GEOSPASIAL

PT. Sarana Geospasial Terpadu

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Technical Approach for UAV Topography Mapping

PT. Sarana Geospasial Terpadu

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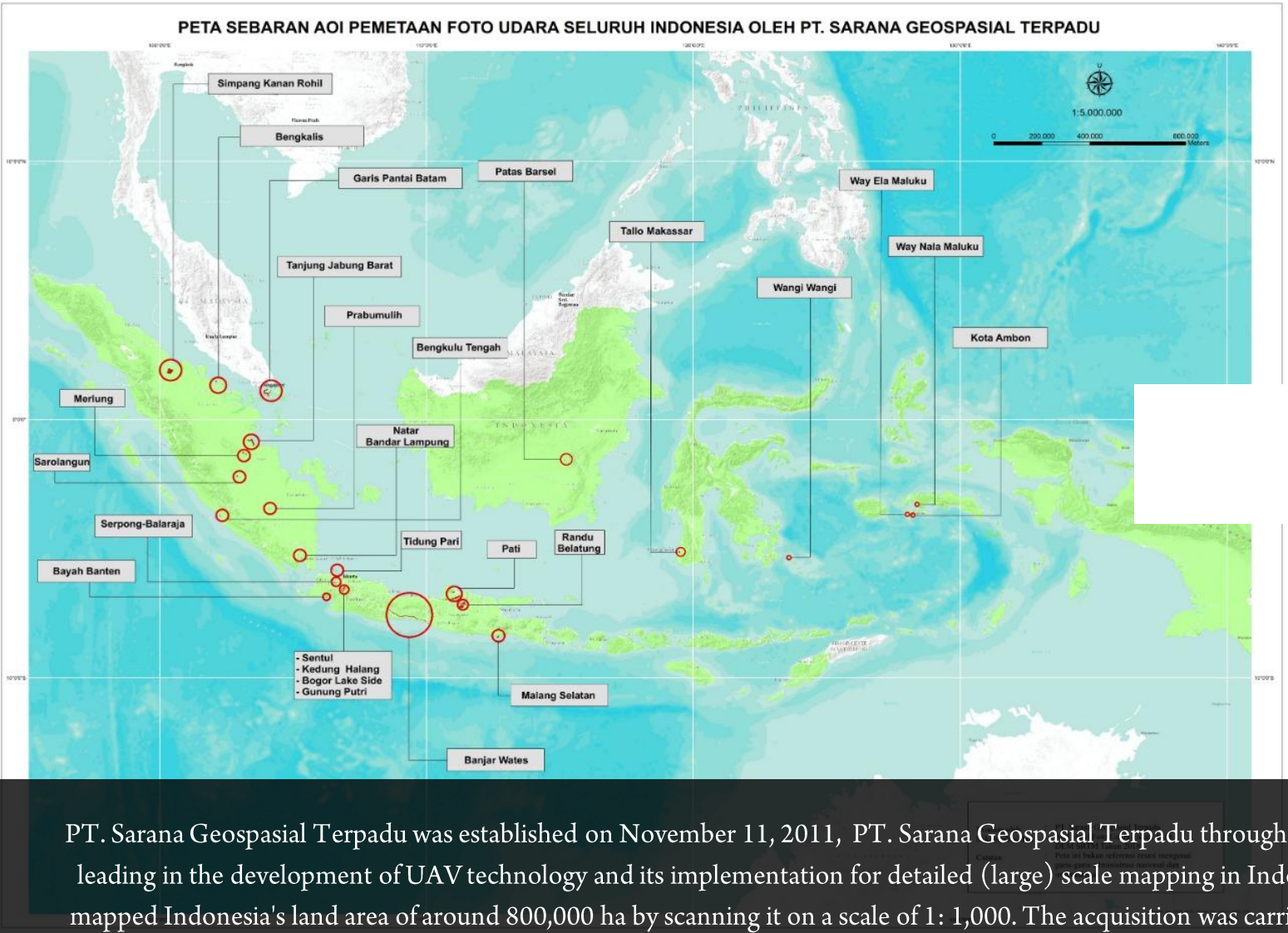


About Us

PT. Sarana Geospasial Terpadu was established on November 11, 2011, PT. Sarana Geospasial Terpadu through SGT UAV Team is currently leading in the development of UAV technology and its implementation for detailed (large) scale mapping in Indonesia. SGT UAV Team has mapped Indonesia's land area of around 800,000 ha by scanning it on a scale of 1: 1,000. The acquisition was carried out since 2011 until now.

Product

CAMERA

Sony Alpha 6000

- *Sensor CMOS APS HD 24,3 MP Exmor™ Full HD 1080p XAVC S Video at 24/60 fps*
- *Built-In Wi-Fi Connectivity with NFC*
- *Fast Hybrid AF & 179 Phase-Detect Points*
- *Focal Length 20mm*
- *Aperture Min f/16, Max f/2.8*
- *Angle of view 70 °*

Parrot Sequoia+

- **16 MPIX RGB CAMERA**
  - Definition: 4608x3456 pixels
  - HFOV: 63.9°
  - VFOV: 50.1°
  - DFOV: 73.5°
- **4 SEPARATE BANDS**
  - Green (550 BP 40)
  - Red (660 BP 40)
  - Red Edge (735 BP 10)
  - Near infrared (790 BP 40)
- **4 1.2 MPIX GLOBAL SHUTTER SINGLE-BAND CAMERAS**
  - Definition: 1280x960 pixels
  - HFOV : 61.9°
  - VFOV : 48.5°
  - DFOV : 73.7°
- **SUNSHINE SENSOR**
  - 4 spectral sensors (same filters as body)
  - GPS
  - IMU & magnetometer
  - 47mm x 39.6mm x 18.5mm

Sky Walker X8

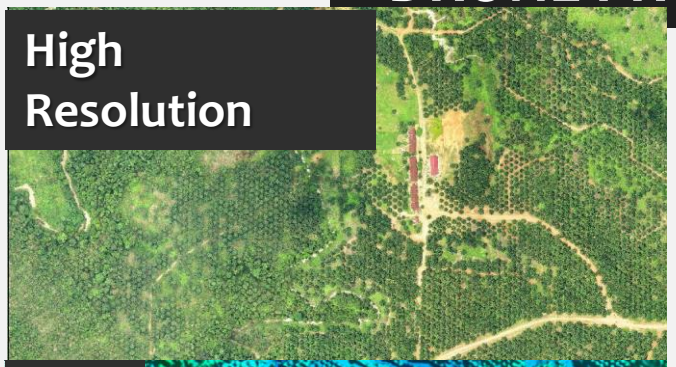
Specification	
Wingspan	240 cm
Material	Composite Fiberglass
Duration	80-90 Minute
Mileage	100 km/ flight
Mapping Area	1500 ha/ flight
Maximum Altitude	6000 Metre From GCS
Telemetry Range	Until 20 km

Sky Walker 2013

Specification	
Wingspan	1880 mm
Material	Coating
Duration	45 - 65 Minute
Mileage	50 km/ flight
Mapping Area	1200 ha/ flight
Maximum Altitude	3000 Metre From GCS
Telemetry Range	Until 20 km

