E-Beef
A Smart Farming Partnership

E-BEEF ONLINE SERIES

SESSION 1: Presentation FAQ Sheet

The E-Beef Project and using NDVI with Cattle Liveweight Data

David Phelps **Department of Agriculture & Fisheries**

1. **What does NDVI stand for and how would you explain it in one sentence?**

   NDVI is an abbreviation of the Normalized Difference Vegetation Index. It is a satellite-based measure of vegetation greenness — it essentially measures green ground cover.

2. **What is the best source (if any) for landholders or extension staff to access NDVI data?**

   A really handy free source of NDVI information across the landscape is straight from NASA at https://worldview.earthdata.nasa.gov/. There are also many commercial providers of NDVI data that can be graphed.

   NDVI is similar to the fractional green cover available from VegMachine https://vegmachine.net/# and the Long Paddock Forage ground cover report https://www.longpaddock.qld.gov.au/forage/report-information/ground-cover/.

3. **What are the issues when analysing this sort of data in paddocks that have high non-grazing vegetation (trees, scrubs) concentrations?**

   High tree and shrub cover means that only tree and shrub leaf greenness will be detected by satellite sensors, with the pasture greenness hidden underneath. Trees and shrubs increase in NDVI over the growing season and decline over the dry season. Whilst this means the pasture greenness under dense tree cover cannot be directly estimated, if the NDVI increases then you know that pasture underneath should also be greening up.

4. **Can you use NDVI data as an indicator of dry matter yield in a paddock?**

   You can use the NDVI as an indicator of the green yield in a paddock, i.e. the current season's fresh growth. If you couple this with on-ground estimates e.g. from your own monitoring sites, then you can start to build up a profile relating green yield and NDVI values. NDVI information is available back to about 2001, usually on a scale of 0 to 1.

   The peak NDVI value during the growing season will also be the peak green yield value. You can use this as a guide to the amount of feed in your own paddock if you also do yield estimates of the green feed. For example, if your paddock average NDVI was 0.6 in mid-March 2010, and your estimated green yield at the same time was 2,000 kg/ha, then an average NDVI of 0.6 in the same paddock should be roughly 2,000 kg/ha in others as well.

   Note that yield estimates should always be on a dry matter basis, i.e. you should dry out the pasture samples before weighing them or try to account for water in the pasture in your visual estimate.

   Because the peak of NDVI is also the peak of the green yield, it can be a useful guide to timing an on-ground feed budget or bringing cattle back into a paddock after wet season spelling. Remember that NDVI only measures green, so it won't indicate how much carry over or older hayed off feed there is.

5. **Can this sort of analysis be applied to improved pasture as well as native pasture?**

   Yes. If you take a look at NDVI across the world using the NASA world view tool https://worldview.earthdata.nasa.gov/ you can see NDVI measured across the whole of the Earth's land surface. The only exceptions are lakes and areas of snow and ice, as these interfere with the measurements.

6. What are the risks & challenges of extrapolating NDVI interpretations across paddocks or properties?

The main risk of extrapolating NDVI values is when using it as a guide to cattle liveweight between properties and paddocks. The paddock average NDVI value depends on the mix of land types, land condition, rainfall and stocking rate. When combining this with cattle liveweight data, it also depends on the class of cattle and supplementation e.g. weaners compared with pregnant cows in their third trimester will have very different growth rates on the same feed. Paddock and property management all contribute to this mix.

A paddock average NDVI value of, say 0.3, could be based on all weeds, a carpet of annual grass, reshooting palatable perennial grasses or because only a third of the paddock had good rain. The main risk is not knowing what the NDVI value means on the ground. It is crucial to look around your paddock to interpret if the NDVI is based on all unpalatable weeds or fresh growth of good grasses.

