



Challenges facing GHG mitigation in cropping systems

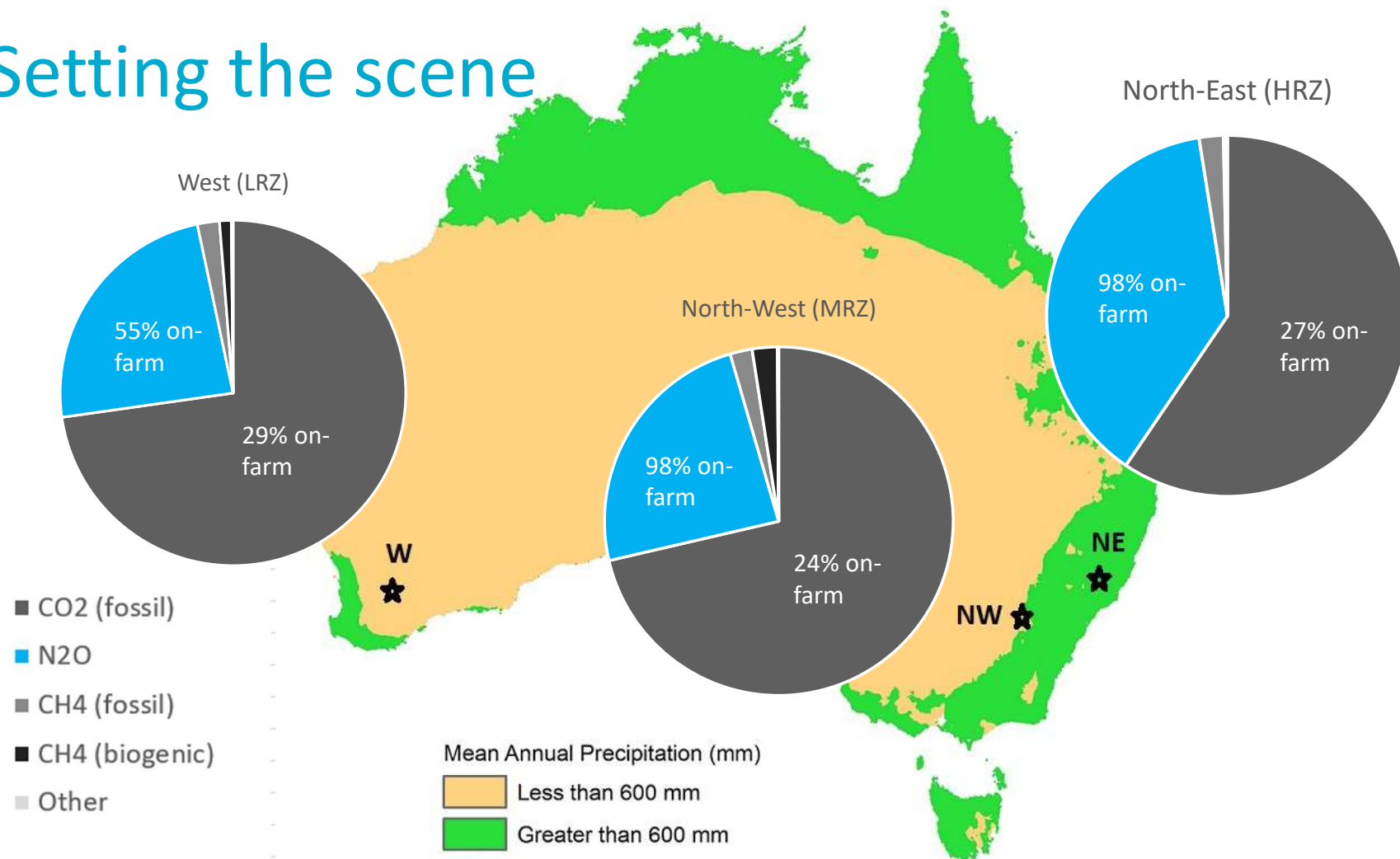
Science & Adoption

Dr M. Sevenster | 23 March 2021

