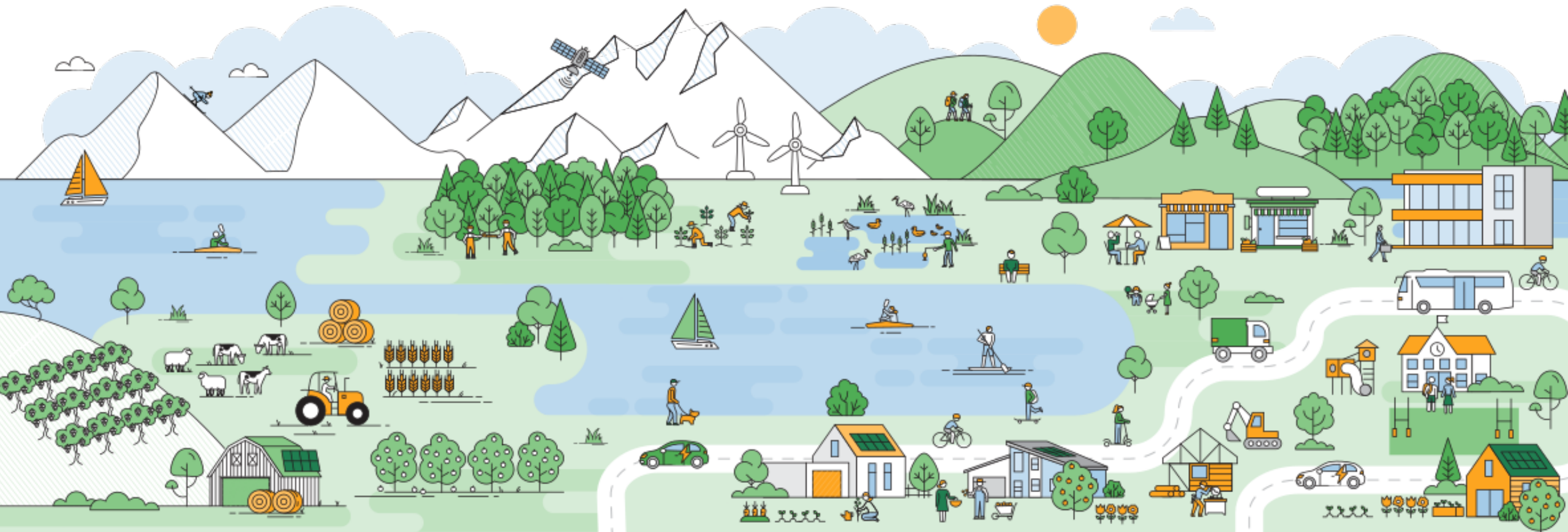
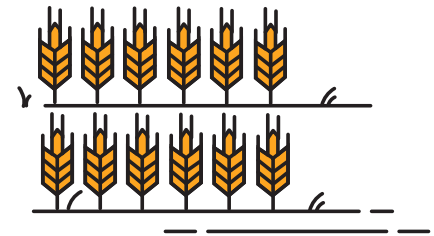


# Understanding and Calculating Agricultural Emissions



# Dr Carly Green

- Bachelor Environmental Engineering; Monash University Melbourne
- PhD – School of Biological Science; University College Dublin
  - Greenhouse Gas Accounting the Agriculture and Forestry Sector



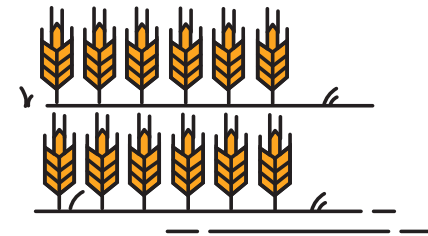
# Affiliations and Clients

- Founding Director of Environmental Accounting Services
- IPCC Lead Author on the 2019 Refinement to the Good Practice Guidelines for National Greenhouse Gas Inventories
- Methods and Guidance Component Manager for the Global Forest Observations Initiative
- Measurement Reporting and Verification Specialist for the World Bank's Forest Carbon Partnership Facility (currently supporting 3 countries)
- UNFCCC; FAO; Govts of Australia, Ghana, Vanuatu, Fiji; Private Clients across 20 countries.....
- Board of Trustees for Wao Wanaka



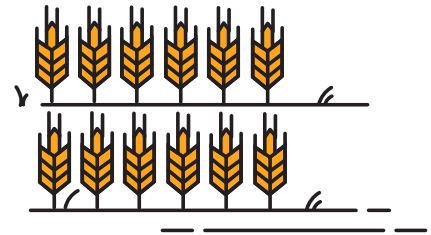
# Environmental Accounting Services

- Environmental Accounting Services (EAS) are an Environmental Consultancy based in Central Otago, New Zealand.
- We support measurement, reporting and verification of greenhouse gas emissions that meet international best practice standards.



