

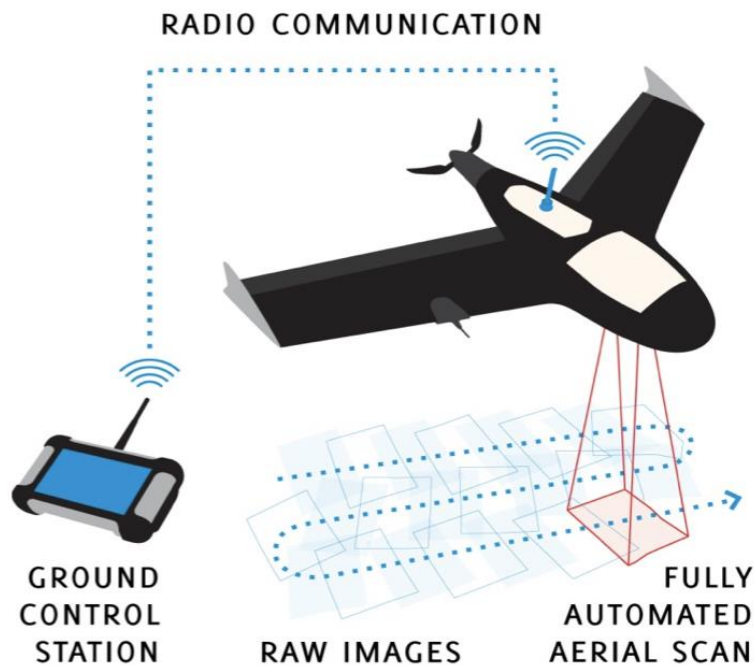
Ronald Bisio | Vice President, Geospatial

September 2017

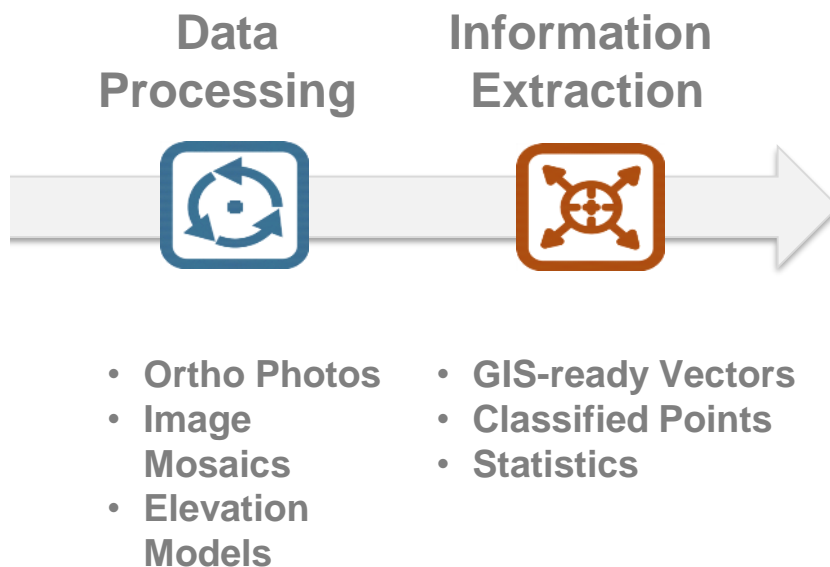
**Beyond surveying & mapping – employing UAS,
image processing & feature extraction to improve
agricultural production**

The goal is to help non-Geospatial professionals make better decisions based on timely and accurate spatial data ...

1 Image acquisition



2 Image processing

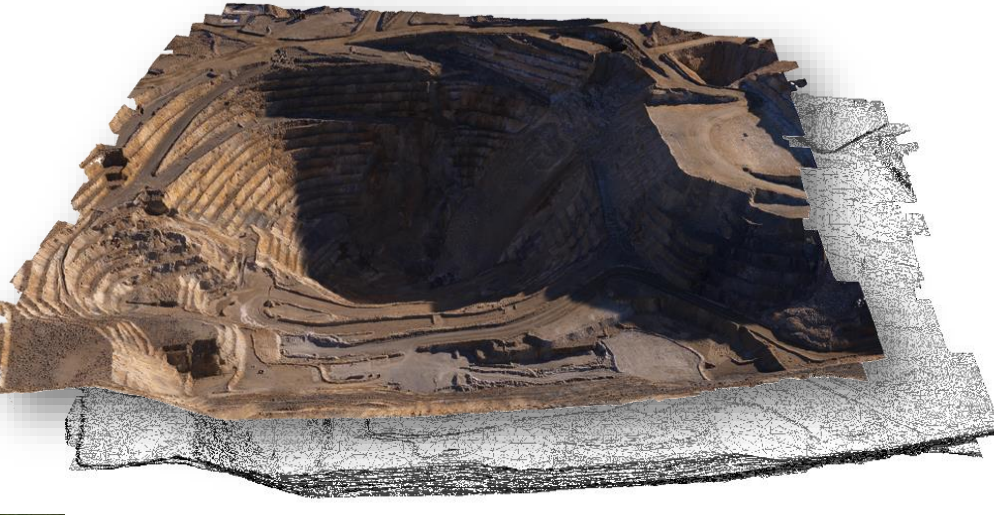


... and the components of the solution to capture and process the data are well known to this audience

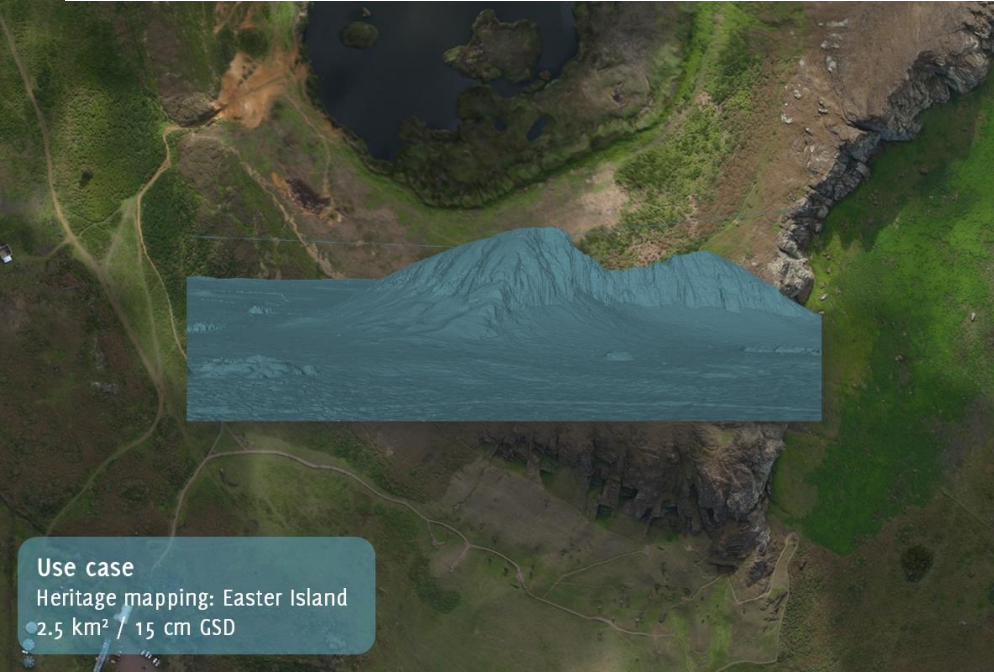
We've used airborne solutions in a variety of applications for decades ... most recently with unmanned aircraft systems (UAS)



