



Australian Government
**Department of Agriculture,
Fisheries and Forestry**



A new northern PDS: Nitrate Supplements, Nutritional Wisdom, Methane and Remote Technologies



Webinar contents:

- 1. Basics of Non-Protein Nitrogen (NPN) Supplementation**
- 2. Nutritional Wisdom**
- 3. Methane from Livestock - basics**
- 4. PDS trial**



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Bionutric PTY LTD



HARRINGTON SYSTEMS ELECTRONICS



Non-protein Nitrogen Supplementation

1. Nitrate introduction
2. Protein fundamentals
3. Digestion of Urea and Nitrate
4. Urea or Nitrate as a NPN source
5. Urea or nitrate supplementation?



Prof. John Nolan
Animal Nutrition
UNE

Poll Question #1



Introducing Nitrate supplementation

- An alternative source of NPN compared to urea
- A N source for growth of rumen microbes
- Typically causes a 10-20% reduction in methane
- A UNE feedlot study showed a 3% better feed conversion efficiency with nitrate rather than urea

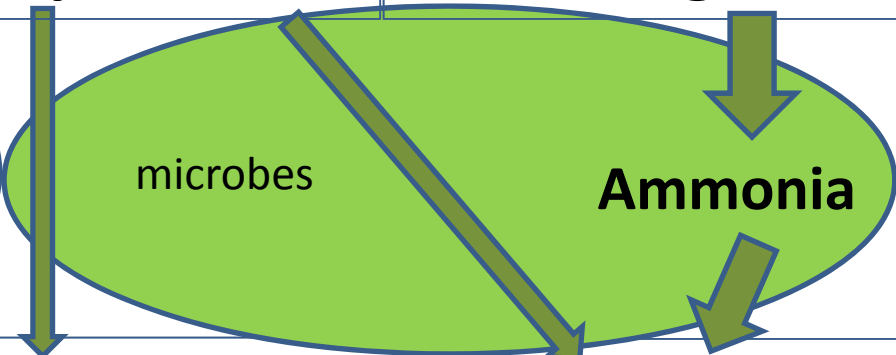
Practical application will more likely be for ruminants on dry, low-protein roughages (dry periods when NPN supplements are widely used)



Feed Protein

True protein **Non-Protein Nitrogen**

Urea or Nitrate



Feed/bypass protein **Microbial protein**

Protein for animal growth

Urea and Nitrate in the Rumen

- Rumen microbes degrade urea supplements to carbon dioxide and **ammonia**
- Microbes degrade nitrate to nitrite and then **ammonia**
- Both provide **ammonia** to support microbial growth and protein production in the rumen



Nitrate reduces methane emissions

- Hydrogen is normally produced in the rumen and is converted to methane (CH_4) and belched out
- When nitrate is present, H_2 is used by microbes in the following reaction
 - Nitrate (NO_3) \rightarrow Nitrite* \rightarrow Ammonia (NH_3)
- So, there is less H_2 available for methane production
 - * nitrite is the salt that causes toxicity

Urea or Nitrate as NPN Supplements

- An alternative source of NPN to urea
- Most graziers have experience with urea supplements
- Excessive intakes risk toxicity but minimize risks by careful management – and benefits outweigh the risks
- Nitrate carries similar risks to urea, but is also an excellent NPN supplement and has antidote
- In addition, nitrate reduces methane emissions in both sheep and cattle.

Poll Question #2



Urea or Nitrate Supplementation?

- Research is still required but nitrate benefits look promising
- As NPN supplements, nitrate and urea give similar production outcomes
 - In addition, nitrate reduces methane emissions;
 - however, currently nitrate (Bolifor) costs more than urea
- Unlikely that current government policy will adequately reward graziers financially for reducing greenhouse gas emissions.



Nutritional Wisdom

une

University of
New England

1. The conundrum
 - *What supplementation strategy*
2. Euphagia
 - *Is Nutritional Wisdom the answer?*
3. Examples of Nutritional Wisdom
4. Free choice
 - *A novel approach to Supplementation*



Prof. Ron Leng
Managing Director
Bionutric PTY LTD
Rumen nutritionist

Poll Question #3



Ruminants have to have the capacity to use a wide range of forages with changing content of minerals and crude protein




The Conundrum

How then to decide on the supplementation strategy?

