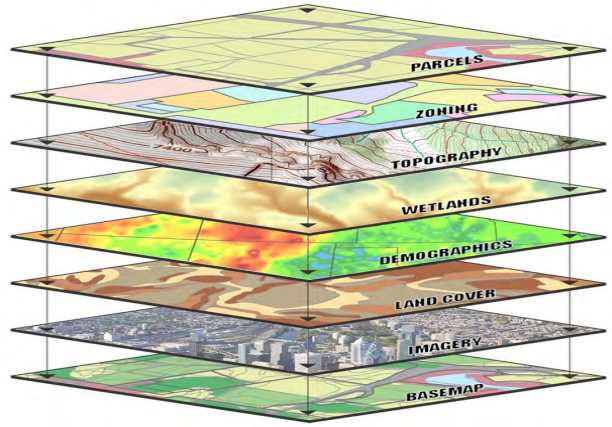
VALUE of NDVI For VARIABLE RATE FERTILISER APPLICATIONS IN PASTURE

- What is NDVI
- Applying NDVI stacked imagery in Pastures across our local region to identify soil sampling zones/areas of high & low plant growth variability
- Interpreting soil test results - Pasture yield limiting constraints
- Calculating Fertiliser rates based on the 95% Critical Nutrient Value for a particular soil type
- Target Zone apply Fertiliser inputs to where they are more needed
- Target Zone inputs to achieve a Cost Saving benefit
- Overall Aim to increase Pasture production in the Lower & Higher yielding zones – increased animal production – increased profit

RGB Image NIR Image NDVI Image

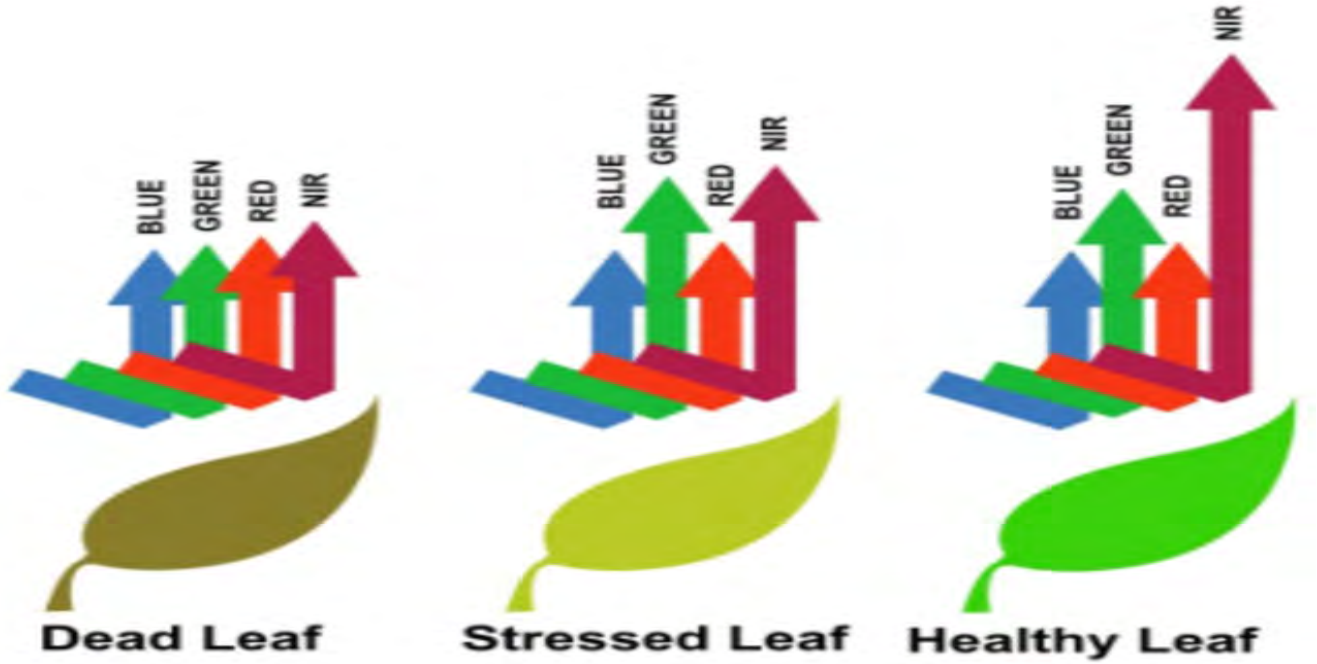


NDVI Stacked

- RGB (red, geen, blue) colour imagery is similar to viewing a digital photograph taken from a plane

