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AI for Sustainable
Precision Viticulture
VineSignal

Suisun Valley Growers
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SUISUN VALLEY
vintners & growers association

Intro to Deep Planet

Harness AI / Machine Learning for the Benefit of the Planet

Help **Growers and Sustainability teams**, **Winemakers and Operations teams**, **and Industry association personnel** to improve vineyard management, efficiency and sustainability at scale

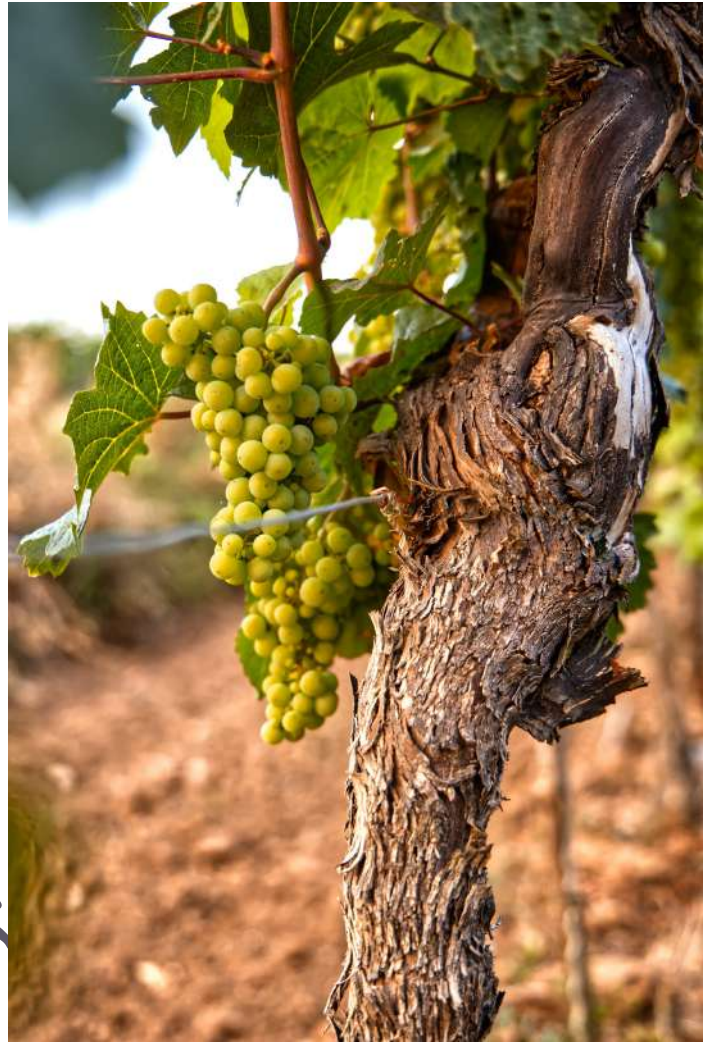
Our VineSignal SaaS product helps to:

- Improve soil health and sustainability – nutrients and carbon
- Improve harvest logistics and efficiency
- Detect diseases and risks to vine health
- Monitor soil moisture and reduce water input

Industry Challenges

If it was possible, which one or two of these would you address tomorrow?

- Harvest logistics and inefficiencies
- Soil health and sustainability
- Input costs (fertilizer, compost, pesticides)
- Water management and irrigation
- Vineyard health and disease pressure
- Labour costs and shortages



Deep Planet Team and Locations

We are talented and passionate machine learning researchers, plant scientists

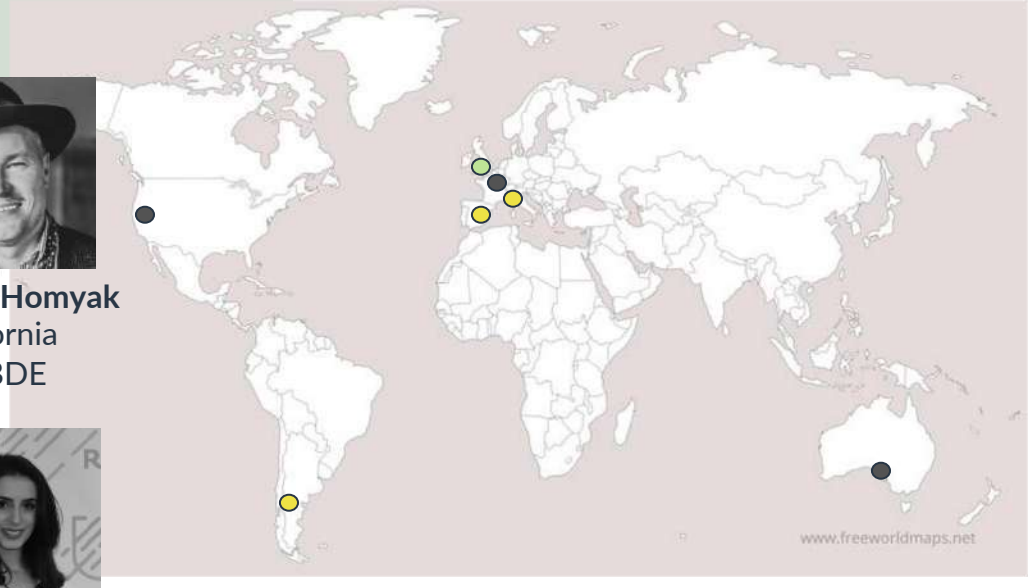
Dave Carter
CEO, Head of USA

Matthew Homyak
California
US BDE

Christopher Pang
Commercial Directeur

Alec Bannister
Customer Success

Lucy Manukyan
Planet Scientist



- **Research Hub (UK)**
- **Country Location (France, USA, Australia)**
- **Future Location (Italy, Spain, South America)**

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Health
In block vine health/stress
Five day and monthly change
Prediction of health
All weather radar
Anomaly Detection

Microclimate
Visualization of microclimate
Canopy wetness
Temperature, wind

Carbon
Stratification and Sampling
Carbon baselining
Soil Organic Carbon
Markets

Digital Twin
3D mapping of vineyard
Biodiversity
Sub surface model
Phenology data

Harvest
Predict harvest date
Optimize harvest resources
Maturity prediction

Pest and Disease
Early warning 9 diseases
Disease detection
Spread monitoring

Yield
Hands off yield prediction
Early, mid and late season
90%+ accuracy
Yield / Profitability Mapping

Water and Nutrients
Leak Detection
Water prescription
Nutrition Detection
Nutrition Optimization

Integrations
APIs to all major systems, irrigation, IOT, tractor guidance, spray diaries

Maturity and Quality
Maturity Mapping
Enable split picking
Improve quality

Phenology & Work Mgt
Phenology data
Job Management
Vineyard Notes

Communities
Share results
Tap experts

How it works

Proprietary Machine Learning Platform

Crop Agronomy

App

Satellite Data Optical + radar

Machine Learning, Catalogs, Models, Data Science

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In Field IOT Data

Cameras

Historical Data

Prediction Web Platform

Patent pending | 20 ML models | API

How it works

Satellite Imagery Hyper and Multi spectral

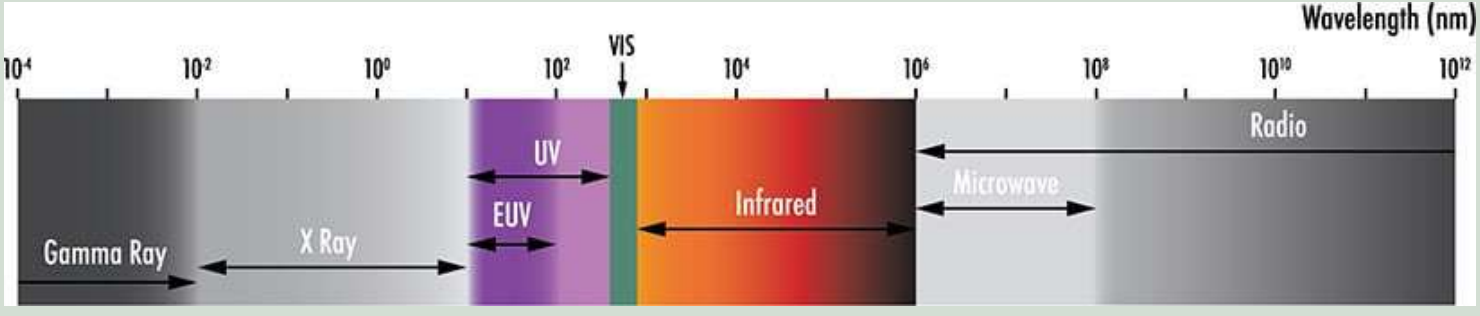
Every 3-5 days — 3-5 days — 3-5 days — 3-5 days

Satellite Data
Optical + radar
Dataset

esa

Hyperspectral and Multispectral

Only a small portion of the wavelength spectrum is visible to the human eye, and wavelength regions outside of the visible spectrum, are utilized in hyperspectral and multispectral imaging.



Growing and Sustainability

- Soil organic carbon
- Soil and Leaf nutrients (NPK)
- Disease detection and monitoring
- Health and Growing
- Water and Irrigation

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1.

