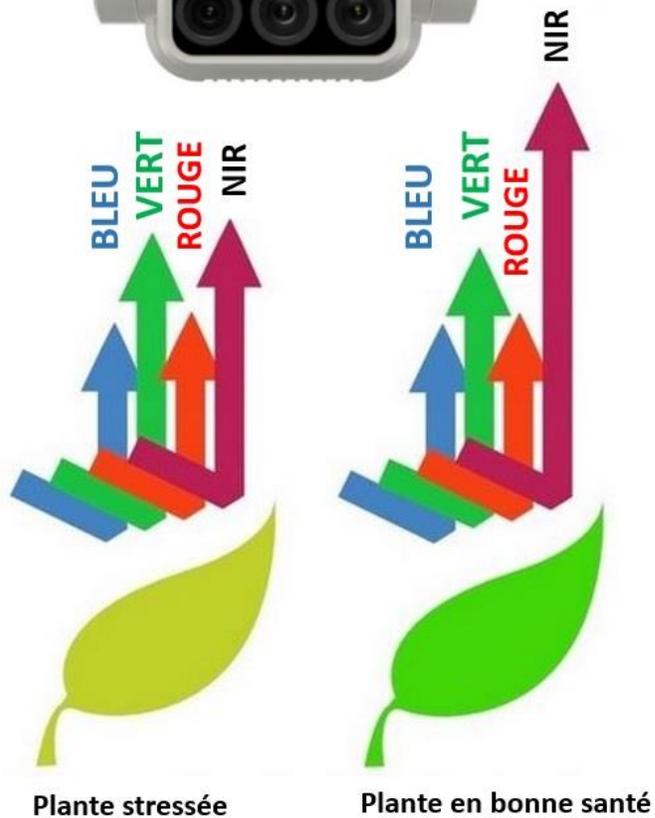
Localisation Adventices
Maïs (Chardon)

Orthophoto (100m, 16/05/2017)

Sur cette parcelle de 12.21 ha, la surface détectée d'adventice est de 0.23 ha (2%).
En considérant une zone tampon de 2 m, cette surface monte à 1.67 ha (14%).



CAPTEUR MULTISPECTRAL

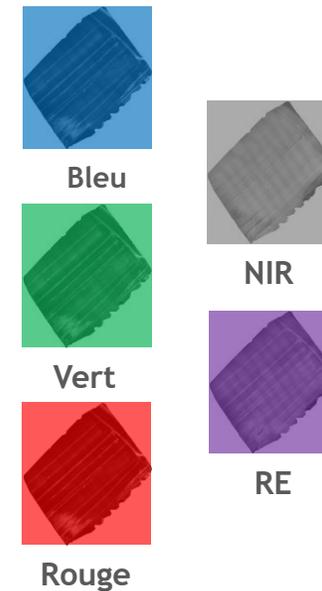
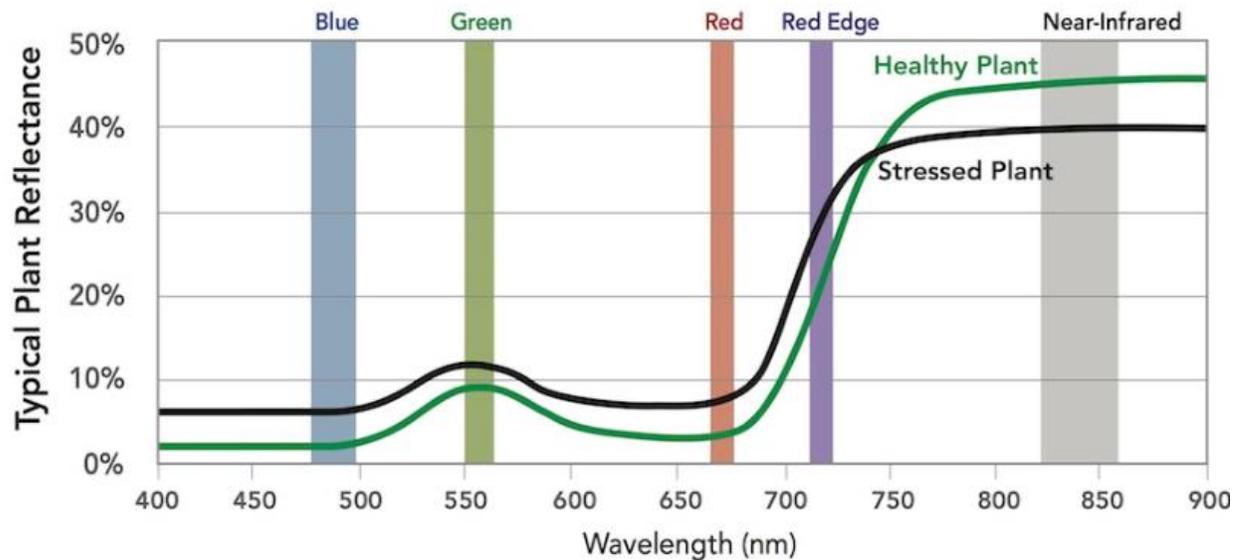


