PalmWatch

WHITE PAPER / VERSION 2.0

Satellite-to-field oil-palm intelligence

An evidence-led framework for connecting repeat satellite context, targeted drone mapping, palm-level history, and field confirmation.

Designed for estate teams, agronomists, and research partners

Screening supports expert review; it does not replace field or laboratory confirmation.

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WHY PALMWATCH

A continuous record from estate to palm.

PalmWatch uses repeat satellite observations for broad context, targeted drone surveys for closer evidence, and field findings for confirmation.

01

Identity before inference

Every mapped palm receives a stable identifier, baseline, and time-linked observation history.

02

Two observation scales

Satellite time series screen broad change; drone surveys add selective crown-level detail.

03

Verification closes the loop

Field findings and, when required, laboratory confirmation remain attached to the record.

The first model target is a three-way screen: healthy, other stress, and suspected Ganoderma. More detailed labels require sufficient confirmed samples.

MINIMUM DEFENSIBLE SCOPE

Scale the evidence before scaling the claim.

These figures are proposed targets for an expanded NBL study. They are not deployment results, accuracy claims, or completed observations.

120
balanced study farms

6,000
mapped palms

3
repeat survey rounds

18,000
tree observations

Design guardrails

- Balance farms across geography, planting age, management, and observable stress contexts.
- Separate training, validation, and locked testing by farm - never randomly by tree.
- Repeat surveys to distinguish persistent decline from seasonal or flight-condition noise.

SIGNAL FAMILIES

Useful screening begins when evidence agrees.

No universal vegetation-index threshold can diagnose a palm. PalmWatch combines calibrated measurements, local comparison, temporal change, and confirmed field labels.

01

Spectral

NDVI, NDRE, GNDVI, red edge, NIR, and calibrated reflectance.

02

Structural

Crown area, density, symmetry, visible gaps, yellowing, and change over time.

03

Thermal

Canopy temperature, transpiration stress, and neighbour-relative anomalies.

04

Contextual

Soil, weather, age, seed, irrigation, fertilizer, infestation, and management history.

A flagged palm is a prioritised observation, not a diagnosis.

FIVE CONNECTED SERVICES

From map to monitored outcome.

Each service produces a traceable hand-off rather than an isolated dashboard event.

01

Satellite watch

Repeat estate-wide optical observations with weather, terrain, and soil context.

02

Change screening

Persistent block and neighbourhood trends enter a transparent review queue.

03

Targeted drone survey

Priority areas receive calibrated RGB, multispectral, and thermal capture.

04

Field verification

Agronomists inspect prioritised palms and attach findings.

05

Monitor & report

Follow-ups connect intervention, outcome, and estate-level reporting.

CROSS-SCALE MONITORING

Breadth first. Detail where it matters.

Satellite and drone systems answer different questions. PalmWatch connects them without presenting either layer as a diagnosis.

Question	Satellite layer	Drone layer
Best use	Repeat estate context	Priority-block detail
Coverage	Large systematic footprints	Selective flight areas
Strength	Temporal and spatial overview	Closer spectral and structural evidence
Limit	Cloud and mixed pixels	Calibration and flight-condition sensitivity
Decision	Where should we look?	What should field teams review?

Sentinel-2 provides 13 spectral bands at 10 m, 20 m, and 60 m native resolutions with a nominal five-day two-satellite revisit. Usable tropical observations can be less frequent because cloud and haze still matter.

YIELD EXPOSURE

Per-acre loss needs assumptions, not slogans.

Published figures describe specific study populations. Estate exposure depends on incidence, palm age, attainable yield, disease progress, price, and management response.

0.016-1.76 t/acre

Approximate conversion of the 0.04-4.34 t/ha FFB reduction reported across 10- to 22-year plantings in a Johor case study.

Up to 68%

A separate Bayesian model estimated loss relative to attainable yield among infected palms. It is not a whole-estate default.

Transparent scenario formula

hectares x affected share x healthy FFB yield x yield-loss fraction

Revenue exposure may be estimated with a dated price per tonne, but it excludes treatment, mortality, replanting, delayed production, and recovery effects.

RESEARCH DISCIPLINE

Build evidence that can survive a new farm.

Validation should test whether the approach generalises across locations, seasons, and management contexts - not whether it remembers a familiar plantation.

Farm-level split

Keep palms from one farm in only one of training, validation, or locked testing.

Repeat capture

Use multiple survey rounds to test persistence and reduce one-flight noise.

Confirmed labels

Retain expert observations and laboratory confirmation where required.

Transparent review

Show the contributing signal families and relevant comparison context.

Initial evaluation questions

Can the screen separate healthy palms, other stress, and suspected Ganoderma? Does performance hold on farms never seen during training? Are prioritised cases explainable and operationally reviewable?

WHAT TEAMS RECEIVE

Decision support with an audit trail.

The platform is designed to keep the estate view connected to the palm, observation, assignment, and field outcome.

- **Palm identity and survey history**
- **Explainable review queue**
- **Field assignments and notes**
- **Repeat-monitoring reports**

Limitations stated plainly

PalmWatch screens for elevated risk; field or laboratory confirmation remains essential.

Thresholds and model behaviour must be calibrated to the study population and capture protocol.

Detailed disease or severity labels are only defensible when confirmed sample counts support them.

EVIDENCE REGISTER

Sources behind the framework.

PalmWatch separates published evidence, proposed study targets, and future deployment results.

Roslan Abas & Idris Abu Seman (2012)

Economic Impact of Ganoderma Incidence on Malaysian Oil Palm Plantation. MPOB Oil Palm Industry Economic Journal.

Kamu et al. (2021)

Estimating the Yield Loss of Oil Palm Due to Ganoderma Basal Stem Rot Disease. Journal of Oil Palm Research. DOI: 10.21894/jopr.2020.0061

Izzuddin et al. (2022)

UAV-Based Remote Sensing for Early-Stage Detection of Ganoderma. Remote Sensing 14(5):1239.

European Space Agency (2026)

Sentinel-2 facts and figures: 13 bands, 10/20/60 m spatial resolution, nominal five-day constellation revisit.

Szulczyk et al. (2020)

Estimating the economic damage and treatment cost of basal stem rot. Forest Policy and Economics 116:102163.

Flood (2006)

A Review of Fusarium Wilt of Oil Palm. Phytopathology 96(6):660-662.

Full links and continuously updated citations are available in the HTML white paper at palmwatch.in/white-paper/.

NEXT STEP

Move from a visual demo to a validated field study.

A PalmWatch pilot should begin with protocol agreement, balanced sampling, farm-level data separation, and a field-confirmation workflow.

White paper scope

This document consolidates the current PalmWatch product narrative, proposed study targets, evidence architecture, service workflow, validation rules, outputs, and limitations. It contains no deployment performance or diagnostic-accuracy claim.

https://palmwatch.in/white-paper/

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