- It is difficult to predict mineral &/or urea requirements of cattle grazing dried or pasture because of:
 - *Variability in climate & its effect on stage of pasture growth;*
 - *Extent of leaching on crude protein and mineral composition*

Deficiencies creates metabolic discomfort

- Ruminants have evolved to survive periods of nutrient deficiencies
 - They have well developed abilities to test materials that removes the metabolic discomfort and correct the deficiencies syndrome
 - Individual sources of urea, or sulphur, or phosphorus, or trace minerals[?] will be selected as these become deficient in available feed
- 

Examples of Nutritional Wisdom

- Research has shown that animals self medicate (selectively seek out materials that supply the deficient nutrient or prevent the harmful effects of toxins in their feed) for example:
 - When fed diets deficient in P, S or crude protein
 - Detoxify feeds by consuming clay minerals that bind toxins
 - Select higher protein diets when pregnant or lactating or infected with worms
 - Sheep infected v uninfected with intestinal parasites consume higher intake of a block medicated with anthelmintics
- Self medication is a result of the animals suffering metabolic distress (metabolic discomfort) that causes them to seek out feed resources that removes the stress

All species display *Nutritional Wisdom* via metabolic stress



A group of green wing and scarlet macaws congregate on a clay lick by a river in the jungles of the Amazon.

Macaws feed on a fruit that contain toxic compounds but immediately fly to the clay licks and consume the clay which binds the toxic compound. The clay is voided in the faeces preventing absorption of the toxin.

P deficient ruminants use trial and error to solve metabolic stress



Wild animals
also show
metabolic
discomfort

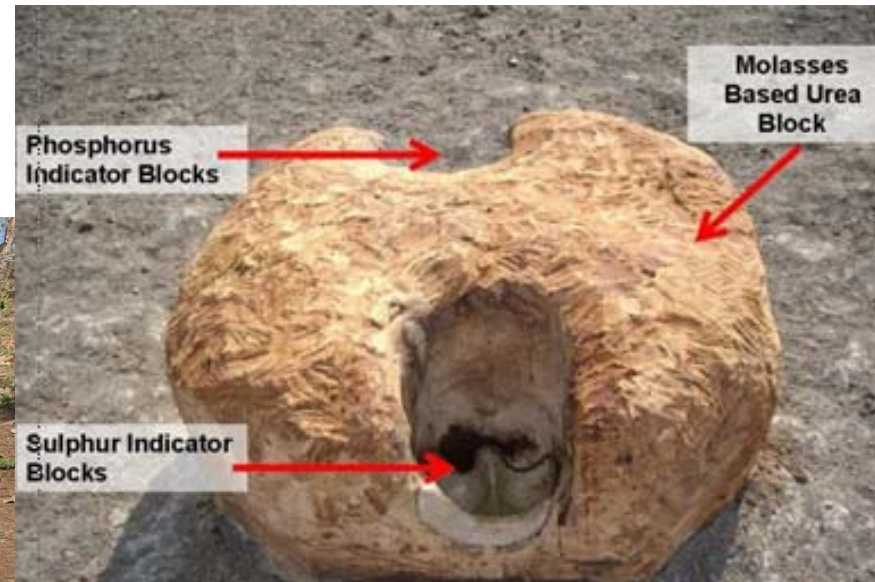
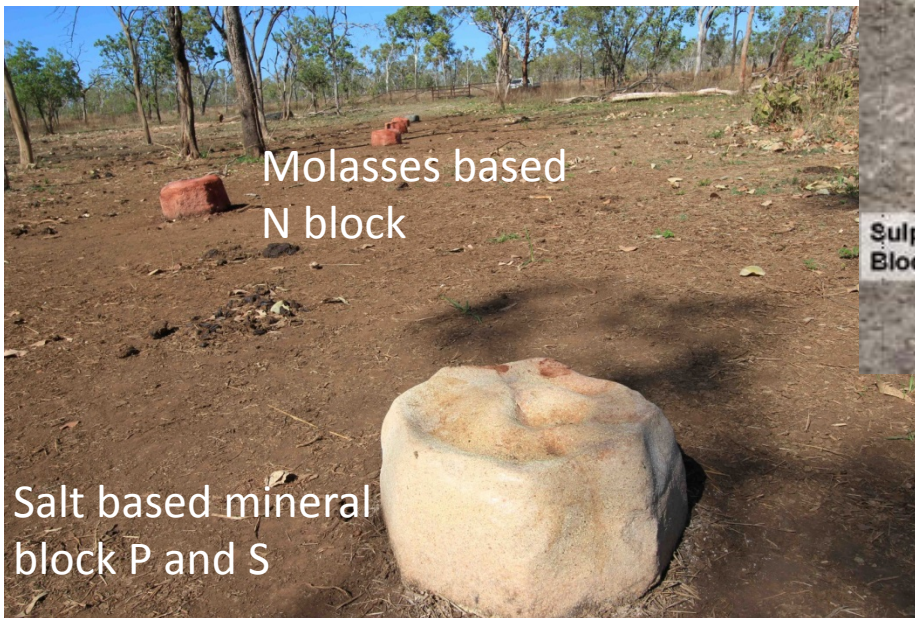