There has been strong adoption of UAS in mining and mapping applications ... with significant interest out of the construction industry



Use case
Inventory management



Use case
Heritage mapping: Easter Island
2.5 km² / 15 cm GSD

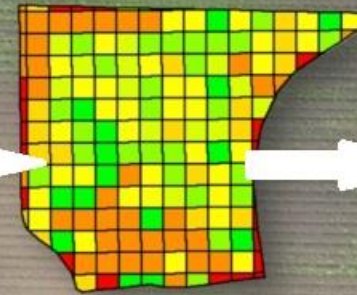


Use case
Road construction
0.8 km² / 5 cm GSD



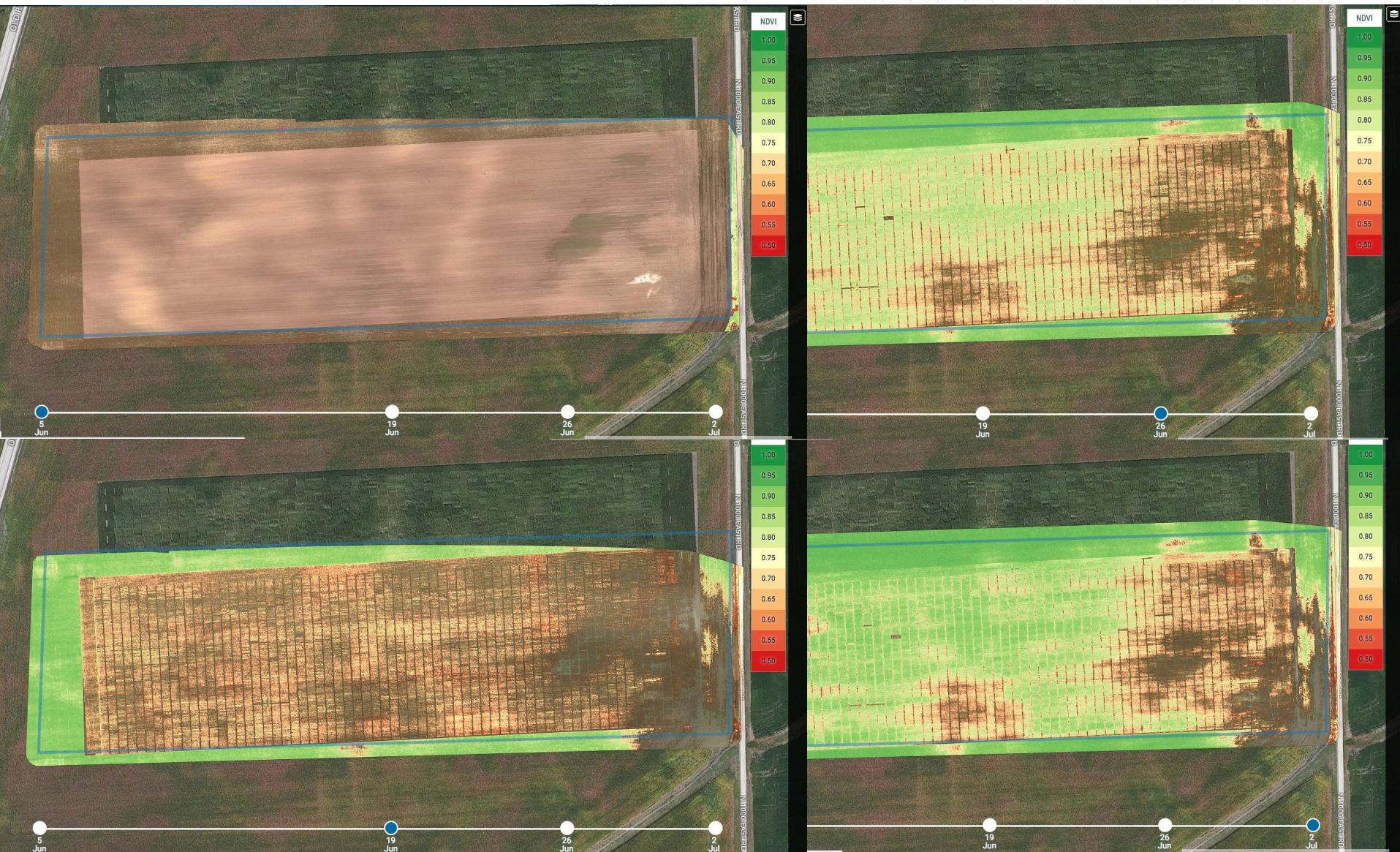
Using imagery to improve farming

UAS in agriculture – using our solutions and knowledge to help increase the productivity of food production

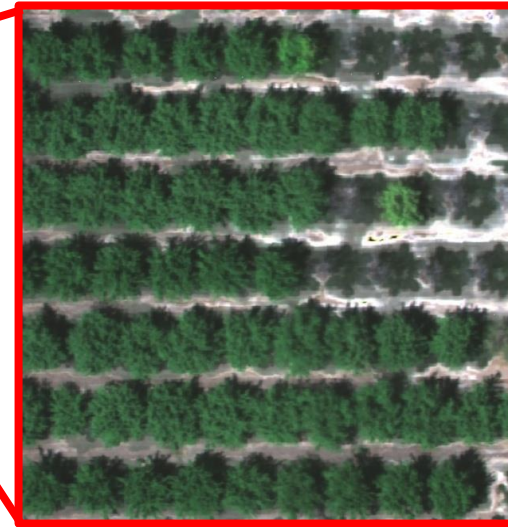
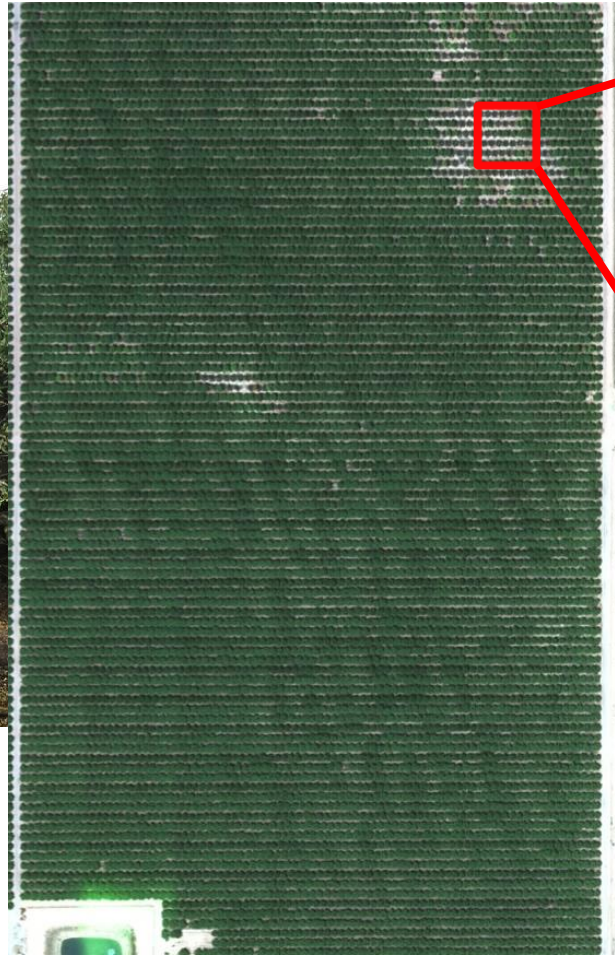


