

Análisis espectral en banano para el monitoreo agrícola: Manejo y detección de enfermedades.

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CENTRO DE GEOMÁTICA Y DETECCIÓN REMOTA

Geomatics and Remote Sensing Center

**SENSORES Y DRONES PARA LA EDUCACIÓN EN
AGRICULTURA**

Sensors and Drones for Education in Agriculture

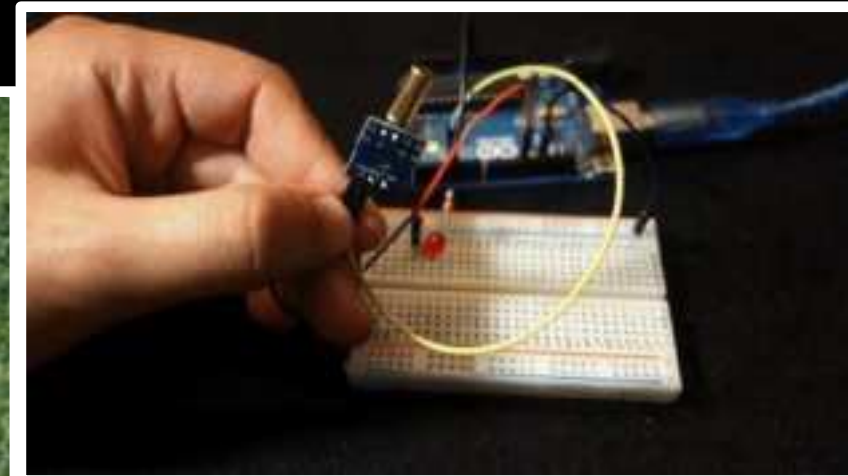
¿En que estamos trabajando?