Plante stressée

Plante en bonne santé

NDVI = 0,14

NDVI = 0,72

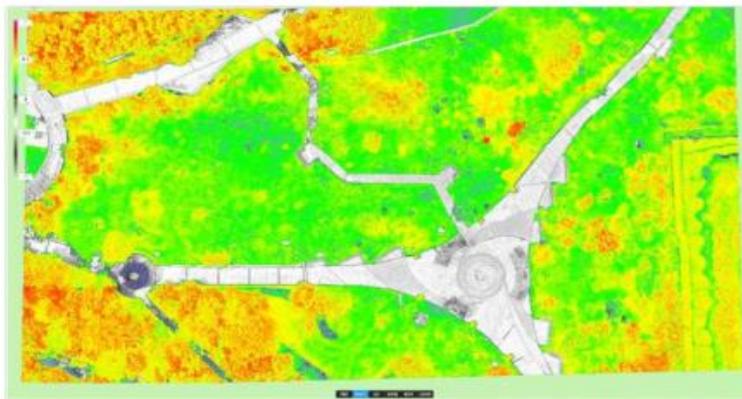


$$NDVI = \frac{NIR - Rouge}{NIR + Rouge}$$

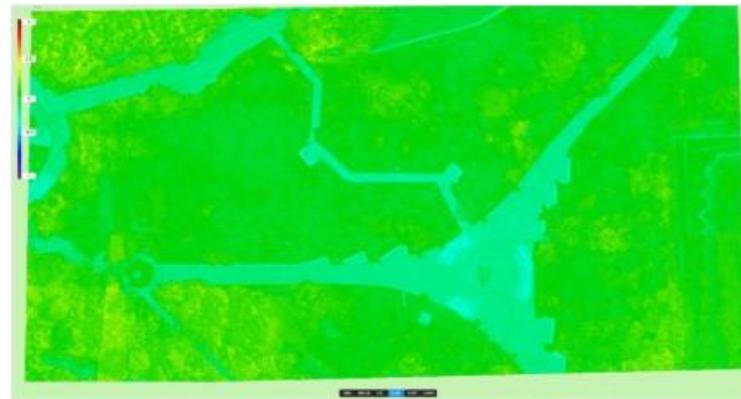
NDVI = Normalized Difference Vegetation Index



