GLOBAL RESEARCH ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES

Country report : New Zealand

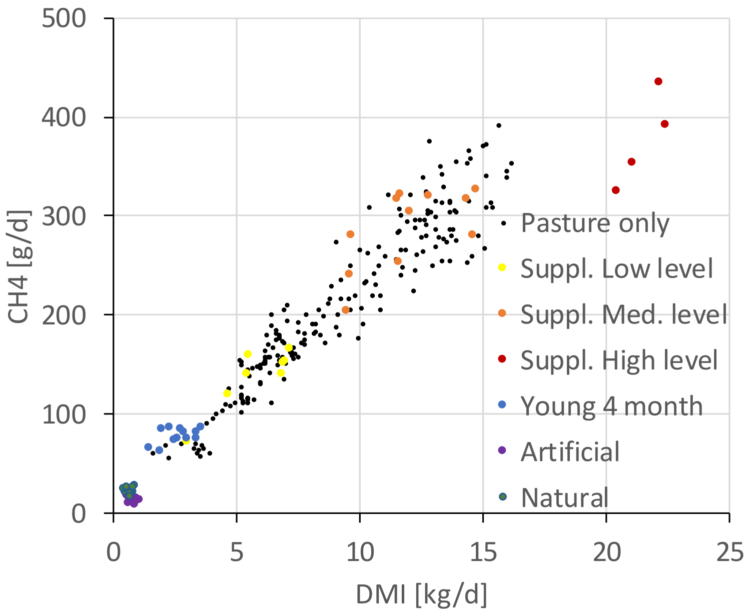
Presentation to IRG Annual Meeting

Cali, 5 February 2019

Current NZ research to support inventory improvement

- Understanding cattle CH_4 yields at very low and very high levels of feed intake (< 6kg and > 14kg), improving accuracy of estimates on young animals and high producing animals respectively.

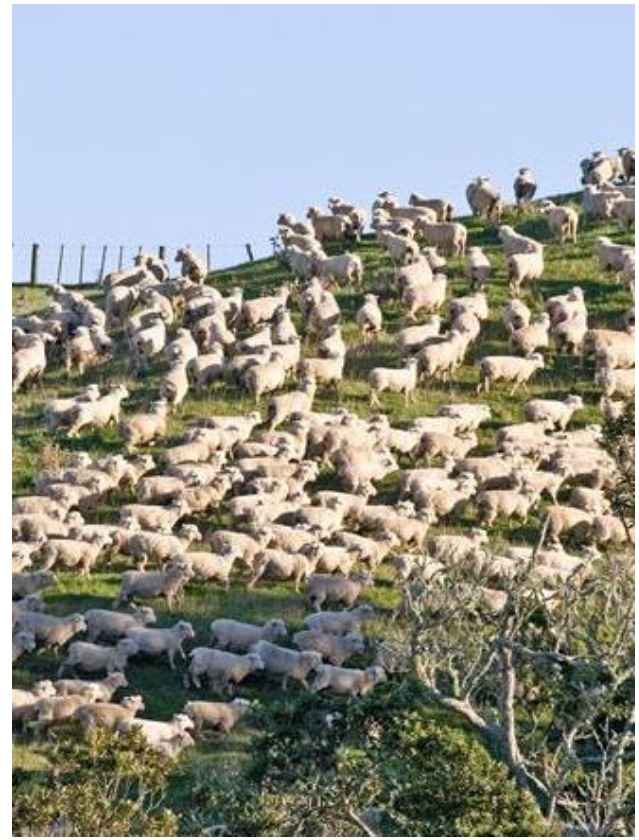
- Review and improvement of the animal weight gain calculation model, to improve transparency and robustness of liveweight estimates.



- Meta-analysis for emission factors from N_2O emissions from livestock on hill country for variable gradient slopes.

Current NZ research to support inventory improvement

- Successful inclusion to inventory: Review of N partitioning relationship for ruminants has resulted in updated methodology and represents improved accuracy in the national inventory.
- Improving estimates of supplemental feed use for Dairy, Beef and Sheep industries.
- Gathering further pasture quality samples to input into framework developed last year of existing national pasture quality data.
- Improving understanding of the causes of variability and the processes driving N_2O emissions from livestock excreta on pasture.



