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# Usages des drones en environnement : de la détection de processus aux synergies possibles avec la donnée satellitaire

Thomas Houet, Emilien Alvarez-Vanhard

## ► To cite this version:

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Submitted on 10 Dec 2021

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# Apports des drones en écologie et en environnement :

## Observation, détection de processus et synergies possibles avec la donnée satellitaire



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Géomatique, Télédétection  
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Géomatique, Télédétection  
[Emilien.alvarez@univ-rennes2.fr](mailto:Emilien.alvarez@univ-rennes2.fr)

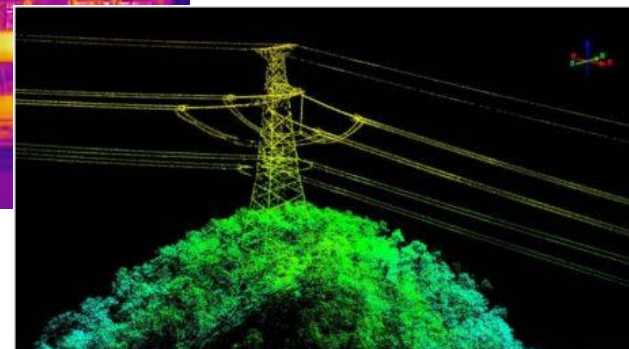
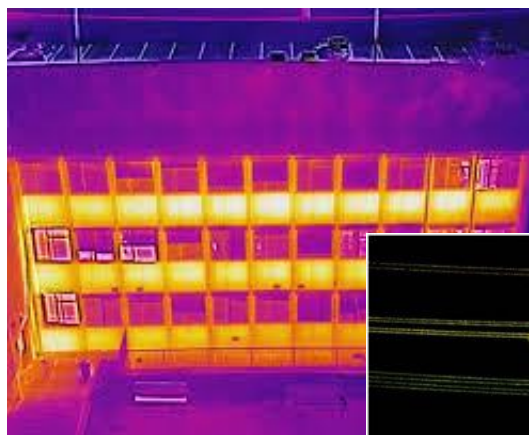
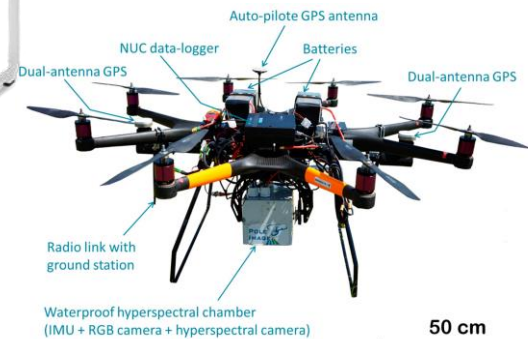




Voilure fixe



Voilure tournante



Grandes étendues  
Applications cartographiques

Plus petites étendues  
Vues obliques / 3D



OBSERVATION



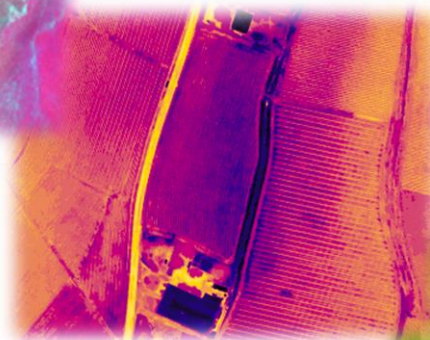
DÉTECTION



CARACTÉRISATION



PROCESSUS



SYNERGIES



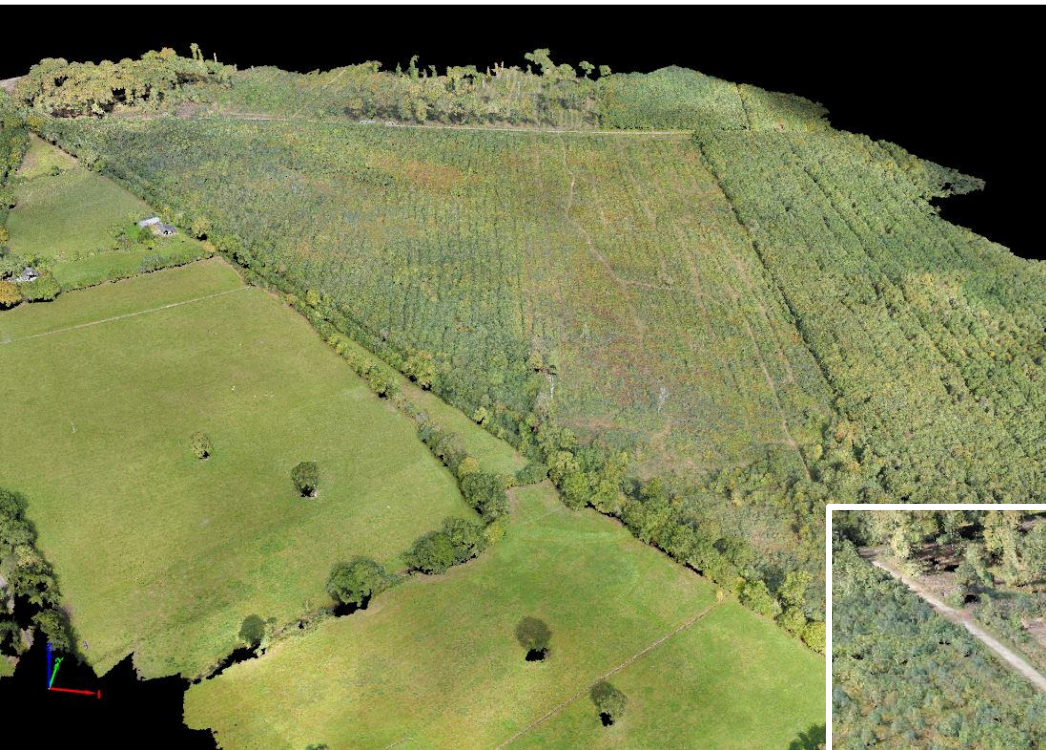
OBSERVATION

DÉTECTION

CARACTÉRISATION

PROCESSUS

SYNERGIES



OBSERVATION

DÉTECTION

CARACTÉRISATION

PROCESSUS

SYNERGIES

Journal of Coastal Research

SI

95

1117–1121

Coconut Creek, Florida

2020

## Towards Better Mapping of Seagrass Meadows using UAV Multispectral and Topographic Data

Dorothee James<sup>†\*</sup>, Antoine Collin<sup>†‡</sup>, Thomas Houet<sup>§</sup>, Antoine Mury<sup>†</sup>, H el ene Gloria<sup>†</sup>, and Nolwenn Le Poulain<sup>†</sup>

