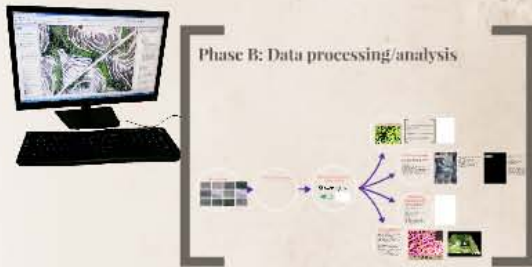
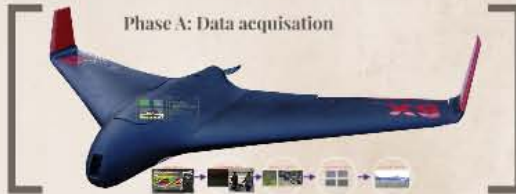
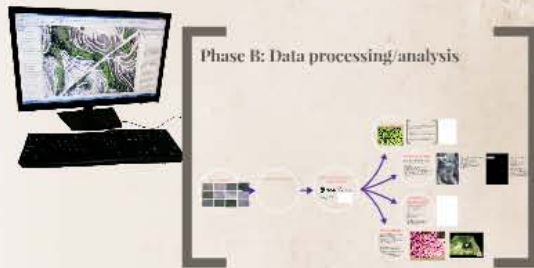


From Precision Plantation Preparation to Management via Drone-Enabled GIS Mapping and Remote Sensing



From Precision Plantation Preparation to Management via Drone-Enabled GIS Mapping and Remote Sensing



Introduction

What is UAV?

-UAV has become popular and widely used in various industries
-"Unmanned Aerial Vehicle"; an aircraft with no human pilot on board. Sometimes called UAS (Unmanned Aircraft System) or drones



Why UAV?

Autonomous Technology



Typically done by the use of GPS/GNSS receiver, and sensors for the local position (barometric and/or inertial).

Disadvantages:
- Limited, increasingly higher cost

Carrier Technology



The use of high resolution imagery from satellite remote sensing and processed computer graphics for the carrier platform.

Disadvantages:
- Difficulty in getting data of other sites

Advanced Technology



For precise, informed & sustainable management of crop production. UAV for PRECISION AGRICULTURE

What is UAV?

-UAV has become popular and widely used in various industries

-“Unmanned Aerial Vehicle”; an aircraft with no human pilot on board. Sometimes called UAS (Unmanned Aircraft System) or drones



Why UAV?

Antiquated Technology:



-Traditionally done by the use of theodolite-assisted, land survey for the land preparation (terrace, roads and row constructions)

Disadvantages:

-Laborious, low productivity, higher cost

Current Technology:



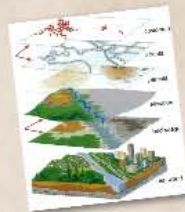
-The use of high resolution imagery from satellite remote-sensing and generated computer graphics for the same purpose.

Disadvantages:

-difficulty in getting days of clear skies

Advanced Technology:

-For precise, informed & sustainable management of oil palm plantations:
UAV for PRECISION AGRICULTURE



Benefits of a UAV system for professional land survey or aerial imagery

- no work carried out for quicker
- can be deployed anytime when needed
- does not obstruct by cloud (since it flies under the cloud)
- reduced exposure to risk for surveyors
- no need for hazardous areas can be surveyed remotely
- high-resolution aerial imagery
- more cost effective (scalable)



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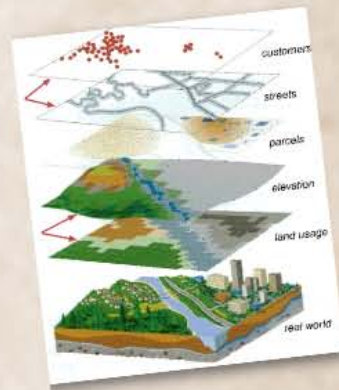
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Advanced Technology:

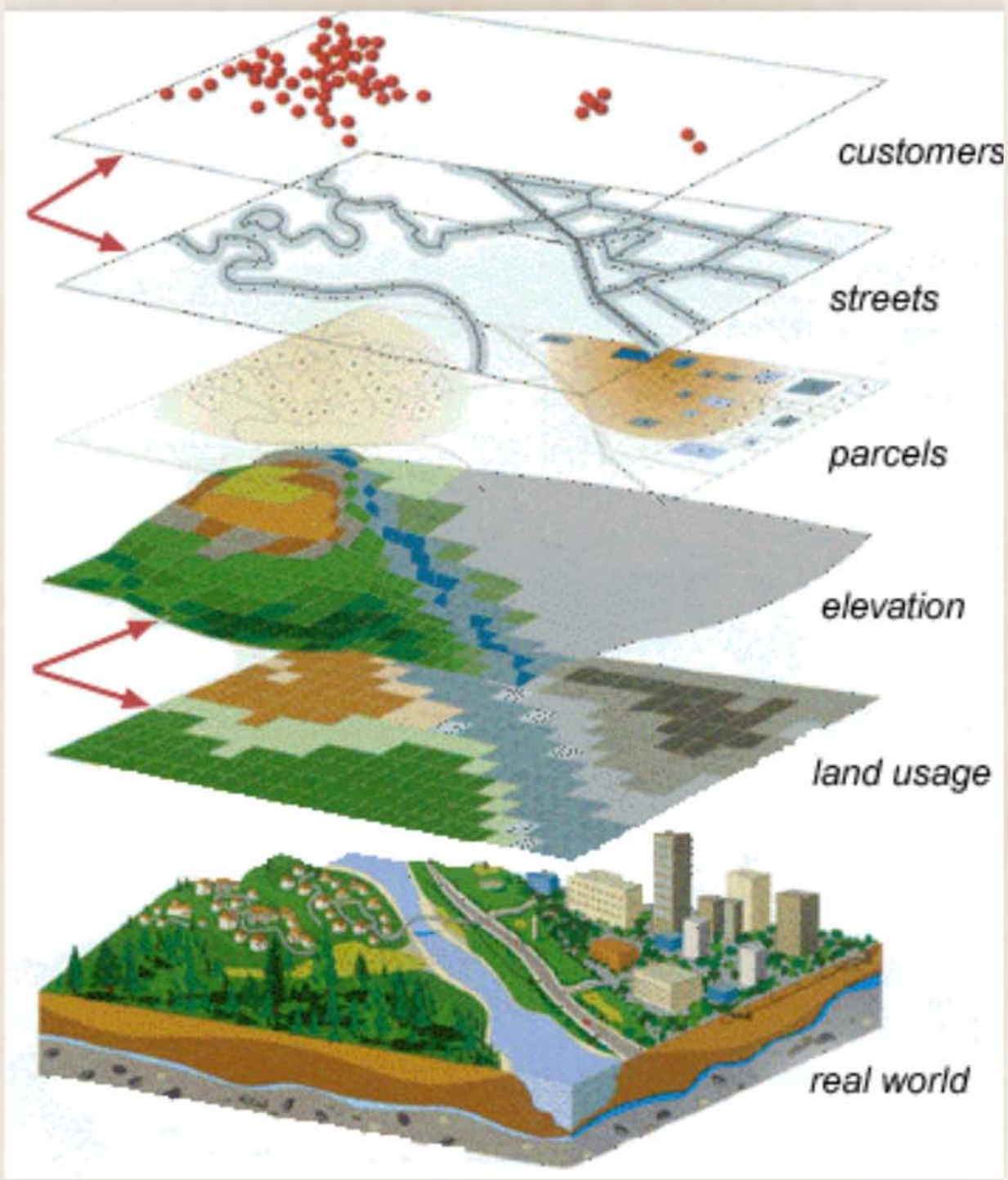
-For precise, informed & sustainable management of oil palm plantations:
UAV for PRECISION AGRICULTURE



Benefits of a UAV survey (vs traditional land survey vs satellite imagery)

- site work carried out far quicker
- can be deployed anytime when needed
- does not affected by cloud (since it flies under the cloud)
- reduced exposure to risk for surveyors
- inaccessible/hazardous areas can be surveyed remotely
- high-resolution aerial imagery
- more cost effective (scalable)



