



# The future of agriculture: a view into the crystal ball

CSIRO Sustainable Agriculture Flagship and CSIRO Ecosystem Sciences

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National Research  
**FLAGSHIPS**  
Sustainable Agriculture



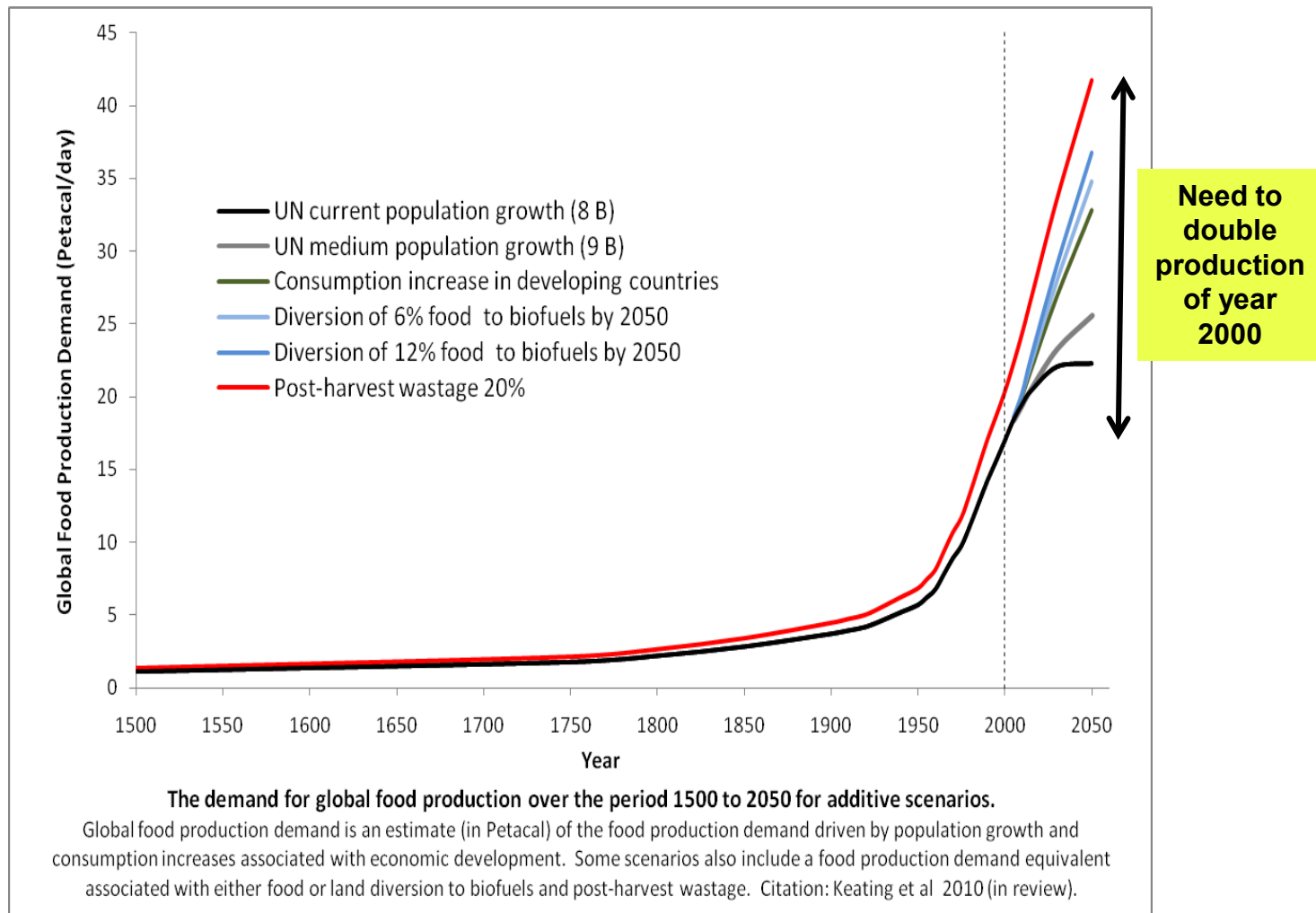
# Outline

- Agriculture in a time of change
- The impressive productivity record of Australian agriculture
- Getting more out of existing inputs
- Variability and risk
- Social change
- Technological change
- Concluding remarks

# A TIME OF UNPRECEDENTED CHANGE...



# Demand for global food production

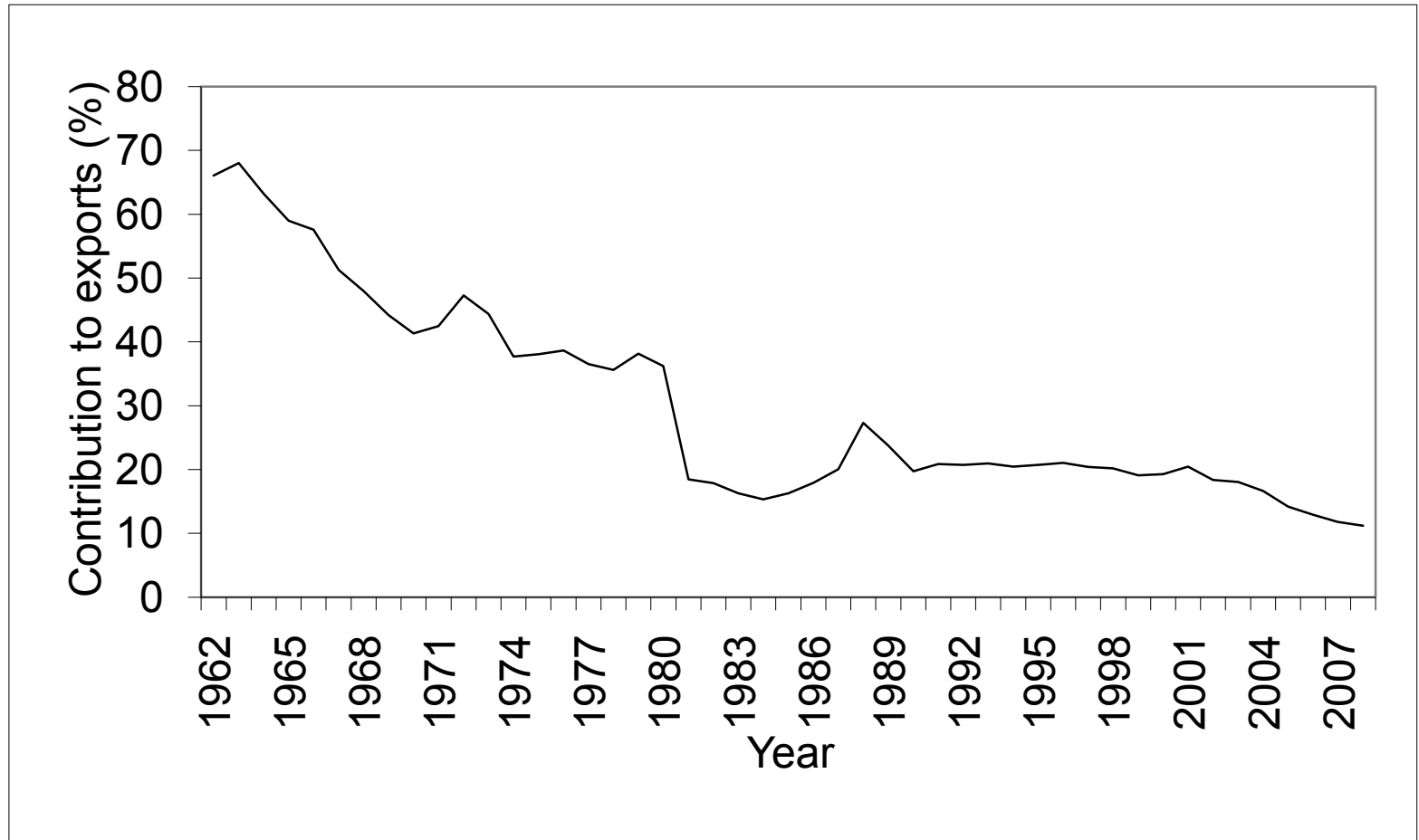




# Contribution to world ....

<i>Commodity</i>	<i>Production</i>		<i>Exports</i>	
	<i>% Australia</i>	<i>% NZ</i>	<i>% Australia</i>	<i>% NZ</i>
Wheat	3	<0.1	10	0
Red meat	4	2	8*	5
Milk solids	2	3	10	21
Butter	1	5	10	53
Cheese	3	2	12	22

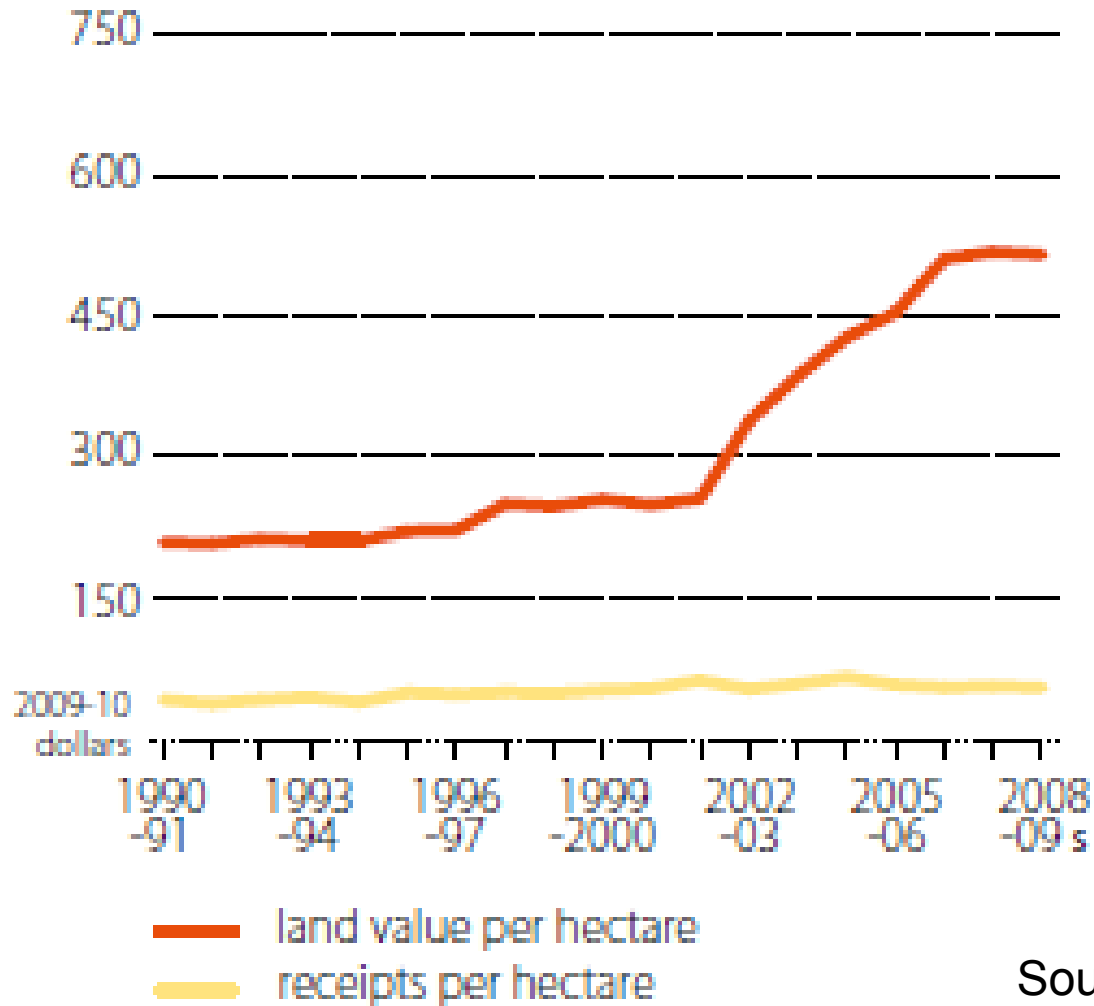
# Agriculture's contribution to Australia's exports