Detección remota



Drones de trabajo



Sensores en campo



Fortalecer el programa académico

Desarrollar investigación

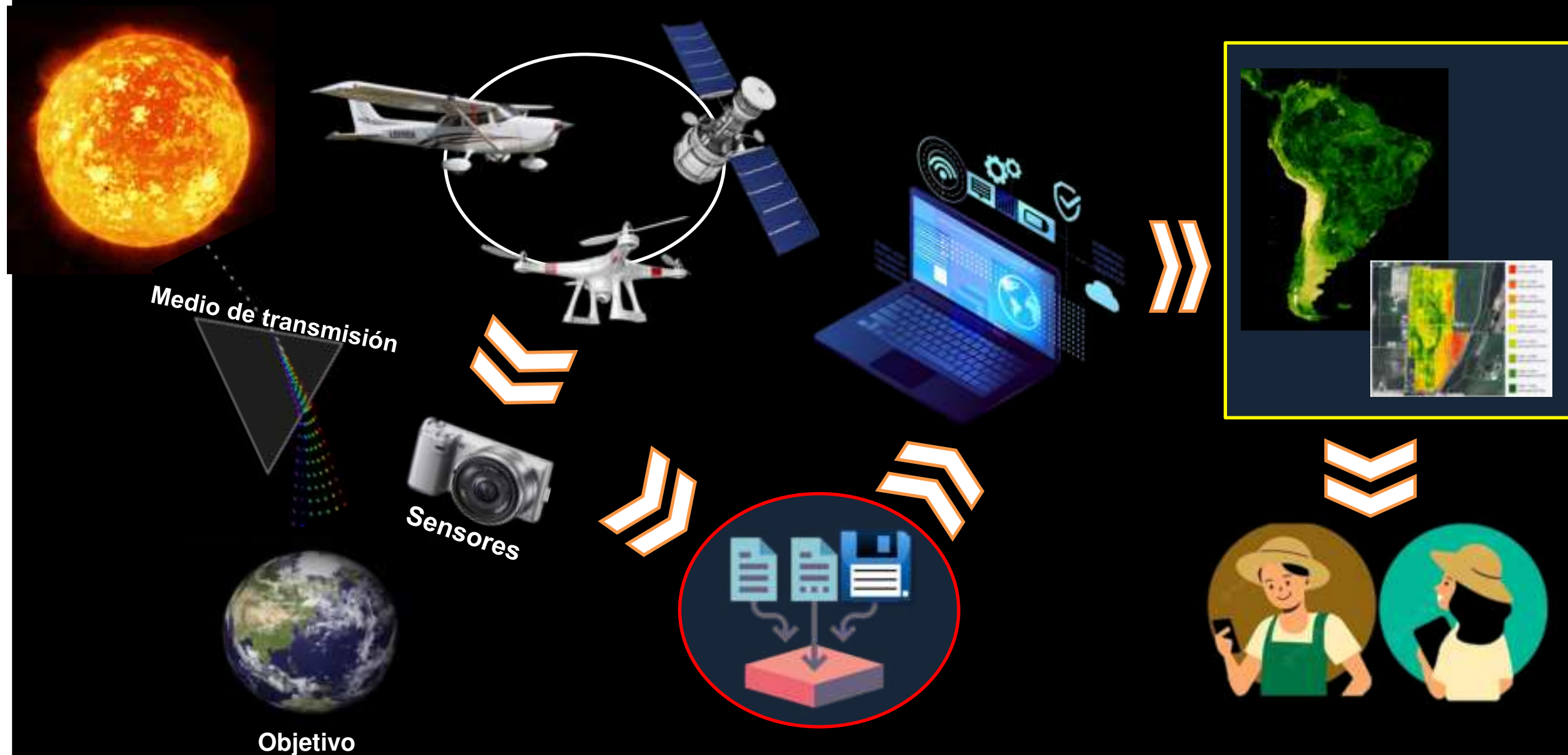


**Centro de
Geomática y
Detección
Remota**