Use case
Precision farming
0.2 km² / 5 cm GSD

Decision making is improved by providing the farmer with timely, consistent and accurate data



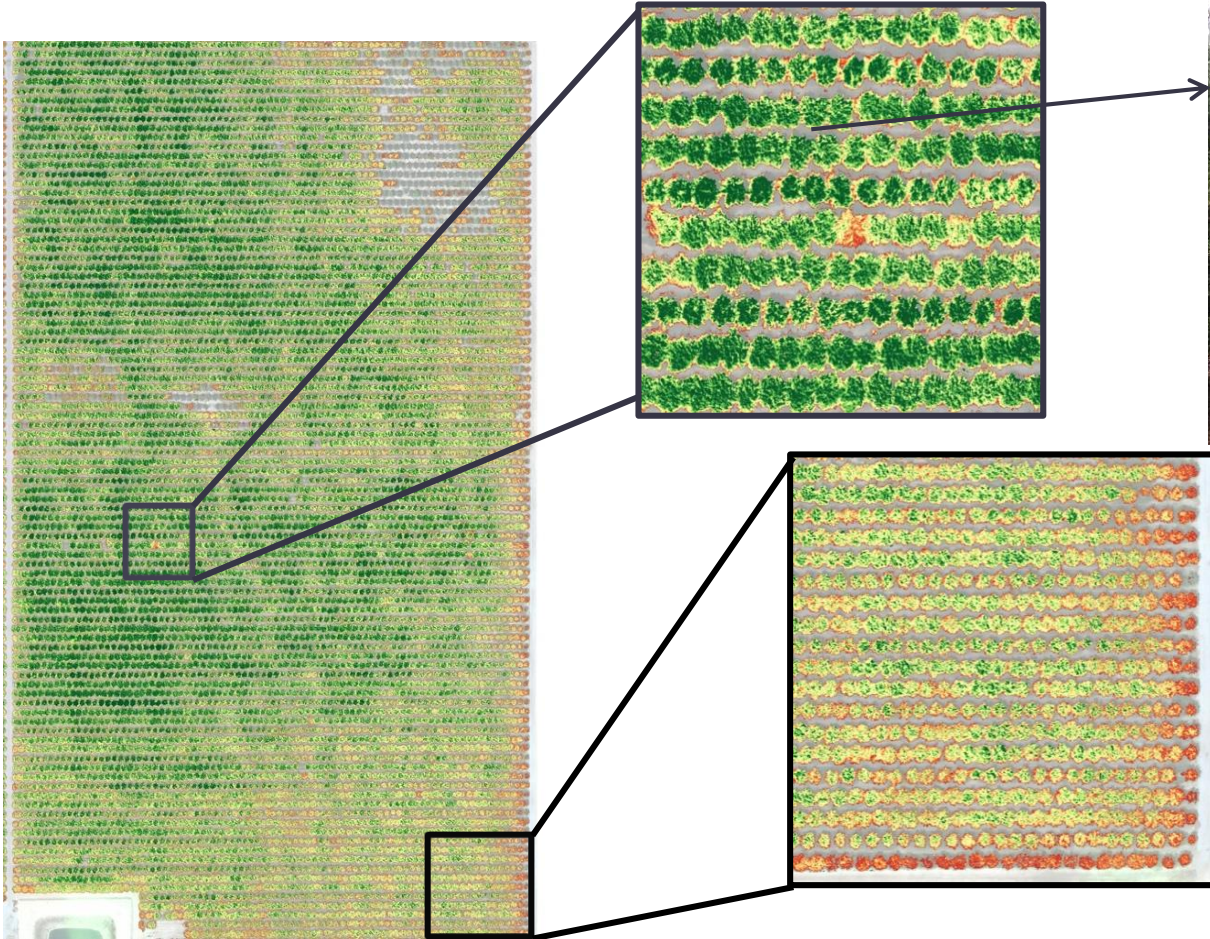
Farmers can identify under performing areas in high value tree groves (almonds)



Leveraging accurate imagery the farmers can manage at the individual tree level

NDRE

- 0.380
- 0.394
- 0.409
- 0.423
- 0.438
- 0.452
- 0.467
- 0.481
- 0.496
- 0.510
- 0.525
- 0.540





Case study: palm oil production

Addressing the plantation lifecycle

Environmental Assessment

- Field & Aerial Data Collection
- Data Processing, Analysis & Management
- Carbon Estimates
- Land Use Mapping

Planning & Planting

- Terrain Modeling
- Optimizing Planting Geometry
- Slope-Sensitive Analysis and Planting Planning

Asset Management

- Immature and Mature Stand Data Capture
- Data Processing
- Palm Indexing, Anomaly and Crown Analysis, Density Mapping
- GIS Integration

Regulatory Compliance

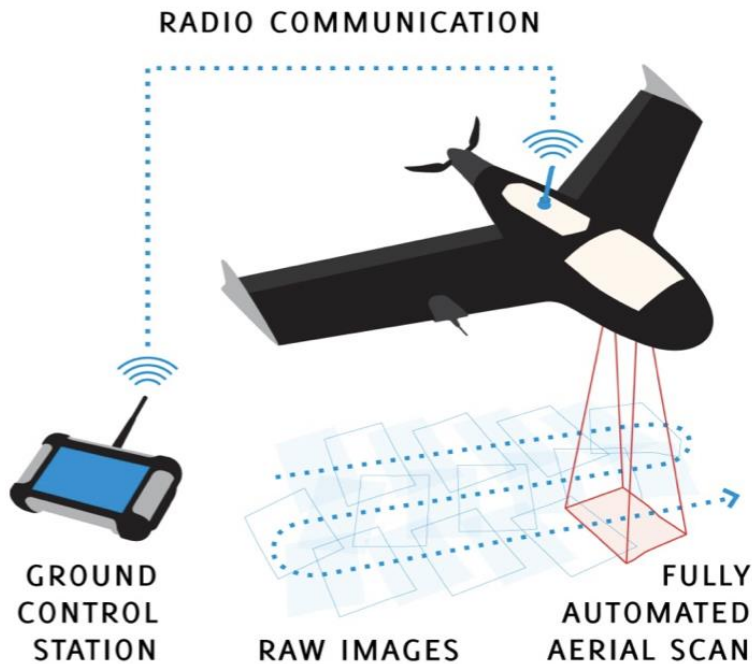
- RSPO and other regulatory field work
- Transparency and Field Data Readiness and Reliability
- Cloud Accessibility
- GIS Solutions

