

# An update on the latest Agritech emerging in the Australian Grazing Industries

Mark Trotter



## Mud-map: what I'll talk about

- Introduction
- The Australian beef industry
- Monitoring pastures and the feed-base
- Monitoring and managing the animal
- Managing the data deluge
- Reaching the next generation
- Opportunities for you to visit Australia



Keep your smart phone handy!



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Before we start... tips on how to listen to an Australian!

Some helpful definitions

- 'producer', 'cocky' = any sort of agriculturalist
- 'grazier', 'pastoralist' = grazing animal producer
- 'paddock' = field
- 'feed-base' = the pasture or grass animals are grazing
- 'drafting' = sorting
- 'crush' = chute
- 'stockyards' = handling facility/corral
- 'mustering' = rounding up
- 'maggot taxi' or 'ground lice' = sheep (derogatory term used by cattlemen)
- 'strewth' or 'crikey' = expression of surprise



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## Introduction and background



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## Background

- I grew up on a dairy farm on the Mid-North Coast of New South Wales (say about half way between Sydney and Brisbane)
- We had a Jersey Stud (now sold)
- Spent a lot of time on my extended families beef operation as well
- Had a small Devon cattle stud
- Spent a lot of time riding horses - Camp drafting (that's a cross between cutting, team penning and a barrel race)



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## Background



- Went to University of New England (in Aus not the US)
- Bachelor of Rural Science
- First job: Agribusiness Analyst in a bank
- PhD in Pasture Agronomy (at UNE)
- Then: Precision Agriculture Research Group at UNE (worked there for ~10 years)
- Focussed on Precision Livestock and Pastures
- Now at CQUniversity (Rockhampton Queensland)



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### CQUniversity


- A baby – founded in 1967
- 24 campuses across Australia
- HQ in Rockhampton
- Strong track record in agricultural research
- Ag degree is only 3 years old
- I'm part of the Precision Livestock Management Group within the Institute for Future Farming Systems

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### Research strategy


- Its all about making a difference for the producers
- Increasing production efficiency
  - Increase the kilograms per hectare per millimetre of rainfall (pounds per acre per inch of water)
  - Reduce the costs of production
    - Labour
    - Inputs (e.g. fertiliser, supplementary feeds)
  - Increase the price received (premium product development)
- A big focus on getting the research outcomes in front of graziers



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### Outcome not technology driven!

- Too many times someone finds a flash new tool and says “now, how can I use this”
- Our research is driven by matching the need or desired outcome with a technology
- However, sometimes a key technology can have such broad impacts that its worth investing in wholesale. This can take a long time!




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### The research team

- All the research I will talk about has been undertaken as part of a team



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### Beef production in Australia

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### Comparing Australia to USA – where are we in the world?



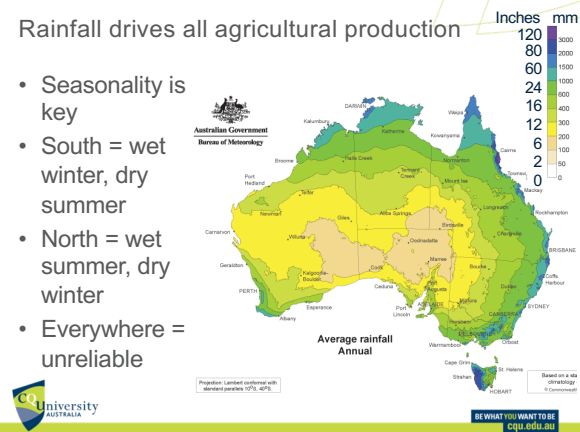
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### Comparing Australia to USA – where are we in the world?



### Rainfall drives all agricultural production

- Seasonality is key
- South = wet winter, dry summer
- North = wet summer, dry winter
- Everywhere = unreliable

