beef+lamb new zealand

By farmers. For farmers

Eye in the sky

Agridrone field day

Neil, Pip & Mark Gardyne's

438 Otama Hill Road, Gore

THURSDAY 16 APRIL, 2015

0800 BEEFLAMB (0800 233 352) | WWW.BEEFLAMBNZ.COM

B+LNZ Strategy

VISION FOR THE SECTOR

A confident and profitable sheep and beef industry

PURPOSE OF B+LNZ

Help farmers make informed business decisions and promote their collective interests

PRIORITIES

Supporting informed business decisions

- **Investing** in Research and Development that meets the needs of farmers and the sector
- **Developing** farm and farmer capability
- **Delivering** knowledge that drives farm performance

Promoting collective interests

- **Attract and retain** talent for the sector
- **Supporting** the sector's market opportunities
- **Advocating** for farmers ability to operate
- **Building** our sector's confidence and profile within communities

PRINCIPLES

Know our farmers

Build partnerships to deliver

By farmers. For farmers

beef+lamb new zealand

Beef + Lamb New Zealand Ltd is the farmer owned industry organisation working for a confident and profitable sheep and beef industry. It works to help farmers make informed business decisions and promote their collective interests. Priorities include investing in research and development that meets the needs of farmers and the sector, developing farm and farmer capability and delivering knowledge that drives farm performance. It also works to attract and retain talent for the sector, supports the sector's market opportunities, advocates for farmers ability to operate and builds sector confidence and profile within communities.

Programme

Time	Outside		Inside
11am	Welcome and introductions, *Olivia Ross*		
	Farm tour *Neil Gardyne*		Virtual fencing *David Lamb*
12pm	Areonavics demo *Simon Thomson*	BBQ lunch	Counting sheep *Bram Visser*
	Biomass estimation *David Lamb*	BBQ lunch	Drones in agriculture *Mark Gardyne*
1pm	Farm tour *Neil Gardyne*	BBQ lunch	Virtual fencing *David Lamb*
2pm	Aeronavics demo *Simon Thomson*	BBQ lunch	Counting sheep *Bram Visser*
	Biomass estimation *David Lamb*		Drones in agriculture *Mark Gardyne*
3pm	Refreshments		

Health and safety

In the spirit of the Occupation, Health and Safety Act, the owners have taken all reasonable care in making your visit to the property as safe as possible. They clearly point out that you enter the property at your own risk. The owners will accept no responsibility for any accident or injury to any person or property that takes place while you are visiting their property. Please abide at all times to the instructions given by farm owners, managers and field day organisers.

Event sponsors

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AERONAVICS

About the farm

Neil and Philippa Gardyne purchased Otama Homestead in 2007 in an equity partnership company structure.

In 2014 they facilitated and invested in another equity partnership near Clinton. The Homestead is a 466ha, 6500 SU property with 70% Class 7 and 30% Class 6 land. Average rainfall is 830mm. Current farming practice is 4700 Kelso composite sheep crossed with a Poll Dorset Sire, making a completely terminal operation buying in 2000-4000 stores per year. They harvest 489kgs of meat/grass/ha area (last seven years average). They recently ceased their BullBeef operation.

The Gardynes also grow 90ha of cereal crops—50ha of oats goes to Harraways and 40ha of wheat ends up as milk. The synergies created by these enterprises add great value to the bottom line. The business has a EBIT of $1188/ha and a ROI of 6.8% with a capital gain of 13%.

The Gardynes have a simple mission statement—"Your Best Life"—and have narrowed down their many values into two usable ones:

1. A good decision making process helps us make good choices.
2. Ownership not entitlement.

These values were used to develop their succession plan.

Two-pronged growth strategy

1. People

- Preferred place to do business
- Equity partnerships

2. Technology

- GPS
- Drones

Past. Present. Future.

Past. The realisation that adopting technology will leapfrog agriculture into the future. Slow to get a drone (took one year). Purchased a cheep model with no technical support (big mistake). The need make our business more efficient and a desire for an "eye in the sky". Early adoption is high risk.

Present. Collection of data (commuting time, cost of cast ewes, counting sheep). We are using an Aeronavics BOT drone which is a quality machine with excellent support. Huge global interest in drone technology use on farm. Young people are very interested in this technology and therefore agriculture. Over 400 suggested applications, plenty of science completed but commercialisation of the apps is the gap and opportunity in NZ agriculture. Management of interest is challenging.

Future. Get the scientists and producers of drones to understand agriculture and our particular needs. Develop apps that are user friendly and readily available. Education of young people with regards to drone technology.

