Akumadan teak plantation Forestry Monitoring

Report of a pilot assignment

Form Ghana, Akumadan, Ghana
20-21 November 2018

Author:
Jan van Til

Client:
Form Ghana

Location:
Akumadan, Ghana

HiView
Costerweg 1V
6702 AA Wageningen
The Netherlands
+31 (0)6 18141772
info@hiview.nl
www.hiview.nl

Table of contents

1	Introduction	**3**
1.1	Background and objectives	3
1.2	Perspectives for the use of FSs	3
1.3	Location of the Akamadan teak plantation	4
1.4	Areas of interest	5
2	Result illustrations	**6**
2.1	Block 1A, RGB and NDVI	6
2.2	Crop fields: RGB Orthomosaics and DEMs	11
Appendix 1: FS derived products		**17**
Appendix 3: Flight logs		**19**

1 Introduction

1.1 Background and objectives

HiView (www.hiview.nl) is a Dutch company that is specialized in terrain observation with the help of Flying Sensors (FSs) in the Netherlands and around the world. Our main market sectors are agriculture, forestry, land & water management. Amongst others HiView has performed assignments for Worldbank USAID, EC, ESA, Waterschap Fryslan, Natuurmonumenten, SBB, University of Utrecht a.o., IHE Delft, University of Delft.

In relation to Africa, HiView has been active, together with our partner FutureWater (www.futurewater.nl), in different countries since 2014, mostly through ThirdEye (http://thirdeyewater.com/), an operational service for farmers based on FS imagery. Next to that, HiView has conducted several trainings and workshops (in Ghana, Kenya, Madagascar, Mozambique) on the use of FSs for different purposes like crops stress detection, elevation measurement and land degradation.

The main products from the Akumadan pilot are:

1. Raw images of all flights NIR (Near InfraRed) and RGB
2. DEMs of a terrain that is set to be developed as teak plantation (50 ha)
3. NDVI of the teak canopies in Block 1A (50ha)

The purpose of this report is to illustrate the full-scale digital results that are transferred to Form by We Transfer.
In Appendix 1 a list is presented with all possible relevant applications of FS imagery.
In Appendix 2 the operational program of the field days is shown.
Appendix 3 contains the flight logs.

Note: the images of F02 (flight 2) have not been applied for making a DEM. The reason for this is that there were not enough GCPs (Ground Control Points) available.

1.2 Perspectives for the use of FSs

Though the pilot still has to be evaluated by Form and HiView, some perspectives for future use of FSs are becoming evident. Some of the most significant applications:

- Further monitoring of the teak plantation with a combination of RGB and NIR cameras in order to produce good overviews, through RGB and NDVI mapping, of the condition of the trees.
- RGB orthomosaics of the forest canopy can be used to assess the number of trees because the contour structures of the trees are clearly visible on the FS images. HiView, in cooperation with FutureWater, can develop an instrument (algorithm) to calculate numbers of trees.
- Making DEMs of the forest canopy can help to assess tree volume. Despite the absence of GCPs it is possible to produce DEMs supplying sufficient information on the height of the trees.

1.3 Location of the Akamadan teak plantation

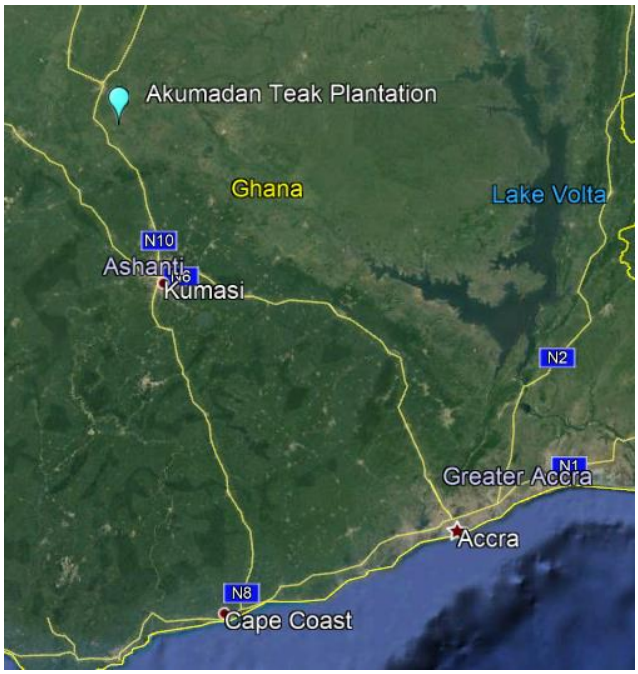
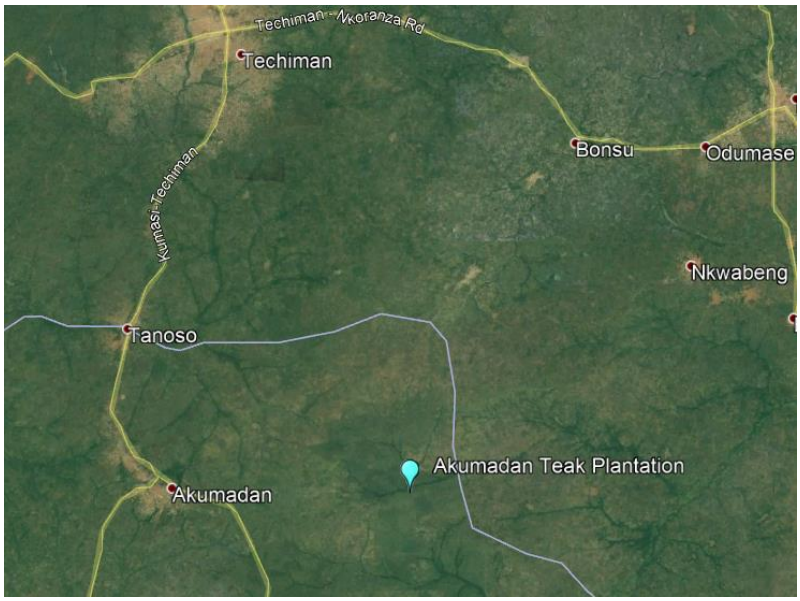