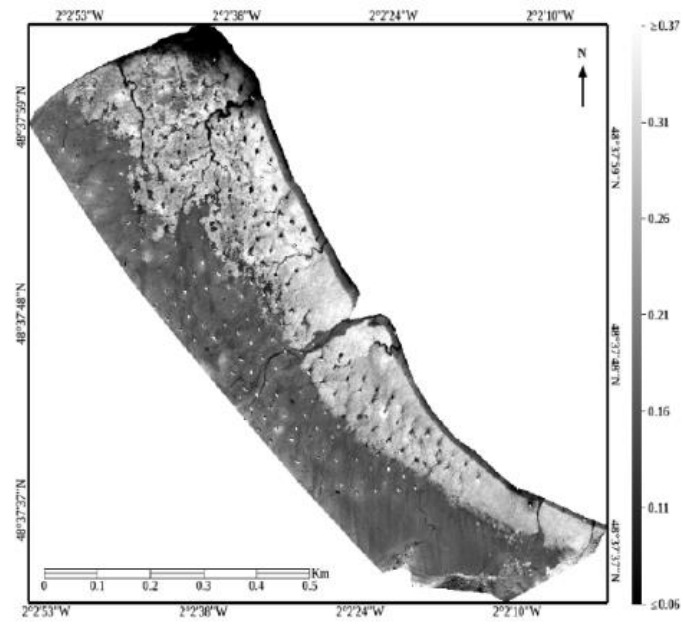
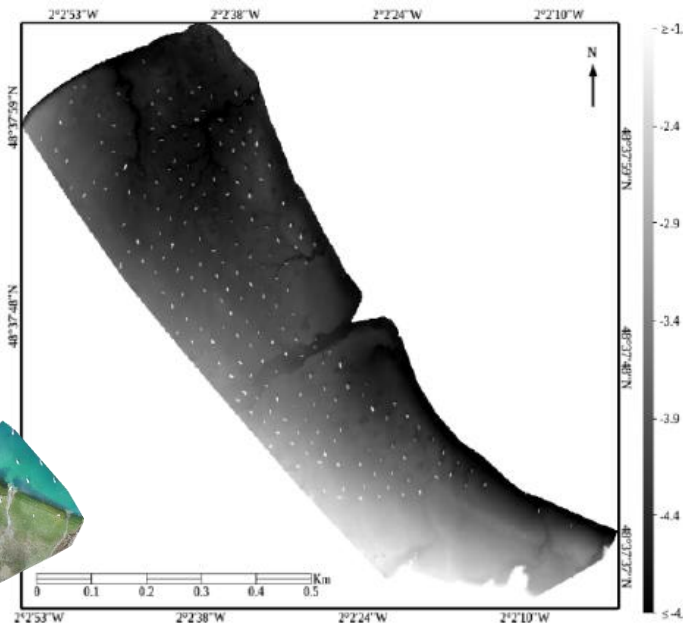
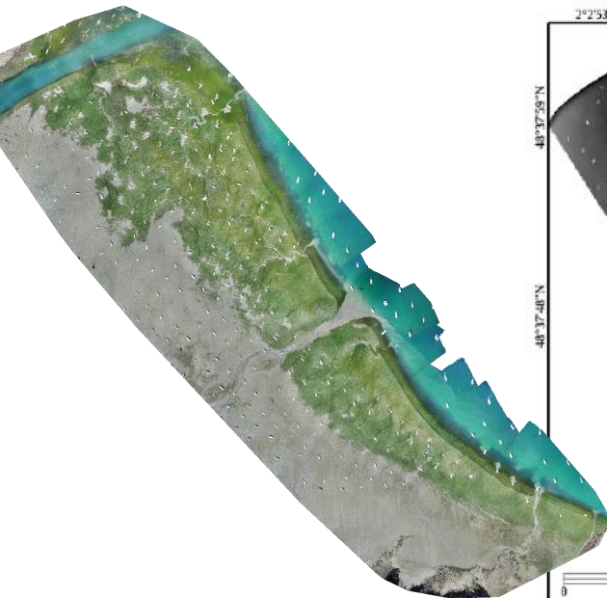
<sup>†</sup>Ecole Pratique des Hautes Etudes (EPHE), PSL Universit e Paris, CNRS UMR 6554 LETG, Dinard, France

<sup>‡</sup>Laboratoire d'Excellence CORAIL, France

<sup>§</sup>CNRS UMR 6554 LETG, Rennes, France



[www.cerf-jcr.org](http://www.cerf-jcr.org)