Overarching frame work - soil C

How much soil carbon nationally and where?

What land uses and practices alter carbon stocks – up or down?

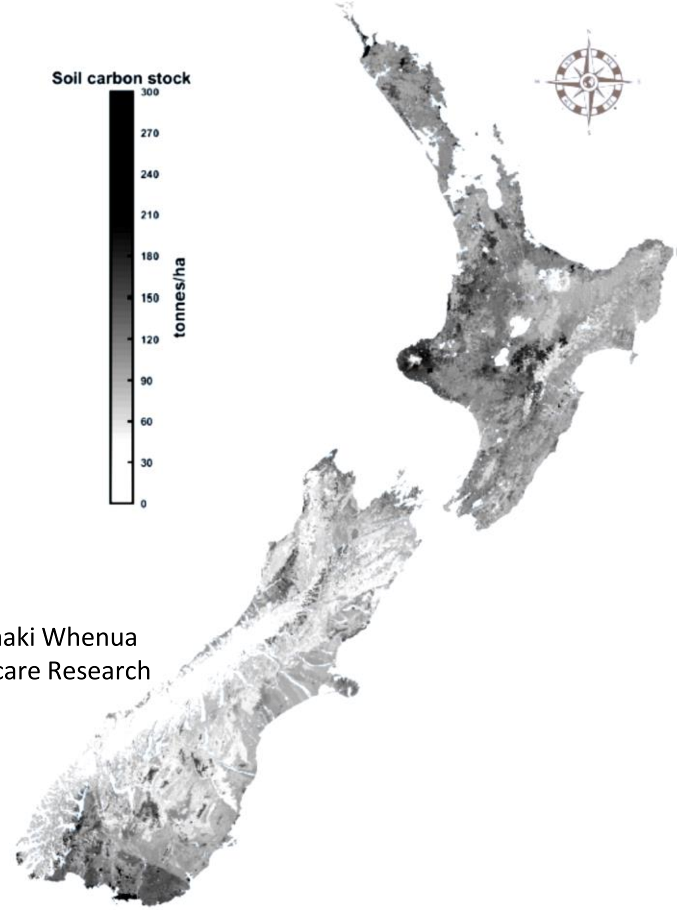
Potential soil carbon storage

Do carbon beneficial management practices result in emissions of other GHGs?

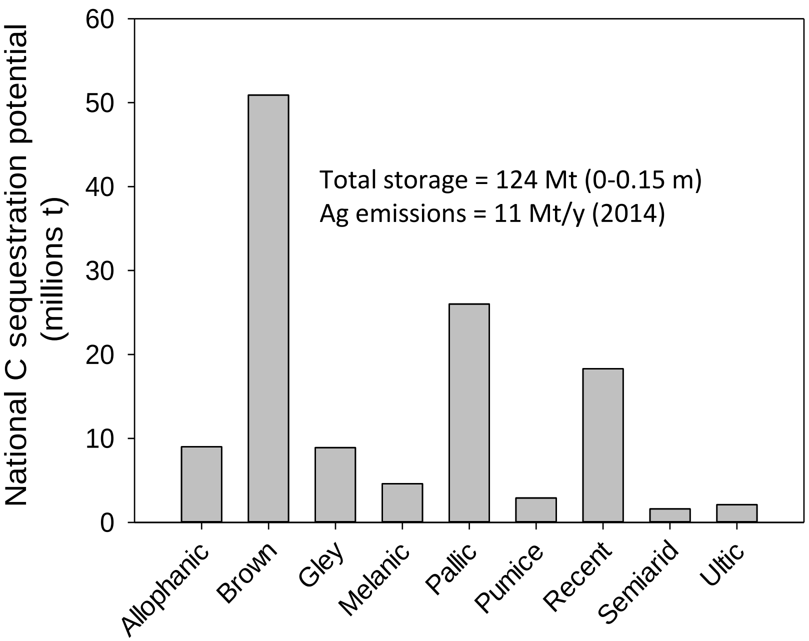
Extrapolation through modelling and spatial sampling