- NIR – (Near infrared) imagery provides a greater assessment of plant health than traditional photos by visualizing colour bands outside of what the human eye can see. NIR sensors capture light invisible to the human eye...
  There are two main sensor types: Multispectral cameras and Modified RGB cameras

- NDVI – (Normalized Difference Vegetative Index) is a commonly provided index that assesses Plant biomass/vigour & health based on a mathematical interpretation of colour and NIR near infrared data



As you can see, a stressed leaf and a healthy leaf reflect nearly the same amount of blue, green, red light, but a healthy leaf reflects more NIR near-infrared light

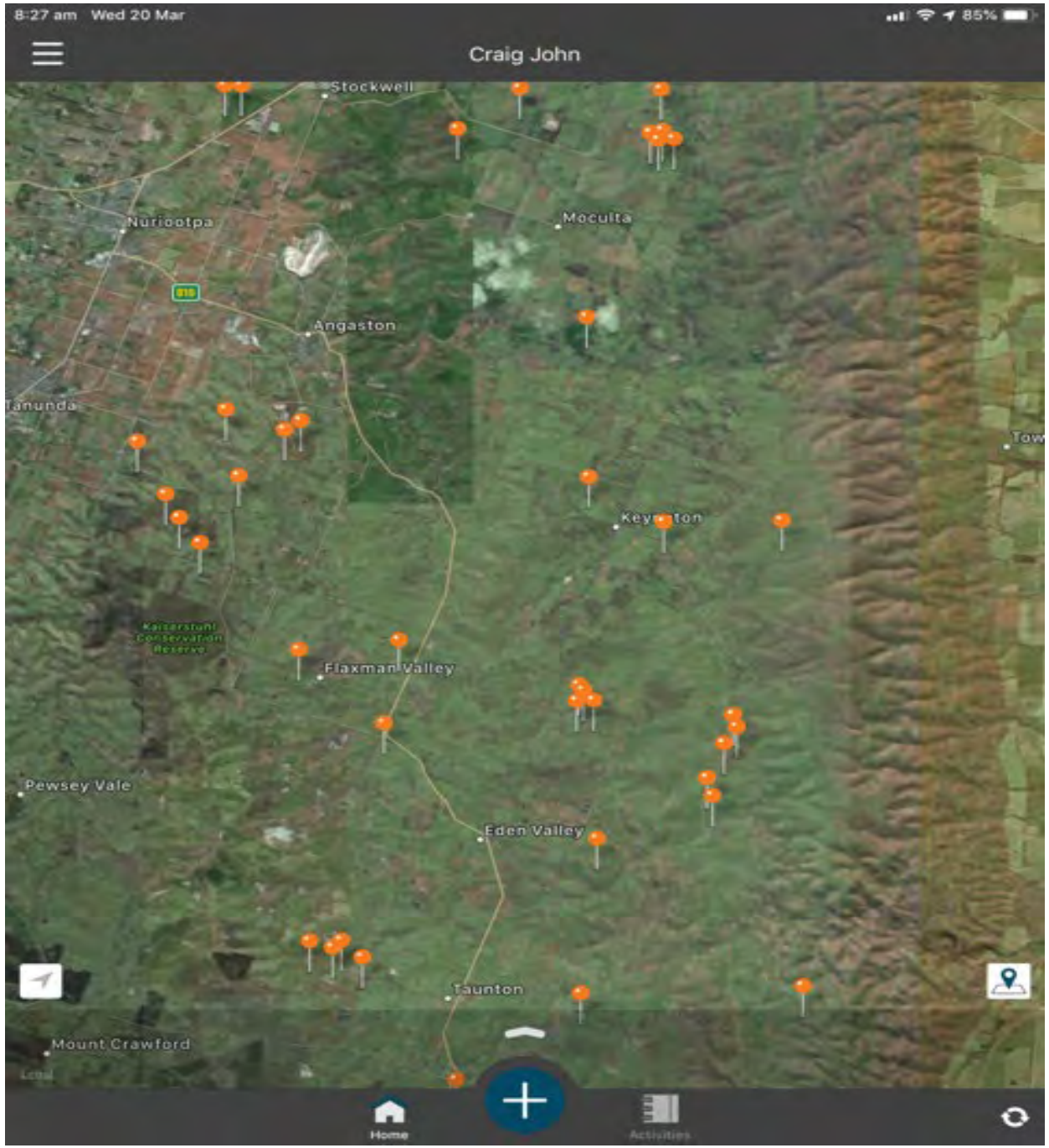
NDVI, simply put, is a calculation of vegetation biomass and/or crop health. Mathematically comparing Red and NIR light signals can help differentiate plants from non-plants (soil, water) and healthy plants from sick plants

