PROJECT CATALYST

PRACTICE FACT SHEET

NDVI: SATELLITE IMAGERY & VEGETATION INDICES

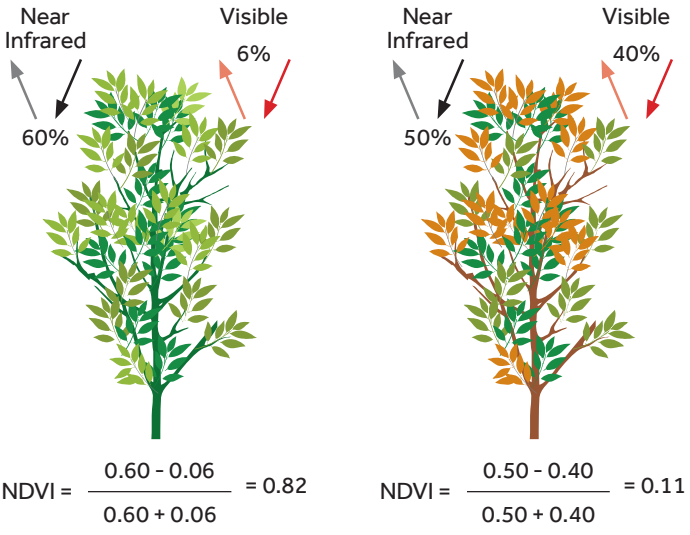
Project Catalyst is a grower-led innovation project in sugarcane that was formed to explore, validate and broadly adopt management practice changes for productivity gains and improved water quality for the Great Barrier Reef.

WHAT IS IT?

Normalised Difference Vegetation Index (NDVI) is a measure of the amount of living green vegetation. Green, healthy plants with plenty of chlorophyll reflect more near-infrared (NIR) and green light while absorbing visible red and blue light whereas sick, dry plants that are browning off absorb near-infrared and reflect red light.

The difference in this absorption and reflection can be captured in a fraction that provides a value between -1 and +1 for the density of vegetation in an area and its greenness. As cover and greenness increase, the NDVI value gets closer to +1.

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$



$$NDVI = \frac{0.60 - 0.06}{0.60 + 0.06} = 0.82 \qquad NDVI = \frac{0.50 - 0.40}{0.50 + 0.40} = 0.11$$

Above - Differences in NDVI based on plant health status

HOW DOES NDVI MAPPING WORK?

NDVI maps are generated from remote sensing data, mainly drone or satellite imagery, like the Sentinel-2 multispectral imagery which includes red and near-infrared image bands as well as a number of other useful spectral bands. The NDVI formula is applied to the NIR and red image data to determine an NDVI value for a particular area.

The satellite revisit every 5 days with potential for up to 73 maps per year. However, cloud or smoke cover may obscure the images and reduce their quality or usability so that it is only possible to compose 5-10 full sets of maps each year.

HOW IS IT USED?

NDVI is a standard method for determining sugarcane growth and crop health though it can become less effective in the later stage of the crop when it matures. In such cases, variations on the index such as Green-NDVI (GNDVI) can be useful.

NDVI maps enable growers and advisors to determine crop health at both spatial and temporal scales. Additional value comes from comparing NDVI with electromagnetic induction (EM) and soil maps to investigate yield constraints from either soil or plant health challenges. NDVI maps are also useful in determining the efficacy of management changes. NDVI maps are commonly used to monitor the response of crops to amelioration, such as lime, gypsum or mill mud within a block. There is also potential for NDVI and other plant health indices to support yield maps and measure nitrogen use efficiency (NUE) to estimate the N response of a crop or across a block in future.

VARI

An alternative to NDVI when it is not possible to access NIR images is to use readily available RGB images to generate Visible Atmospherically Resistant Index (VARI) maps. This is helpful when RGB-captured drone images are used to investigate poor areas in-field at a finer scale.

$$VARI = \frac{Green - Red}{Green + Red - Blue}$$

While VARI is not a direct substitute for NDVI, these maps are able to replicate the same patterns and trends seen within VARI to provide a useful indicator of crop water demand and plant health and can be used to determine variability within a crop.

CASE STUDY 1

Grower 'X' also had an older ratoon block with a history of significant patchiness. After speaking with their agronomist, they decided to address the soil-related issue in plant with an application of banded mud across the bare zones. The block was EM mapped and the zones for mud application identified. Mud was then applied to the areas where there was poor strike in plant.

As part of the ongoing monitoring of the block NDVI maps were generated to compare the growth and vigour of cane in the mud and no-mud zones. While the areas of poor strike were still visible in the first few months after the mud application, the NDVI comparisons showed that over the course of the plant crop the mud appeared to provide moisture and nutrients that improved and maintained the growth and vigour of the cane through the abnormally dry summer in early 2022. NDVI mapping has continued to show the improvement of the cane in the mud zones to the extent that the zones without mud have appeared marginally poorer in comparison.

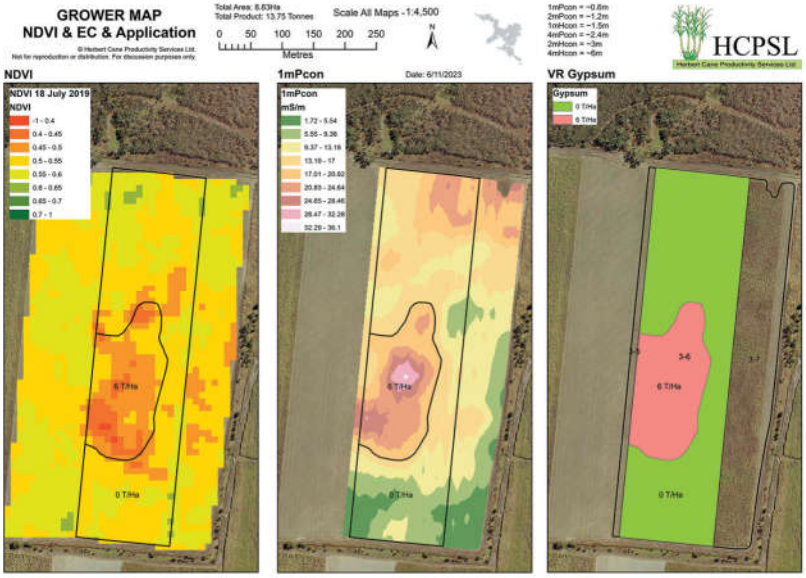
Using NDVI maps for monitoring has given the grower confidence that the lower rates of banded mud have been effective in improving the health and evenness of their crop. The grower is now using NDVI mapping to monitor plant health and the effect of other ameliorant applications across their farm.

CASE STUDY 2

Grower 'Y' was aware of a patch in his cane block which always struggled to grow cane. To investigate the total area affected and how badly the cane was performing Grower X's agronomist EM mapped the block after harvest and generated a series of NDVI maps to look back at past cane growth.

Reviewing the NDVI mapping showed a large, poor zone in the middle of the block, normally out of sight until harvest. The corresponding EM map and analysis also showed a large, central area with higher EM values.

After soil testing based on the EM map, an application of gypsum at 6t/ha was recommended and the grower decided to apply the gypsum zonally as the NDVI showed the rest of the block was performing to potential. Using the EM and NDVI map layers a zonal application map was produced for the grower to apply amendments. NDVI maps produced post-application also allowed the grower and agronomist to monitor the improvement in cane growth through the season.



Australian Government
REEF TRUST
Great Barrier Reef Foundation
THE Coca-Cola FOUNDATION
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Project Catalyst is funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation, The Coca-Cola Foundation and WWF-Australia.

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