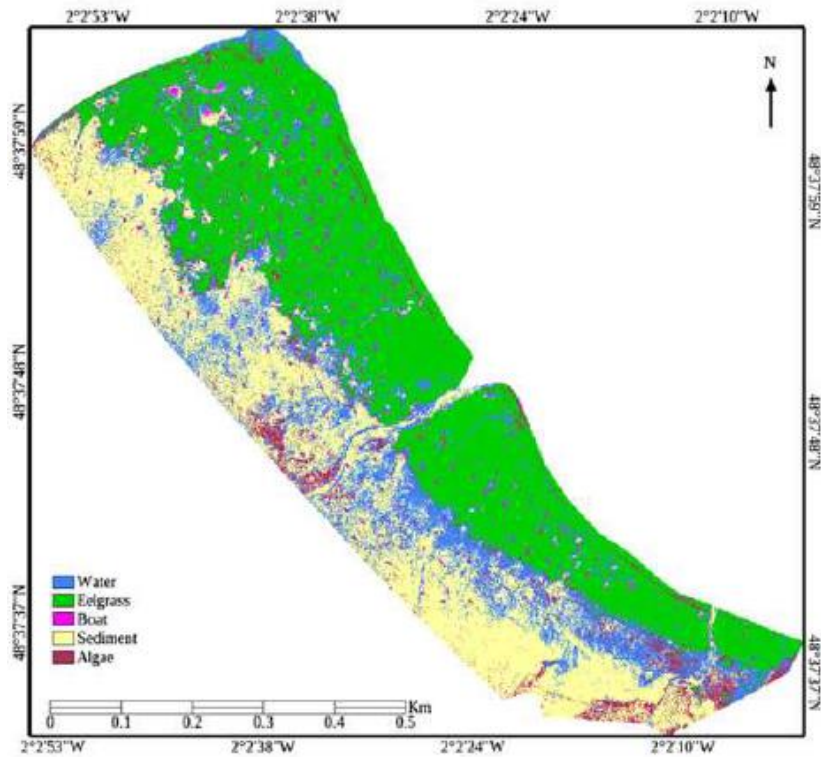
OBSERVATION

DÉTECTION

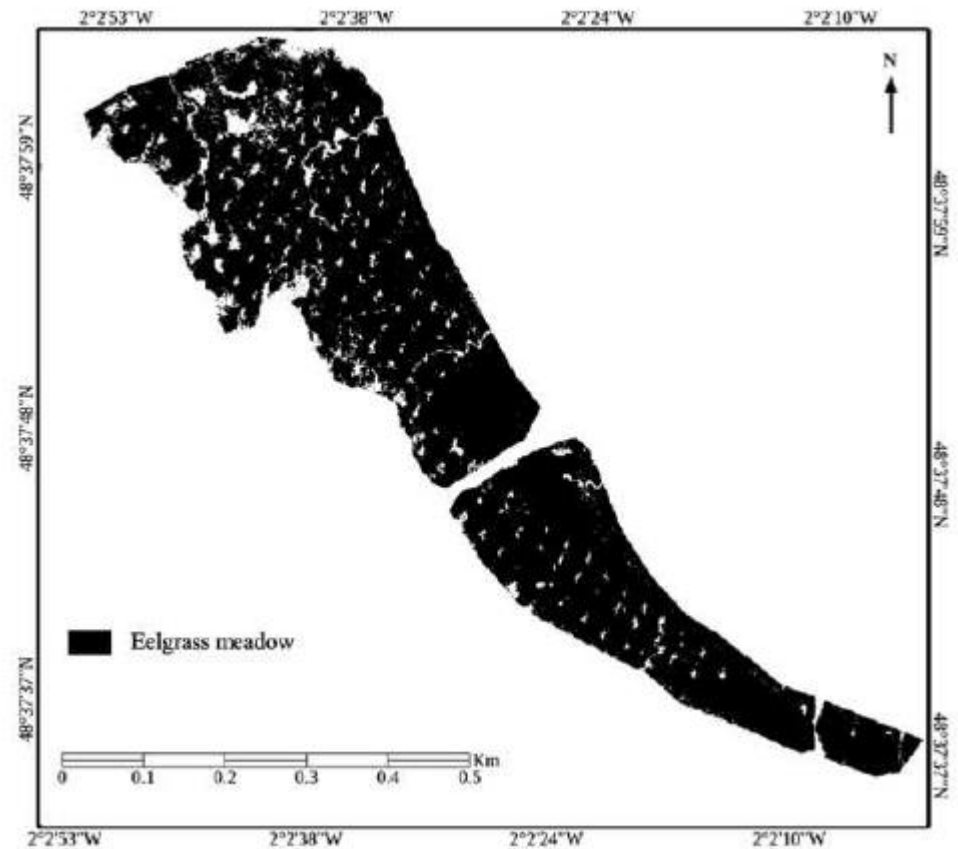
CARACTÉRISATION

PROCESSUS

SYNERGIES



14.64% de l'herbier est abimé par les bateaux





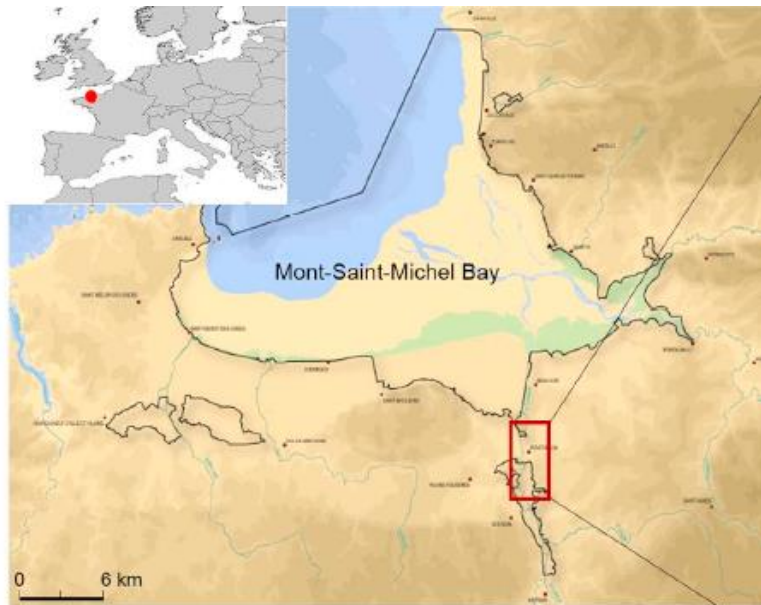
ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

## Remote Sensing of Environment

journal homepage: [www.elsevier.com/locate/rse](http://www.elsevier.com/locate/rse)

## Can UAVs fill the gap between in situ surveys and satellites for habitat mapping?