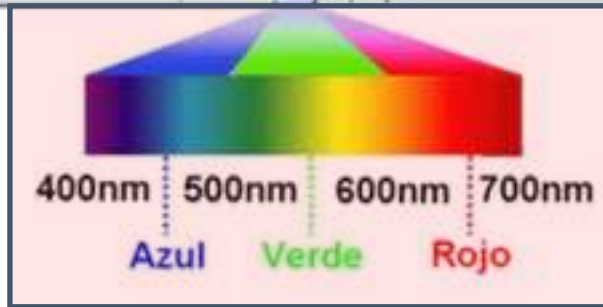
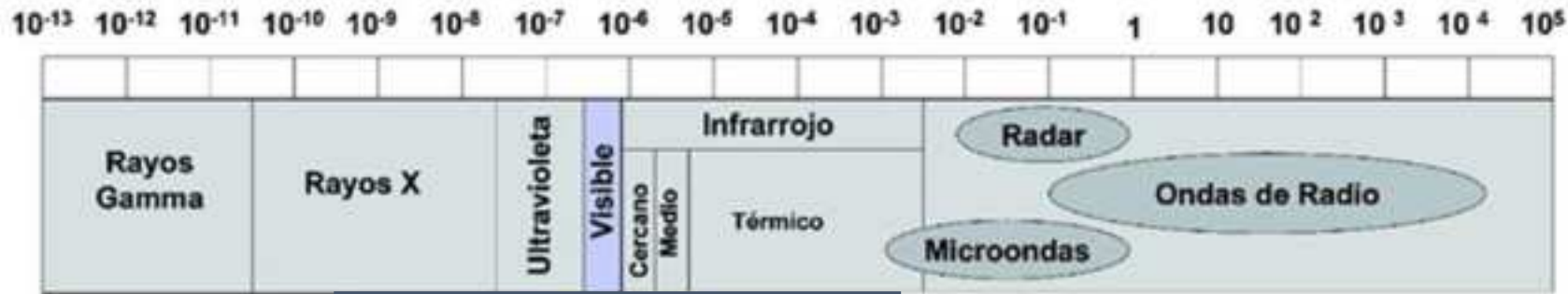
Crear relaciones de trabajo



EL FLUJO DE TRABAJO



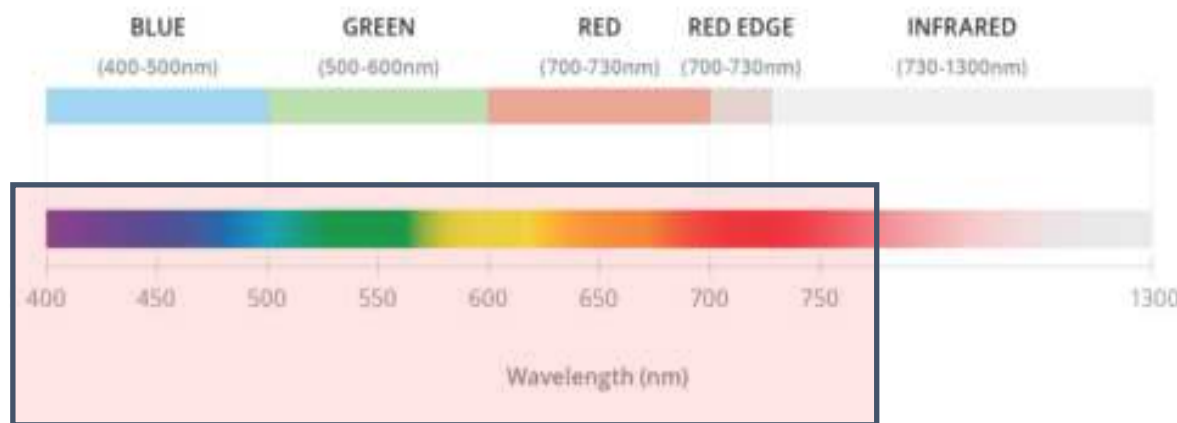
El espectro de trabajo...