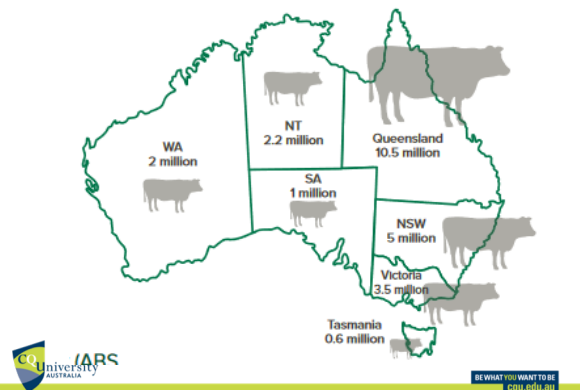


### Beef industry in Australia

- 47,000 farms with beef cattle
- 25 million head of cattle
- Breeding herd of 11m
- Gross value of \$13 billion (20% of farm GDP)
- 40% of cattle slaughtered are grain finished
- 7<sup>th</sup> in world for production
- 3<sup>rd</sup> in world for export



### Where are all the cattle?



### Sensors and tools for measuring the feed-base



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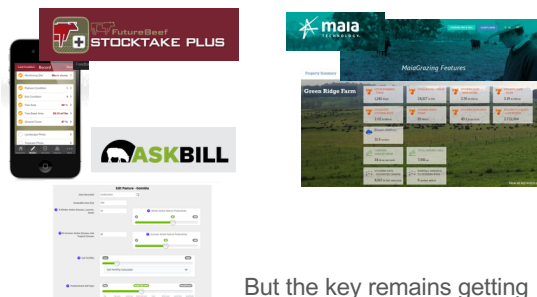
### Why is measuring pasture so important Measuring the feed-base

- Why?
  - Pasture utilisation thought to be as low as 30%
  - Improved feed budgeting
  - Grow more and graze more = increased production efficiency
  - Too little biomass = reduced growth rates
  - Too much pasture = poor quality and low growth rates
  - Too little pasture = reduced ground cover = soil loss
- Get it right = an extra \$128/acre (Henry et al)



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Many tools to manage the data once known



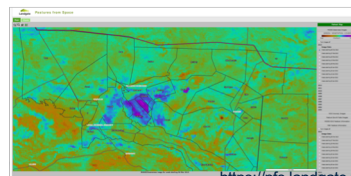
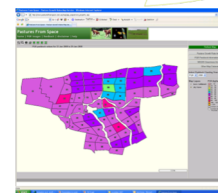
But the key remains getting good data to input into them



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Satellite sensing systems

- Pastures from Space™
- Rangewatch
- Farm Map4D
- Pasture IO
- Cibo Labs



<https://pfs.landgate.wa.gov.au/>

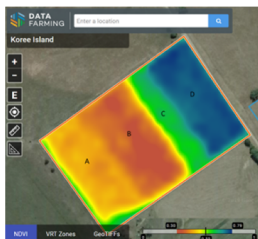


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Exciting developments

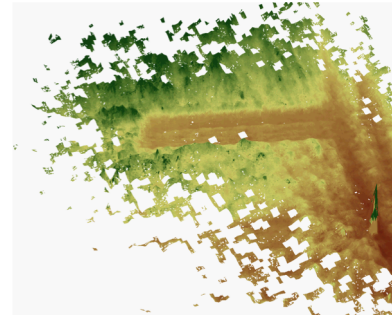
- High spatial and temporal resolution satellite data for free!
- Emerging radar satellite systems

**Do you want to start exploring satellite data? I have a free tutorial I can provide for FarmMap4D!**



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Proximal sensors – active optical and lidar



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The future?

- Ground robotics
- UAV deployment of active optical, Lidar and SfM type sensors
- Integrating satellite and proximal sensors
- Towards pasture quality measures



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Sensors and tools for monitoring animals



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There's a lot of hype around "smart tags" and other agtech, but what's the actual need and value?

Three key bits of information producer would love to have from a sensor system:

1. Location – where are they?
2. Behaviour – what are they doing?
3. Biological state – are they healthy, are they reproductively active, are they gain weight?



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How does this provide value?

- We surveyed producers...

Application	All respondents (%) n=60	Pastoral beef (%) n=21	HRWS* Beef (%) n=21	HRWS* sheep (%) n=12	HRWS* beef/sheep (%) n=18
Water related behaviour	53	44	67	42	56
Welfare monitoring	45	22	38	83	39
Mustering efficiency	42	89	33	50	33
Timing grazing rotations	40	89	29	42	33
Health alerts for critical injuries	38	11	48	33	44
Calving and lambing detection	35	11	57	0	39
Landscape utilisation	33	67	29	17	33
Pregnancy status	30	22	38	8	33
Disease detection	27	11	19	25	61
Refining supplementary feeding	25	44	14	25	33
Stock theft	25	22	38	50	0
Predation detection	20	11	5	33	28
Genetic matching (dam/offspring)	20	22	14	42	6
Oestrus detection	18	22	29	8	11
Poisoning detection	17	0	14	25	22
Refining fertiliser application	13	0	19	8	17
Genetic matching (male/female)	10	11	10	8	11



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### 1. Location - where are they?

