R&D for rangeland grazing systems in an increasingly uncertain world

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Comparative advantages and challenges of rangeland grazing systems

- Relatively intact ecosystems compared with most agriculture
- Increasing demand for safe, natural, traceable, provenance
- Carbon footprint of ruminant livestock production
- Welfare issues associated with extreme events: drought, floods
- Sustainable intensification?
- Vulnerability to climate variability and change

Emerging key questions to shape R&D

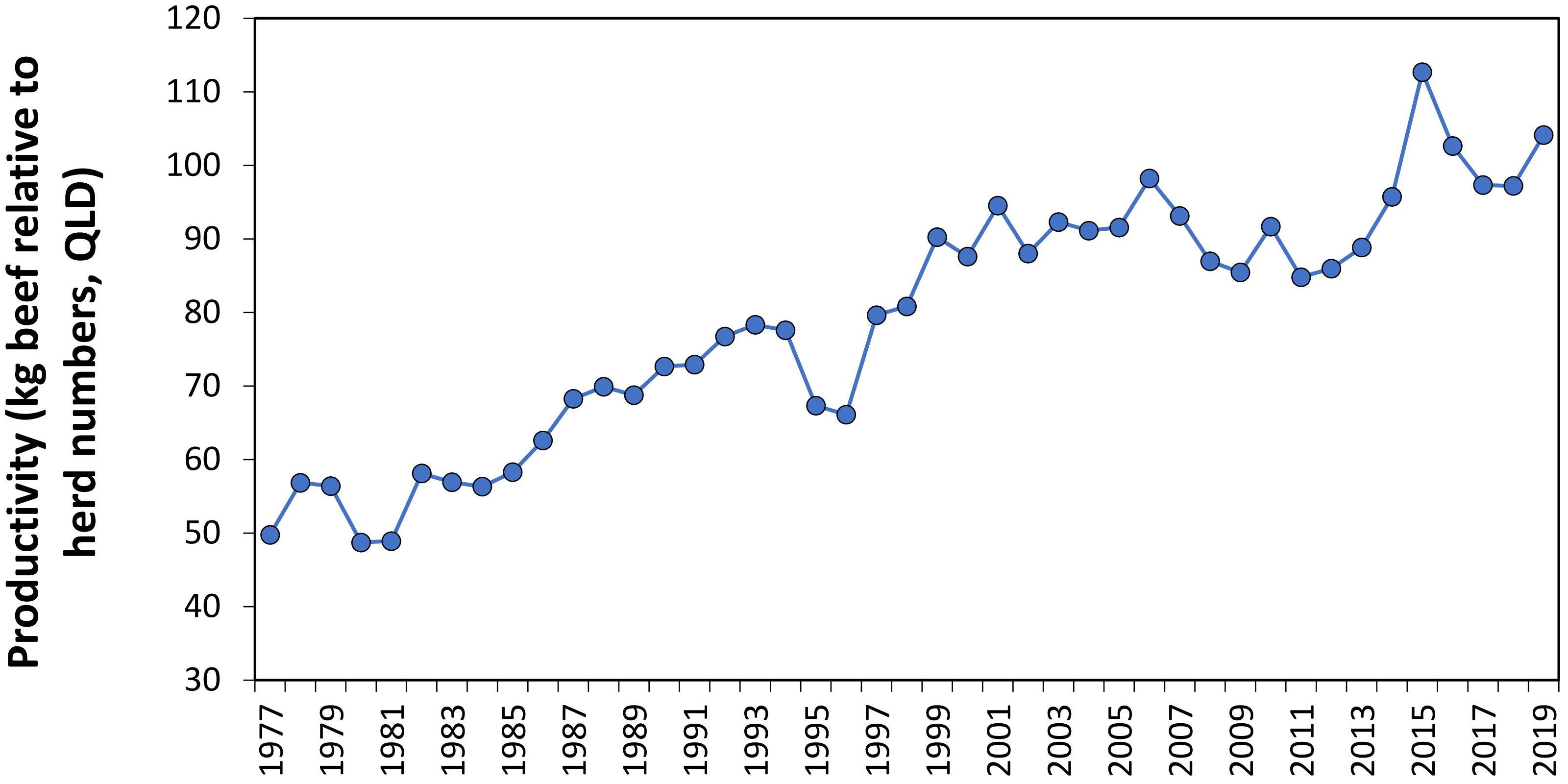
- Where will productivity gains come from to offset ongoing increases in costs of production?
- How will increasing climate variability and extreme events affect productivity and sustainability?
- Can productivity gains be achieved whilst reducing the environmental footprint and ensuring long-term ecosystem health?
- Can income be diversified into non-pastoral activities?