Increase soil carbon or avoid losses nationally

Current C stocks and sequestration potential



Manaaki Whenua
Landcare Research



McNally et al. (2017) GLOBAL CHANGE BIOLOGY: 23: 4544-4555

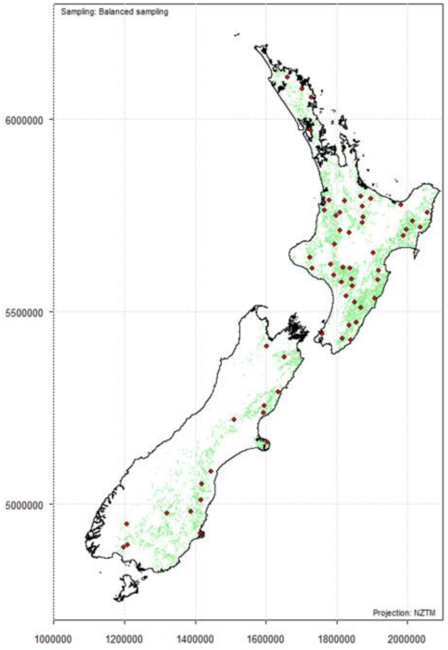
Future tracking national soil carbon stock change
Sampling strategy and measurement

Sampling design for soil carbon research

- **Data for inventory/research has generally come from historical surveys:**
  - Biased towards areas of intensive agricultural activity
  - Subjective sampling design, rather than random
  - Less representative of whole of New Zealand environment
  - Low- or under-powered studies in some cases
- **End users are now asking more complex questions:**
  - How are soil properties changing over space & time?
  - Can we be sure the conclusions using this data are reliable?
  - What is the chain of evidence for this analysis?
- **Increased use of spatial sampling power analysis:**
  - Generally, simulation methods must be used
  - More effort required to document and quantify justifiable assumptions
- **Challenge is to communicate results to end users in clear non-technical language**

Recent examples of sampling design

- **Is hill-country grassland soil carbon increasing over time?**
  - Power analysis based on a published pilot study
  - Balanced spatial sampling for representativeness
  - Sampling set selection based on minimum visit distance
- **Design framework for lowland grassland soil carbon monitoring**
  - Power analysis using simulation, based on:
    - ❖ Published historical data
    - ❖ Expert knowledge concerning justifiable assumptions
  - Have already shown that sample effort strongly dependent on chosen assumptions



Ongoing… farm scale assessment approach

Mitigation practices: Looking for gains and avoiding losses

Supported by mechanistic process studies

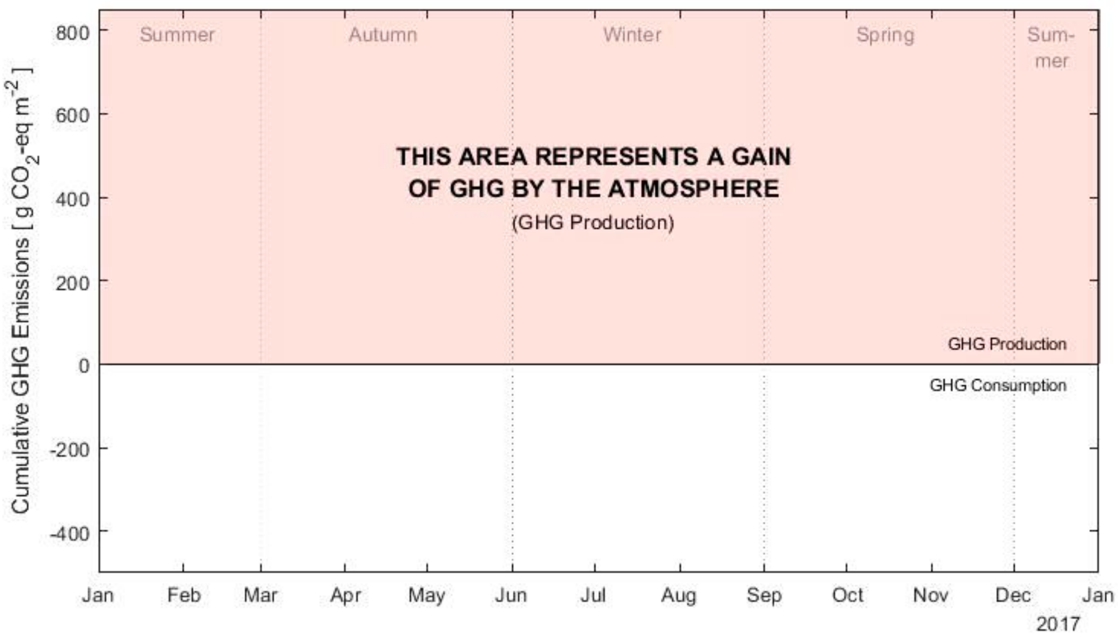
	Losses/lost	Maintain	Gains/gained
Tested or under testing	Irrigation ★★★★ Pasture renewal process ★★★★ Maize ★ Conversion from pasture to forest ★★★	Phosphorus ★★ Conversion to dairy? ★	Diverse swards ★ Inversion tillage ★ Biochar ★★ Conversion from forest to pasture ★★★
Known unknowns	Nitrogen fertiliser, fodder cropping, plantain, cut and carry, tussock management, grazing regimes…		