Why is this important?

- You can use this information to infer important things about your animals
- You can find your animal if you need to intervene



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The evolution of GPS on cows



Simple stuff...Are my cows in the paddock where I left them?



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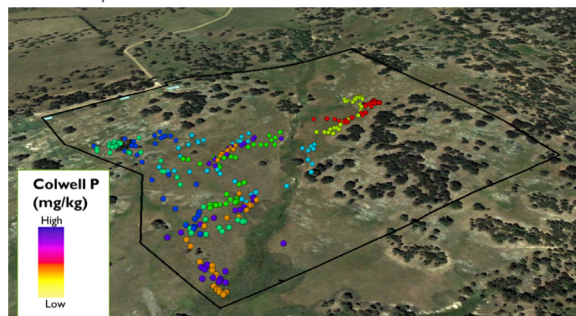
Stock theft (a little bit more complicated)

- Yes, people still steal cattle & sheep in Australia!
- Stock theft costs \$67million per year
- It has a major economic but also social and emotional cost
- Solution – aberrant human interaction related behavior (detecting a mustering event)



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### More complex applications – Understanding landscape utilisation and nutrient redistribution



Colwell P  
(mg/kg)

High

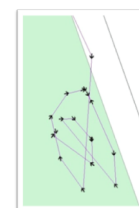
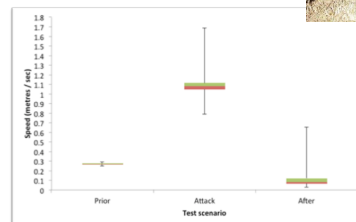
Low

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### Other applications...

- Predation detection

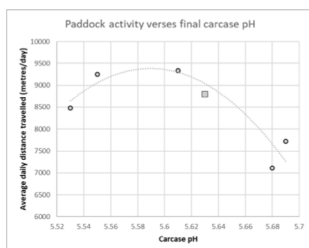


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### Some interesting possibilities...

- Can we predict dark cutting well before slaughter? All the way back in the grazing phase?



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### From research to reality...

- Commercialisation of GPS tracking systems is moving fast!



SMART PADDOCK

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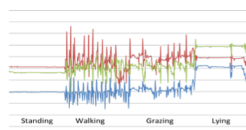
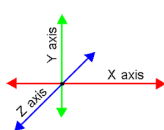


iotag

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### 2. Behaviour – what are they doing?

- Fine scale behavioural data from accelerometer sensors
- Can be used to detect activities and behaviours that can be linked to the 'state' of the animal

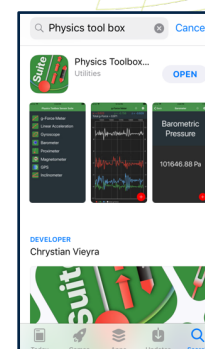


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### Lets try this out...

- Download the 'Physics Toolbox Sensor Suite' onto your phone
- i-phone Ap store
- Google Play



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Intensive animal industries have been using these for many years

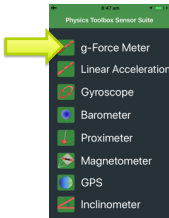
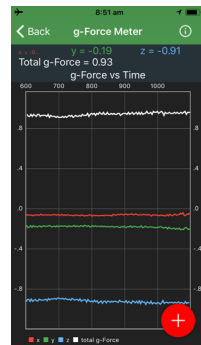


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Open up the app...