# Declining importance of agriculture

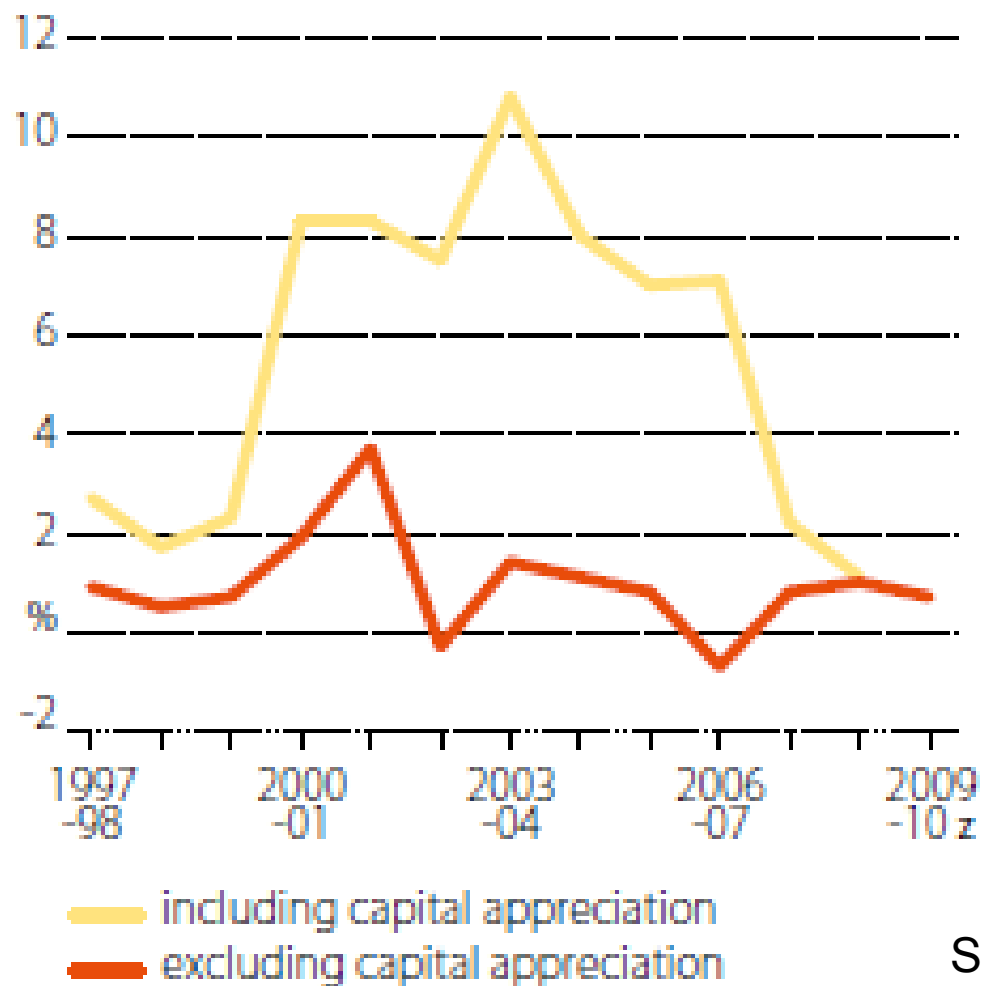
Contribution to national...	
Exports (%)	14
Employment (%)	3
GDP (%)	3