Business challenges

- Northern beef industry (Qld, NT and the northern half of WA) had operating return on assets of 1.4% (2005-2017). For the top 25% of producers, operating return on assets was 3.3%.
- Large pastoral companies had operating returns for the period 2012-2017 of around 2% average across all stations and as high as 5% for the top 25% of stations analysed. Company properties had higher returns per AE because of higher productivity but despite larger operations had higher operating expenses per AE.

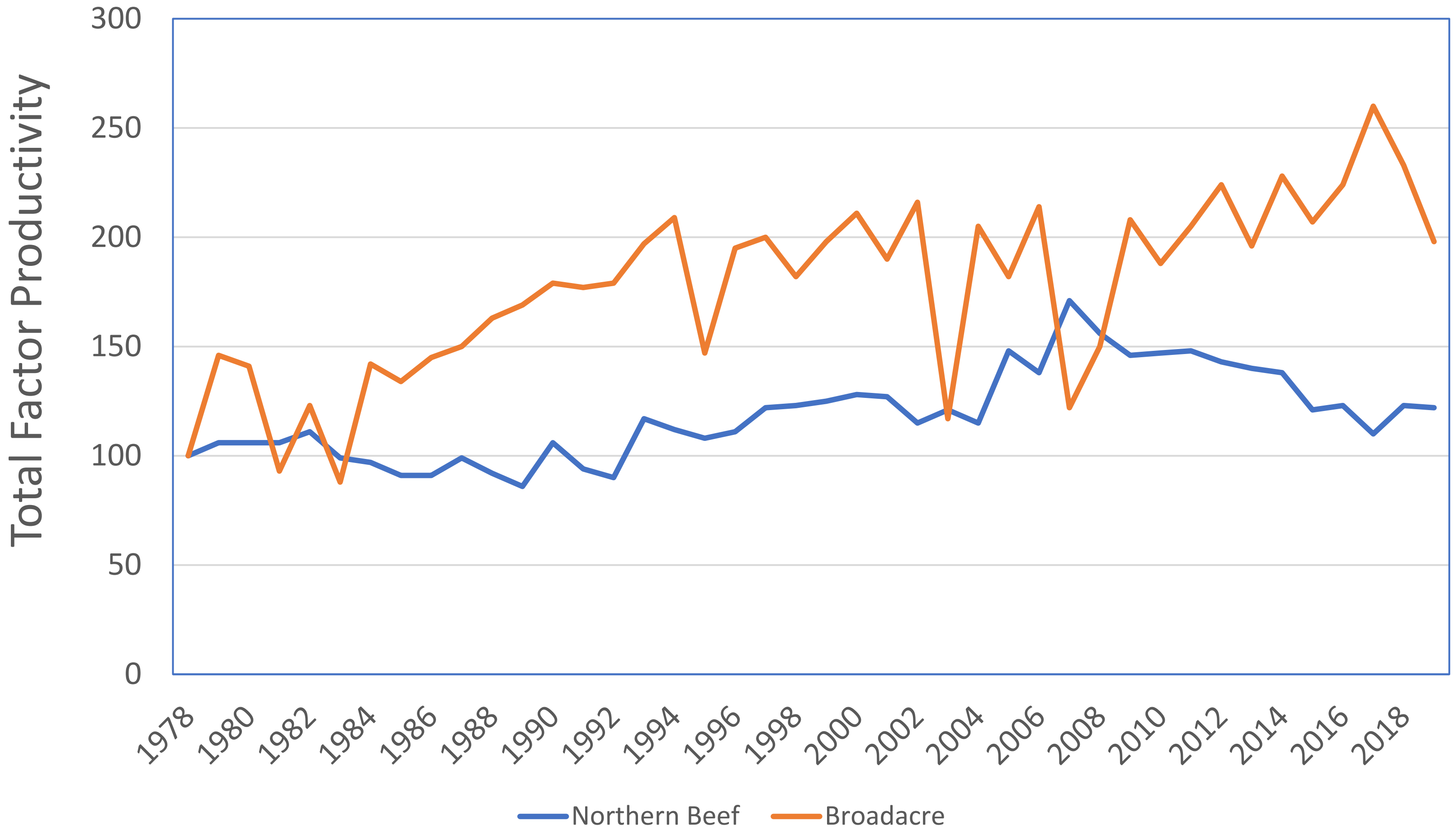
Australian Beef Report 2017 and McLean et al. 2018