Farm map


Otama Homestead Ltd
0
0.3
0.6
1.2 Kilometers
N
1:12,000
environment
SOUTHLAND

Why use drones in agriculture?

Mark Gardyne

Drones have many uses in agriculture. They have many applications that can save money, provide real time data to help proactive decisions and encourage young people into the sector. Drones provide "eyes in the sky" for general farm management.

Missions can easily be set up for manual or autonomous operation. 80% of the Gardynes 11000km quad bike commuting is just for getting from A to B without an end purpose. They hope to reduce this by 50% using a drone. Each kilometer on a quad bike costs $4.

Drones will be as big as smart phones for agriculture

Futurte apps

- Weed and Pest
- Eyes in the Skies 11,000km a year

Potential savings

- $15k saving e.g. 4-wheeler use, less travel time
- Expectation of $35k increase in productivity gains this year and up to $200k in the future

Applications

Find cast ewes

Automatically fly over your farm looking for cast sheep, watching live video or viewing the footage in your own time. About half of cast sheep flown over by drone right themselves, if gotten to early enough.

40 ewes saved x $300 = $12K per year.

The lambing round

Fly your lambing round and watch live, or review the video in your own time. React only when you have to. Look at recent videos of the lambing paddock to determine if you need to go out. Reduce morning lambing runs from seven to two per week.

"The drone has reduced our quad bike commutes by 2000 km last year. We've saved $8,000 and lowered our accident risk."

Monitor water troughs

Fly a mission over several water troughs and take a photo at each site. A list of photos instantly gives a detailed view of the water situation on the farm. If maintenance is required, you know you're taking the right tools
for the job.

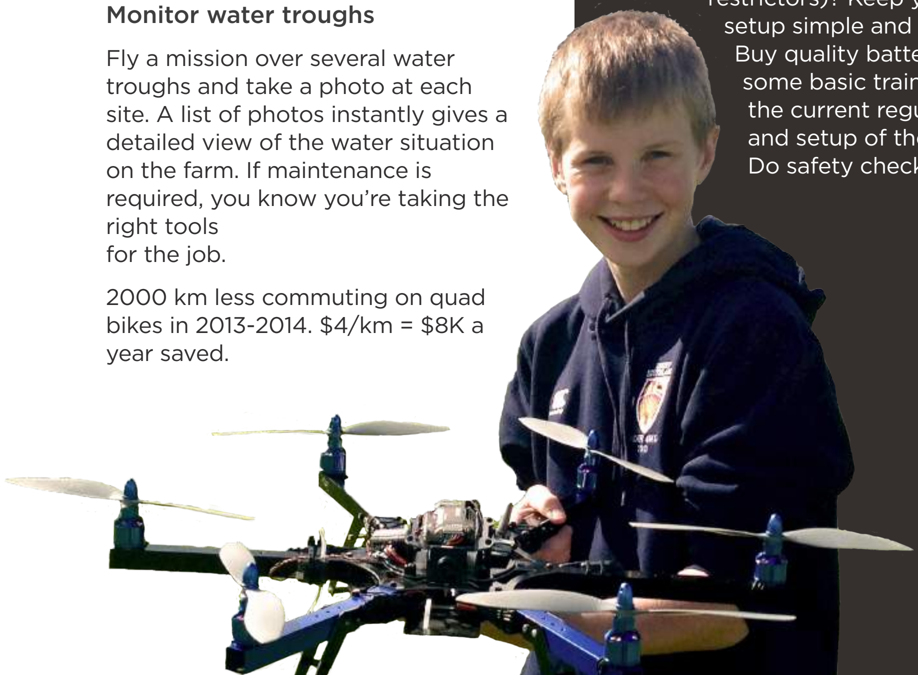
2000 km less commuting on quad bikes in 2013-2014. $4/km = $8K a year saved.

Considerations for purchasing a drone

It is important to purchase a quality machine as it is not a toy. It is a farm implement.

Your purchase must have the necessary technical support and availability of parts that that can be quickly accessed—preferably in New Zealand.

When considering price, work out what value this machine will bring to your business. Look at current CAA regulations and what machine you will purchase, i.e. a drone under 2kgs has very few restrictions. Ask questions—will this drone do what I want it to do? What attachments do I need (gimbles, waterproof, safety restrictors)? Keep your setup simple and mobile. Buy quality batteries. Do some basic training in the current regulations and setup of the drone. Do safety checks.



