Precision Agriculture Technologies and UAV Applications

Precision Engineering Program

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Southwest Florida Research and Education Center

Agricultural and Biological Engineering Department,

University of Florida

4th Agricultural Revolution

Digital Farming / Big Data / Internet of Things (IoT)

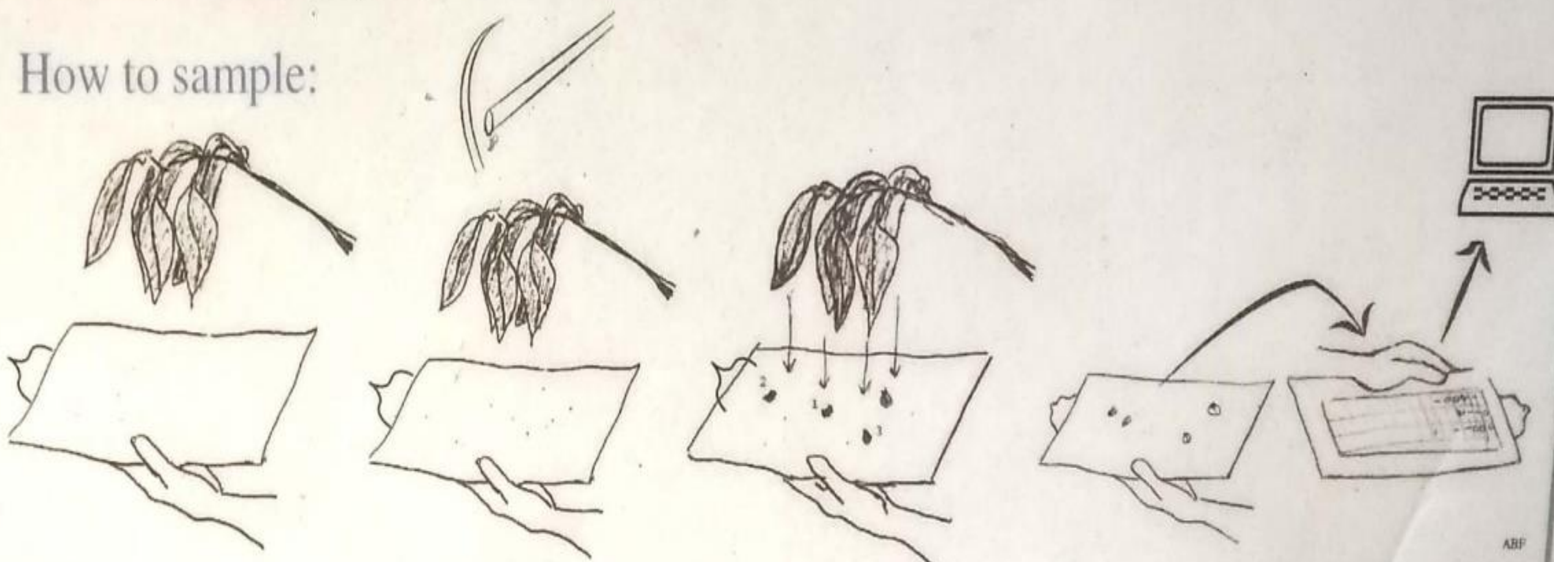
Smart Farming / Smart-Intelligence Machinery

Robotics / Artificial Intelligence (AI) / Automation

Traditional (manual) ACP Monitoring
Tap Sample Method

Monitoring of ACP populations is an important tool in the integrated management of citrus greening. The most efficient way to estimate field populations of this insect is by monitoring the adults. Tap sampling has proven to provide data needed to make informed decisions for managing this insect pest (Qureshi and Stansly 2007).

How to sample:



1. Place back side of this sheet 1 foot under the branch to be sampled.
2. Tap the selected branch with a PVC tube or your hand 3 times.
3. Quickly count the insects (beneficials and pests) that fall onto the paper. Pay special attention to ACP.
4. Write the number of insects from each sample on the provided datasheet for later reference and entry into a database.

Automated system and method for monitoring and mapping insects (e.g. ACP) in orchards" using AI. U.S. patent application No. 62/696,089.

https://twitter.com/i/status/1110151596770500608

Partel V., Leon Nunes, and Ampatzidis Y., 2019.Automated Vision-based System for Monitoring Asian Citrus Psyllid in Orchards Utilizing Artificial Intelligence. Computers and Electronics in Agriculture (accepted).

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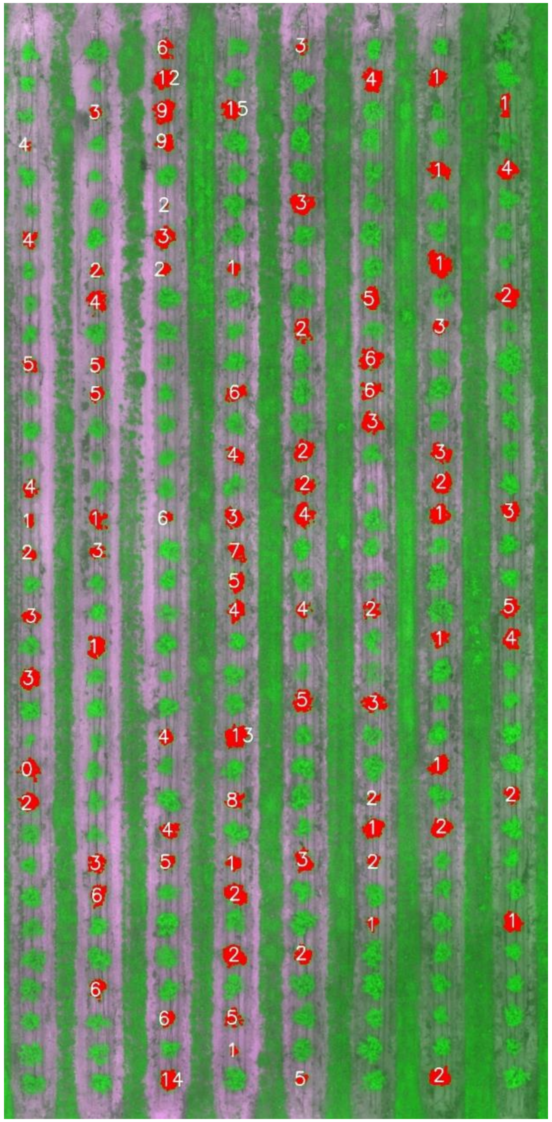
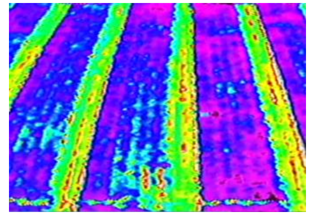


Partel V., Leon Nunes, and Ampatzidis Y., 2019. Automated Vision-based System for Monitoring Asian Citrus Psyllid in Orchards Utilizing Artificial Intelligence. Computers and Electronics in Agriculture, 162, 328-336

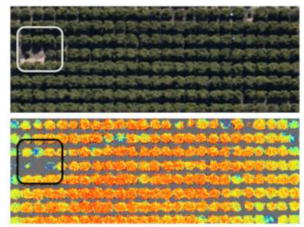
https://twitter.com/i/status/1110151596770500608