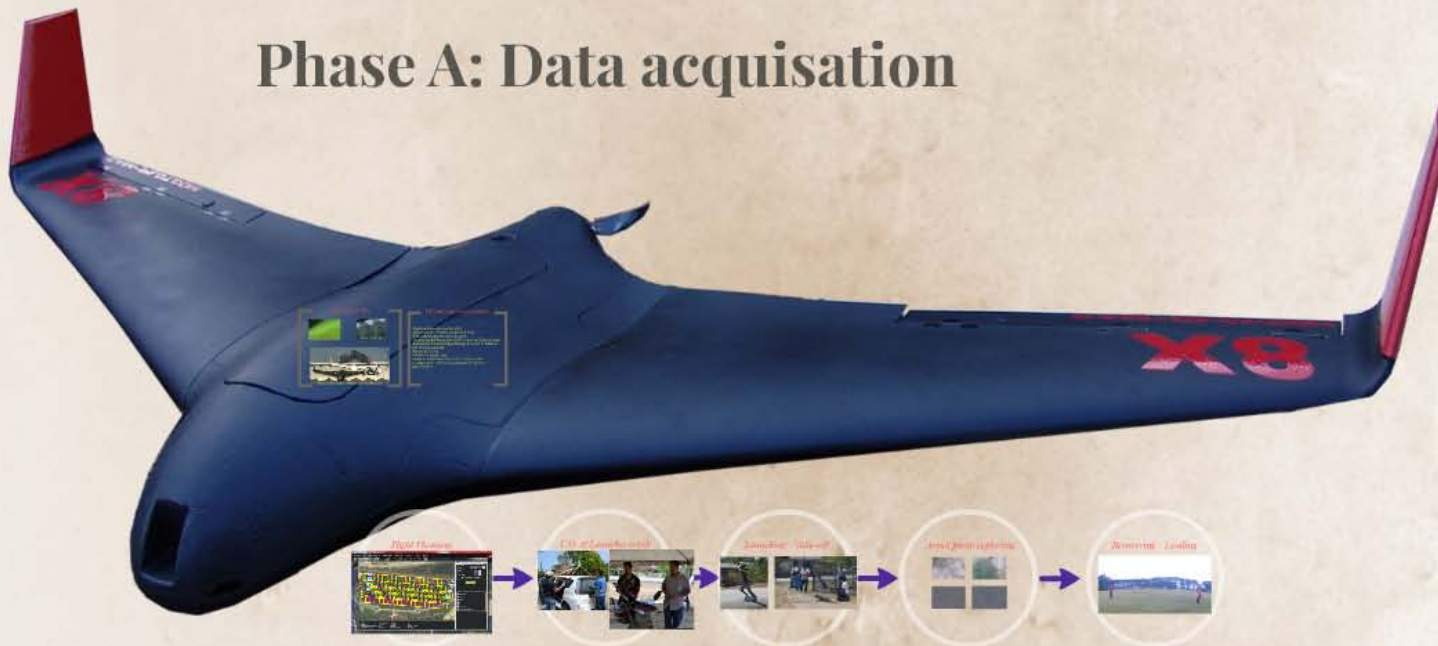


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Phase A: Data acquisition

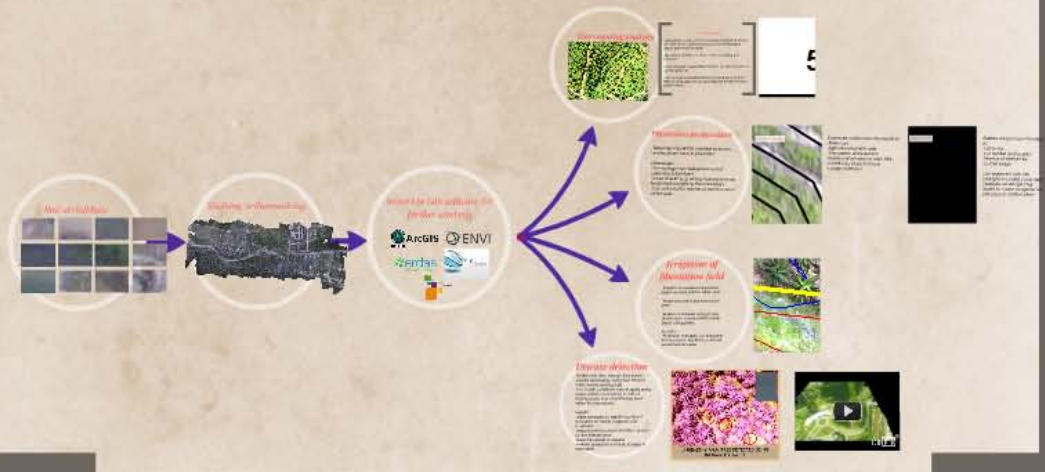


Phase B: Data processing/analysis

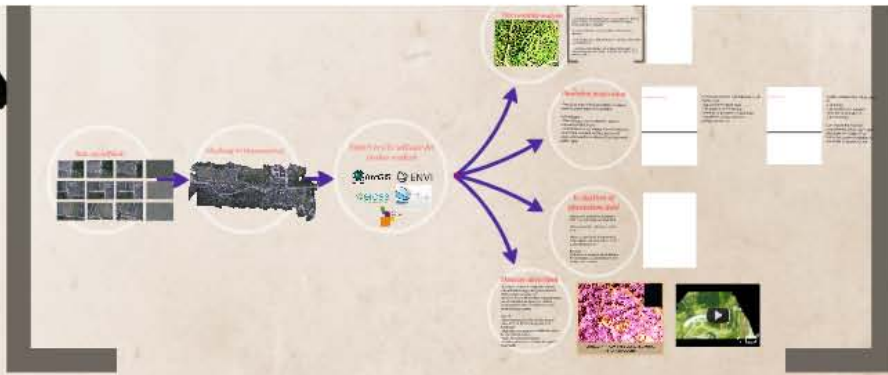




Phase B: Data processing/analysis



Phase C: On-Site Implementation



Phase C: On-Site Implementation



BR

Phase A: Data acquisition



Phase B: Data processing/analysis

Our set of UAVs



Quadcopter SK450 with GoPro/
SJCam camera



Octocopter DJI S1000+ with
Canon 5D Mark II DSLR camera



Marcus UAV, Skywalker X8 (black & white body) & Zagi



Quadcopter SK450 with GoPro/
SJCam camera



Octocopter DJI S1000+ with
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SJCam camera

Octocopter DJI S1000+ with
Canon 5D Mark II DSLR camera



Marcus UAV, Skywalker X8 (black & white body) & Zagi

UAV specs (for aerial mapping)

- 200ha to 500ha per day per UAV
- Cruise speed: 47 km/h (20 mph or 13m/s)
- Typical flying altitude: 100m to 300m
- Ground Spatial Resolution (GSD): 3.2cm (at 100m altitude)
- Endurance: 0.5 hour (single battery) to 3 hour (4 batteries with minimal payload)
- Wingspan: 2.12m
- All take off weight: 5kg
- Camera: SONY NEX-5N or ILCE 5100 or A7R II (16Megapixel, 16mm lense) *swapable for multi or hyperspectral*



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Flight Planning



UAV & Launcher setup



Launching / Take-off



Aerial photo capturing



Flight Planning

Mission Planner 1.2.86 build 1.1.5058.12387

FLIGHT DATA | FLIGHT PLAN | INITIAL SETUP | CONFIG/TUNING | SIMULATION | TERMINAL | HELP | DONATE

GridUI

Persiaran Selatan

Distance: 2000 m
Prev: 2000 m
Home: 2000 m

80
40
39
1
60
59
20
19

Simple | Grid Options | Camera Config | Trig

Simple Options

Camera: Nex5 16mm

Altitude: 100

Angle [deg]: 274

Camera top facing forward

Accept

Display

Boundary

Markers

Grid

Internals

Footprints

Advanced Options

©2015 Google - Map data ©2015 Tele Atlas Imagery ©2015 TerraMetrics

Stats

Area:	143686 m ²	Pictures:	72
Distance:	3.23 km	No of Strips:	4
Distance between images:	44 m	Footprint:	146.3 x 97.5 m
Ground Resolution:	3.19 cm	Dist between lines:	48.75 m