# Land values and earning capacity



Source; ABARE

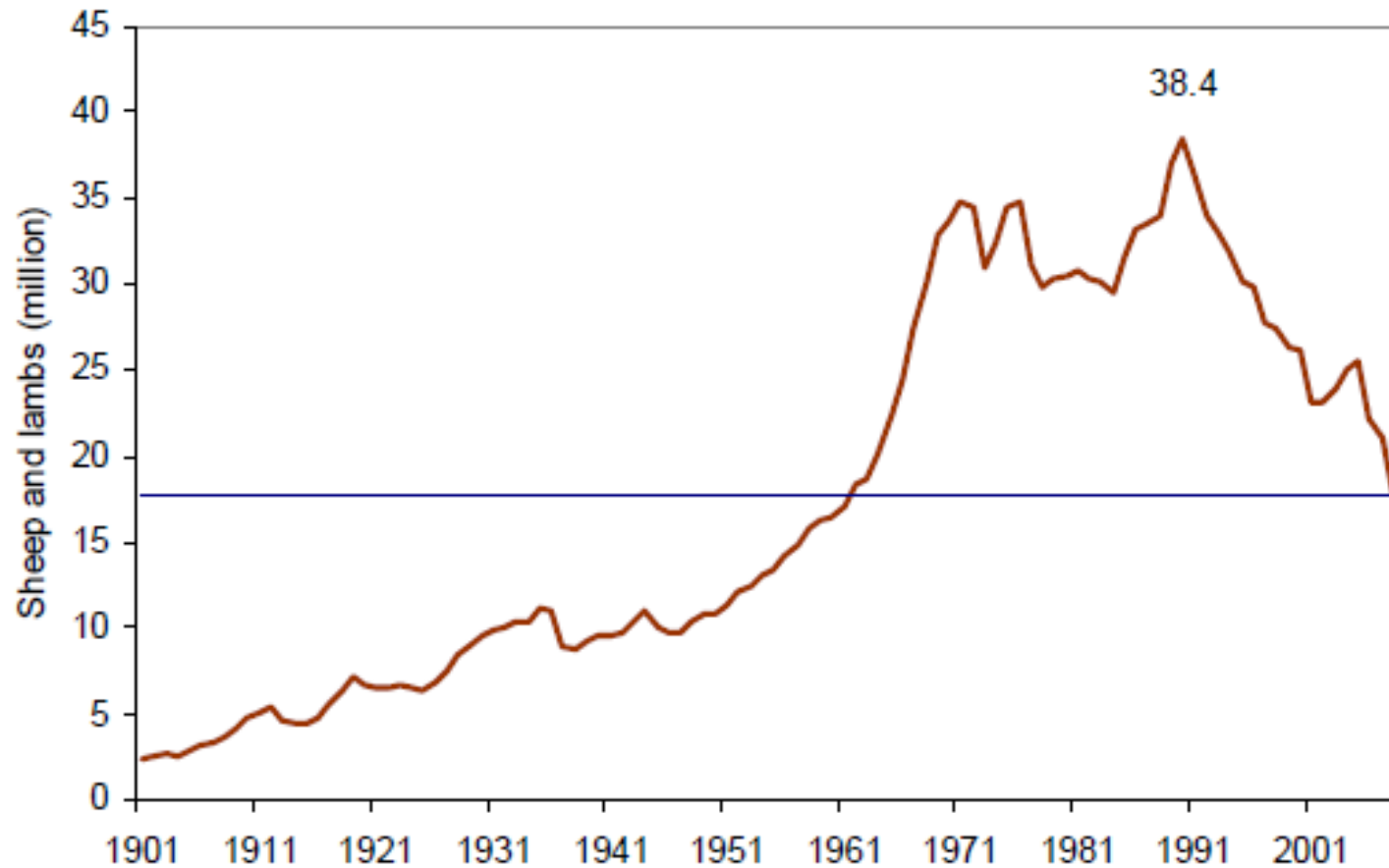
# Return on capital



Source; ABARE



# Decline in WA sheep flock

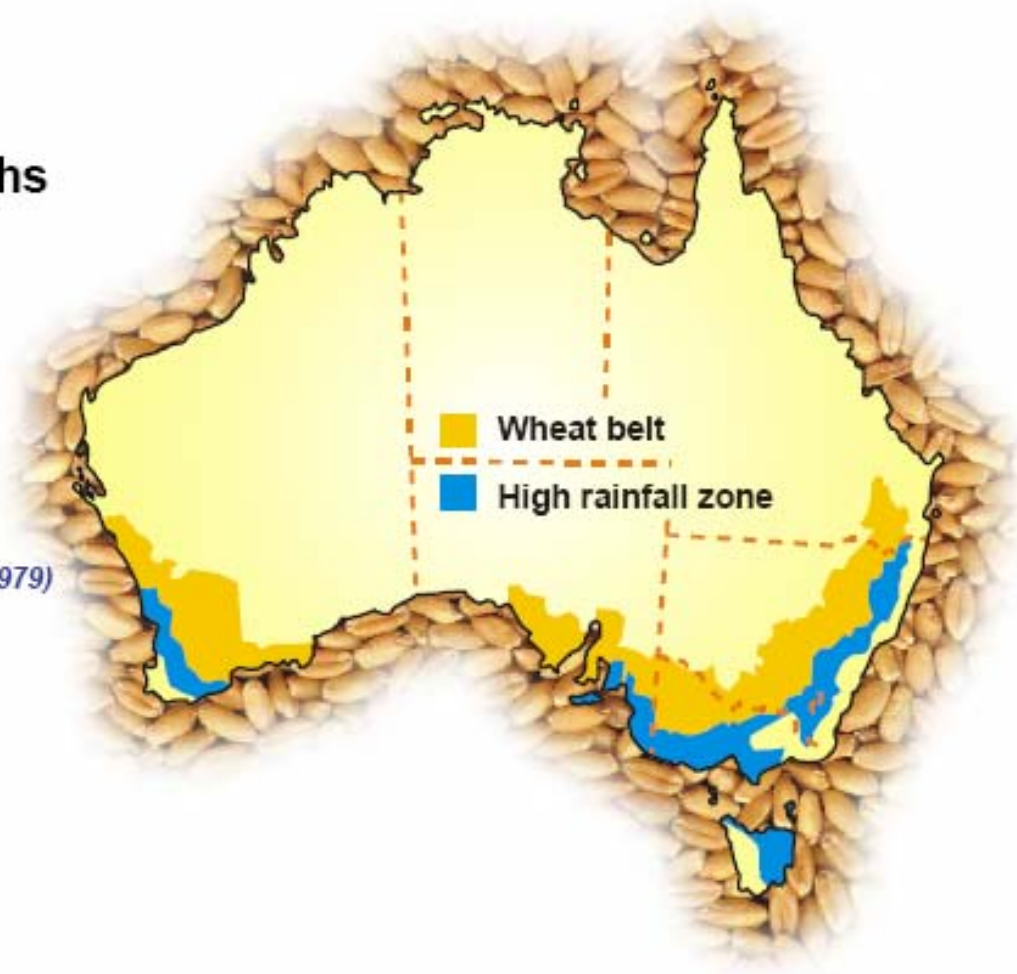


Source; DAFWA

# A region under change - high rainfall zone

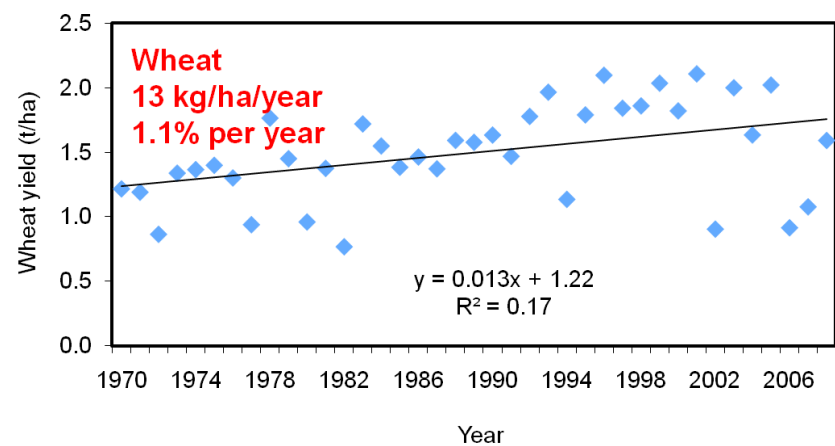
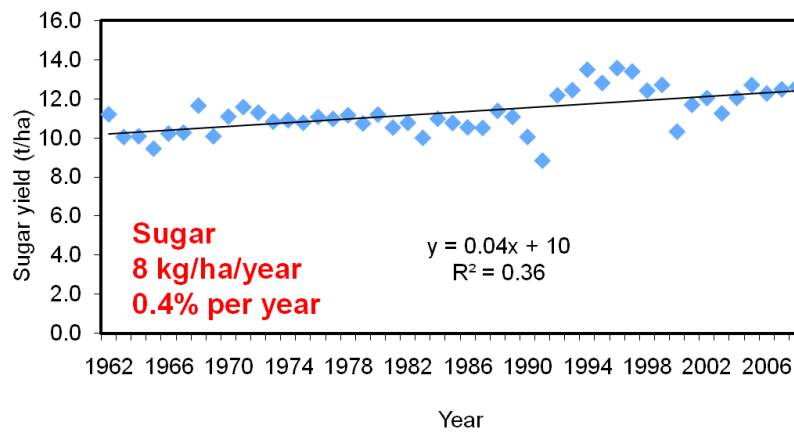
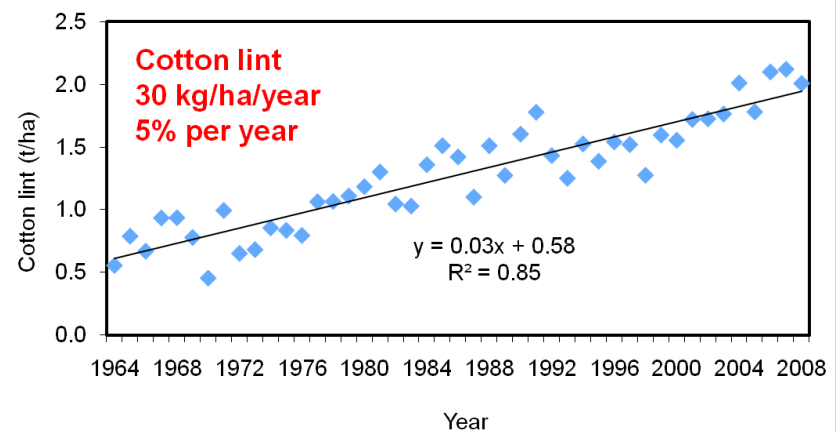
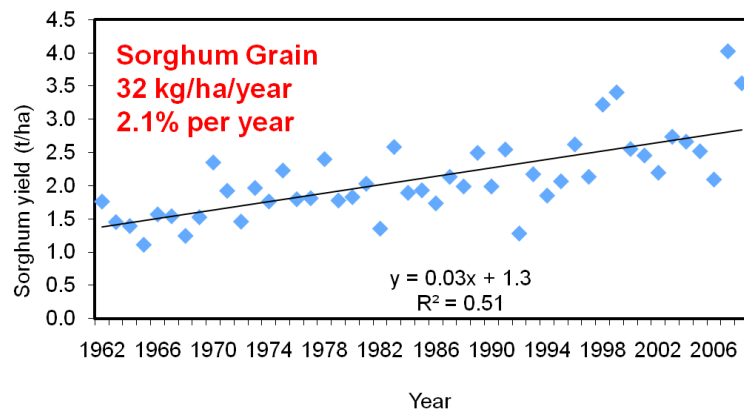
**Growing season** > 9 months  
**Total area** 32 Mha  
**Area for farming** 20 Mha  
**Arable area** 2-6 Mha

*(Johnstone 1984, Stewart et al 1979)*



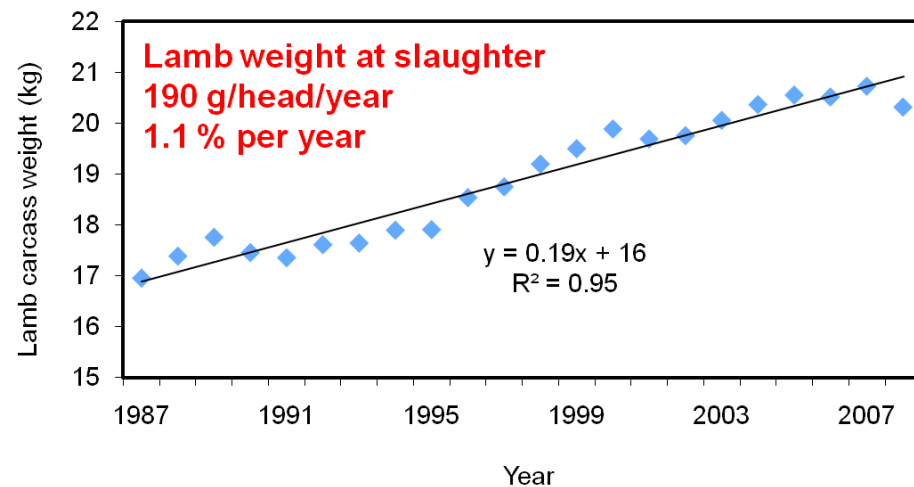
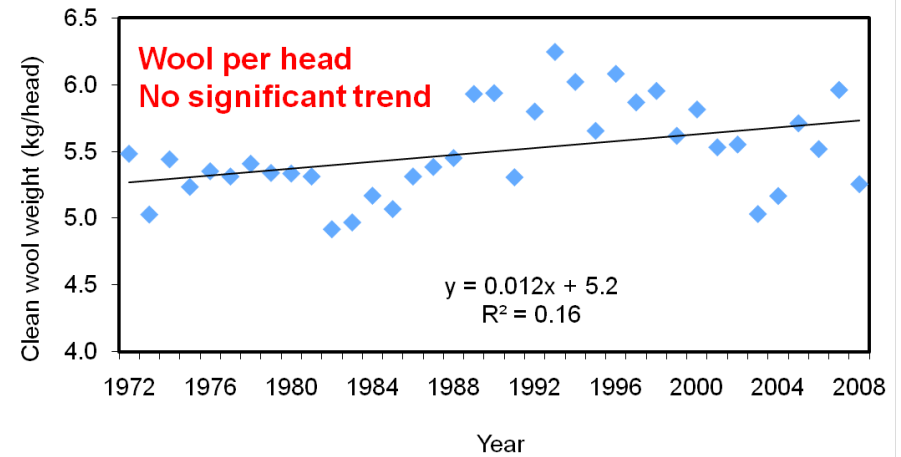
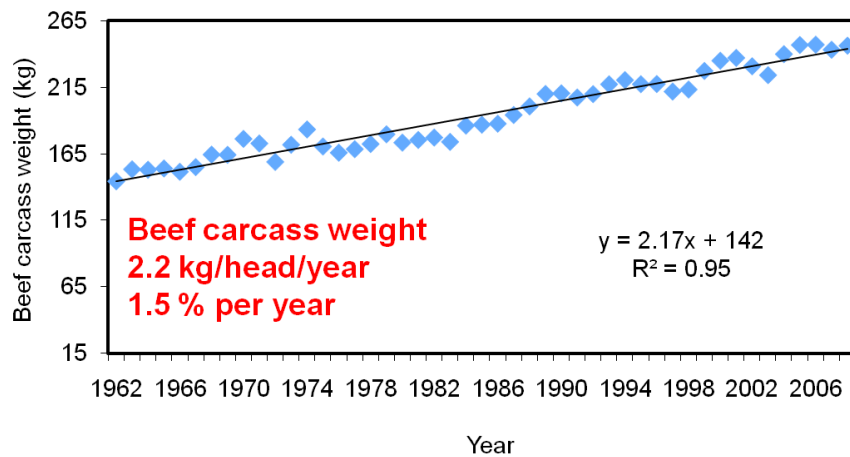
# **THE IMPRESSIVE PRODUCTIVITY RECORD OF AUSTRALIAN AGRICULTURE**