VARI (Índice de Resistencia Atmosférica Visible)

$$(\text{Verde} - \text{Rojo}) / (\text{Verde} + \text{Rojo} - \text{Azul})$$

1

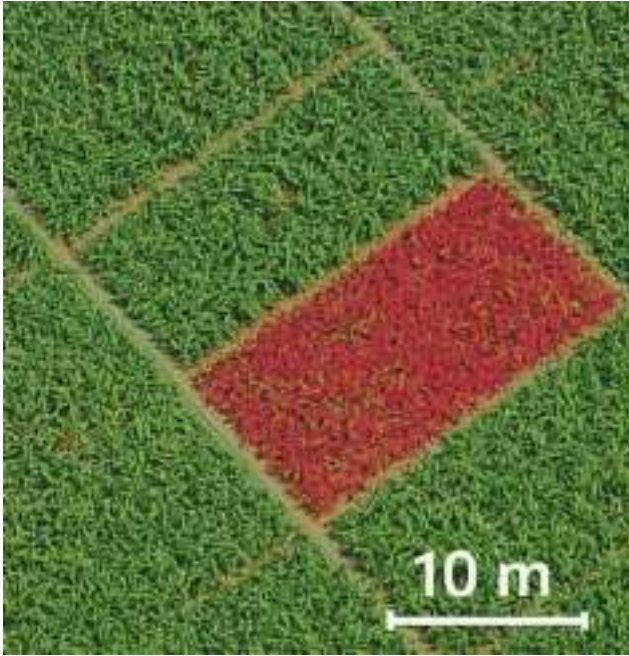


2

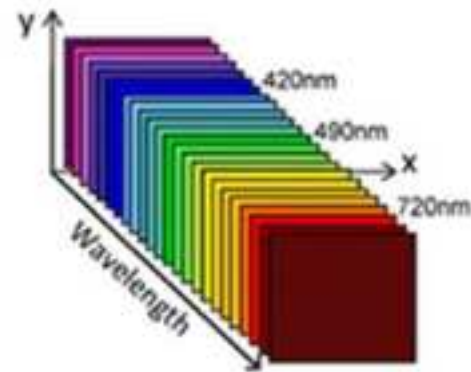
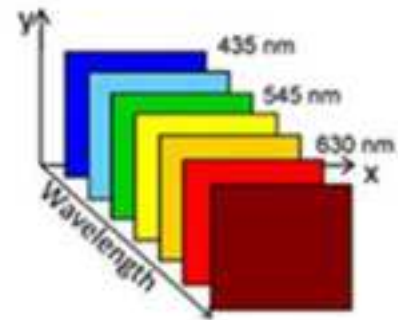
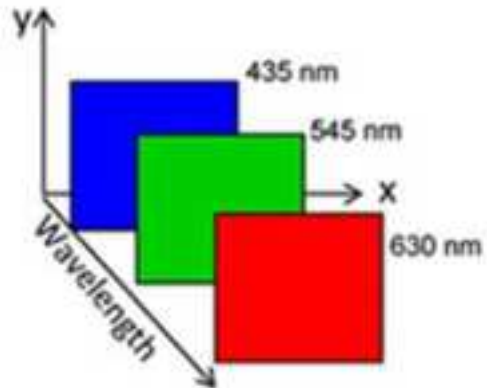
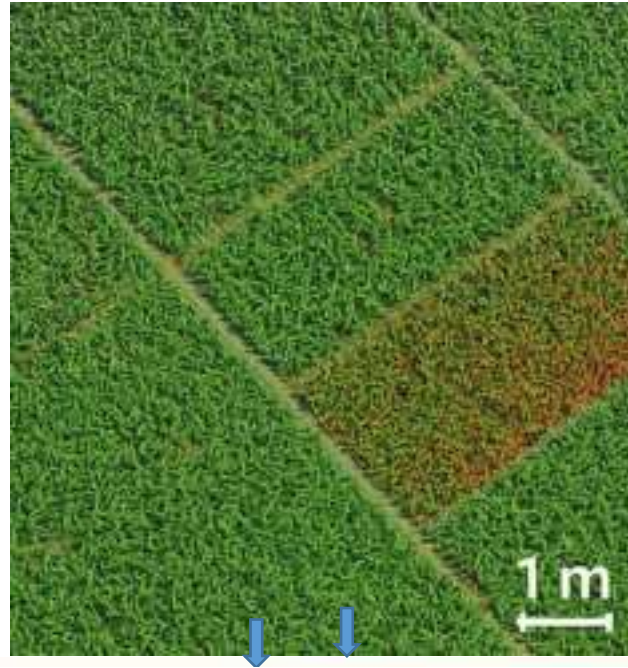
NDVI (Índice de vegetación de diferencia normalizada)