UAV & Launcher setup



Launching / Take-off



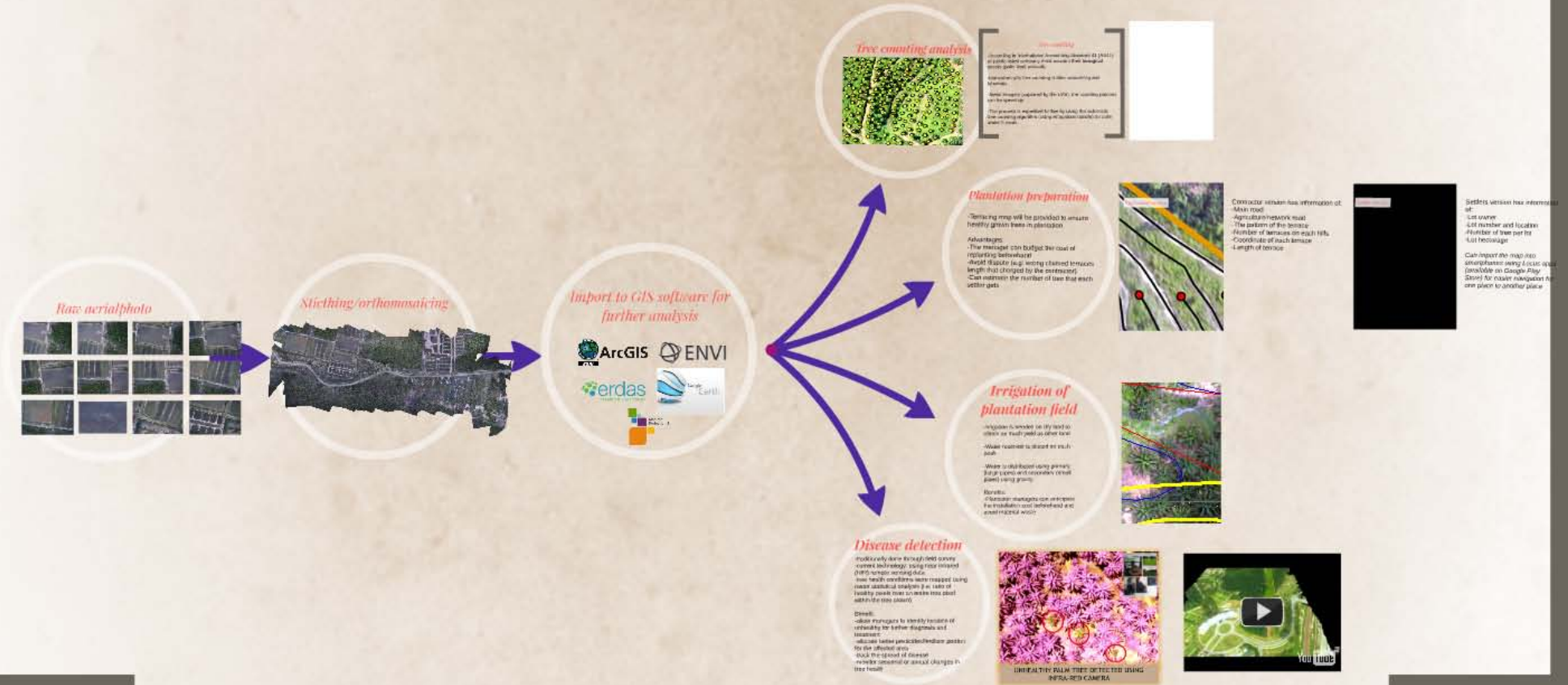
Aerial photo capturing



Recovering / Landing



Phase B: Data processing/analysis



Raz@ aerialphoto



Sticthing/orthomosaicing



*Import to GIS software for
further analysis*



ArcGIS®



ENVI



Stitching/orthomosaicing



Import to GIS software for further analysis



Tree counting analysis



Tree counting

-According to International Accounting Standard 41 (IAS41) all public listed company must account their biological assets (such as) annually.
 -Manual on-site tree counting is time consuming and laborious.
 -Aerial imagery (captured by the UAV), the counting process can be speed up.
 -The process is expedited further by using the automatic tree counting algorithm (using eCognition bundle) for palm under 5 years.

Plantation preparation

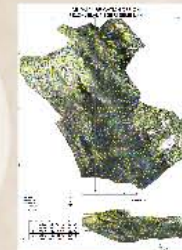
-Terracing map will be provided to ensure healthy grown trees in plantation
 Advantages:
 -The manager can budget the cost of replanting beforehand
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 -Can estimate the number of tree that each settler gets



Contractor version has information of:
 -Main road
 -Agriculture/network road
 -The pattern of the terrace
 -Number of terraces on each hills
 -Coordinate of each terrace
 -Length of terrace

Irrigation of plantation field

-Irrigation is needed on dry land to obtain as much yield as other land
 -Water reservoir is placed on each peak
 -Water is distributed using primary (large pipes) and secondary (small pipes) using gravity
 Benefits:
 -Plantation managers can anticipate the irrigation cost beforehand and avoid material waste.



Disease detection

-traditionally done through field survey
 -current technology: using near infrared (NIR) remote sensing data
 -tree health conditions were mapped using raster statistical analysis (i.e. ratio of healthy pixels over an entire tree pixel within the tree crown)
 Benefits:
 -allow managers to identify location of unhealthy for further diagnosis and treatment
 -allocate better pesticides/fertilizer portion for the affected areas
 -track the spread of disease
 -monitor seasonal or annual changes in tree health



UNHEALTHY PALM TREE DETECTED USING INFRA-RED CAMERA



Tree counting analysis



-According to Int
all public listed c
assets (palm tree

-Manual on-site t
laborious

-Aerial imagery (c
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-The process is v
tree counting alg
under 5 years