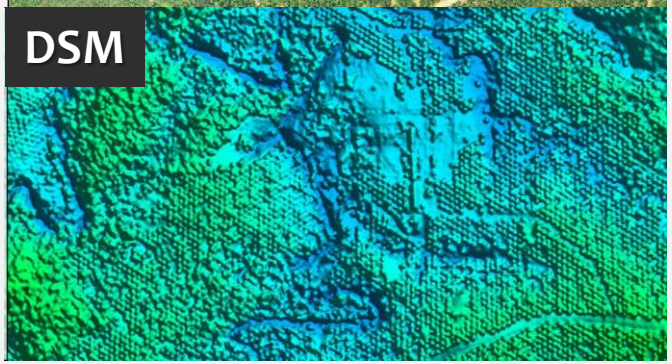
DRONE PRODUCT TARGET

High Resolution

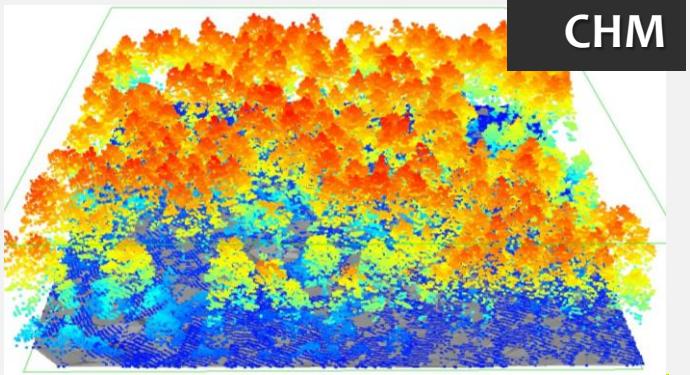


Contour

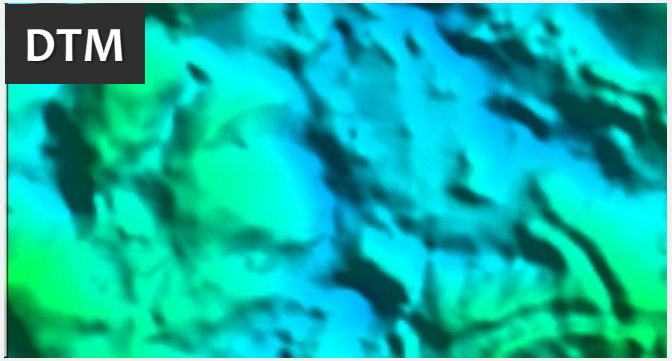
DSM



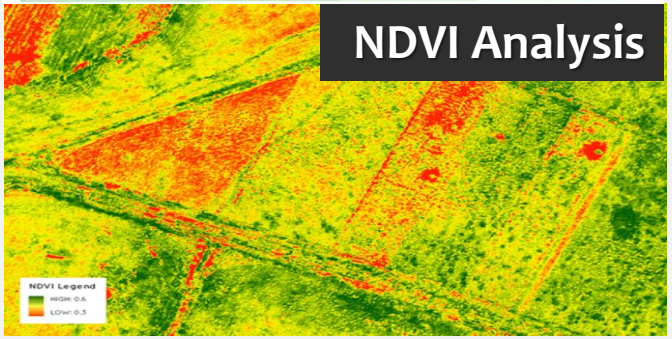
CHM



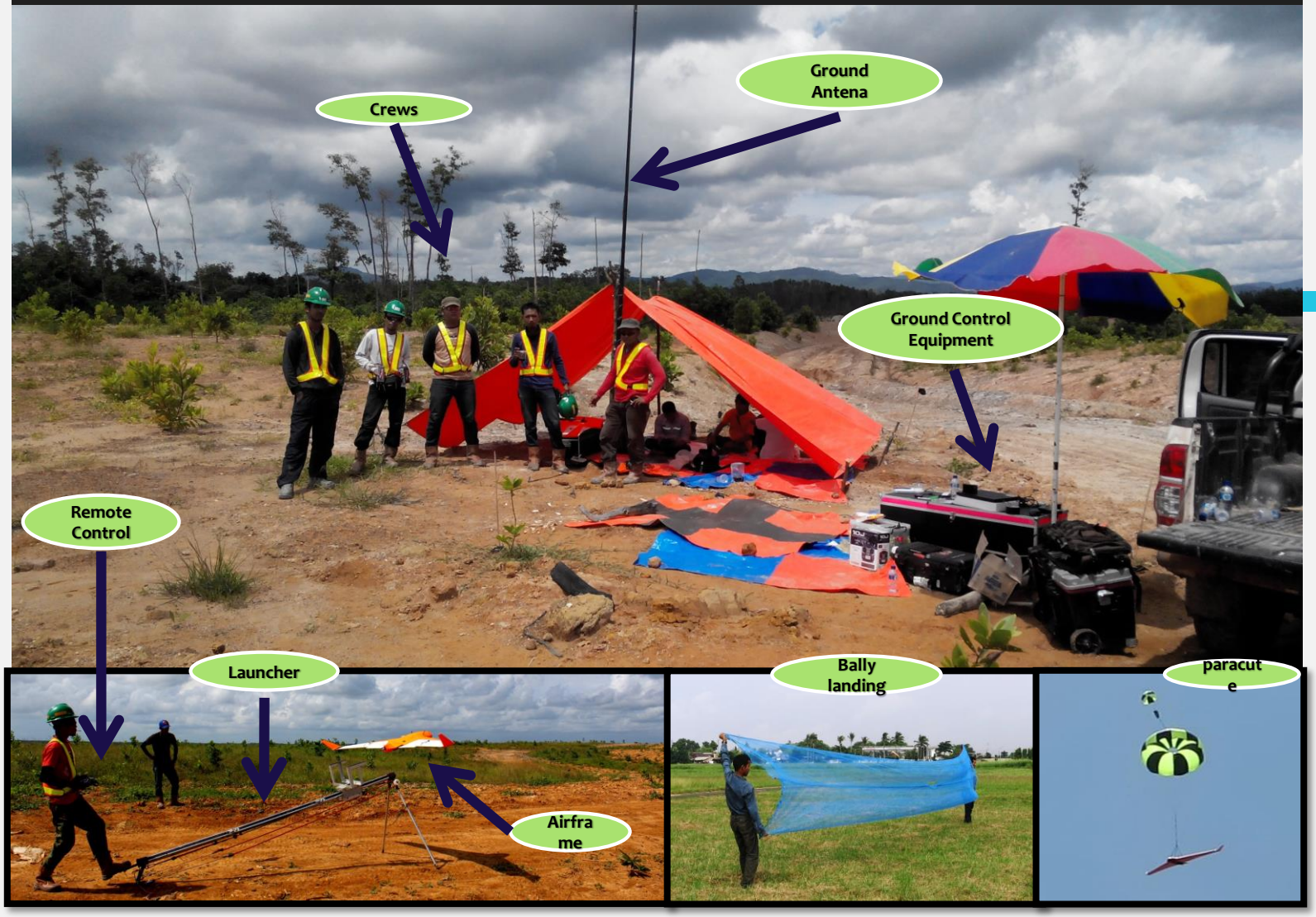
DTM



NDVI Analysis



DRONE SYSTEM COMPONENT

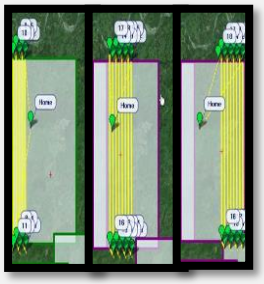


TARGET AREA

TAKE OFF/LANDING SITE SURVEY

GCP-PREMARK SURVEY

FLIGHT PLAN

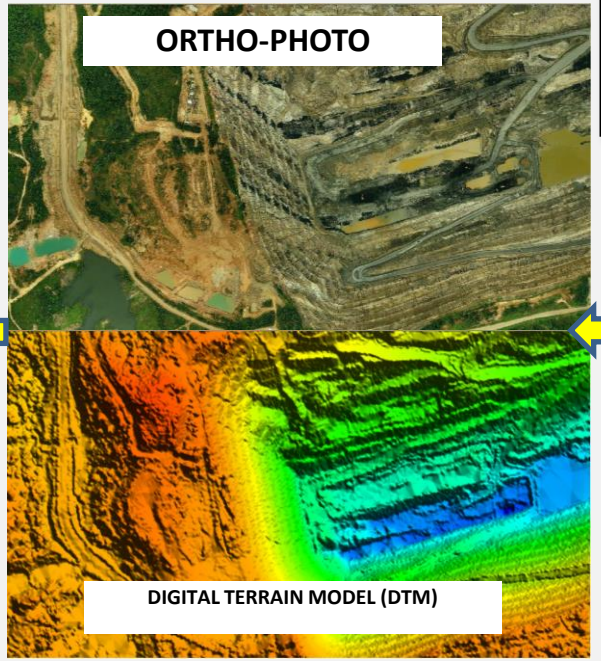


UAV DATA ACQUISITION

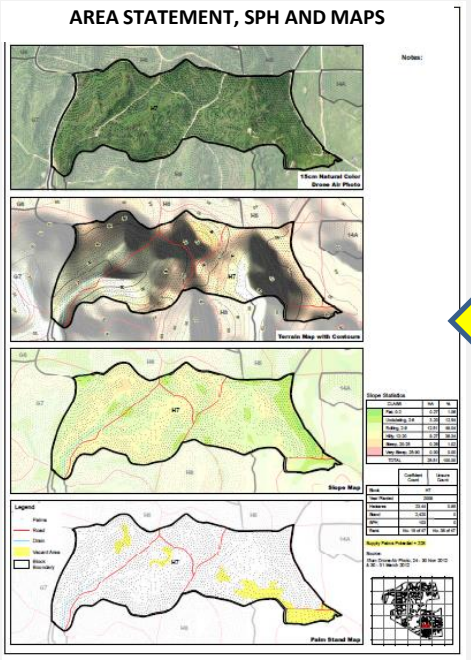
DRONE OPERATIONAL WORKFLOW

UAV DATA PROCESSING

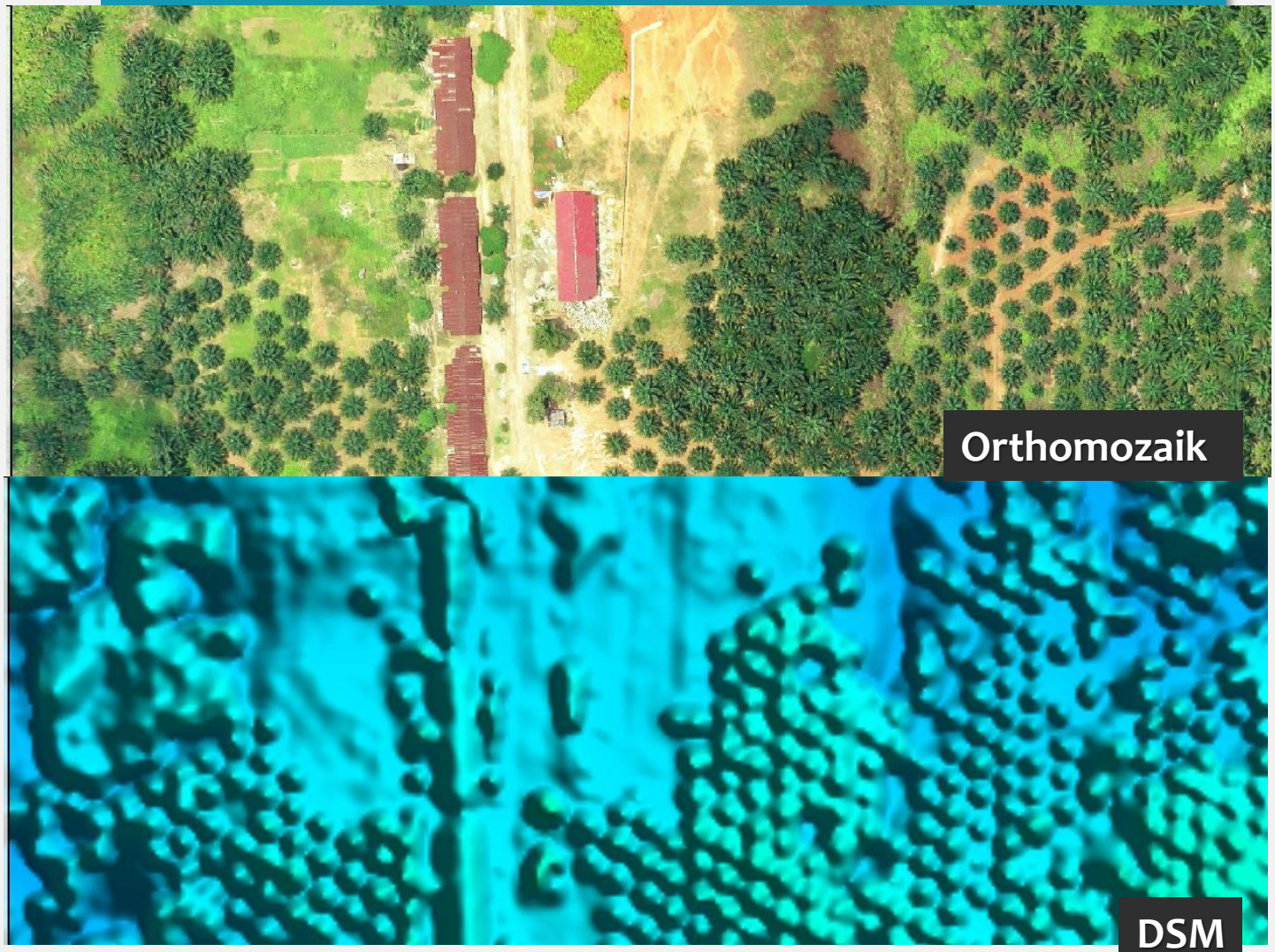