Carbon and Soil Health

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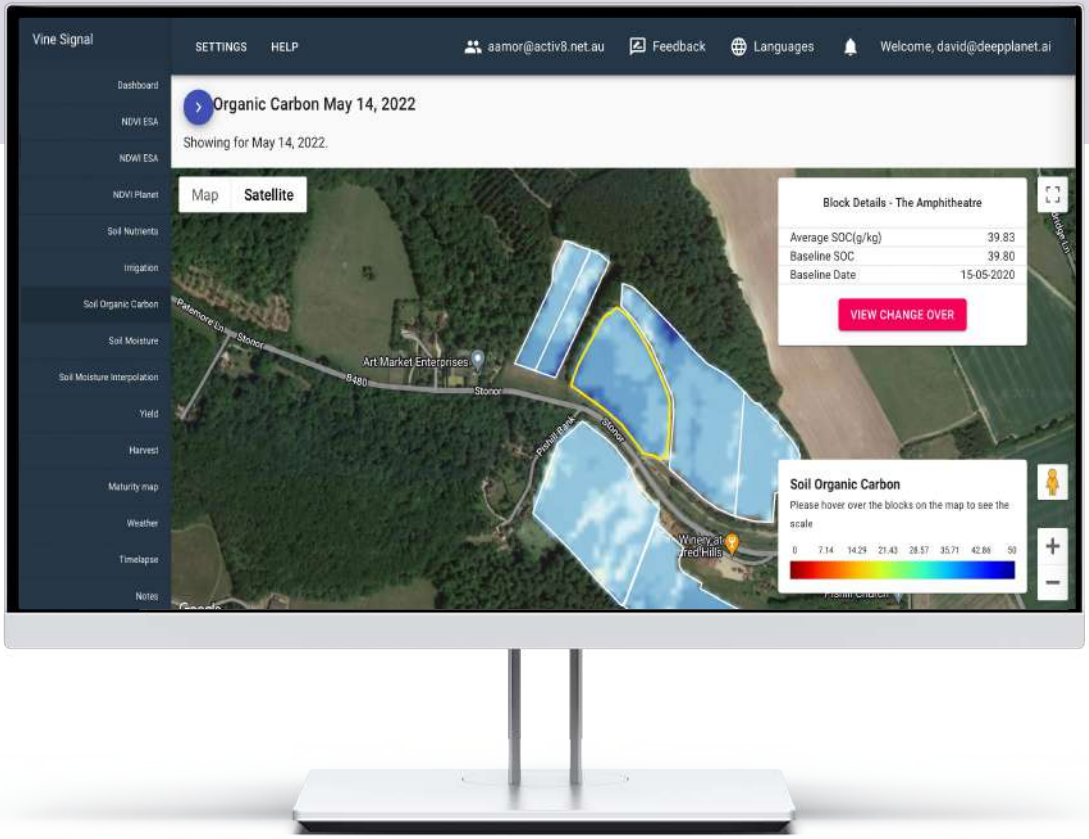
Carbon



Soil Organic Carbon

- Baseline Soil Organic Carbon
- Track improvements and degradation over time
- Improve farming outcomes and profitability

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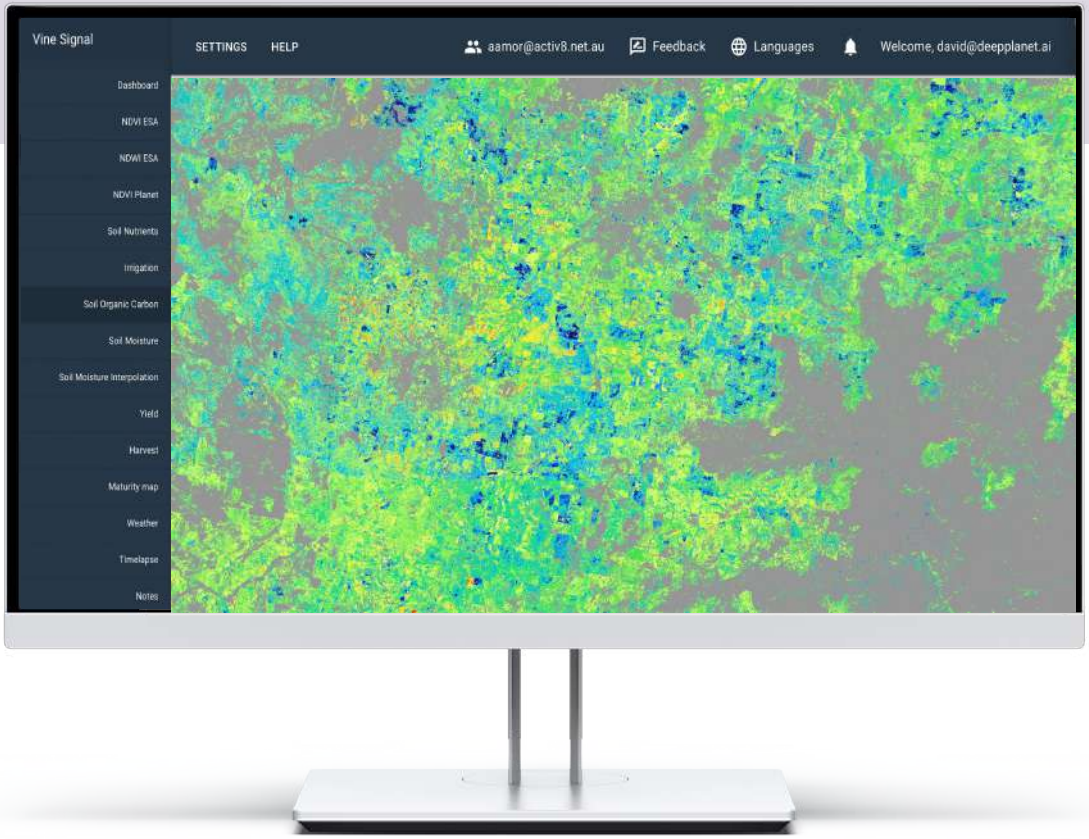
Sustainable Supply Chains



Sustainable Supply Chains

- Identify leaders within regions
- Take Snapshot at a point in time.
- Track actions, improvements and degradation over time

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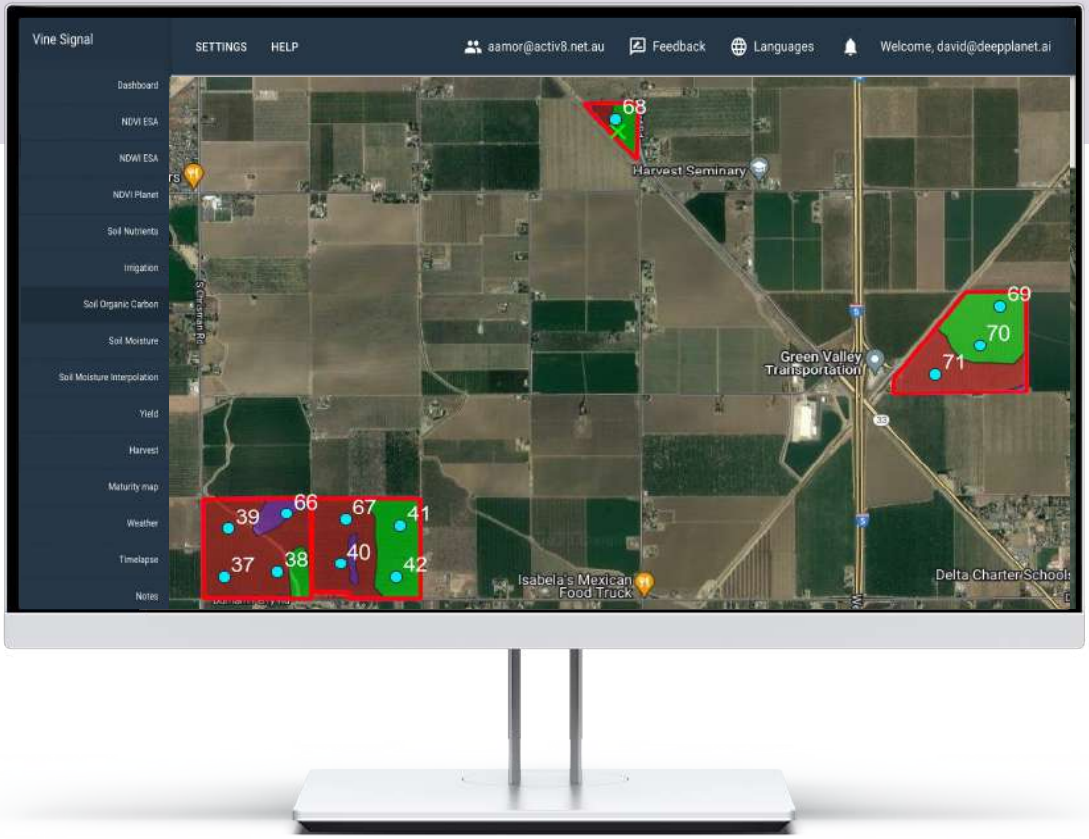
Stratification



Stratification

- Identify stratification across farms using elevation, clay content, soil bulk density, topographic wetness, soil depth
- Apply randomised sampling points.
- Prepare for soil moisture probe installation