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41 (AS41)
ological

and

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automatic
) for palm

OIL PALM PLANTATION INVENTORY FELDA KERTEH, TERENGGANU



Index Map

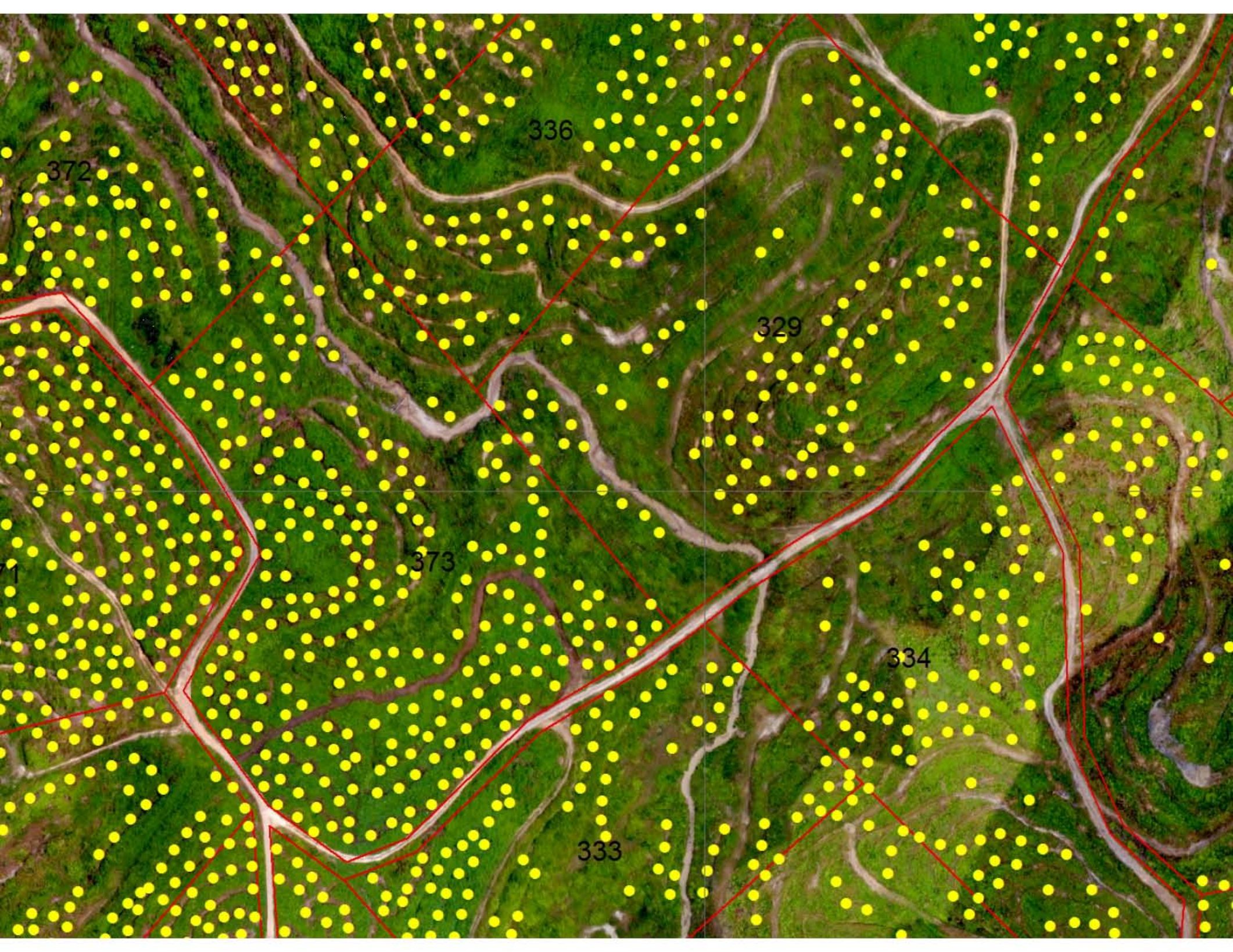


- Legend
- Oil Palm
- Forest
- Plantation Road
- Terrace
- Cadastral Map

Tree Counting

Block	Area (ha)	Oil Palm	Forest	Plantation Road	Terrace	Cadastral Map
01	100	100	0	0	0	0
02	100	100	0	0	0	0
03	100	100	0	0	0	0
04	100	100	0	0	0	0
05	100	100	0	0	0	0
06	100	100	0	0	0	0
07	100	100	0	0	0	0
08	100	100	0	0	0	0
09	100	100	0	0	0	0
10	100	100	0	0	0	0
11	100	100	0	0	0	0
12	100	100	0	0	0	0
13	100	100	0	0	0	0
14	100	100	0	0	0	0
15	100	100	0	0	0	0
16	100	100	0	0	0	0
17	100	100	0	0	0	0
18	100	100	0	0	0	0
19	100	100	0	0	0	0
20	100	100	0	0	0	0
21	100	100	0	0	0	0
22	100	100	0	0	0	0
23	100	100	0	0	0	0
24	100	100	0	0	0	0
25	100	100	0	0	0	0
26	100	100	0	0	0	0
27	100	100	0	0	0	0
28	100	100	0	0	0	0
29	100	100	0	0	0	0
30	100	100	0	0	0	0
31	100	100	0	0	0	0
32	100	100	0	0	0	0
33	100	100	0	0	0	0
34	100	100	0	0	0	0
35	100	100	0	0	0	0
36	100	100	0	0	0	0
37	100	100	0	0	0	0
38	100	100	0	0	0	0
39	100	100	0	0	0	0
40	100	100	0	0	0	0
41	100	100	0	0	0	0
42	100	100	0	0	0	0
43	100	100	0	0	0	0
44	100	100	0	0	0	0
45	100	100	0	0	0	0
46	100	100	0	0	0	0
47	100	100	0	0	0	0
48	100	100	0	0	0	0
49	100	100	0	0	0	0
50	100	100	0	0	0	0
51	100	100	0	0	0	0
52	100	100	0	0	0	0
53	100	100	0	0	0	0
54	100	100	0	0	0	0
55	100	100	0	0	0	0
56	100	100	0	0	0	0
57	100	100	0	0	0	0
58	100	100	0	0	0	0
59	100	100	0	0	0	0
60	100	100	0	0	0	0
61	100	100	0	0	0	0
62	100	100	0	0	0	0
63	100	100	0	0	0	0
64	100	100	0	0	0	0
65	100	100	0	0	0	0
66	100	100	0	0	0	0
67	100	100	0	0	0	0
68	100	100	0	0	0	0
69	100	100	0	0	0	0
70	100	100	0	0	0	0
71	100	100	0	0	0	0
72	100	100	0	0	0	0
73	100	100	0	0	0	0
74	100	100	0	0	0	0
75	100	100	0	0	0	0
76	100	100	0	0	0	0
77	100	100	0	0	0	0
78	100	100	0	0	0	0
79	100	100	0	0	0	0
80	100	100	0	0	0	0
81	100	100	0	0	0	0
82	100	100	0	0	0	0
83	100	100	0	0	0	0
84	100	100	0	0	0	0
85	100	100	0	0	0	0
86	100	100	0	0	0	0
87	100	100	0	0	0	0
88	100	100	0	0	0	0
89	100	100	0	0	0	0
90	100	100	0	0	0	0
91	100	100	0	0	0	0
92	100	100	0	0	0	0
93	100	100	0	0	0	0
94	100	100	0	0	0	0
95	100	100	0	0	0	0
96	100	100	0	0	0	0
97	100	100	0	0	0	0
98	100	100	0	0	0	0
99	100	100	0	0	0	0
100	100	100	0	0	0	0





372

336

329

373

334

333

71

592000

592500

Tree Counting

Legend



Oil Palm



Forest



Plantation Road



Terrace



Cadastral Map

NO LOT	NO OF TREES
278	636
279	115
280	114
282	29
283	77
290	15
295	15
304	137
305	0
306	33
307	9
308	22
309	9
310	152
311	76
312	34
313	16
314	28
315	42
316	19

NO LOT	NO OF TREES
317	62
318	51
319	26
320	22
329	112
330	26
331	91
332	186
333	83
334	90
335	53
336	89
337	87
338	4
339	96
340	55
341	101
342	42
343	25
344	76

NO LOT	NO OF TREES
345	15
346	3
347	50
348	13
349	10
350	104
351	171
352	31
353	84
354	64
356	36
357	49
358	51
359	24
360	89
361	27
362	112
363	26
364	82
365	66

NO LOT	NO OF TREES
366	95
367	89
368	88
369	55
370	131
371	281
372	98
373	239
374	178
375	97
376	103
377	106
378	96
379	55
380	78
381	145
382	230
383	157
384	191
385	154

NO LOT	NO OF TREES
386	0
387	159
388	169
389	247
390	137
391	147
392	113
393	14
394	37
395	82
396	181
397	71

Tree counting analysis



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Plantation preparation

-Terracing map will be provided to ensure healthy grown trees in plantation

Advantages:

- The manager can budget the cost of replanting beforehand
- Avoid dispute (e.g: wrong claimed terraces length that charged by the contractor)
- Can estimate the number of tree that each settler gets