Emilien Alvarez-Vanhard<sup>a,c,\*</sup>, Thomas Houet<sup>a,c</sup>, Cendrine Mony<sup>b,c</sup>, Lucie Lecoq<sup>b,c</sup>, Thomas Corpetti<sup>a</sup><sup>a</sup> CNRS UMR 6554 LETG, Université Rennes 2, Place du recteur Henri le Moal, 35000 Rennes, France<sup>b</sup> CNRS UMR 6553 ECOBIO, Université Rennes 1, Avenue Général Leclerc, 35000 Rennes, France<sup>c</sup> LTSER site "ZA Armorique", France

Natura 2000 area





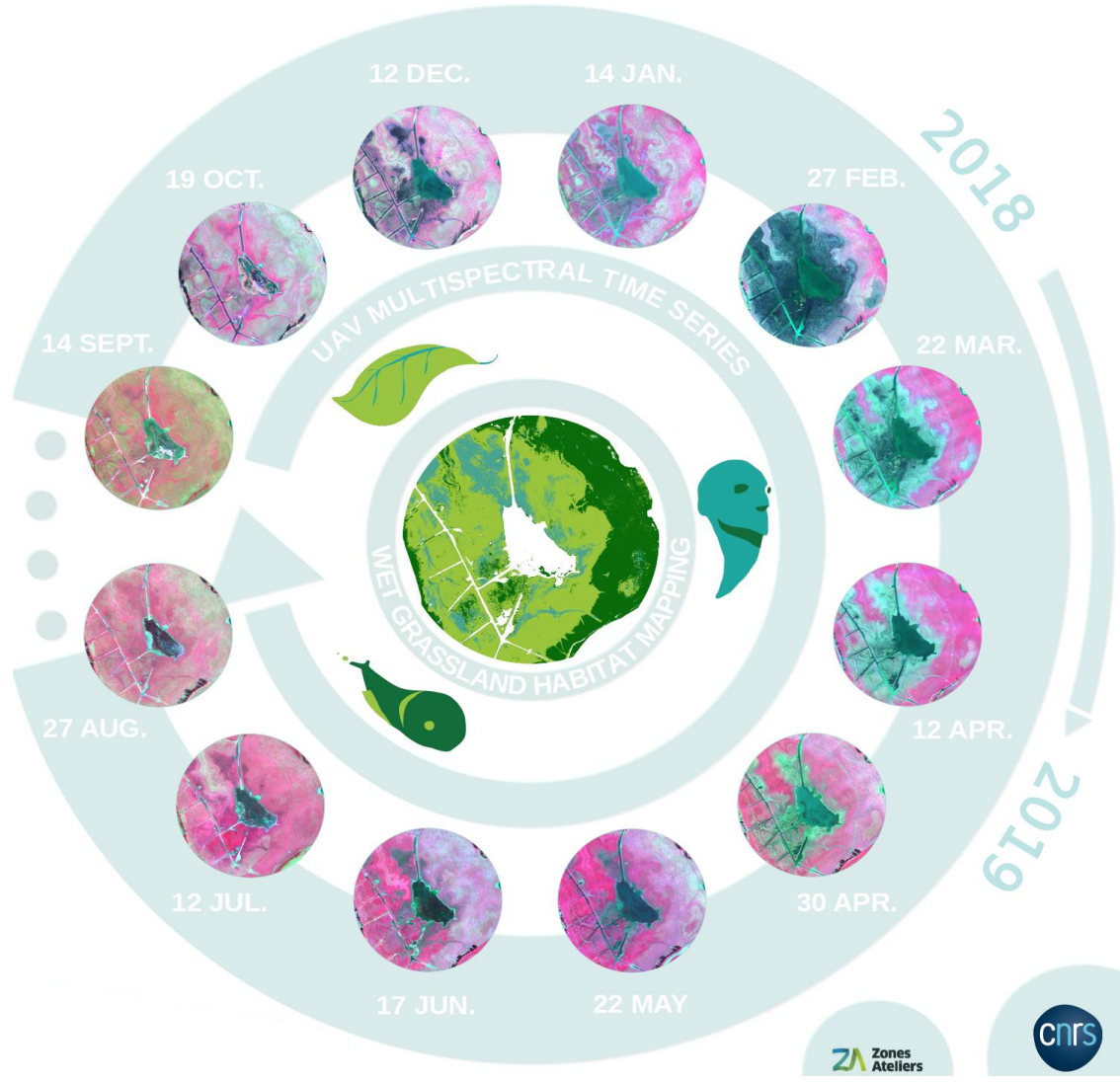
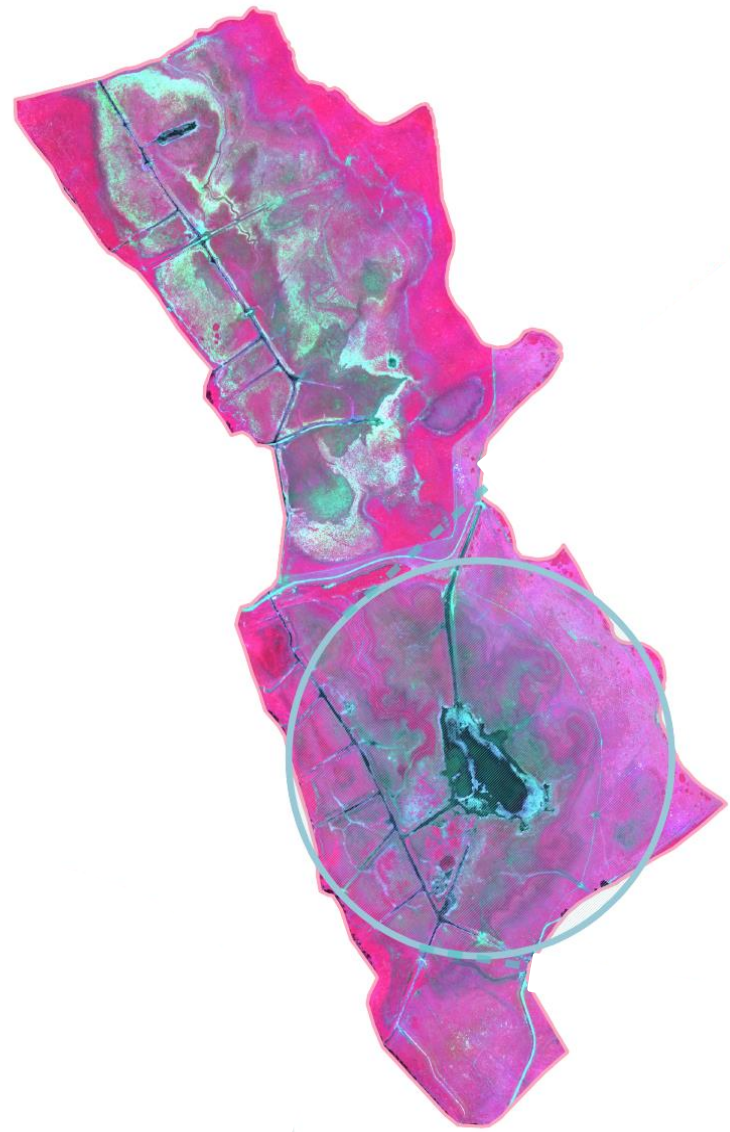
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DÉTECTION