Herd productivity has increased slowly since 2000



Source: ABS Data

Total factor productivity not increasing



Source: ABARES 2020

Where can on-farm productivity gains be made?

- Increases in productivity can be achieved by:
  - Increased herd no. through development
  - Increased weaning rates
  - Increased growth rates
  - Reduced mortality rates

  - Reduced costs e.g. digital and electronic livestock technologies, infrastructure efficiencies

Scenarios

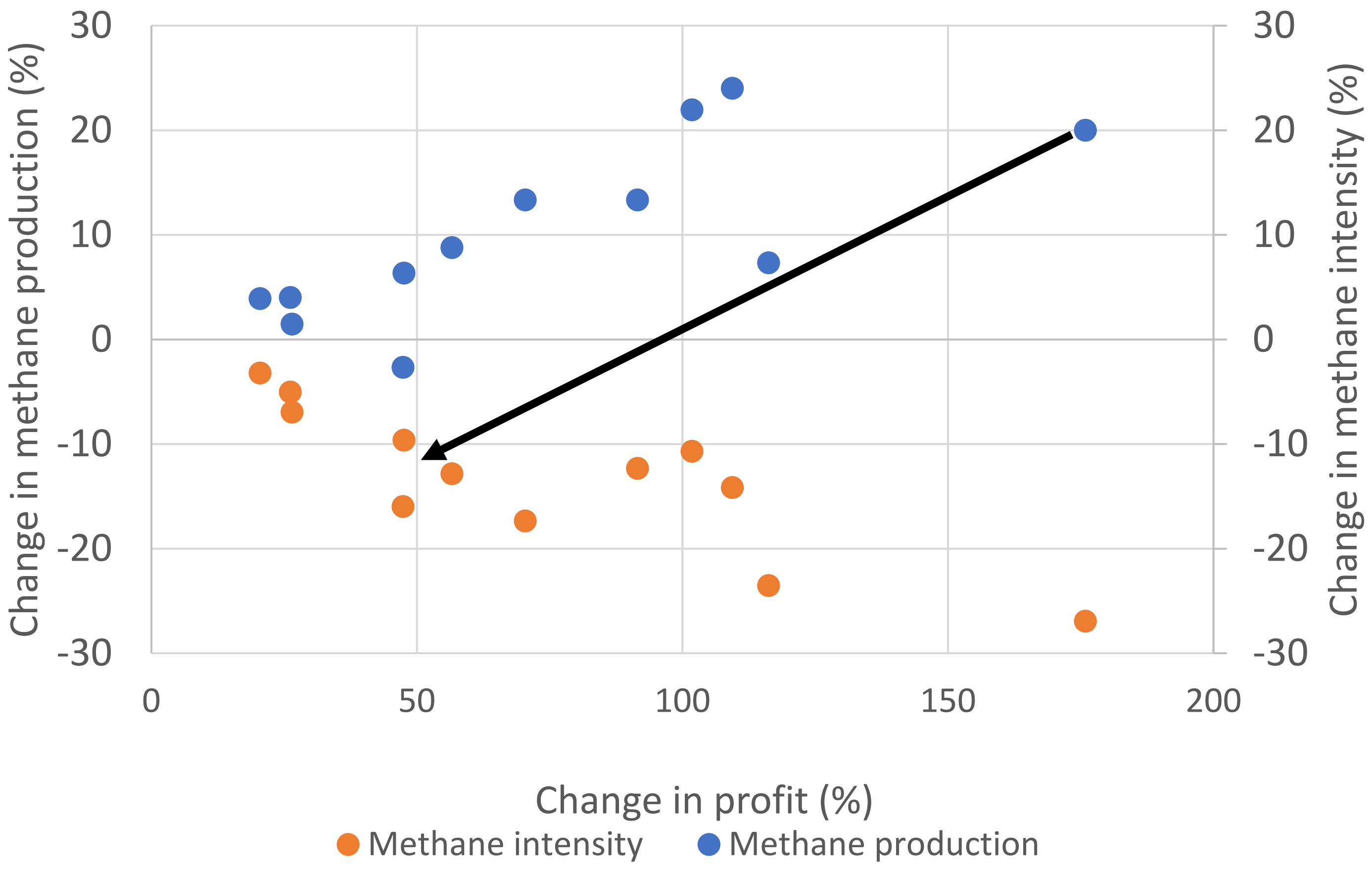
- Baseline – average commercial practice
- Development scenarios to increase productivity designed so that land condition is maintained