- Select the G-force meter

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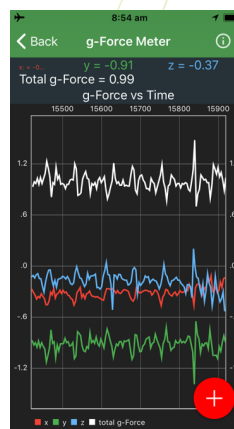
Leg tag simulation – standing up and lying down



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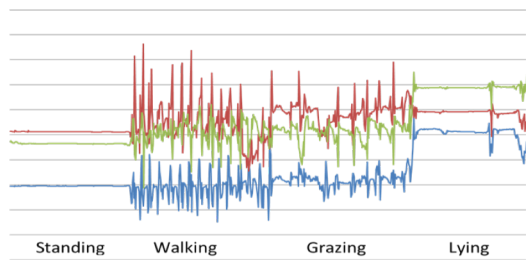
Ear tag simulation

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Behavioural modelling from accelerometers



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Simple modelling – detecting buffalo (horn) fly



Head shake or turn: rapid, head movement to the side of their body

Ear twitch: twitching of one or both ears

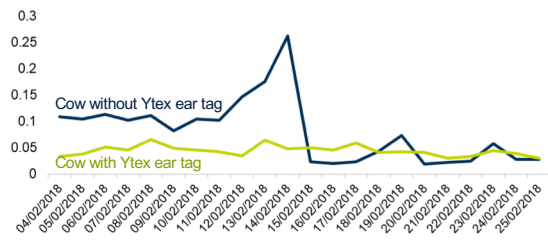
Cow fitted with a GPS tracking collar and ear accelerometer

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## Fly agitation index

- Guess which day the cow (blue line) was treated with pour on?



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## What else are we working on?

- Detection of bull mating activity (OSU)
- Detection of calving and quantifying dystocia
- Detection of calf death (through maternal behaviours)
- Quantification of temperament in yards and paddock (agitation)
- Disease detection
- Grazing/ruminating behaviour as an indicator of pasture quality



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## Commercial developers of behaviour sensors



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HerdDogg



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## Managing the animal: virtual fencing



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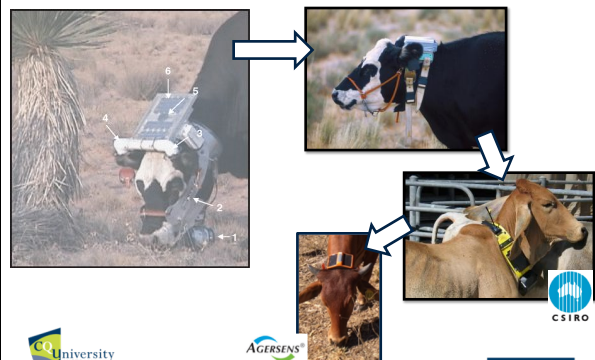
## Virtual fencing

- Virtual fencing allows remote location management of livestock
- Why?
  - Increase pasture utilisation
  - Reduce the impacts of overgrazing
  - Exclude grazing from sensitive areas (riparian zones)
  - Automated mustering



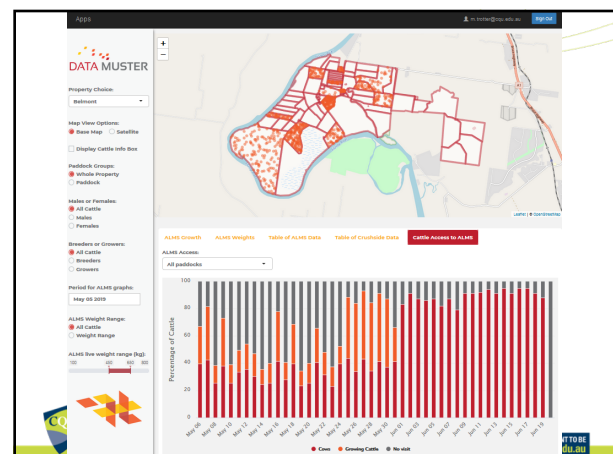
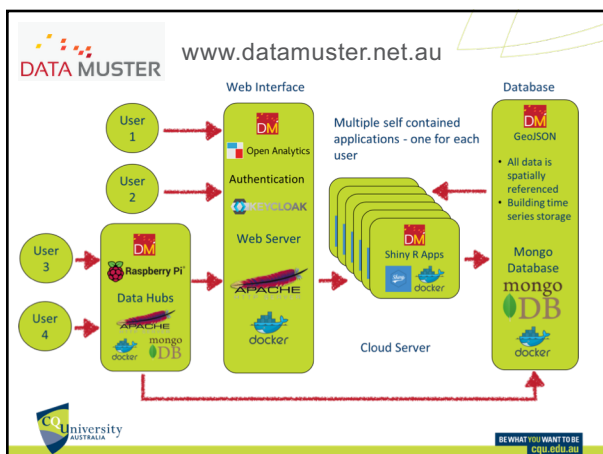
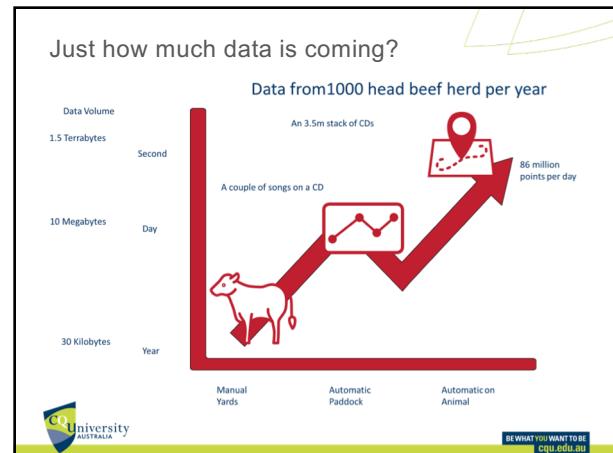
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## The evolution of VF systems