Free Choice Supplementation

- Year round availability of mineral and urea/nitrate
- Essentially 3 separate supplements are needed with a background of other minerals
 - *High in Urea or Nitrate*
 - *High in Phosphorus*
 - *High in Sulphur*
- Animals learn to balance their needs and the disappearance of blocks signals the onset of deficiency.

Self medication program example

3 separate blocks or
an aggregate block



Urea or Nitrate supplementation?



Livestock Methane (CH₄)

1. What it means to the animal
2. Does it really matter?
3. a) Reducing emissions
b) Improved efficiency of the animal



Prof. Roger Hegarty
Professor of Animal
Nutrition UNE

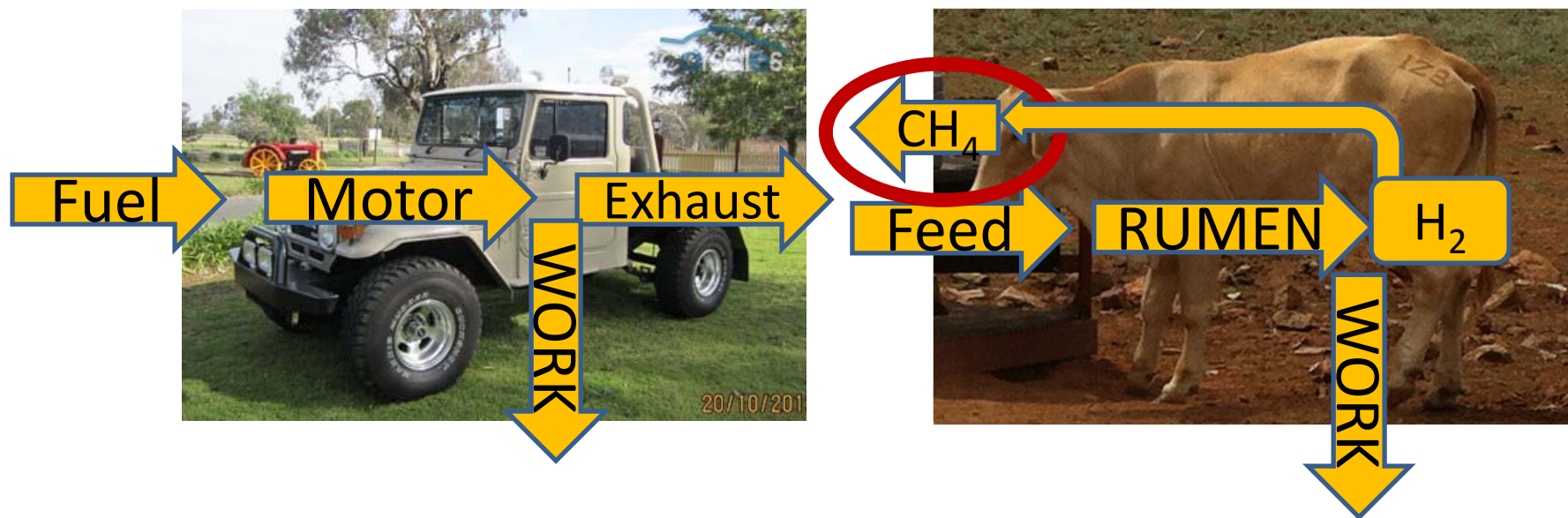
1. Methane – And the Animal

Methane is a cow's way of disposing of hydrogen exhaust



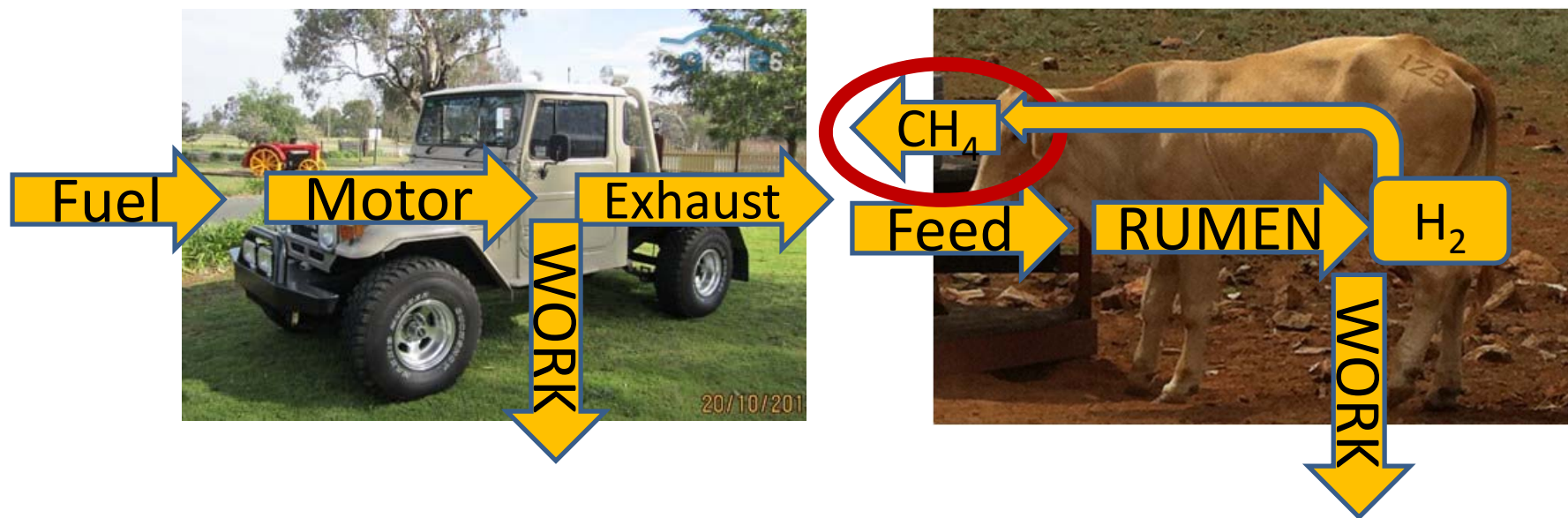
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1. Methane – And the Animal

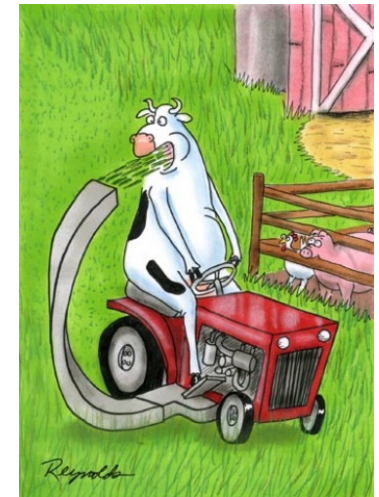
Methane is a cow's way of disposing of hydrogen (H_2) exhaust



Methane is an inefficiency in converting feed to product.... But better to run inefficiently than not at all.