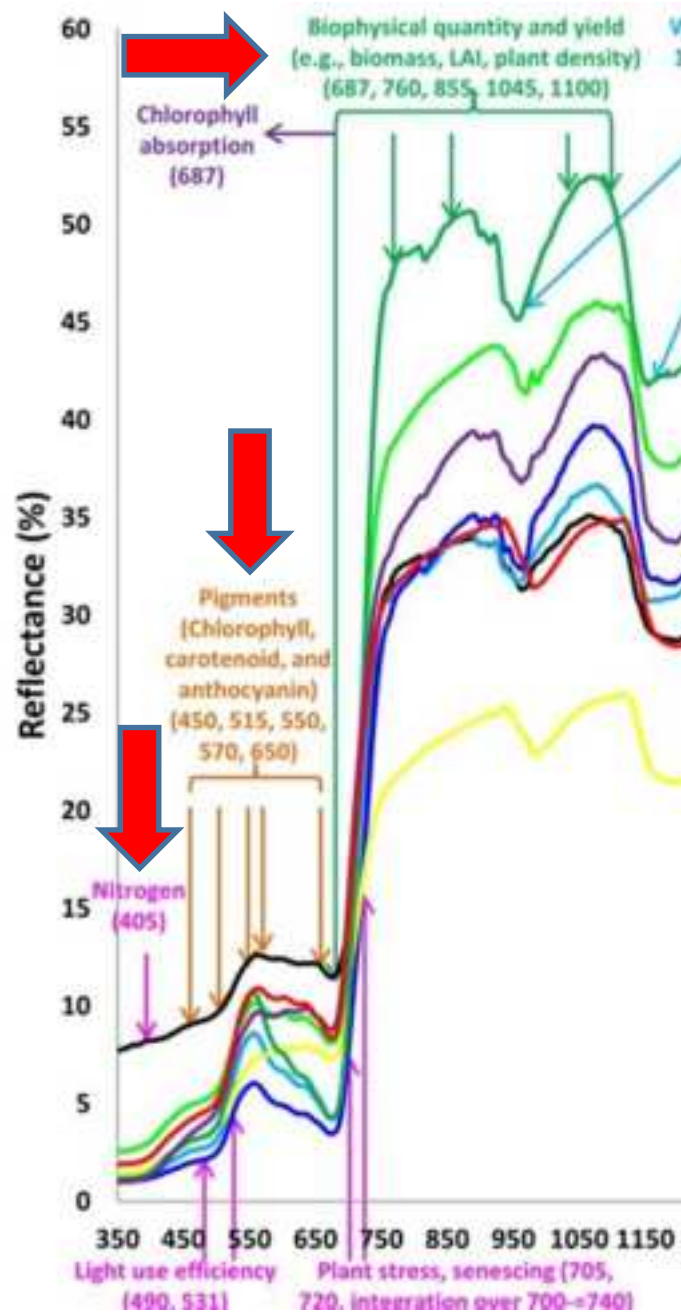
Multiespectral



Hiperespectral



PRI (Índice de reflectancia fotoquímica) $(R_{531} - R_{570}) / (R_{531} + R_{570})$



OCO-2 Solar-Induced Chlorophyll Fluorescence Variability across Ecoregions of the Amazon Basin and the Extreme Drought Effects of El Niño (2015–2016)

by Antony Oswaldo Castro ^{1,*} , Jia Chen ² , Christian S. Zang ¹ , Ankit Shekhar ^{2,3} ,
Juan Carlos Jimenez ⁴ , Shrutilipi Bhattacharjee ² , Mengistie Kindu ¹ ,
Victor Hugo Morales ⁵  and Anja Rammig ¹ 

¹ Technical University of Munich, TUM School of Life Sciences Weihenstephan, 85354 Freising, Germany

² Technical University of Munich, TUM Department of Electrical and Computer Engineering, 80333 Munich, Germany

³ ETH Zurich, Department of Environmental Systems Science, 8092 Zurich, Switzerland

⁴ University of Valencia, Global Change Unit, Image Processing Laboratory, 46003 Valencia, Spain