If two paddocks in the same property have a very similar mix of land types, land condition, rainfall and stocking rate, then the NDVI values are very likely to relate to each other. This also means that cattle liveweight changes in one paddock *should* be very similar for the same class of cattle on the same supplements in the other paddock. The greater the differences between land types, land condition, rainfall, stocking rate, class of cattle, supplementation and management, the harder it is to extrapolate liveweight trends based on NDVI and the greater the risk of trends from one property not being a good guide to another. It is very unlikely that the average daily liveweight gain will be same between properties, but trends should be similar.

One of the things that e-beef is exploring through smart farms and innovation hubs is how useful the information from one property within a district might be for decision making on other properties with similar mixes of country and cattle. For example, within a district, if NDVI is rapidly falling and the smart farm liveweight stalls four weeks later, this could be a useful guide that all the innovation hub properties with similar average paddock NDVI will also see stalled growth rates. This could be a guide for everyone to start their supplementation in two weeks' time.

If one of the innovation hub properties has received more rain and the NDVI is staying higher for longer than the smart farm, then this would be a guide that weight gains on that innovation hub property should be better than the smart farm. It might also mean that the innovation hub won't need to supplement as early as the smart farm.

7. Has this concept (NDVI and Cattle Weights) been tested across multiple years and land types?

Yes, the concept was tested in paddocks between 2013 and 2016 in the Precision Pastoral Management Tools project across northern Australia on commercial properties in WA, NT and Queensland. The country types included spinifex, floodplains, Mitchell grass and Eucalypt woodland. The concept of linking the NDVI and cattle liveweight held true across all of these land types within paddocks, even in wooded country. The actual average NDVI between these paddocks with different land types varied considerably and made it obvious that you can't just assume what the NDVI value means – including the cattle weights was the key to interpretation.

8. Is there a difference in the behaviour of NDVI data for coastal grasses such as signal grass?

There is no difference in the way that the NDVI is measured between any pastures or trees – it only relates to how much green is present. However *what* the NDVI value means is different. An NDVI value, for example of 0.7, for a paddock of Mitchell grass will be a different pasture quality from signal grass, spinifex or a dense stand of bloodwood trees. Collecting information to interpret the NDVI value is important. This could be estimates of green cover, green yield, pasture quality, dung sample for NIRS, or cattle liveweight.

From the webinar example:

9. Is the threshold of 24, where cattle start to decline, for dry non-pregnant livestock? If so, would this figure differ with cattle of different classes?

This example was for steers. The threshold value will be different for different classes of livestock. It is best to try and establish the threshold using dry classes of cattle, as the growth rates are then based on gains in muscle and fat, rather than weight increase due to pregnancy. It is probably best to avoid using weaners to estimate the threshold, as a lot of their growth is also in bone and connecting tissue as their frame size increases.

10. **Is the threshold of figure 24 specific to that one paddock? If not, when and how could you use this figure in other areas of your property?**

    The example threshold figure of 24 (on a scale of 0 to 100, instead of 0 to 1) was for that paddock. If two paddocks in the same property have a very similar mix of land types, land condition, rainfall, stocking rate and supplementation then the threshold NDVI values will be very similar.

For more information visit www.southerngulf.com.au/project/e-beef-smart-farming-in-northern-queensland/.

Weigh, Monitor & Process your cattle remotely with the Walk-over-Weigh system.

Tim Driver **Tru-Test [Datamars]**

1. **What is the baseline cost for a setup and what does it include? What is the additional cost for the drafting mechanism?**

   The baseline cost of the Remote WOW Flexi (weighing only) is $12,000 + GST. Adding the draft-gate is $6,000 + GST. For the full range of WOW product available please contact your local Ag merchandise store.

2. **How many systems are currently deployed around Australia, and what sort of operations are these mostly used on? Do private landholders find it difficult to utilise?**

   Currently the WOW systems are deployed right across AUS in northern and southern productions system with a reasonably even split of Corporate and Private producers.

   No private or corporate landholders find it difficult to use as it can deployed in multitude of ways depending on the outcome the producer requires / has purchased the equipment for.