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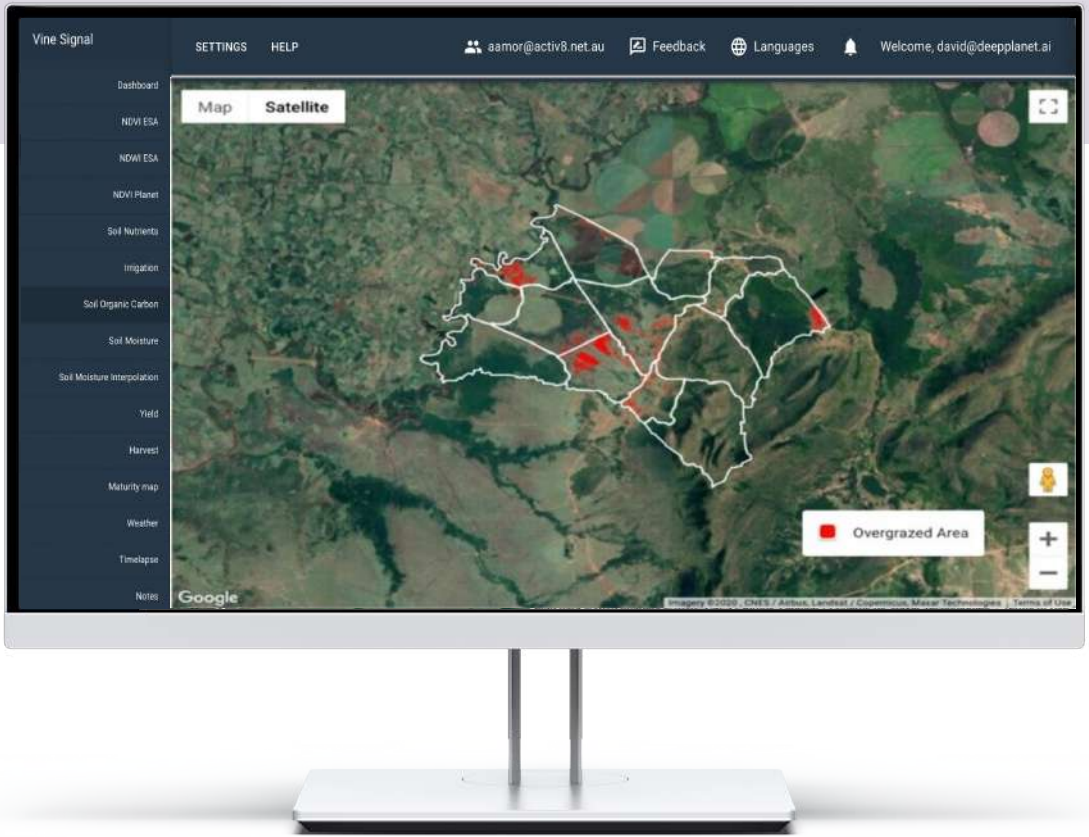
Rotational Grazing



Rotational Grazing

- Overgrazed Areas
- Biomass
- Grass Height
- Species

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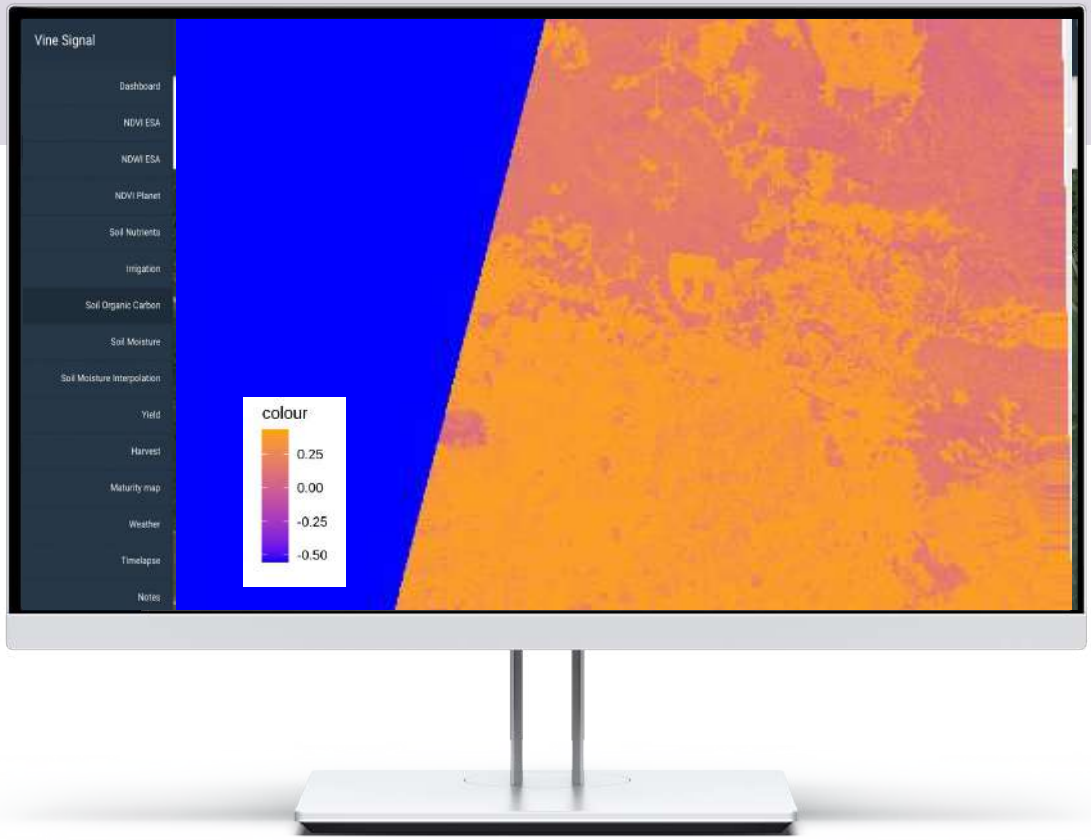
Biodiversity Measures



Biodiversity

- Identify Species
- Tag assets or events around the property
- Shannon Index

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2.

Soil and Leaf Nutrients

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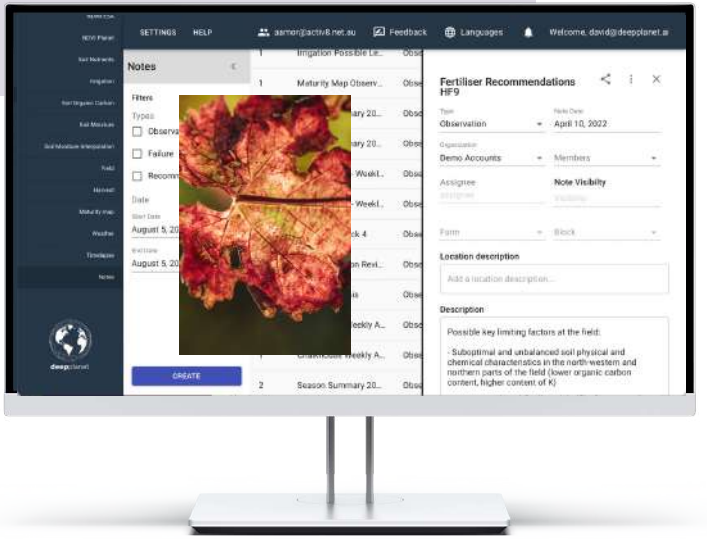
Vine Nutrient Deficiency



Snag Photo, Tag location and Send to Deep Planet

Get nutrient results and identify nutrient deficiency.

Determine treatments

Optimise Nutrient and Fertilizer Applications

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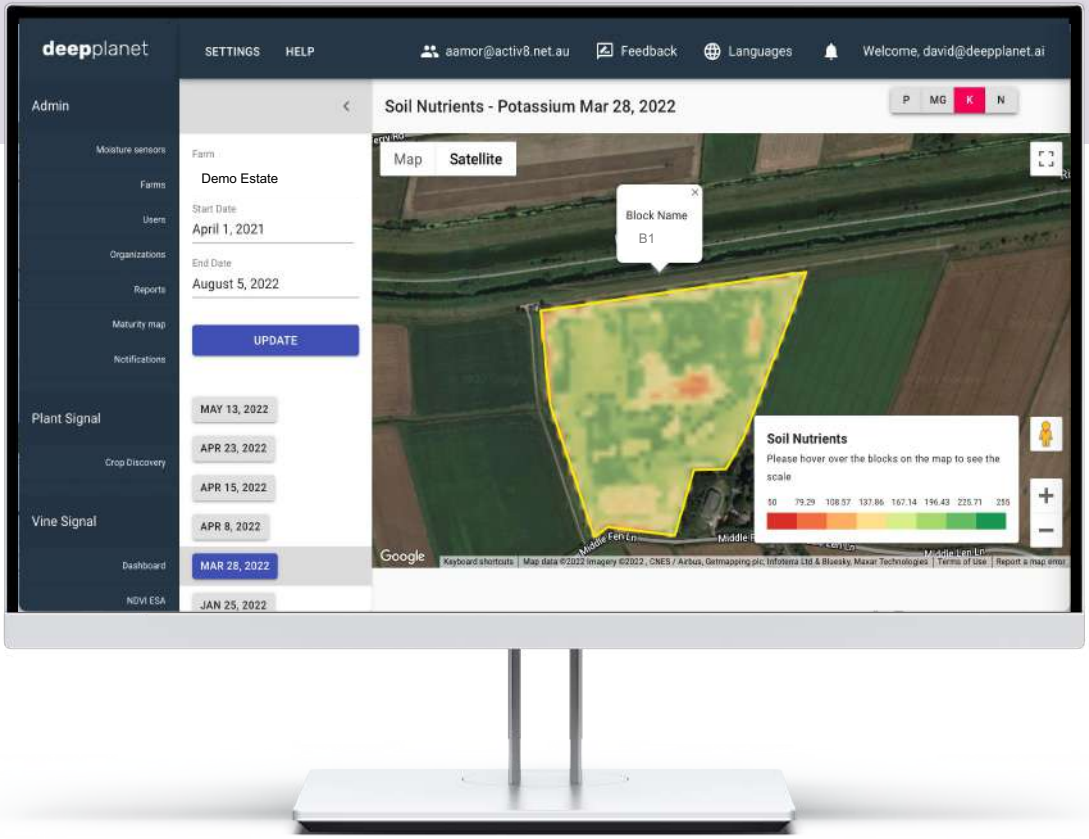
Soil Nutrients



Soil Nutrients

- NPK + Mg variability across block
- Inform Fertilizer applications
- Identify areas for remediation