AGERSENS<sup>®</sup>

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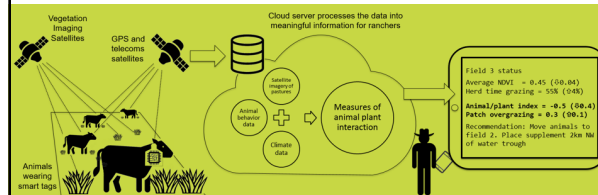


## Opportunities for the future



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## Data integration



- Combining data from multiple sources (animal, plant & climate sensors) to drive better decision making



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## Engaging the next generation of innovative producers and industry experts



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## A critical problem for Australian Agriculture

- Fewer people wanting to be employed
- Agriculture has a bad image
- Fewer really smart kids coming through (the industry leaders and researchers of the future)



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## Solution

- Take the current emerging technologies and expose high school students to them in an engaging way...
- This is what ag is now!
- GPS cows (in QLD and NSW)
- We are also working on Active Ewe (NSW Maths curriculum)



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www.gpscows.com

### COURSES



Course 1:  
Getting started



Course 2:  
Getting your  
data ready for  
analysis



Course 3:  
Introduction to  
ArcGIS online



Course 4: Data  
analysis in  
ArcGIS online  
and Excel

BROWSE ALL COURSES



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## Opportunities to visit us!



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Come visit us!

- More than the beef capital of Australia!



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Beef Week 2021 (held every three years)

- Shuts Rockhampton down for 2 weeks



1<sup>st</sup> week of May 2021



beefaustralia.com.au/

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Advanced Queensland Industry Research Fellowships

- 3 year industry integrated post-doctoral or research fellowships
- Early Carer Industry Research Fellowships (\$120k per year)
- Mid Career Industry Research Fellowships (\$200k per year)



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Fulbright Scholar Program

- CQUniversity provides funding for 1 Fulbright scholar each year
- Applications due 16<sup>th</sup> September
- Student programs as well!



Professor Derek Bailey  
(NMSU) – Fulbright Scholar 2017



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Joint PhD Program (Cotutelle)

- Undertake PhD program at both your US institution and spend time in Australia doing research
- Currently establishing these with NMSU and OSU
- Keen to discuss other opportunities



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### Undergraduate Student Study Tours

- We have developed a 2 week study tour program for animal science courses
- Provides students with a very broad range of experiences in Australian agriculture
- From beef, dairy and sheep to squab and crocodile farming



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### Visiting while in the US?

- My family and I will be in New Mexico / Arizona July/August and Ohio August/November this year for Fulbright
- I'm keen to see more of the USA!
- If your located near these locations, we'd be keen to come visit! (particularly if you have a craft brewery in town)



Hudson and Edmond Trotter  
Dr Tienke Trotter (Lecturer & researcher in cropping systems + runs study tours)



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Thanks!

More info:

[m.trotter@cqu.edu.au](mailto:m.trotter@cqu.edu.au)

[www.datamuster.net.au](http://www.datamuster.net.au)

[www.gpscows.com](http://www.gpscows.com)

Meat & Livestock Australia Report (free)  
Google "MLA Demonstrating the value of location behaviour data in the red meat value chain"



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