Methane is also lost opportunity

- We can make a better motor....can we make a better cow ?
- 26Million cattle @ 208g methane/d in 2011
 - ≈ 2MT CH₄/year
 - ≈ energy in 6MT of grass
 - ≈ If feed is 50% digestible this means 12MT of grass eaten for no energy gain to the animal
 - ≈ Half of cattle emissions are from Qld & NT



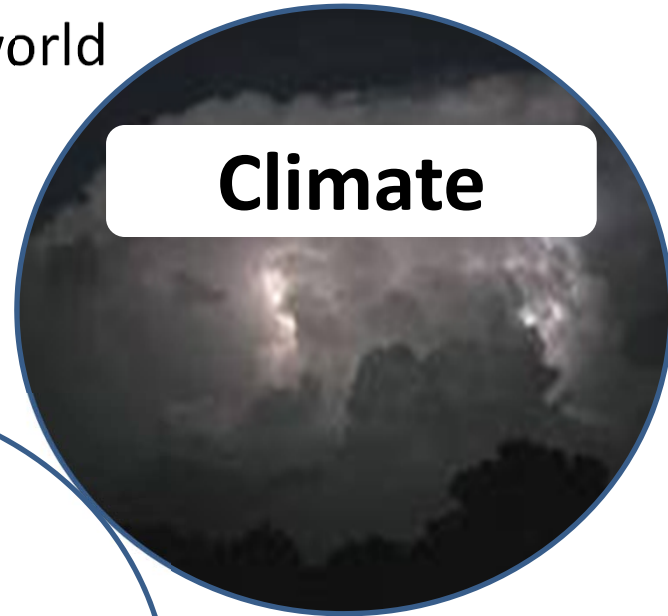
.....*appeals to self interest*

2. Methane – Does it really matter?

For you and the world



Population



Climate



Energy

2. Methane – Does it really matter?

For you and the world



Population

1 billion in Asia
1 billion in Africa
70% ↑ in livestock
product demand
2005-2050



Climate



Energy

2. Methane – Does it really matter?

For you and the world



Population

1 billion in Asia
1 billion in Africa
70% ↑ in livestock
product demand
2005-2050



Climate

Livestock = 14.5%
of human induced
GHG emissions



Energy

2. Methane – Does it really matter?

For you and the world

Population

1 billion in Asia
1 billion in Africa
70% ↑ in livestock
product demand
2005-2050

Climate

Livestock = 14.5%
of human induced
GHG emissions

Energy

Use energy where it
offers highest
financial return.

Solar (grass)
powered cows, not
coal (grain) powered
cows

3. Reduce emissions & raise efficiency



It is VERY hard to reduce an animal's emissions from 200g/d to 150g/d without starvation or grain feeding – **Nitrate is promising**

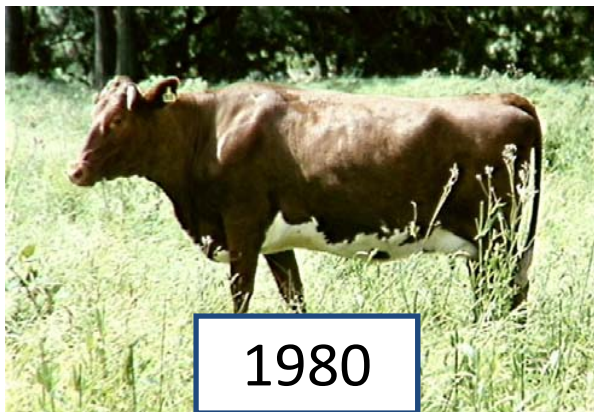


Anything that will improve production/animal will reduce emissions/kg animal product

3. Reduce emissions & raise efficiency

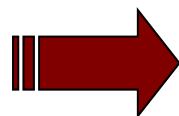
- Changing herd management delivers profit + emission intensity