UAV Imaging

- Thermal

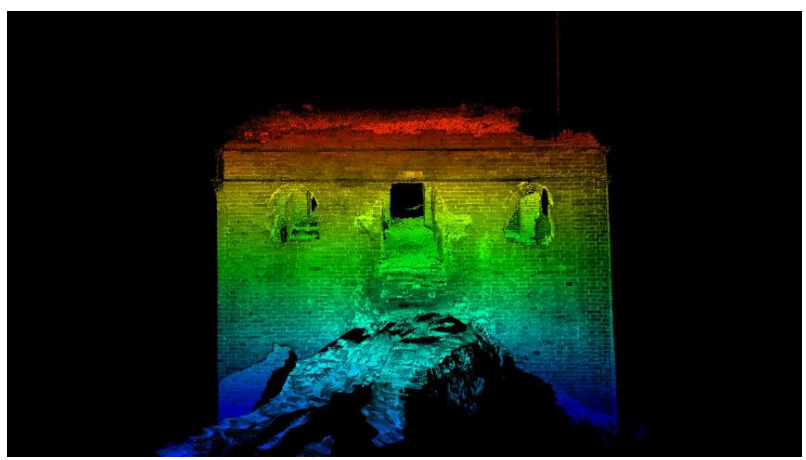


- Multi-Spectral



- Visual – RGB

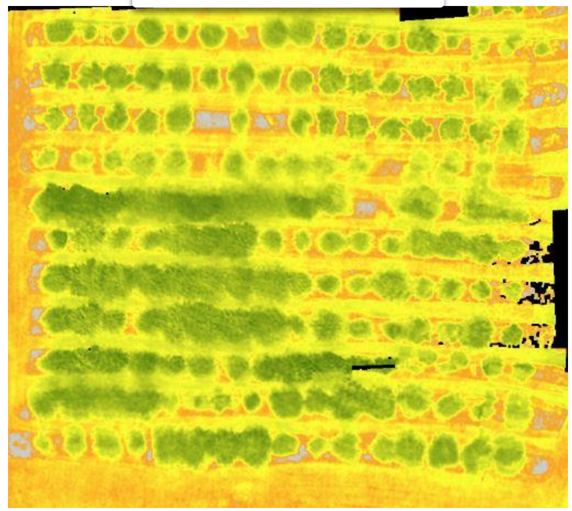
- LiDAR



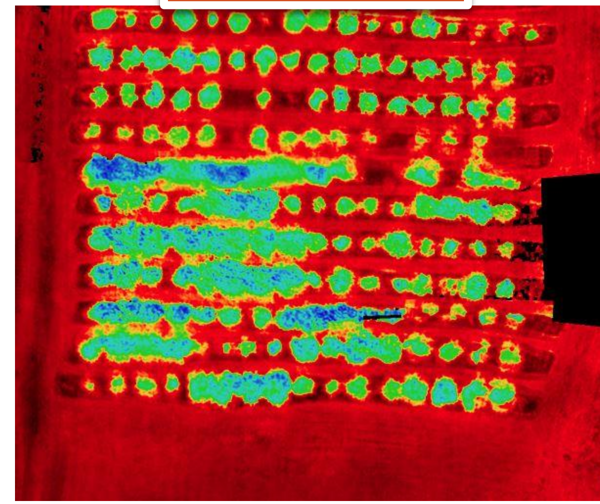
Intelligent Imagery

RGB Map

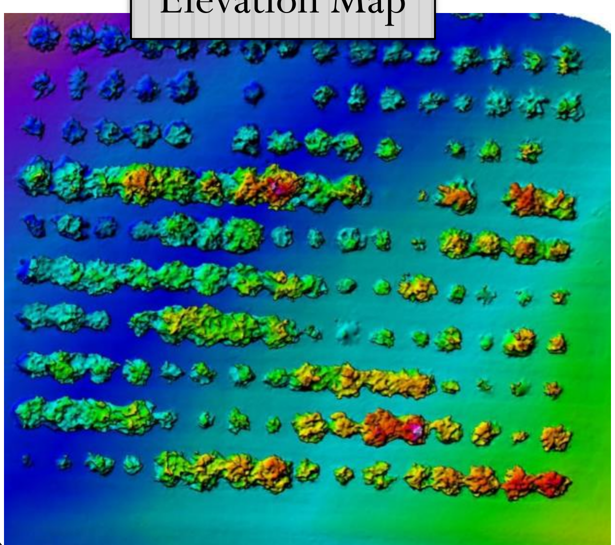
Canopy Map



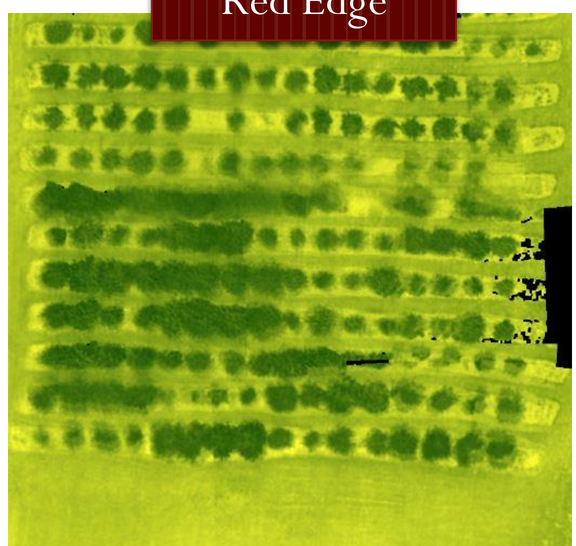
Stress Map



Elevation Map



Red Edge



Green NDVI

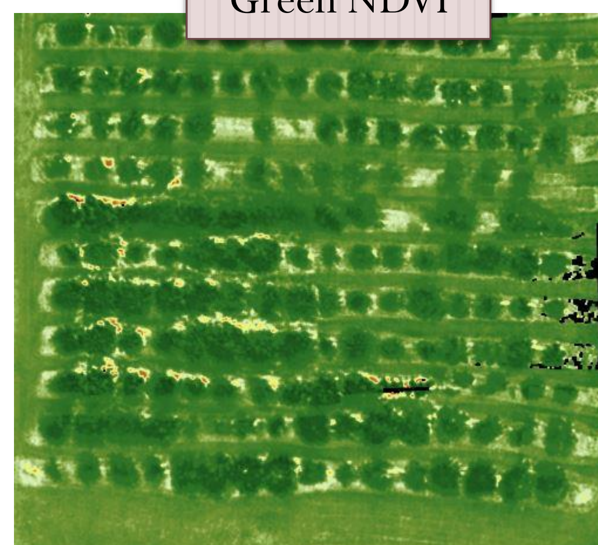


Image Detection using Artificial Intelligence (AI)

- Using AI and deep learning algorithm, we make use of an existing neural network such as alexnet, googlenet and train them to identify and detect objects according to our requirements
- We are currently using YOLO on NVIDIA Jetson TX2 board to train the neural networks such that it identifies and detects flowers, fruits, leaves and categorize them into healthy or unhealthy.
- We are also planning on incorporating the image detection process into various mechanical systems such as harvesters and weed blasters for effective extraction of fruits and removal of weeds.

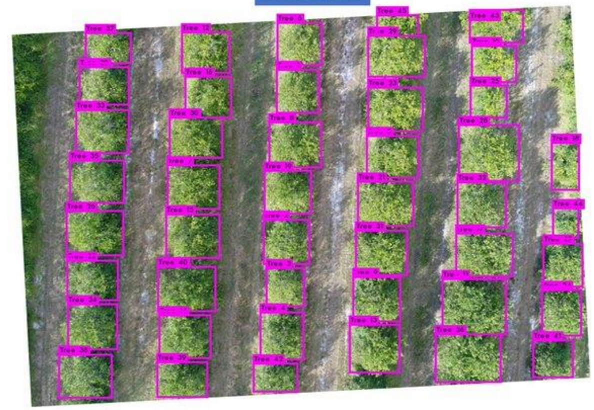
Detection of trees and categorizing them based on health and size

Image Source: PrecisionMapper

UAV-based Image Analysis Using Artificial Intelligence-AI: #TreeCount, #TeeGeoreference, & #TreeCategory