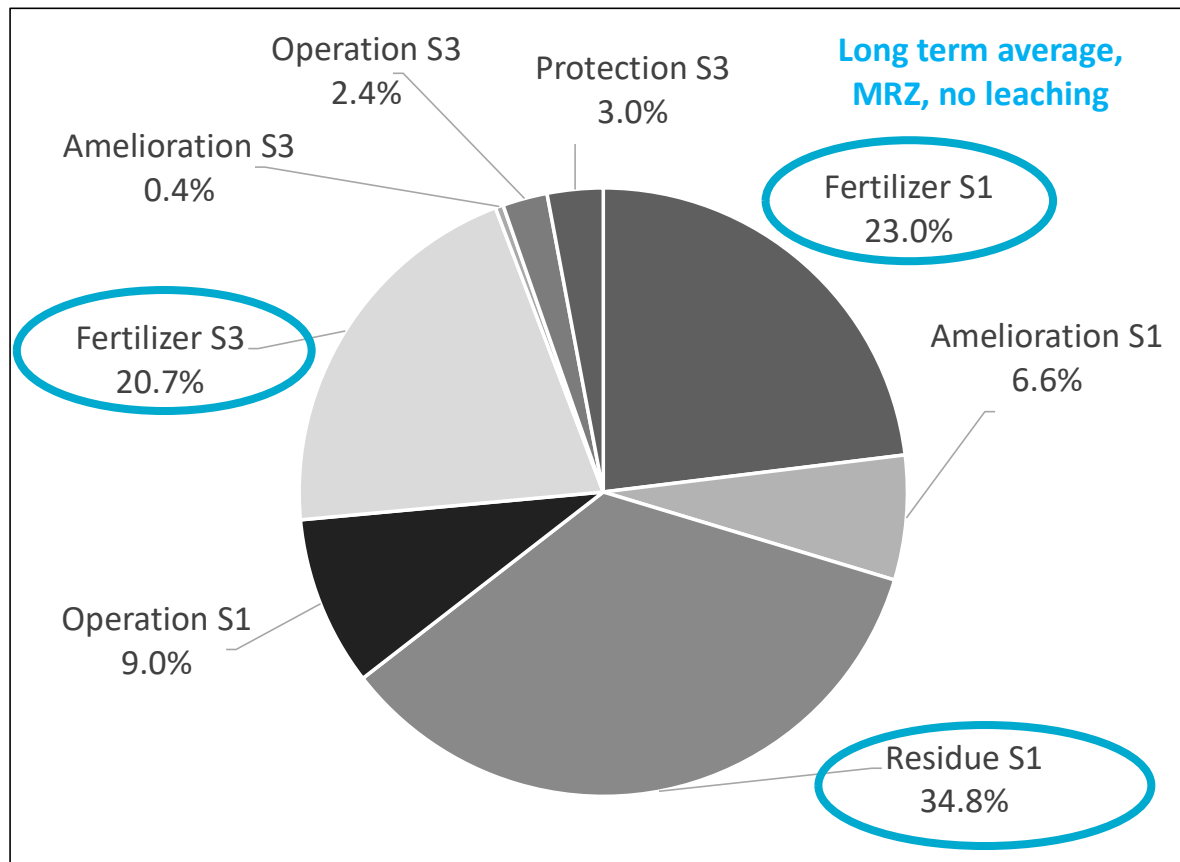
Australia's National Science Agency



Setting the scene



Setting the scene