Real-time pasture biomass estimation

David Lamb, Mark Trotter, Andrew Robson

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Introduction

The review commissioned by MLA (B.GSM.0004—Potential for information technologies to improve decision making for the southern livestock industries) identified the following as significant opportunities for producers in using information technologies:

1. Improved pasture production through soil fertility assessments and variable rate fertiliser application;
2. Improved feed allocation—allocating appropriate quality and quantity of feed to different classes of stock in a timely manner;
3. Pasture yield mapping—understanding, managing and optimising pasture production within and between paddocks; and
4. Feed prediction—the mitigation of risks associated with adverse climatic conditions and opportunities associated with good seasons.

This project addresses the second and third opportunities through the development of tools for real time estimation of biomass and allocation of pasture resources to meet feed supply demands.

The Prograze Initiative highlights the opportunity for farmers to assess pasture biomass and allocate stock to paddocks on the basis of matching feed demand and feed supply. However, the determination of feed availability using traditional methods is subjective, time consuming and subject to error. It has been estimated that producers are on average achieving 40% of the optimum level in terms of efficient allocation of feed and that precision technologies can increase this to 60%. Economic analysis indicates that an improvement in feed allocation will result in an increase in gross margin/ha (gm/ha) of $96 for sheep and $52 for cattle enterprises.

While tools to accurately measure pasture biomass exist (e.g. C-DAX or sonar pasture meter) within the grazing sector, they are expensive (i.e. greater than $5000 in cost) and/or struggle to delineate the green fraction (most important for predicting animal performance on pasture). The challenge has been to develop a technology which is low cost and capable of being deployed from a vehicle to provide real-time estimates of available biomass.

Newer technologies such as Active Optical Sensors (AOS) have been developed for use in the cropping industry, primarily for inferring crop nitrogen levels. These handheld devices direct a beam of light onto the canopy and an on-board detector records the returning radiation and

Figure 1 *Sensors developed in the cropping industry can now be adapted for use in grazing systems.*

Figure 3 *The relatively new Trimble Greenseeker Handheld can be calibrated to measure the green fraction of a pasture sward.*

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calculates the optical reflectance of the target canopy in those specific wavelengths. They are now relatively low cost (around $600 per unit), can be deployed from a vehicle and have the potential to be integrated with GPS to provide spatial measures of biomass. However, challenges remain in making this technology commercially available. This includes the need to develop a calibration and data management package that can be easily used by producers.

An Australian project funded by CRC Spatial information and MLA will evaluate, calibrate and validate AOS for measuring pasture biomass. Calibration will occur across a range of species and seasons. Once the equipment has been calibrated, the project will work at satellite sites to develop calibrations across a range of pasture species and agro-ecological regions. Developed a series of regional, seasonal and species specific calibrations that can be used by graziers to measure biomass using AOS for six key pastures types: ryegrass, fescue, phalaris, sub-clover, cocksfoot and lucerne.

The project will also developed a smart phone app supporting the use of AOS as a real-time biomass estimation tool integrating the regional, seasonal and species calibrations and incorporating a simple self-calibration process to allow red meat producers to develop their own.

www.mla.com.au

www.une.edu.au/parg

www.crcsi.com.au

Virtual fencing—determining the potential of virtual fencing for application to grazing livestock

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Traditional fencing techniques are not flexible enough to manage the dynamic aspects of grazing systems. Virtual fences, as the name suggest, are fences that are not entirely physical. Rather, they rely on controlling or restricting animal movement via some form of external stimulus that is applied through, say a collar or ear tag. Virtual fences are literally a line drawn in the ground- be it in the form of a buried wire that triggers a stimulus when animals approach and attempt to cross it, or a line that exists on a computer and the animal location is cross referenced to that line and stimulus applied when the animal approaches or crosses it. Importantly, virtual fencing offers producers the opportunity for flexible, real time control of livestock distribution. In other words it is possible to move the fence or sequentially energise a buried wire array- both of which allows the manager to 'walk' the animals from one part of a field to another.

For virtual fences to work however, an understanding of how animals respond to VF is needed before commercial development of units can be undertaken. The objectives of this project are to study the potential for VF to be applied long term to grazing livestock. The project will specifically examine the behavioural response of livestock to VF under cell grazing; in our case we have a collar and a buried-wire configuration and the paddock divided into four segments. As the animals approach the wire they receive an aural stimulus (a 'beep' and if they approach even closer then they receive a very small electric shock. We plan to electronically 'drop' and 'rebuild' the fence during cell changeover in order to encourage animals to move between the cells.

Preliminary results to date indicate that after two attempts cattle respond well to the aural stimulus, avoiding the need for further stimuli, although this has yet to be tested on animals of different age and temperament.