Figure 1. Situation of the teak plantation in Ghana



Figures 2. Local situation of the teak plantation

1.4 Areas of interest

Two areas of interest have been identified for the pilot.

- Block 1A (for NDVI)
- Crop fields near the watch tower (for DEMs)

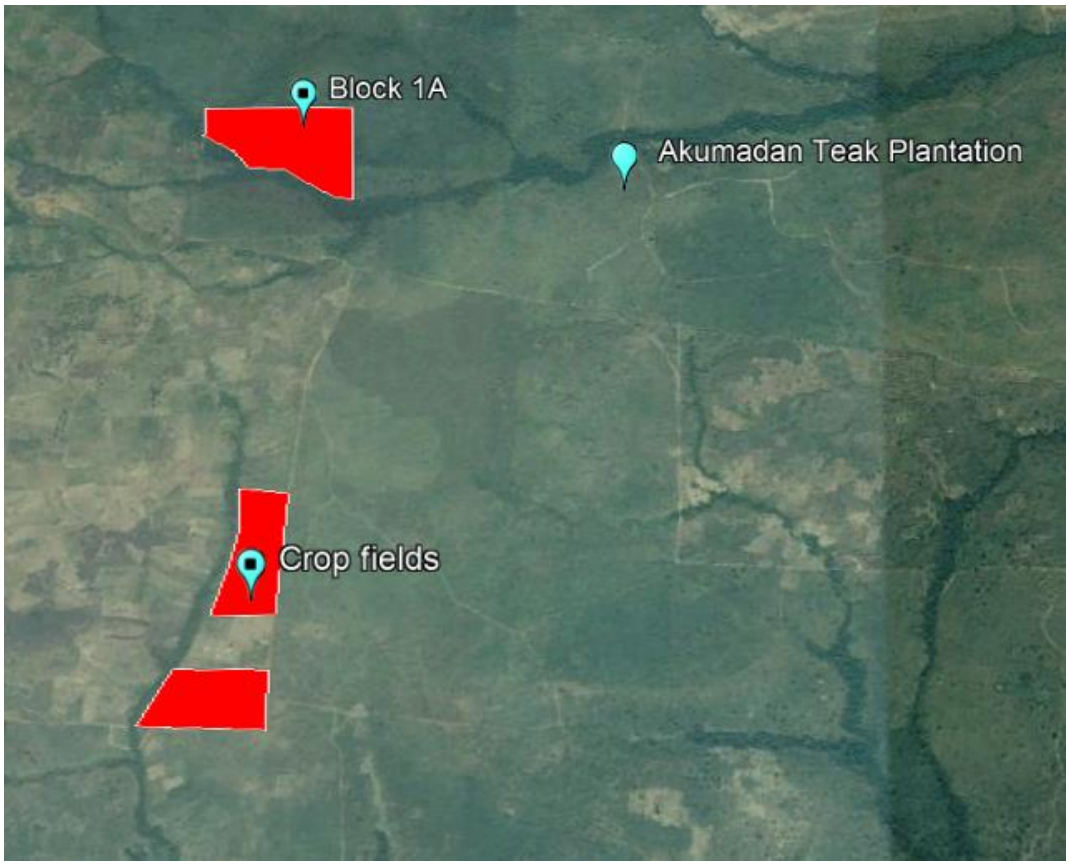