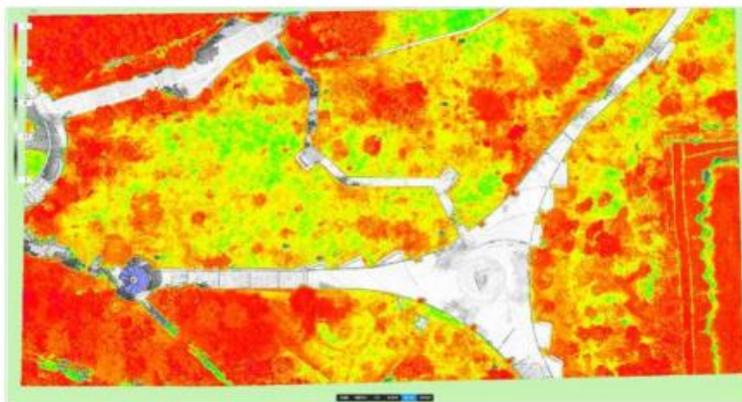
CAPTEUR
MULTISPECTRAL



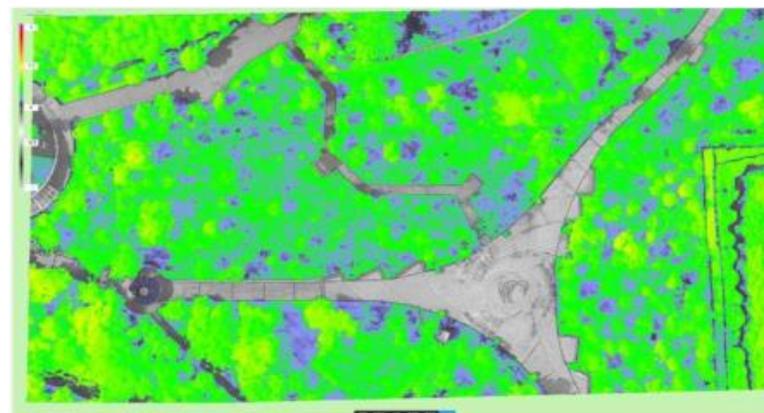
GNDVI



NDRE



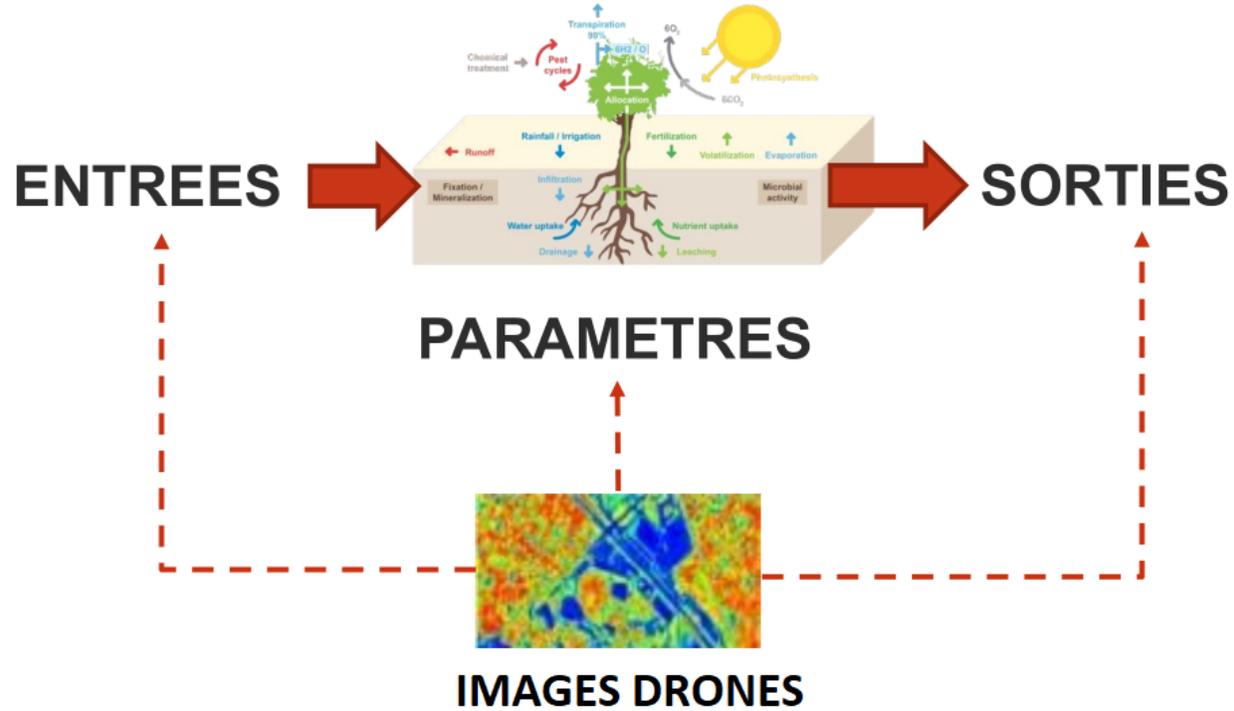
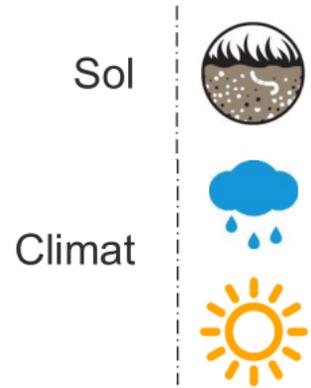
NDVI