Technology	Herd size (AE)	Profit ($)	Weaning rate (%)	Annual LWG (kg/head/yr)	Beef sold (kg/AE)
Baseline	11,870	808,947	56	121	101
Reduced mortality	12,209	1,085,237	58	121	108
Improved reproduction	11,967	998,836	62	121	107
Increased growth efficiency	12,154	1,099,107	61	136	109
Oversown legume	13,796	1,573,272	64	147	116
Irrigated forage sorghum	12,406	1,149,207	57	191	123
Cheap protein	11,970	1,270,457	64	154	126
Rumen modification	12,001	1,224,896	64	140	115
Integrated genetics	12,512	1,370,985	66	135	112
Genetics + legume	14,095	2,224,774	69	161	124
Genetics + rumen modifier + protein	12,575	1,891,360	74	179	136

- **The best gains come from integration of technologies**
- **Need for systems R&D**

Trade-offs in environment

- Keeping pasture utilization sustainable while productivity is increasing
- Potential to increase productivity in parts of the landscape and reduce grazing in other areas
- Methane production up, intensity down



Integrated approaches needed to reduce emissions

- New technologies (animal + landscape), policy instruments (e.g. ERF)
- Intensify parts of the enterprise, no grazing and ecosystem services inc carbon on other areas
- Need to understand unintended consequences e.g. social/community, impact of "woodier" landscapes

Intensification/extensification within an enterprise needs far more research attention

Challenges in infrastructure intensification

- Capital costs of development are high ($12,000 - $20,000/ha)
- Learning costs can be high in new environments
- Costs of production of can be high ($2.50 to $3.50/kg LW gain)
- Even though revenues can be improved significantly, returns on capital can be negligible, NPVs can be negative

Integrating forages and crops into a beef enterprise

The pathway forward may be through vertically integrated systems, not stand-alone beef production