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Pest & Disease

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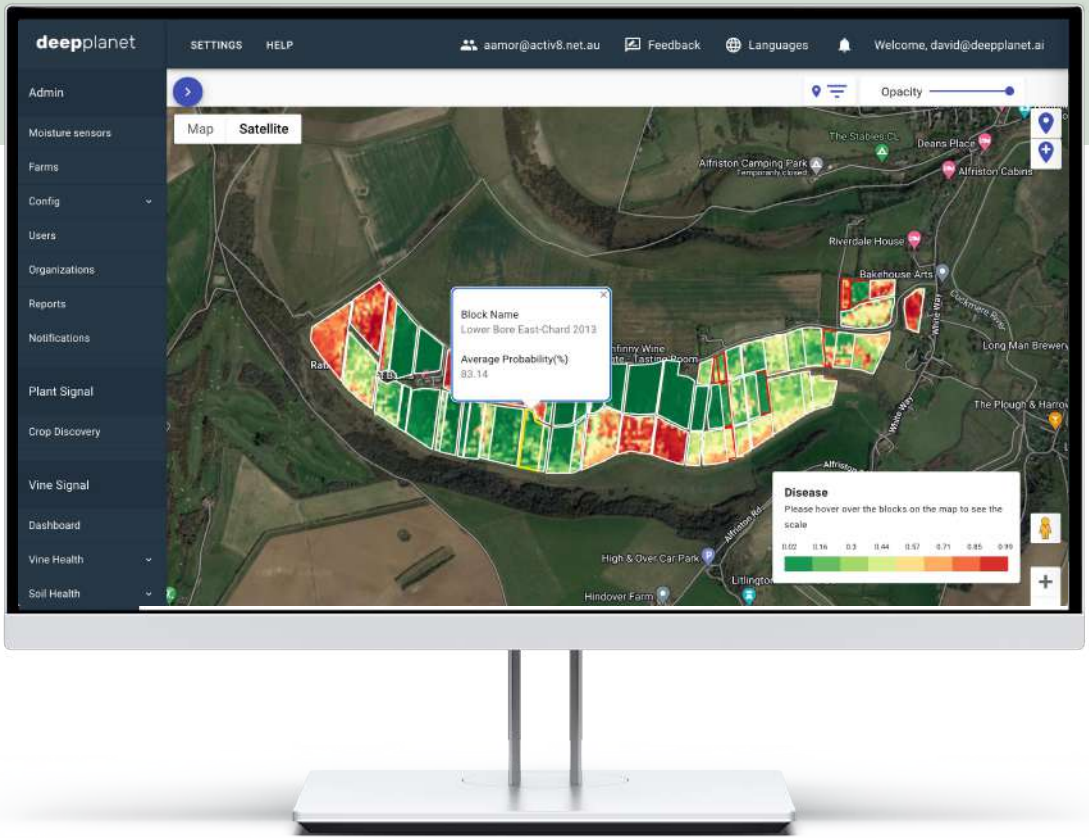
Pest and Disease



- Disease conditions early warning (Powdery and Downy Mildew, Botrytis)
- Track spread
- Identification and detection of major pest and diseases

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Pest and Disease

- Disease conditions early warning (Powdery and Downy Mildew, Botrytis)
- Track spread
- Identification and detection of major pest and diseases:

- Phylloxera
- Leafroll
- Leaf Blotch
- Aspergillus
- Ripe Rot
- Downy Mildew
- Botrytis
- Pierce's Disease
- Bitter Rot
- Sooty Mould
- Powdery Mildew
- Eutypa Dieback
- Grapevine Virus
- Penicillium
- Sour Rot

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4.

Irrigation

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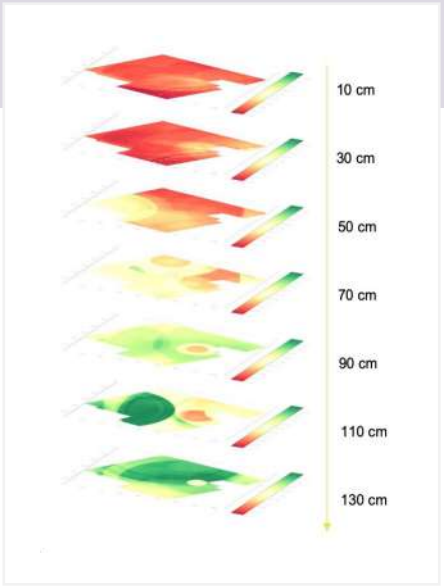
Irrigation



Know where to irrigate

Don’t blanket irrigate based on one point

Variable application: Reduce water usage, last longer

$300/ha, 2% push blocks where needed, yield

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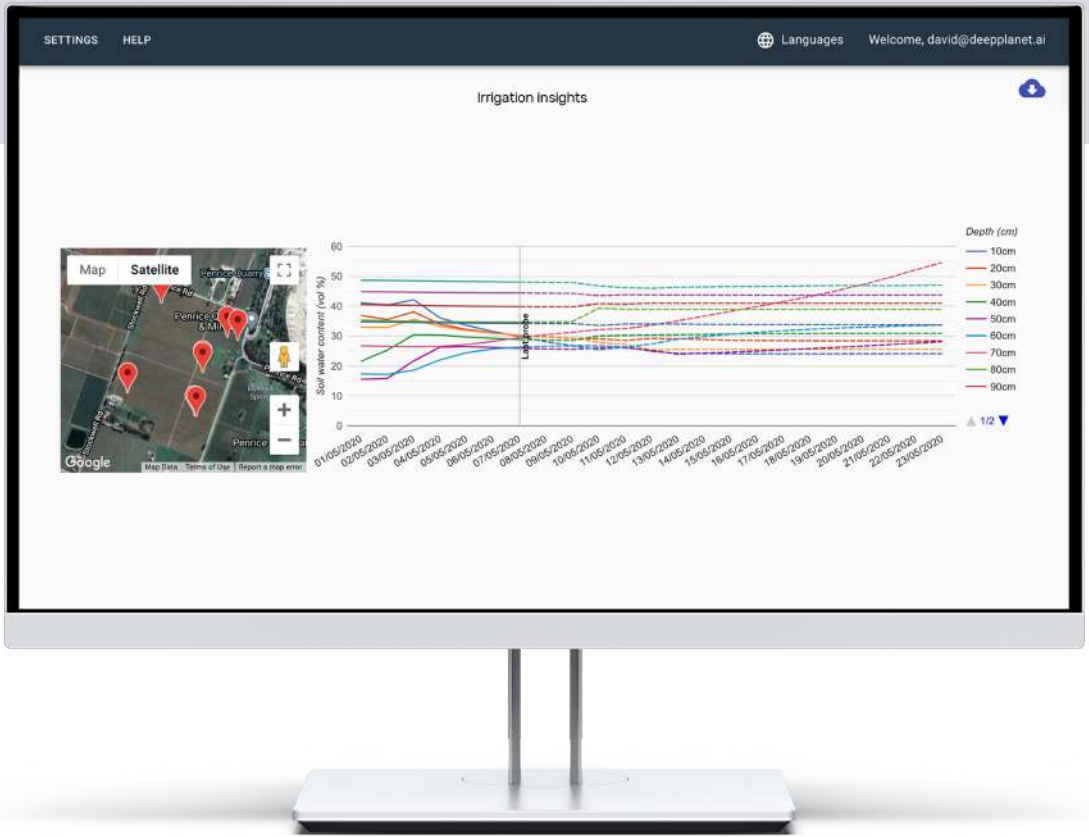
Irrigation