Source

AI Output



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Email: i.ampatzidis@ufl.edu

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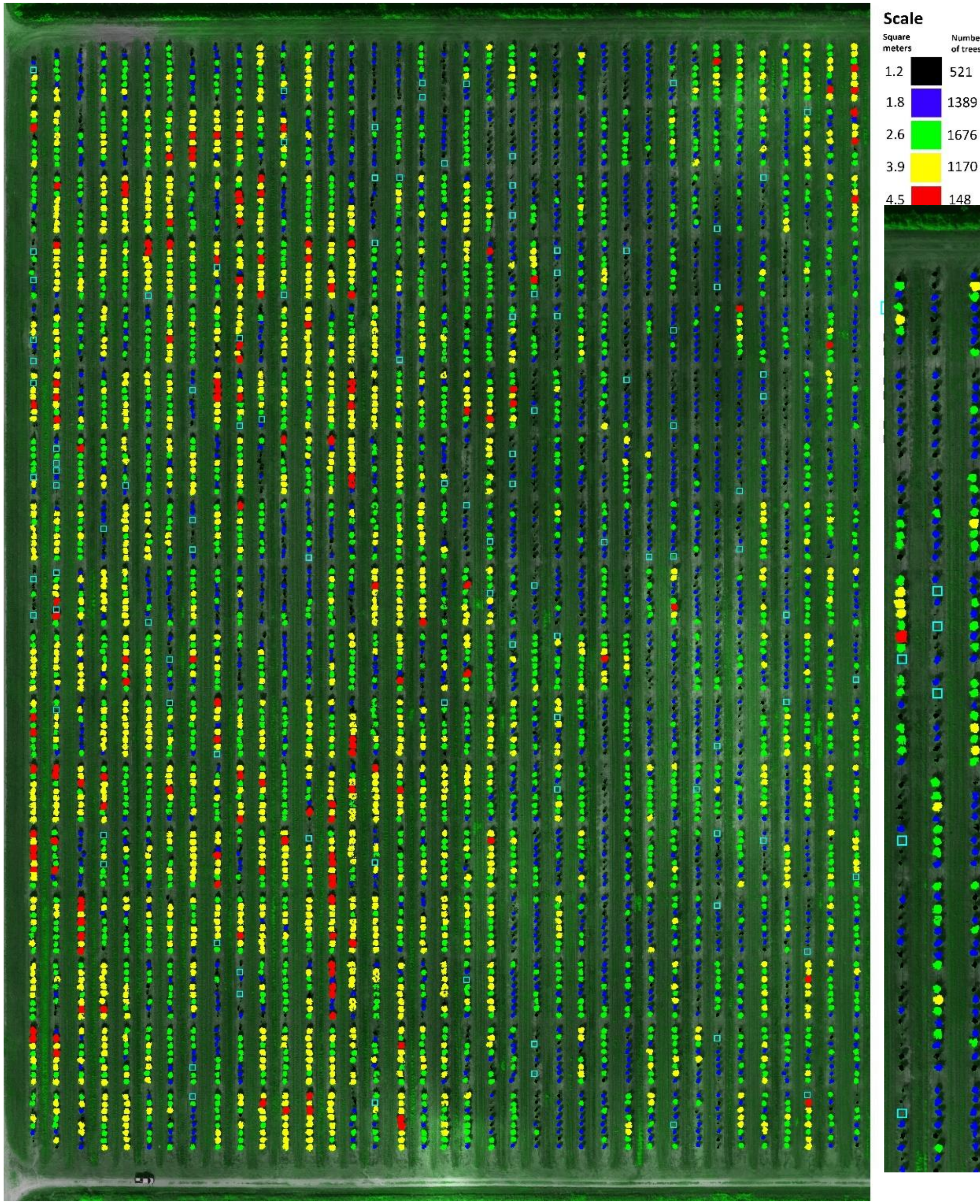
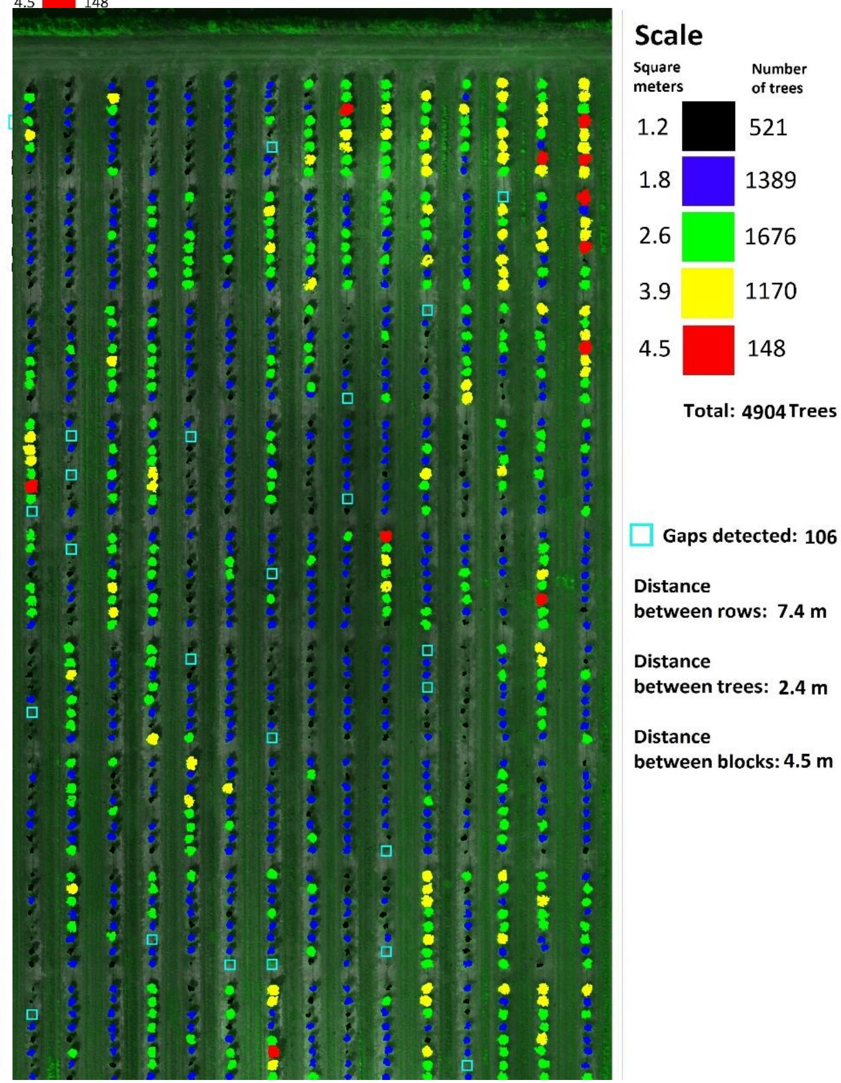
Ampatzidis Y., and Partel V., 2019. UAV-based High Throughput Phenotyping in Citrus Utilizing Multispectral Imaging and Artificial Intelligence. Remote Sensing, 11(4), 410; doi: 10.3390/rs11040410.





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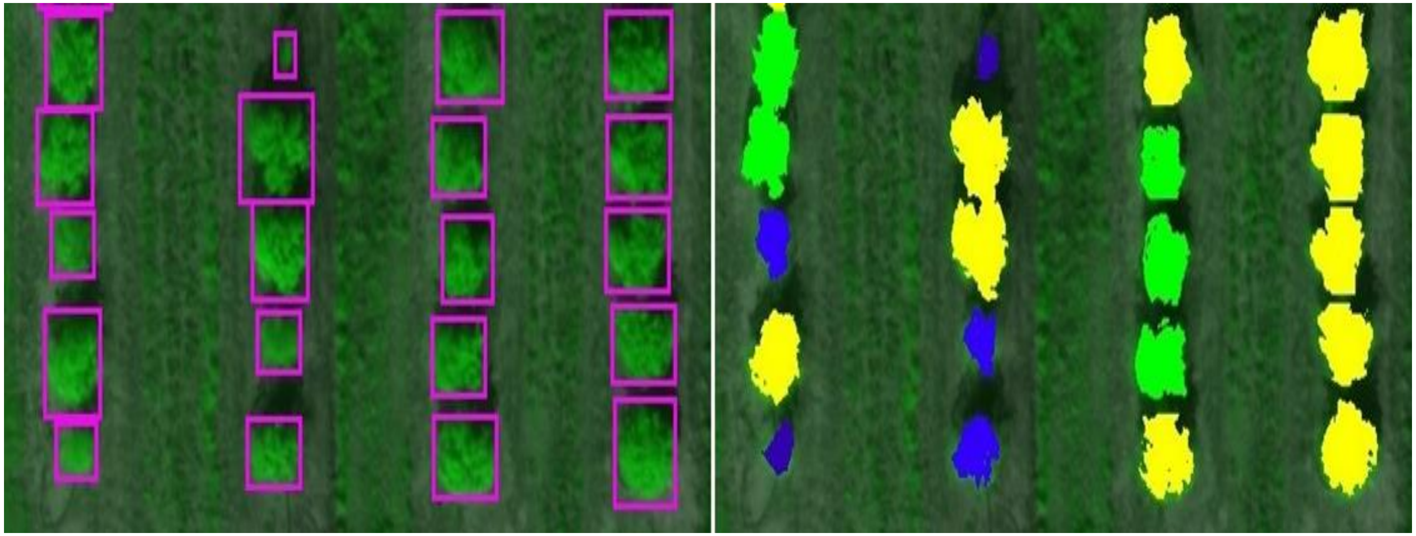