CARACTÉRISATION

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SYNERGIES



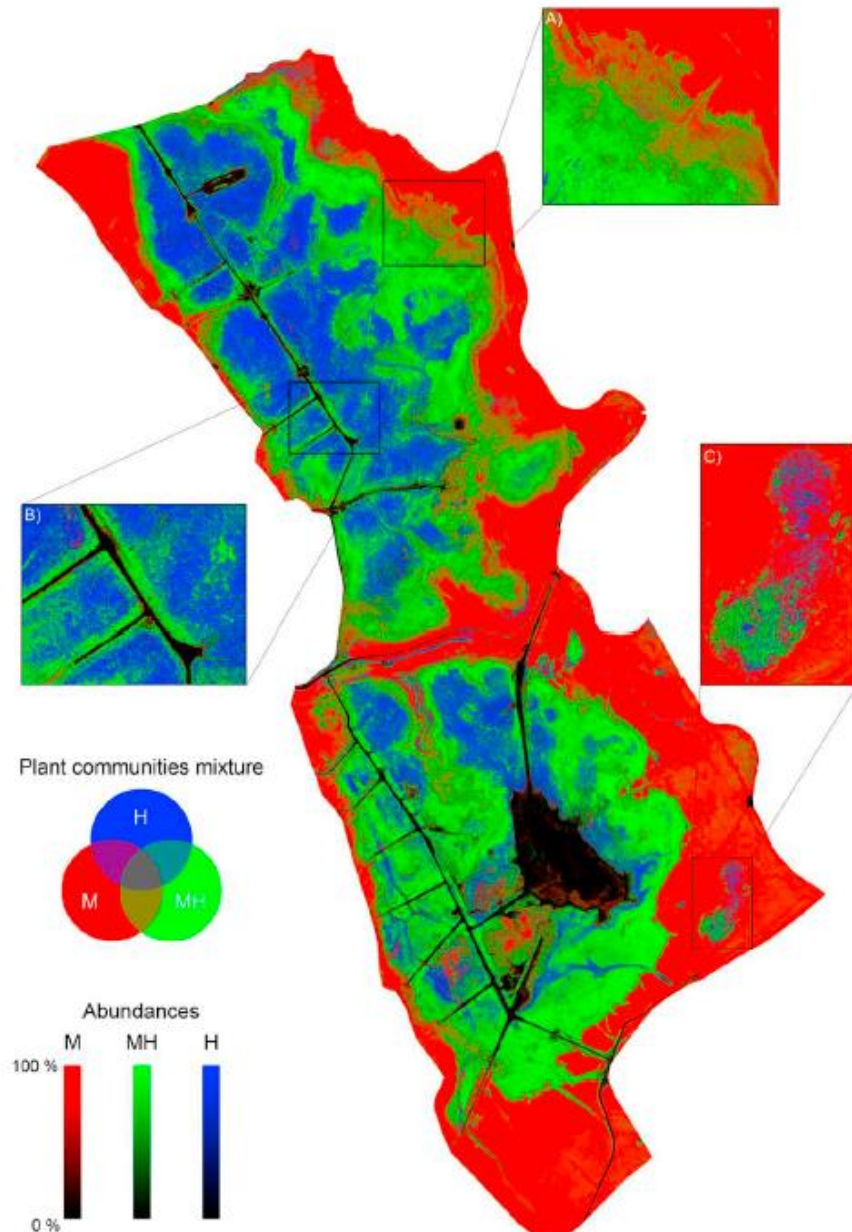
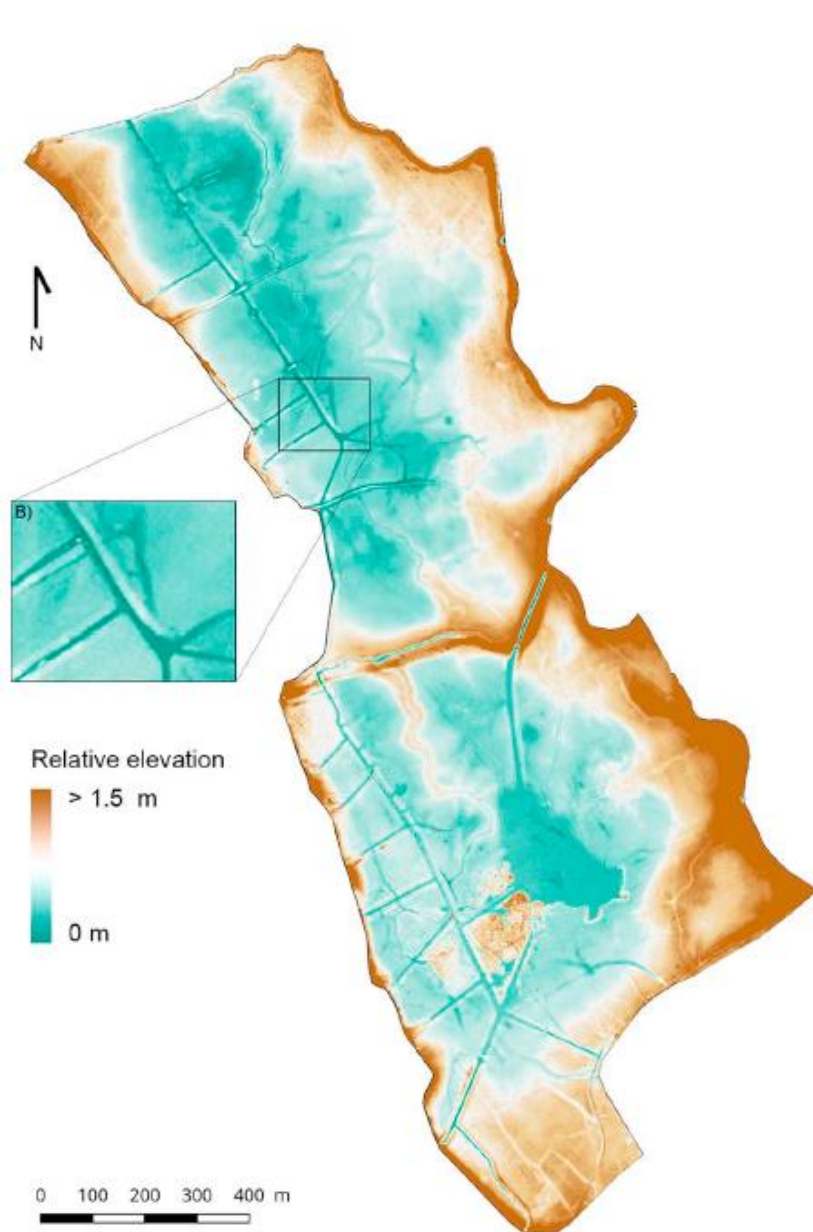
OBSERVATION