OSAVI



CAPTEUR MULTISPECTRAL



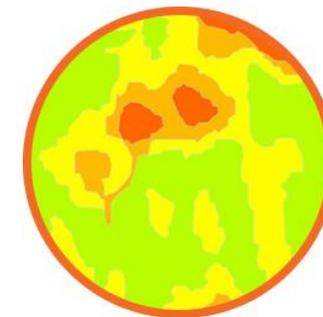
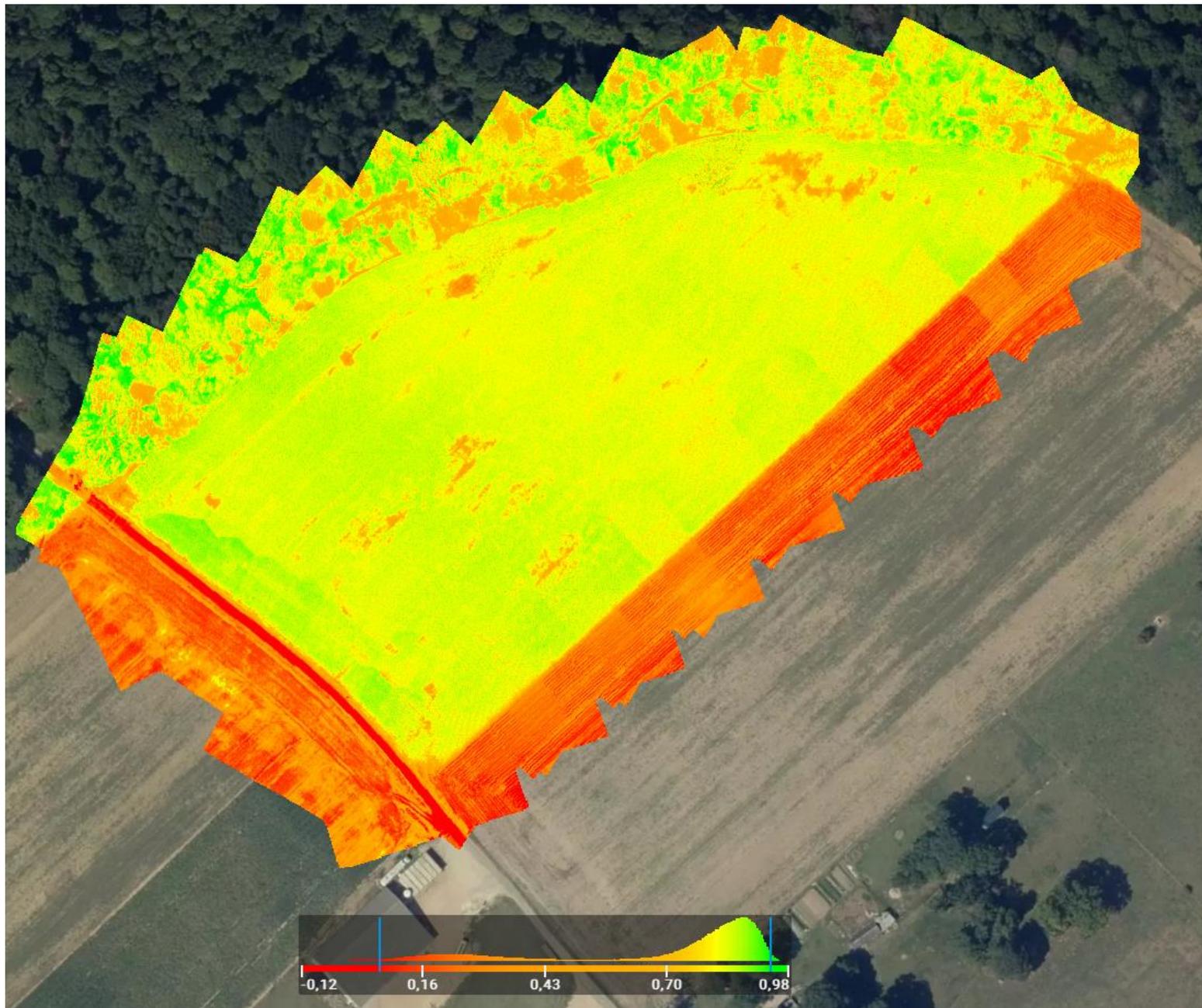
- ⊕ Rendement
- ⊕ Statut azoté
- ⊕ Statut hydrique
- ⊕ Recommandations



- Spatialisation des sorties
- Amélioration de la qualité de prédiction



CAPTEUR
MULTISPECTRAL



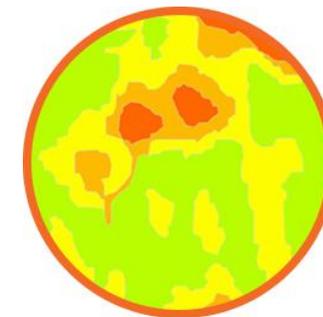
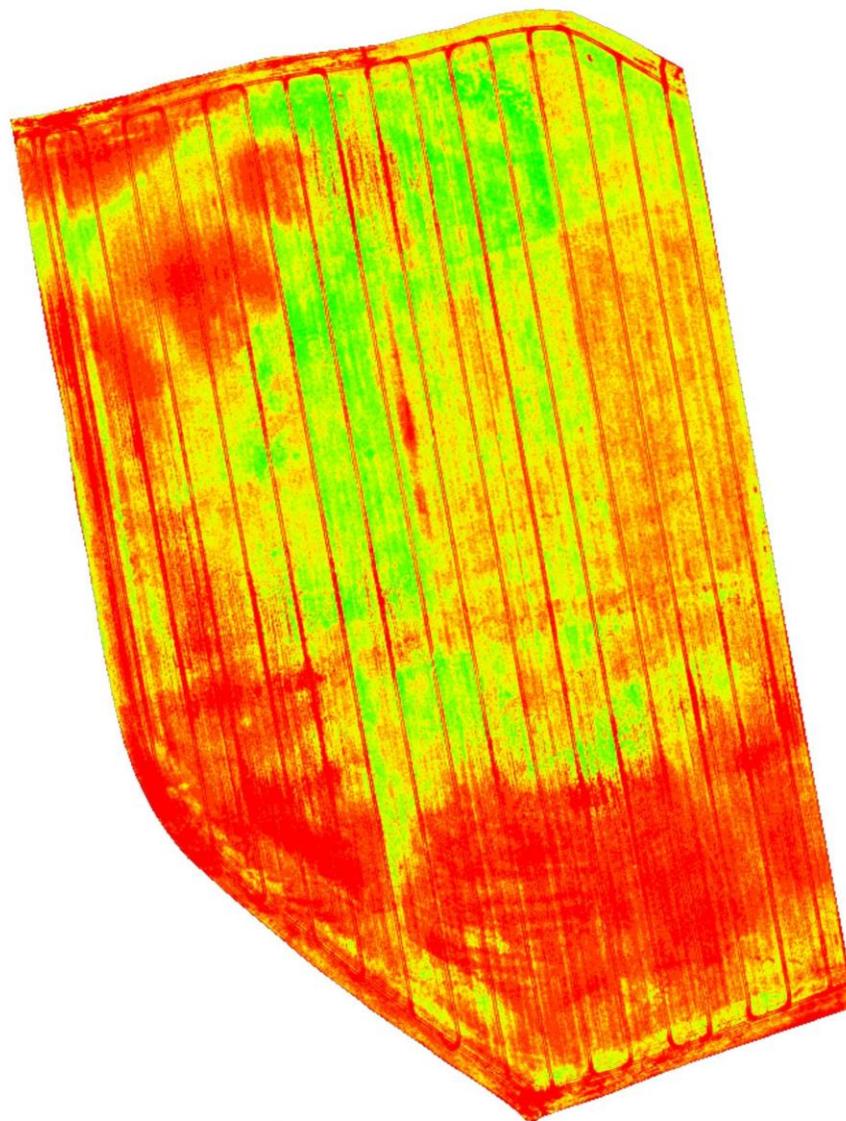
Statut nutritif