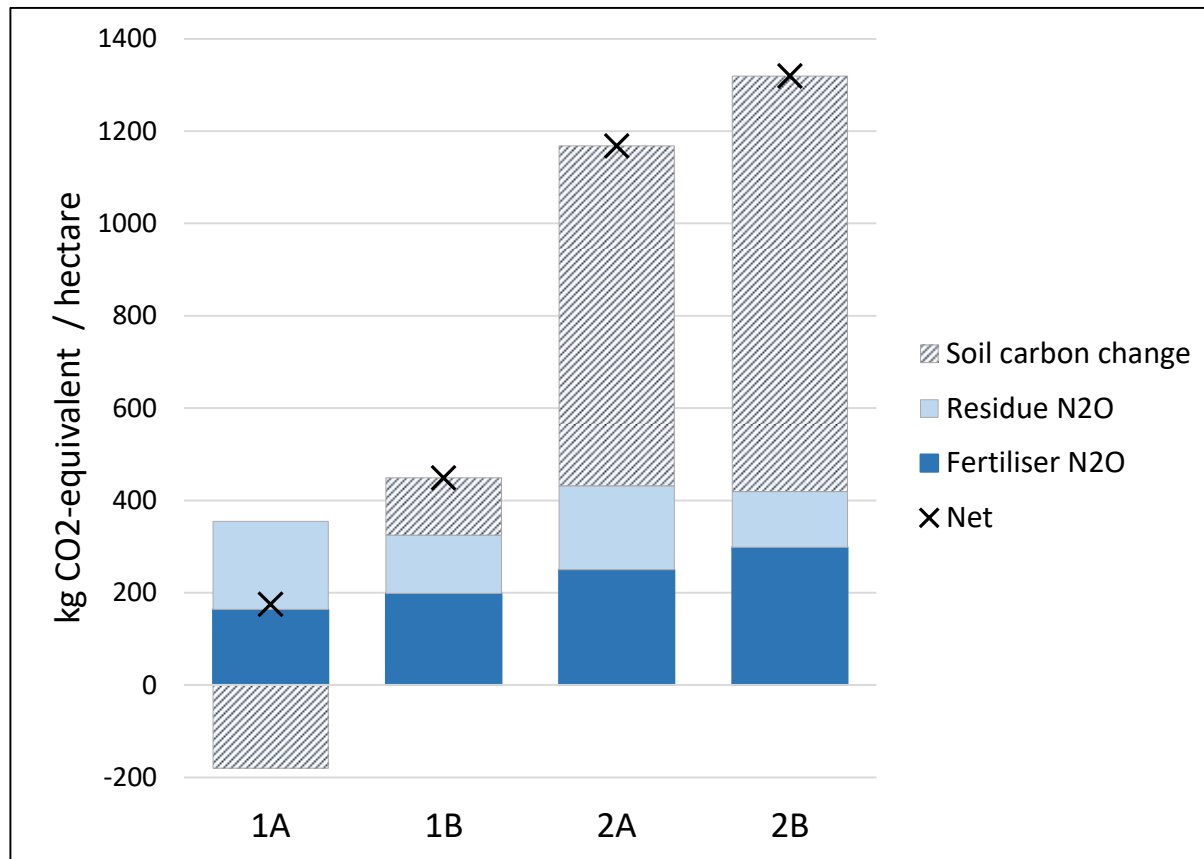


Case: grains in rotation, residue burning, low application of pesticides, medium rainfall zone (MRZ)