“Alexandria” NAPCO



British breed cattle

1.25 t CH₄/t LW weaned




Tropically adapted cattle

0.86 t CH₄/t LW weaned

- a 31% improvement -

Conclusions

- Methane production is normal and advantageous.
 - But.... Diverting today's methane energy into tomorrow's growth would be better.
 - Reducing methane as an inefficiency in livestock systems will become more important as food demand and climate policy & impacts change price signals.
 - We can do great things to reduce methane/kg beef sold by making every animal more productive
- 

Poll Question #4



AOTG PDS Trial

une

University of
New England

1. What is the AOTG PDS trial
2. PDS Aims & Activities
3. Trial Design
4. Remote equipment
5. What are we doing
6. What the future holds



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Poll Question #5



What is Action on the Ground PDS?

- Station-based trial testing the effects of Urea, Nitrate and free choice mineral supplement systems (namely NPN, Phosphorus & Sulphur) on productivity and emissions
- A producer demonstration trial demonstrating the use of remote pastoral management technologies



PDS Aims and Activities

Aims:

- Demonstrate safe replacement of Urea with Nitrate
- Demonstrate the resultant production on Free choice supplementation programs
- Quantify variation in individual animal grazing, supplement and watering behavior and the relationships with individual performance



Remote equipment



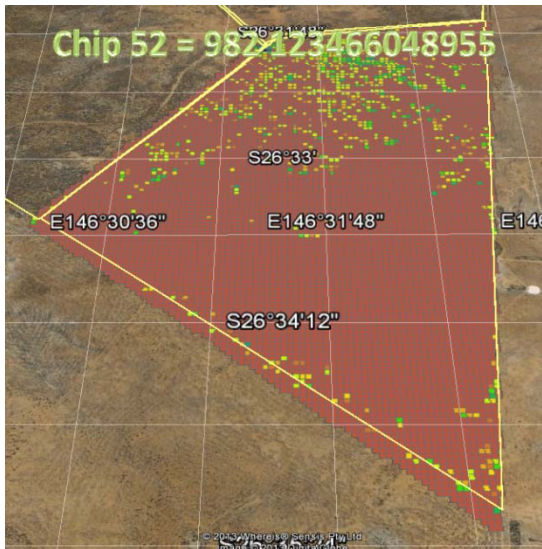
Remote equipment



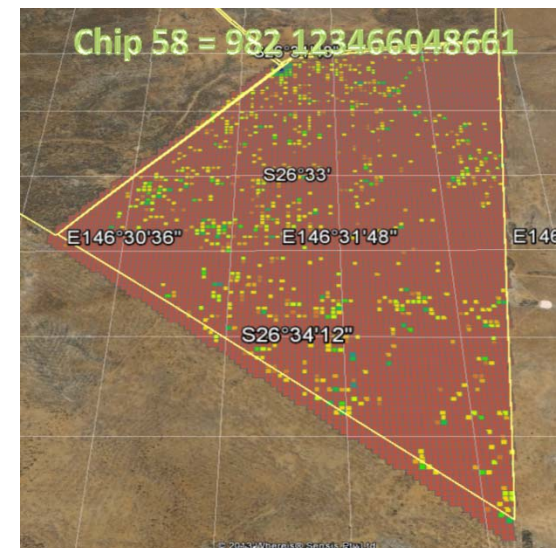
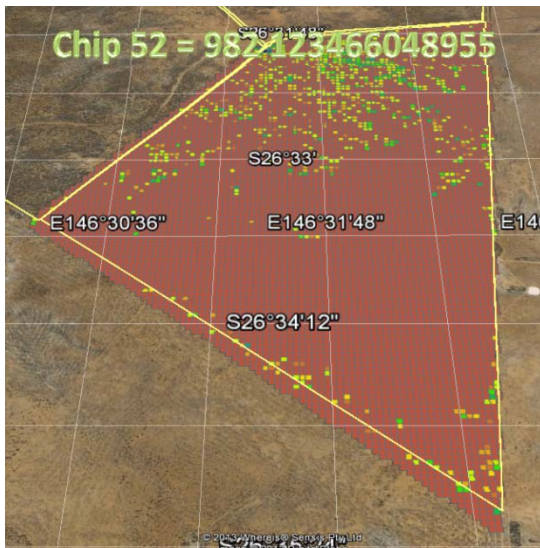
Remote equipment