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CAPTEUR MULTISPECTRAL

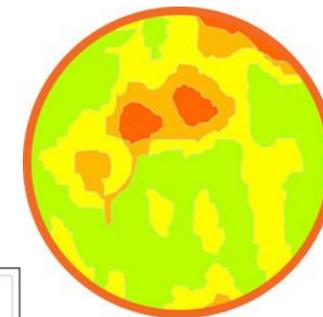
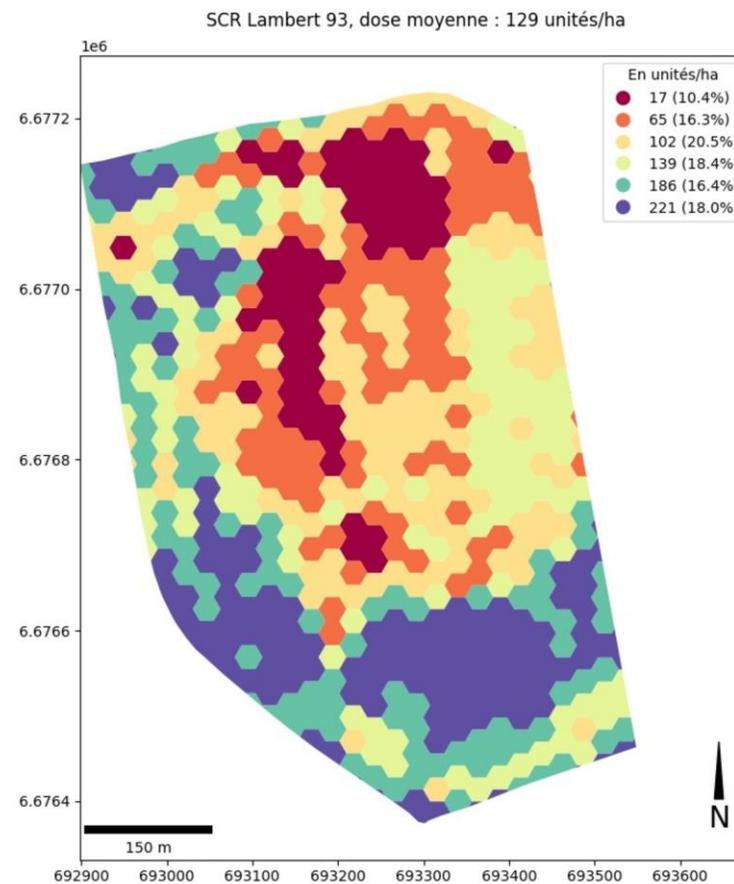
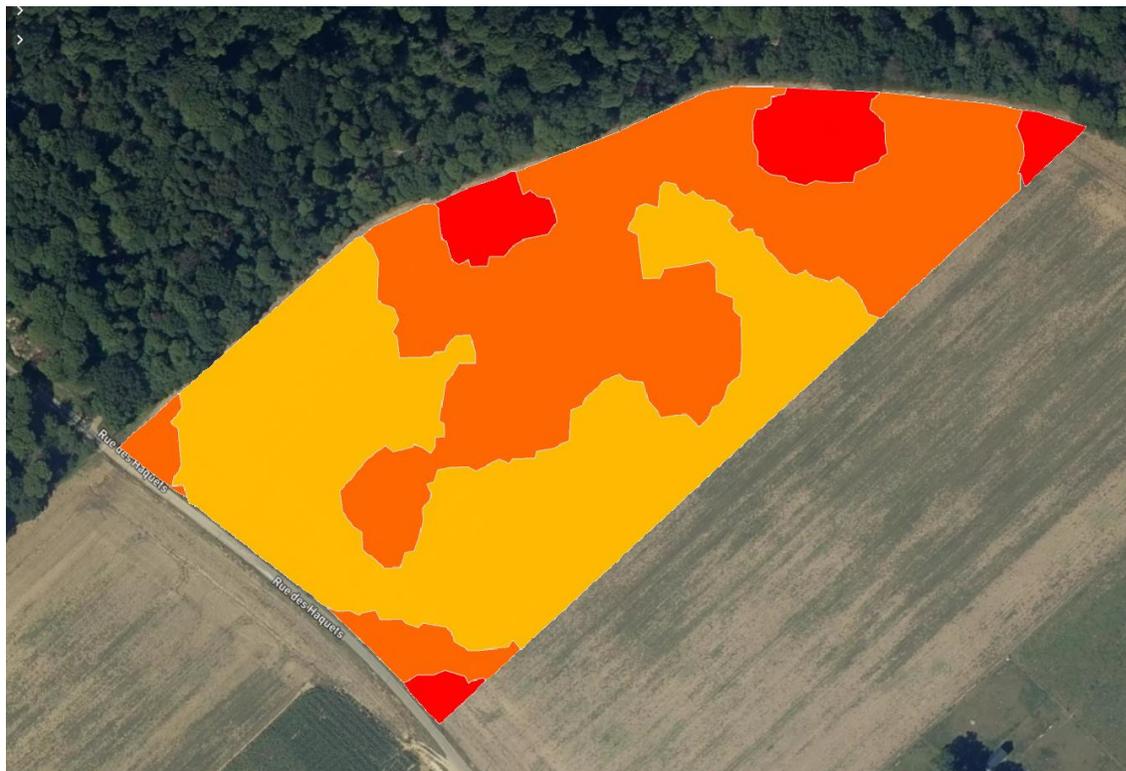