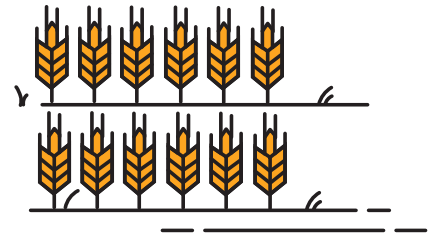
# Introductions

- Tell us
  - Your name
  - A bit about your farming system
  - Do you 'Know your Number'?
  - What do you want to learn today?

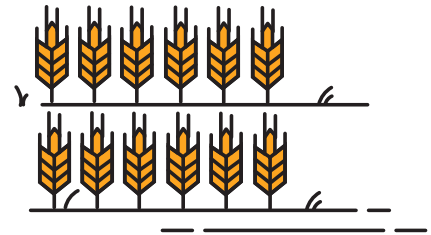


# Outline

- Emissions from Agriculture
- National GHG reduction commitments
- Policy position on Agricultural Emissions
- Calculating on-farm emissions
- Variation between tools

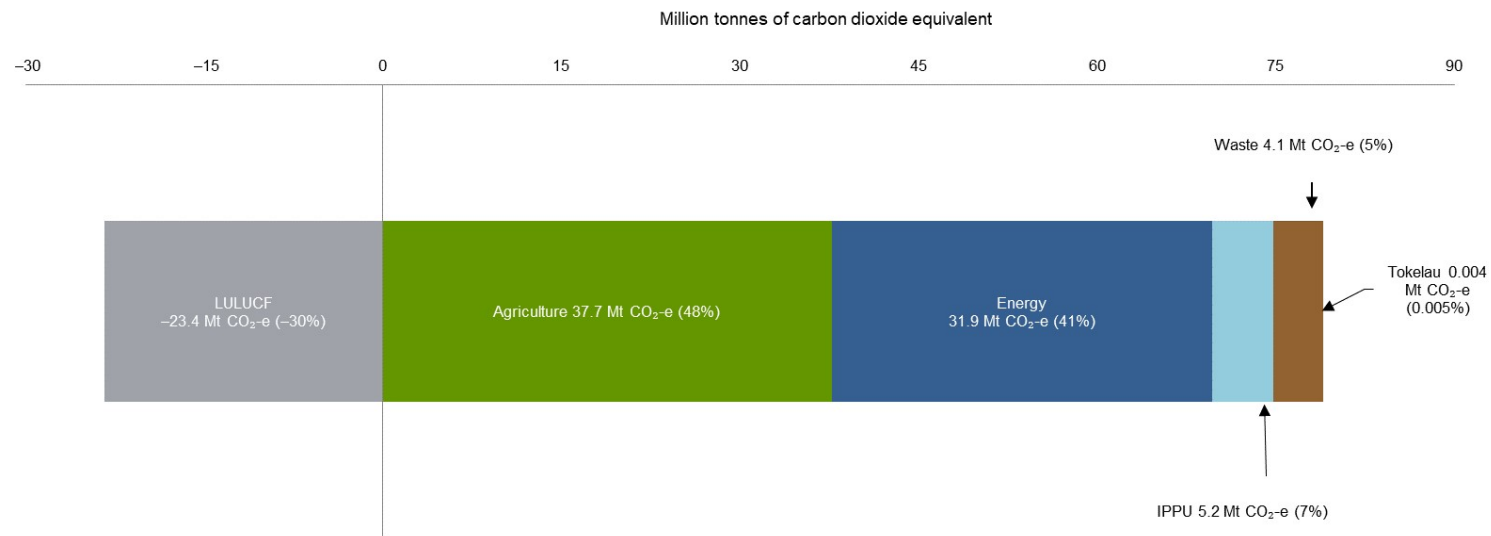


# Emissions from Agriculture



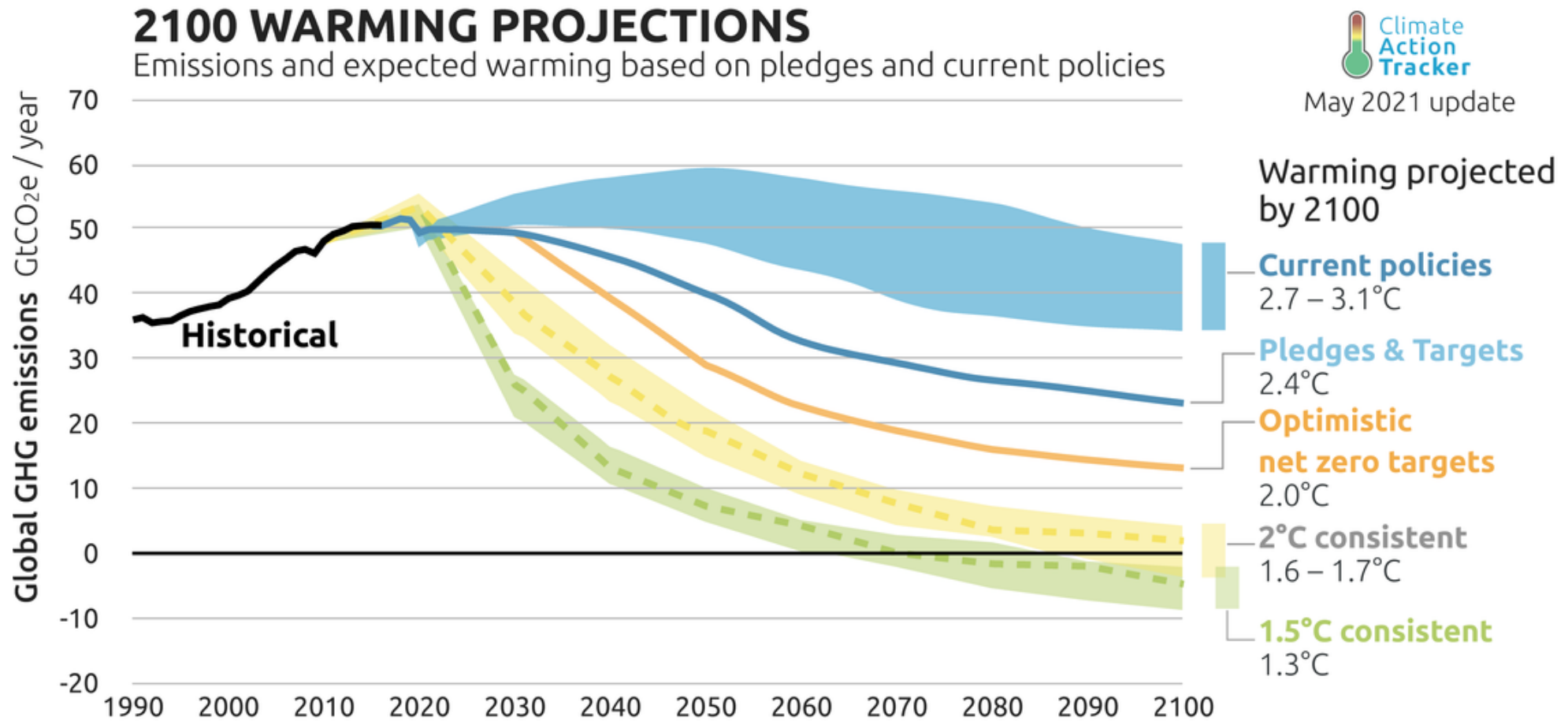
# New Zealand Emission Profile in 2018

- Most emissions come from Agriculture (48%) and Energy (41%)
- The Land Use, Land-Use Change and Forestry (LULUCF) sector offset nearly one third of New Zealand's gross emissions in 2018

