 **Computer-assisted farm & farm environment management**

Andrew Moore and Michael Robertson  
CSIRO

 **Context**

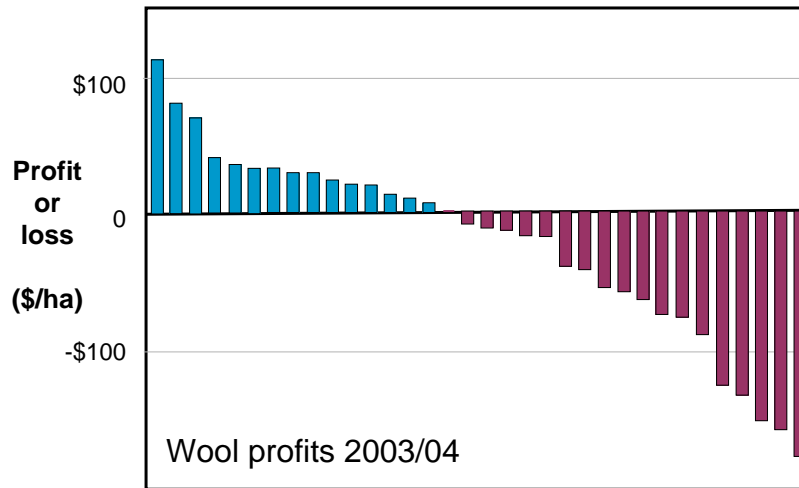
- Decline in terms of trade**
  - driving increased production efficiency
- Uncertainty in short-term production**
  - largely driven by weather
- Long-term resource management issues**
- Increasing concern about ecological, social and ethical impacts**



Moore & Robertson – Fenner 2006 (2)



## The importance of management



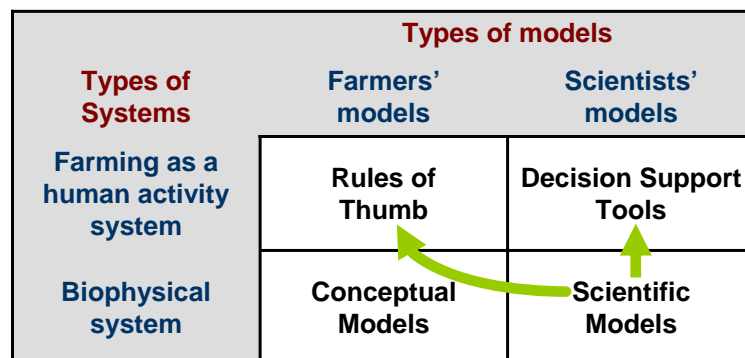
34 local farms participating in an annual comparative analysis

Moore & Robertson – Fenner 2006 (3)

Boyce & Co (Goulburn)



## Paths to impact



Moore & Robertson – Fenner 2006 (4)



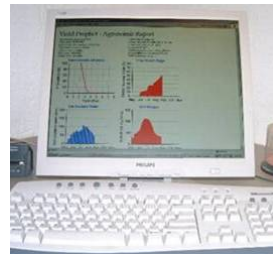
## Learning through simulation

### Flight Simulators



Moore & Robertson – Fenner 2006 (5)

### Farming Simulators



## GrazFeed: How much feed is just enough?

**Predicts production response of sheep and cattle to hay or grain**

**Australian Ruminant Feeding Standards in useable form**

- decades of research brought together

**Especially valuable in drought**



Moore & Robertson – Fenner 2006 (6)



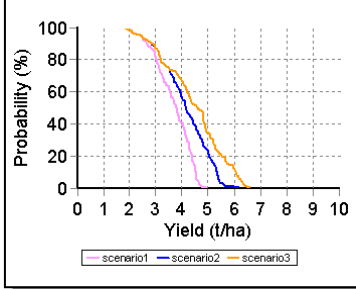
## Yield Prophet: What if I apply more nitrogen?