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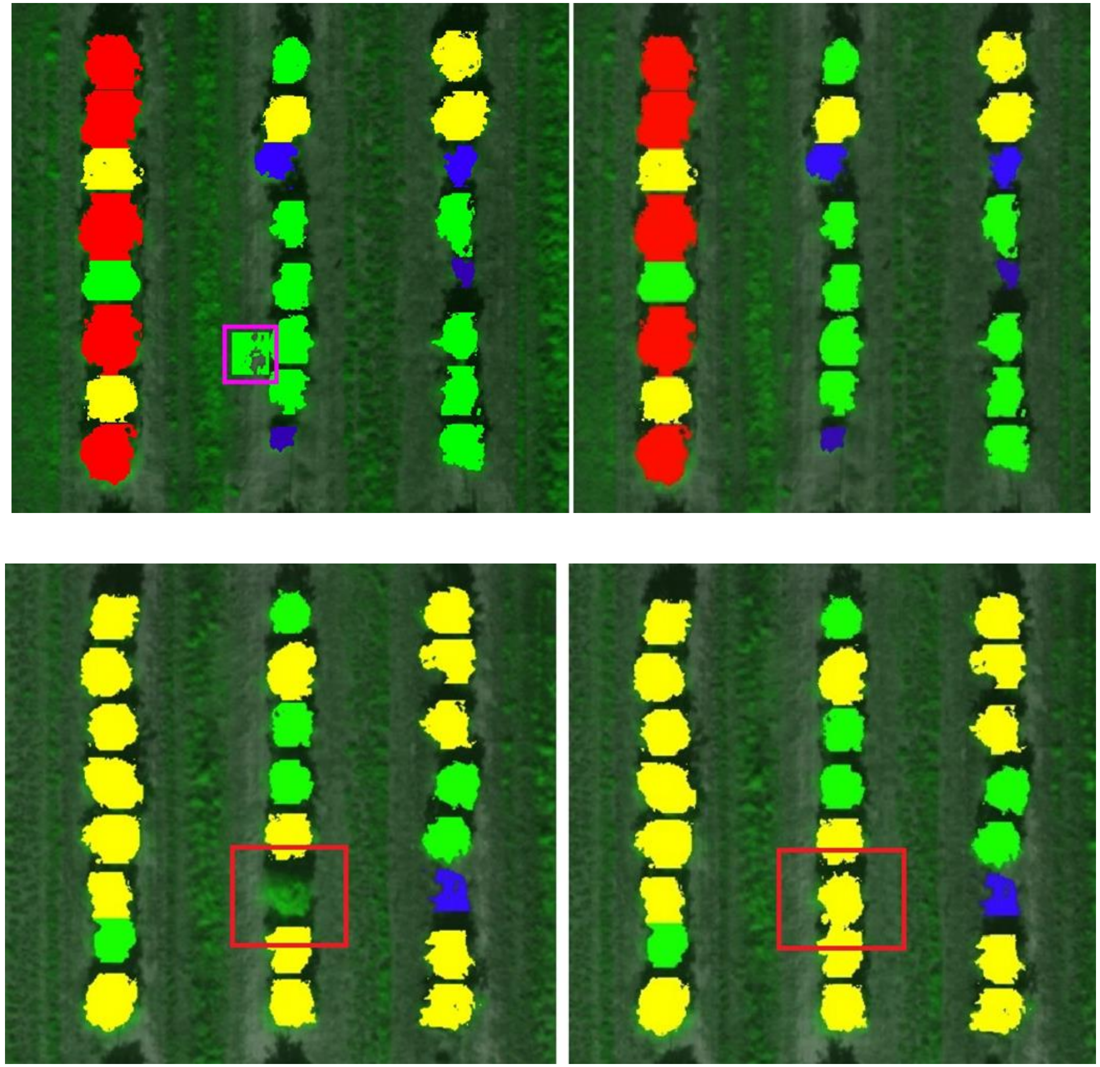
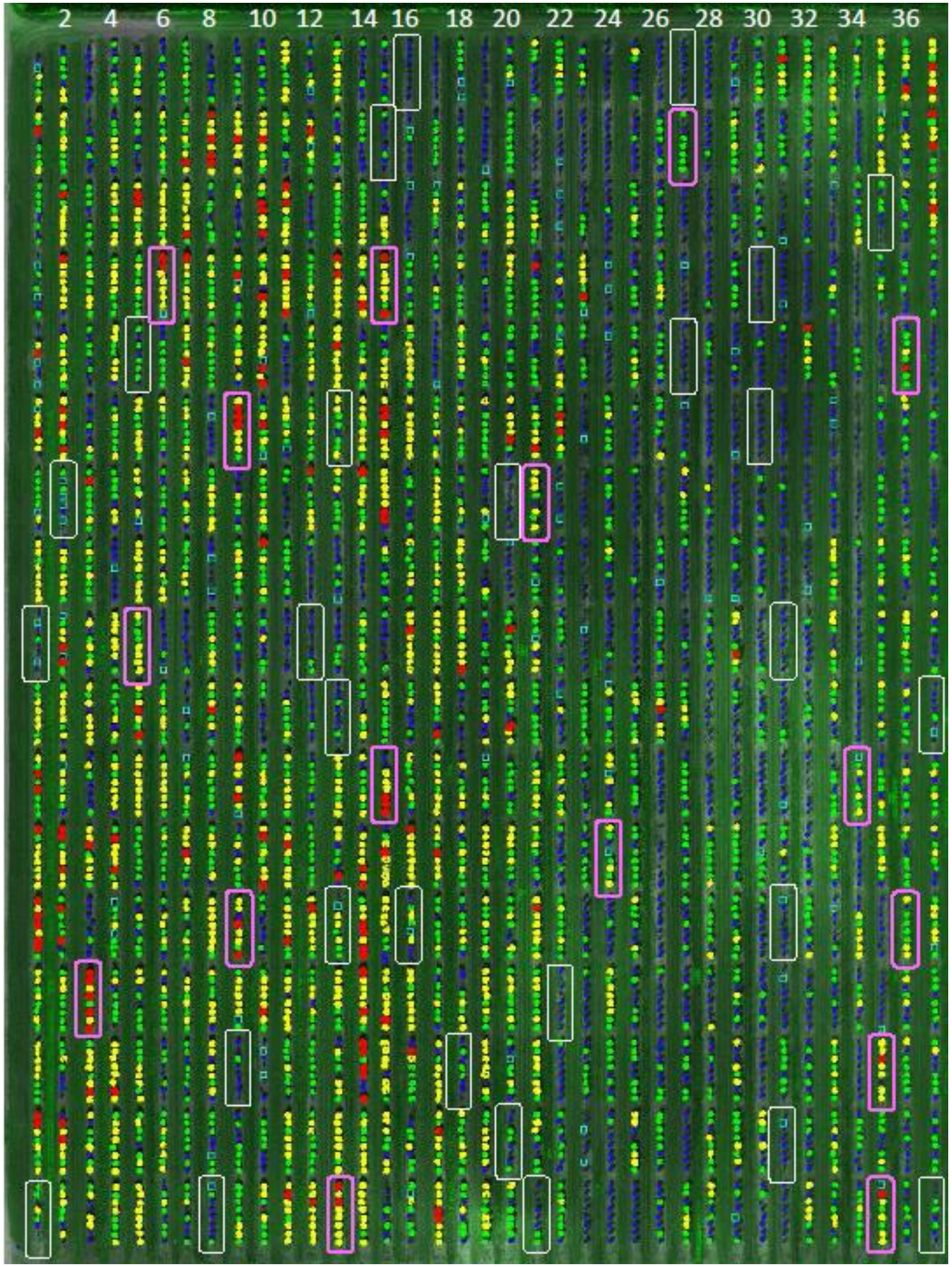
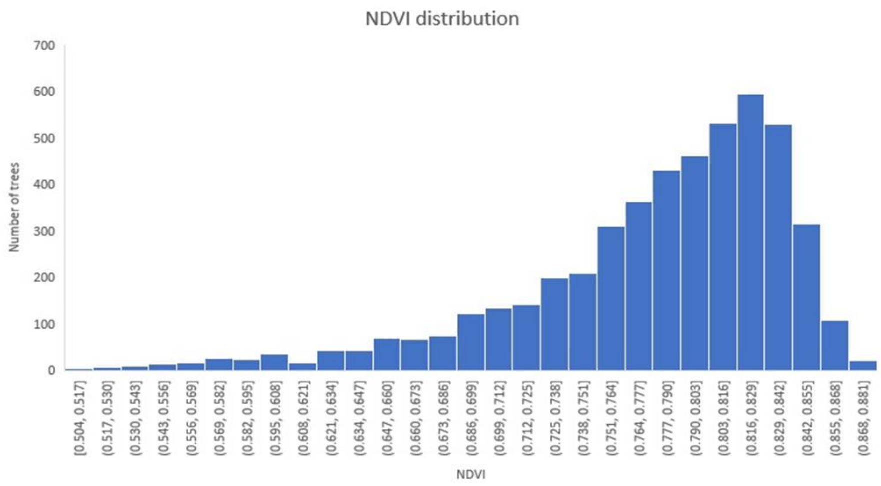
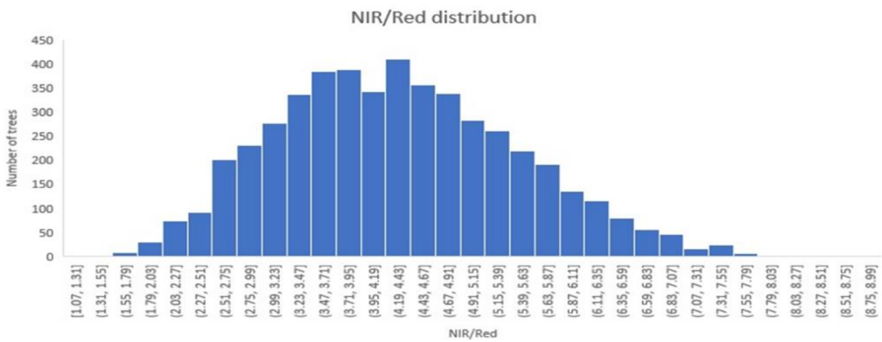
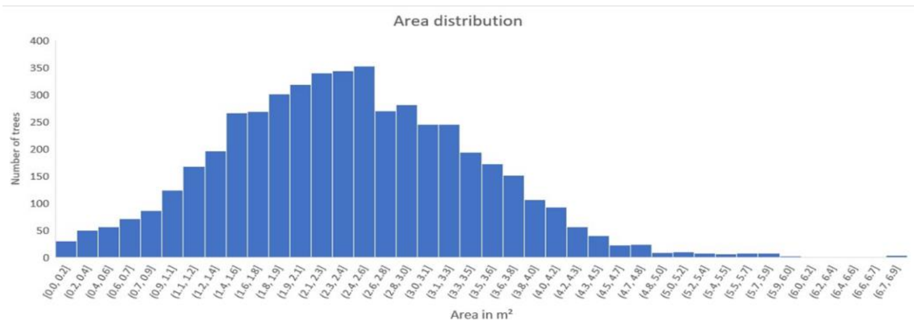