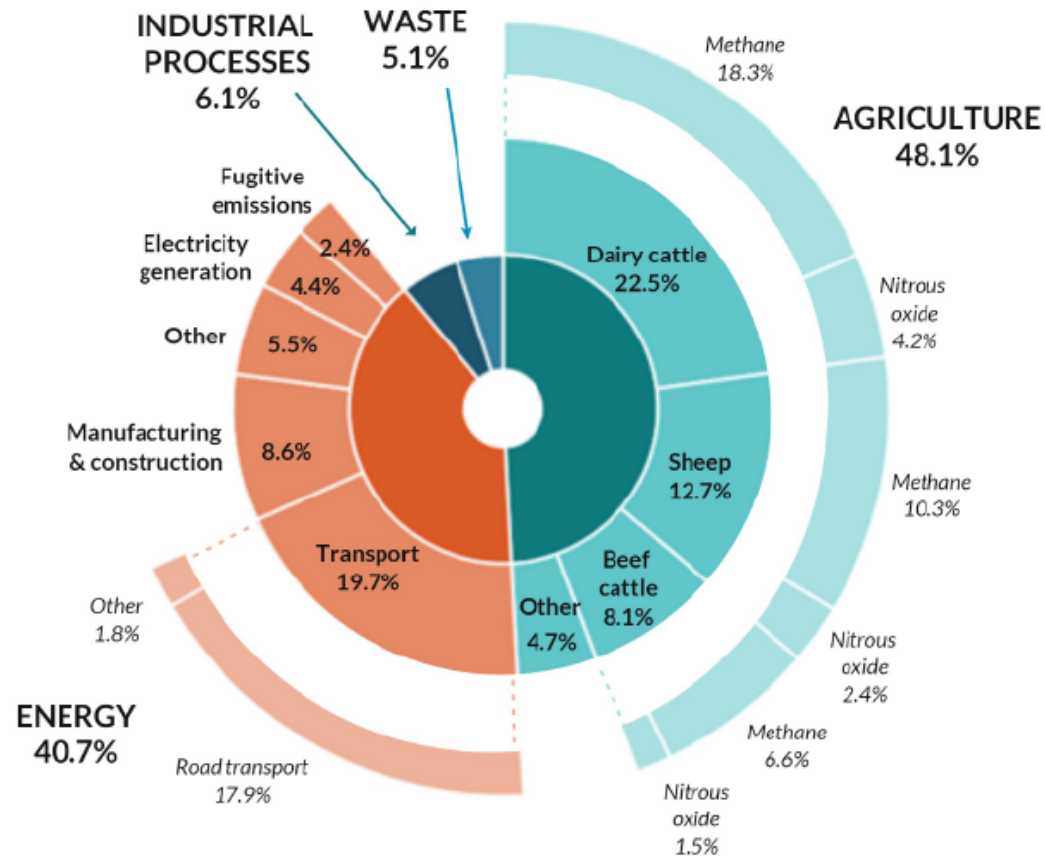




# Warming Projections



# Contribution of Agriculture – New Zealand



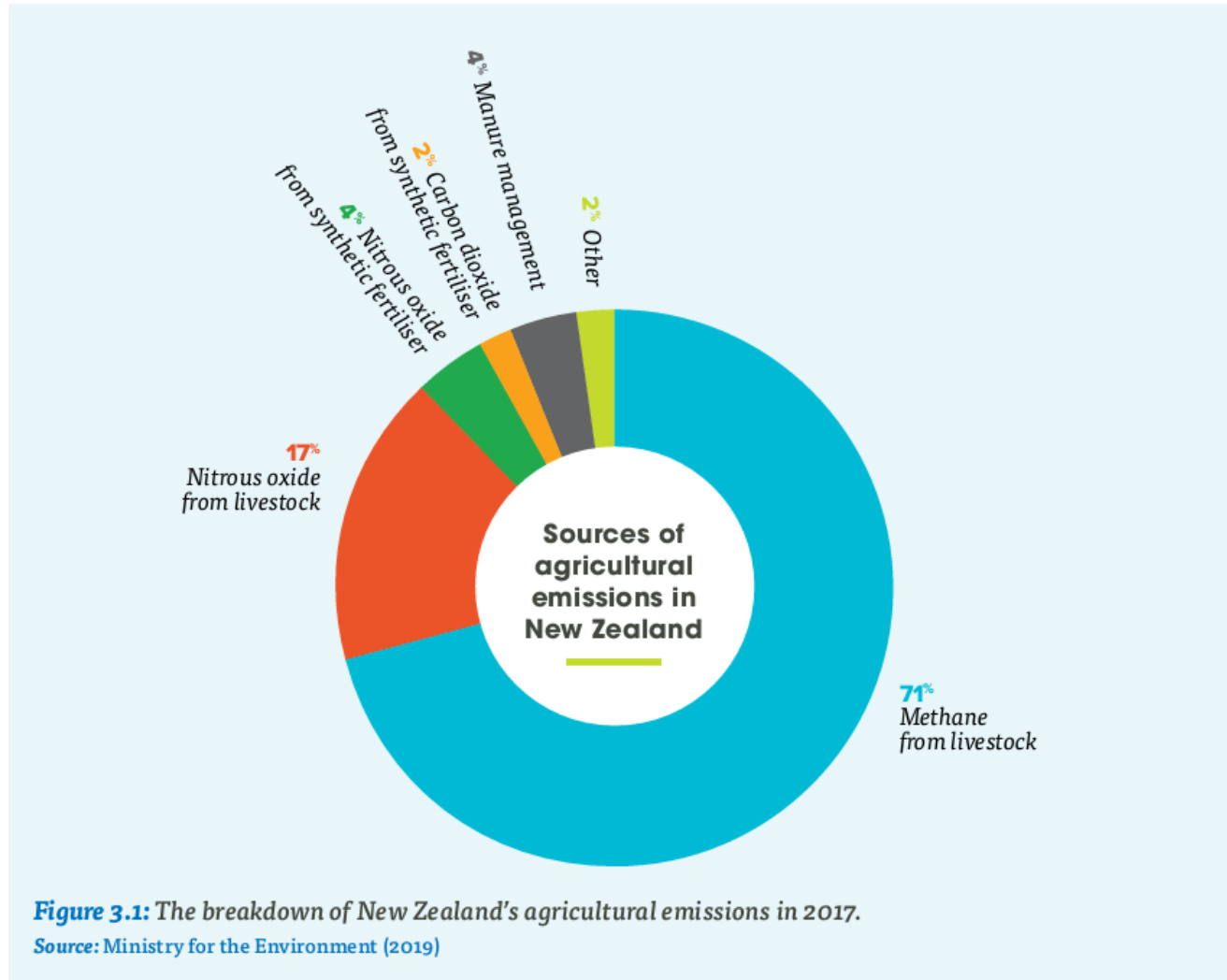
- 92% of Agricultural emissions related to livestock
- Rest relates to fertilizer and burning

# What Are We Doing About It

- Response is being measured under the Paris Agreement
- Each country put forward Nationally Determined Contributions
  - Actions linked to Science Based Targets aimed at stabilising GHG concentrations that result in 1.5/2/3/6 ? degrees warming

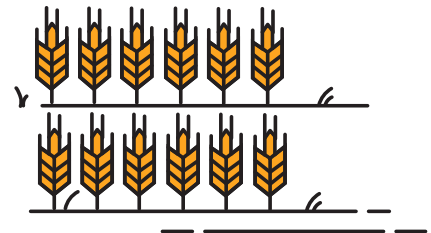


# Breakdown of Agricultural Emissions

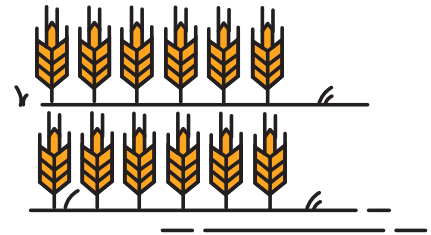