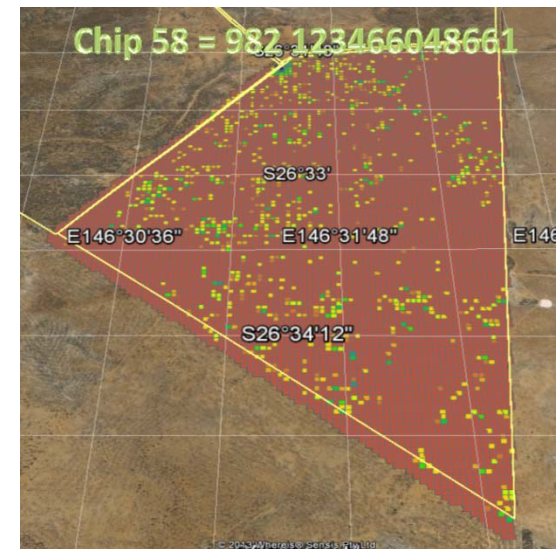
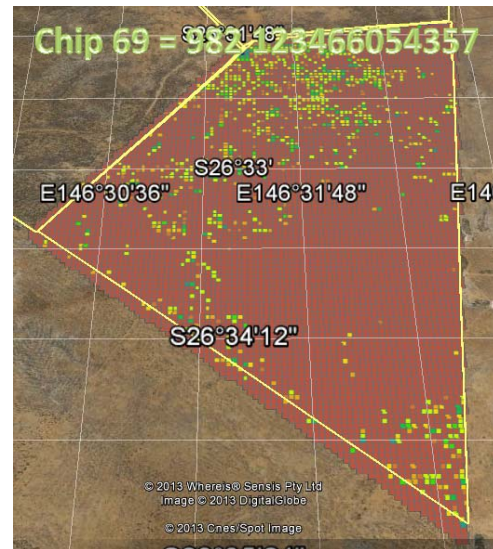
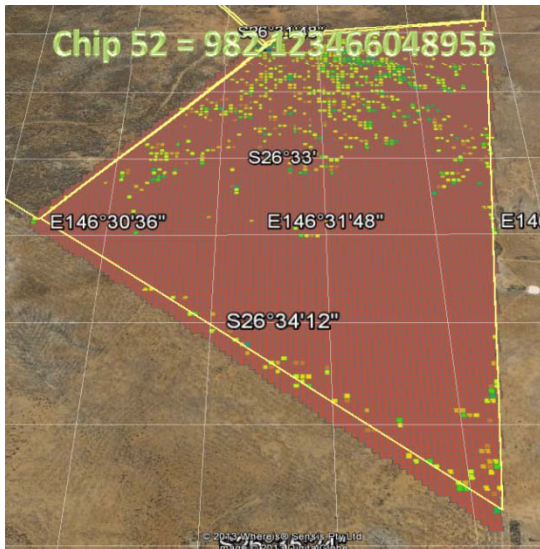
Tracking performance behaviours



Tracking performance behaviours



Tracking performance behaviours



High and Low Performers

- What makes a “good doer” (excluding genetics)?
- What behaviors and nutrition make a:



» High performing animal
&/or


» Low performing animal



Poll Question #6



What the Future holds...

- Individual performance – Production and reproduction
- Individual behaviors – Supplement, Grazing, Watering
- Individual Supplement use and subsequent performance
- Individual supplement use and response to environment
- Individual physiological responses
- Performance of different supplements
- Performance of animals given free choice Supp.
- Remote mgmt. of animals using precision equipment.
- Individual methane measurements in grazing environment
- And the list goes on.....  ***Precision Supplementation***

Thanks for joining and your support:



Bionutric PTY LTD



Thank you and Questions



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