Long-Term Operational Efficiency

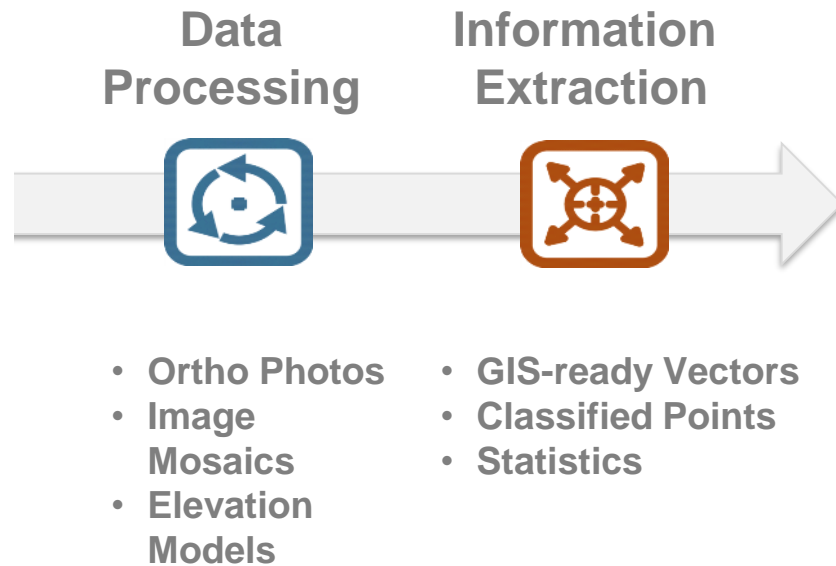
- Common Reference Frame Foundation
- Full-Solution Integration

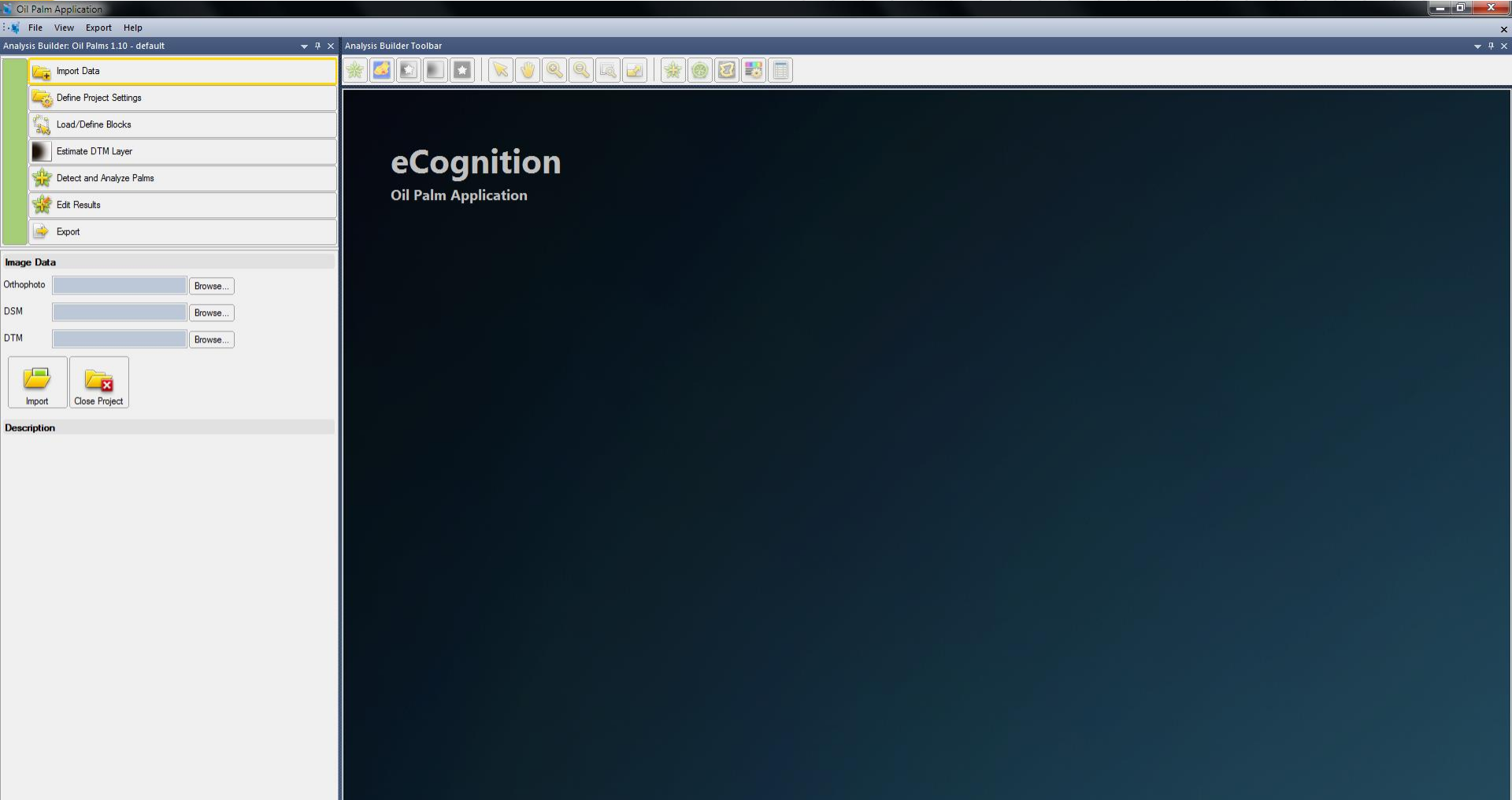
The goal is to provide the palm oil plantation manager with timely and accurate spatial data ... with much of the workflow automated