DÉTECTION

CARACTÉRISATION

PROCESSUS

SYNERGIES



OBSERVATION

DÉTECTION

CARACTÉRISATION

PROCESSUS

SYNERGIES

## MICRO-CLIMATOLOGIE VITICOLE

### Saint-Emilion – Château Ausone



OBSERVATION

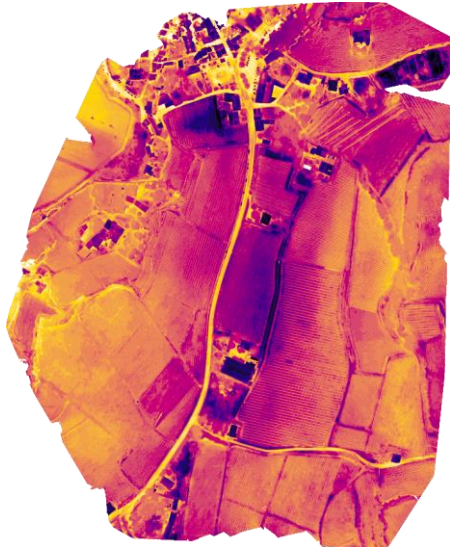
DÉTECTION

CARACTÉRISATION

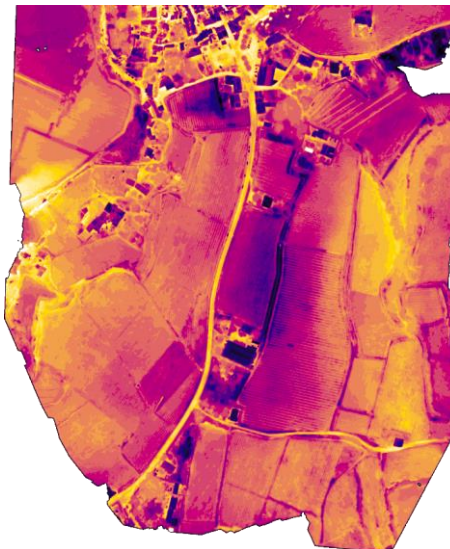
PROCESSUS

SYNERGIES

T1: 7h



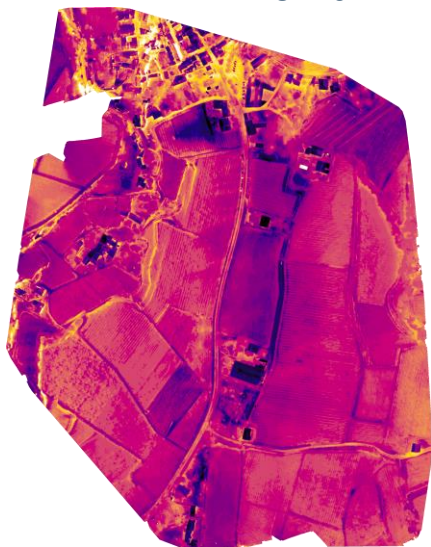
T2: 7h20



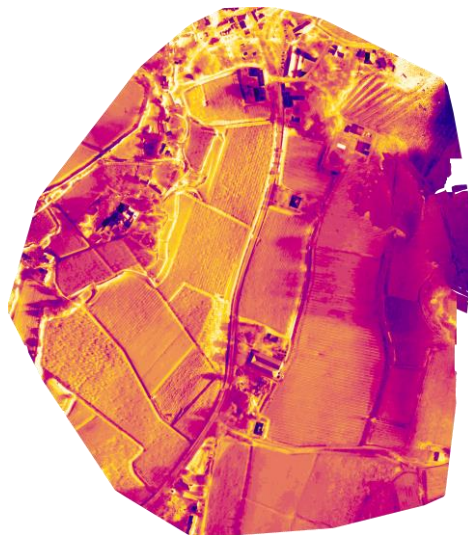
T3: 7h40



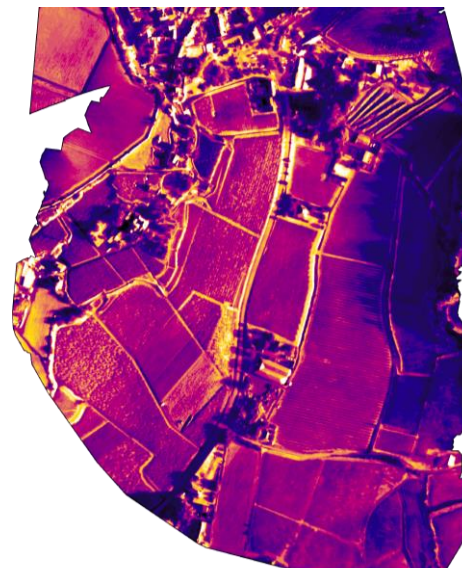
T4: 8h10



T5: 8h40

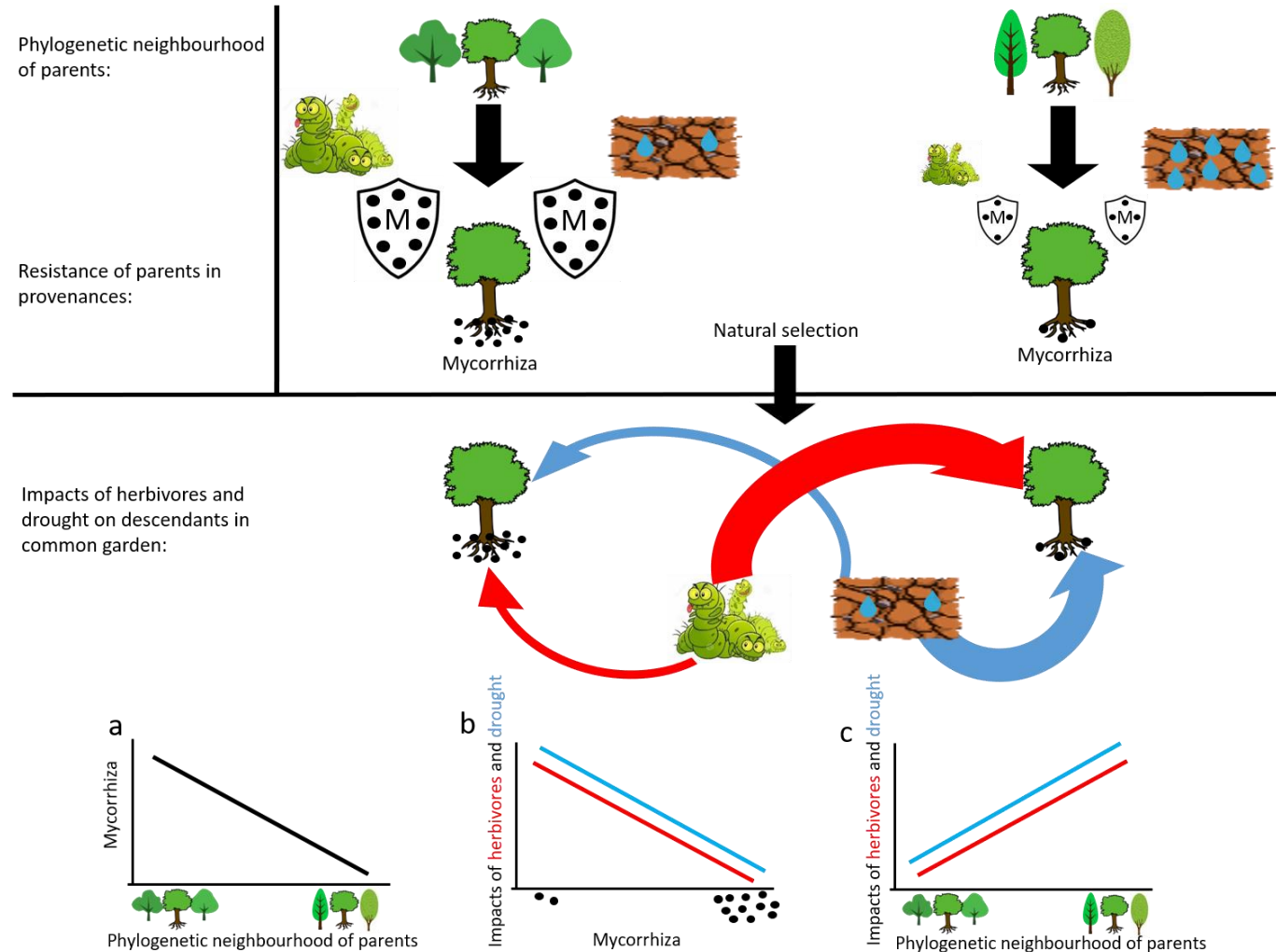


T6: 9h40



## Compréhension des processus en écologie forestière Forêt de la Petite Charnie

Pihain et al. (Submitted) Nature Ecology and Evolution



OBSERVATION

DÉTECTION

CARACTÉRISATION

PROCESSUS

SYNERGIES



<https://portail.indigeo.fr/geonetwork/srv/api/records/a3cf45c2-5dde-49eb-a7b4-794e2da17b45>

<https://doi.org/10.35110/a3cf45c2-5dde-49eb-a7b4-794e2da17b45>

### Jeu de données Drone de la Forêt de la Petite Charnie

Jeu de données acquises par drone sur la forêt INRAe de la Petite Charnie. Acquisition le 2018-09-01\_

Téléchargements et liens

	<p>Digital Object Identifier (DOI)</p> <p><a href="https://doi.org/10.35110/a3cf45c2-5dde-49eb-a7b4-794e2da17b45">https://doi.org/10.35110/a3cf45c2-5dde-49eb-a7b4-794e2da17b45</a></p>	Ouvrir le lien
	<p>Charnie_2018-09-01_MNS</p> <p>Charnie_2018-09-01_MNS</p> <p>Charnie_2018-09-01_MNS <a href="https://portail.indigeo.fr/geoserver/D2T/wms?REQUEST=getCoverage&amp;service=WCS&amp;coverage=Charnie_2018-09-01_MNS&amp;version=1.0.0&amp;CRS=EPSG:2154&amp;bbox=464004.623,6780709.3861,465567.973,6781320.5861&amp;resx=0.0499999999999993&amp;resy=0.05000000000000152&amp;format=geotiff">https://portail.indigeo.fr/geoserver/D2T/wms?REQUEST=getCoverage&amp;service=WCS&amp;coverage=Charnie_2018-09-01_MNS&amp;version=1.0.0&amp;CRS=EPSG:2154&amp;bbox=464004.623,6780709.3861,465567.973,6781320.5861&amp;resx=0.0499999999999993&amp;resy=0.05000000000000152&amp;format=geotiff</a></p>	Télécharger
	<p>Charnie_2018-09-01_MS</p> <p>Charnie_2018-09-01_MS</p> <p>Charnie_2018-09-01_MS <a href="https://portail.indigeo.fr/geoserver/D2T/wms?REQUEST=getCoverage&amp;service=WCS&amp;coverageId=Charnie_2018-09-01_MS&amp;version=2.0.1&amp;CRS=EPSG:2154&amp;bbox=463966.19802,6780769.73788,465524.55174,6781301.3329&amp;resx=0.1260599999999974&amp;resy=0.1260599999999974&amp;format=geotiff">https://portail.indigeo.fr/geoserver/D2T/wms?REQUEST=getCoverage&amp;service=WCS&amp;coverageId=Charnie_2018-09-01_MS&amp;version=2.0.1&amp;CRS=EPSG:2154&amp;bbox=463966.19802,6780769.73788,465524.55174,6781301.3329&amp;resx=0.1260599999999974&amp;resy=0.1260599999999974&amp;format=geotiff</a></p>	Télécharger

Aperçu

Étendue spatiale

Étendue temporelle

**Date de publication**  
2021-03-22

**Période**  
Sat Sep 01 2018 00:00:00 GMT+0200 ▶ Sat Sep 01 2018 00:00:00 GMT+0200

Fourni par

OBSERVATION

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Science of Remote Sensing 3 (2021) 100019

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### Science of Remote Sensing

journal homepage: [www.journals.elsevier.com/science-of-remote-sensing](http://www.journals.elsevier.com/science-of-remote-sensing)