- Main road
- Agriculture
- The pattern
- Number of
- Coordinate
- Length of

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RED

Contractor



tree counting algorithm (using segmentation) under 5 years

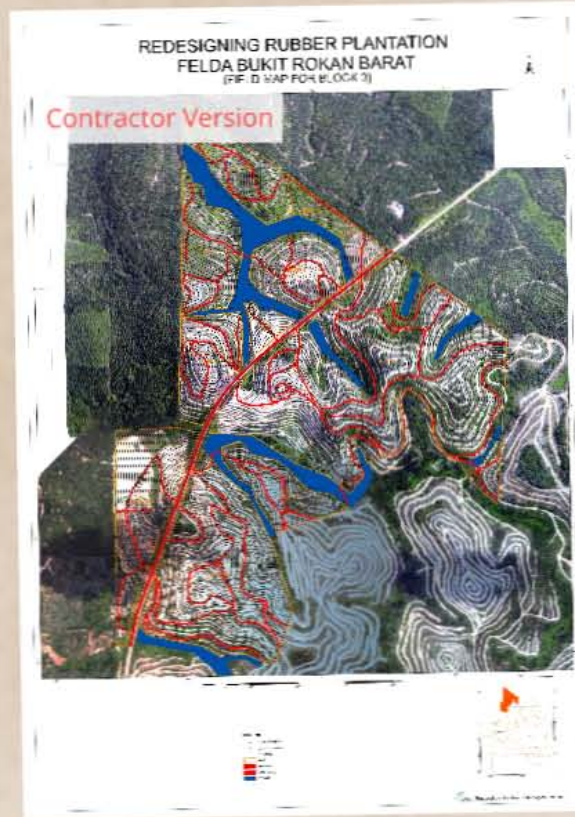


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Contractor version has information of:

- Main road
- Agriculture/network road
- The pattern of the terrace
- Number of terraces on each hills
- Coordinate of each terrace
- Length of terrace

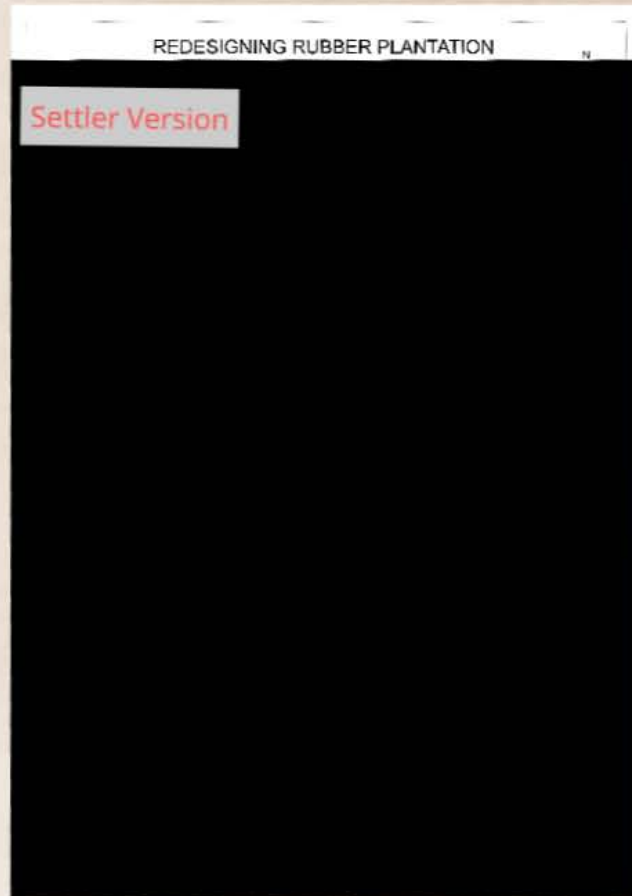
Irrigation of plantation field





on has information of:

work road
he terrace
ices on each hills
ach terrace
e



Settlers version has information of:

- Lot owner
- Lot number and location
- Number of tree per lot
- Lot hectarage

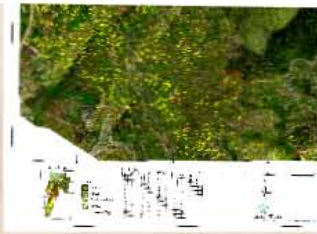
Can import the map into smartphones using Locus apps (available on Google Play Store) for easier navigation for one place to another place



laborious

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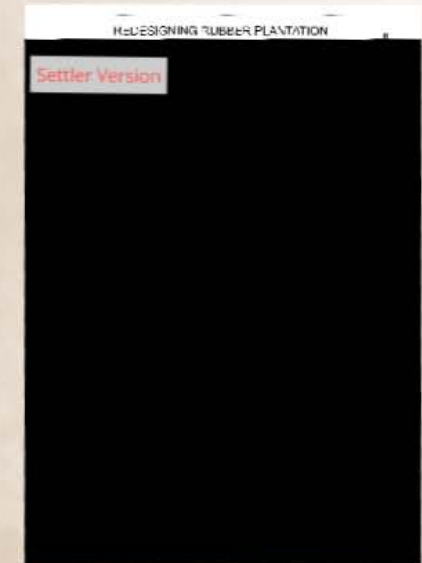
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- Coordinate of each terrace
- Length of terrace



Settlers v of:

- Lot owner
- Lot number
- Number of trees
- Lot hectare

Can improve smartpho (available Store) for one place

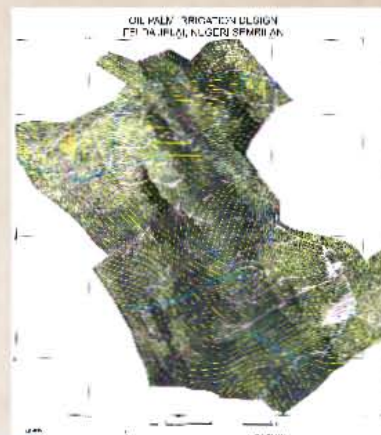
Irrigation of plantation field

-Irrigation is needed on dry land to obtain as much yield as other land

-Water reservoir is placed on each peak

-Water is distributed using primary (large pipes) and secondary (small pipes) using gravity

Benefit:



Irrigation of plantation field

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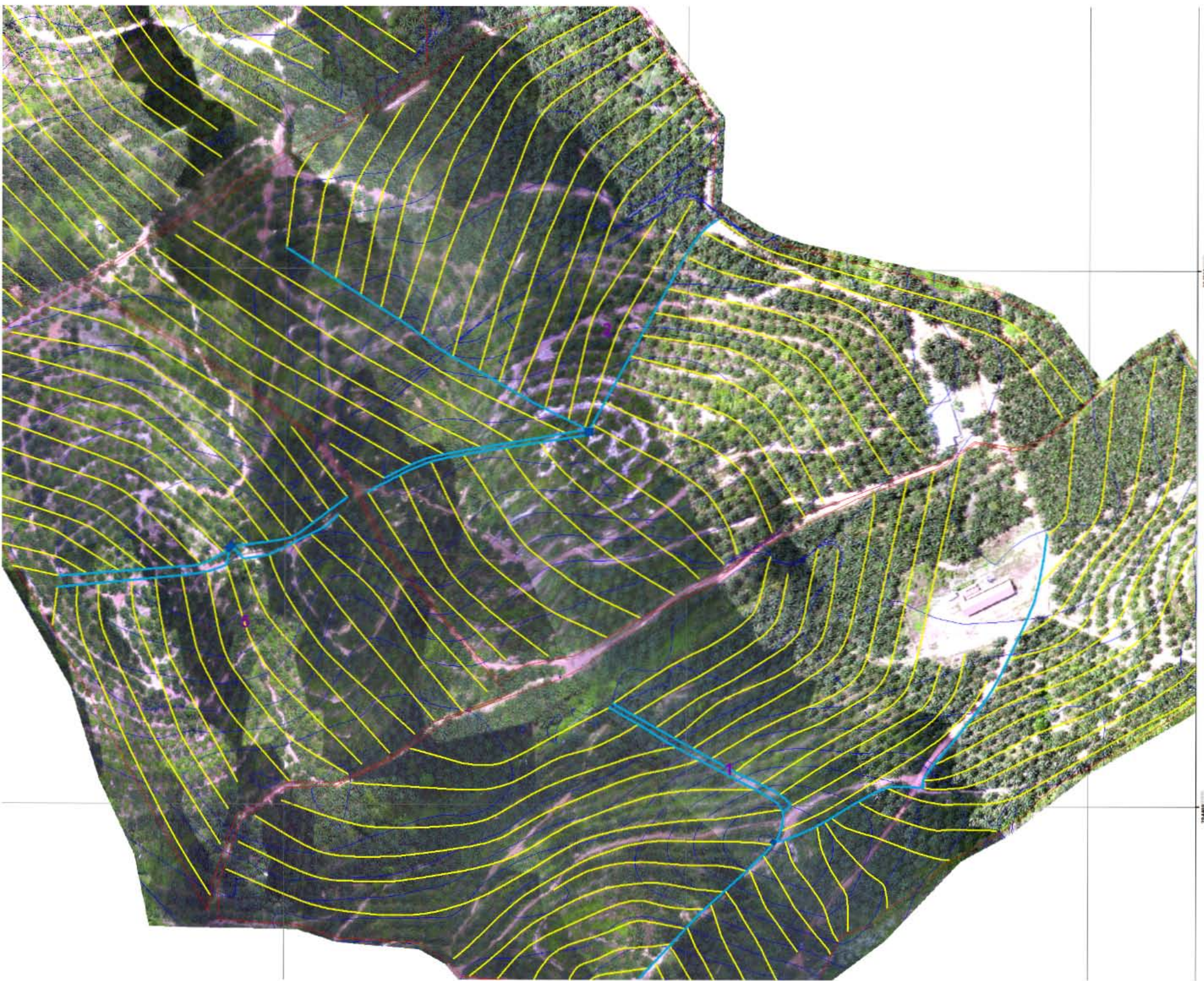
Benefits:

-Plantation managers can anticipate the installation cost beforehand and avoid material waste



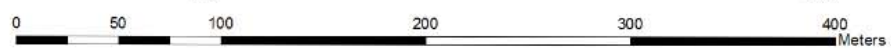
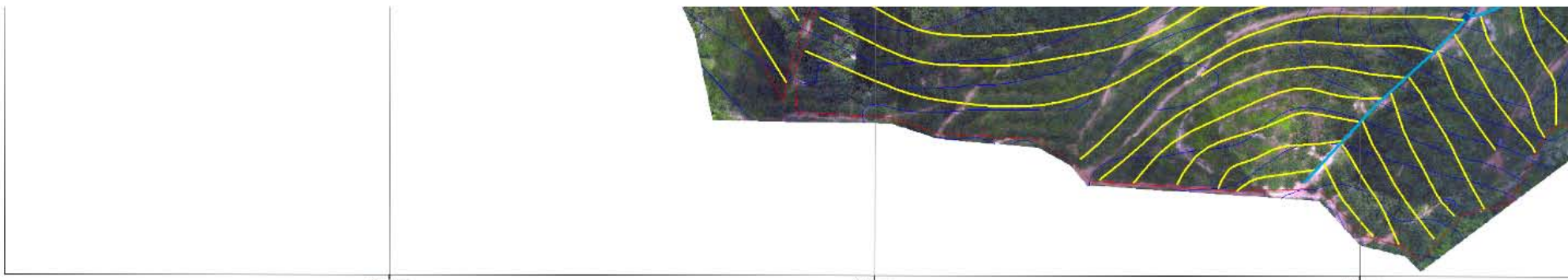
LEGEND
- MAIN LINE
- SECONDARY
- TOTAL PIPE
- AREA COVER

BLOCK	AREA COVER	TOTAL PIPE
1	18243.21	18.241
2	18243.21	18.241
3	18243.21	18.241
4	18243.21	18.241
5	18243.21	18.241
6	18243.21	18.241
7	18243.21	18.241
8	18243.21	18.241
TOTAL	145946.56	145.946



1:4000

1:4000

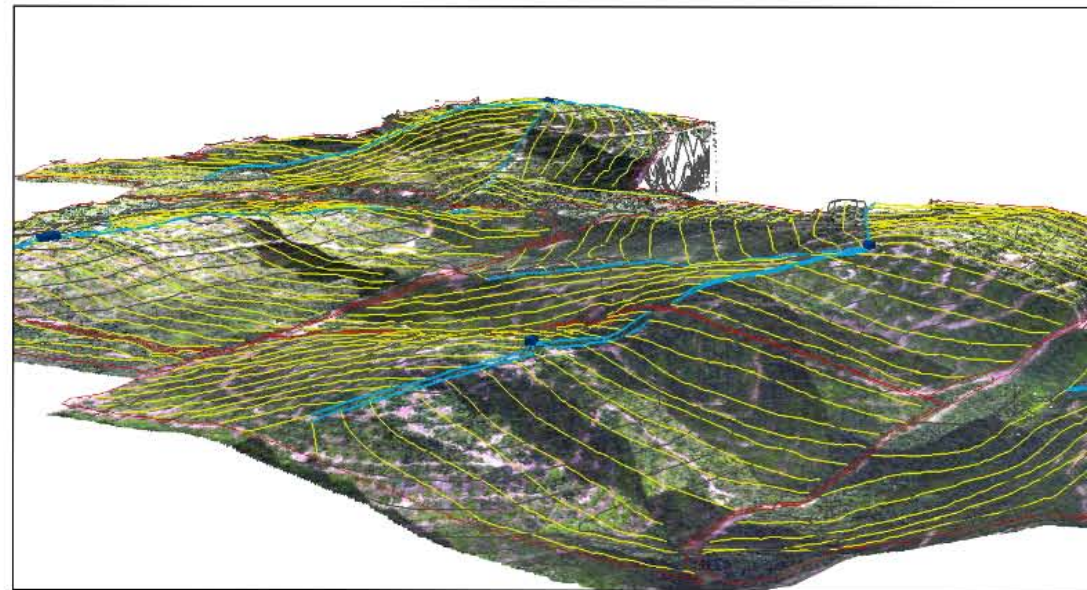


LEGEND

- WATER TANK
- MAIN PIPE
- SECOND PIPE
- CONTOUR
- BLOCK BOUNDARY



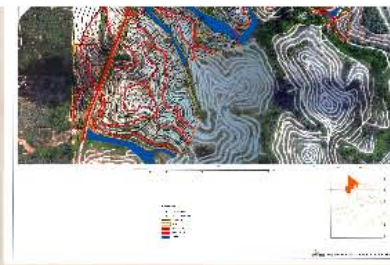
3D JELAI IRRIGATION



BLOCK	AREA COVER		TOTAL DISTANCE (m)	
	(m ²)	(ha)	MAIN PIPE	SECOND PIPE
1	182405.21	18.241	815.828	8579.083
2	183433.74	18.343	774.661	8013.105
3	152477.94	15.247	751.201	7916.701
4	125102.65	12.51	676.682	6752.092
5	93990.105	9.399	452.883	4734.868
6	48390.165	4.839	222.419	2923.312
TOTAL	785799.81	78.579	3693.674	38919.161



length that charged by the contractor)
 -Can estimate the number of tree that each settler gets



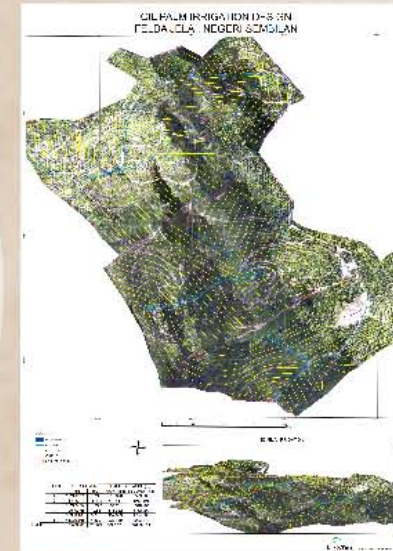
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 -track the spread of disease
 -monitor seasonal or annual changes in tree health



UNHEALTHY PALM TREE DETECTED USING

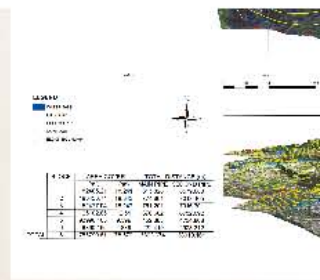




pipes) using gravity

Benefits:

-Plantation managers can anticipate the installation cost beforehand and avoid material waste



Disease detection

-traditionally done through field survey
-current technology: using near infrared (NIR) remote sensing data
-tree health conditions were mapped using raster statistical analysis (i.e: ratio of healthy pixels over an entire tree pixel within the tree crown)