# Broadacre crops - Australia



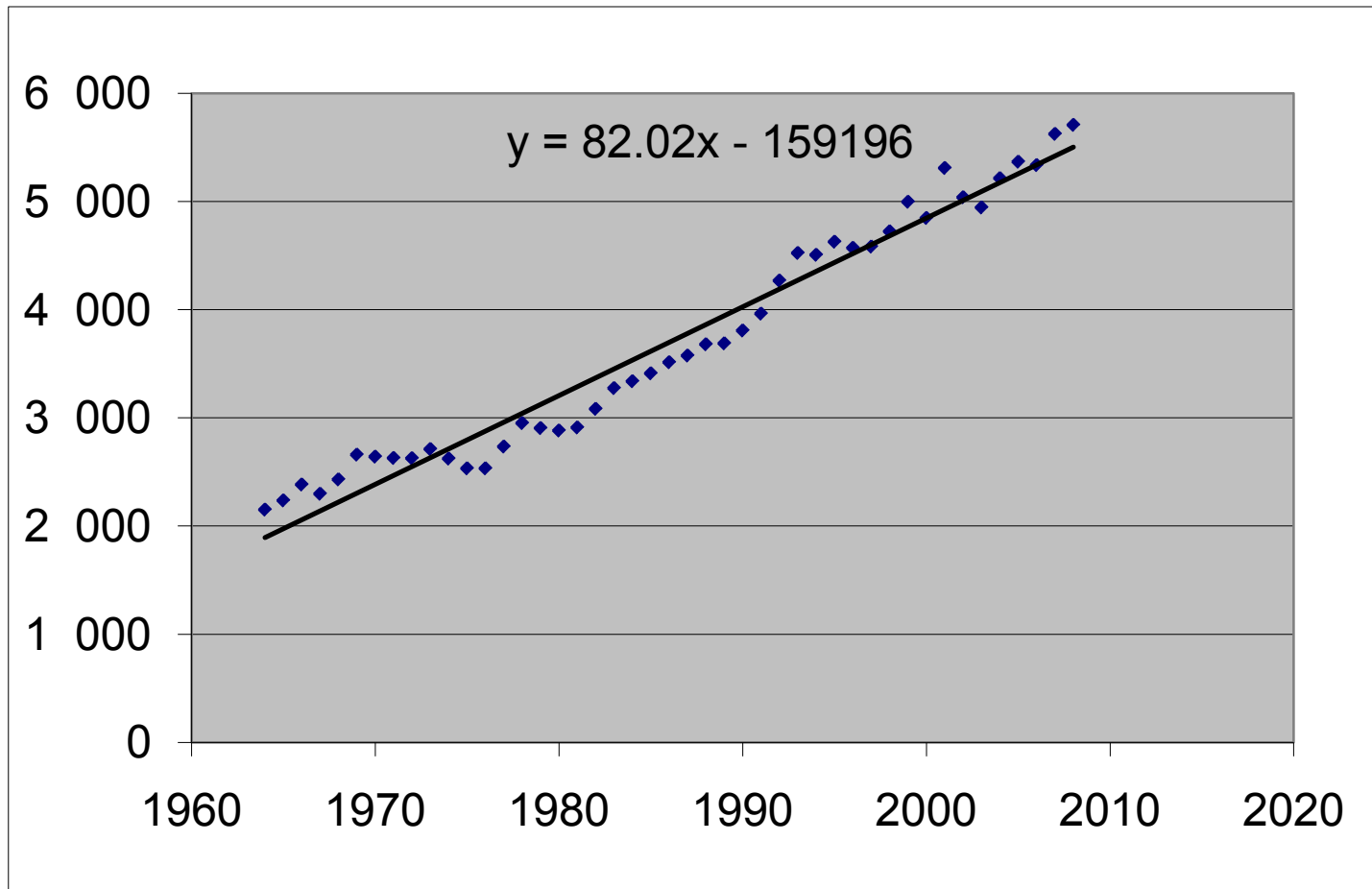
Source; ABARE

# Livestock production - Australia



Source; ABARE

# Milk production (litres) per cow



Source; ABARE

# New systems



Raised bed cropping in high rainfall zone



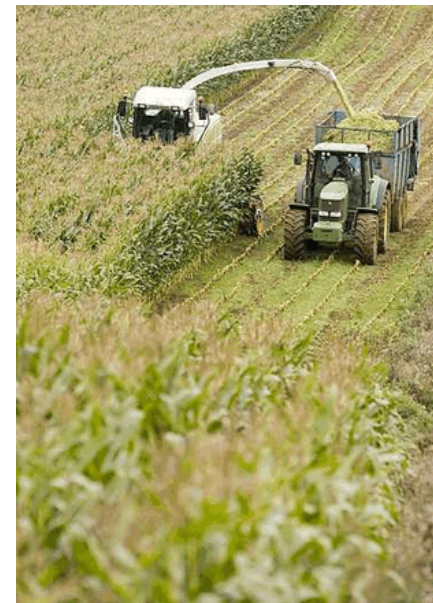
Rotational grazing



No-till grain cropping

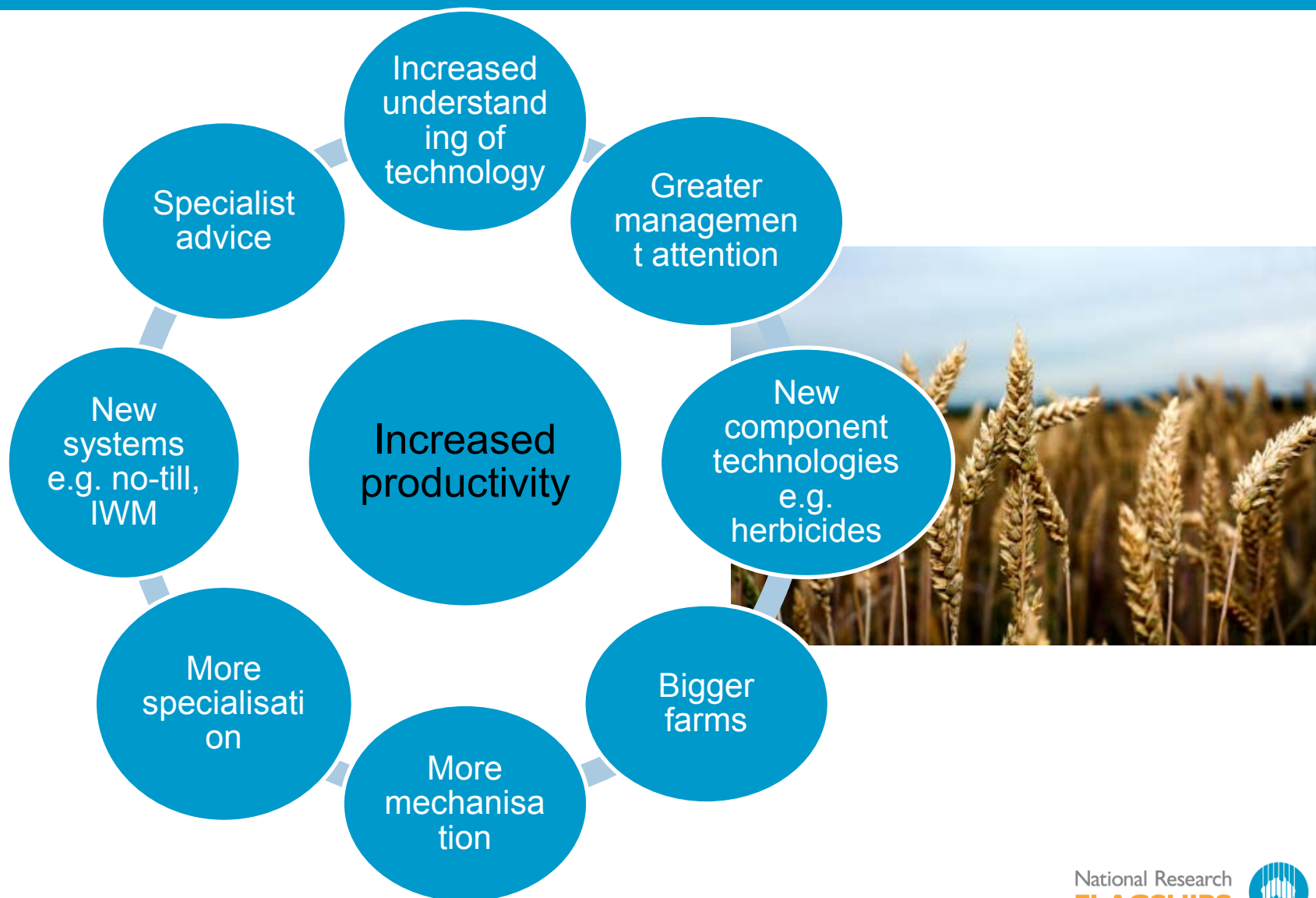


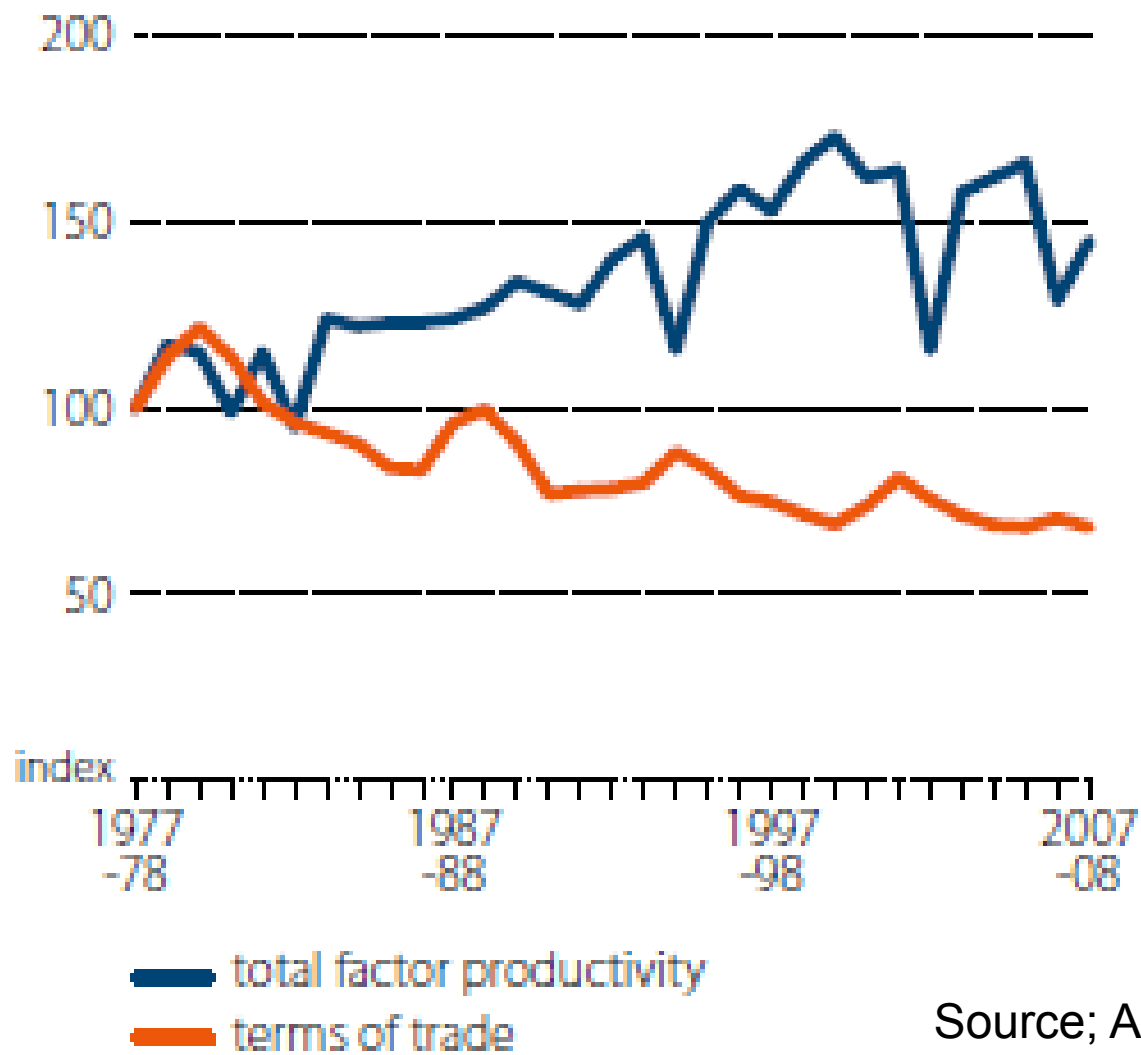
Controlled traffic, min-till, legume rotations in sugarcane



High input forages in dairy

# Contributors to productivity increases in Australian grains industry





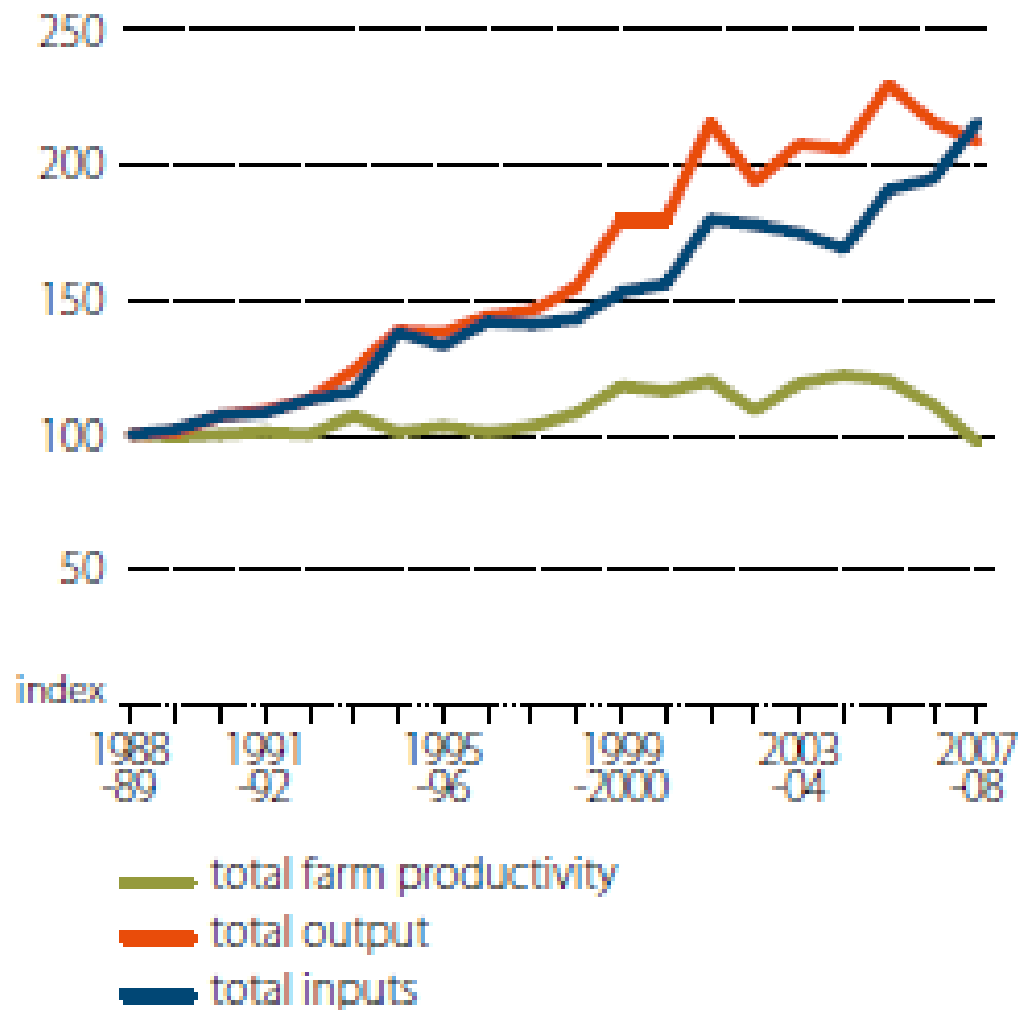
Source; ABARE

# Farm average growth rates (% per year) 1988-89 to 2003-04. Western Australia grains and mixed farms

Total factor productivity	2.5
Outputs	4.8
Crops	4.7
livestock	0.6
wool	-2.9
Inputs	2.3
land	2.7
capital	-0.1
labour	0.1
materials	5.9
chemicals	17.7
fuel	3.5
services	2.6