Figure 3. Areas of interest

2 Result illustrations

2.1 Block 1A, RGB and NDVI

Figure 4. Block 1. RGB

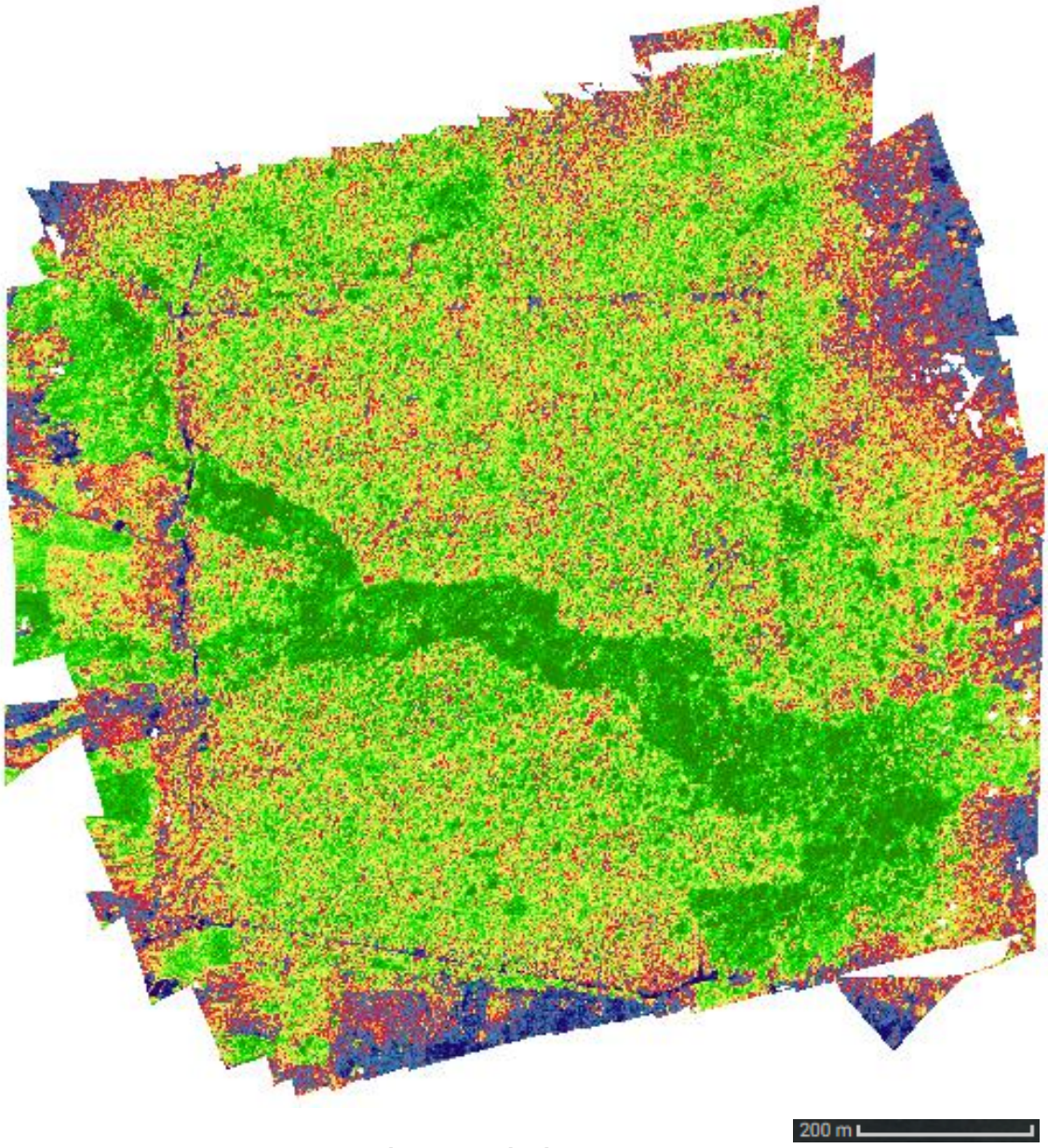


Figure 5. Block 1. NDVI

Figure 6. Block 1A. RGB

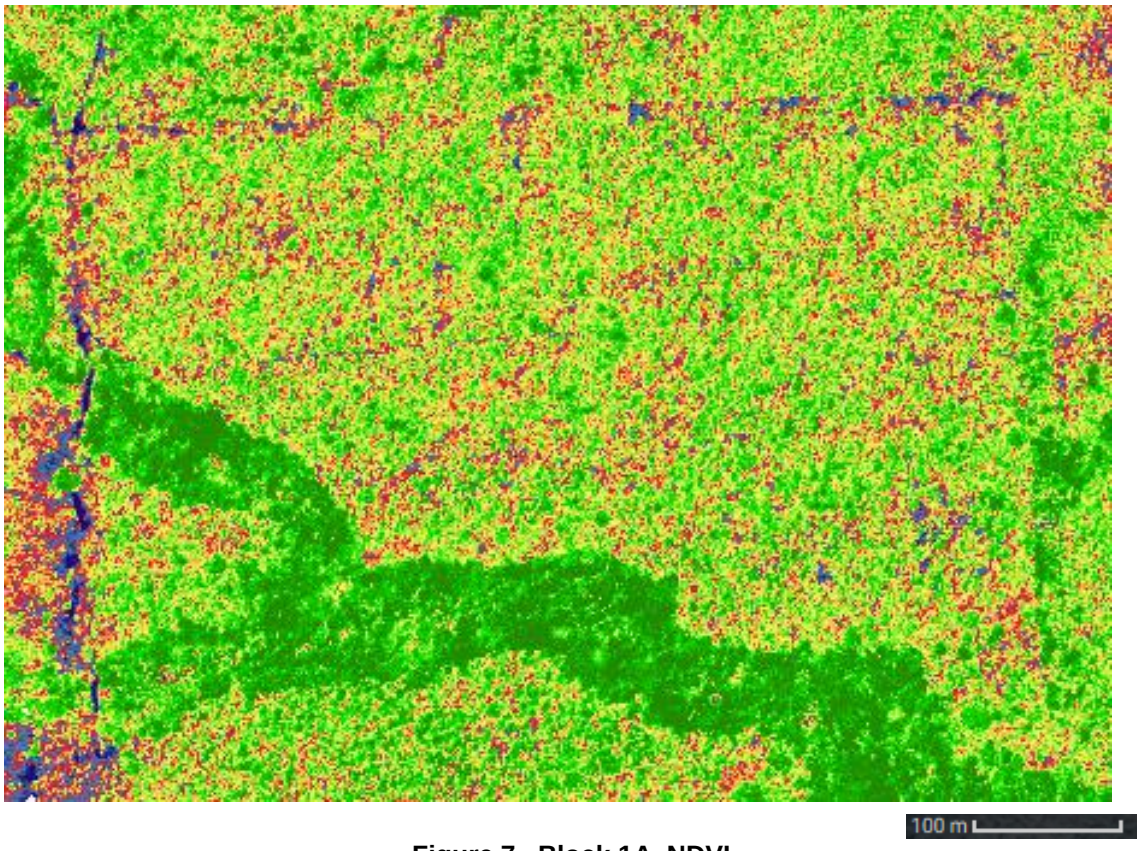


Figure 7. Block 1A. NDVI

Figure 8. Block 1A. RGB (zoomed in)