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

NDVI values will range from -1 to +1

The higher the index value (more positive), the greater the crop health and vigour

- Government Departments, Scientists and Agronomists first began using NDVI in the late 1970s
- NDVI has now become a successful low cost tool to easily and quickly assess crop or pasture health
- Over the last Decade Remote-Sensing has achieved large improvements in access to high resolution NDVI satellite imagery, sensor system technologies and digital computing at a lower cost…
- Today in precision agriculture, NDVI is the most common vegetation index captured using satellites and drones.. (Satellite Ground Resolution - Sentinel 10m / Landsat 30m)


8:27 am Wed 20 Mar
85%
Craig John
Stockwell
Nuriootpa
Moculta
Angaston
Tanunda
Keyneton
Flaxman Valley
Pewsey Vale
Eden Valley
Taunton
Mount Crawford
Home
Activities

- What is the 95% Critical Nutrient Value for a particular soil type ?
- Phosphorous Buffer Index PBI = (Ps + Colwell P)/c0.41) is used to help Predict Critical Soil P Values

SOIL TEST	Target 95% Critical Value SOIL 0-10 10-20	Pasture Dry Matter Response KgDM/kg Nutrient Applied	Dry Matter Value DM @ 25c/kg	Nutrient Cost Value per Kg	Break Even Dry Matter Response Kg DM
Nitrogen (mg/kg)	20-35	5-35	$1.25 - $8.75	$1.15	**5**
Phosphorous (mg/kg colwell)	25-40	5-35	$1.25 - $8.75	$3.60	**14**
Potassium (mg/kg colwell)	80-150	5-35	$1.25 - $8.75	$1.25	**5**
pH (CaCl) (Lime per Tn rate)	**5.0-5.5**	**150-550**	**$38 - $138**	**$55**	**220**
Organic Matter (%)	>3.4				
Organic Carbon (%)	>2.0				

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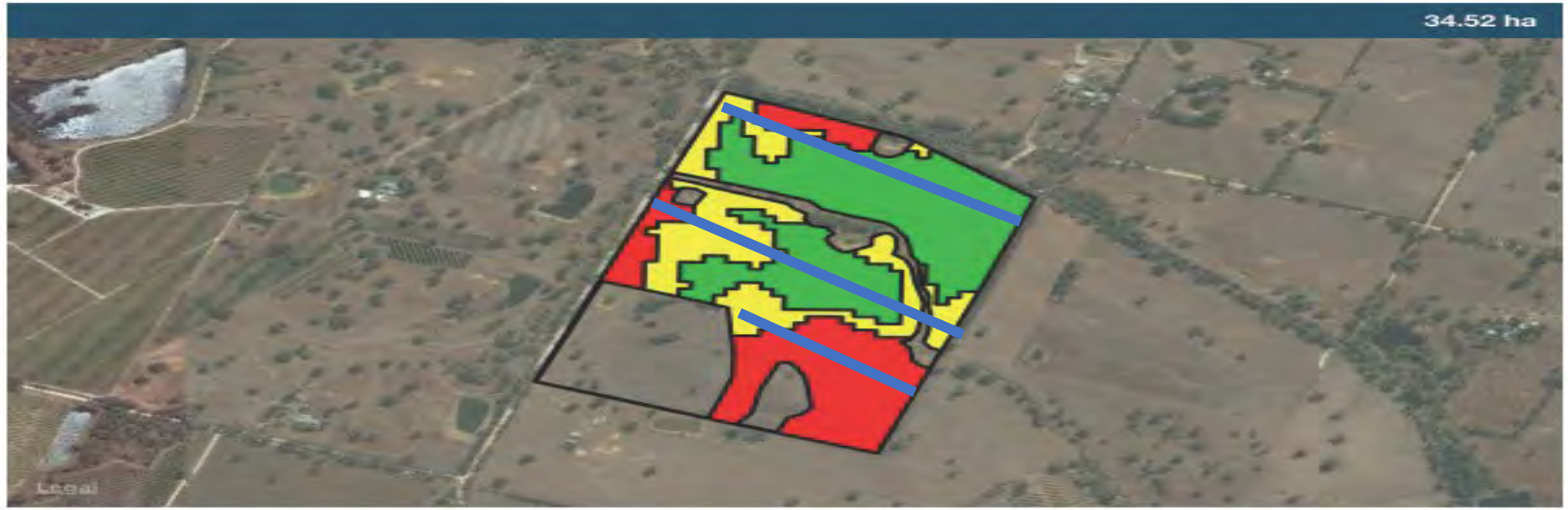