Source; Knopke et al

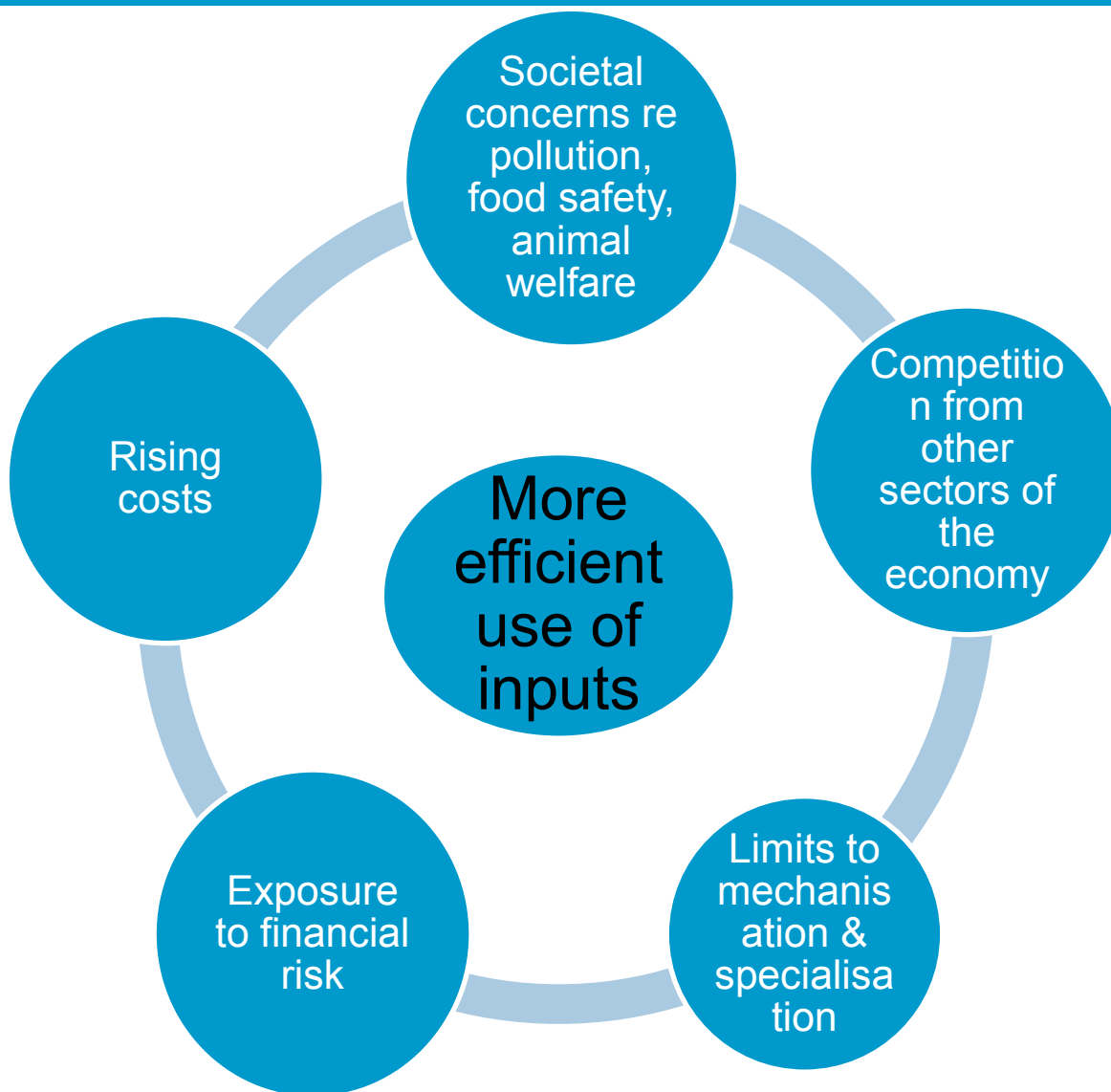
# Dairy productivity growth



Source; ABARE

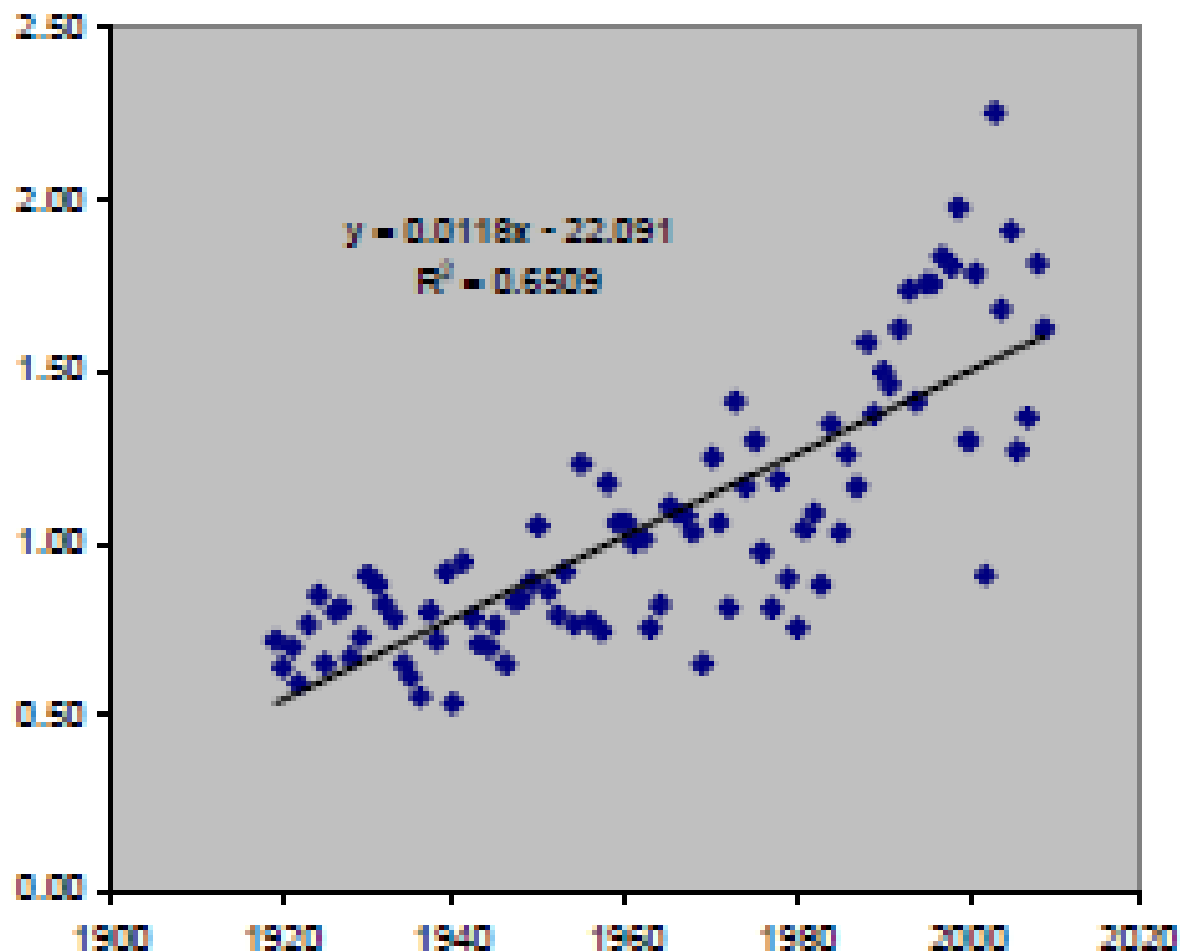
# GETTING MORE OUT OF EXISTING INPUTS

# A key issue – input use efficiency



# VARIABILITY AND RISK

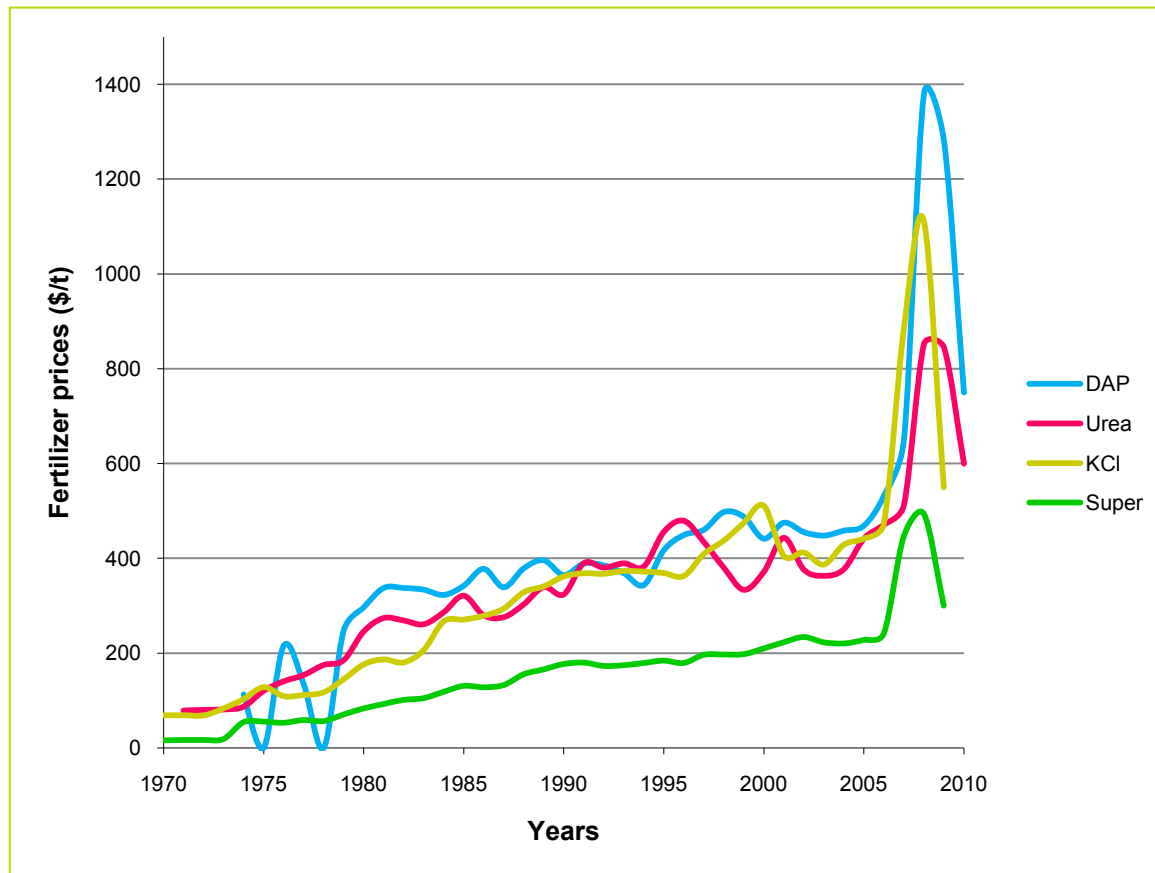
# Production variability



Source; R Kingwell, DAFWA  
WA wheat yield (t/ha) and: linear trend

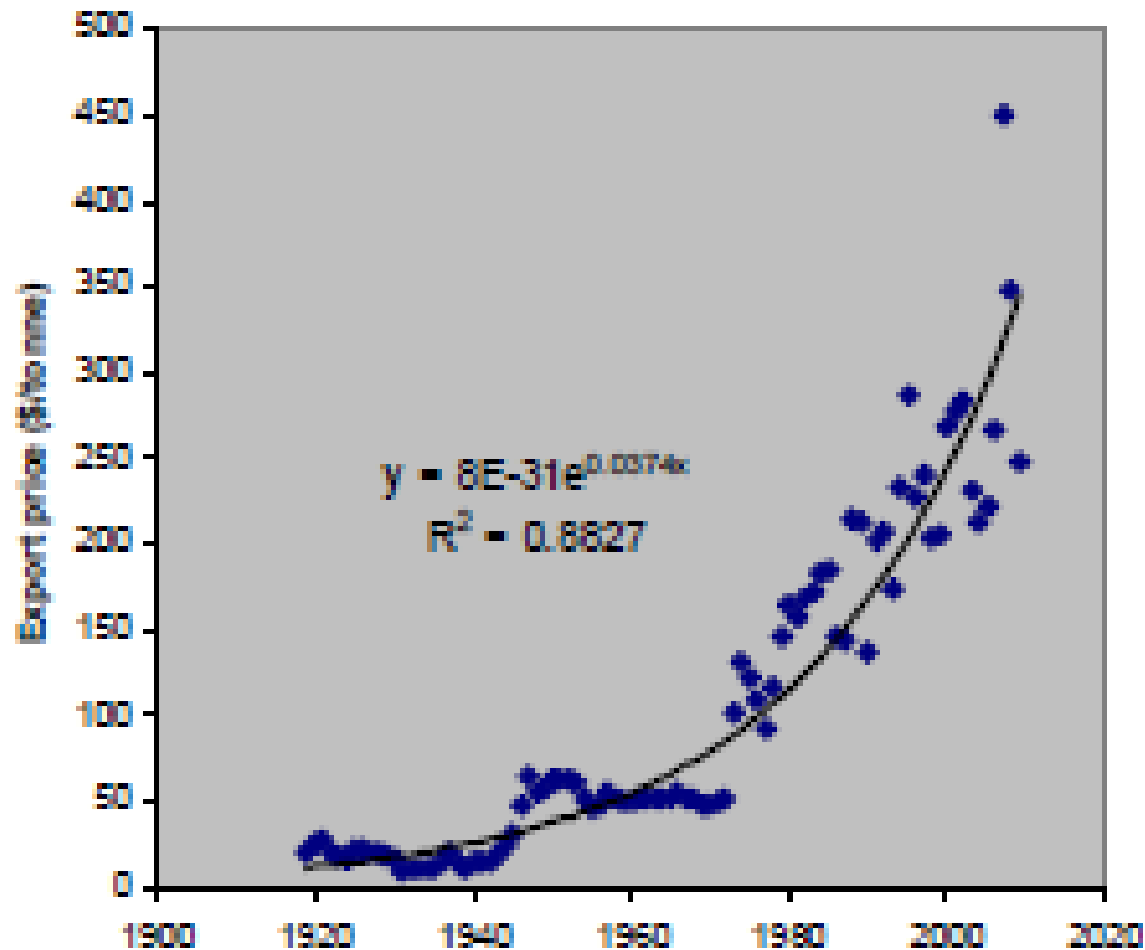
# Cost variability

Historical prices for fertilizers in Australia between 1970 and 2010 (Source: ABARE).



Source: ABARE

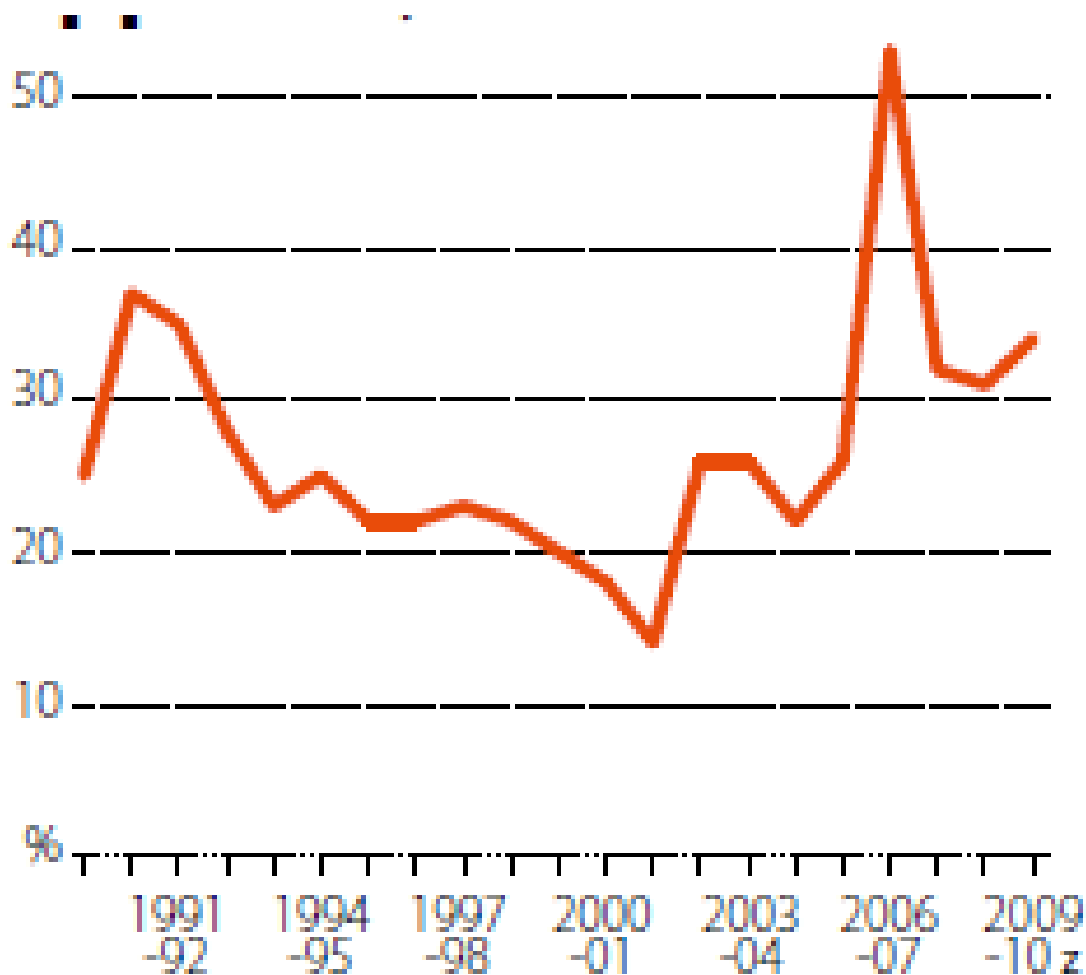