### On-line paddock monitoring & risk management tool

- Context-specific information
- Risk taken into account

#### 1. Yield Outcome for Nitrogen Scenarios



**Scenario 1**    May 13: 14 kg N/ha  
 July 14: 30 kg N/ha

**Scenario 2**    May 13: 14 kg N/ha  
 July 14: 60 kg N/ha

**Scenario 3**    May 13: 14 kg N/ha  
 July 14: 90 kg N/ha



## Grain & Graze : Farming systems research

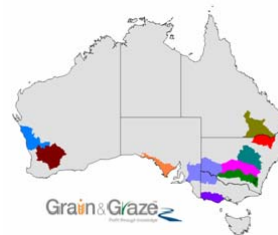
### National RD&E project focussed on mixed farming systems

- 60+ organizations involved
- Seeking to improve the TBL

### Systems analyses with regional teams to enhance experimental results

- Using dual-purpose wheats effectively
- Perennial grasses in WA
- Lucerne phase farming on raised beds
- Ground cover – production tradeoffs

### Balancing economic and NRM outcomes





## CAT-3D: Farm management vs catchment water balance

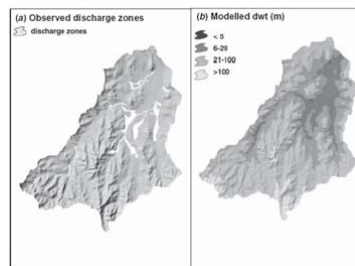
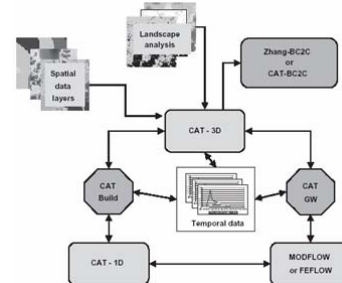
### CRC for Plant-Based Management of Dryland Salinity

- Dryland salinity is a catchment problem
- Investments are applied at the scale of paddocks or farms
- How to cross the scales?

### Link 1D farming systems models & 3D groundwater models

- Can predict streamflow & discharge zones

### “What-if” analyses for policy makers



Moore & Robertson – Fenner 2006 (9)

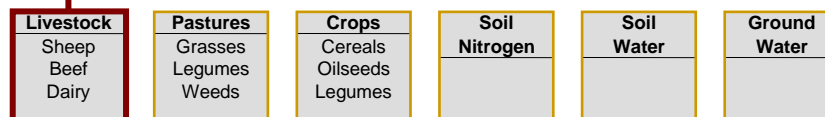
Beverly et al. (2006). AJEA 45:1453



## A modelling “tool kit”

### Different combinations of models

### Purpose-specific interfaces



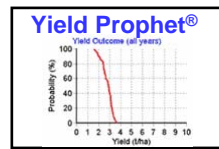
Moore & Robertson – Fenner 2006 (10)



## A modelling "tool kit"

Different combinations of models

Purpose-specific interfaces



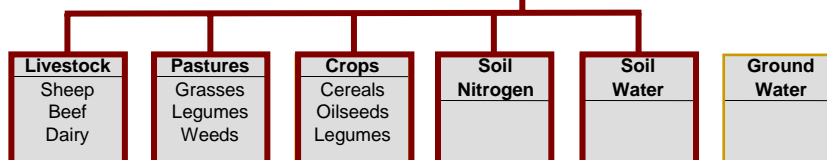
Moore & Robertson – Fenner 2006 (11)



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Different combinations of models

Purpose-specific interfaces



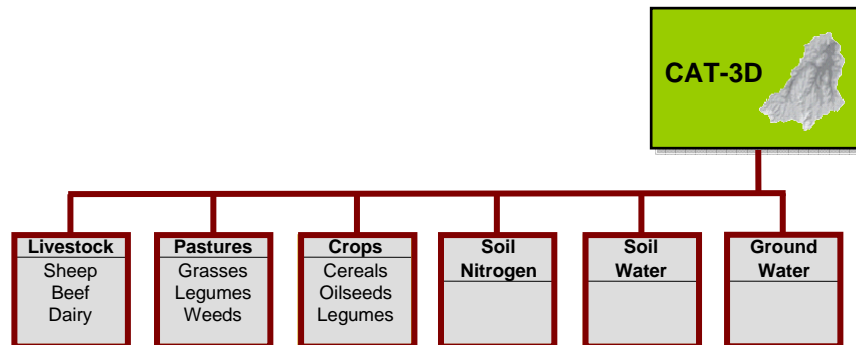
Moore & Robertson – Fenner 2006 (12)



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Different combinations of models