1 Image acquisition

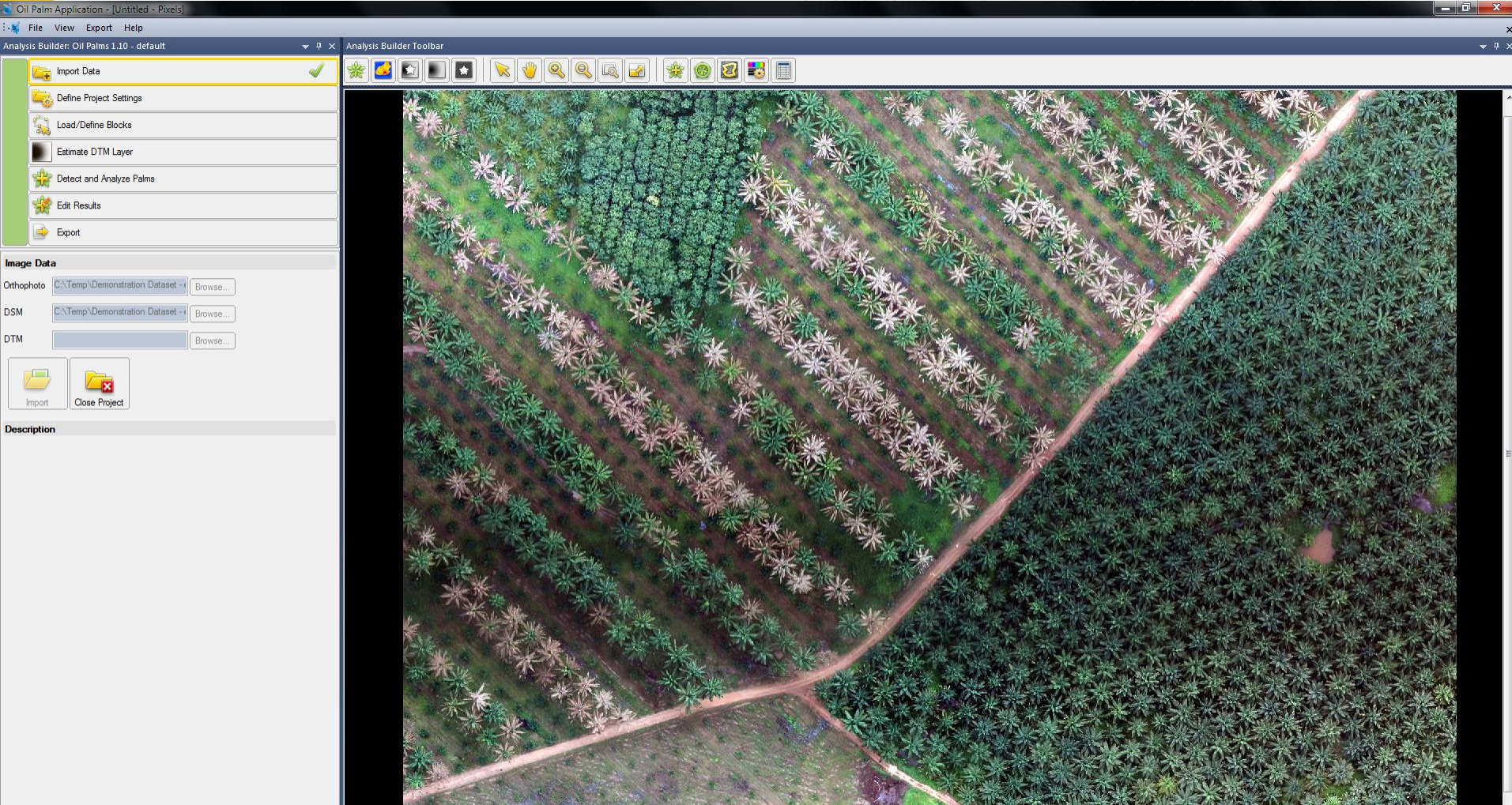


2 Image processing

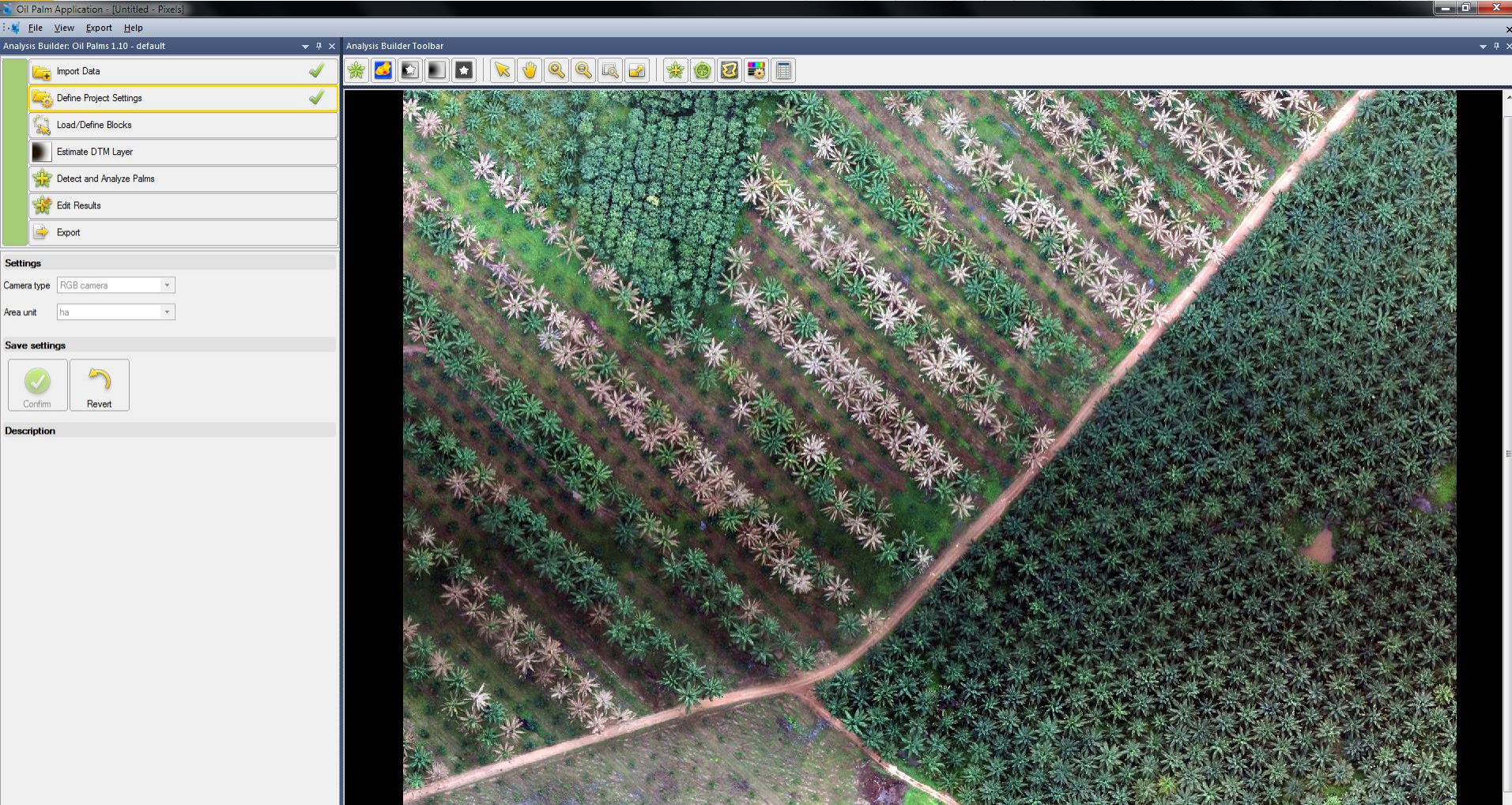




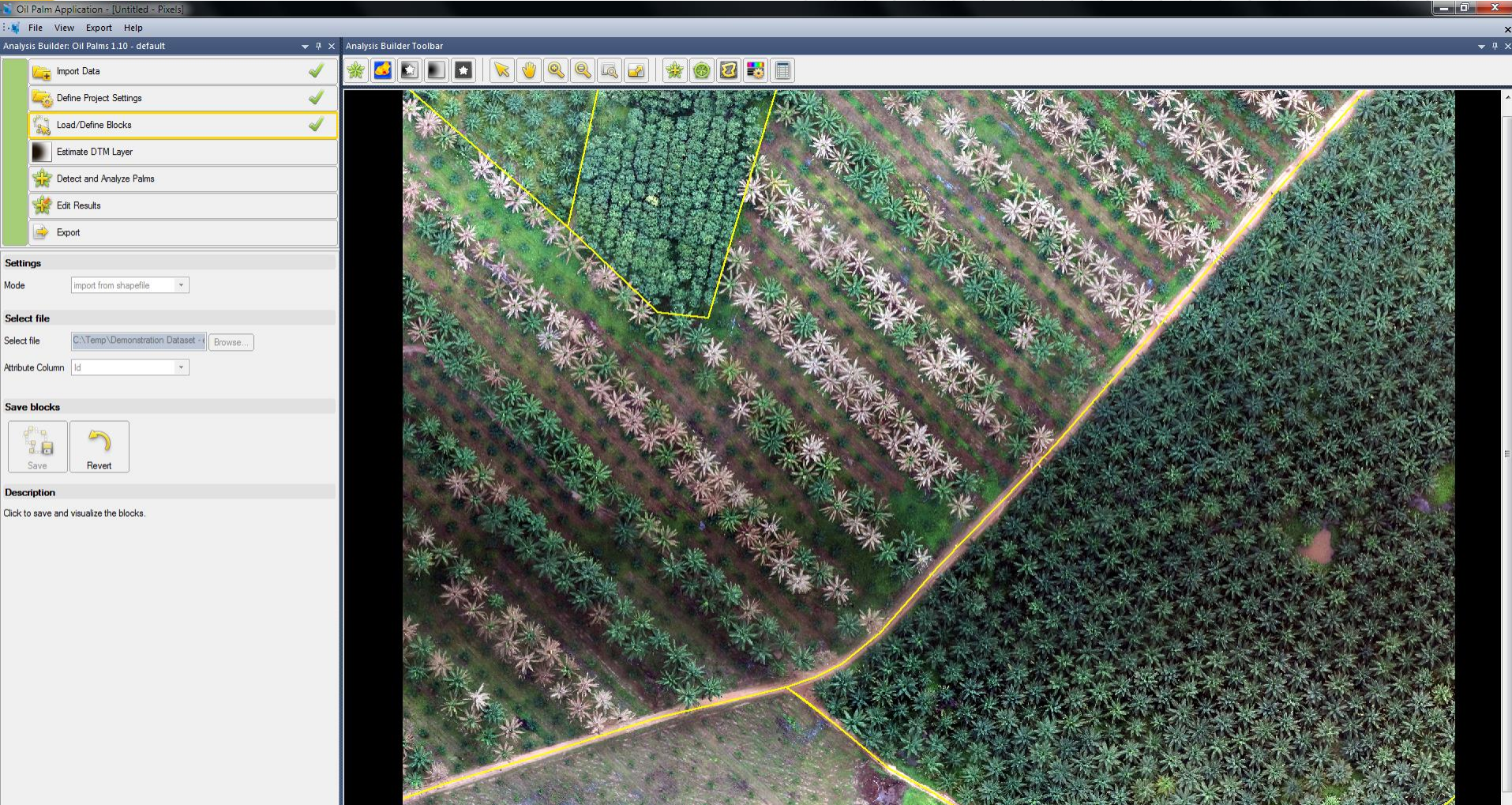