Synthetic reviews:

The current position: *Schipper et al. (2017) NZ J Ag. Res. 60(2): 93–118.*

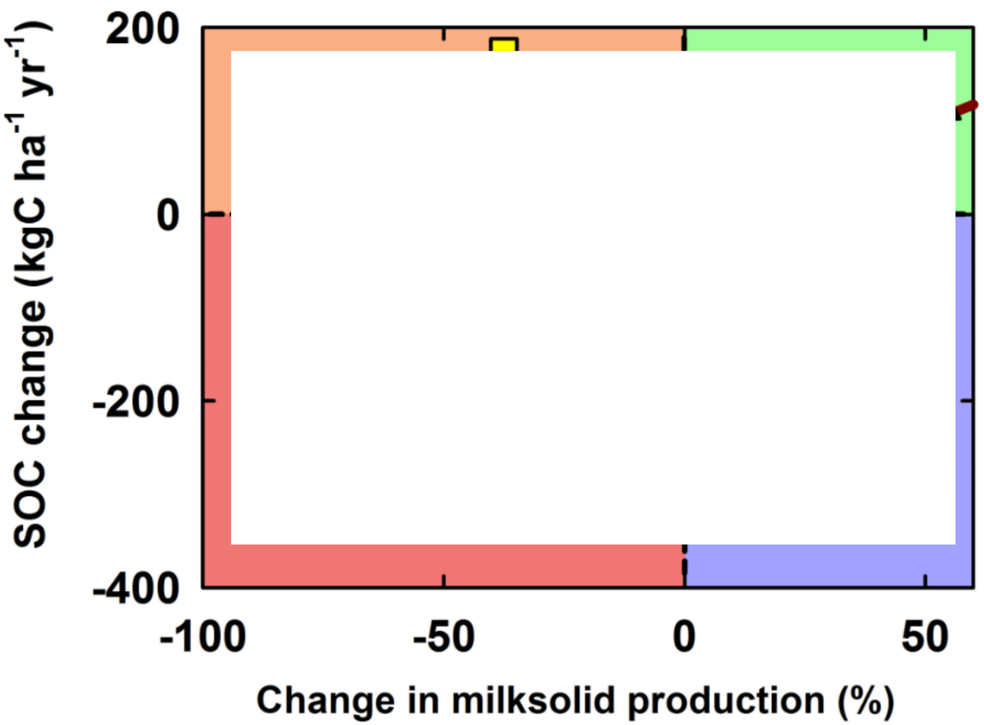
The opportunities: *Whitehead et al (2018) Ag. Ecosystems Environ. 265:432-443.*

WORKING TOGETHER



Note: not a full carbon balance

Connecting measurement, modelling, and production trade-offs



Needs LCA including nitrous oxide and methane

Supported by process studies

Feedback loop to experimentalists

Kirschbaum et al (2017). Science of the Total Environment 577: 61-72.