Purpose-specific interfaces



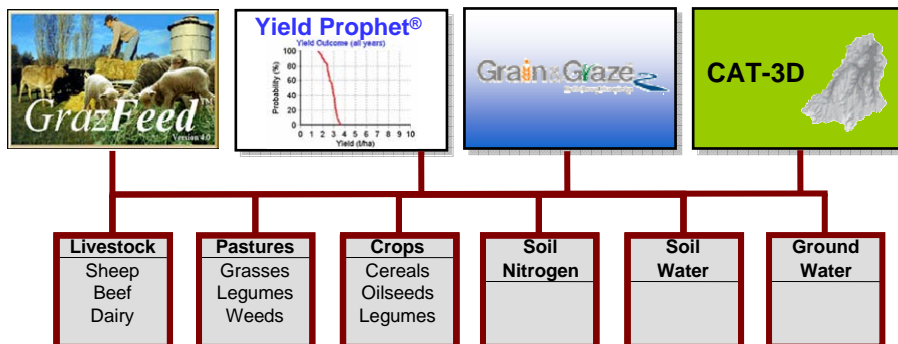
Moore & Robertson – Fenner 2006 (13)



## A modelling "tool kit"

Different combinations of models

Purpose-specific interfaces

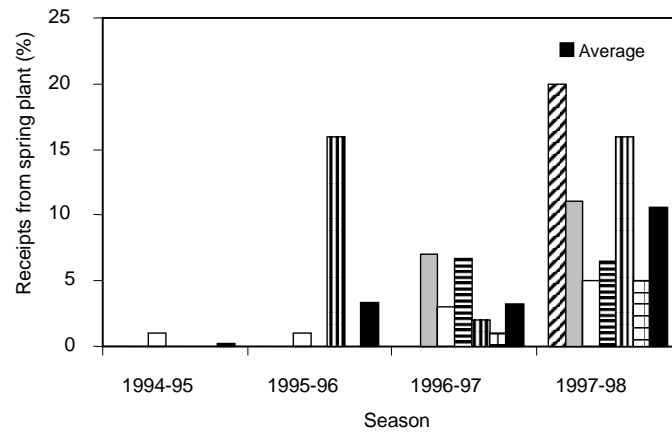


Moore & Robertson – Fenner 2006 (14)



## Changes in farm management practice

### Mungbeans – shift from summer to spring sowing



Moore & Robertson – Fenner 2006 (15)

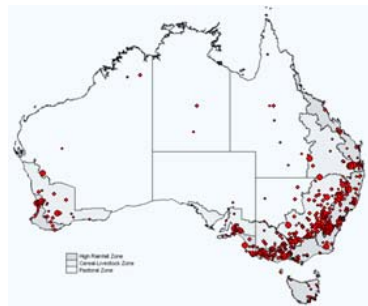


## Substantial economic impacts

### GrazFeed used throughout southern Australia

- ~1200 copies
- advisors and farmers

**Net present value ~ \$300M**



Moore & Robertson – Fenner 2006 (16)





## Shift to quantitative monitoring & decision-making

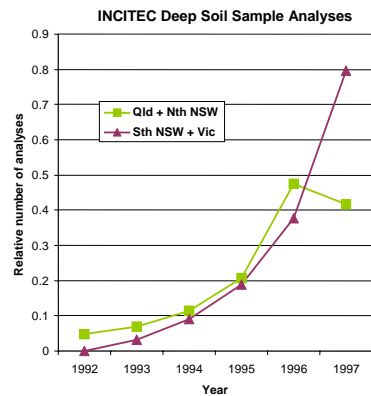
**Management**  
Soil testing  
**Unearthing the benefits of deep soil nitrogen**

by Mike Foale,  
CSIRO AND APSRU  
and Tony Good,  
INCITEC

**CROPPING**

Australian farmers could save up to \$300 per hectare on fertilizer by taking advantage of nitrogen buried deep in the soil profile and known as the nitrogen budget. Soil tests carried out in Queensland and New South Wales have revealed a build-up of deep soil nitrogen in areas which had experienced a run of dry years. Crops in these areas were unable to take full advantage of applied nitrogen or the release of nitrogen from organic reserves, due to lack of moisture. But fertilizer was still applied to many paddocks as farmers were unsure about the fate of nitrogen applied in previous years. Deep soil nitrogen research in central Queensland started on-farm during 1992 (see Figure 1) and in the black clay soils of the Darling Downs during 1993. Most unused nitrogen was found between 300 and 900 millimetres depth (see Figure 2).

A soil coring rig can detect deep soil nitrogen levels at depths up to one metre. This provides valuable information about where mineral nitrogen is located throughout the soil profile.



Moore & Robertson – Fenner 2006 (17)



## The future...

### The current context is long-term:

- decline in terms of trade
- uncertainty in short-term production
- long-term resource management issues
- Increasing concern about ecological, social and ethical impacts

### Fewer landholders, larger farms

### Twice the profit from half the land?

### Imperative to manage well will accelerate



Moore & Robertson – Fenner 2006 (18)



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Thank You