Name	Area
High	15.49 ha
Mid	8.96 ha
Low	10.07 ha

SOIL TEST	Low NDVI SOIL 0-10 10-20	High NDVI SOIL 0-10 10-20	Low NDVI Nutrients / Lime (kg/ha)	High NDVI Nutrients / Lime (kg/ha)	Low NDVI Growth Response KgDM/ha (350/tn lime)	High NDVI Growth Response KgDM/ha (350/tn lime)	ROI Low NDVI ($245 DM @ 25c/kg – $154 Lime @ $55/tn)	ROI High NDVI ($61 DM @ 25c/kg – $39 Lime @ $55/tn)	MONEY SAVED Total 34ha Vs 15ha High 10ha Low 9ha Mid
Nitrogen (mg/kg)	7	10	35 ($41)	35 ($41)	525 ($131)	525 ($131)			
Phosphorous (mg/kg colwell)	24	23	30 ($110)	30 ($110)	600 ($150)	600 ($150)			
Potassium (mg/kg) 0-20cm	94	64	35 ($44)	55 ($69)	525 ($131)	825 ($206)			
pH (CaCl)	**4.5**	**5.1**	**2800**	**700**	**980**	**245**	**$91 DM/ha**	**$22 DM/ha**	**$1700 ($50/ha)**
Aluminium (%)	1.6	0.7							
Sodium (%)	3.1	2.3							
CEC (meq/100g)	5.3	5.4							
Organic Matter (%)	3.8	3.2							
Organic Carbon (%)	2.2	1.9							

Coopers Farm Supplies - VI Pressure - Plt: 85662611

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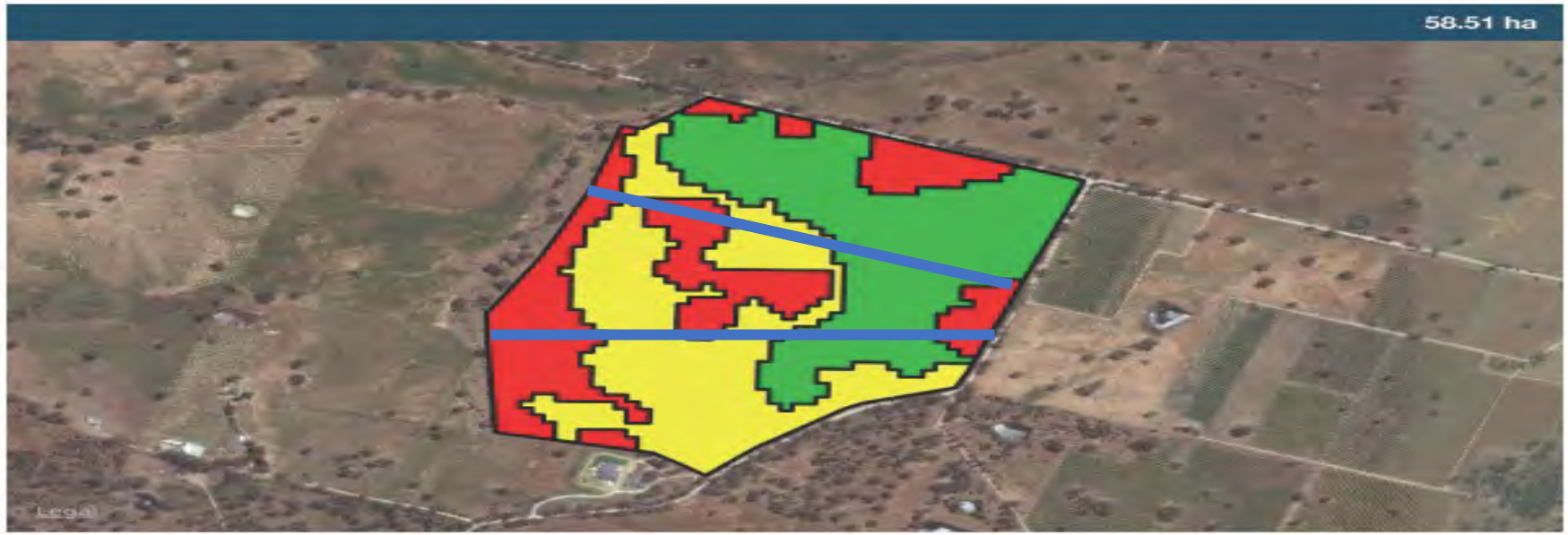