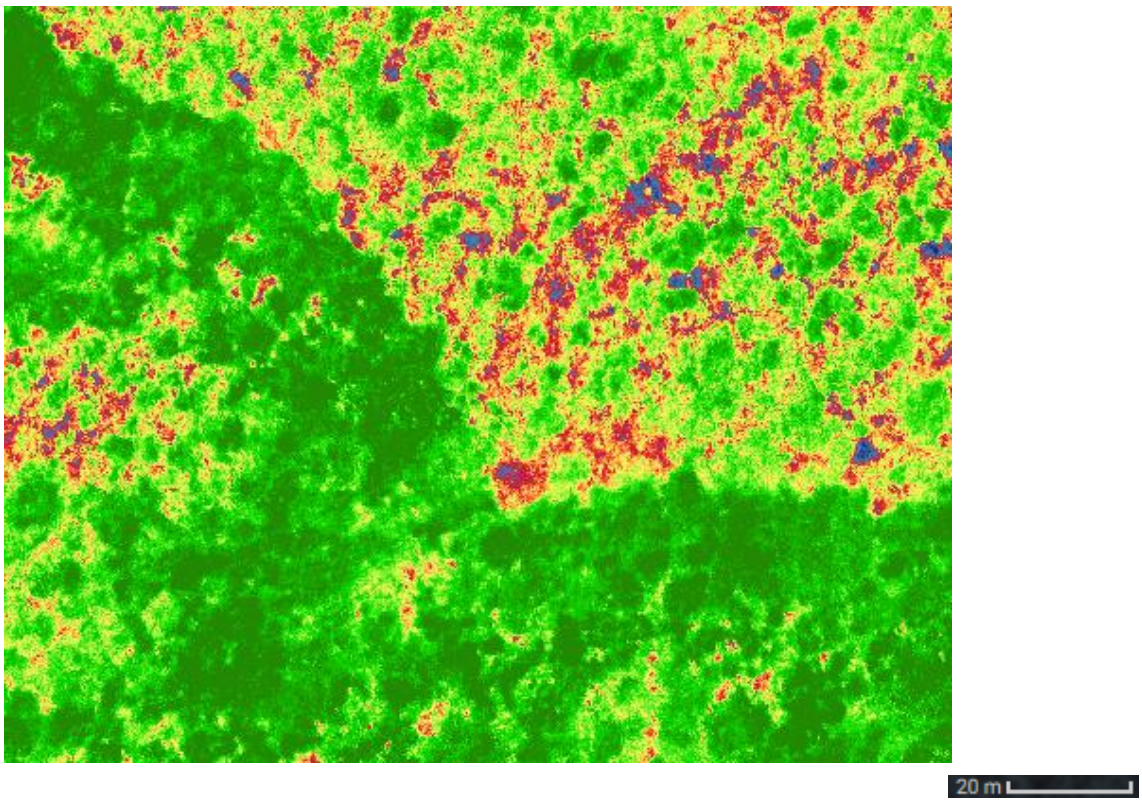


Figure 9. Block 1A. NDVI (zoomed in)