   In its most basic installation (panel or electric fence around the water trough) is extremely easy to use. This is all that is required to record herd growth for use with NDVI, but the system lends itself to be deployed in more advanced setups (using spear traps) to take advantage of the drafting functionally. In these deployments, the producer is moving towards an automated production system and is modifying their management to achieve this outcome.

3. **Is it possible to move the system to different locations? How easily can this be done?**

   Yes, the unit is designed to be portable and there is an additional wheel/trailer kit that will be available in August which will attach/retrofit to all product in the range.

4. **What is the influence of stocking rate on the 'threshold' points? How is it considered with your modelling (algorithms)?**

   Stocking rate does not have any influence on the threshold point. Stocking rates only influence how fast the NVDI reaches this point in the current year. If the software detects that the decline in NDVI is occurring faster than predicted it will then reforecast the cattle stall date.

   The great thing about NDVI is that the Satellite does not care why the plant is not photosynthesising. Whether it is haying off, frosted or it is simply not there, the result on cattle growth is the same. The growth stall date tells us when the animal will move into a plateauing plane of nutrition, but it does not state why. It is then up to the producer to inspect the paddock to decide whether the stalling in growth rate is due to the decline in pasture quality or simply out of feed. If the producer decides that it is a decline in pasture quality, then supplement can be fed. The WOW unit will measure the response (and return on investment) of the supplementation program and will report when animals enter the second stall of growth which is a strong indication that there is no longer enough palatable feed left in the paddock. The information collected on this herd can then be extrapolated to similar land types only within the property boundary.

5. **At the moment you use NDVI in your forecasting tool; Would pasture estimates of kg DM/ha be more useable data than assessing the growth activity of the plant (particularly in the dry season)?**

   Yes, especially if the pasture yield estimates are on a weekly to forthrightly basis. The high frequency is important to detect rapid changes and relate this directly to the weekly cattle liveweight.

6. **Is this technology being used on breeder herds to make more accurate estimates on herd reproductive performance?**

   Yes, this currently is our primary use for our corporate northern productions clients to forecast weaning rates for budgeting/resource allocation purposes.

7. **Are there any government grants (or other assistance schemes) that would make the Tru-Test WOW system more affordable?**

   To-date Tru-Test product offering has been systems designed for large pastoral operations. Tru-Test has just released a new range for Remote WOW products starting at $12,000 + GST for portable WOW only units. For the full range of WOW product available please contact your local Ag merchandise store.

For more information visit https://www.livestock.tru-test.com/en-au/product/remote-wow-systems

Using FORAGE Reports for Grazing Land Management & Risk Assessment

Grant Stone **Department of Environment & Science**

1. **Will the newly developed mapping capability of long paddock, be able to replace basic property mapping programs (potentially)?**

   The MyForage online property tool will allow the user to:

   - Create a property map, draw property boundaries, create paddocks, waters, gates and exclusion zones on an interactive satellite background.
   - Import/upload existing shapefiles, Kmls from other mapping programs.
   - Save project for further use.
   - Export property / paddock carrying capacity and pasture productivity estimates.
   - Export property as shapefile or GeoJSON file for use in other packages.
   - Run 'what if' scenarios by adding fences and watering points.
   - Change pasture species, land condition and land type names (for your property only).
   - Order all FORAGE reports per paddock/polygon.
   - It will be free to use following registration.
   - N.B. It is not intended that the tool will:
   - Have advanced features of commercial mapping packages, but enough to relate basic property features for FORAGE calculations.
   - Be designed for producing surveying type accuracy.

   A working prototype of the MyForage online mapping product is currently being tested. It is expected to be released in basic form for public use in 2021, enhancements to follow.

2. **The 'Growth Alert' maps and the 'Ground Cover' maps appear to be using different data and require different interpretations. Can you provide some more information on this?**

   The Pasture Growth Alert and Ground Cover report both use the same monthly imagery/data on a 30m pixel basis – however, they provide different (but complementary) information.

   The **Ground Cover** map (front page) is "absolute" ground cover – shown as "percentage" ground cover (0-100%). The second map in this report (minimum ground cover) is a 'composite' map that shows the lowest cover on record for each individual 30m pixel (1986 to present) – this is also shown as "percentage" ground cover.