Name	Area
High	21 ha
Mid	20.95 ha
Low	16.56 ha

SOIL TEST	Low NDVI SOIL 0-10 10-20	High NDVI SOIL 0-10 10-20	Low NDVI Nutrients / Lime (kg/ha)	High NDVI Nutrients / Lime (kg/ha)	Low NDVI Growth Response KgDM/ha (15/kg K) (350/tn lime)	High NDVI Growth Response KgDM/ha (15/kg K) (350/tn lime)	ROI Low NDVI (K $131 DM @ 25c/kg – $44 K @ $1.25/kg). (Lime $219 DM @ 25c/kg – $137 Lime @ $55/tn)	ROI High NDVI	MONEY SAVED Total 58ha Vs 16ha Low 21ha Mid
Nitrogen (mg/kg)	11	12	35 ($41)	35 ($41)	525 ($131)	525 ($131)			
Phosphorous (mg/kg colwell)	13	12	55 ($200)	55 ($200)	1650 ($400)	1650 ($400)			
Potassium (mg/kg) 0-20cm	**85**	**220**	**35**	**0**	**525**		**$87 DM/ha**		**$930 ($16/ha)**
pH (CaCl)	**4.6**	**5.5**	**2500**	**0**	**875**		**$82 DM/ha**		**$2900 ($50/ha)**
Aluminium (%)	1.8	1.1							
Sodium (%)	3.1	1.6							
CEC (meq/100g)	2.4	5.5							
Organic Matter (%)	1.7	2.9							
Organic Carbon (%)	1.0	1.7							

Coopers Farm Supplies - VR Prescript - Pts: 85663011

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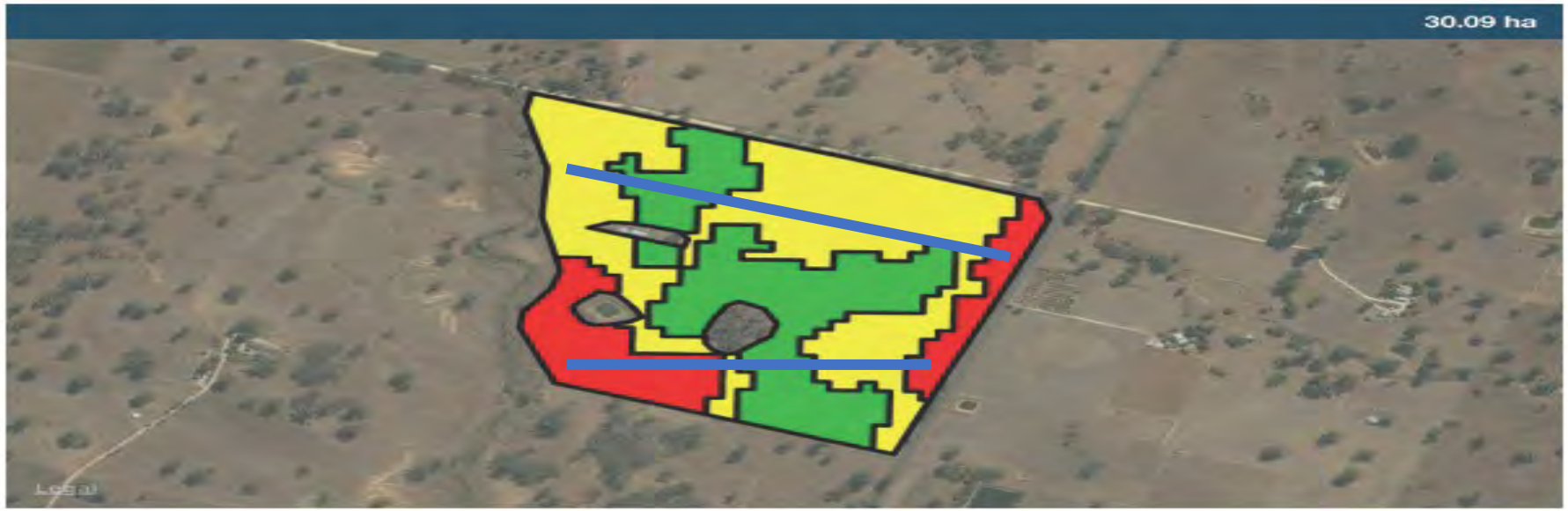