S1: emissions occur on farm

S3: emissions occur in supply chain

Residue management



Case 1: medium rainfall & soil carbon

Case 2: high rainfall & soil carbon

A: 100% residue retained

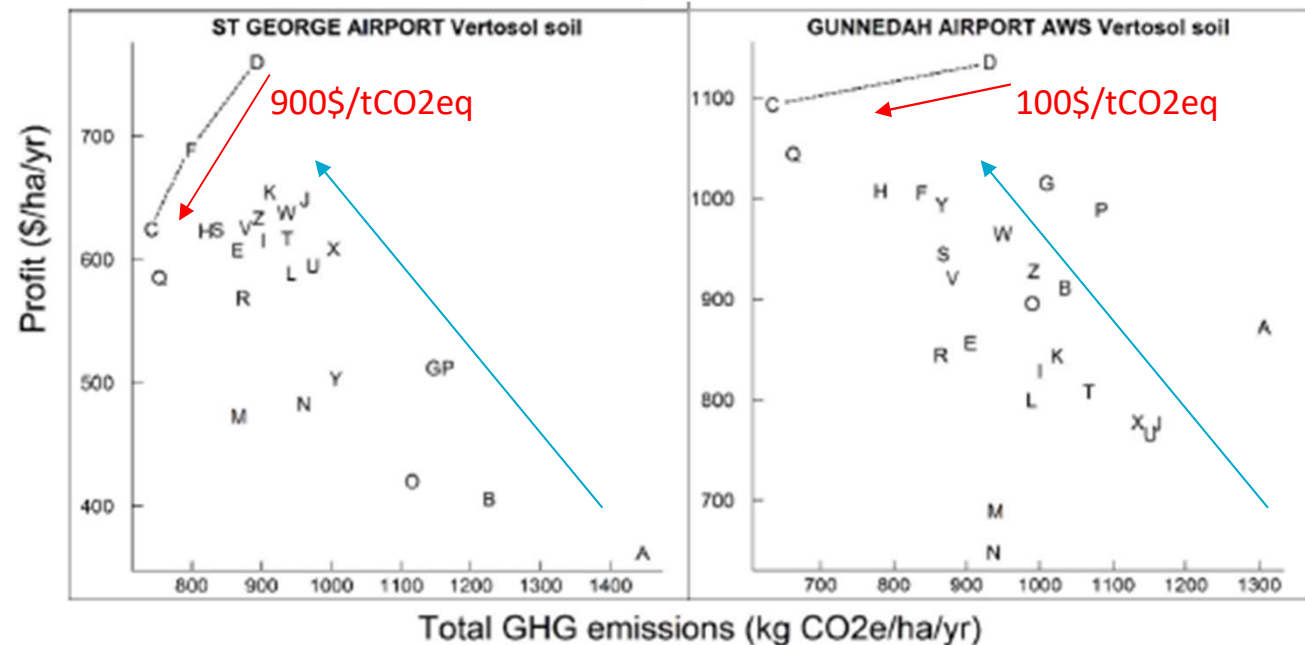
B: 50% residue retained

Rotations

Most profitable rotations have **low emissions**

To shift from highest profit to lowest emission rotation has **high abatement cost**

Hochman, Navarro, Horan, Whish, Bell, 2021 (submitted)

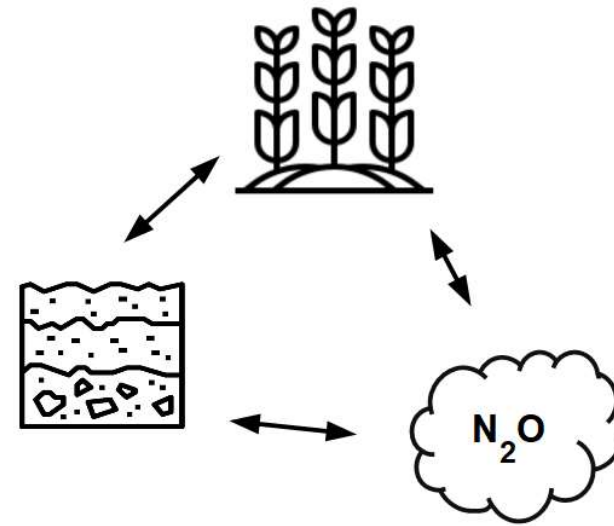


C Wheat-Wheat-Chickpea (3 fallow seasons)

D Sorghum-Mungbean-Wheat-Chickpea (2 fallow seasons)