⁵ EARTH University, Center of Geomatics and Remote Detection, Mercedes 70602, Costa Rica

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Remote Sens. **2020**, *12*(7), 1202; <https://doi.org/10.3390/rs12071202>



Orbiting Carbon Observatory-2 (OCO-2)

Recognition of Banana Fusarium Wilt Based on UAV Remote Sensing

by Huichun Ye ^{1,2,3} , Wenjiang Huang ^{1,2,3,*} , Shanyu Huang ⁴ , Bei Cui ^{1,2,3} , Yingying Dong ^{1,2} , Anting Guo ^{1,5} , Yu Ren ^{1,5}  and Yu Jin ⁶ 

¹ Key Laboratory of Digital Earth Science, Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, Beijing 100094, China

² Aerospace Information Research Institute, Chinese Academy of Sciences, Beijing 100094, China

³ Key Laboratory of Earth Observation of Hainan Province, Sanya 572029, China

⁴ Chinese Academy of Agricultural Engineering Planning & Design, Beijing 100125, China

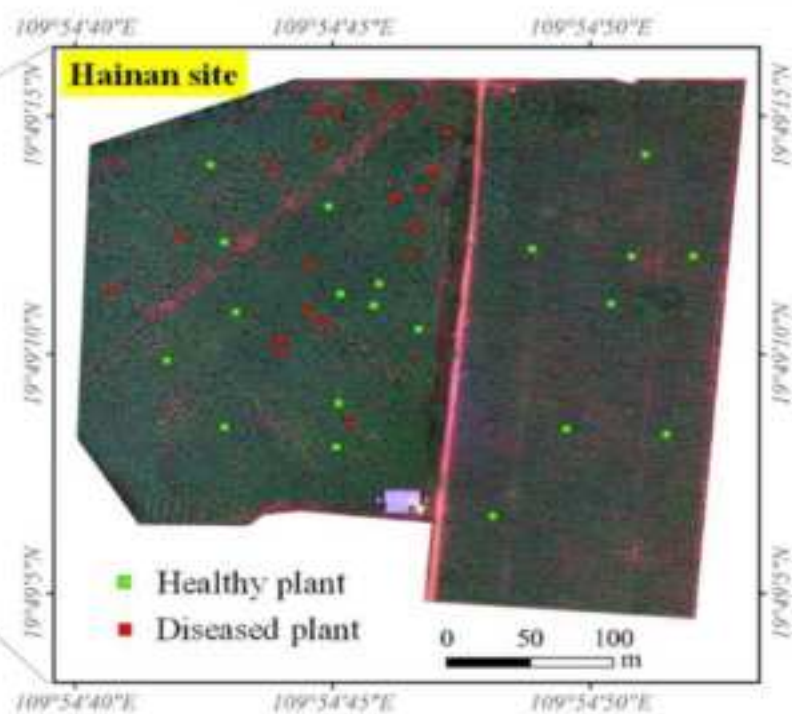
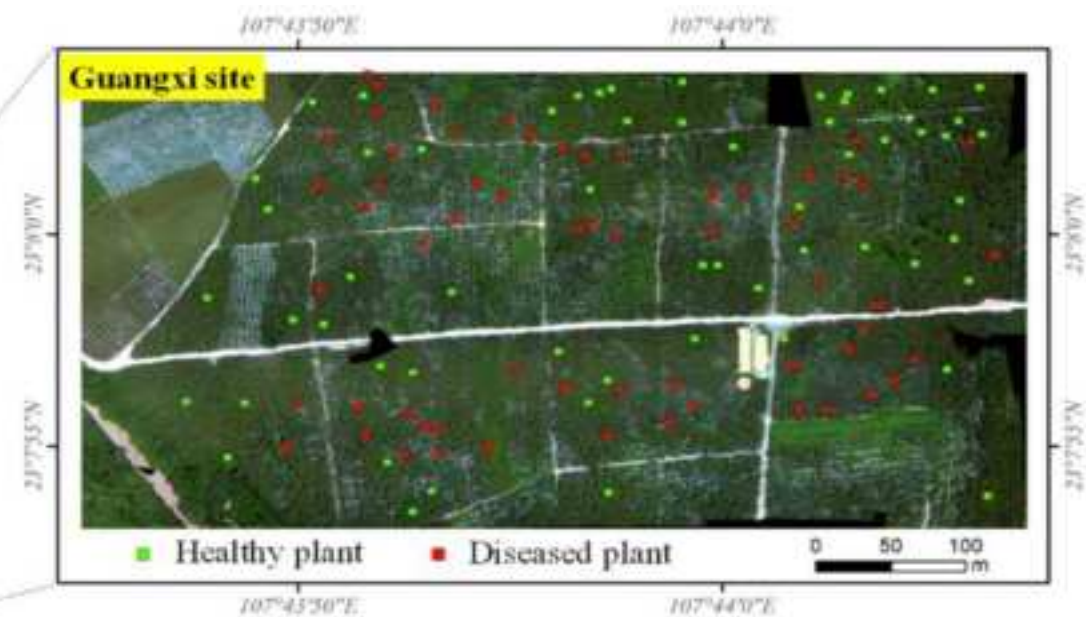
⁵ University of Chinese Academy of Sciences, Beijing 100049, China

⁶ School of Electronics and Information Engineering, Anhui University, Hefei 230601, China

* Author to whom correspondence should be addressed.