UAV-based High Throughput Phenotyping



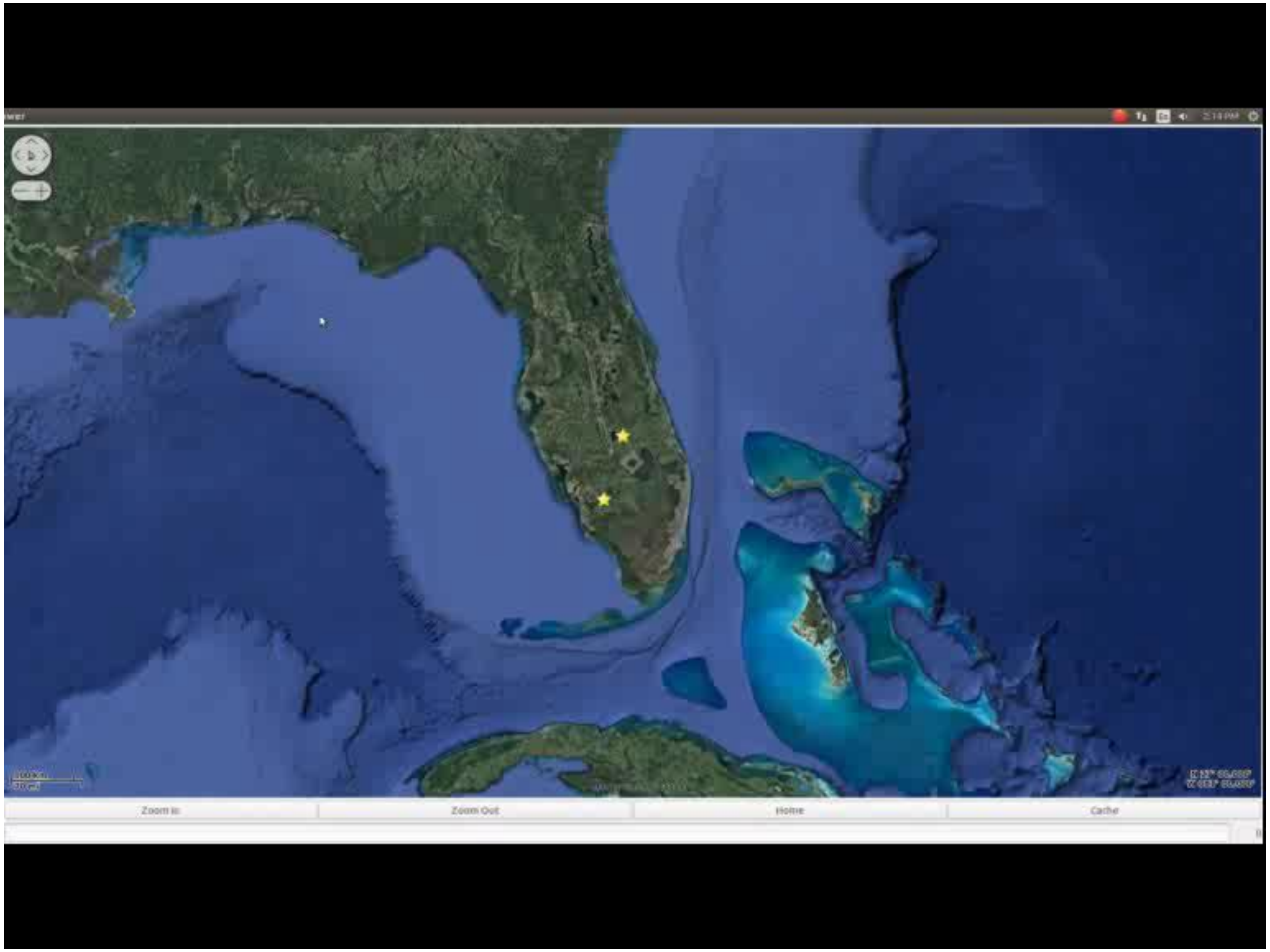






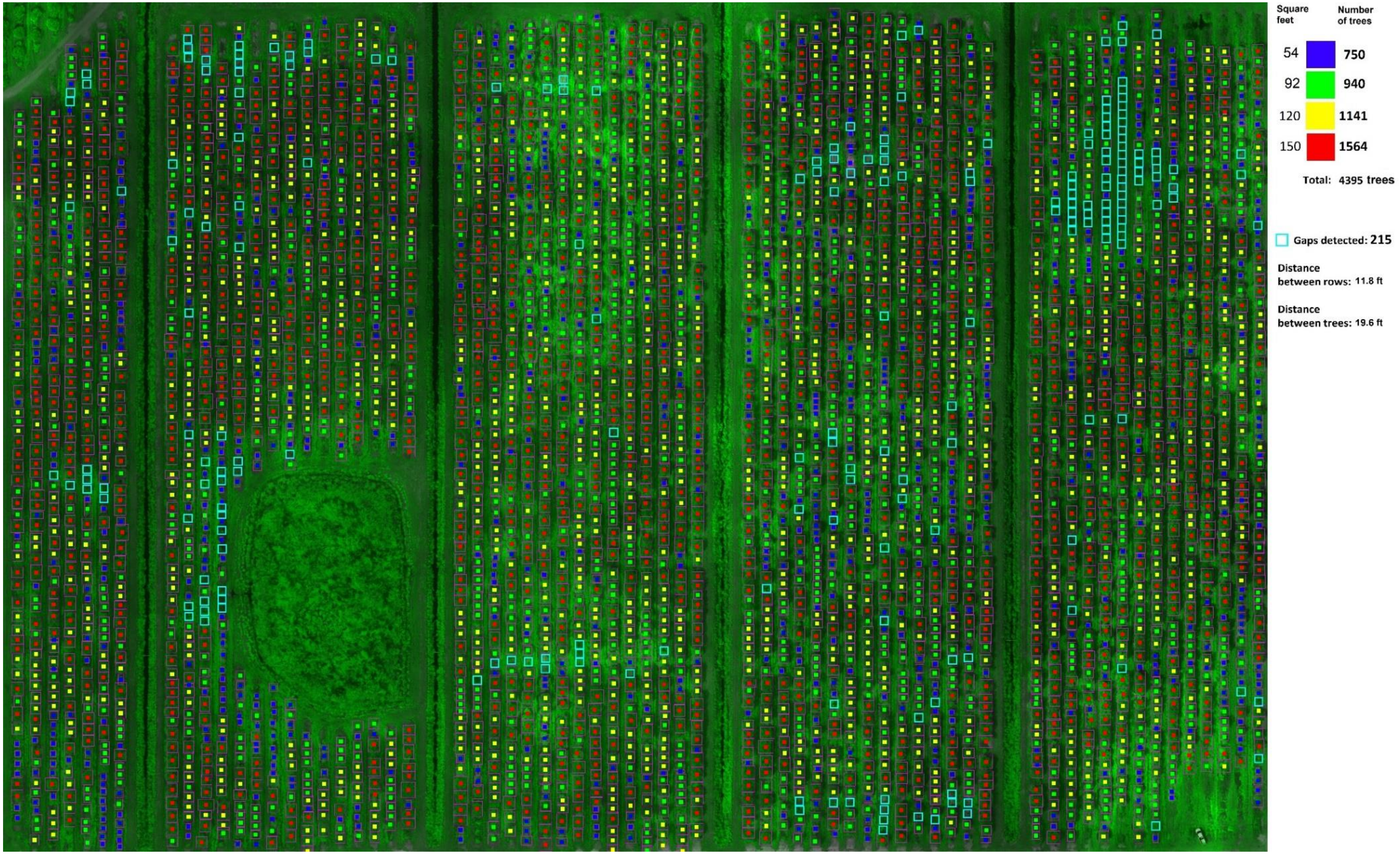
Rootstock	Tree Canopy Area in m^2	NDVI	NIR/Red
SORP+SH-991	1.54 ± 0.51	0.72 ± 0.04	3.38 ± 0.62
X639	3.47 ± 0.68	0.82 ± 0.03	4.97 ± 0.55