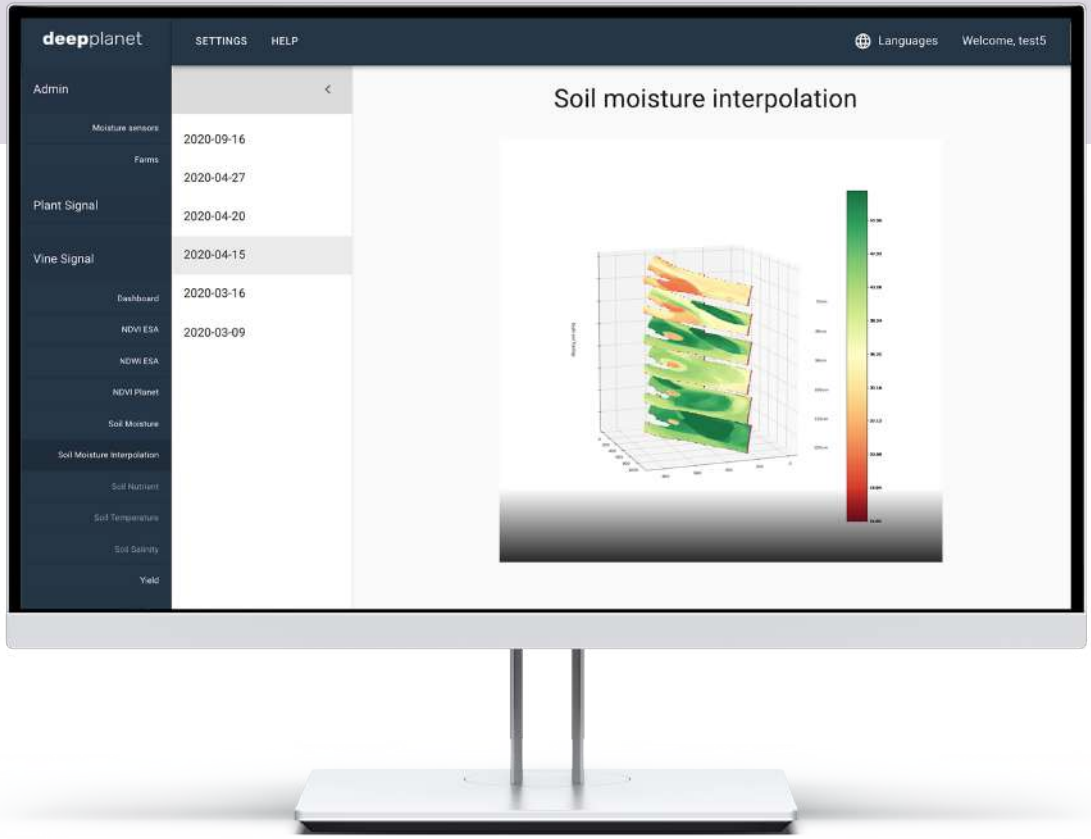


Soil Moisture

- Sensor prediction
- 2 weeks
- 95% accuracy

SoilSignal Product – Demo

Irrigation



Soil Moisture

- Soil moisture across whole site
- Targeted Irrigation prescriptions

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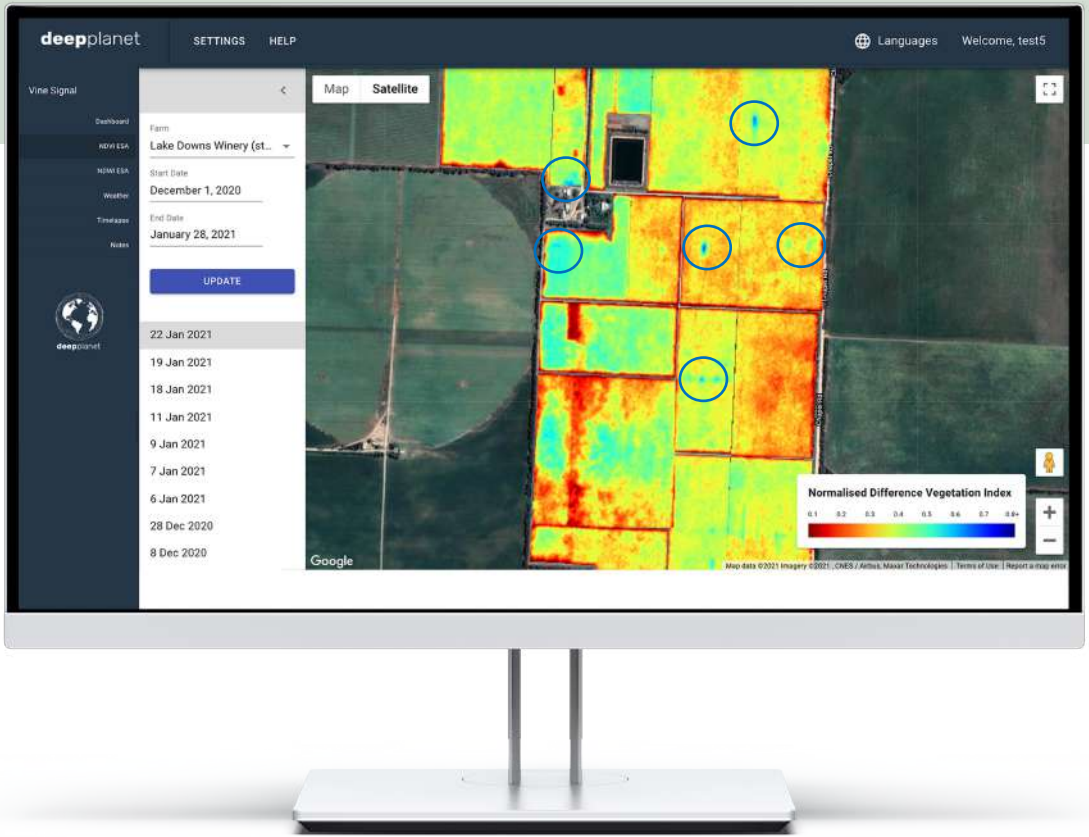
Irrigation



Irrigation leaks

- Daily imagery
- Every 3 vines per pixel

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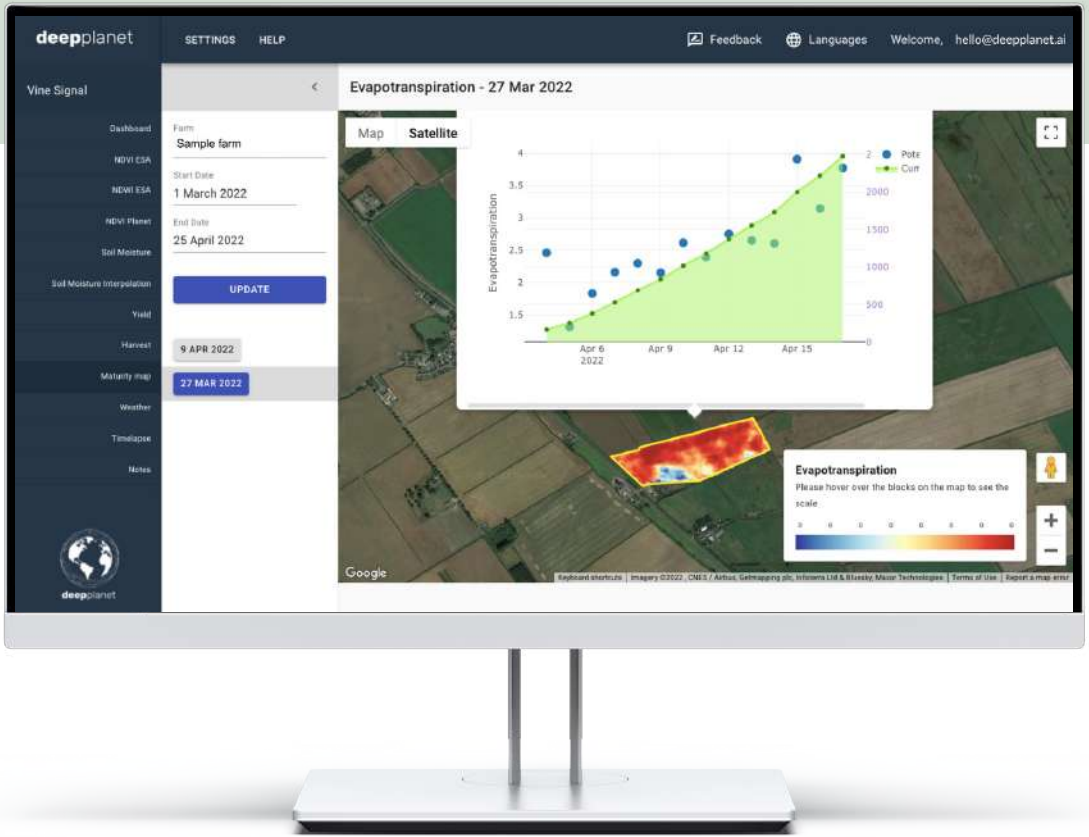
Evapotranspiration



Evapotranspiration

- Hands off ET monitoring
- Evapotranspiration visualization
- Daily and cumulative ET across the season
- Use for dynamic Irrigation scheduling

Winemaking, and Harvest Logistics Efficiencies

- Where to harvest?
- When to harvest?
- What's the productivity?

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5.

Baume/Brix Heat Maps

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Maturity and Quality

Identify Split Picking
opportunities for higher quality

Ensure consistent Quality
across the vineyard

Grape up and downgrade
opportunities to maximize quality and across wine portfolio

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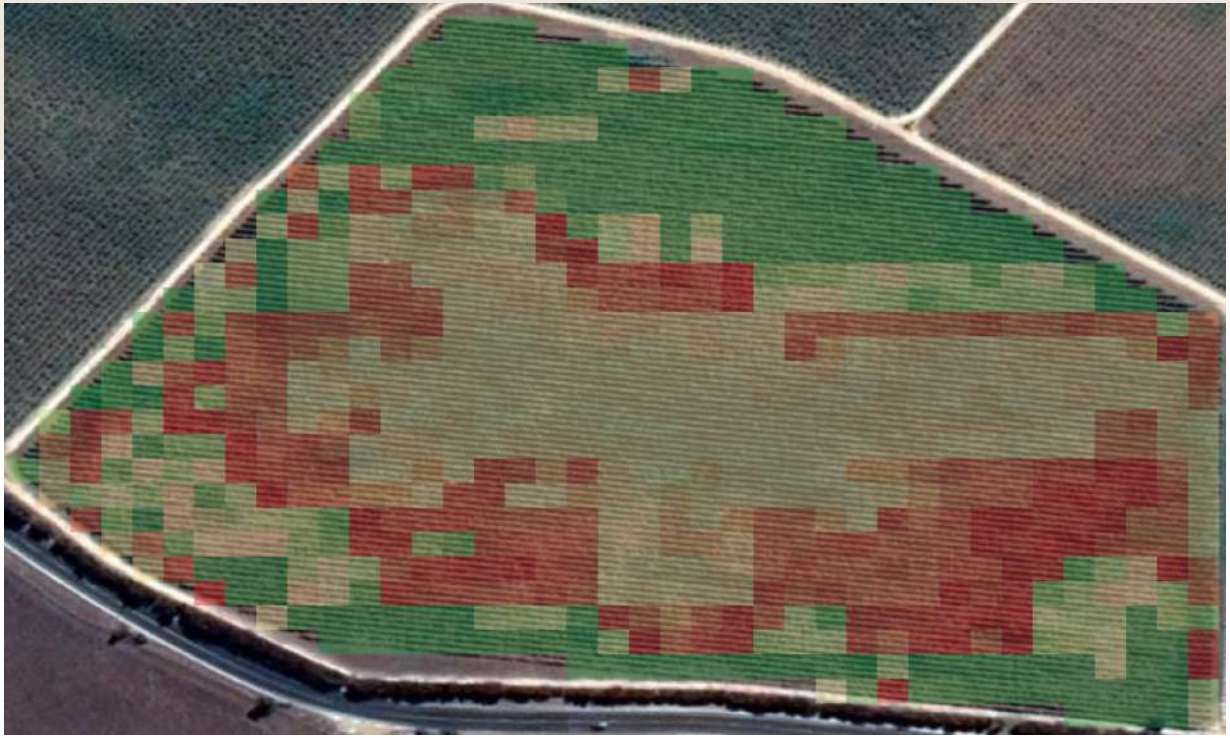
Brix / Baume Heat Maps