Statut nutritif

	0.1 - 0.5 kg/m ² (10.8%)
	0.5 - 1.0 kg/m ² (17.5%)
	1.0 - 1.5 kg/m ² (13.5%)
	1.5 - 2.0 kg/m ² (15.3%)
	2.0 - 2.5 kg/m ² (15.4%)
	2.5 - 3.0 kg/m ² (12.6%)
	3.0 - 3.5 kg/m ² (8.8%)
	3.5 - 4.0 kg/m ² (4.4%)
	4.0 - 4.5 kg/m ² (1.6%)
Biomasse moyenne (kg/m ²)	
1.8	



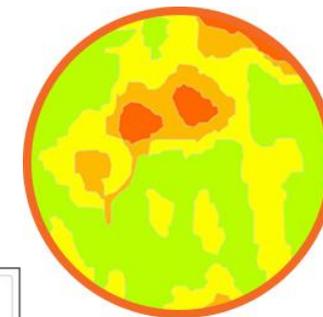
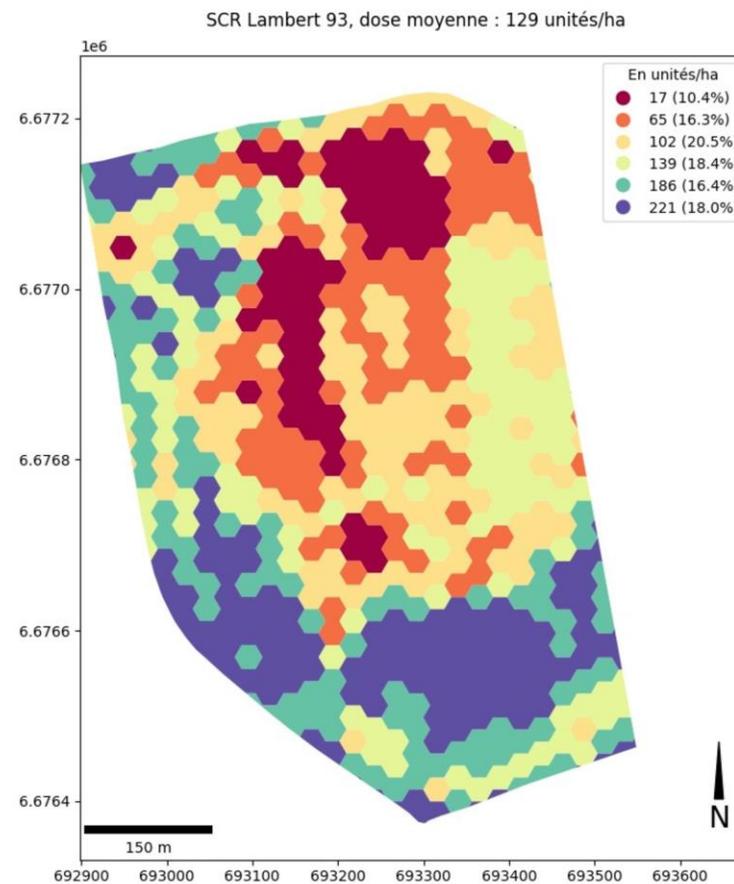
CAPTEUR MULTISPECTRAL