ORTHO-PHOTO



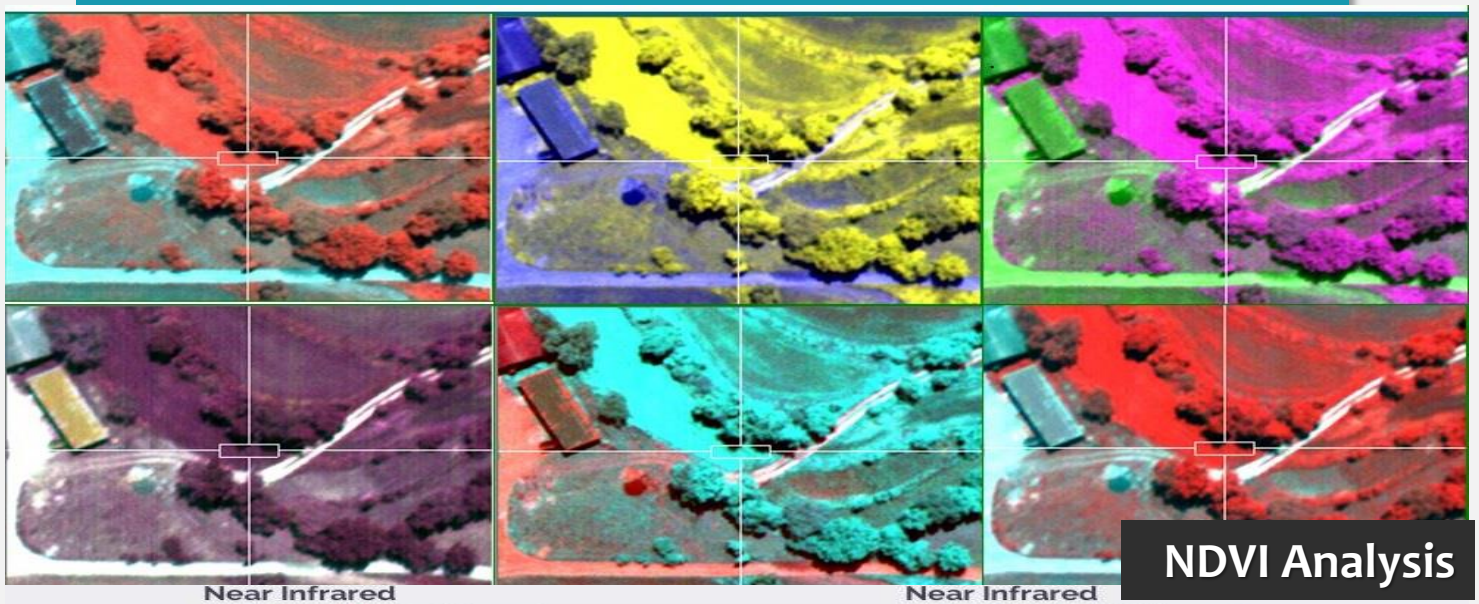
AREA STATEMENT, SPH AND MAPS



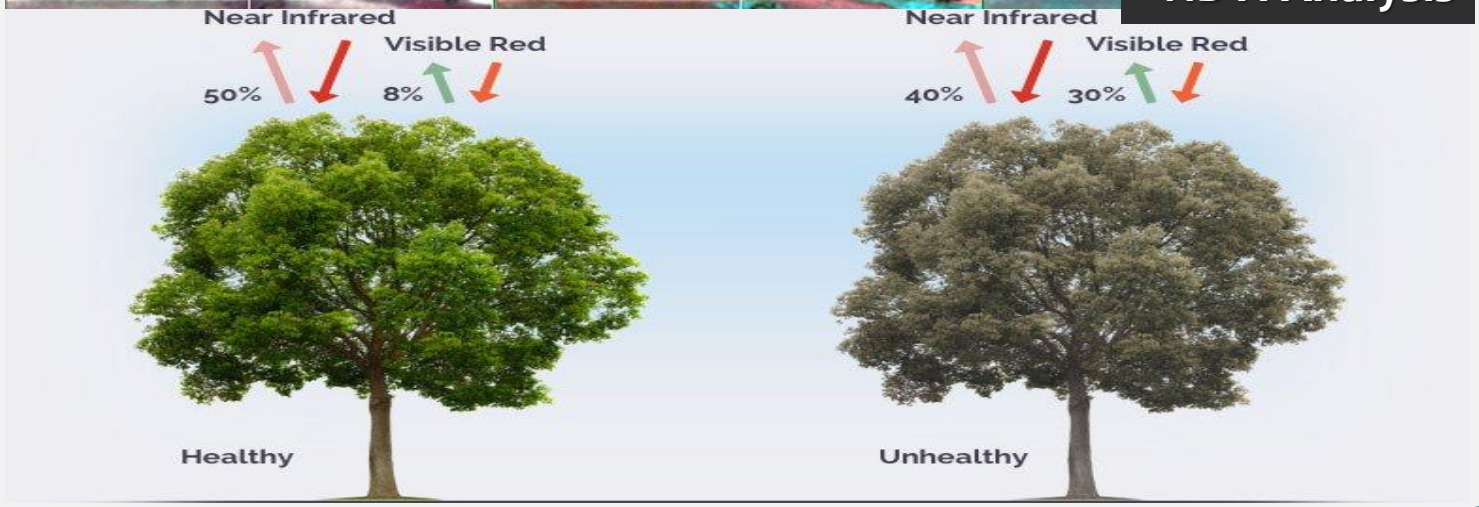
DRONE AIR PHOTO



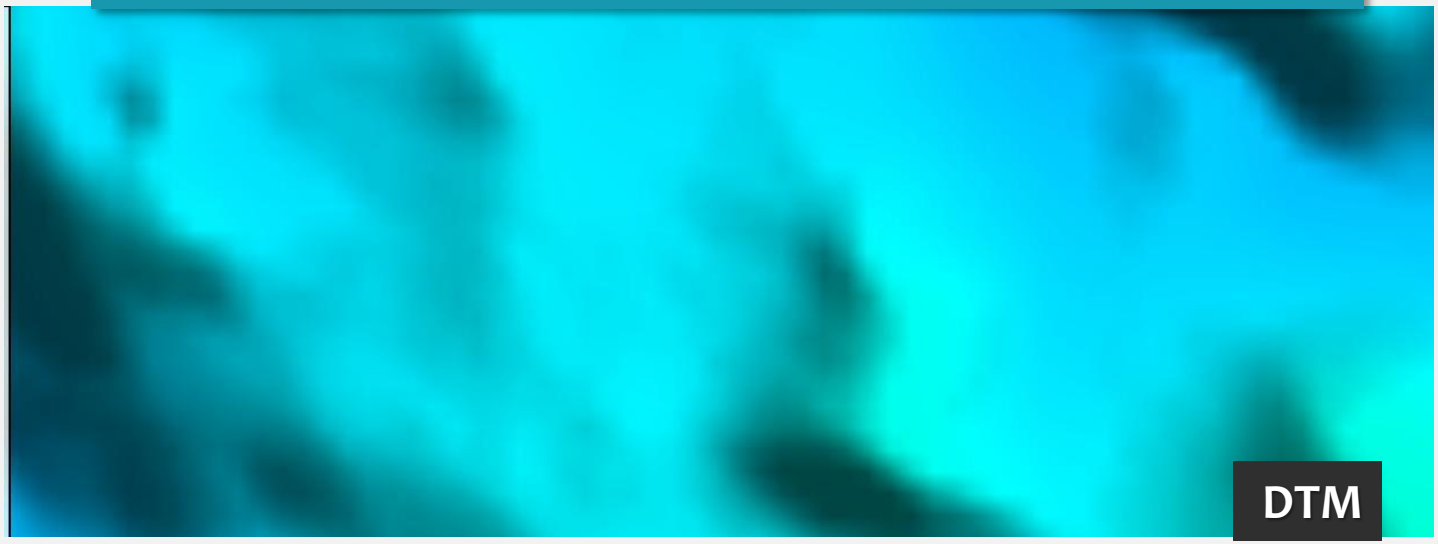
PRODUCT DRONE AIR PHOTO



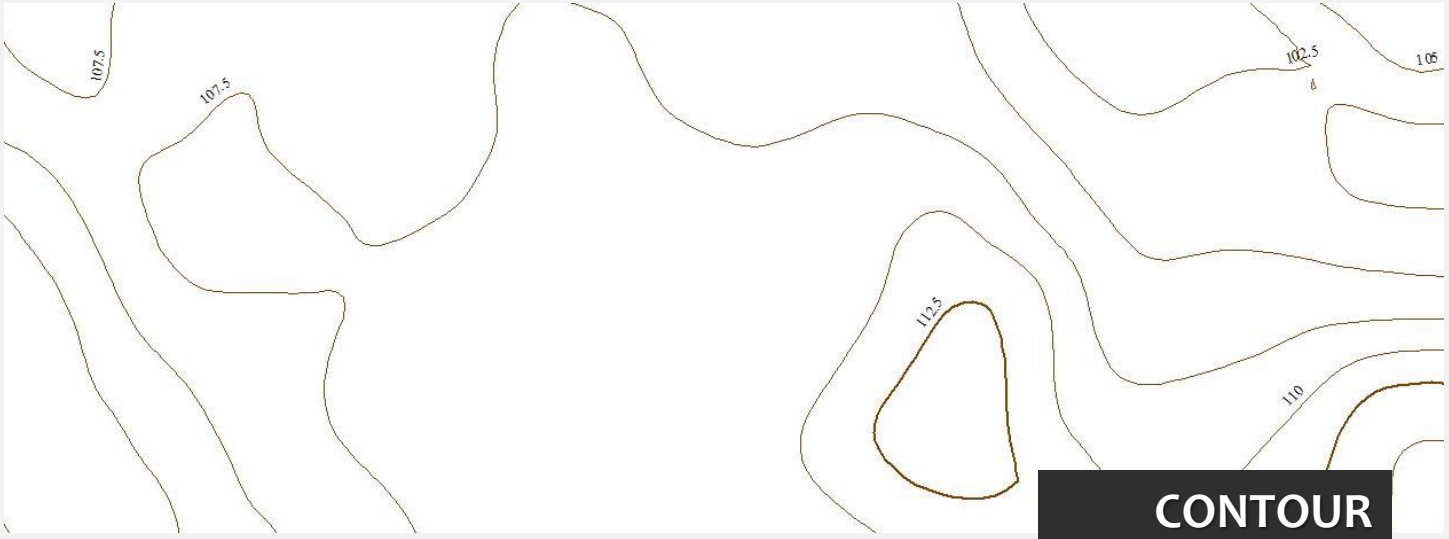
NDVI Analysis



DRONE AIR PHOTO

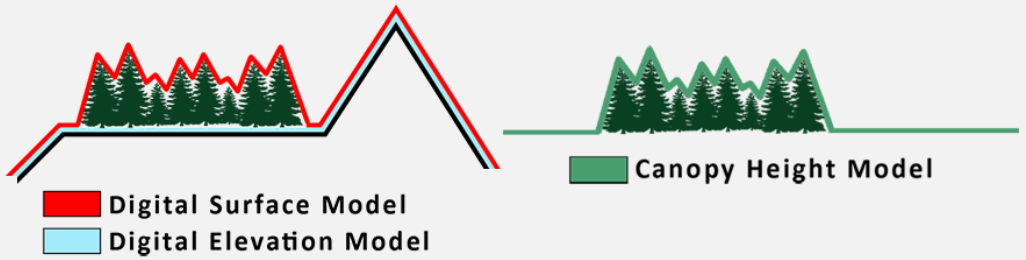


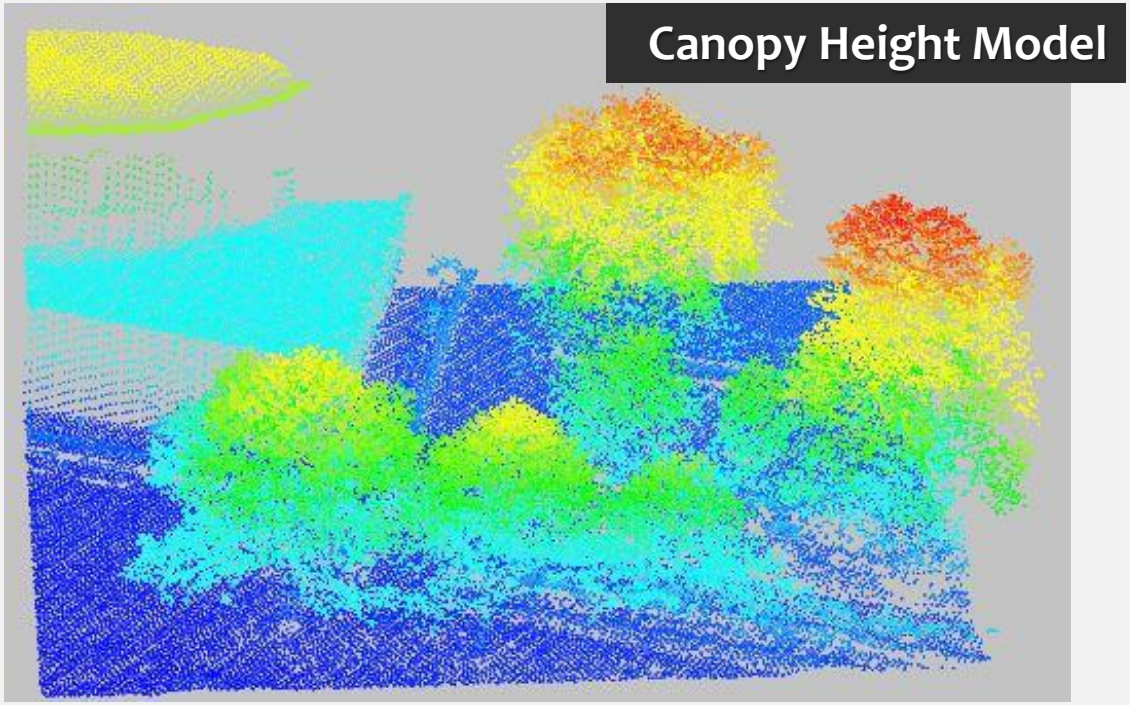
DTM



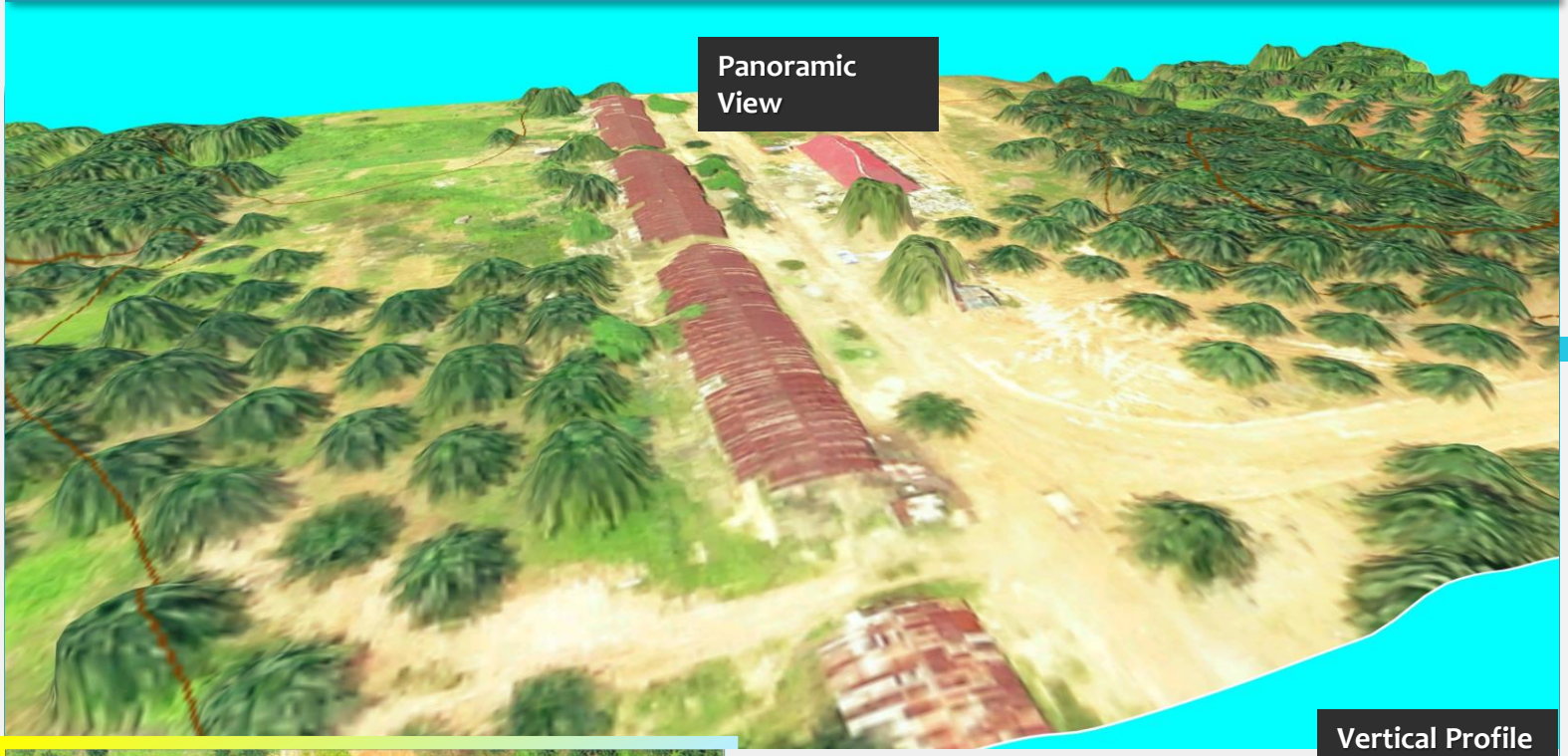
CONTOUR

DRONE AIR PHOTO

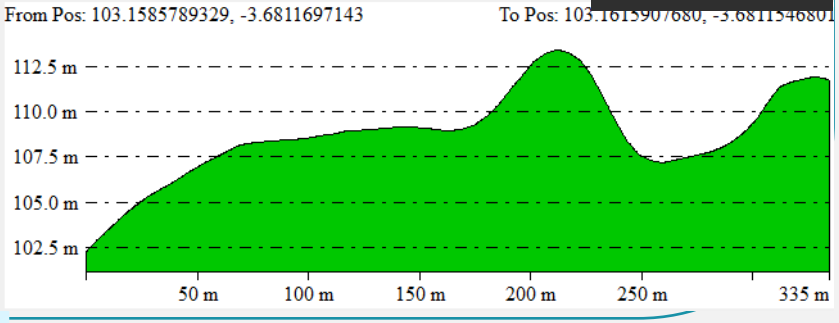




DRONE AIR PHOTO



Vertical Profile

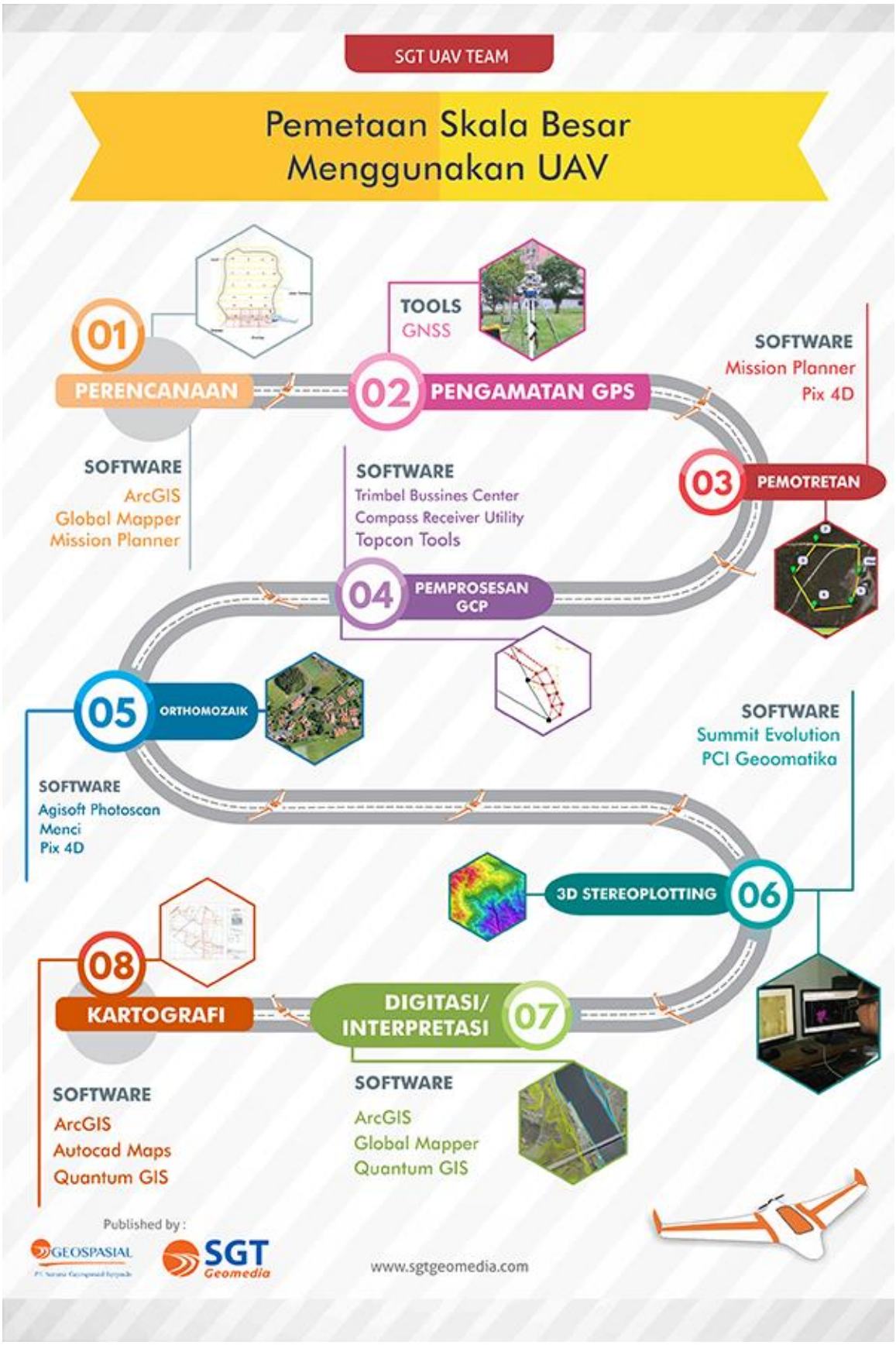


Technical Approach

A. Technical Mechanisms to Complete Past Project

PT. Sarana Geospasial Terpadu have successfully enforce various aerial photo mapping work using UAVs, for example in 2018 we have mapped the entire forest area who was owned by PERUM PERHUTANI in West Java and Central Java, country border between RI-RDTL , mapping plantations belonging to the Rokan Hilir Regency plantation office and various other aerial photo mapping project.

Our work was successfully carried out because of the structured work methods and managerial expertise of the experts, along with the methods / techniques of work of the majority of the work we have done:


SGT UAV TEAM
Pemetaan Skala Besar
Menggunakan UAV
01
PERENCANAAN
SOFTWARE
ArcGIS
Global Mapper
Mission Planner
TOOLS
GNSS
02
PENGAMATAN GPS
SOFTWARE
Trimbel Bussines Center
Compass Receiver Utility
Topcon Tools
SOFTWARE
Mission Planner
Pix 4D
03
PEMOTRETAN
04
PEMPROSESAN
GCP
05
ORTHOMOZAIK
SOFTWARE
Agisoft Photoscan
Menci
Pix 4D
SOFTWARE
Summit Evolution
PCI Geoomatika
3D STEREOPLOTTING
06
08
KARTOGRAFI
DIGITASI/
INTERPRETASI
07
SOFTWARE
ArcGIS
Autocad Maps
Quantum GIS
SOFTWARE
ArcGIS
Global Mapper
Quantum GIS
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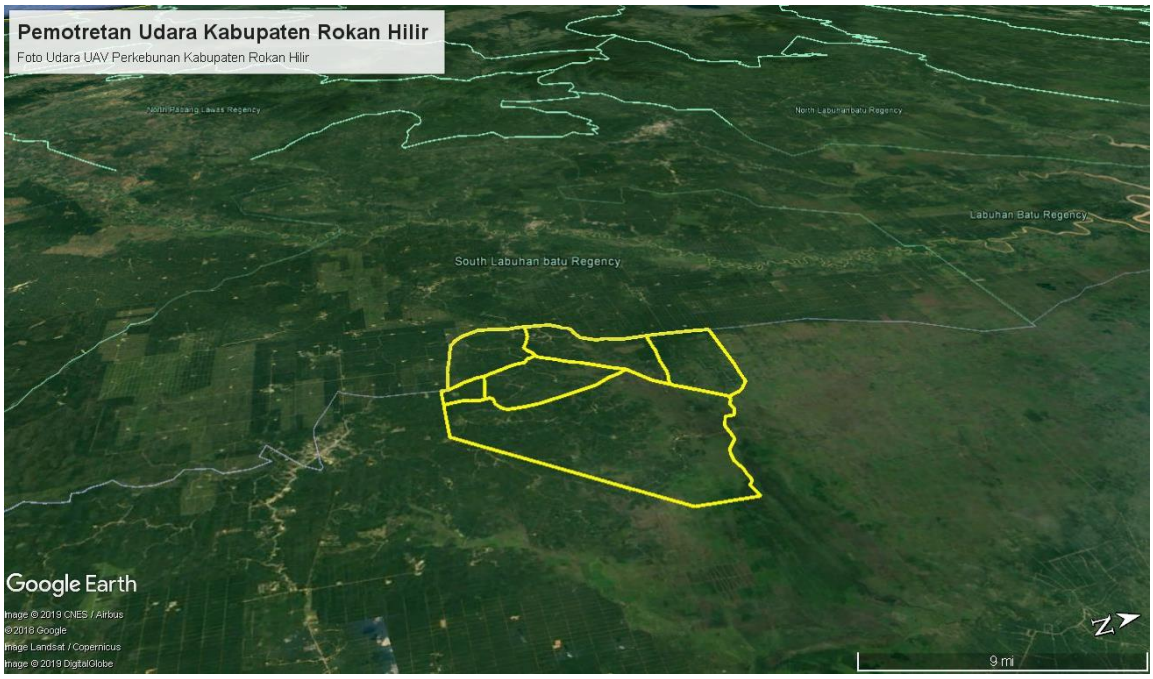
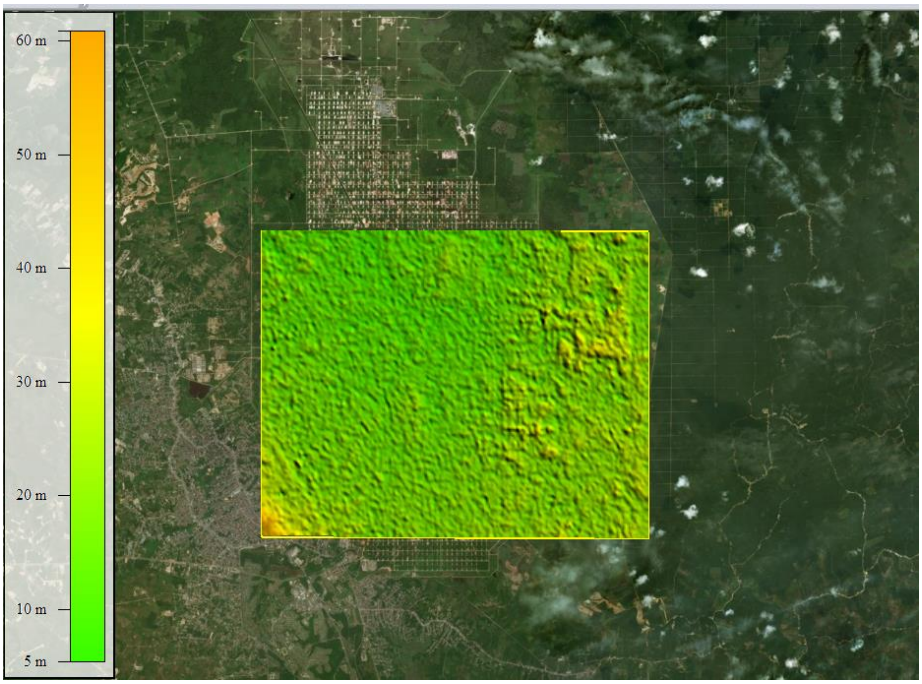
There is the example for project we have carried out at plantation area of Rokan Hilir Regency Plantation Service.



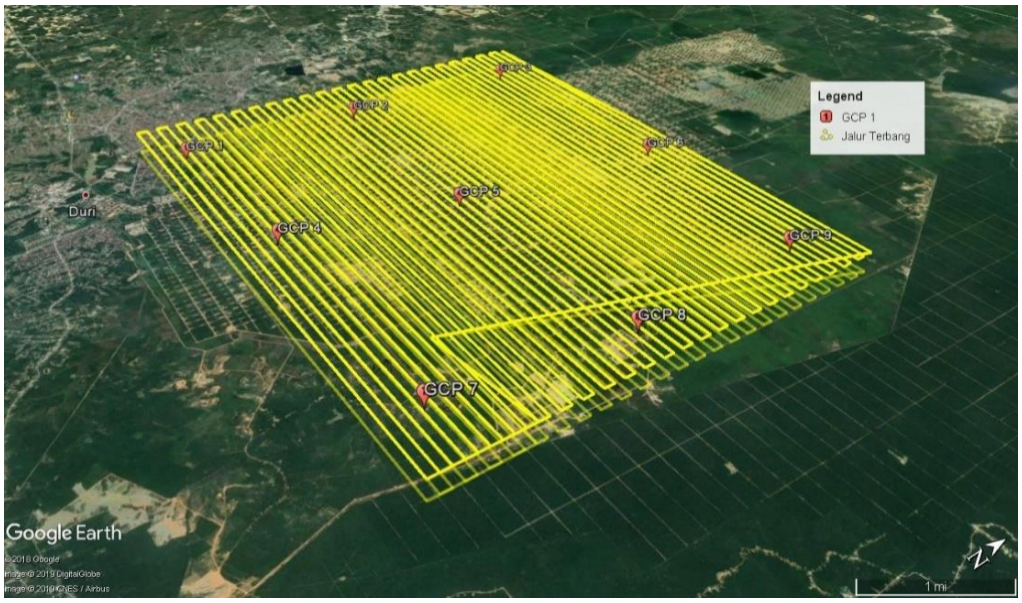
Gambar 1 AOI Project Area

After we defined the area to be acquisition, we observe the topography at area acquisition. This is related to height flight for acquisition data.



Gambar 2 Visualization based on DEM

From our observation digital, we have conclusion that acquisition can be doing with low altitude, because there is no significant difference height in area we acquisition and the area located in low altitude. So as that we planned to flight with 350 meters from surface of the Ground Control System



Gambar 3 Aerial Photogrammetry plan and GCP Distribution

Then, the final step is make a flyway plan based on the area to be acquisition, number of blocks, sidelap and overlap also GCP Distribution. For GCP not always used for every projects. Its use can adjust to the conditions of supervision, the location of supervision and the function of monitoring data

B. Image Acquisition UAV

In principle, aerial photo acquisition and video recording for monitoring have a way of working that is not much different. More clearly, are as follows.

a. Photo Recording

The earliest stage for the acquisition of aerial photographs is the camera set in photo mode as shown below.

Figure 4 Setting the Photo Mode on the Camera

Then proceed with creating a flyway that can meet the photogrammetric rules and cover the mapping area. Drone settings use a mission planner, as shown below.

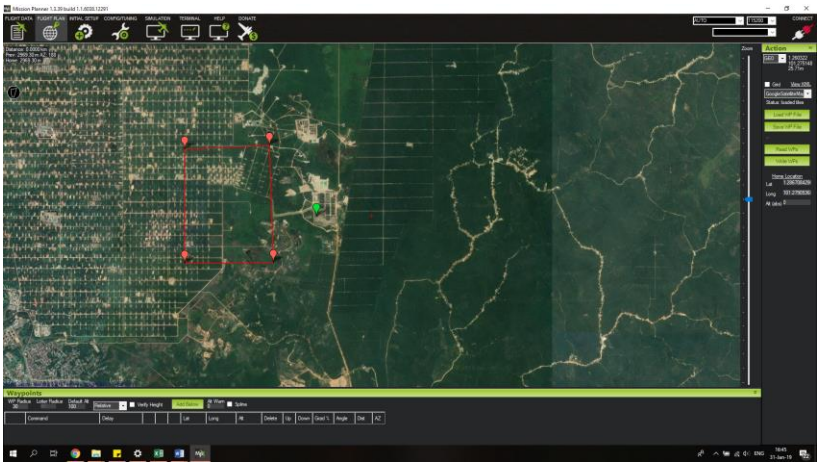


Figure 5 Plan for the Flyway Using Mission Planner

Then set the flight height,so that it can produce good spatial resolution.

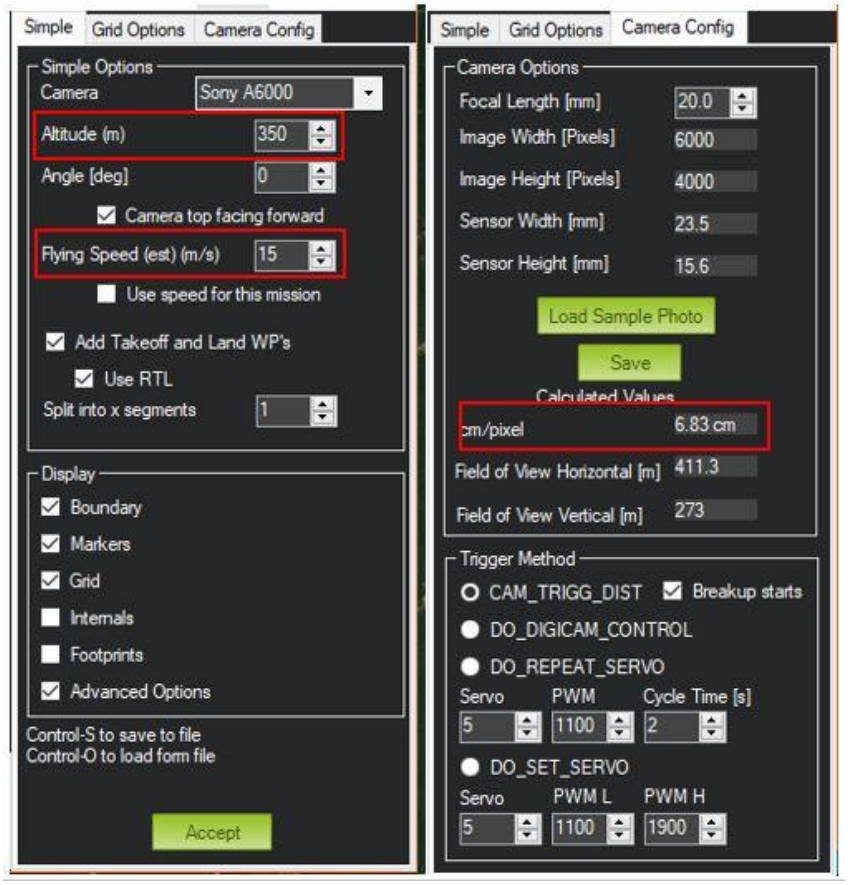


Figure 6 Configuring Flight Plans and GSD photos

The results of the settings are as follows:

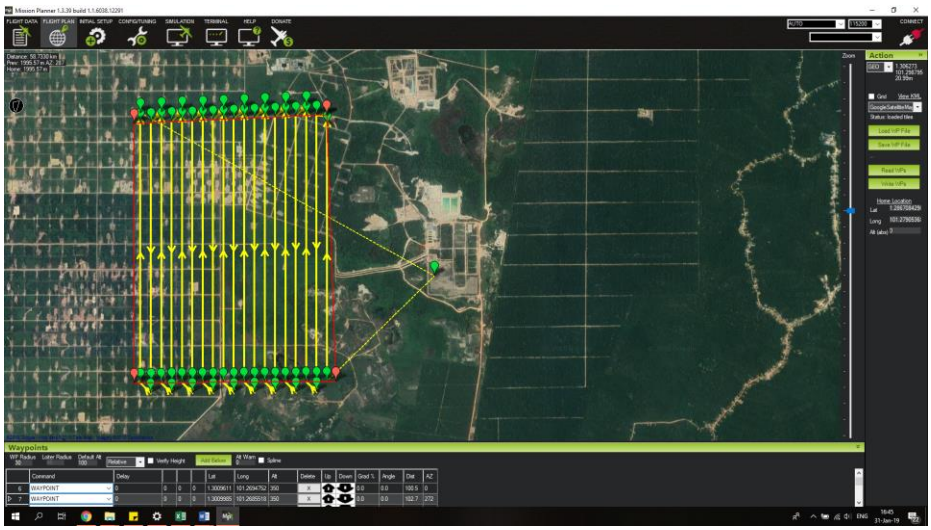


Figure 7 Results of Configuring the Flyway

Then the Drone/ UAV is flown after the mission is uploaded to the Drone/ UAV autopilot and will carry out the mission according to the predetermined path.