GIS-based software to visualize UAV data



https://twitter.com/i/status/1104117633505509377

UAV-based High Throughput Phenotyping in Citrus Utilizing Multispectral Imaging and Artificial Intelligence



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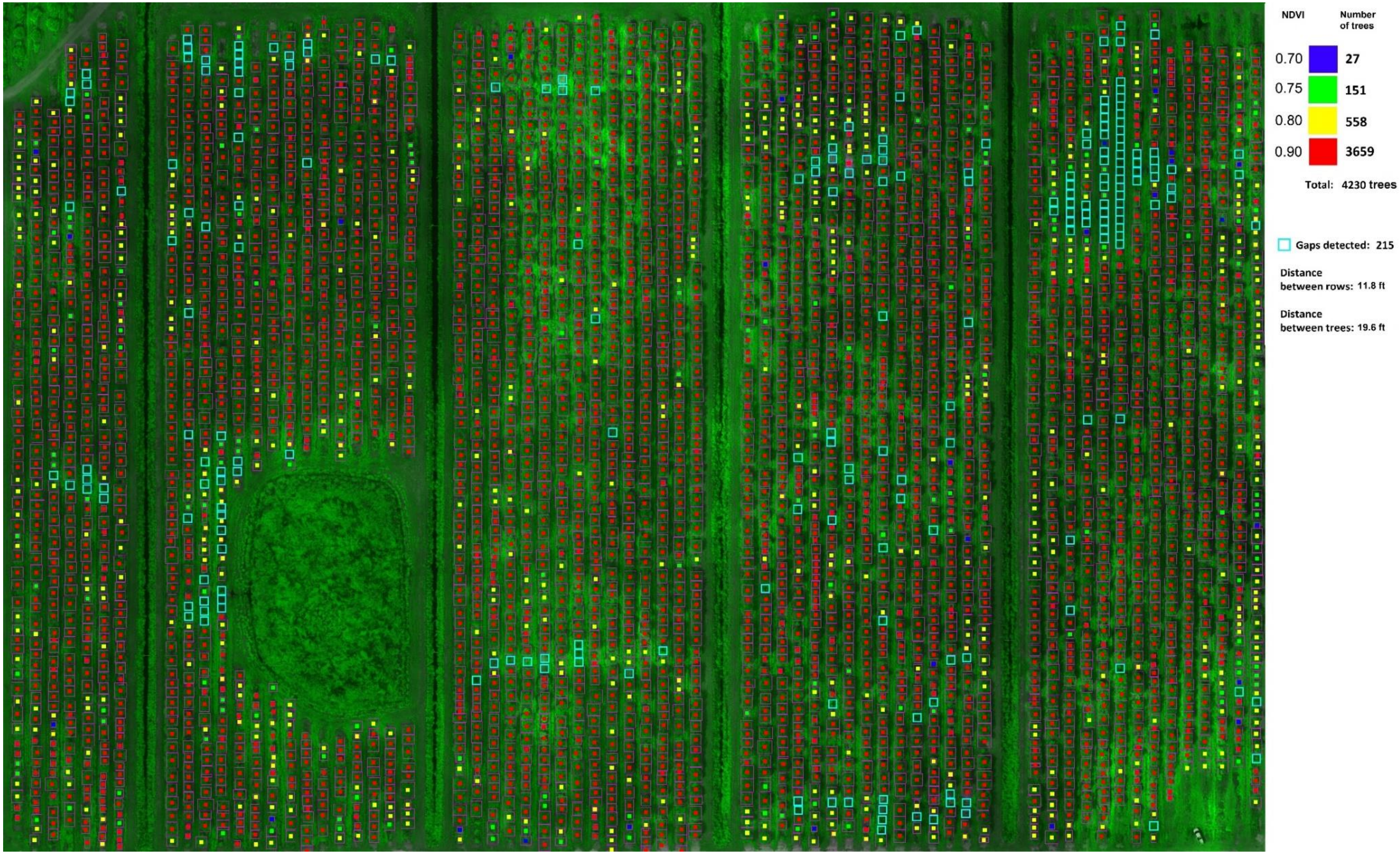

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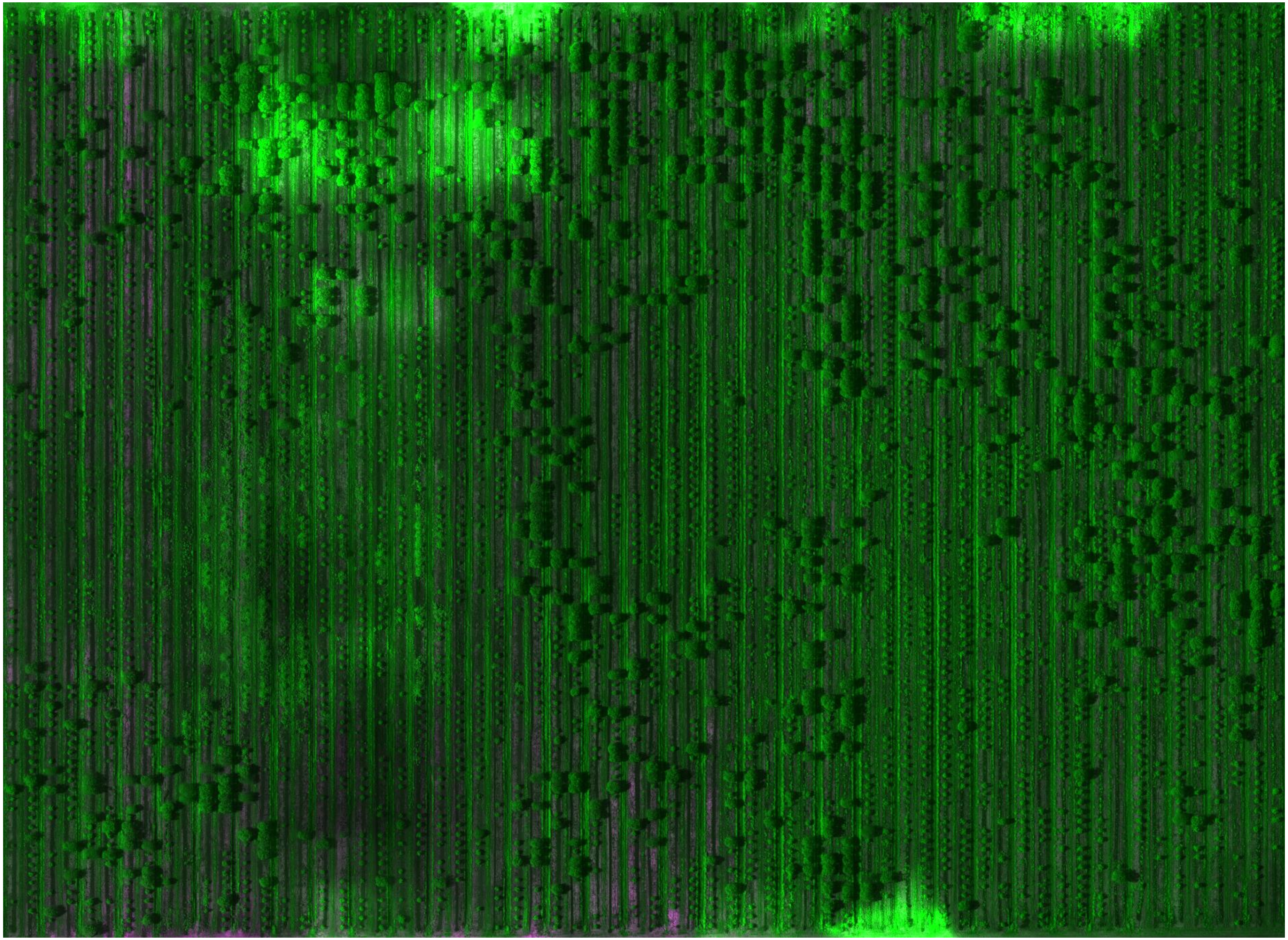