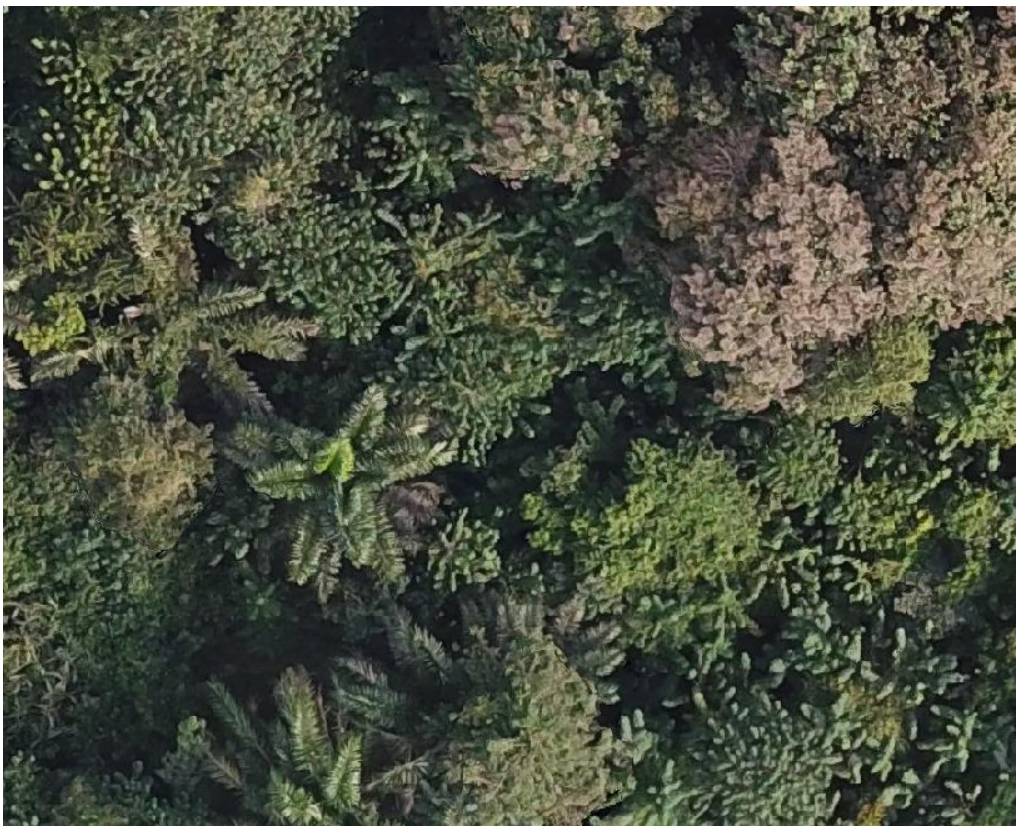


Figure 10. Block 1A. RGB, zoom of zoom 1

2.2 Crop fields: RGB Orthomosaics and DEMs

Figure 11. Crop Fields. RGB Orthomosaic, flight area 01, 03 & 04

Figure 12. Crop Fields. RGB Orthomosaic, random detail (zoomed in)

1

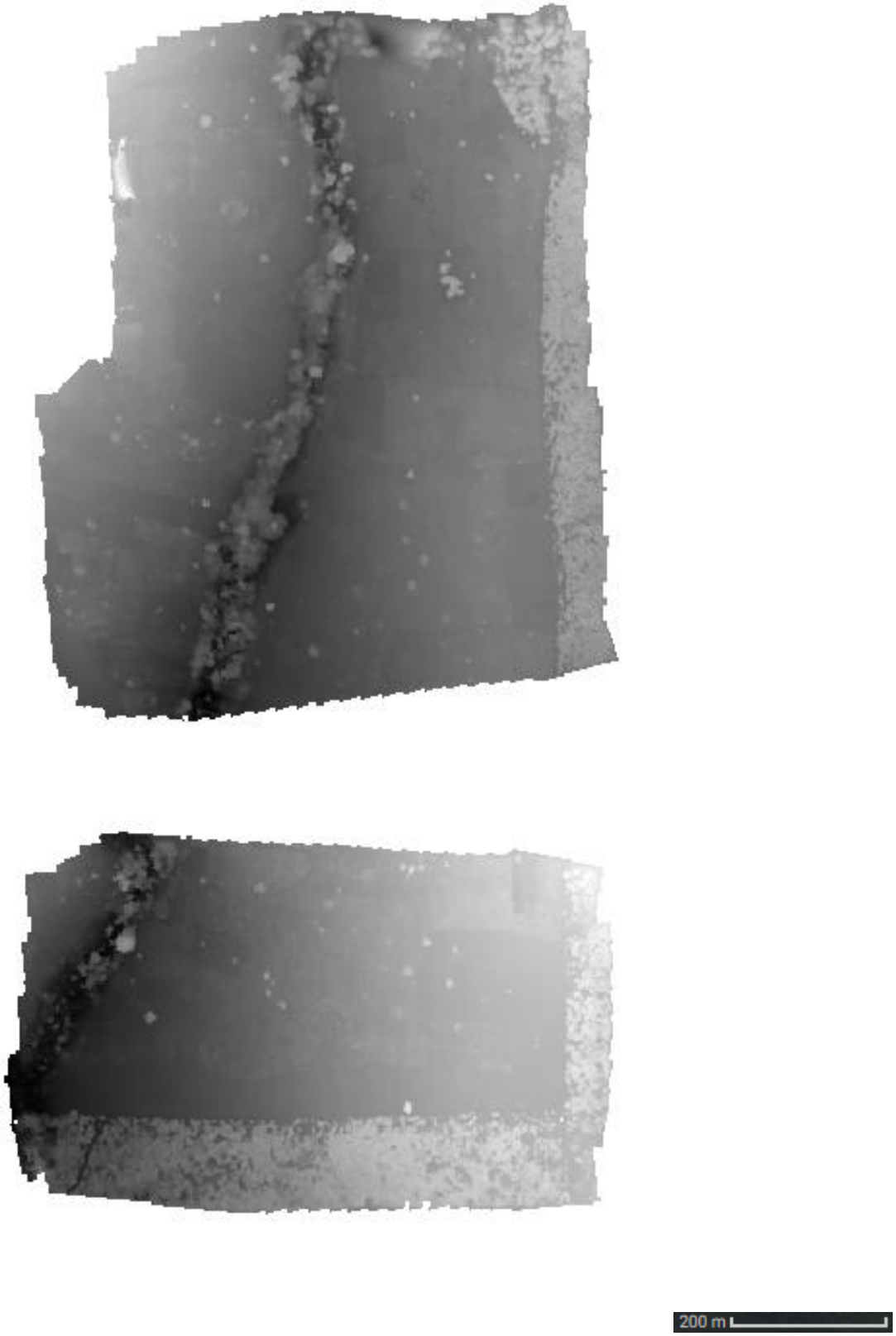


Figure 13. Crop fields.DEM, flight area 01 (under), 03 & 04 (above)