Science challenge

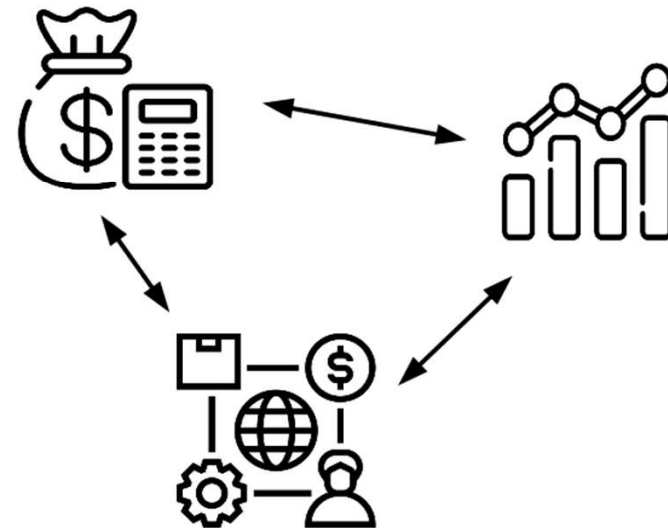
- Yield – Soil Organic Carbon – GHG emissions
- Study real systems under local conditions
- Inform locally optimized management



*Soil sampling has to be part of this
but is currently very costly*

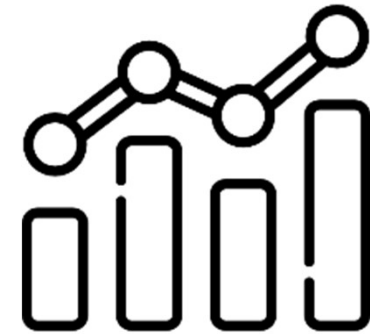
Adoption challenge

- Costs – Drivers (benefits) – Accounting Methods
- Reporting is crucial to access benefits
- Methods need to be transparent, trusted and relevant

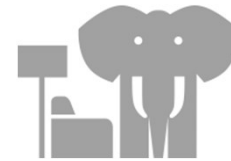


Reporting & methods

- Climate Research Strategy for Primary Industries (CRSPI) – Common GHG Baseline Accounting Framework for Australian Agriculture [2021-2022]
- CSIRO FarmPrint – Farm-level environmental accounting tool to be integrated with vegetation and soil modelling