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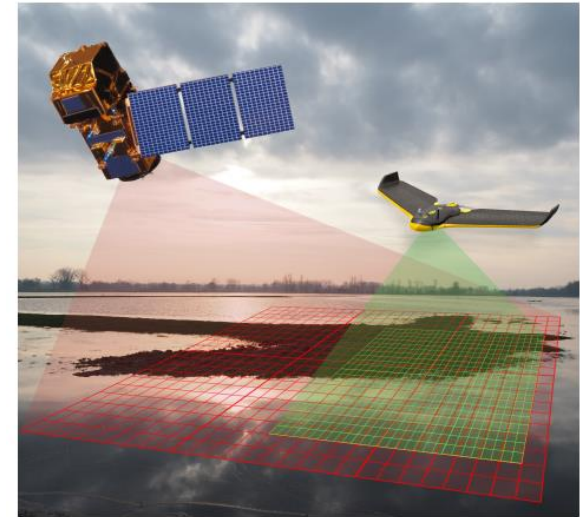


Review Article

### UAV & satellite synergies for optical remote sensing applications: A literature review

Alvarez-Vanhard Emilien\*, Corpetti Thomas, Houet Thomas

CNRS UMR 6554 LETG, Université Rennes, Place Du Recteur Henri Le Moal, 35000, Rennes, France



1 à 30cm

Illimitée

(Infra-horaire à mensuelle, Jour / nuit)

Qq 10<sup>aines</sup> à 100<sup>aines</sup> d'Ha

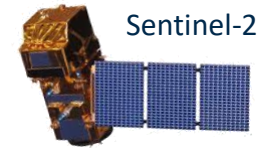
RGB, multispectral, thermique, Lidar

**RESOLUTION SPATIALE**

**FREQUENCE**

**ETENDUE**

**CAPTEURS**



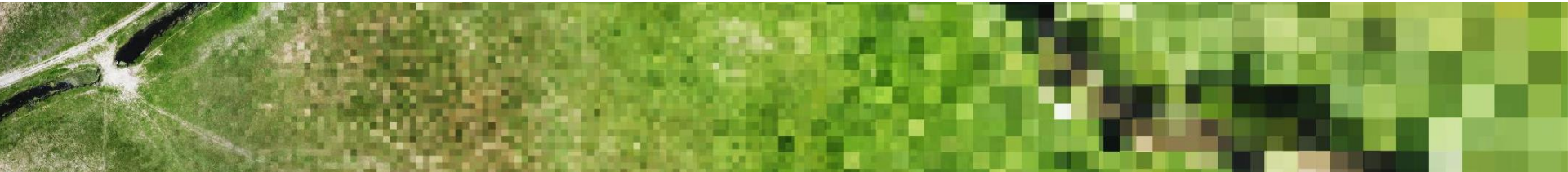
Sentinel-2

10m

5 jours / Heure fixe

Milliers de km<sup>2</sup>

Multispectral



OBSERVATION

DÉTECTION

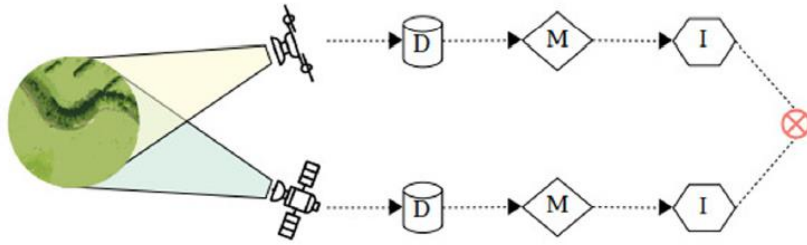
CARACTÉRISATION

PROCESSUS

SYNERGIES

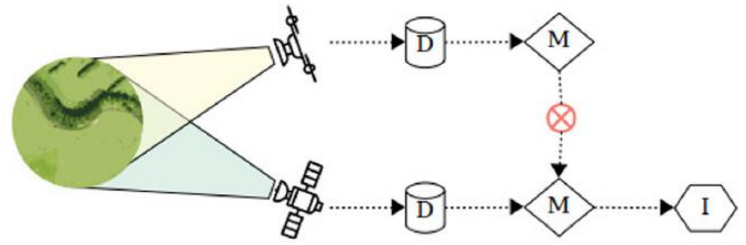
A)

Data Comparison



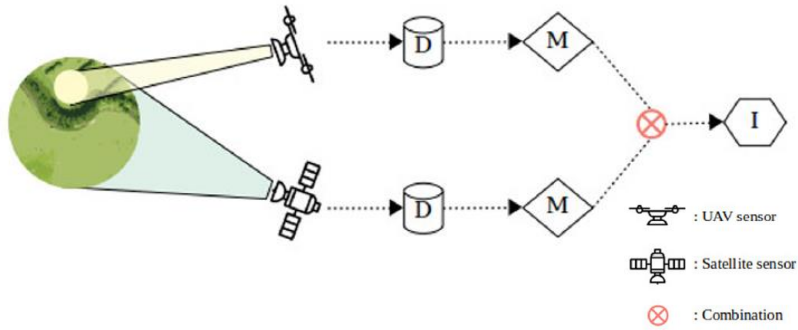
C)

Model Calibration



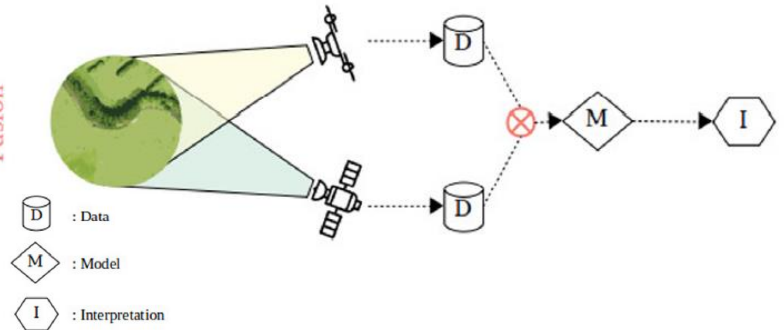
B)

Multiscale Explanation



D)

Data Fusion



A)





OBSERVATION

DÉTECTION

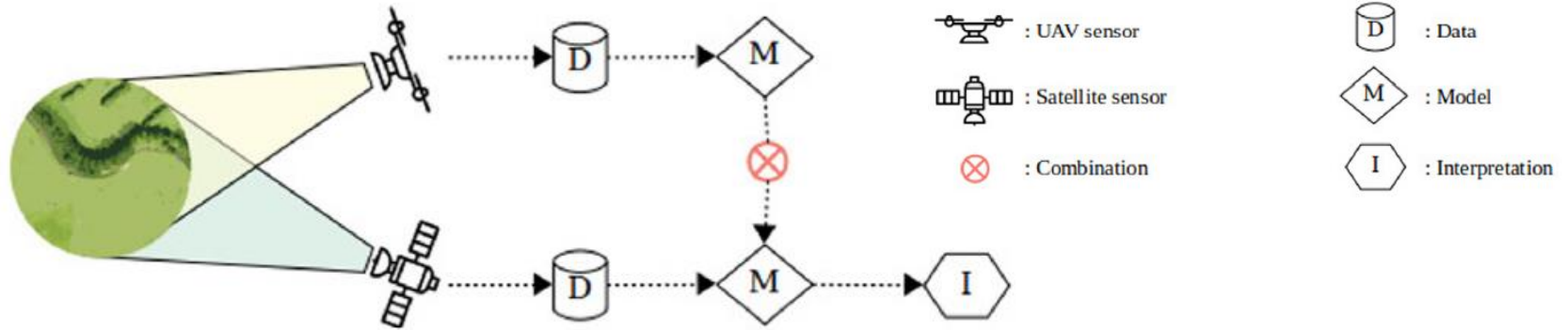
CARACTÉRISATION

PROCESSUS

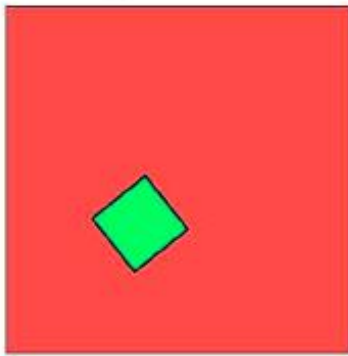
SYNERGIES

C)

