New technologies to improve productivity and sustainability of livestock production

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Marked differences in livestock production systems in Europe and Australia.
Similar challenges for sustainable production

- Productivity => Economic sustainability
- Environmental sustainability
- Animal health and welfare
- Product quality and safety
- Rural life (social aspect)
- Production efficiency
  - Increased inputs costs
  - Decreasing resources
  - Reduced labour availability and high cost?

Optimising production systems
Our approach: sensors and models

**Animals**
- Sensors
- Models

**Vegetation**
- Proximal sensing
- Remote sensing

**Environment**
- Weather
- Soil
- Water

**Integration**
- Animals
- Vegetation
- Infrastructure
- Environment

**Goal is to improve:**
- Productivity and profitability
- Environmental sustainability
- Animal health and welfare
- Rural life

**Infrastructure**
- Fences
- Feeders
- Buildings
Productivity and Profitability

Ongoing work (intensive and extensive)

- **Timely and accurate decision making**
  - Growth, reproduction and mortality
  - Grazing management
  - Feed supplementation
  - Management of non-performers
  - Reaching market specifications

- **Genetics => automatic phenotyping**
  - Weight gain and loss
  - Carcass quality
  - Reproduction
Real-time and automatic animal weight
Remote weighing stations

Real-time animal production

Real-time monitoring of weather and management effects
Remote weighing stations

Amount of supplementary hay to avoid weight loss

- Time to start
- Supplement type
- Outcomes: Performance, Environmental, Economic

Hay 70% DMD and 20% CP
Remote weighing stations

- Huge differences between animals
- Understand reasons
- Manage variability
Remote weighing captures:
- Individual profiles
- Mob / paddock profiles
- Temporal effects
  - Seasons
  - Rain events
- Management

Remote and automatic phenotyping
Ongoing work

- Early disease detection
  - Feedlot
  - Grazing
- Detection of animals under stress, injured and diseased in abattoirs
- Adaptation to hot and cold climate
Environmental sustainability

Ongoing work

- **Methane emissions**
  - Predictions (Department of Environment)
  - Management (real-time predictions)

- **Landscape management**
  - Managing climate variability / drought
  - Cell and rotational grazing systems
  - Great Barrier Reef
  - Monitoring the feedbase
  - Understanding animal behaviour and impact
Real-time predictions from live weight

![Graph showing live weight, feed intake, growth rate, and methane emissions over time.](image-url)
Methane emissions

Quantifying methane emissions with models and remote monitoring

Methane emissions with no production:

Methane
Jul: 38 kg CH\(_4\)/hd
Jan: 78 kg CH\(_4\)/hd
+ 105%

Intake
Jul: 1.12 ton DM/hd
Jan: 2.51 ton DM/hd
+ 122%

LW:
Jul: 436 kg CH\(_4\)/hd
Jan: 427 kg/hd
-11 kg/hd

Cumulative CH\(_4\), kg / head

0.55 kg CH\(_4\) / kg growth

vs.

0.25 kg CH\(_4\) / kg growth
Sustainable beef: Project Pioneer

- Beef producers, WWF, USYD and RCS
- Reduce the environmental impact of beef production on the Great Barrier Reef
  - 50% of GBR has disappeared since 1985
  - 75% of GBR catchment are grazing lands
- Biodiversity
- Improve productivity and profitability
- Identify and promote adoption of new technologies for improved land management
  - Remote weighing
  - Drones
  - Satellite imagery

http://www.worldwildlife.org/projects/wildlife-crime-technology-project
Supporting climate change policy

**Emissions Reduction Fund => approved methods**

- Producers paid for abating GHG (to achieve target under Kyoto)
- Whole Herd Management methodology
  - Efficient production (growth rate, reproduction, mortality)
  - Productivity gains outweigh GHG emissions
- University of Sydney Livestock in Landscapes group is working with Department of Environment to develop:
  - **Modelling tools** necessary for a **Beef Cattle Herd Management methodology**
  - **Decision support tool for producers** => ‘what if scenarios’
Reducing GHG emissions from cattle ...and increasing productivity

Animal production, kg LW / hd / yr

- Native pastures only: 157
- Improved pasture: 200
- Improved pastures and grain: 220

Economic outcomes?

Productivity and environmental outcomes

- Methane emissions, t CO2e / hd / yr
  - Native pastures only: 8.9
  - Improved pasture: 7.8
  - Improved pastures and grain: 7.4

- Emissions intensity, kg CO2e / kg LW
  - Native pastures only: 1.39
  - Improved pasture: 1.55
  - Improved pastures and grain: 1.62

Model results for steers with an initial LW of 350 kg/hd
Irrigated animal production
Using drones to assess the feedbase and groundcover
Intensive grazing systems

Efficiency of production in the rangelands
Intensive grazing systems
Intensive grazing systems

Understanding landscape use and diet selection

- Designing farming systems
Thank you and happy to respond any questions!!!!