Statut nutritif



CAPTEUR MULTISPECTRAL



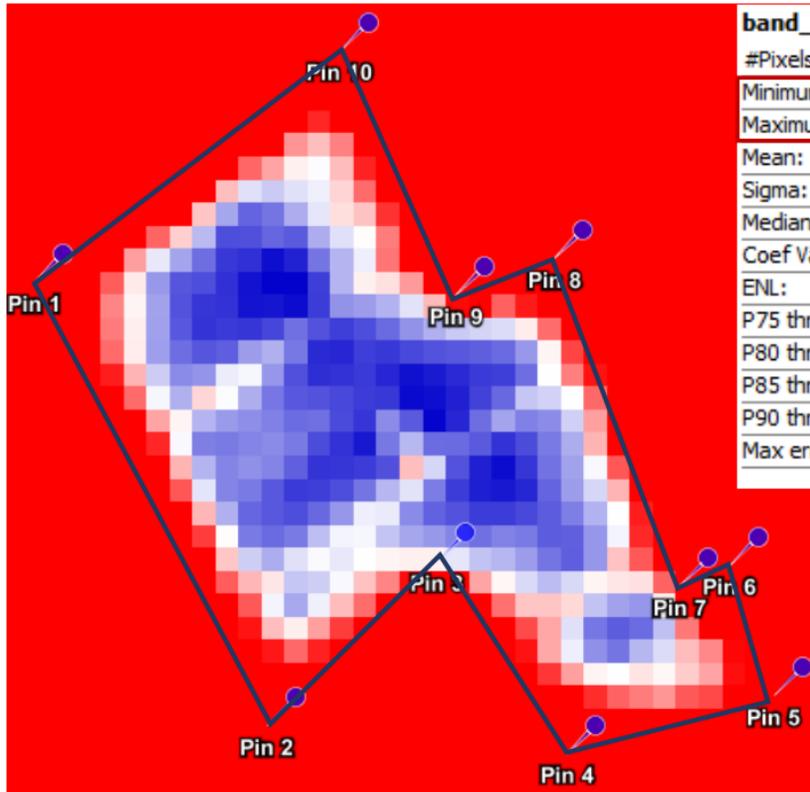
Statut nutritif



CAPTEUR MULTISPECTRAL

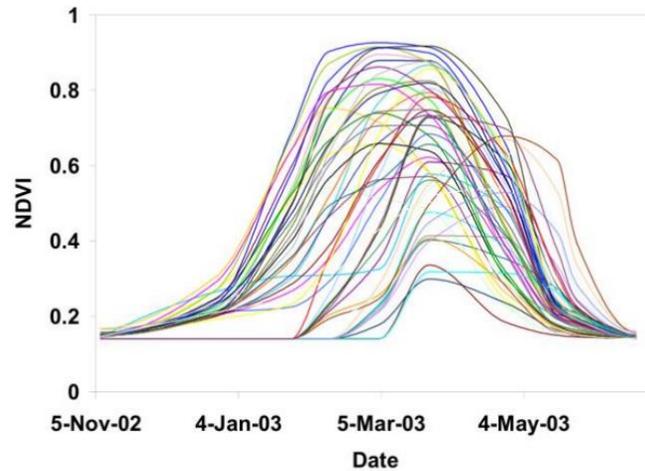
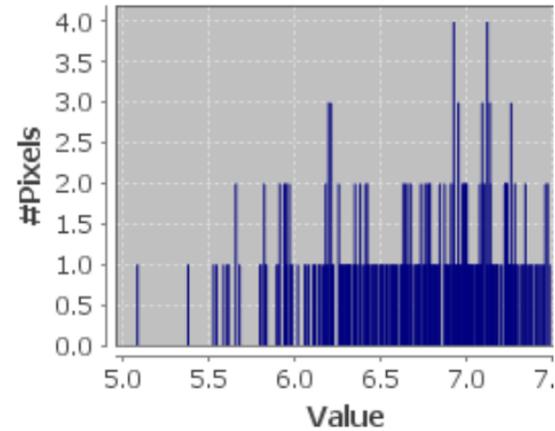