Specific contributions to other Groups related to IRG activities

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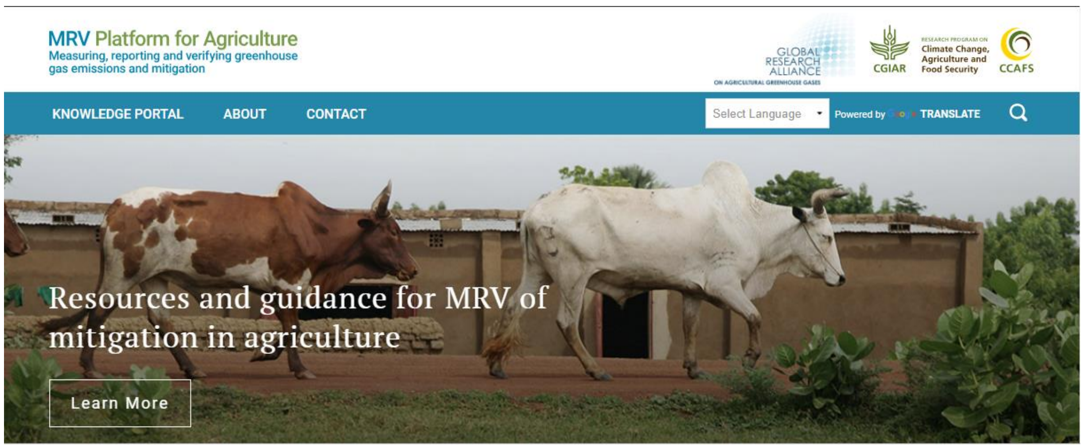
- Developed agricultural MRV platform www.agmrv.org with CCAFS



- Produced collection of Tier 2 Inventory approaches in the livestock sector

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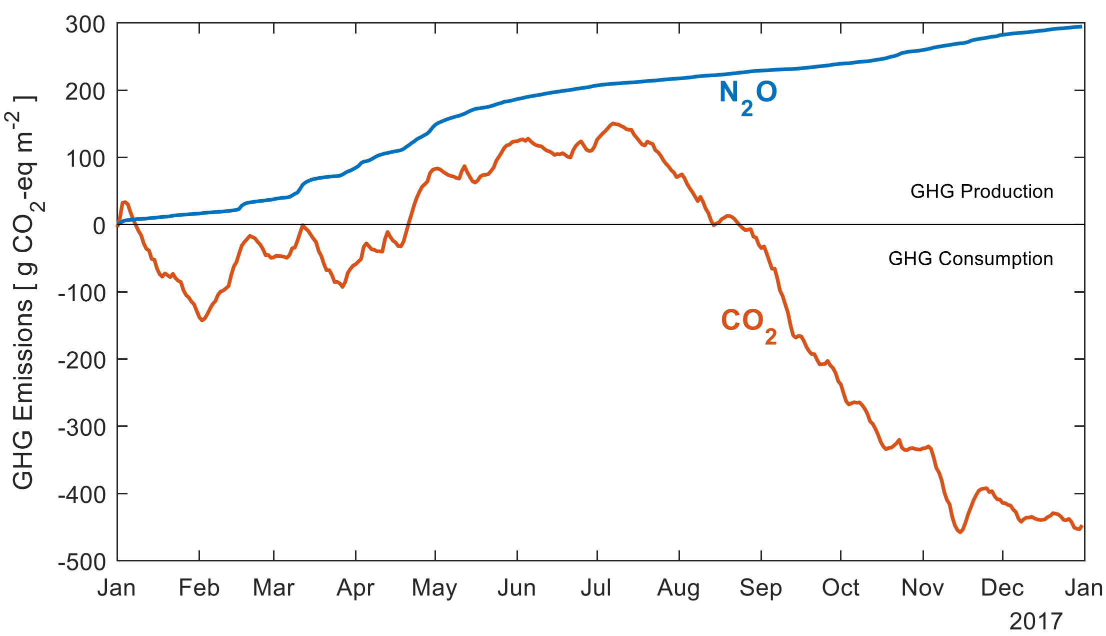
Comparing trade-offs soil carbon and nitrous oxide



We need to ensure that any mitigation practice successful for one gas does not cause does not emissions of another.

Liang et al 2018 *Agriculture Ecosystems and Environment.* 268:171-180.