Name	Area
High	9.98 ha
Mid	14.71 ha
Low	5.4 ha

SOIL TEST	Low NDVI SOIL 0-10 10-20	High NDVI SOIL 0-10 10-20	Low NDVI Nutrients / Lime (kg/ha)	High NDVI Nutrients / Lime (kg/ha)	Low NDVI Growth Response KgDM/ha	High NDVI Growth Response KgDM/ha	ROI Low NDVI (25c/kg DM)	ROI High NDVI (25c/kg DM)	CARBON FOO VALUE
Nitrogen (mg/kg)	13	13	35 ($41)	35 ($41)	525 ($131)	525 ($131)			
Phosphorous (mg/kg colwell)	86	56	5	5					
Potassium (mg/kg) 0-20	89	80	30 ($38)	40 ($50)	450 ($113)	600 ($150)			
pH (CaCl)	5.1	5.2							
Aluminium (%)	1.0	1.4							
Sodium (%)	1.7	2.0							
CEC (meq/100g)	4.0	5.8							
Organic Matter (%)	2.0	3.0							
Organic Carbon (%)	**1.1**	**1.8**	65kg N mineralised	110Kg N mineralised	**3000**	**5000**	**$750 DM/ha**	**$1250 DM/ha**	**$500/ha**

Coopers Farm Supplies - VI Prescript - Ph: 85662011

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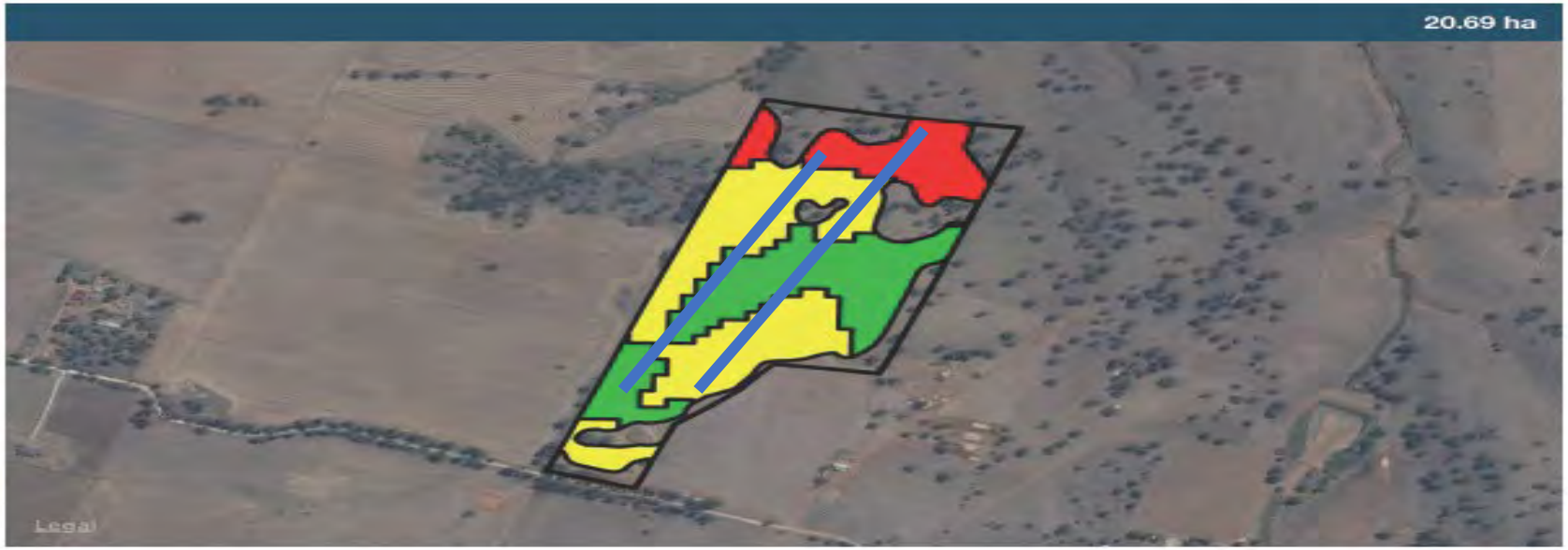
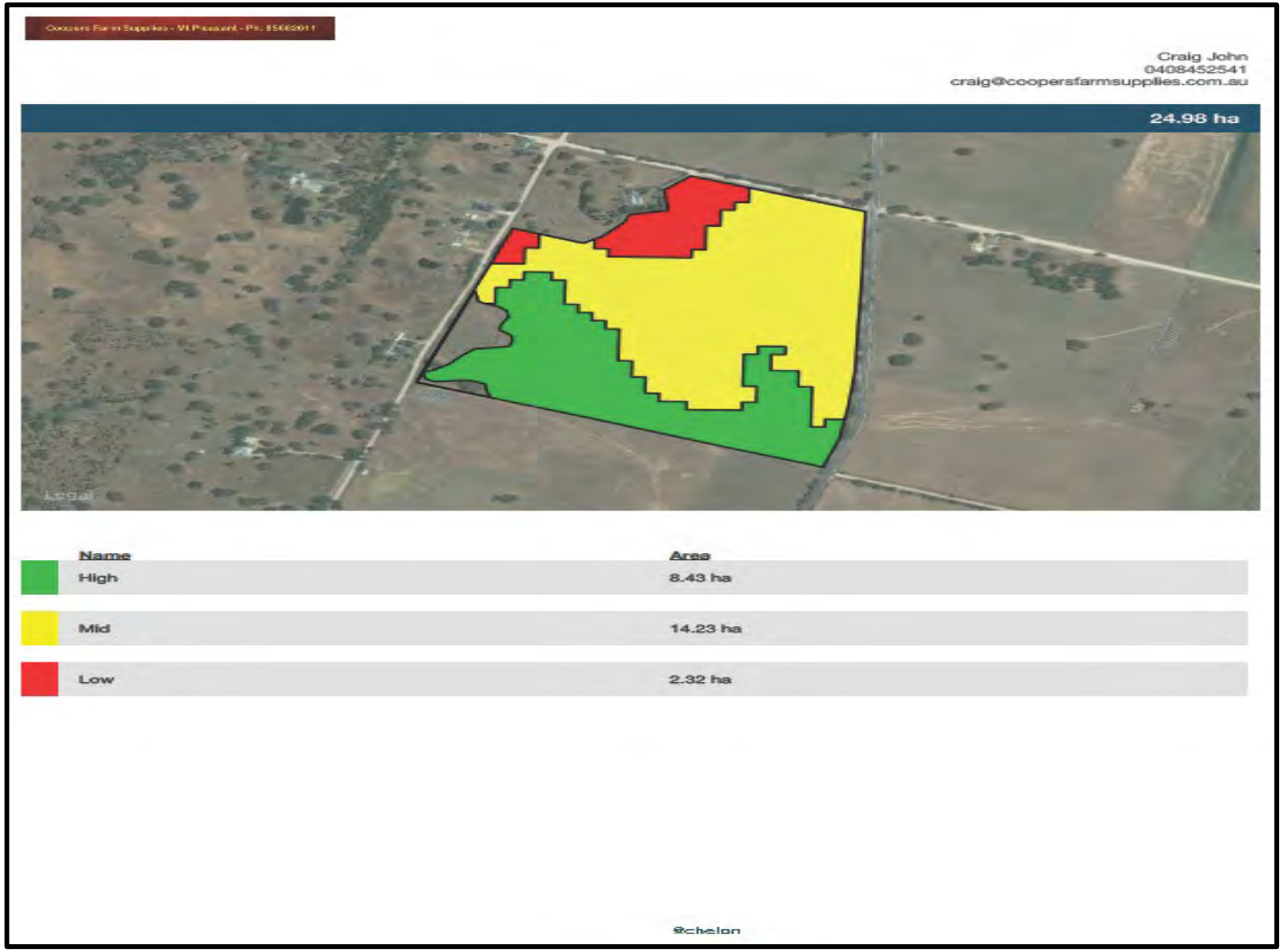