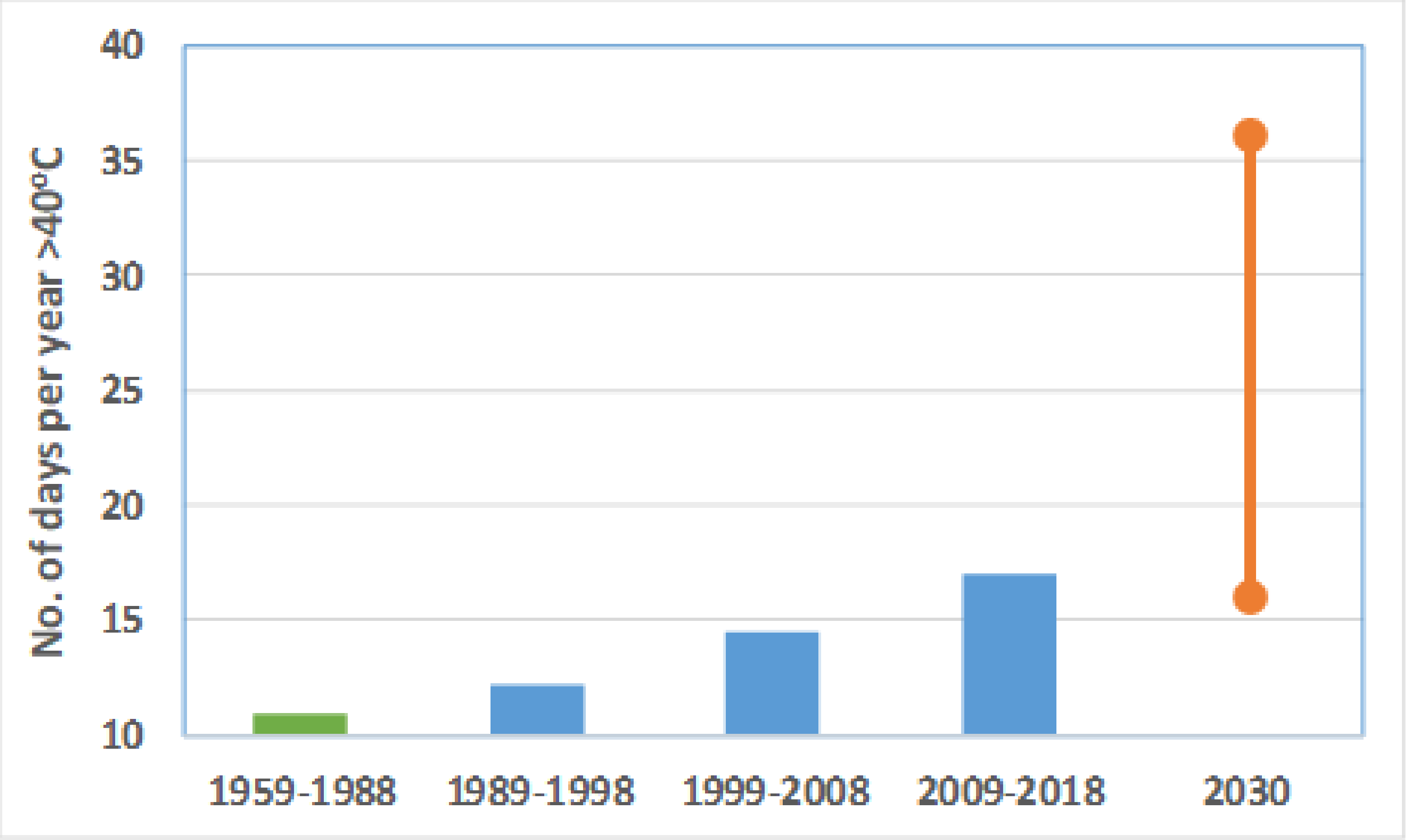
Factoring in future changes in the production environment – climate change

- Analysis shows small declines in productivity and profitability on a 2030 timeframe, mostly due to a more variable growing season

- **Changing nature of extreme events not well accounted for in current analytical approaches**