Start eCognition Oil Palm Application



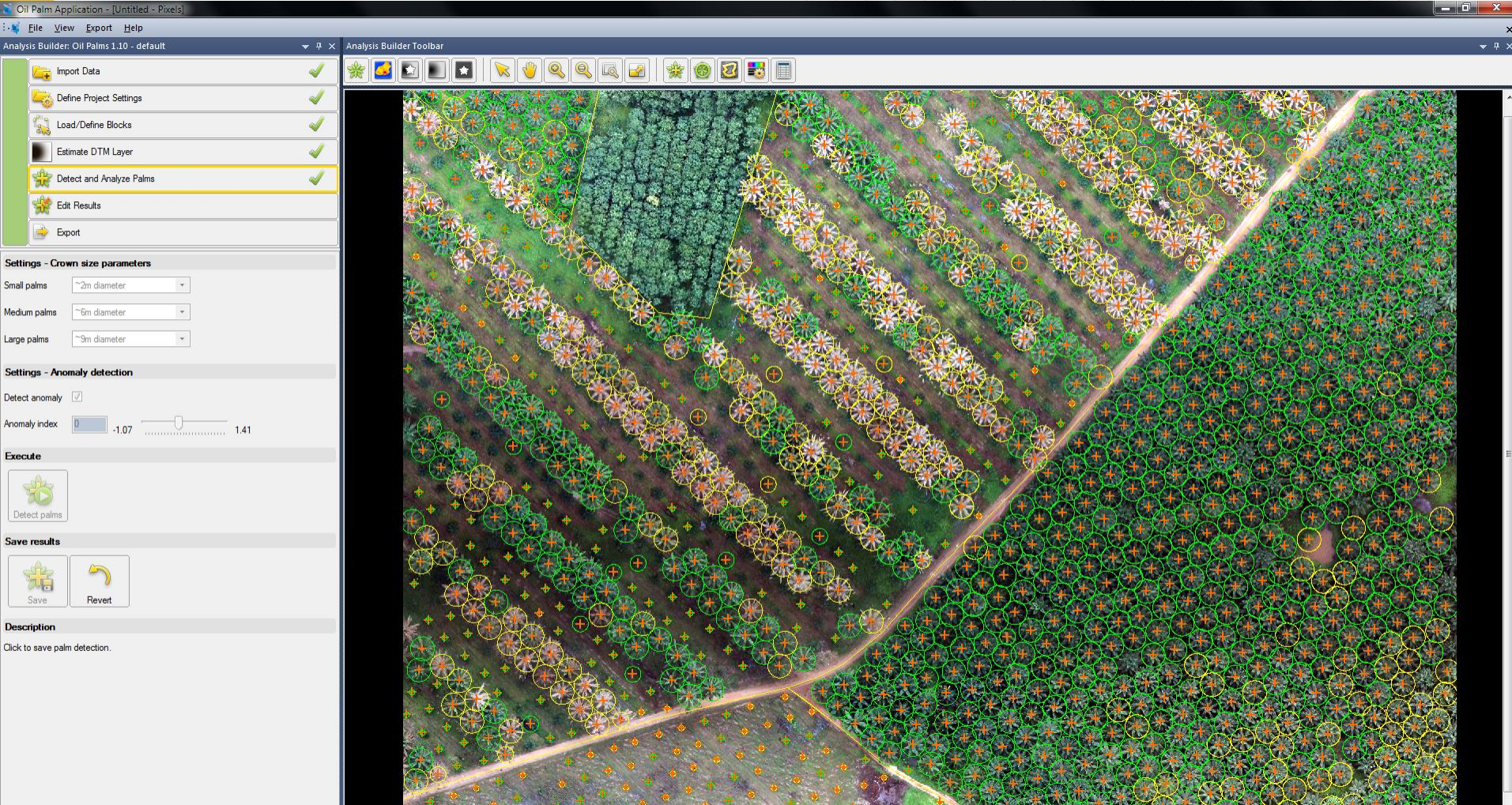
Load Input Data (Orthophoto & DSM, DTM optional)