   The Pasture Growth Alert total cover "percentile" map assesses each 30m pixel on the current monthly map and rates that pixel against the same month for the historical record. If the pixels are red/orange/yellow this indicates cover is near the lowest on record (bottom 10, 20, 30% of years). If the pixels are green/blue this indicates cover is near the highest on record (top 80, 90, 100% of years).

   It is informative to use both reports in conjunction, as the absolute cover may be less concerning than the percentile cover – as the percentile cover is showing a trend/ranking. Other reports to add information include the Land type, Fire scar and Foliage projective cover reports.

Pasture Growth Alert Report https://longpaddock.qld.gov.au/forage/videos/

Percentile Animation www.longpaddock.qld.gov.au/forage/videos/understanding-percentiles-in-climate-data/

3. In transitional land areas, the grazing land management reports can become quite inaccurate, can this be improved?

When particular FORAGE reports use Grazing Land Management (GLM) land type information, they use the current GLM land type mapping – DAF is the custodian of the underlying mapping and GLM description sheets. While upgrades have been made to the GLM land type mapping layer, changes are still being made to broad land types if there is enough evidence to do so. However, it is hard to justify changing localised pockets (which may be causing issues for modelling at that location), as it will cause issues at a greater scale. Revisions of herbarium mapping of regional ecosystems will also be incorporated from time to time.

The land type ID "drives" the subsequent pasture modelling output. While the polygons and naming are generally accurate and agreed to, sometimes there are issues with a land type/naming for a local area. Transitional/land type issues will be able to be resolved with the use of the MyForage online mapping tool (in development – see previous question). The user will have the ability to change pasture species (e.g. Buffel grass, Indian couch, Stylos), land condition and land type names for your property of interest and save the changes to a personal project. This will not change the general GLM land type mapping layer – it will be a user's personal change.

4. Are there limitations with heavily wooded areas in these reports?

Any products that use satellite-derived information do have limitations at high levels of woody cover and for ground cover under trees that is estimated up to a limit of 60% foliage projective cover (FPC). There has, however, been extensive fieldwork to ascertain and check ground cover and pasture growth information in a range of woody densities across Queensland. This program is ongoing and strives to better integrate modelling and remote sensing approaches

New ground cover mapping will be released soon that will use more calibration data from fieldwork to refine algorithms for cover under trees. It is expected that the new mapping will provide better estimates, which will, in turn be used in Forage products.

Pasture growth modelling takes account of tree density by accounting for tree/grass competition for soil moisture, sunlight and available soil nitrogen. The pasture growth model also accounts for tree microclimate effects that are positive for pasture growth (i.e. lower maximum temperatures – higher minimum temperatures) and rainfall interception by the tree canopy. However, modelling of such a complex system is not perfect and some aspects remain uncertain (e.g. tree rooting depth).

5. Can landholders 'request a session with extension staff when first signing up to these reports? It may be helpful in landholders becoming more confident in their interpretation of these resources.

It can be daunting to see all the reports and to know how and what they should be used for. A good first step is to watch the webinars and videos provided on the Long Paddock website https://longpaddock.qld.gov.au/about/webinars/ and https://longpaddock.qld.gov.au/forage/videos/. There are also guides and frequently asked questions on the FORAGE webpage.

The next step would be to order some reports – there is no limit to the number and there is no cost involved for anything. The reports can be requested as a "one-off", or you can use the subscription service to have the reports emailed regularly (every 1, 2 or 3 months). If you don't get around to looking at them, they will be delivered again as a prompt!

A number of NRM & DAF Extension officers are proficient with the use of FORAGE reports and can be contacted to help with interpretation. The E-Beef project is designed to assist all users to have greater understanding with new technologies such as the suite of FORAGE reports.

For more information visit https://www.longpaddock.qld.gov.au/

If you have a further query about report information, please send the issue and the report to longpaddock@qld.gov.au for our small team to assist you.