Drivers



Can't have your cake and eat it

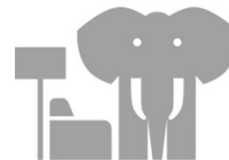
Finance sector



Carbon markets



Market for ecosystem services

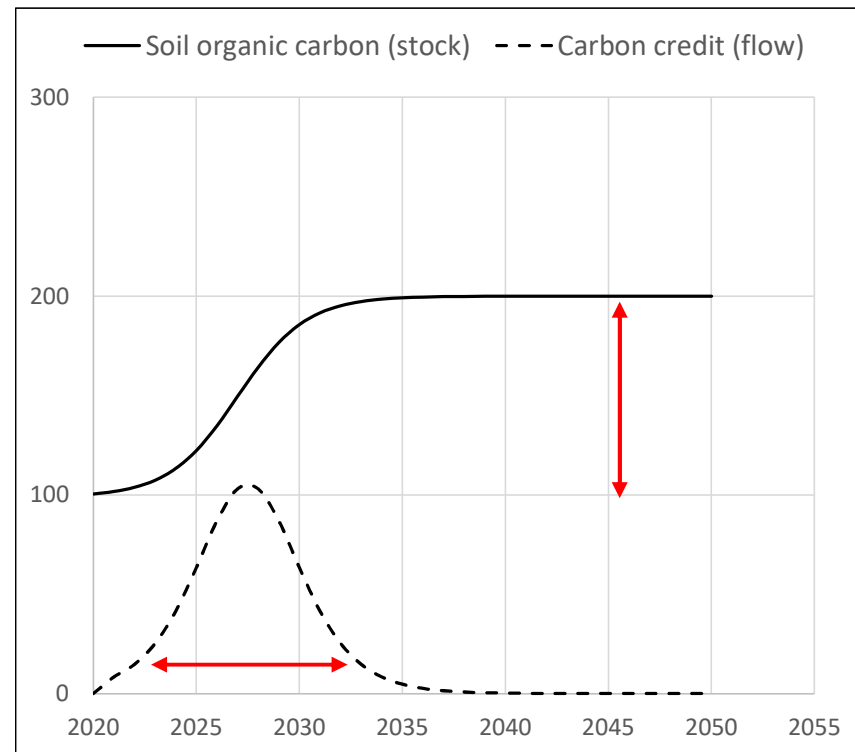


Soil sequestration is not going to last forever

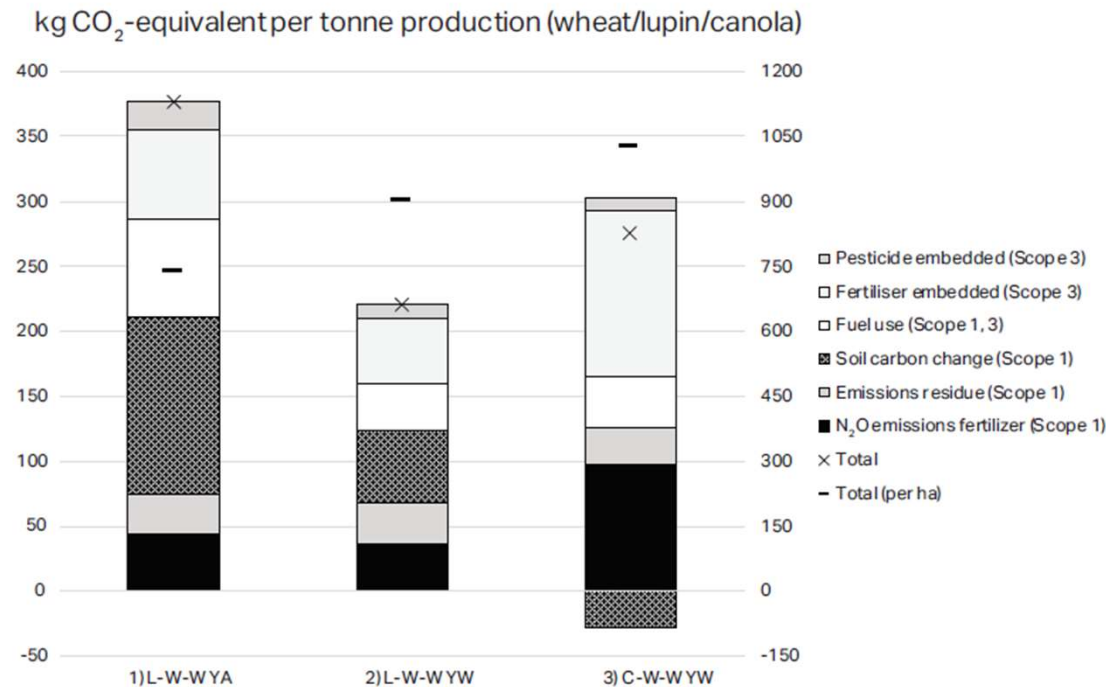
Market access/value chain

Ecosystem services

- Focus on overall soil quality / function
- Ongoing ecosystem services (water regulation, pest management, yield,..) from improved asset
- The asset will keep the CO₂ out of the atmosphere but no longer generate “carbon credits”



Sevenster, Ogilvy, Kirkegaard, 2020, Farm Policy Journal



LCA results for greenhouse-gas emissions associated with the three scenarios (L=lupin, W=wheat, C=canola, YA=actual yield, YW=water limited yield). The right-hand vertical axis is for the total emissions per ha; all other quantities are plotted against the left-hand vertical axis.

Does the build up of soil carbon stock (natural capital) in Case 3 outweigh the higher net GHG emissions in terms of overall 'sustainability'?

Mitigation challenges in cropping

- Increase knowledge about yield & soil & GHG emissions in real farm systems
- Reduce the cost of soil sampling
- Develop transparent, trusted and relevant GHG accounting that can increase the benefits of monitoring & reporting
- Develop metrics beyond soil carbon to soil function & quality to account for natural capital and ongoing ecosystem services