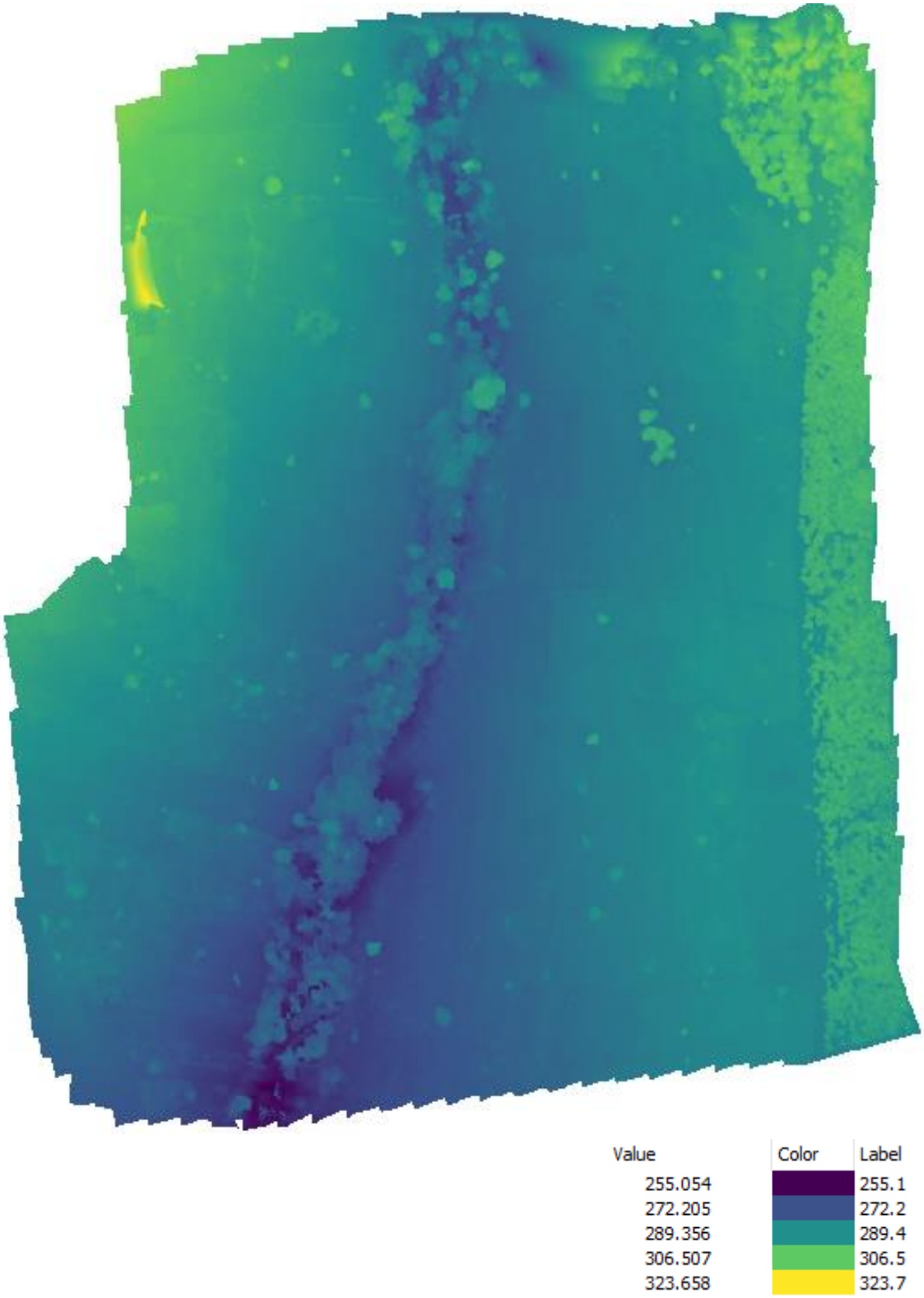


Figure 14. Crop fields.DEM false color, flight area 03 & 04