C. Novel Solutions to Complex Problem Past Project

PT. Sarana Geospasial Terpadu have a myriad of experiences in aerial photography work throughout Indonesia, here are a small part of the project we have done:

1. Trase Mapping of Banjar - Wates Toll Road with Unmanned Aerial Photography (UAV) Scale 1: 5000

Job description: Making a map of toll road development plans using UAV

Job Location: Banjar - wates

corridor: 2 km along 200 kmKendala:

a. Large volume, done with a short time (60 days)
b. The topography of the mapping area is very varied
c. It requires high accuracy due to road construction planning
d. Work area extends, so the ground control station always moves

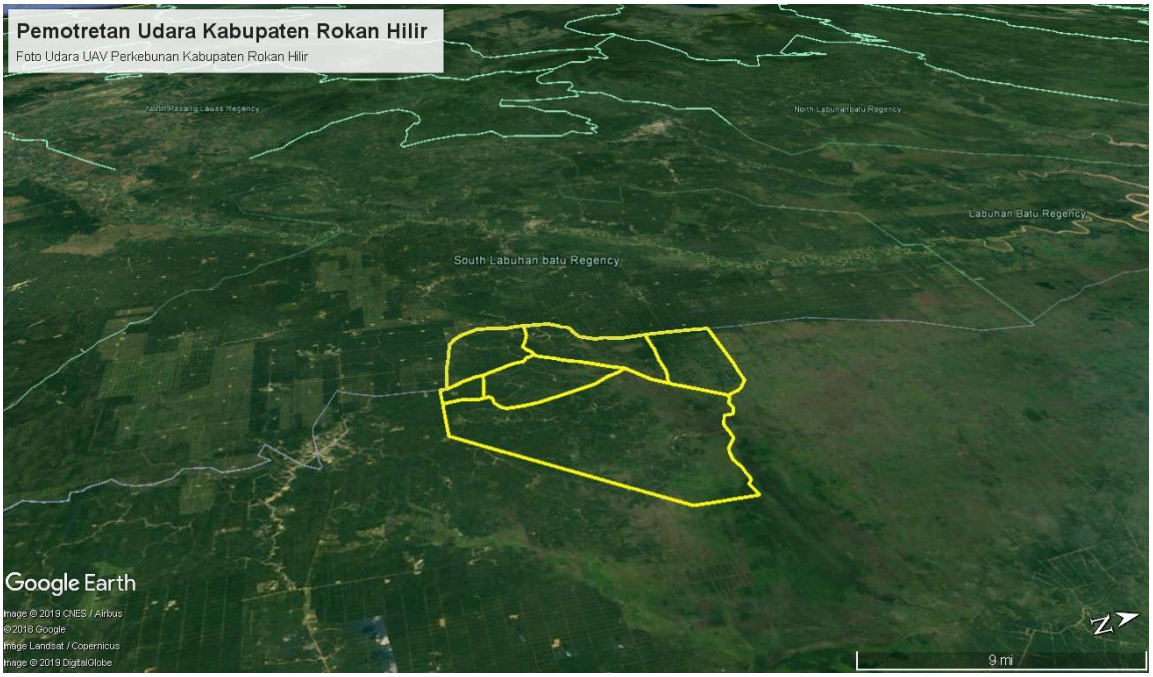
Solution:

a. PT. Sarana Geospasial Terpadu have enough experts and equipment, so that in the process more than 1 team can be formed to acquire aerial photography.
b. PT. Sarana Geospasial Terpadu have experienced and professional pilot and navigator experts, so they always plan flight planning as best as possible in accordance with topographic conditions.

c. PT. Sarana Geospasial Terpadu have equipment and appropriate personnel who are also experienced so that they can meet the technical specifications needed.

d. PT. Sarana Geospasial Terpadu have experienced experts and can master different ground control station conditions.

1. Mapping and Inventory of Plantation Land by Using Aircraft Technology without Awsak and Interpletation of Lansat Image in Rokan Hilir Regency



Job Description: Establishment of a Plantation Map of Rokan Hilir Regency with an area of 80,000 ha

Job Location : Kabupaten Rokan Hilir

Obstacles:

a. The work volume is quite large with a fairly short turnaround time

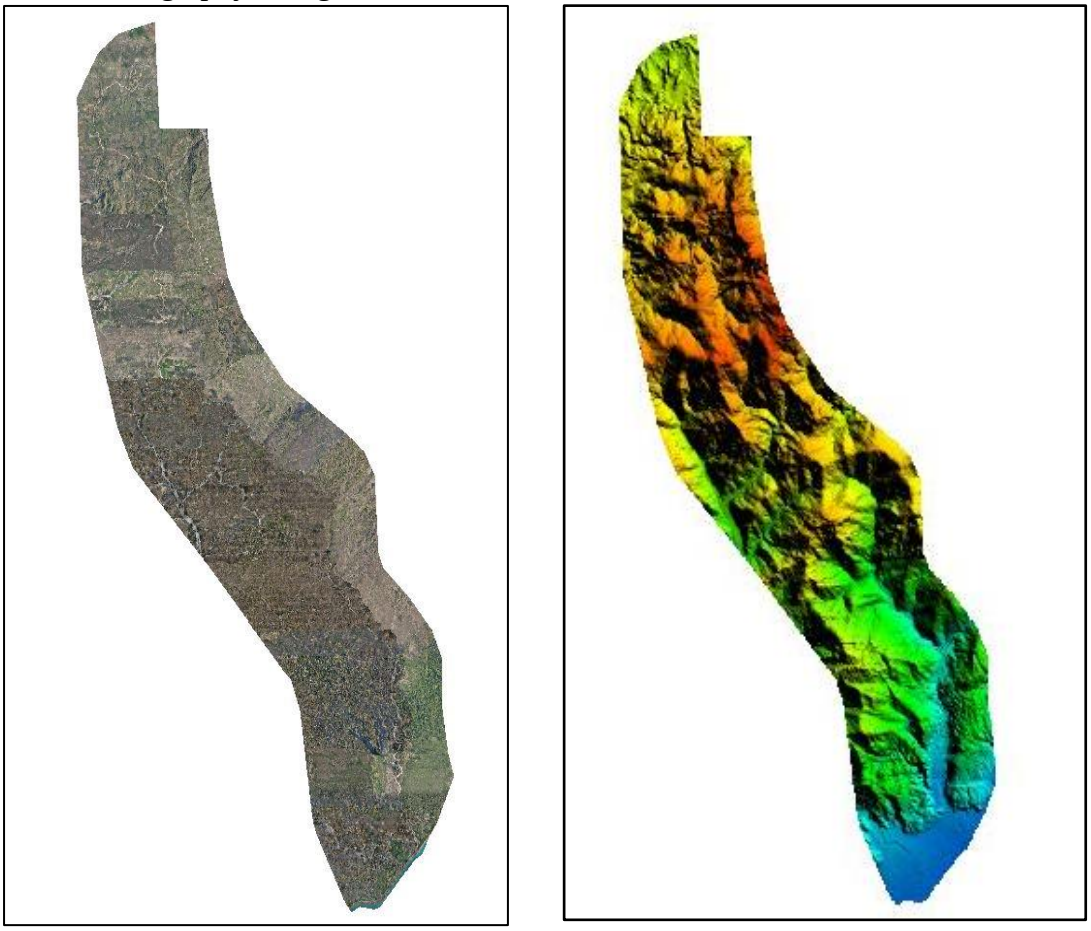
b. The topography of the mapping area is dominated by swamp and peat areas

c. In carrying out work, it is constrained by the surrounding conditions that are smoky (land burning)

Solution:

a. PT. Sarana Geospasial Terpadu have enough experts team and equipment, so that in the process more than 1 team can be formed to acquire aerial photography.
b. PT. Sarana Geospasial Terpadu, have supporting equipment in the form of *drones / UAV* that have quite far roaming power.
c. PT. Sarana Geospasial Terpadu have experienced and professional pilot and navigator experts, so that they know the right time to do aerial photography acquisition.

1. Aerial Photography Using UAV in RI-RDTL Border Corridor



Job Description: Manufacture of Aerial Photo Maps and Digital Elevation of the RI-RDTL Border Corridor Model with an area of 25,000 hectaresKendala dan Solusi

Constraints faced during the implementation of premark installation and measurement include:

- Measurements of the Republic of Indonesia and RDTL cannot be carried out simultaneously, and there is a long lag after the premark installation and measurement has been completed in the Republic of Indonesia until the premark installation and measurement in the RDTL area.
- Disorders of wild animals, which damage the premark that has been installed and observed.
- Theft and burning of forests by local residents.

Solustion:

- The gap between the premark installation and shooting is made not too long to avoid the premarital collapse.
- Simultaneous installation on two sides of the country, so that work becomes faster and more efficient.