# Price variability



Source; R Kingwell, DAFWA

Export wheat prices and exponential trend

# Debt servicing ratio – broadacre farms



Source: ABARE

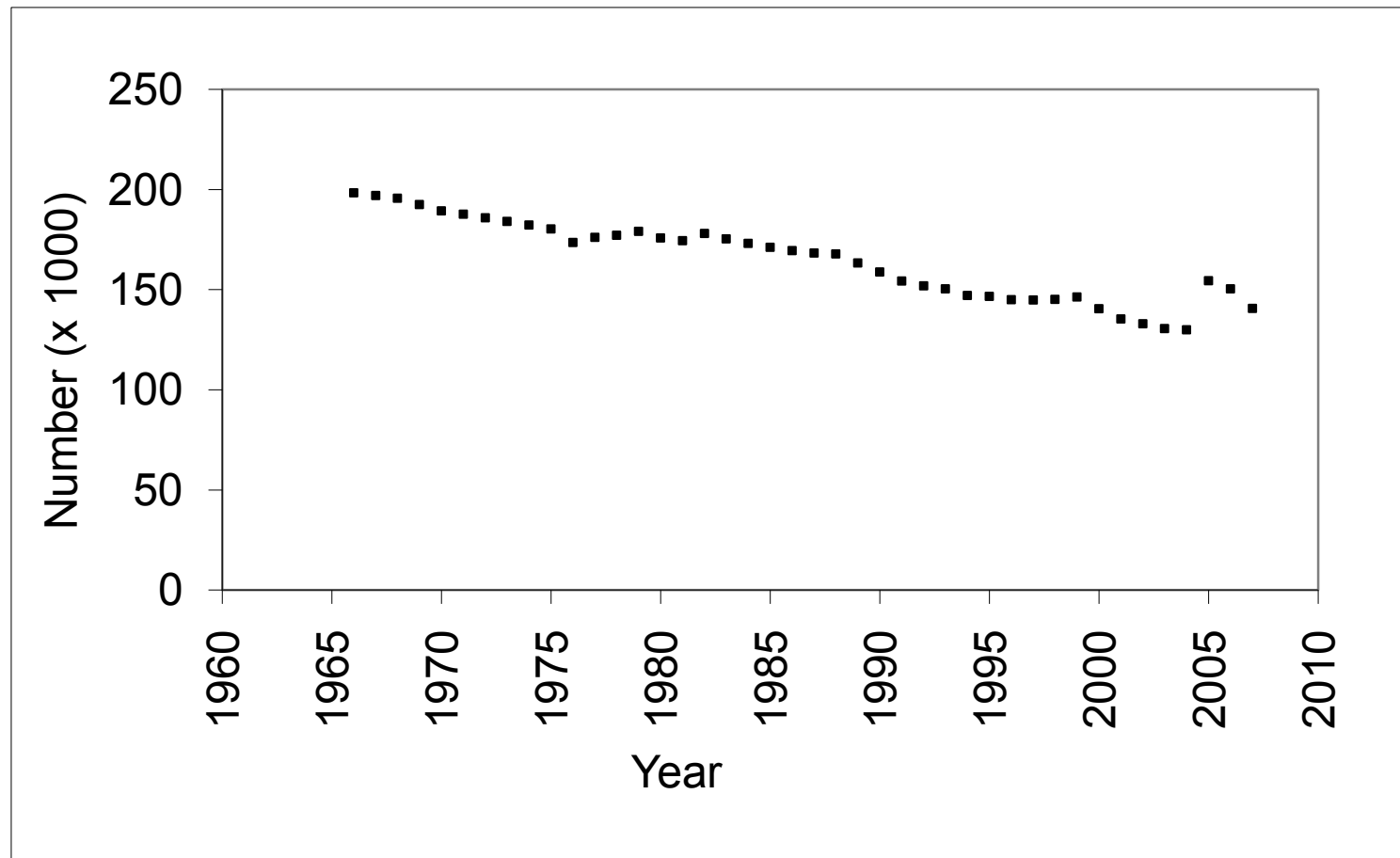
# Off-farm income

- Now just under half of the average total family income
- Small farms with lower incomes, rather than medium or larger farms, are more likely to be dependent on off-farm income.
- Over the past two decades broadacre farmers experienced a greater rise in average off-farm income than dairy farmers.
- women (29%) on broadacre and dairy farms were more likely than owner-managers (17%) to participate in off-farm employment