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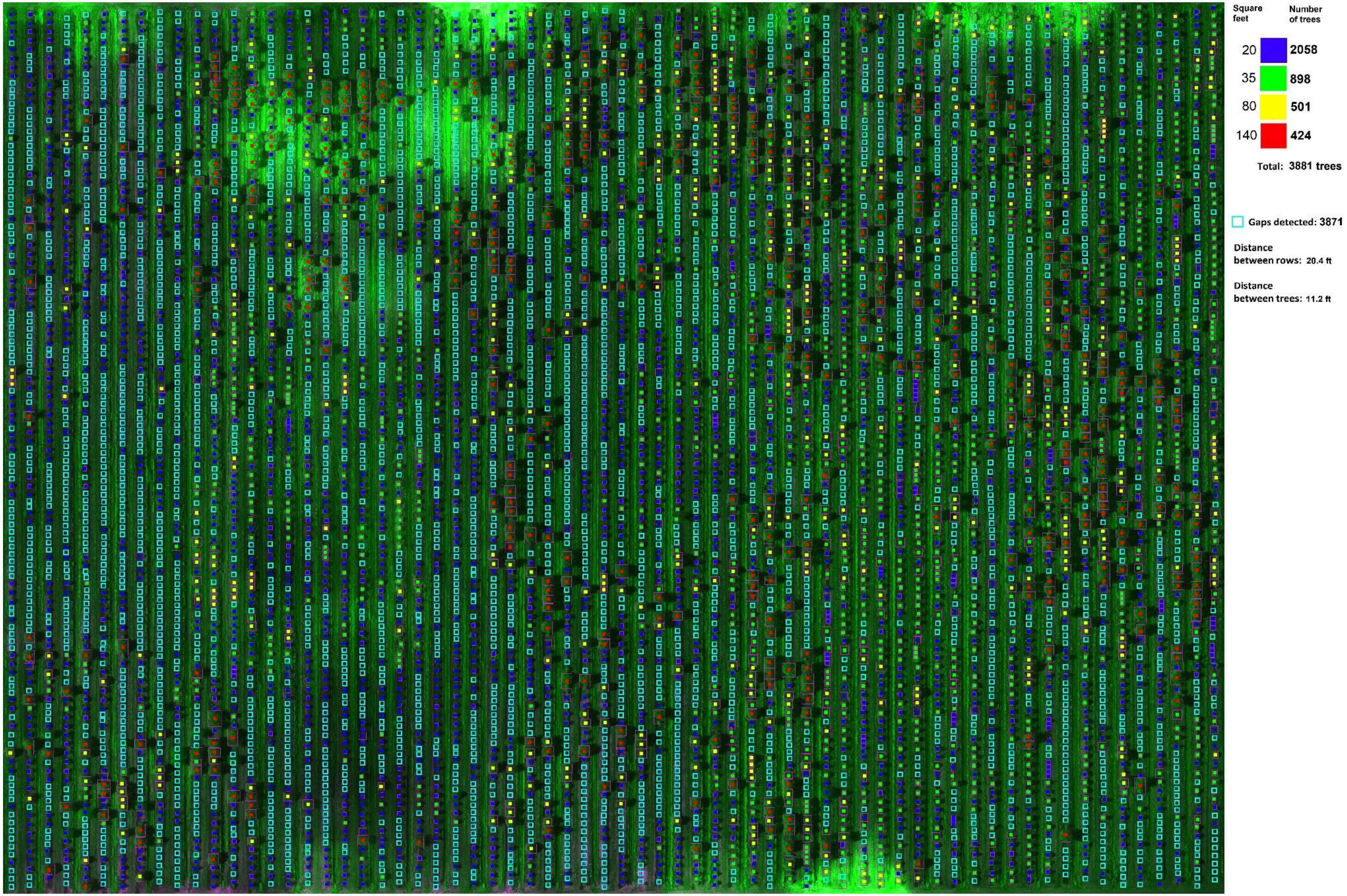