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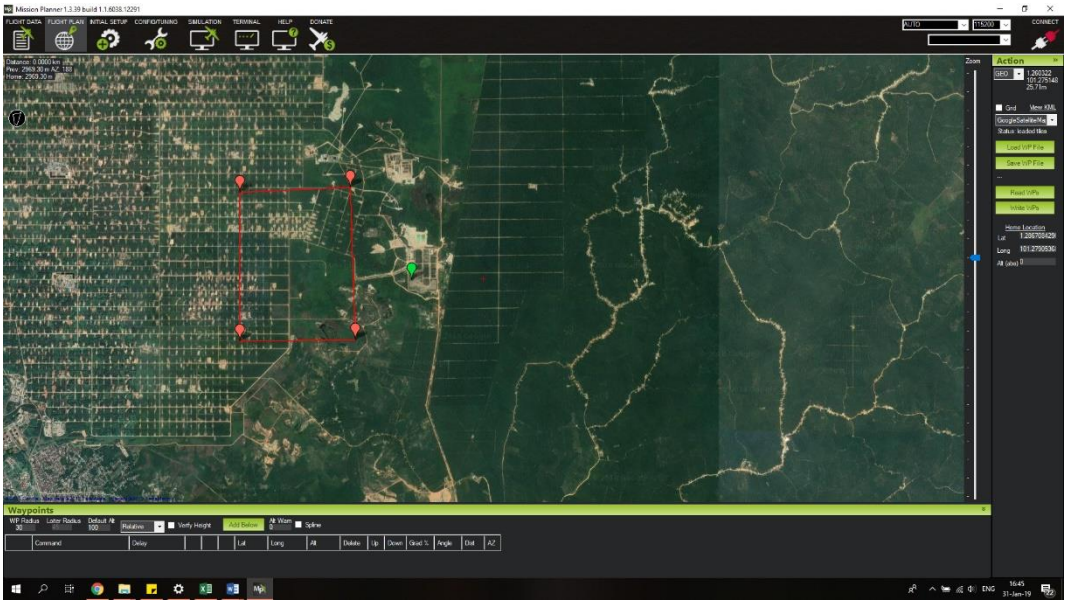
Technical Data and Capture Analysis

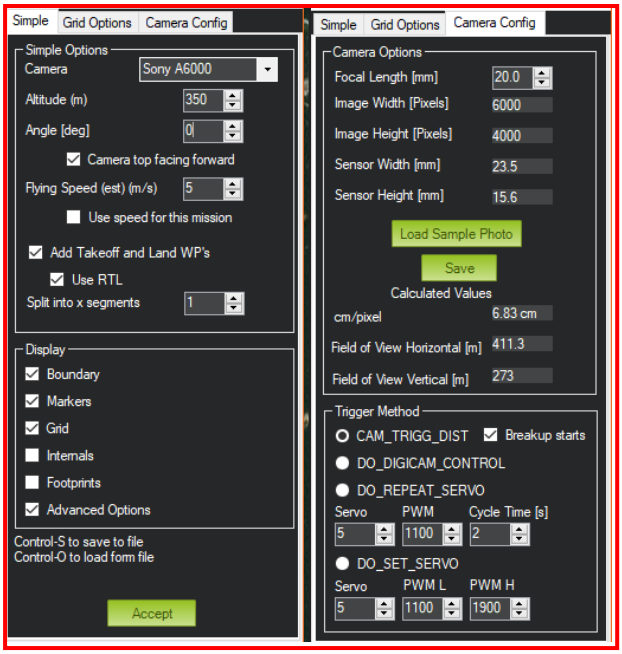
Technical Data and Capture Analysis

A. Air Photo Acquisition Method

Air photo acquisition for both ***RGB camera*** and ***multispectral camera*** is using the same method. The difference between them is their focal length setting, which is based on lenses used in camera. Multispectral camera needs to be flight in low altitude (<200 M AGL) to get the best result, meanwhile RGB camera can be used high altitude (>250 M AGL) and still get best result. Both RGB and Multispectral will be using ***Mission Planner Software***. First we need to determine the area, like photo below.



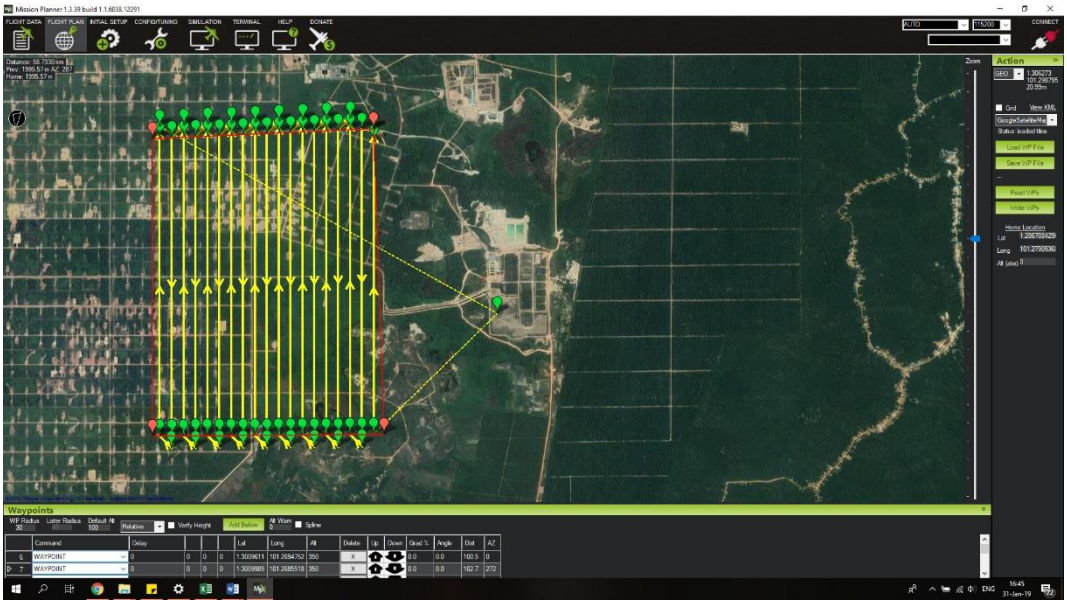
After we determine the area, next we determine the flight height, and its different for multispectral and RGB acquisition, show on picture below.



RGB Camera setting

Multispectral Camera Setting

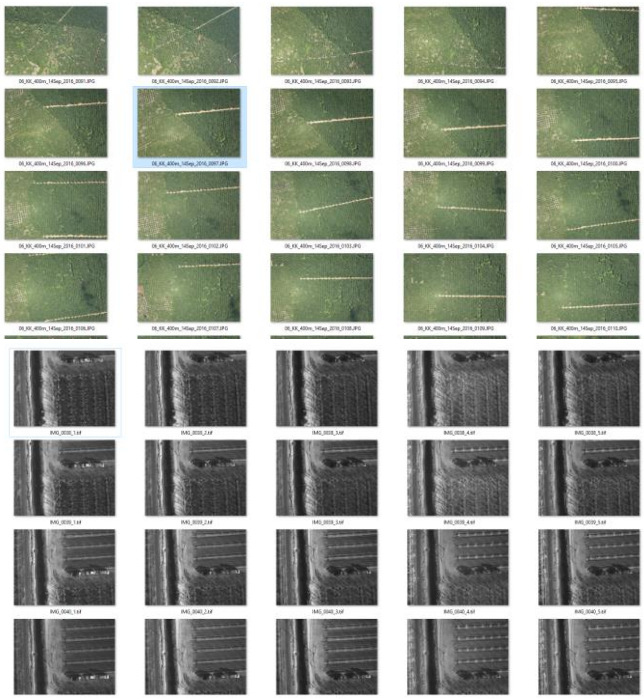
Then it will be generating flight path like picture below.



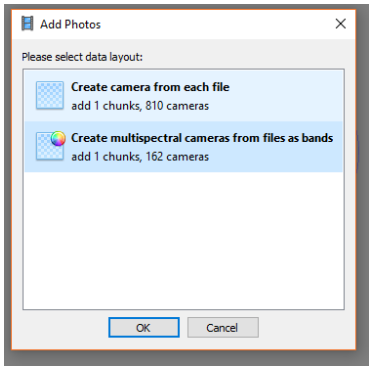
That flight plan will be uploaded to UAV Autopilot and UAV will be do the mission like we created.

B. Data Processing

RGB Camera and Multispectral Camera have different RAW data. RGB camera will take only 1 picture/ take, meanwhile multispectral have 5 picture/ take. The difference shows on picture below.



When import the photo, RGB choose all photo, meanwhile multispectral we will process it as multiband photo like below.



C. Result

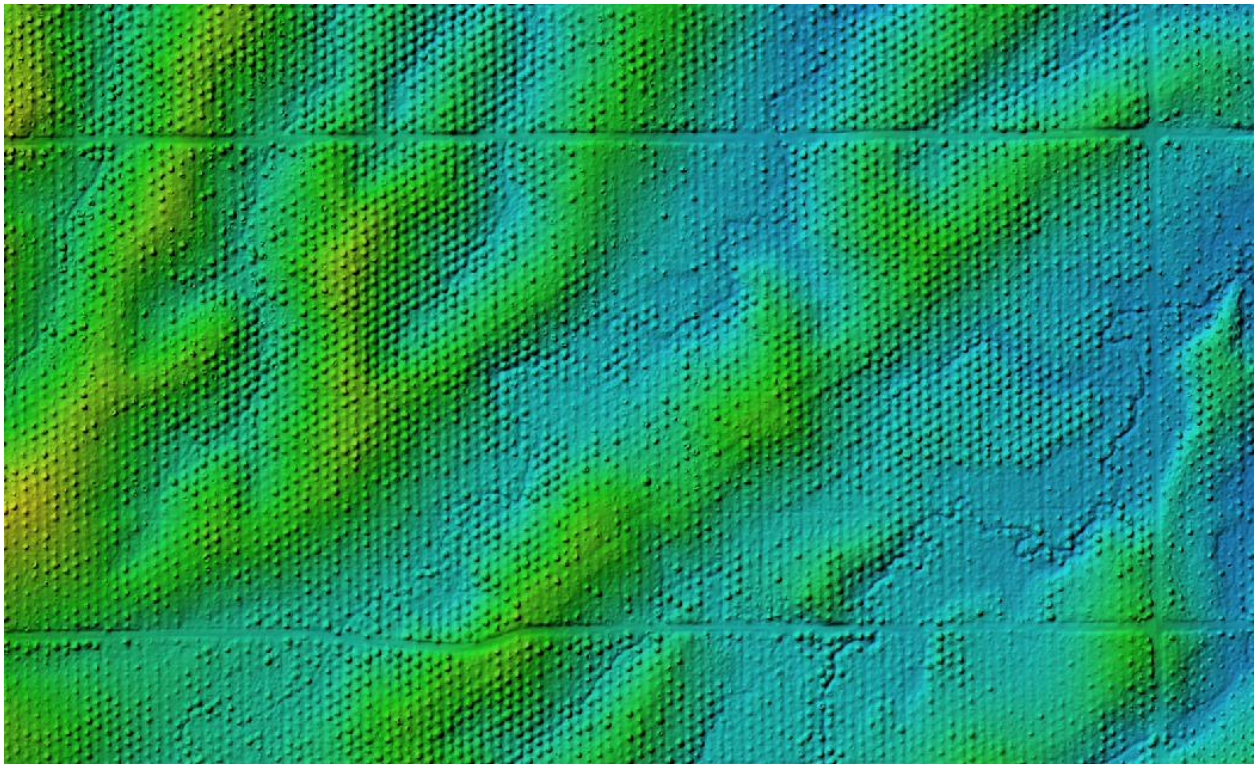
Data processing product will be categorized by the source,

1. RGB Photo

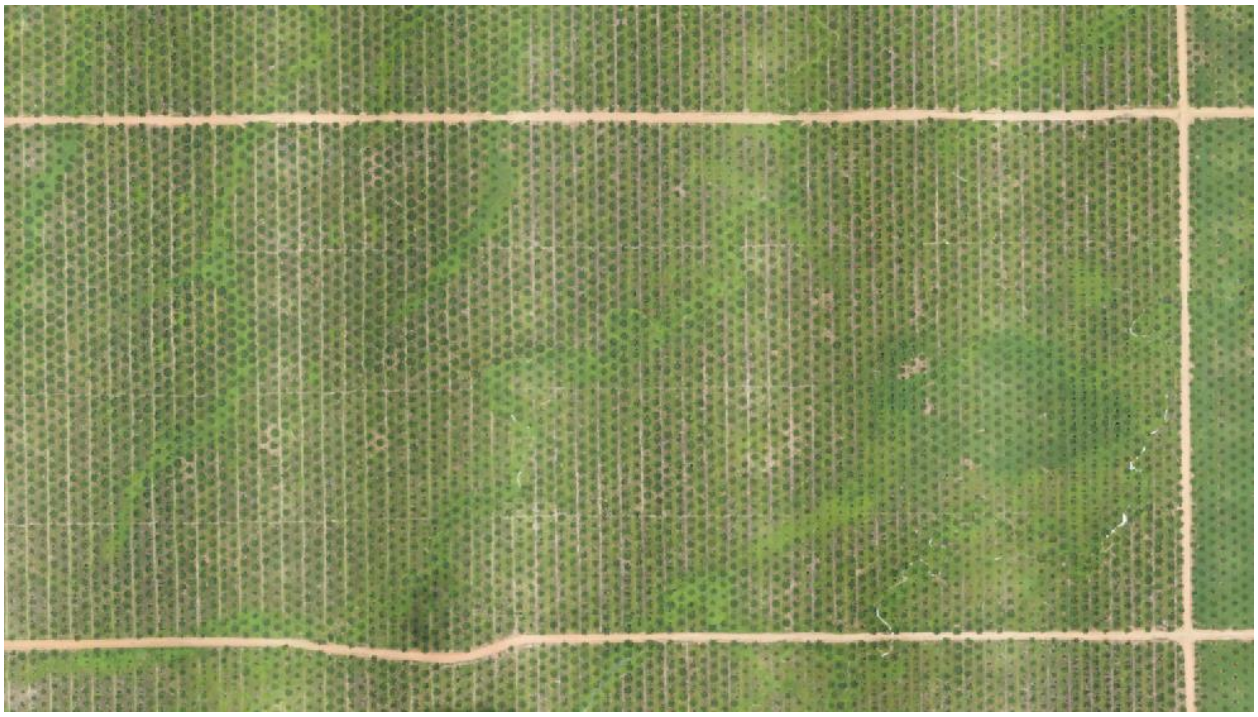
Processing RGB photo will produce:

- **Point Cloud**

- **Digital Surface Model (DSM)**

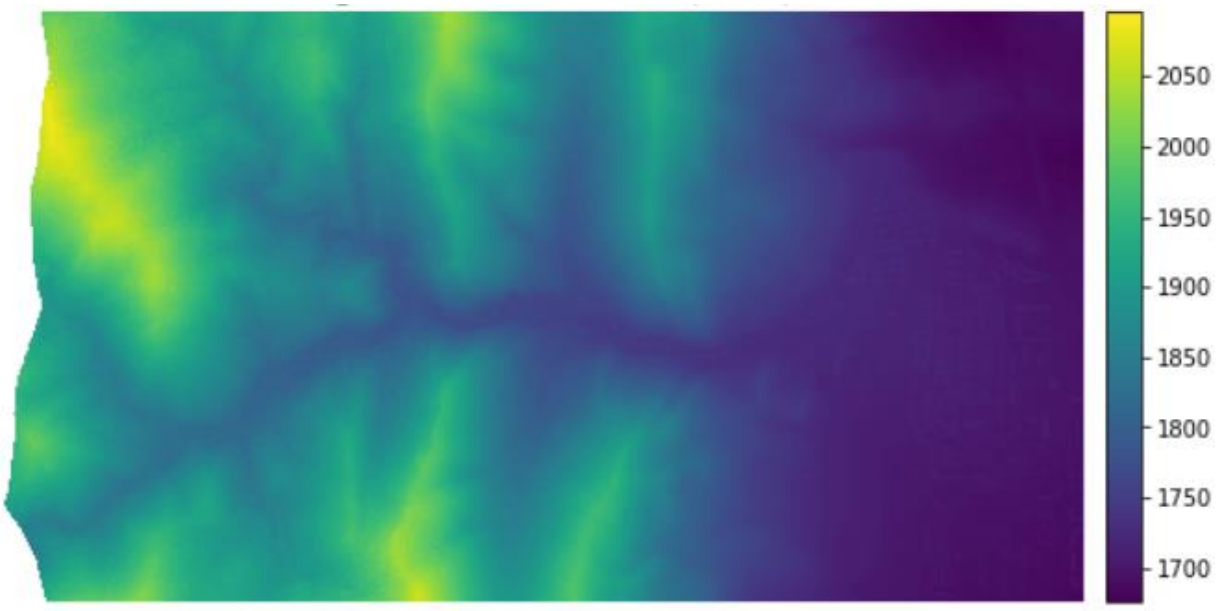


- **Orthophoto**

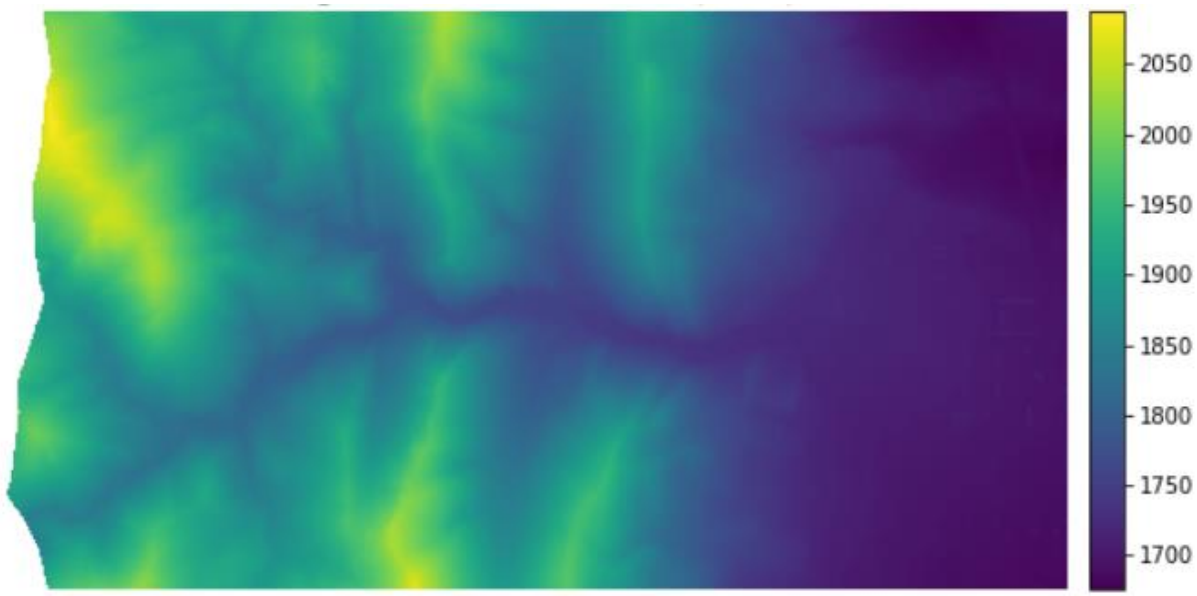


After we get the main data result (DSM, Orthophoto), we can do post processing, or analytical processing to get the Digital Terrain Model (DTM). DTM is the barren earth, and DSM is the surface earth which is include building and vegetation.

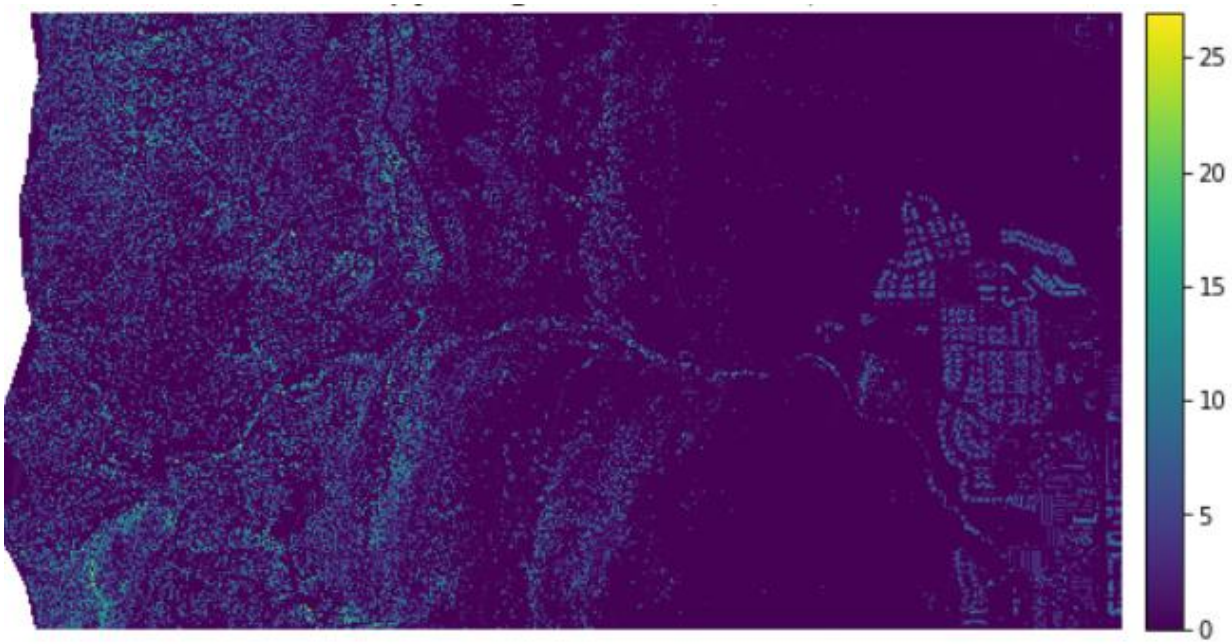
From DSM Below we will remove the vegetation and building.



It will be resulted DTM below. Method for creating it can be using software computation or using 3D stereo plotter for the best DTM result.

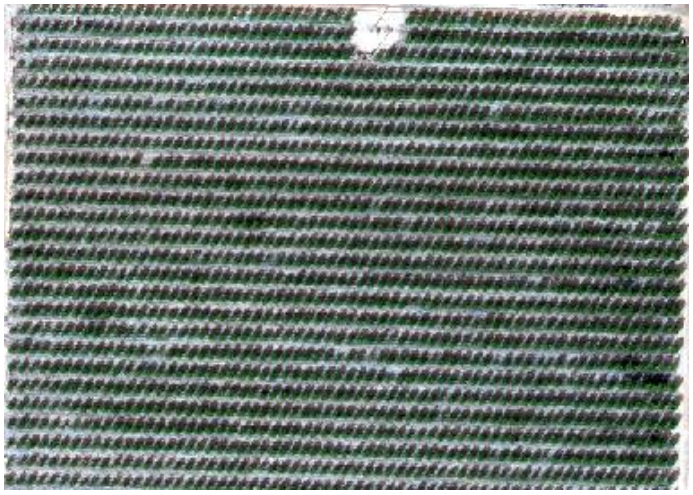


To get Canopy Height Model (CHM) the computation is simple, which is only subtract DSM with DTM.

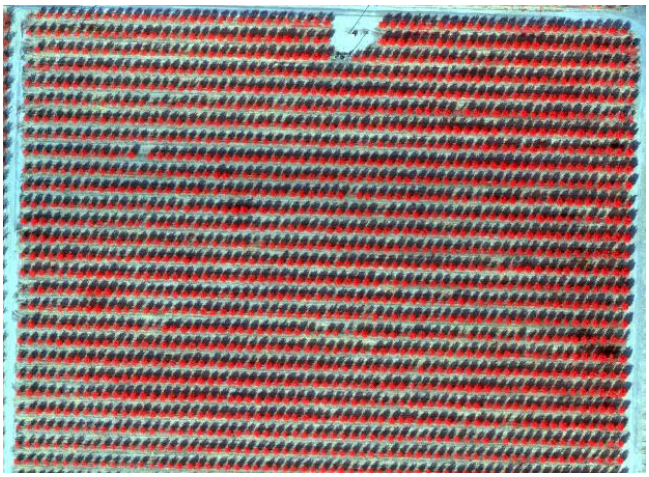


2. Multispectral Photo

Multispectral photo processing will produce multispectral orthomozaic.



The multispectral othomozaik can be used for further analysis.

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