Source: ABS

# SOCIAL CHANGE

# Decline in number of farms in Australia



Source: ABARE

# Changes in demography

- Less recruitment of young, delayed retirement
- Since 1976 the number of farmers aged 20 to 29 has declined by over 60 per cent.
- The number of farmers aged over 55 has changed little.
- The dairy and cropping industries have maintained a relatively young age profile
- Majority of those in the beef industry are aged between 50 and 64.
- The sheep industry appears to be in a progression towards an older population profile similar to the beef industry

Source: Neil Barr 2004, Victoria DPI

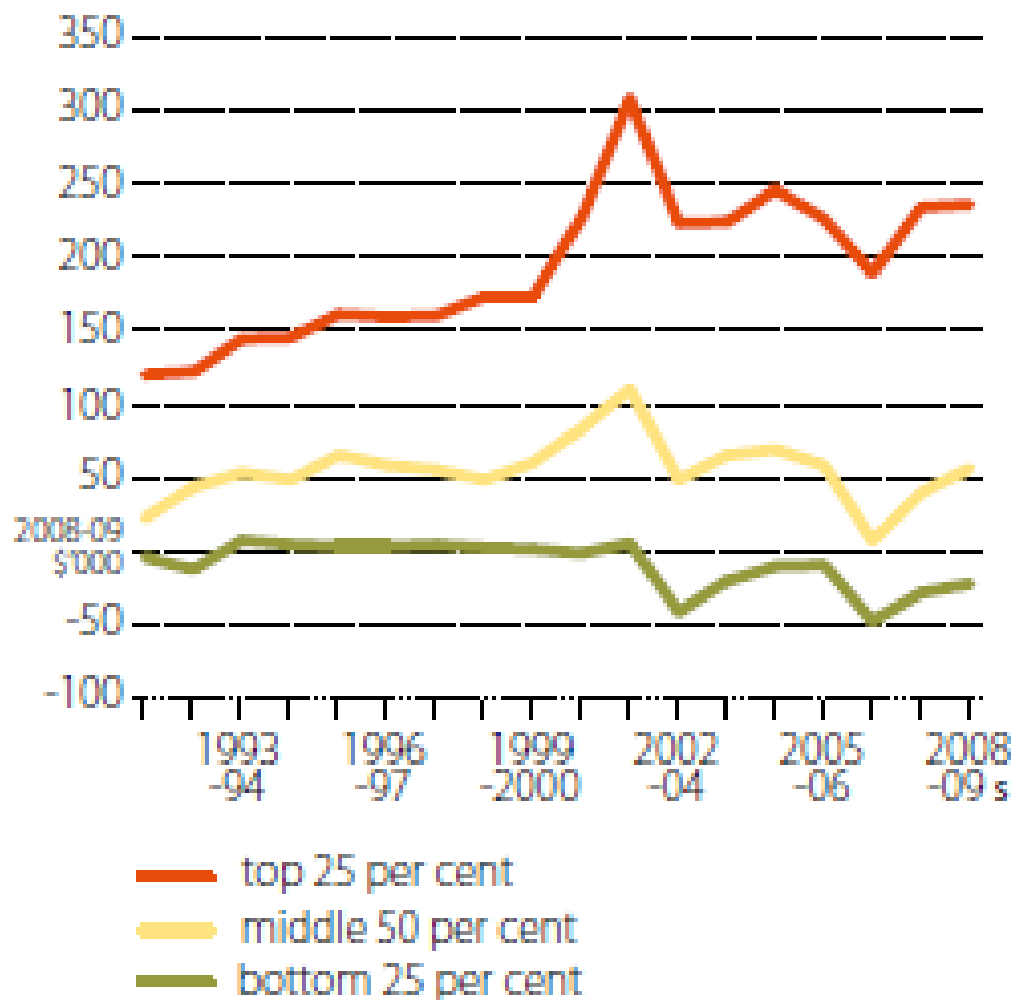
# Small and lifestyle farm sector are..

- distinct groups, so programs/policies should be appropriately targeted and networks developed for this sector.
- generally concerned with lifestyle, not economics, as a driving force of why they own land and how they manage it.
- responsive to horizontal network approaches (e.g. Landcare) not just because of an interest in sustainable land management but because these networks can help them "settle in" to their new lifestyle and can be a source of local information and friends.
- interested in new ideas and learning. Particularly learning which involves exchange of a range of alternative strategies that:
  - are based on local information;
  - are presented in a practical way and at an appropriate time (generally outside of business hours)
  - allow for networking with other landowners and provide personal contact with extension providers.

Source: Neil Barr 2004, Victoria DPI

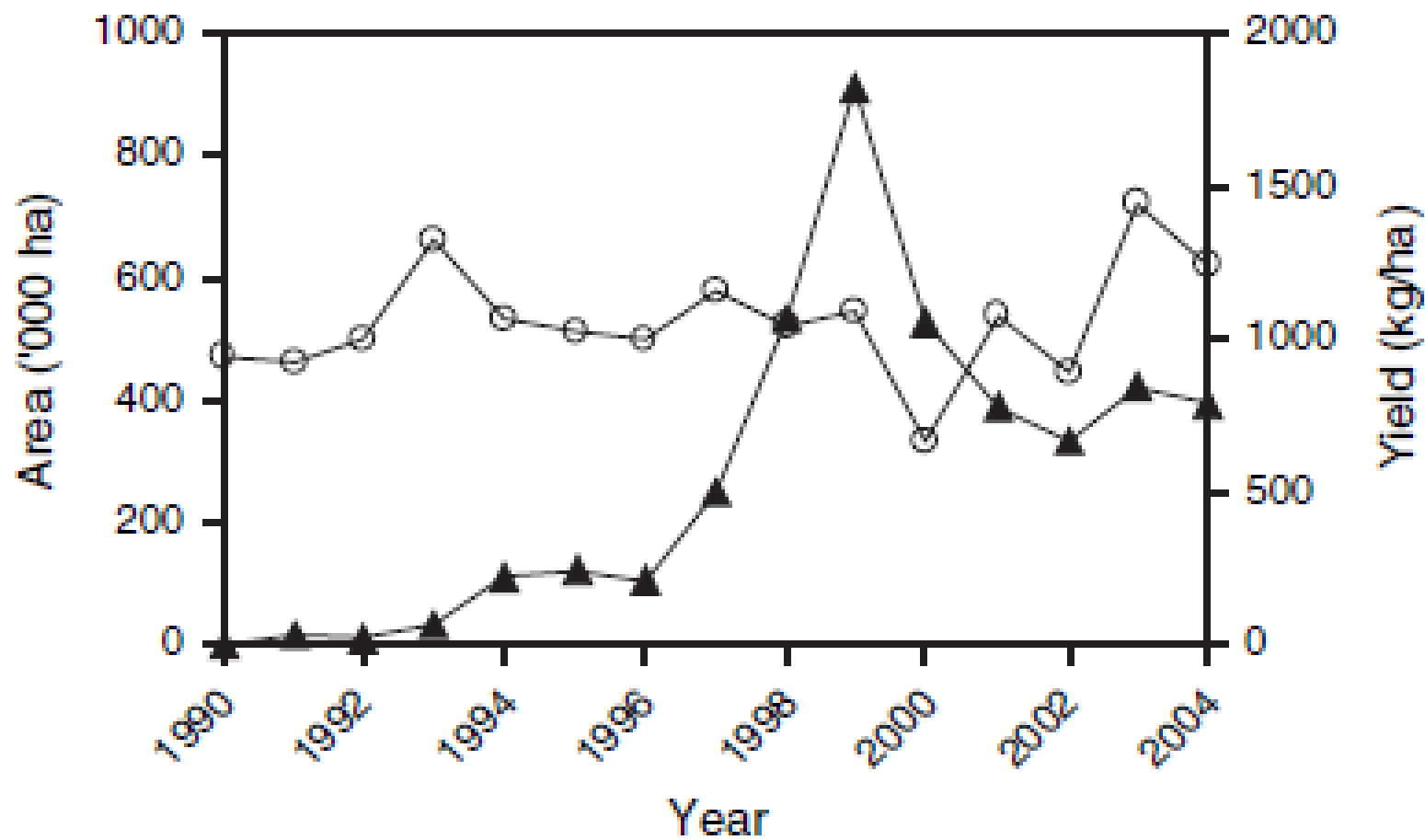
# TECHNOLOGICAL CHANGE AND THE ROLE OF R&D

# Farm cash income – broadacre farms



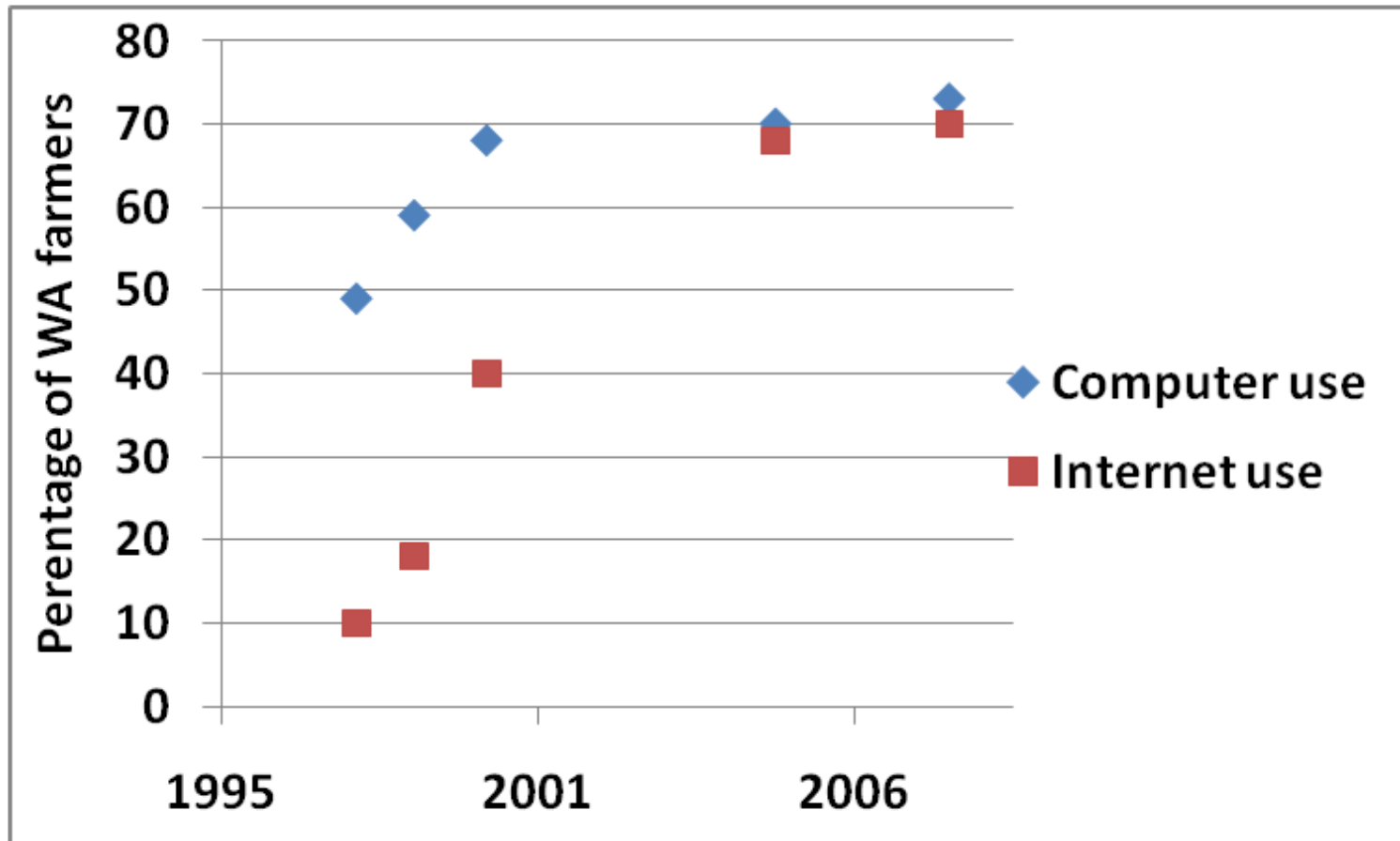
Source: ABARE

# Australian farmers adopt new technology quickly



Area and yield of canola in WA 1990-2004 (Farre et al 2006)