Statut hydrique



band_1 with ROI-mask geometry

#Pixels total:	314
Minimum:	5.0743
Maximum:	7.5096
Mean:	6.7131
Sigma:	0.4841
Median:	6.7863
Coef Variation:	0.1405
ENL:	50.6795
P75 threshold:	7.1078
P80 threshold:	7.1540
P85 threshold:	7.2222
P90 threshold:	7.2685
Max error:	0.0024



$$ETC = KC \times ETO$$

$$Kc = 1.181 \times NDVI - 0.0265 \text{ (Mjeira, 2016)}$$

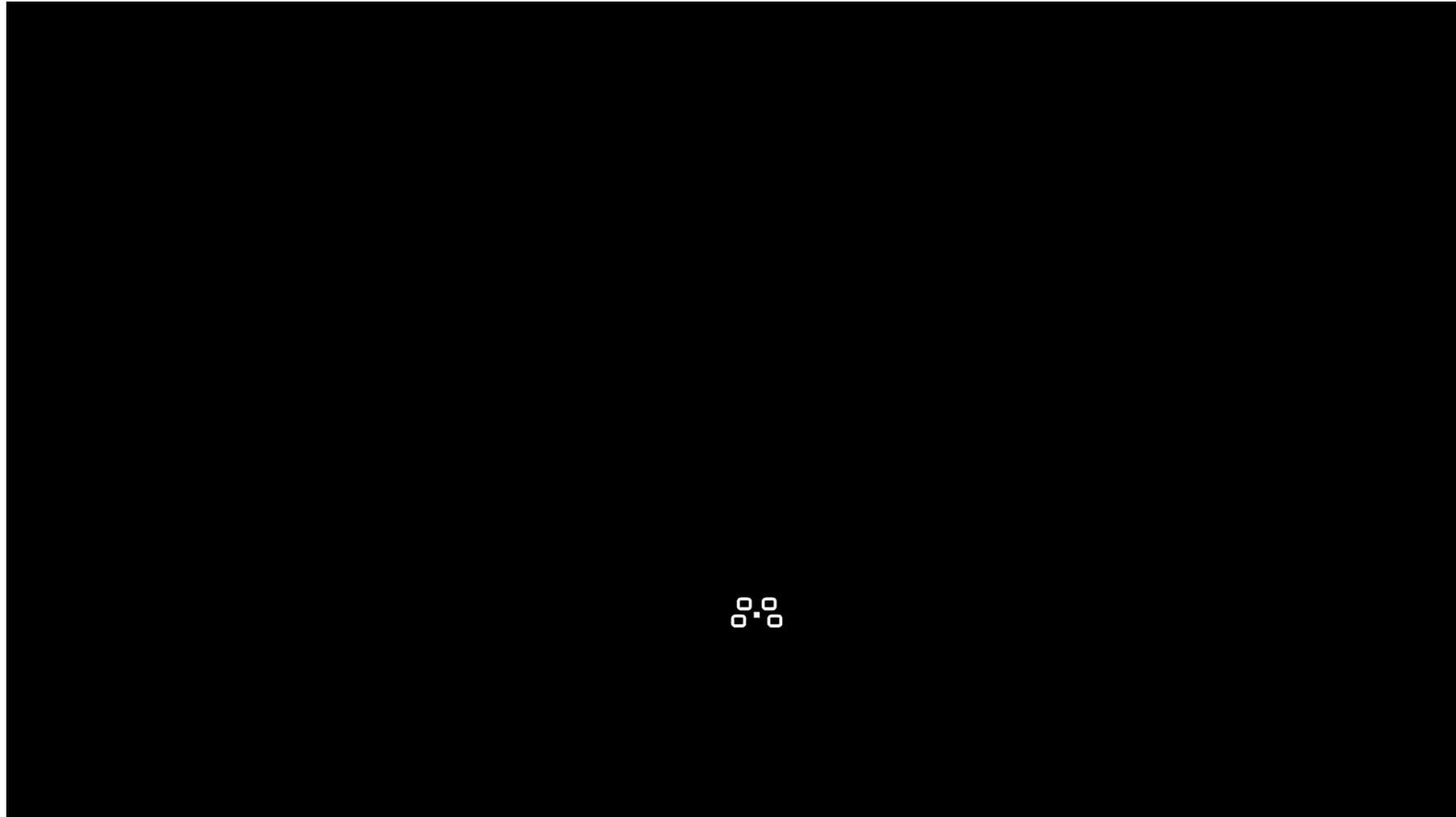
Cette relation est établie pour les plantations arborées.



CAPTEUR THERMIQUE



Identification animale



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DJI P4 MULTISPECTRAL



ADD-ON OUTILS



Épandage



Trichogrammes



Phéromones



Semis