

# Quantifying drivers of crop-livestock integration

## National Farm Business Risk Forum, Perth

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### This presentation

- Introduction to climate adaptation project in WA mixed-farms
- Modelling mixed farms and outputs for risk assessment
- Livestock-cropping interactions in 2030
- Risk assessment for current climate
- Discussion & feedback

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## Mixed farm modelling

- AusFarm is...
  - Coupling APSIM and GRAZPLAN
  - Can be configured for mixed farming systems
- Management: via rule-based scripts

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## Framing a risk assessment

### Biophysical model to

- Biophysical processes have to be linked with decision-making processes to enable simulation of changes, the impacts of management decisions on the biophysical system but also the feedbacks,
- Feed to economic calculation e.g. distribution function to evaluate risk and return

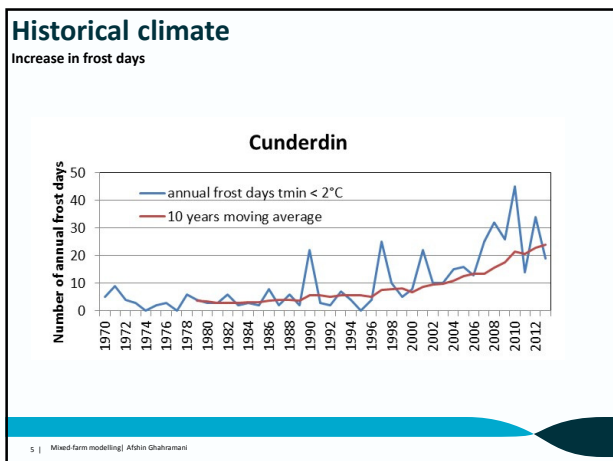
### Risk measures:

- Value at risk
  - Conditional value-at-risk as a measure of downside risk; as used here, CVaR is the average of the gross margins in the worst 20% of financial years.

### Return measures

- Expected return

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## Transformational adaptation project

- Examine adaptation options that provide resilience to likely climate change for a range of land managers with mixed grazing/cropping enterprises.
- Consider the effectiveness of adaptations at **multiple scales** (farm, community and region) and against **multiple criteria** (profit, risk, environmental impacts, GHG emissions and community impacts).
- Consideration of **more systemic and transformative adaptation** options derived from effective packaging of multiple incremental changes.

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### Some characteristics of the work

- 29 team members across states
- Broad spatial coverage,
- Building complex (current) systems
- Diverse soils, crops, pasture, livestock, rotation systems
- Stakeholder engagement
- Modelling changes in management practice and modelling farmer choice
- Model input & Verification through workshops (and observations)
- Designing work flows for large simulations
- on-job training (DPI, DEPI, SARDI, BCG)
- Maintaining model consistency across transects

Several workshops

Producers workshops: potential adaptations, model inputs & verification

Model input, adaptation options

Whole farm modelling in AusFarm (AFSIM & GRAZPLAN)

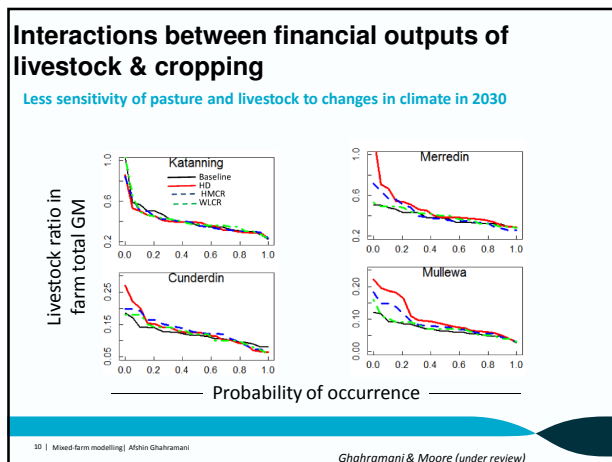
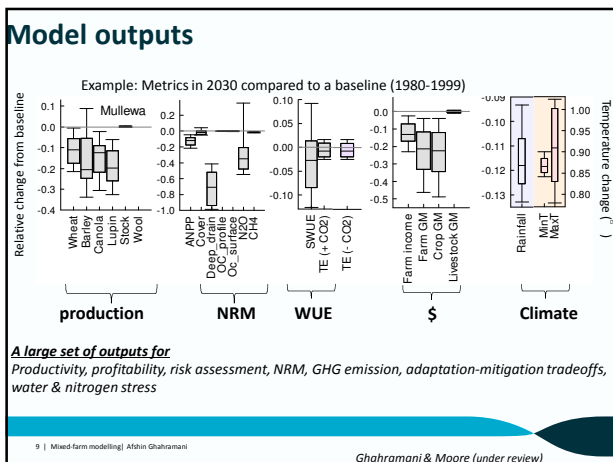
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### Transformational adaptation project

Representative mixed farms

- Katanning
- Cunderdin
- Merredin
- Mullewa
- Salmon Gums

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### Levels of integration

1. a cropping-only system ("C") - wheat, canola and barley; 100%
2. a livestock-only system ("L"); 100%
3. a segregated mixed farming system ("S") in which the "C" and "L" management systems (54% and 46% of farm area) were allocated to the soil types better suited to each activity; 54% 46%

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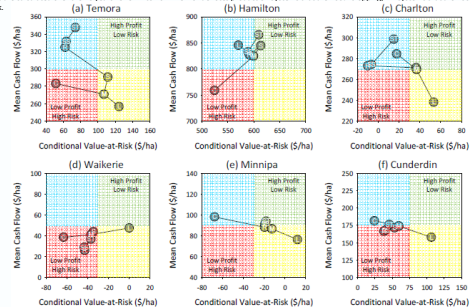
### Levels of integration

4. mixed farm with rotations of 3-5 year phases of legume-based pastures and grain crops on the better soil types ("R");
5. a "strategically synchronised" mixed farm ("SS") in which the "R" management system was further integrated
6. a "tactically synchronised" mixed farm ("ST");

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### Financial risk assessment (up to Gross margin) of different level of livestock-cropping integrations

Cropping and livestock production are assumed to be operated on a single soil type and are completely segregated in space and time. Gross margin statistics are calculated over the 40 years 1975-74 to 2012-13. "C" denotes production systems that are 100% cropping, "L" systems that are 100% livestock.



Moore, AD et al., 2015

conditional value-at-risk: the average of the gross margins in the worst 20% of financial years.

### Systemic to transformative adaptation

- Elicited adaptation options are very locally-specific
- Alteration of the crop-livestock balance,
- Low-variability to high-intensity mixed farming,
  1. low risk and low return approach
  2. Medium risk and medium return approach
  3. High risk and high return approach.
- Segregation + perennial pastures,
- Seasonally responsive farming,

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#### Risk assessment of above packages

Thank you very much

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