# IT use by farmers in WA

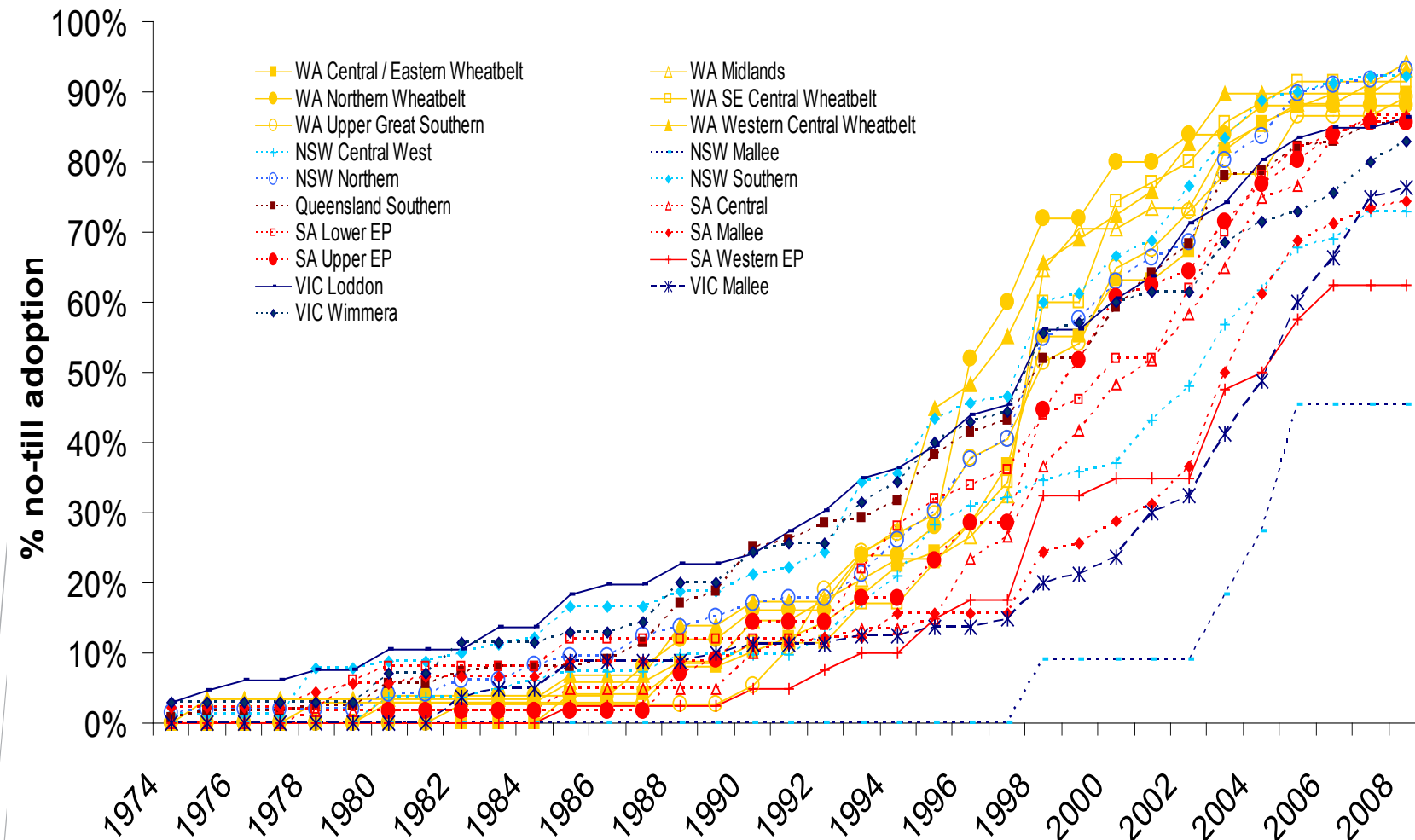


Source: Use of Information Technology on Farms, Australia, June 2000 (8150.0).

# New ways of delivering information and staying connected



# No-till adoption across Australian cropping regions



Llewellyn et al 2009

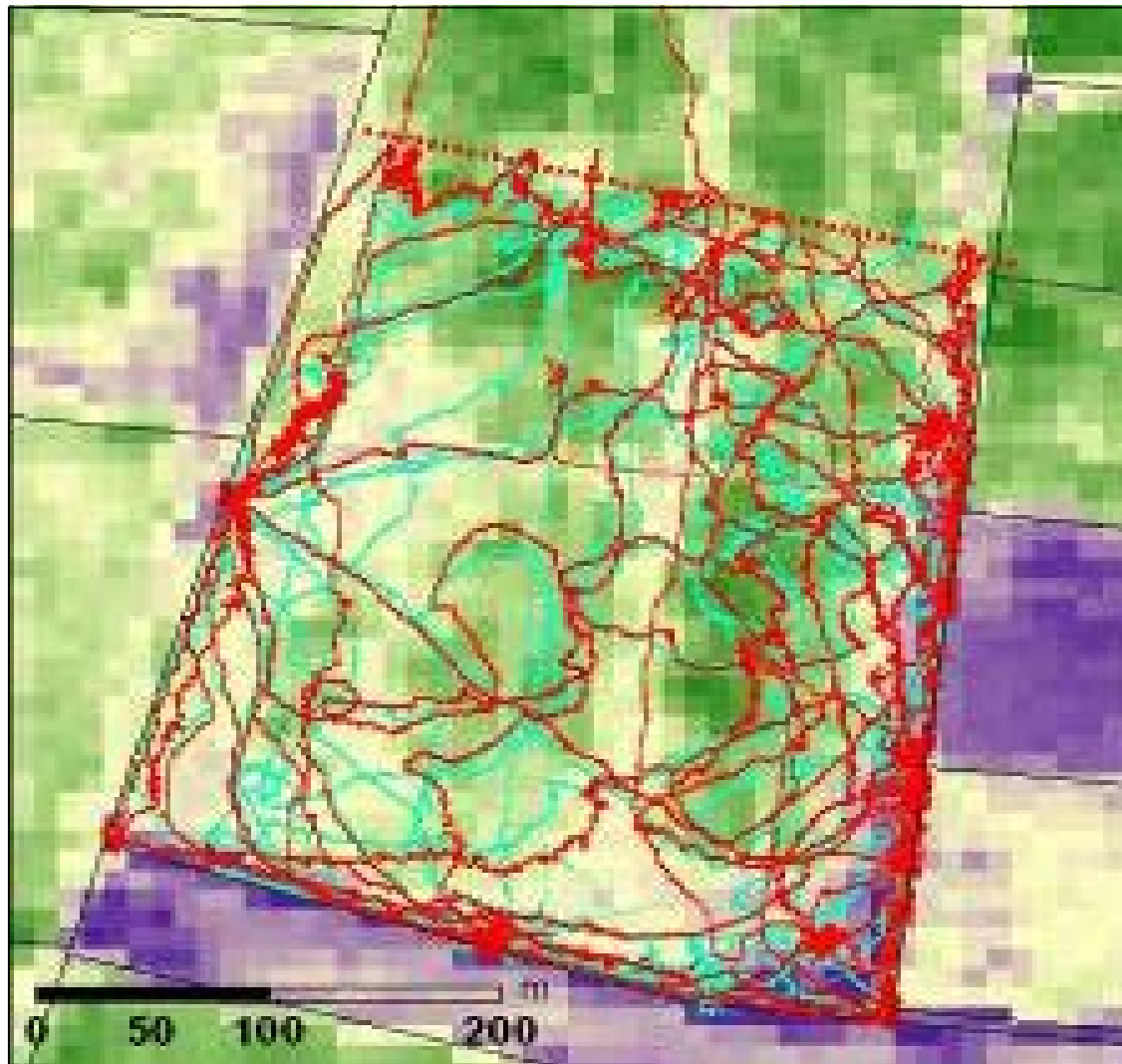
# Exciting new technologies

- Precision livestock mgt
- More accurate seasonal climate forecasts

# Precision livestock management



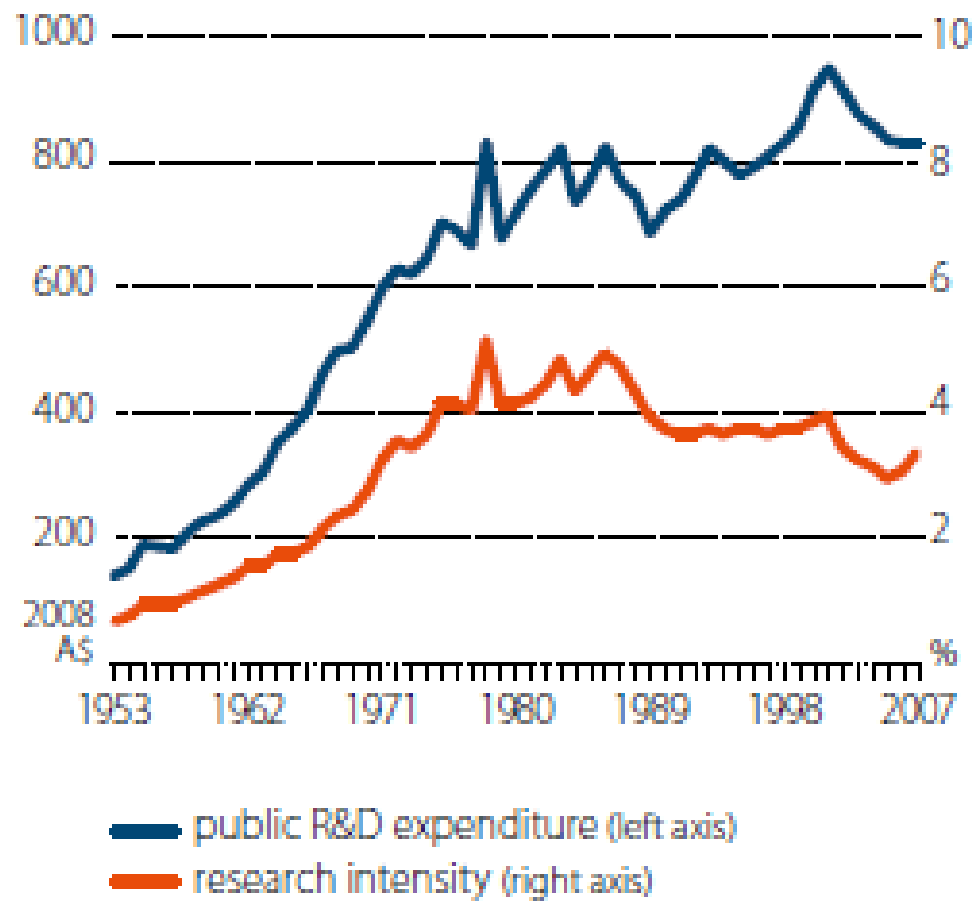
# Tracking animal movements



Source: Bishop-Hurley, CSIRO

# More accurate seasonal climate forecasts





Source: ABARE

# Conclusions

- A time of unprecedented change for agriculture
- Impressive historical gains in productivity
- Declining importance of agriculture
- A need to make better use of existing inputs and manage increased risk
- Social changes in rural landscapes
- Science & technology needed more than ever – new components and systems that are sustainable

## CSIRO Sustainable Agriculture Flagship

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# Thank you

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