Figure 1 *Cattle approach a virtual fence consisting of a buried wire. Note the collars through which aural and electrical stimuli are applied.*

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Counting sheep from aerial images

Bram Visser, Abacusbio, 17 March 2015

Sheep counting

First steps and initial problems

Right off the bat it was clear that there are no "off the shelf" solutions for the stock counting problem. A custom solution was required. Fortunately a lot of research has been done on a very similar image processing problem: automated cell nuclei counting in microscope images. We decided to adapt this method for our purpose.

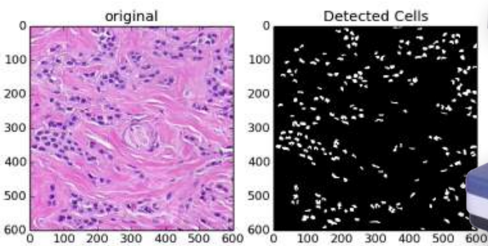
The first tries with photos from the airborne GoPro were demonstrating that we were on the right track with the "cell counting" approach. It wasn't that we could detect every single sheep in a photo, but at least we could find some of them automatically.

Bram Visser (AbacusBio): "The sheep counting script was written in Python. The Python language was chosen because it is a free programming language, is very flexible and has access to powerful image processing libraries like Matplotlib and Scikit-Image."

Methods

Early on we found out that it would be impossible to create a program that could accurately count animals in every photo. There are simply too many variables to take into account. Think about different shades and textures of pasture, dirty sheep, muddy tracks, fences, water reflections, trees, photos taken at different altitudes and angles, blurry images, etc.

We decided to focus our efforts on two images taken with a GoPro at roughly 200 ft AGL. This meant that we could fine-tune the counting algorithm and parameters for a specific situation, learn how to overcome problems and increase counting accuracy. The photos were cropped slightly to get rid of the distortion caused by the wide angle lens. Both photos had approximately one hundred sheep in them.



Results

When Python is installed on a PC, the counting script can be run. The program will open an explorer window and prompt the user to select an image file with sheep in it. When a file is selected and opened, the program will start counting and after a few seconds a plot will be displayed that shows the count. The program also draws red boxes around every detected animal for reference. A second plot shows the histogram of the area sizes of labelled shapes.

Compared with visual counts as the gold standard, the accuracy of the automated counting program is between 99% and 100% (Table 1) for the two test images.

Table 1: Accuracies of the optimised sheep counting program.

File name	Visual count	Automated count	Accuracy
sheep	97	96	99%
sheep2	107	107	100%

There are still some small issues, sometimes sheep are close together and the program thinks that it's a single animal. This can be resolved by flying lower, using a better camera, or by improving the algorithm.

Example

The counting program gives a result in under five seconds. How fast can you count the animals in the picture? An original GoPro image and program output are printed opposite (Figures 3 and 4).

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Figure 3: Photo "sheep2" taken by the aerial robot equipped with a GoPro. There are approximately one hundred sheep in this image (how fast can you count them?)

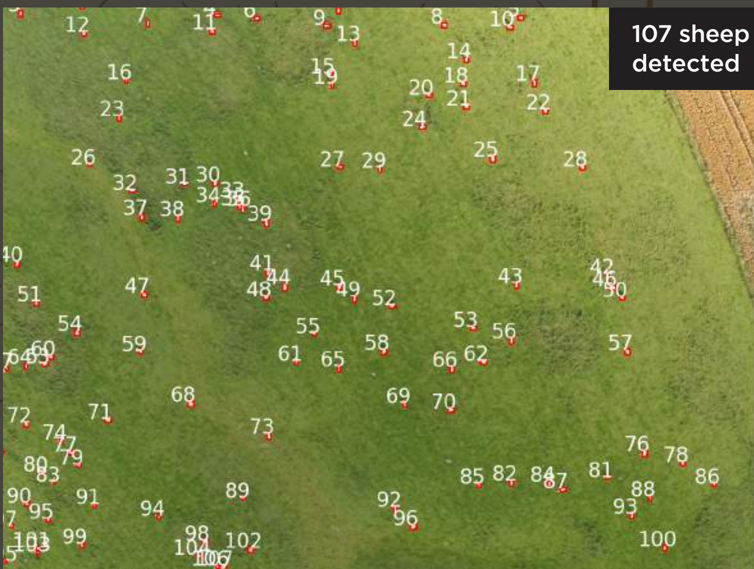

Figure 4: The result of processing "sheep2" with the counting program. The title of the output image shows the number of sheep that were detected. Individual sheep have been numbered and are labelled with a red rectangle.

NOTES