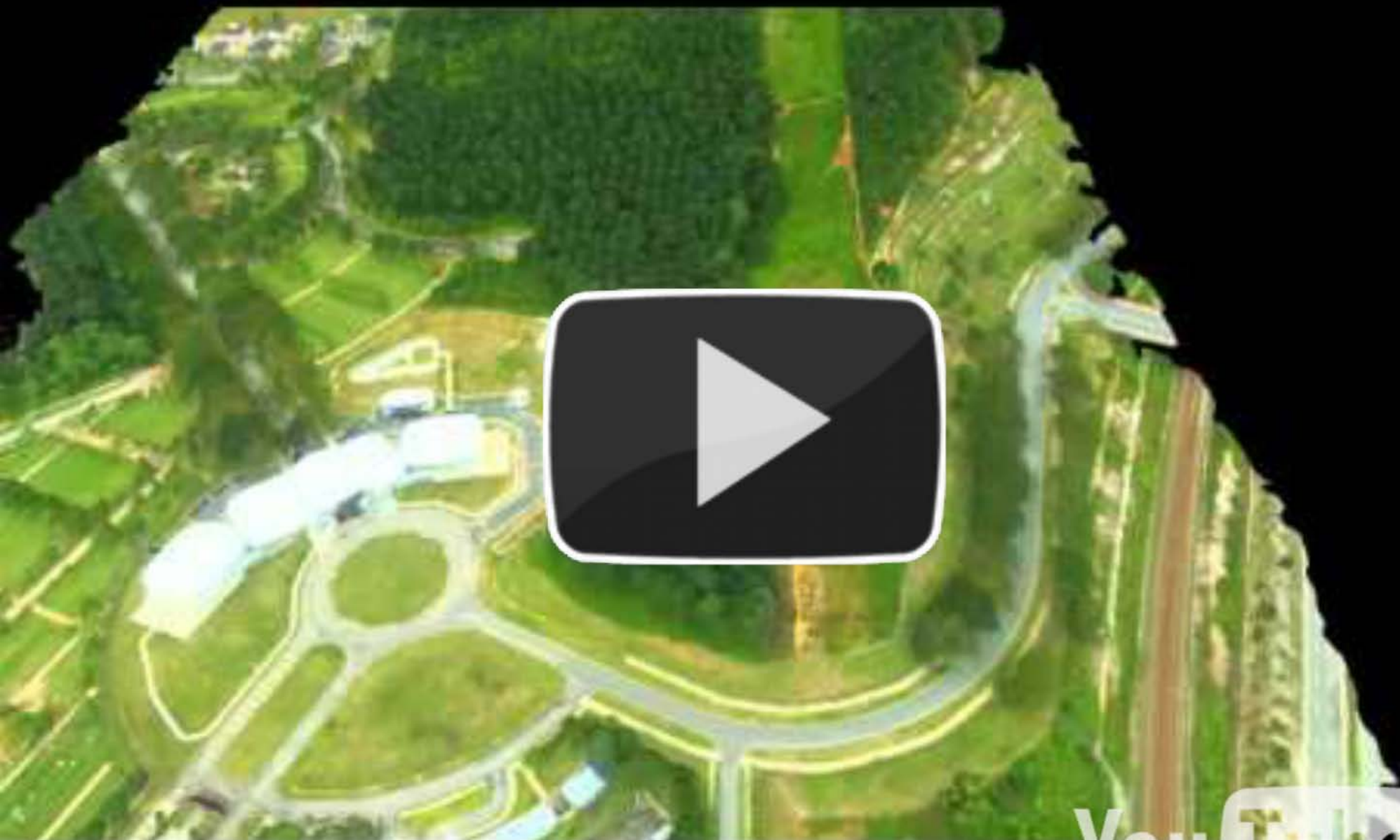
Benefit:

-allow managers to identify location of unhealthy for further diagnosis and treatment
-allocate better pesticides/fertilizer portion for the affected area
-track the spread of disease
-monitor seasonal or annual changes in tree health



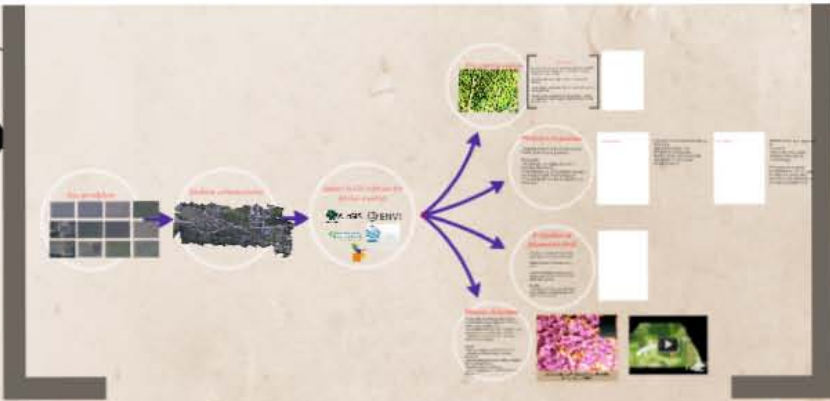
UAV OCTOCOPTER PROVIDE BY BRAINTREE AND RESONON HYPERSPECTRAL CAMERA BY SISB





You Tube





Phase C: On-Site Implementation

A video player interface showing a landscape of terraced fields. A large play button is centered over the video. The YouTube logo is visible in the bottom right corner of the video frame.

YouTube

A horizontal sequence of four small circular images, each with a red title above it, connected by blue arrows. The images show different stages of the on-site implementation process, from site preparation to the final terraced field.