Model  
Calibration

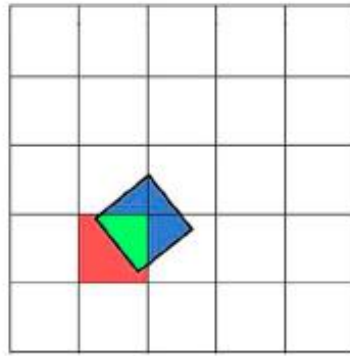


1) Sentinel-2



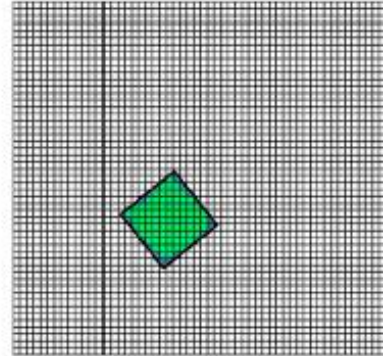
10 m

2) Pleiades



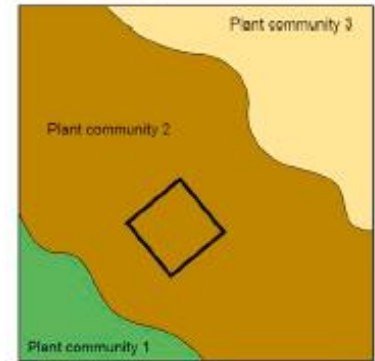
2 m

3) UAV



0.2 m

4) Vegetation cover

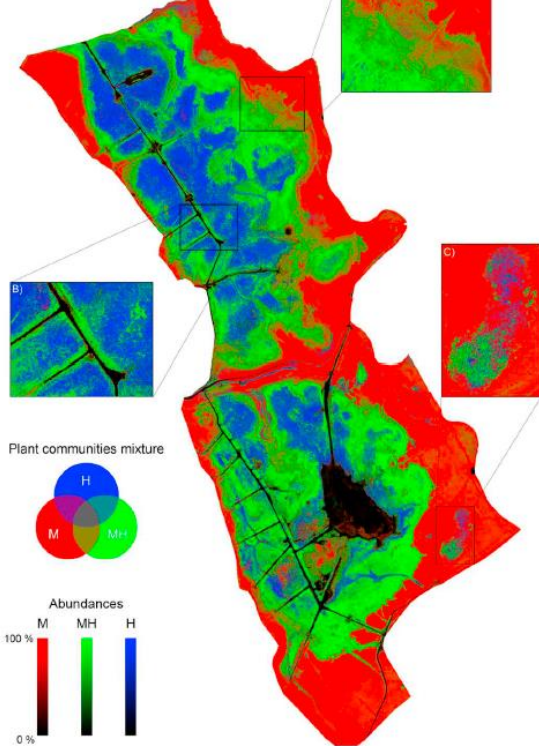


Spatial resolution of remotely sensed data (pixel size)

- Red square: Potential mixture
- Green square: Pure signal
- Blue square: Missing signal



Plot area



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journal homepage: [www.elsevier.com/locate/rse](http://www.elsevier.com/locate/rse)



Can UAVs fill the gap between in situ surveys and satellites for habitat mapping?

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<sup>a</sup> CNRS UMR 6554 LETG, Université Rennes 2, Place du recteur Henri le Moal, 35000 Rennes, France

<sup>b</sup> CNRS UMR 6553 ECOBIO, Université Rennes 1, Avenue Général Leclerc, 35000 Rennes, France

<sup>c</sup> LTSER site "ZA Armorique", France

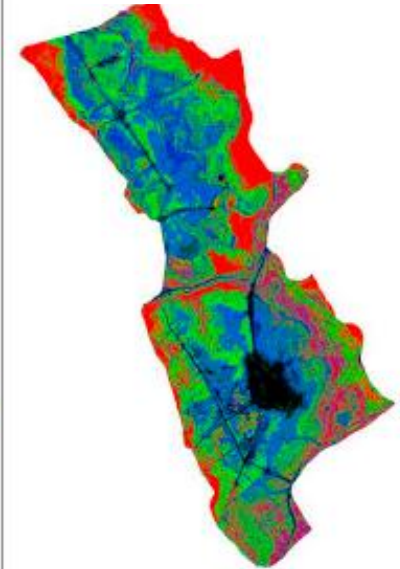
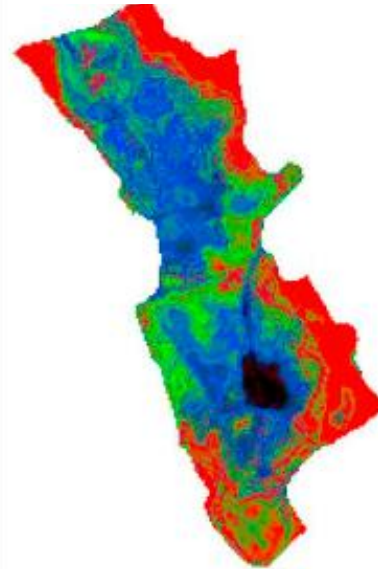
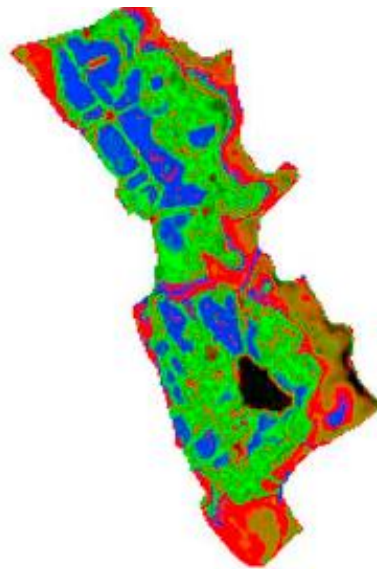
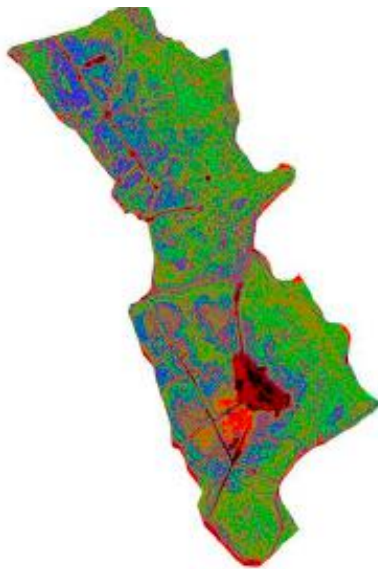
Nov 2017 Pléiades

Apr 2018 – S2

May 2018 S2

May 2018 – Pléiades

UAV  
Endmembers



## CONCLUSIONS

- Une approche de l'écologie et de l'environnement à la fois indépendante et complémentaire aux approches existantes (in situ monitoring, surface sensing, remote sensing)
- Le trait d'union entre l'espace (satellite) et le terrain indispensable dans le suivi des socio-écosystèmes