Remote Sens. **2020**, *12*(6), 938; <https://doi.org/10.3390/rs12060938>





Application Article |  **Open Access** | 

Early detection of black Sigatoka in banana leaves using hyperspectral images

Jorge Ugarte Fajardo , Oswaldo Bayona Andrade, Ronald Criollo Bonilla, Juan Cevallos-Cevallos, María Mariduená-Zavala, Daniel Ochoa Donoso, José Luis Vicente Villardón

First published: 28 August 2020 | <https://doi.org/10.1002/aps3.11383> | Citations: 23



Geospatial Approach to Determine Nitrate Values in Banana Plantations

by **Angélica Zamora-Espinoza**¹ ✉, **Juan Chin**^{1,2} ✉, **Adolfo Quesada-Román**^{3,*}  and **Veda Obando**⁴ ✉

¹ Escuela de Ingeniería en Biosistemas, Universidad de Costa Rica, San José 2060, Costa Rica

² Centro de Investigación en Contaminación Ambiental (CICA-UCR), San José 2060, Costa Rica

³ Escuela de Geografía, Universidad de Costa Rica, San José 2060, Costa Rica

⁴ Corporación Bananera Nacional (CORBANA), San José 6504-1000, Costa Rica

* Author to whom correspondence should be addressed.

AgriEngineering **2024**, *6*(3), 2513-2525; <https://doi.org/10.3390/agriengineering6030147>



CONTEO

Sixaola, Costa Rica



C = 1326
Precisión: 96%

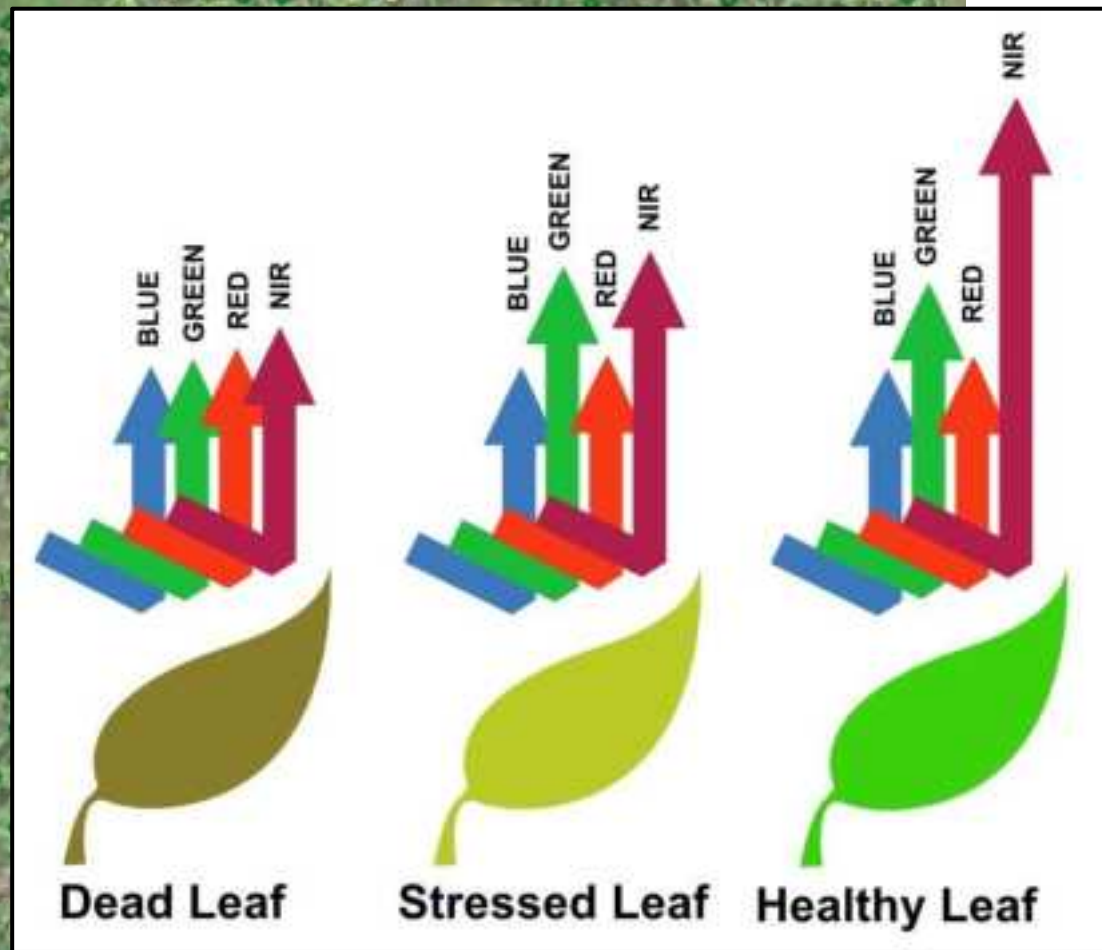
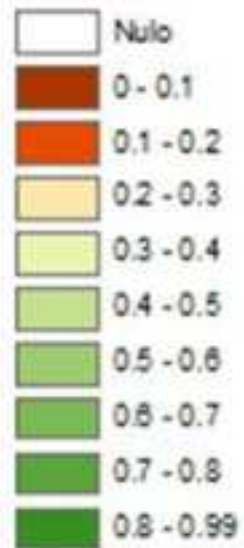
ESTADO DE SALUD