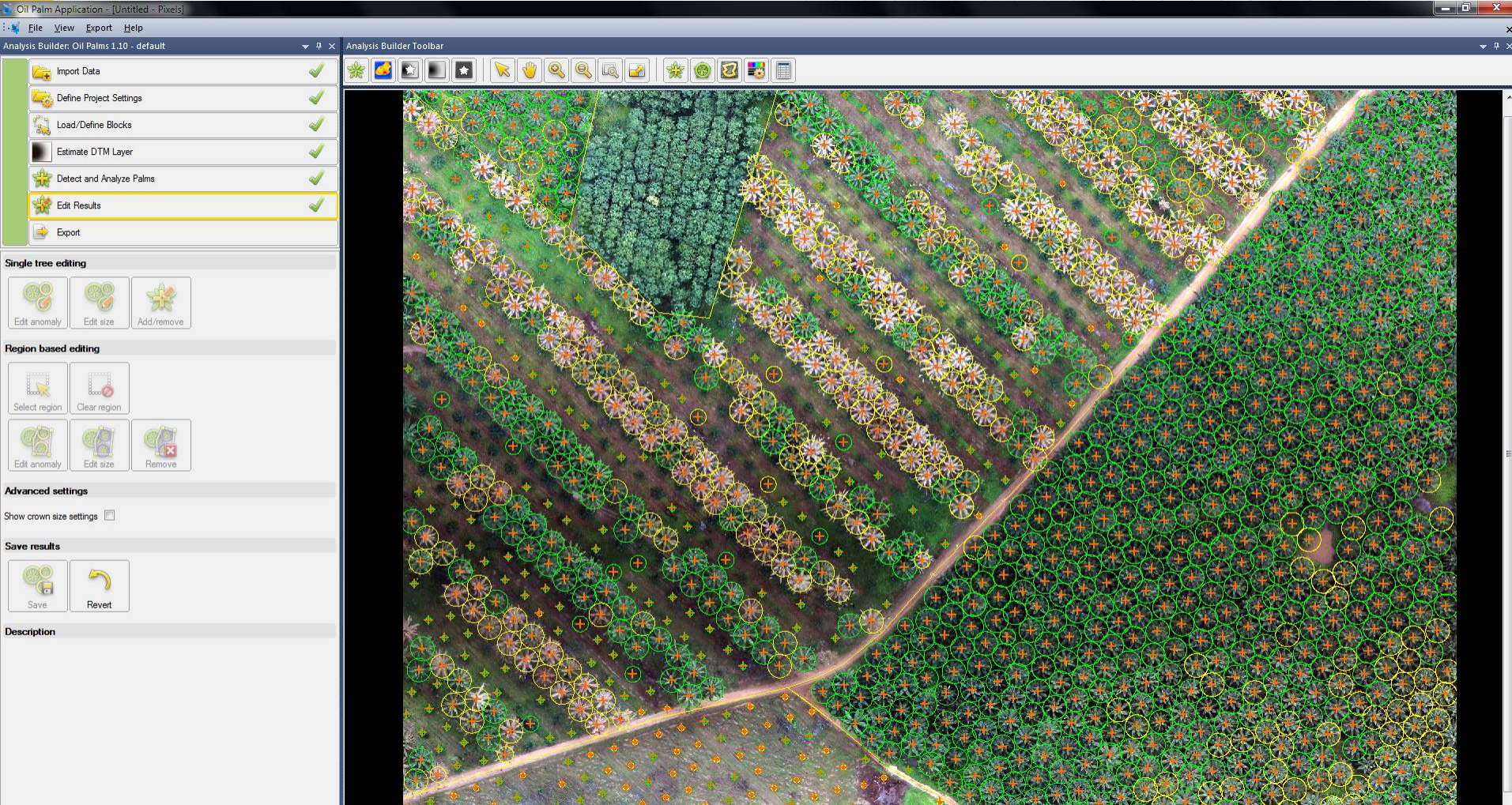
Define Project Settings (Camera Type [RGB | CIR], Area Unit [ha, arces, etc])



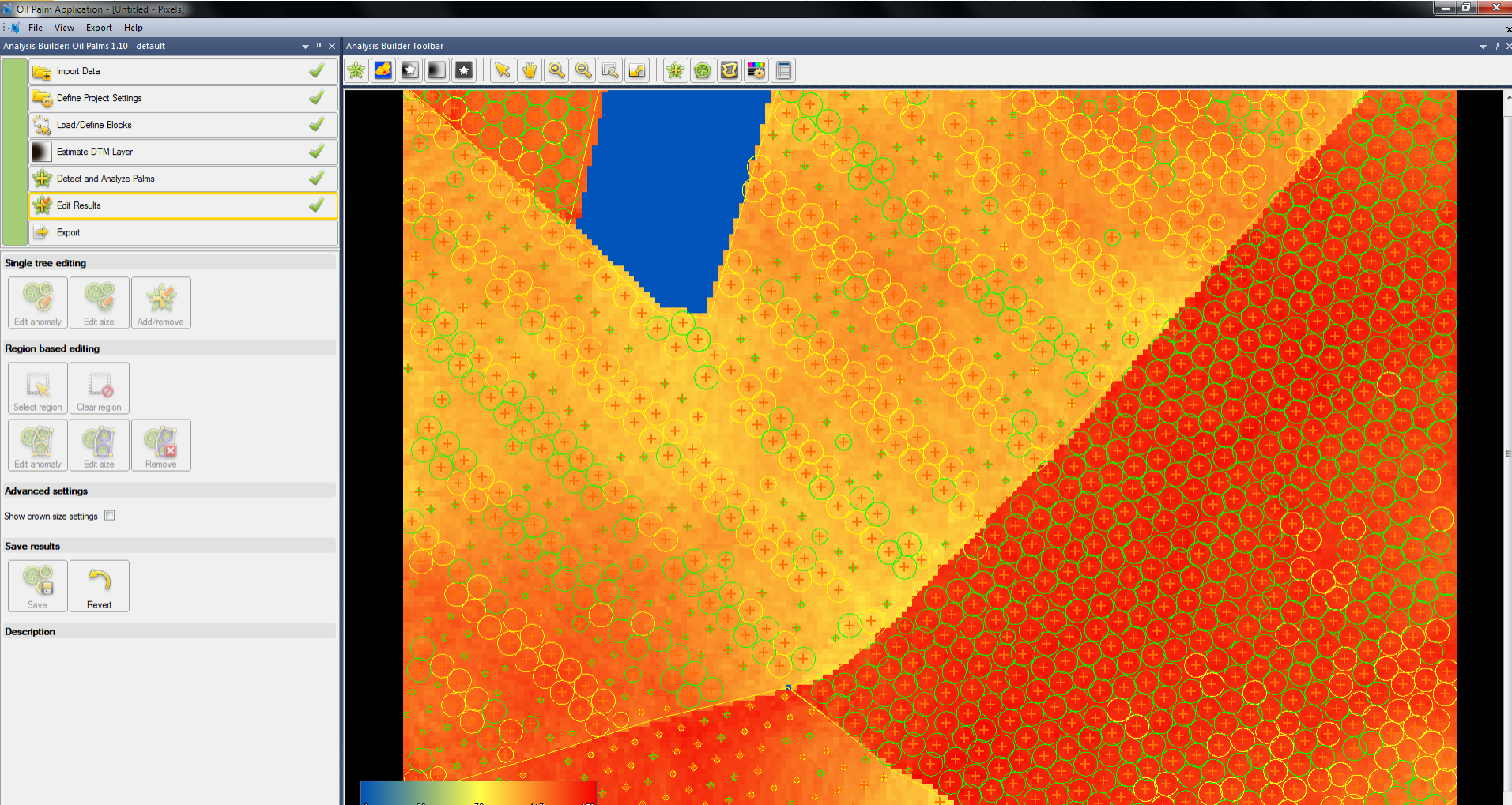
Define or Load (Shapefile) Blocks (Regions of Interest)