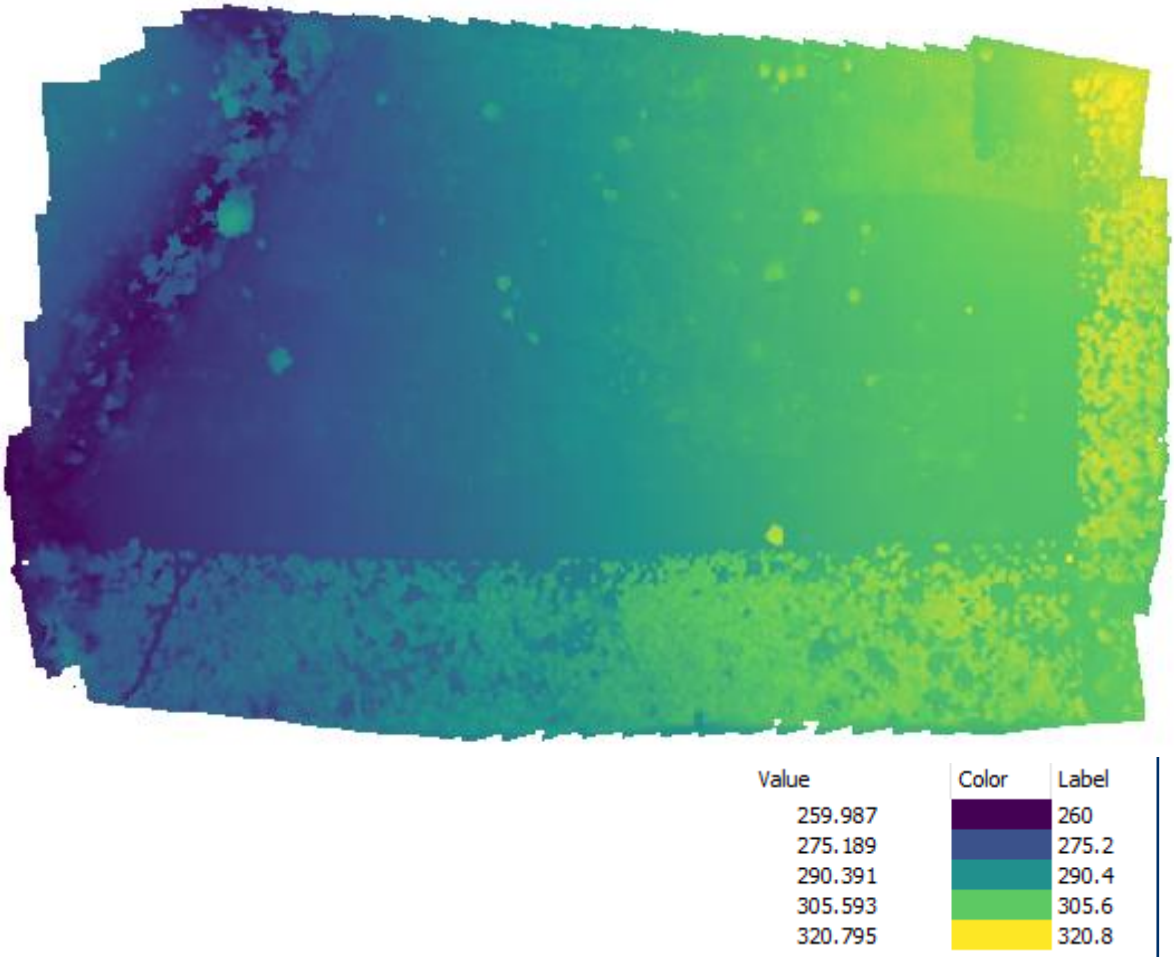
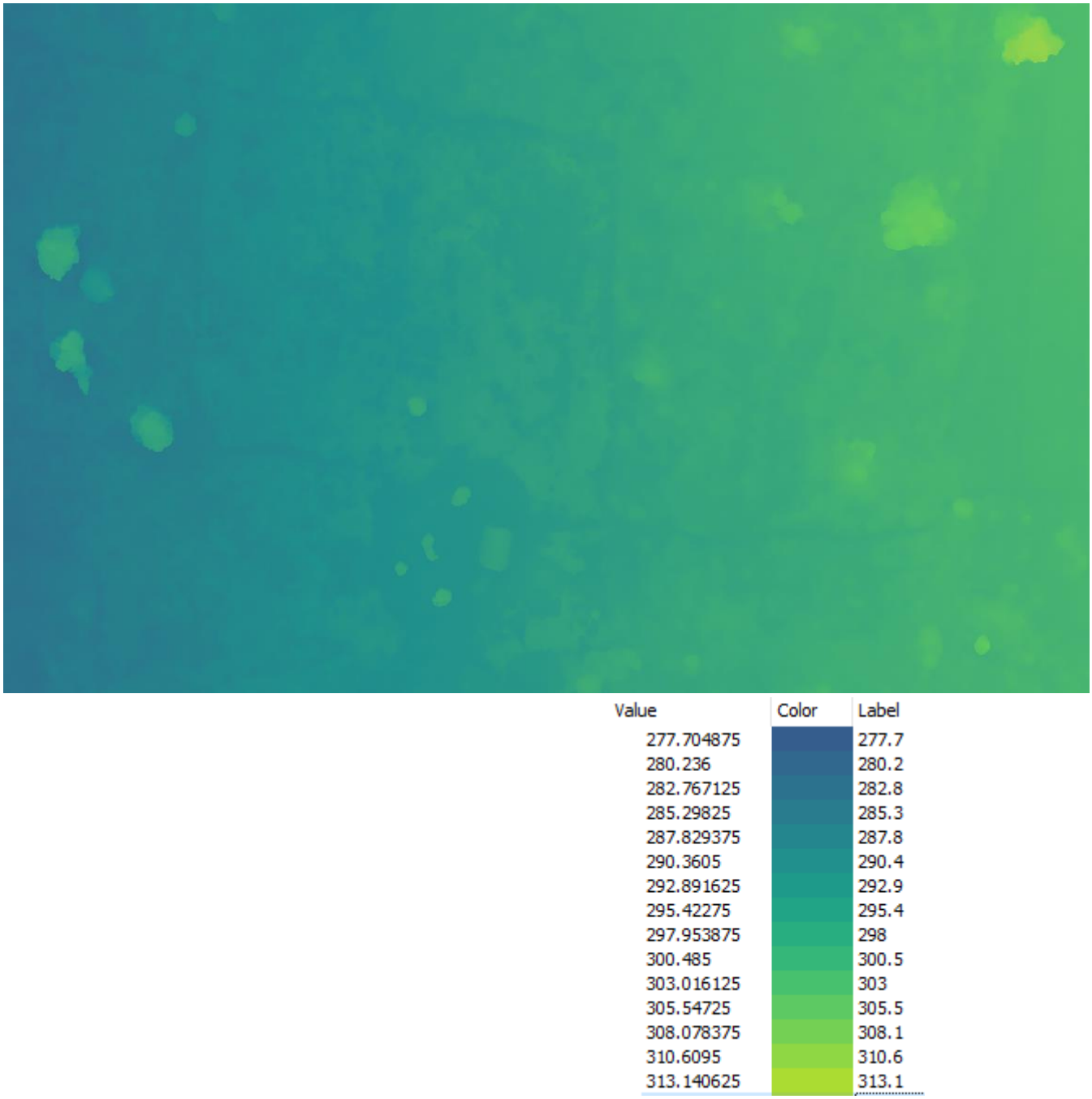