Sixaola, Costa Rica

Leyenda

NDVI

Valor



Fuente: <https://physicsopenlab.org/2017/01/30/ndvi-index/>

¿Análisis espectral por sí solo?

Relación Agua – Nutrición

**VARIABILIDAD
CLIMÁTICA**

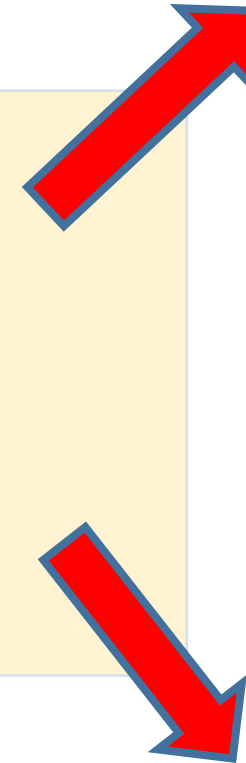
- Cambios en precipitación
- Cambios en temperatura
- Eventos extremos (sequías, inundaciones, vientos)

Impacta

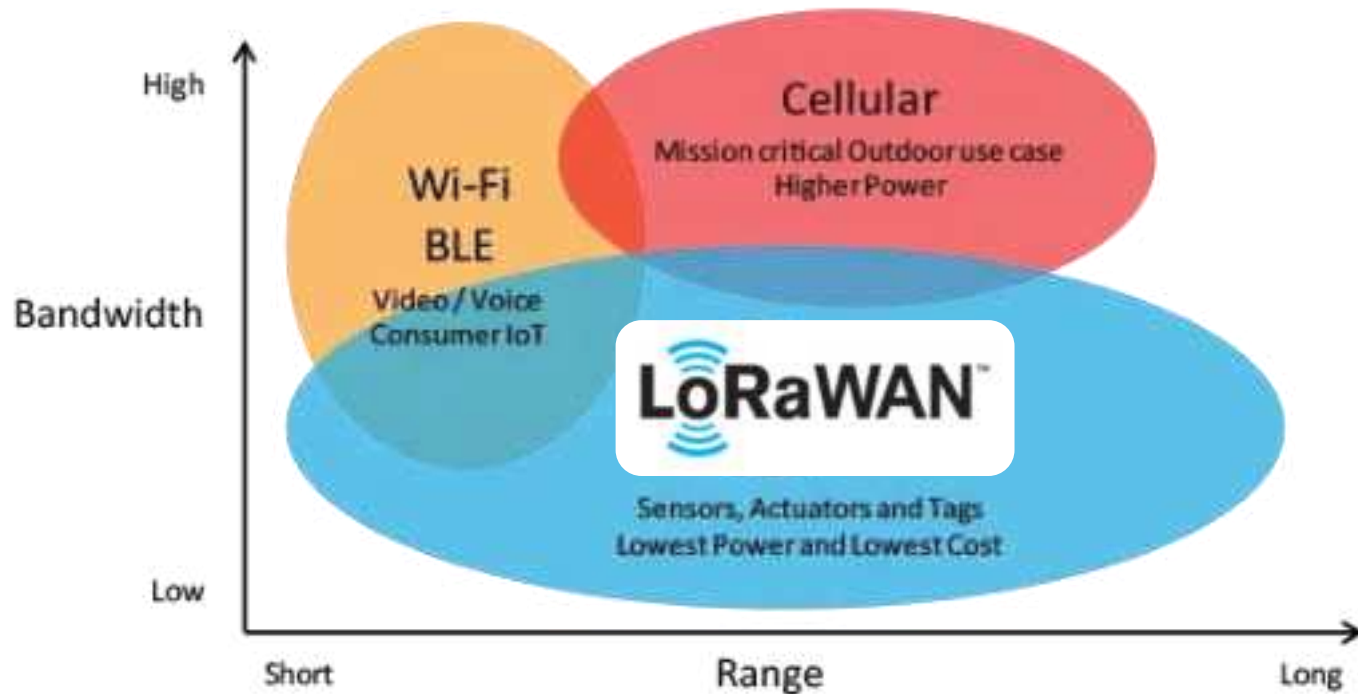
**CULTIVO
DE
BANANO**

- Estrés hídrico
- Alteración del crecimiento y desarrollo
- Aumento de incidencia de plagas y enfermedades

Manejo Integrado



¡Se requieren capas de información espacio temporal!



1



LoRaWAN™



Bajo consumo de energía, alcance (5-10 km), escalabilidad y seguridad mejorada

Microclima

Capa suelo



1

LoRaWAN™

THE THINGS
NETWORK



2

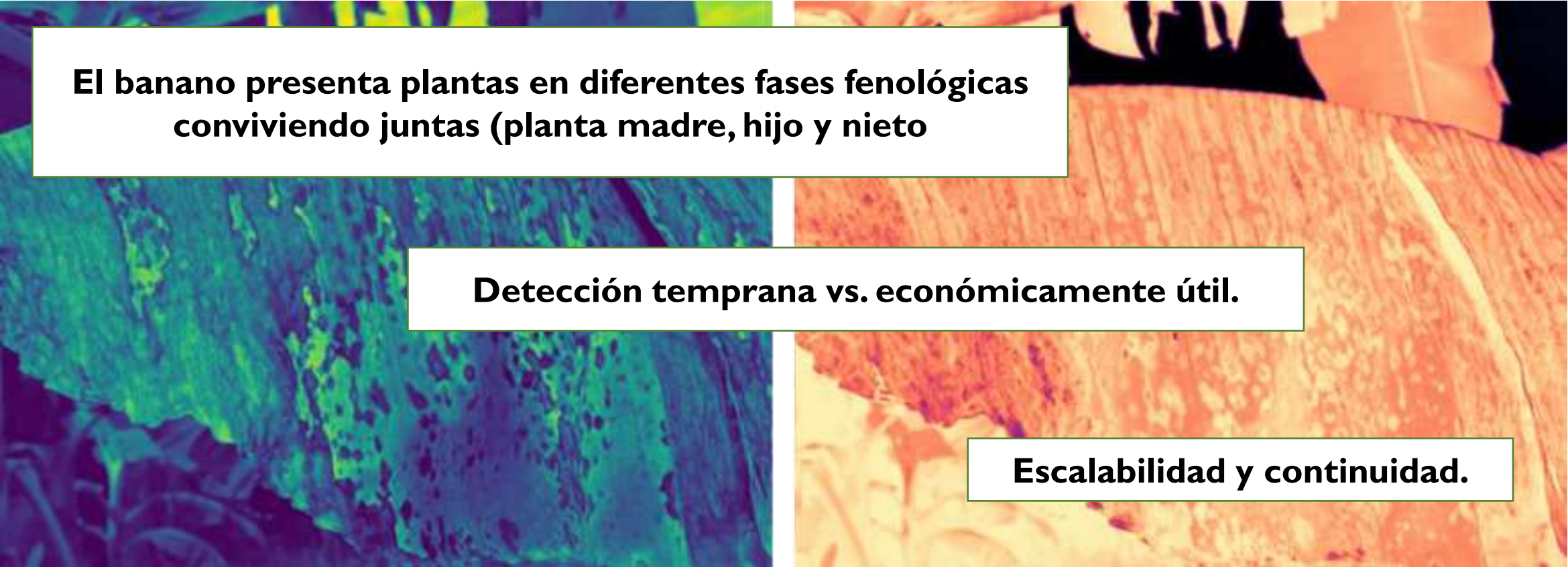


3





IDEAS FINALES



**El banano presenta plantas en diferentes fases fenológicas
conviviendo juntas (planta madre, hijo y nieto**

Detección temprana vs. económicamente útil.

Escalabilidad y continuidad.




UNIVERSIDAD
EARTH

gracias