- Woody thickening likely to continue

Extremes are increasing exponentially



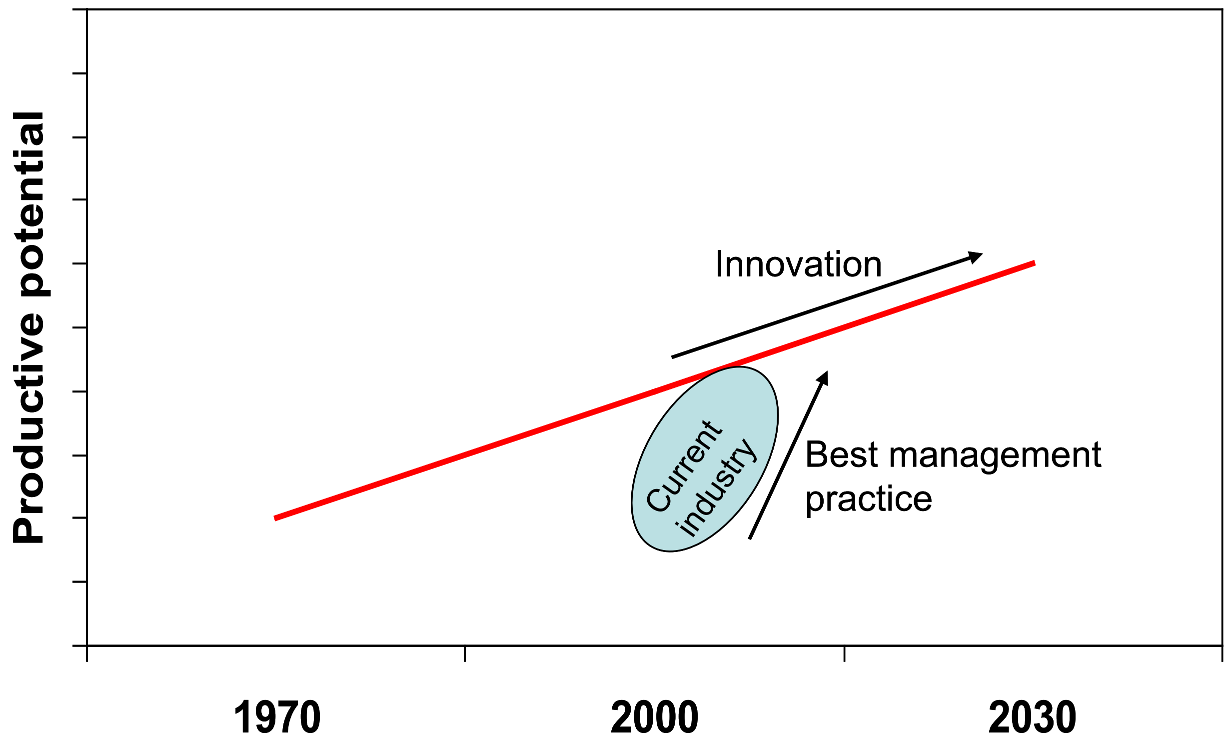
Records are being broken by larger margins

Station No.	Station Name	Years of record	Jan/Feb 2019 – 10 day rainfall (mm)	Previous 10 day rainfall record n(mm)
29036	Millungera	129	782	482
30045	Richmond	130	646	468
33051	Mingela	120	952	579

- Even with current climate variability, extremes esp drought not well managed despite knowing the management responses needed
- Thwarted by misplaced optimism and non-coherent national drought policy
- But we haven't got the solutions to manage more extreme events.
- We need to shift R&D on climate change from mean/incremental changes to "shocks".