Identify areas of the vineyard for split picking opportunities
Ensure consistent quality across the vineyard
Target locations for sample testing
Identify grapes for quality upgrade and downgrade opportunities.
2022 - Reduce sampling required

Brix / Baume Heat Maps

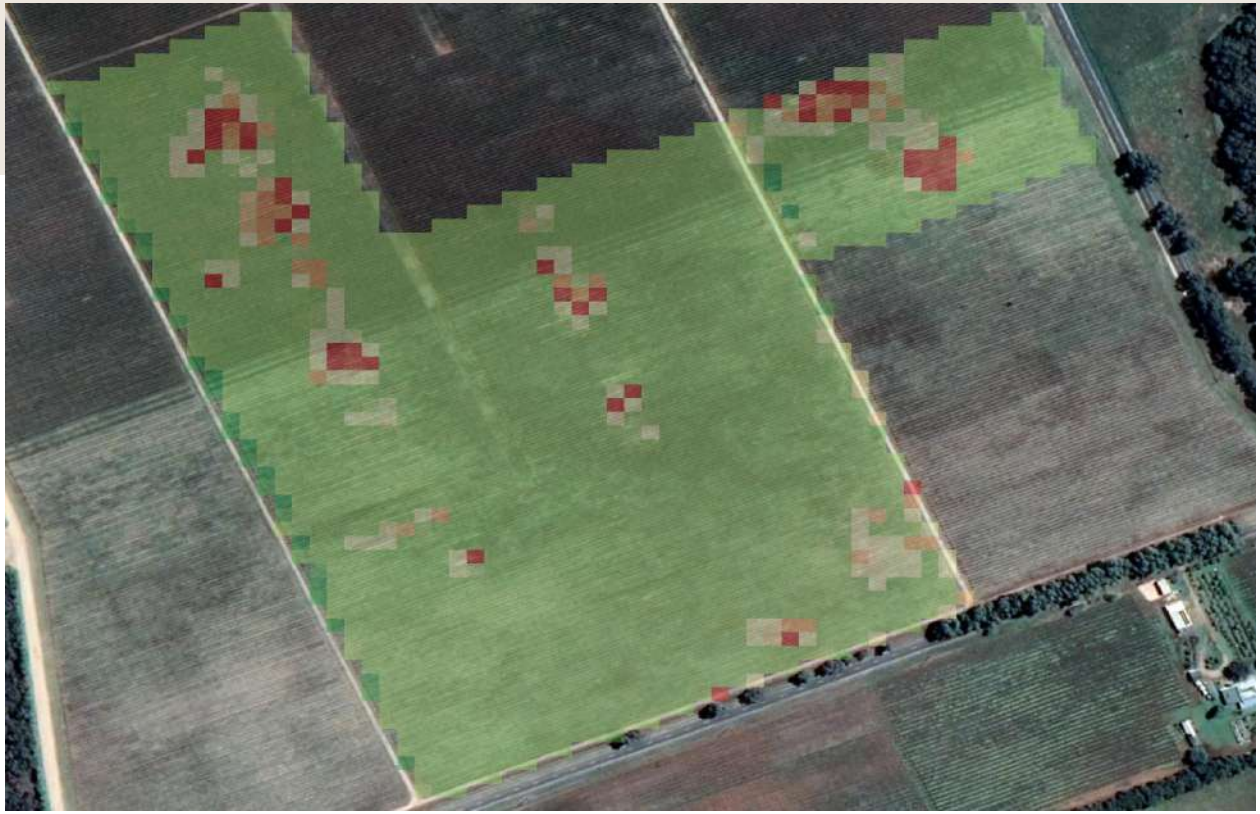
Brix / Baume variable blocks



Variability
Variability in the brix / baume of the block

Brix / Baume Heat Maps

Brix / Baume variable blocks



Small Variability
Small variability in the brix / baume of the block, but good to know.

Brix / Baume Heat Maps

Brix / Baume consistent blocks

Consistent
Consistent brix / baume of the block

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Brix / Baume Heat Maps

Brix / Baume in-consistent blocks

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6.

Maturity and Harvest Date

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Harvest Date

Optimize harvest costs
by planning accurate harvest dates

Automatic updates
of harvest scheduling

Accurate coordination
and reporting between wineries and growers

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Maturity and Harvest dates

- Maturity Curve
- Harvest date prediction.
- Maturity from Satellite imagery
- 4 readings to high accuracy

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7.

Yield prediction (Crop Estimates)

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Hands off yield prediction

Save time in sampling
to get more accurate results

1-2% avoidance
of loss destructive sampling

Accurate coordination
and reporting to wineries
maximizing commercial terms

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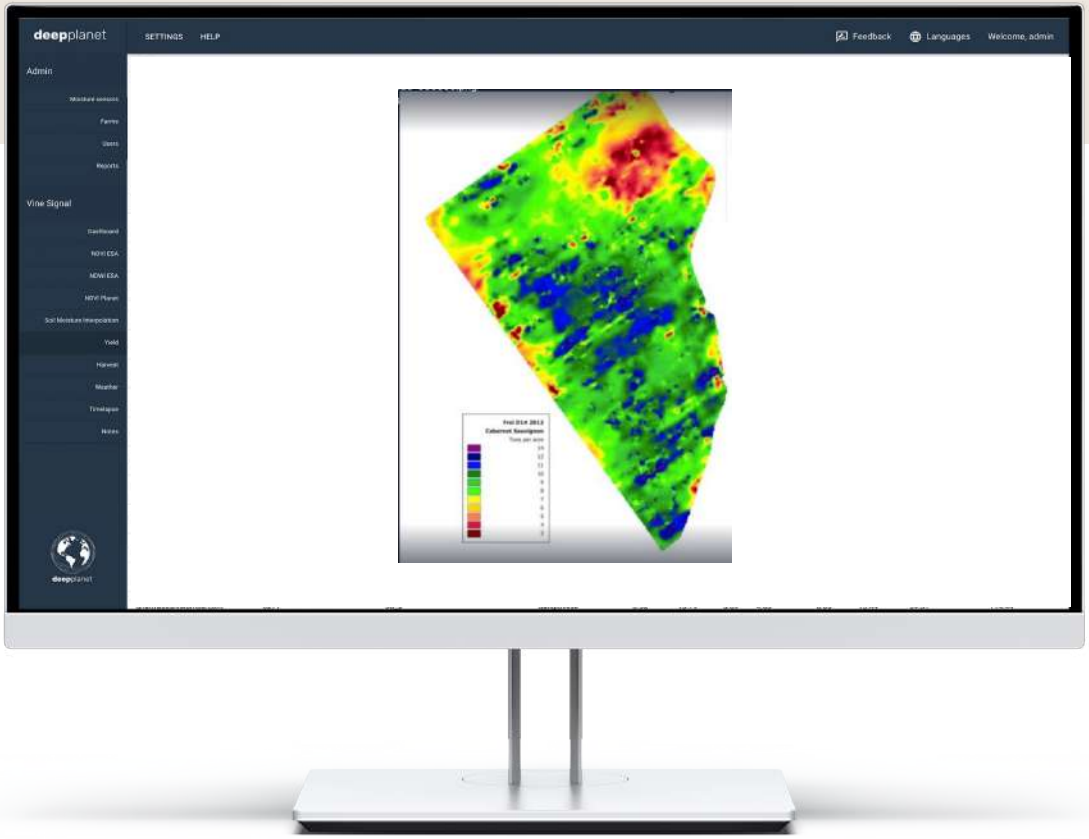
Yield Variability Maps - Beta



- Understand visually yield production vineyard areas
- Combined with quality maps can build profitability visuals.