Fully automated Oil Palm Tree Detection and Analysis



Optional: Manual editing of detected Oil Palm Trees



Optional: Visualization of Oil Palm Tree Density

Oil Palm Application - [Untitled - Pixels]

File View Export Help

Analysis Builder: Oil Palms 1.10 - default

Analysis Builder Toolbar

- Import Data ✓
- Define Project Settings ✓
- Load/Define Blocks ✓
- Estimate DTM Layer ✓
- Detect and Analyze Palms ✓
- Edit Results ✓**
- Export

Single tree editing

- Edit anomaly
- Edit size
- Add/remove

Region based editing

- Select region
- Clear region
- Edit anomaly
- Edit size
- Remove


Advanced settings

Show crown size settings

Save results

- Save
- Revert

Description



Thematic Layer Attribute Table

Active layer: Trees_Healthy

No.	BLOCK_ID	TREE_ID	Anomaly	Crown	Density	X_Center	Y_Center	Elevation	Height	Comment
859	100	1303	No	large (~9m diameter)	146	273.875	-165.275	54.4	4.8	Approach: manual edit.
860	100	1304	No	large (~9m diameter)	145.2	240.575	-200.375	55.1	7.1	Approach: manual edit.
861	100	1305	No	large (~9m diameter)	146.9	387.575	-86.975	58.4	6.8	Approach: manual edit.
862	100	1306	No	large (~9m diameter)	147.7	396.575	-84.575	57.8	6.2	Approach: manual edit.
863	100	1310	No	large (~9m diameter)	143.4	361.475	-161.675	54.8	8.9	Approach: manual edit.
864	100	1311	No	large (~9m diameter)	133	383.375	-178.375	56.4	9.8	Approach: manual edit.

Optional: Display of individual Tree attributes

Oil Palm Application - [Untitled - Pixels]

File View Export Help

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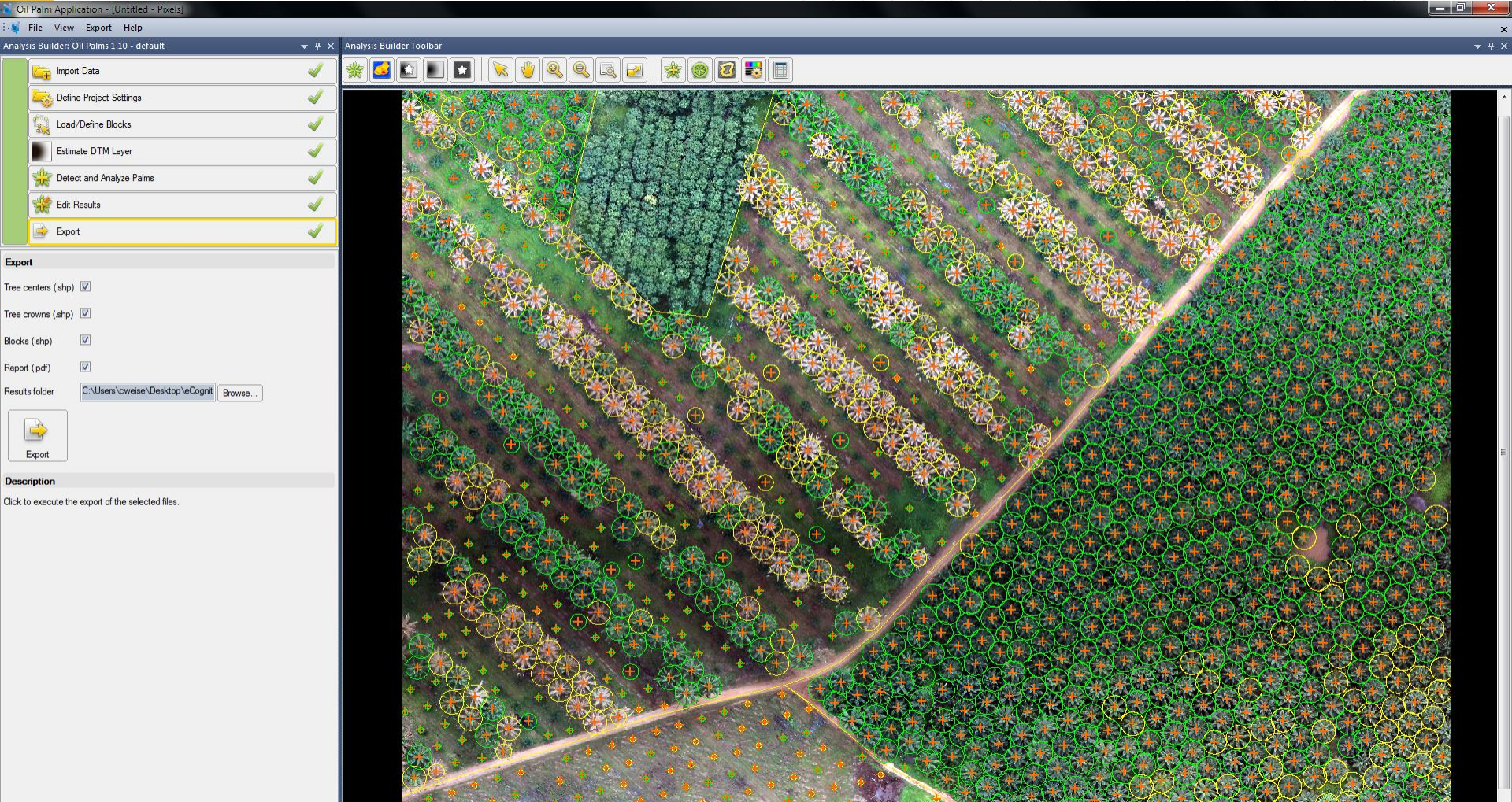


Thematic Layer Attribute Table

Active layer: Blocks

No.	BLOCK_ID	Area_ha	Palms_no	Palms_ha	No_larg...	No_med_cro...	No_small_crown	Pct_large_crown	Pct_med_...	Pct_small_crown	No_anomaly	Pct_anomaly
1	100	4.44084317648	582	131	573	6	3	98.4	1	0.5	76	13
2	200	1.03189736994	121	117.2	0	0	121	0	0	100	77	63.6
3	300	0.223138122067	29	129.9	26	3	0	89.6	10.3	0	6	20.6
4	400	5.74794376062	580	100.9	380	37	163	65.5	6.3	28.1	288	49.6

Optional: Display of computed Block statistics



Export Results (Shapefile [point, polygon] and Report [pdf])

eCognition-based oil palm solution

Input

- RGB or CIR orthomosaics
- DSM and DTM elevation data (optional)
- Supported image data types: TIFF, IMG, JP2
- Required GSD (ground sample distance) <10 cm for imagery; <30 cm for DSM/DTM

Output

- Tree Positions: point Shapefile that contains the center points of the detected palm trees and according attributes
- Tree Crowns: polygon Shapefile that represents the crowns as well as all attributes from the tree centers shapefile
- Blocks: polygon Shapefile that contains the defined analysis area (blocks) and all attributes that were evaluated during analysis



This timely and accurate spatial data can then be used by the planation managers to make better informed decisions, improving productivity and reducing the environmental impact