	Name	Area
	High	7.25 ha
	Mid	9.9 ha
	Low	3.53 ha

SOIL TEST	Low NDVI SOIL 0-10 10-20	High NDVI SOIL 0-10 10-20	Low NDVI Nutrients / Lime / Gypsum (kg/ha)	High NDVI Nutrients / Lime / Gypsum (kg/ha)	Low NDVI Growth Response KgDM/ha (350/tn lime)	High NDVI Growth Response KgDM/ha (350/tn lime)	ROI Low NDVI ($ DM @ 25c/kg – $ Lime Gyp @ $55/tn)	ROI High NDVI ($ DM @ 25c/kg – $ Lime Gyp @ $55/tn)	MONEY SAVED by FOO Total 21ha 7ha High 4ha Low 10ha Mid
Nitrogen (mg/kg)	11	11	35 ($41)	35 ($41)	525 ($131)	525 ($131)			
Phosphorous (mg/kg colwell)	47	50	7	7					
Potassium (mg/kg) 0-20cm	**195**	360							
pH (CaCl)	**4.4**	**4.5**	**3200**	**2800**	**1120**	**980**	**$104 DM/ha**	**$91 DM/ha**	-$165 lime **+ $30/ha**
Aluminium (%)	**3.5**	1.9							
Sodium (%)	**11**	**11**	**3000**	**3000**	**1050**	**1050**	**$98 DM/ha**	**$98 DM/ha**	-$165 Gyp **+ $30/ha**
CEC (meq/100g)	4.8	5.8							
Organic Matter (%)	3.1	3.3							
Organic Carbon (%)	1.8	1.9							

Soil sampling error ?



SOIL TEST	Low NDVI SOIL 0-10 10-20	High NDVI SOIL 0-10 10-20
Nitrogen (mg/kg)	4	6
Phosphorous (mg/kg colwell)	32	18
Potassium (mg/kg) 0-20	74	128
pH (CaCl)	4.9	4.4
Aluminium (%)	0.5	4.8
Sodium (%)	2.1	2.7
CEC (meq/100g)	5.3	3.3
Organic Matter (%)	3.4	2.4
Organic Carbon (%)	2.0	1.4

Where to from here….

- Create Variable Rate prescription maps – use spreader to target apply calculated inputs where most needed
- Setup double rate Test Strips that run across sections of Low, Med & High NDVI zones
- Measure the Dry Matter yield response just prior to grazing – a must do

- **Measure Dry Matter Response from applied Nutrients**

Supported Yield Formats

- John Deere
  - Original GS (.GSD or .GSY)
  - GS2 (RCD Folder)
  - GS3 (GS3_2630 Folder)
- AgLeader
  - Advanced Text (.txt)
  - YLD (.yld)
  - ILF (.ilf)
  - AGDATA (.agdata)
- Case
  - Case IH YLD (.yld)
  - Voyager 1 (.CN1 Folder)
  - Voyager 2 (.CN1 Folder)
- Precision Planting
  - YieldSense (.dat)
- Raven (.jdp.zip & .jdf)
- Trimble
  - TaskData.xml (.xml)
- Enalta
  - TXT (.txt)
  - XML (.xml)
- FieldStar II
  - TaskData.xml (.xml)

**Text in parenthesis indicates which file(s) or folder(s) are required to be zipped prior to upload.*

- **Ability to Format Variable Rate Prescription maps that will upload into any monitor manufacturer in Aust**
- **Some monitors use 'shape files' however others need a more specific file type - onto USB - into monitor**

SUMMARY

- NDVI stacked imagery is very useful to identify areas of high and low Pasture variability

- Ground truthing is highly important by **Measuring** the variation in Pasture Growth response to the double-rate Vs single rate fertiliser/lime test strips

- By applying NDVI and Variable Rate inputs in Pasture, there is scope for significant cost saving benefits to be gained and to increase animal production and gross margin profit