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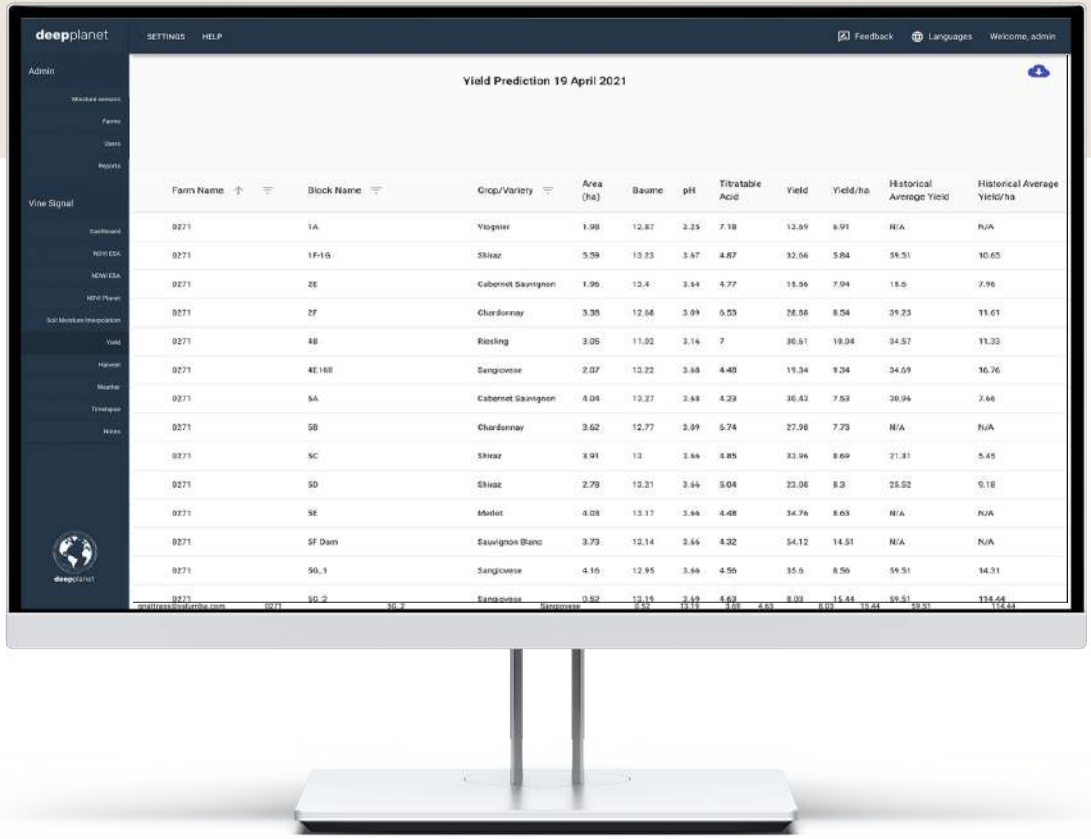
Yield Planning



- H/M/L Estimates of yield by block using Satellite Imagery, Weather, Historical Data.
- Hands of yield prediction, provide weekly adjustments.
- Data dependent.

Imagery

- Regular heartbeat
- Daily, weekly and monthly change monitoring.
- Health and Growing

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8.

Health and Growing

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Growing

Normalised Difference Vegetation Index (NDVI)

Benefits:

Focus your time

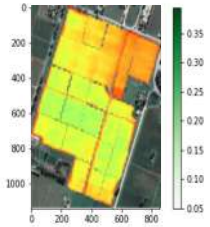
See and predict changes to remedy before they occur

$100/ha per tractor run

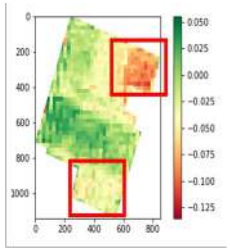
$330/ha Variable rate vs uniform

$50-100/t LVY v HVY grapes

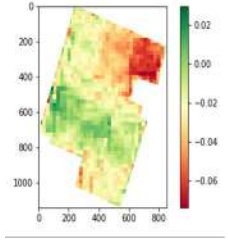
NDVI of Signature Vineyard from sentinel imagery, 28/11/19



Difference in NDVI on 28/11/19 from previous image. Highlighted areas have shown a decline in vegetation health.



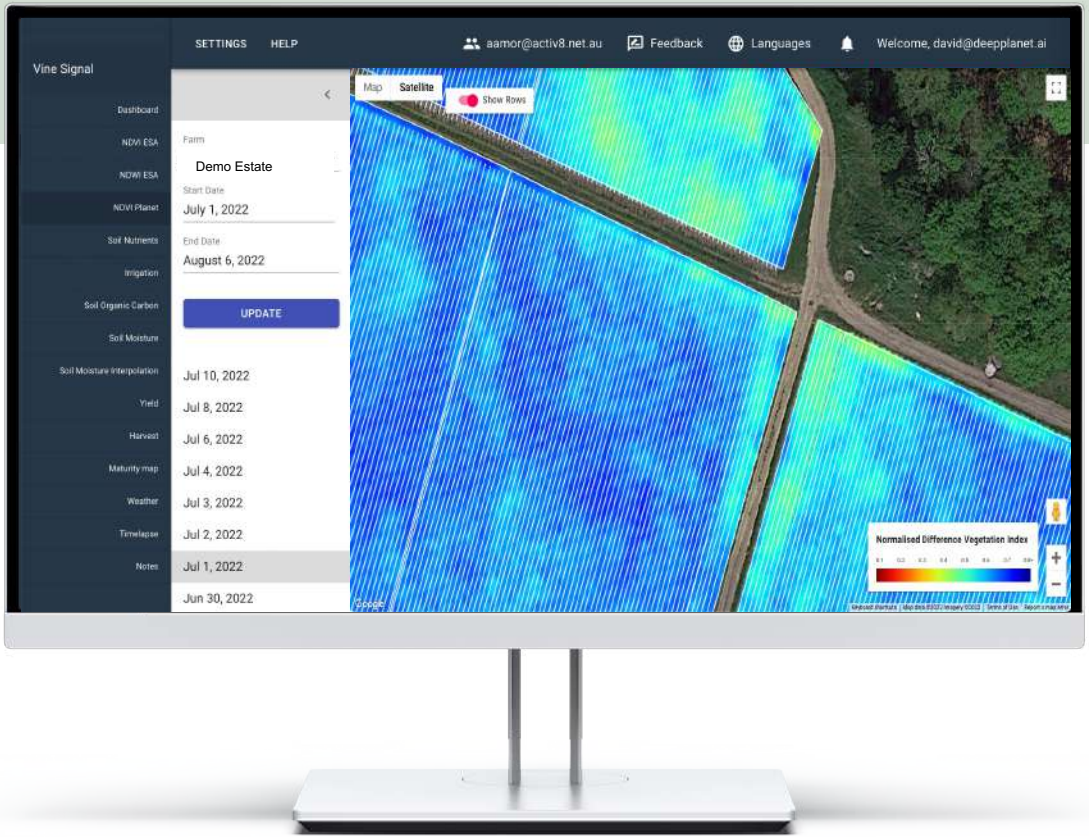
Difference in NDVI on 28/11/19 against the average for the previous month.



- Monitor changes frequently across multiple vineyards
- Daily, Weekly and Monthly
- Season Summary

VineSignal Product – Demo

Daily and High Resolution Imagery

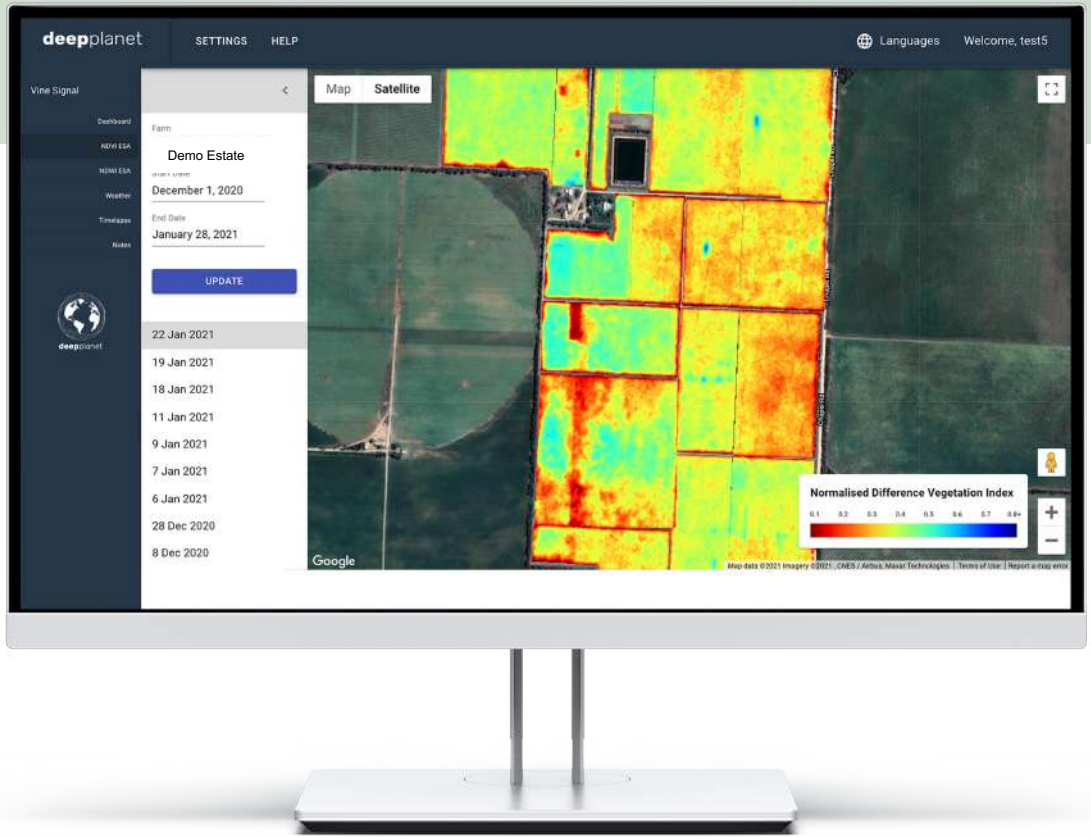


Daily and High Resolution Imagery

- Daily imagery
- Every 3 vines per pixel
- High Resolution
- 2x a month during the season
- Identify each individual vine