Low rates of adoption in rangeland grazing systems

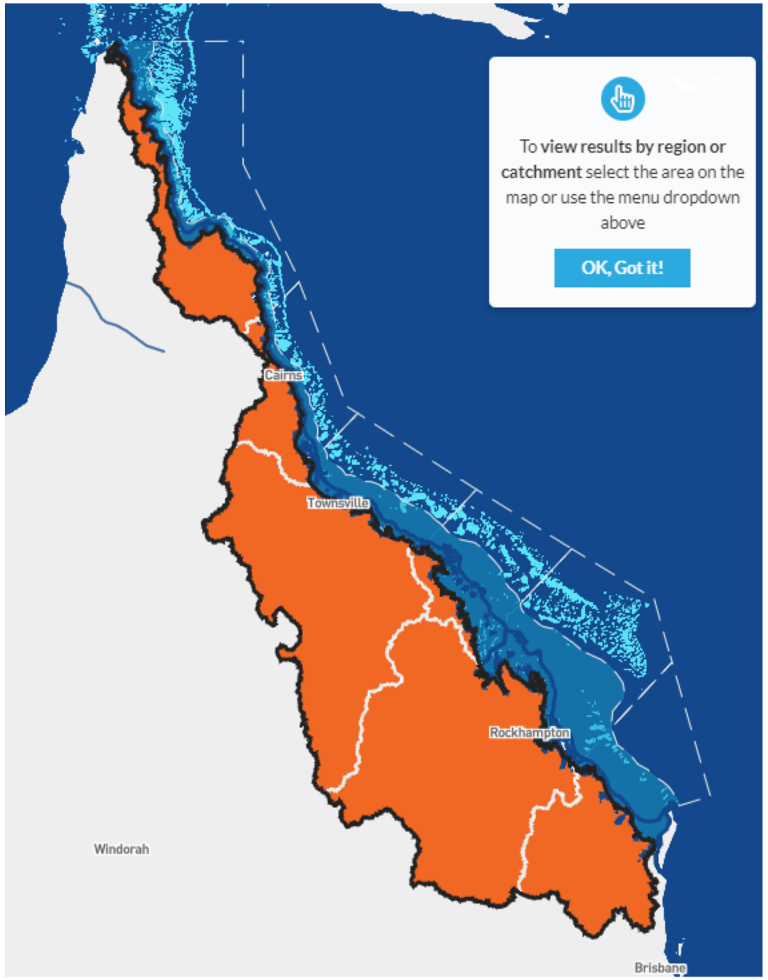
Developing Northern Australia CRC – Beef Situation Analysis
There is a need to improve the translation of proven R&D to farm practice for the majority of the northern Australia beef industry. (Chilcott et al. 2019)



Reef Water Quality Report Card 2017 and 2018

Overview | Reef and wetland condition | 2025 catchment targets

Showing **Grazing** (Change indicator) > **Great Barrier Reef wide** (Change location)



2025 land management target: **90 percent** of land in priority areas under grazing are managed using best management practice systems for water quality outcomes (soil, nutrient and pesticides).

Results

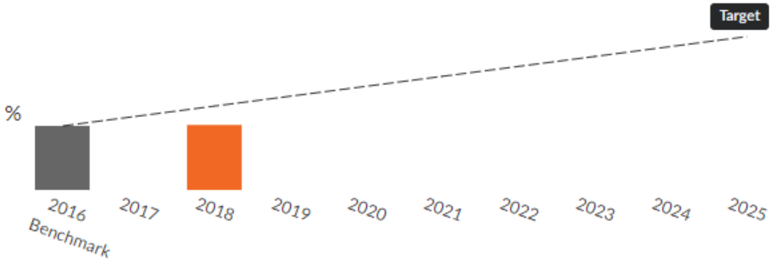
Grade: **D** Poor

Overall progress: **35.8%** adoption to date

Data confidence ●●○○○

2017-2018 progress: **+0.5%** adoption

2025 Outlook



Contributing to the results

Key management practices targeting pollutants

Gully management	Pasture management	Streambank management
D — 24.7% adoption to date	D — 31.1% adoption to date	C — 51.7% adoption to date
Go deeper >>	Go deeper >>	Go deeper >>

Addressing low rates of adoption

- Simply increasing resources with the same approach will not be sufficient
- Needs transformational thinking and approaches to overcoming barrriers:
  - Behavioural sciences – finding the right “triggers” for action
  - Improved delivery of information for management decisions through new digital technologies
  - Approaches need to be explicitly “place-based”

Summary

- While individual technologies will continue to be important, integrated systems research and adoption is needed
- Balancing production and environment in sustainable intensification (which can include extensification)
- More focus on how to better prepare for system shocks e.g. extreme events
- Transformational approaches to adoption needed