Phase C: On-Site Implementation





YouTube

Load proposed map into tablet



Mount GNSS receiver & tablet on the vehicle



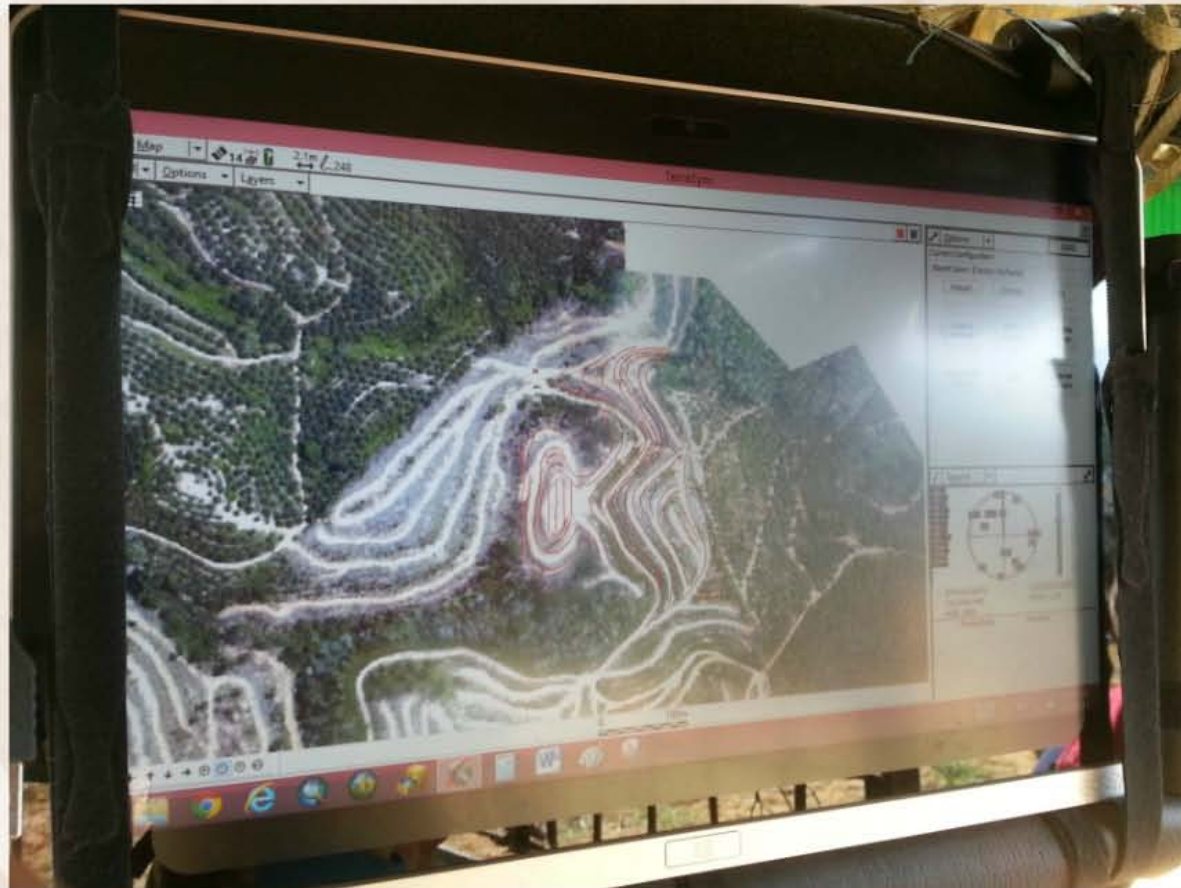
Vehicle operators begin on-site work



Completed terraces, roads & drainages



Load proposed map into tablet



Mount GNSS receiver & tablet on the vehicle



on the vehicle





Vehicle operators begin on-site work



Completed terraces, roads & drainages



Other services



Future services



Exoskeletons: Wearable hydraulic-enabled Robot Suite

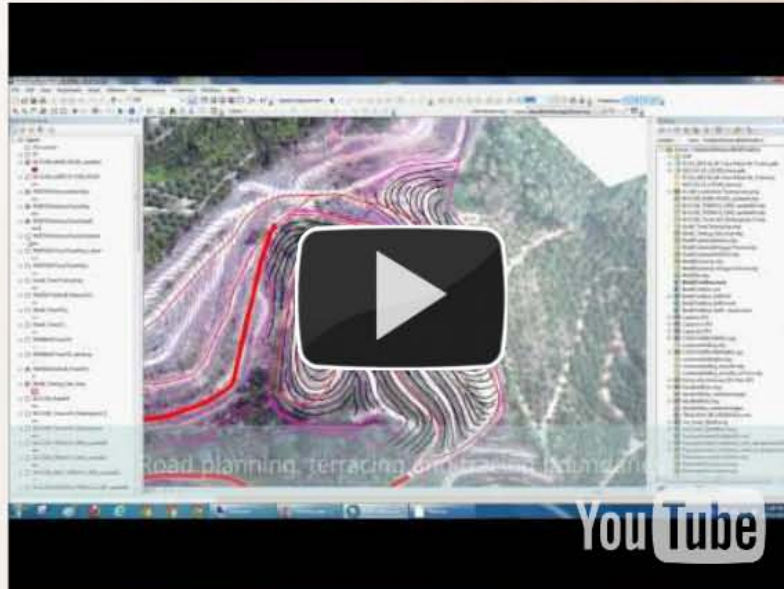


Aerial photoshoot & filming





Video Summary



THANK YOU!

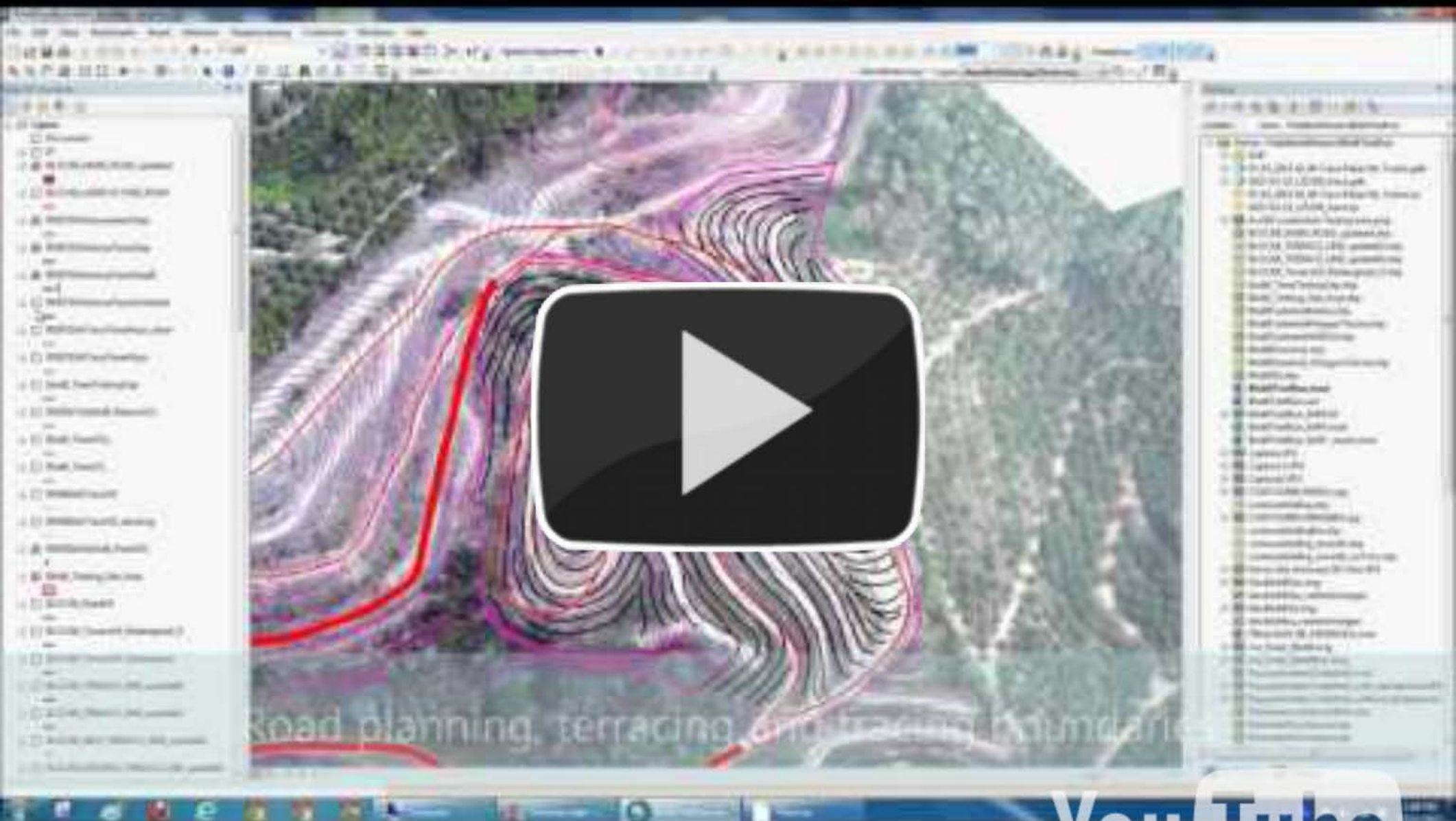
Presented by: Mustaqiim bin Mohd Abidin

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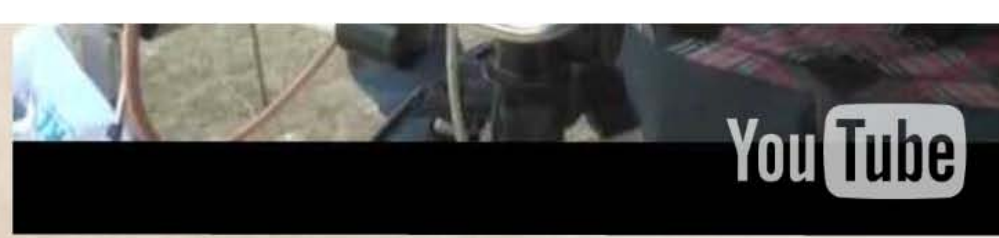
Road planning, terracing and tracing boundaries



Drone demo



You Tube



THANK YOU!

Presented by: Mustaqiim bin Mohd Abidin

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www.braintreetechnologies.com



From Precision Plantation Preparation to Management via Drone-Enabled GIS Mapping and Remote Sensing