Figure 15. Crop fields.DEM false color, flight area 01



Value	Color	Label
277.704875		277.7
280.236		280.2
282.767125		282.8
285.29825		285.3
287.829375		287.8
290.3605		290.4
292.891625		292.9
295.42275		295.4
297.953875		298
300.485		300.5
303.016125		303
305.54725		305.5
308.078375		308.1
310.6095		310.6
313.140625		313.1

Figure 16. Crop field.DEM false color, flight area 01 (zoomed in)

Appendix 1: FS derived products

The previous chapter demonstrates a number of derived products from FS imagery, all having very high resolution due to observation of the land surface from a relatively low altitude. Each processed mosaic, map or model has its own features and potential applications. Different parameters can be determined, such as NDVI, volume, vegetation conditions, soil conditions and land cover type. Within the context of the Acumadan pilot, relevant applications include especially:

- inspection of forestry through NDVI and RGB
- overview images
- land inspection
- terrain surface modelling (DEM)

Table 1 shows an overview of FS-derived products, their resolution and example applications.

Table 1. Derived products of FS images and their relevant applications

Description	***Example applications***	***Resolution***
Ortho RGB	Overview image Visual inspection Deriving inputs for biophysical model	Max GSR: 2 cm Common GSR: 10 cm
Ortho NIR	Input for NDVI	Max GSR: 2 cm Common GSR: 10 cm
NDVI map	Vegetation stress diagnosis Assessment land degradation (LD) maintenance Assessment bare soil Input for biophysical model	Max GSR: 2 cm Common GSR: 10 cm
Land cover map	Vegetation classification Forestry Land use / land cover change assessment Input for biophysical model	Max GSR: 2 cm Common GSR: 10 cm
DEM	Damage inspection LD volume assessment Evaluating SLM practices / terracing Input for biophysical model	Max x-y res. 5 cm; z res. 5-10 cm Common x-y res. 10 cm; z res. 10-20 cm
3D model	Visualization / dissemination Inspection tool for decision makers	Max x-y res. 5 cm; z res. 5-10 cm Common x-y res. 10 cm; z res. 10-20 cm
KMZ /KML	Localization in Google Earth Visualization / dissemination	Max x-y res. 5 cm; z res. 5-10 cm Common x-y res. 10 cm; z res. 10-20 cm

Appendix 2: Operational planning

Day 1, Monday 19 November

- 1.00-5.00h pm. Field orientation. Trip around the relevant part of the plantation

Day 2, Tuesday 20 November

- 8.00-12.00h am. Positioning markers (GCPs=Ground Control Points), in the area near the watch tower> purpose: DEM.
- 1.00-4.00h pm. Four flights in the area near the watch tower> purpose: DEM.
- 4.00-5.00h pm. One flight Block 1>test

Day 3, Wednesday 21 November

- 8.00-12.00 am. Three flights Block 1>purpose: overview and NDVI
- 1.00-3.30 am. Gathering markers

Appendix 3: Flight logs

Tuesday 20 November

F01

Mavic: FW_Farmerline
Area: farmland near tower, diverse crops
Coord: 7.379017, -1.869687
Purpose: DEM
Cams: NIR+RGB
Height: 100m (slope inclination towards river: 40m)
Mission surface: 250x500m

F02

Mavic: FW_Farmerline
Area: farmland near tower, diverse crops
Coord: 7.379017, -1.869687
Purpose: DEM
Cams: NIR+RGB
Height: 100m (slope inclination towards river: 40m)
Mission surface: 250x500m

F03

Mavic: FW_Farmerline
Area: farmland near tower, diverse crops
Coord: 7.381216, -1.869722
Purpose: DEM
Cams: NIR+RGB
Height: 100m (slope inclination towards river: 40m)
Mission surface: 250x500m

F04

Mavic: FW_Farmerline
Area: farmland near tower, diverse crops
Coord: 7.384364, -1.869508
Purpose: DEM
Cams: NIR+RGB
Height: 100m (slope inclination towards river: 40m)
Mission surface: 400x400m

Wednesday 21 November

F01

Mavic: FW_Farmerline
Area: Block 1A teak, North
Coord: 7.405267, -1.869819
Purpose: NDVI and RGB overview
Cams: NIR+RGB
Height: 200m
Mission surface: 300x790m

F02

Mavic: FW_Farmerline
Area: Block 1A teak, Middle
Coord: 7.405267, -1.869819
Purpose: NDVI and RGB overview
Cams: NIR+RGB
Height: 200m
Mission surface: 300x790m

F03

Mavic: FW_Farmerline
Area: Block 1A teak, South
Coord: 7.405267, -1.869819
Purpose: NDVI and RGB overview
Cams: NIR+RGB
Height: 200m
Mission surface: 300x790m