VineSignal Product – Demo

Growing

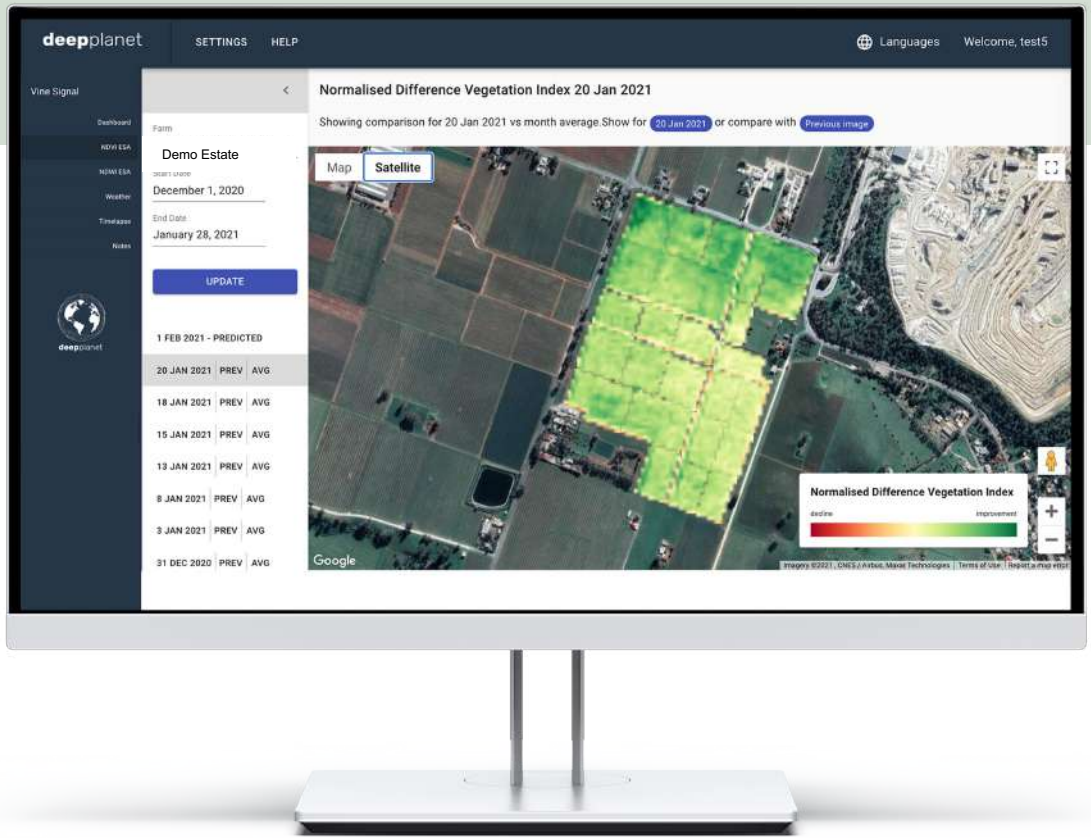


Irrigation leaks

- Daily imagery
- Every 3 vines per pixel

VineSignal Product – Demo

Growing



Daily, Weekly and Monthly Change

Example of Vineyard well managed and consistent variability

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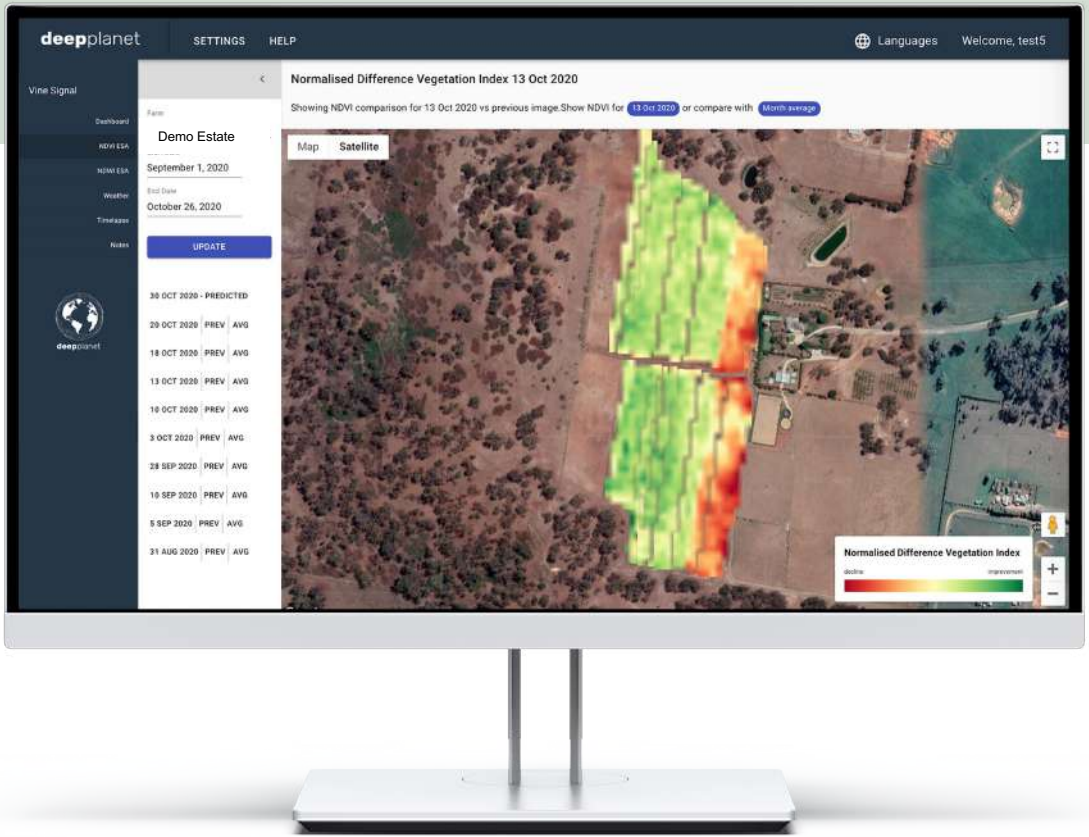
Growing



Daily and Weekly Change

Identification of affected area from a frost event

Vineyard showed decline after the frost event

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9.

Notes and Work Mgt

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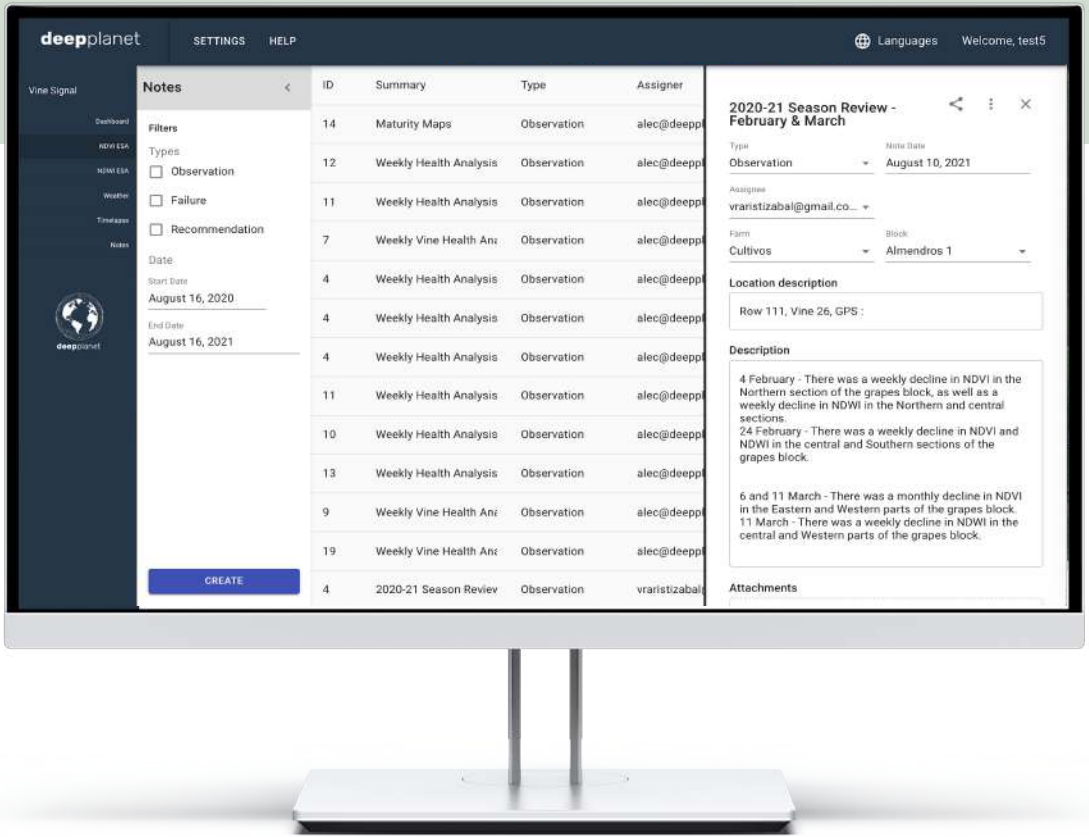
Vineyard Notes and Work Management



- Build vineyard history.
- Record notes & work mgt.
- Share with others within org and external.
- Delegate work.
- Record inspection data.
- Record pest, disease and failure data.
- Get feedback from field.
- Integrate with spray diaries and statutory systems.

VineSignal – $USD

Getting Started

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Sign up today

https://www.deepplanet.ai/vinesignal-signup

- 15 minutes to sign up
- Send us your blocks
- We'll do mapping
- Free tool
- 14 day trial
- ***Enterprise pricing available***

A la Carte

- Disease
- Soil Organic Carbon
- Soil Nutrients

Imagery

Daily Vine health and Leaf Health, Weather, Notes

Setup in 15 minutes

$10 acre per year

Winemaker & Logistics

Imagery + 2 week prediction of leaf and soil health

Setup in 1 day

$25 a vineyard block or plot

Grower and Sustainability

Imagery + Soil Organic Carbon, Soil Nutrients, Disease, Leaf Nutrients, Leaks, Evapotranspiration

Setup in 3 days

$25 acre per year

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AI for Sustainable Precision Viticulture

VineSignal

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