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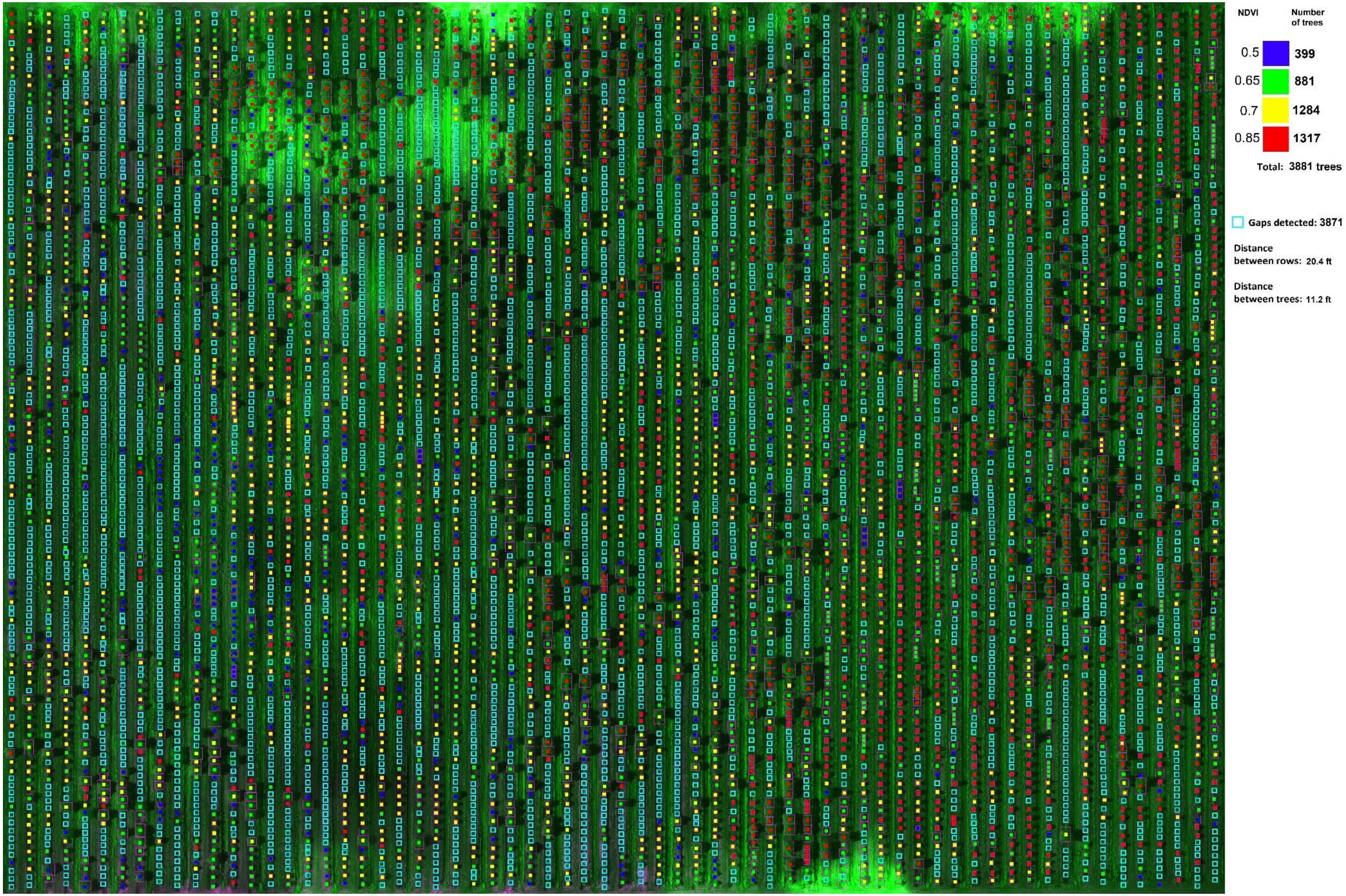
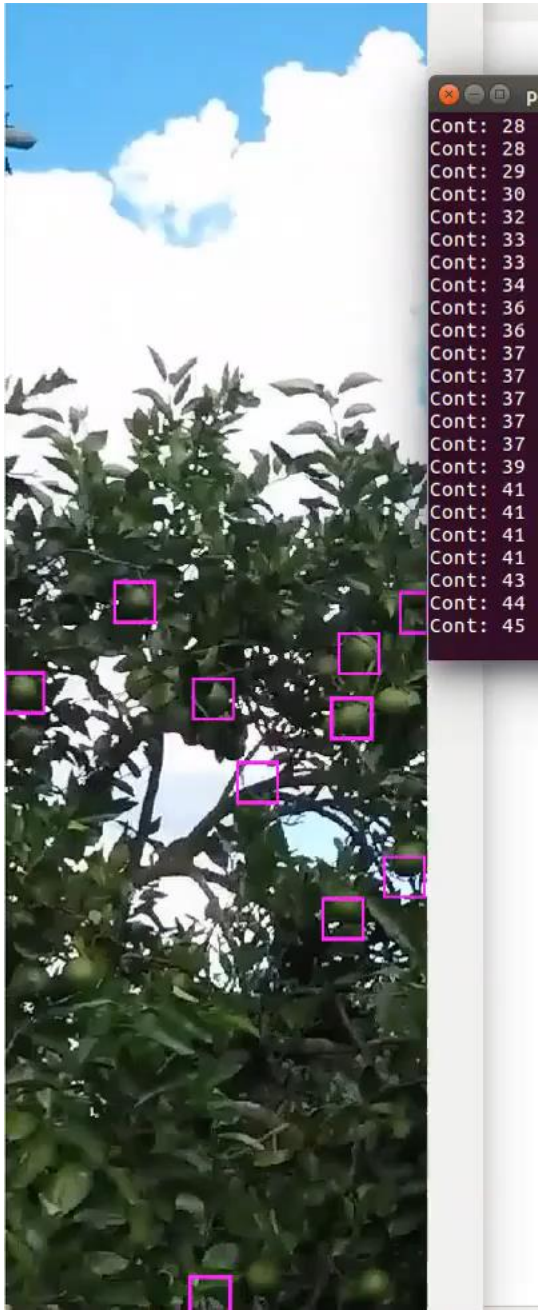
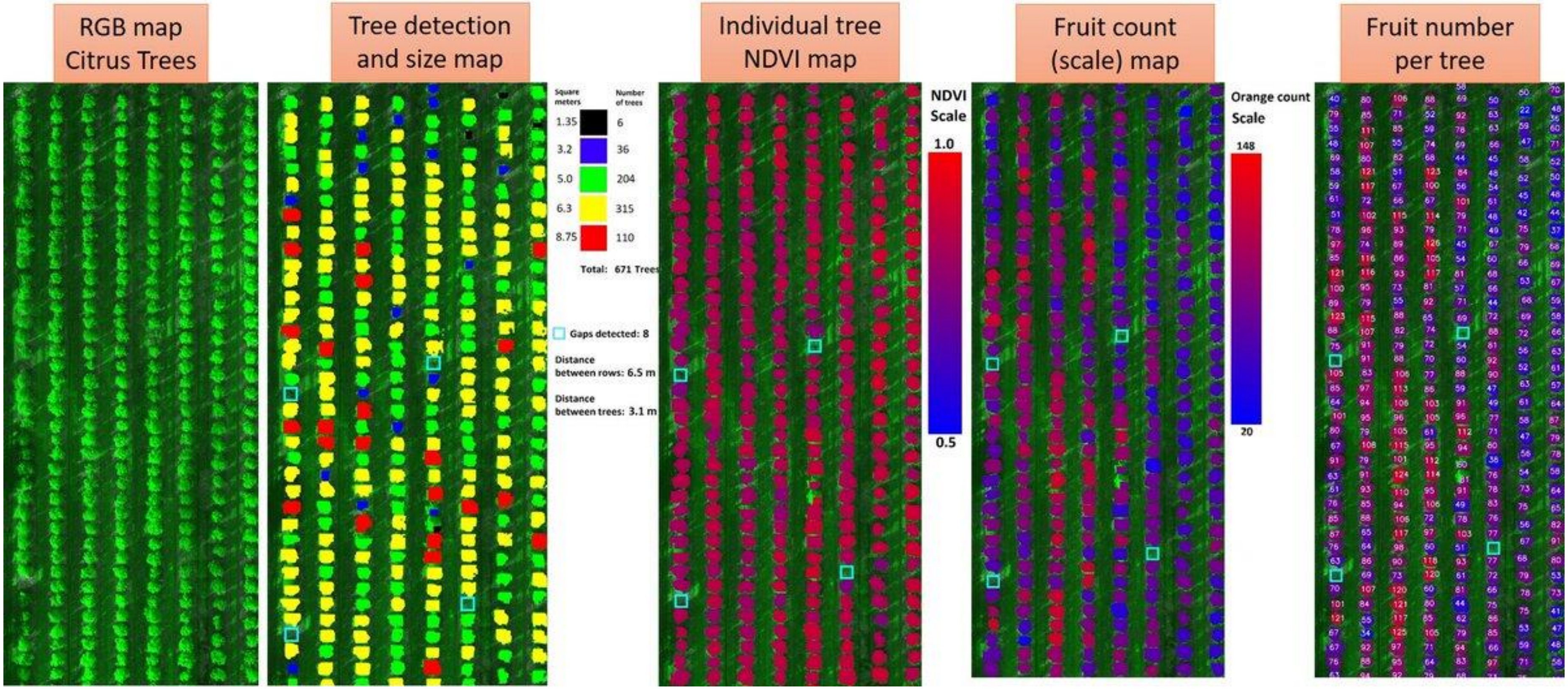



Detections: 133



https://twitter.com/i/status/1042058065481269248

UAV- and Ground-based High Throughput Phenotyping in Citrus



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Remote Pilot License Training

In order to obtain a Remote Pilot Certificate from FAA under the Small UAS (Part 107) rule, you must pass the initial aeronautical knowledge exam. This training will prepare you to pass this exam and obtain your certificate.

What you learn:

Airspace and Aeronautical Symbols

Aeronautical Charts

FAA Part 107 Regulations

Airspace Classification

Aviation Weather

Risk Management

and much more ....

Tuesday, April 30th, 2019
9:00 a.m. - 3:45 p.m.

UF / IFAS Southwest Florida Research and Education Center
2685 SR – 29 / Immokalee, Florida 34142

UAV-based high throughput phenotyping

Register for your spot on the Eventbrite link ($75 per person) below. There is no registration fee for extension agents, and UF faculty, students and staff ($10 is requested for lunch). Still need to register here:
https://www.eventbrite.com/e/remote-pilot-license-training-tickets-59955736221
Lunch is provided.
For questions, call 239-658-3415 or email Jennifer Derleth at jderleth@ufl.edu.

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Remote Pilot License Training
April 30, 2019
Southwest Florida Research and Education Center

Agenda

9-9:15 am

- Opening remarks and introductions- Dr. Yiannis Ampatzidis and Jennifer Bearden -15 min

9:15-9:55 am

- Section 1 – Aircraft identification and registration – 30 min

Break/questions – 10 minutes

9:55-11:15 am

- Section 2 – Airspace and Aeronautical Symbols – 50 min
- Sectional Chart Reading Activity – 20 min

Break/questions – 10 minutes

11:15-12:15 pm

- Section 3 – Aviation weather and effects – 50 min

Lunch Break

1-1:20 pm

- UF procedures- John Rouse – 20 min

1:20-2 pm

- Section 4 – Risk management – 30 min

Break/questions – 10 min

2-2:45pm

- Section 5 – Aeronautical knowledge – 30 min

2:45-3:15 pm

- Applications in Agriculture-Yiannis Ampatzidis and Jennifer Bearden-30 mins

Final questions – 20 min

Planning Committee: Yiannis Ampatzidis, Jennifer Bearden, Jim Fletcher, Gene McAvoy

Precision Ag Engineering Program

From Left to Right: **Daniel Escobedo** *Summer Intern*, **Jorge Escobedo** *Summer Intern*, **Dr. Jaafar Abdulridha** *Post Doctoral Associate*, **Dr. Yiannis Ampatzidis** *Program Leader*, **Dr. Xiuhua Zhang** *Visiting Scholar from China*, **Dr. Thanos Balafoutis** *Visiting Scholar from Greece*, **Magda Derival** *Research Assistant*, **Shirin Ghatresamani** *PhD Student*, **Sri Charan Kakarla** *Engineer* Not Pictured: **Victor Partel** *Research Assistant*

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Questions/Comments?
Thanks for your attention!

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