# New Zealand's Response

- Bipartisan support for
  - Emission Trading Scheme
  - Zero Carbon Bill
- Disputes between political parties relating to the Implementation Plan
  - 70 cross sector actions suggested by the Climate Change Commission

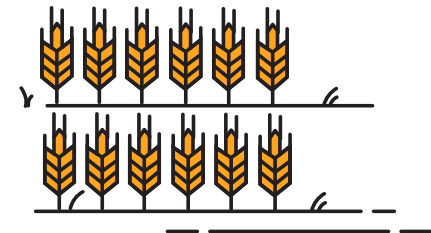


# National GHG mitigation commitments



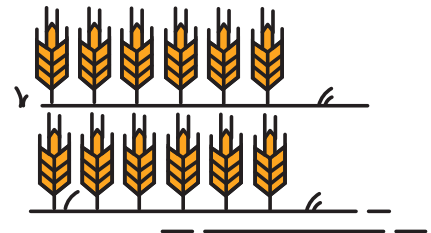
# New Zealand National Policy

- Influenced by UN processes
  - Kyoto Protocol (country negotiated target)
  - Paris Agreement (Science Based Targets)
- Nationally specific sectorial responses
  - Emissions Trading Scheme
  - Zero Carbon Bill
  - Ag sector response



# Paris Agreement

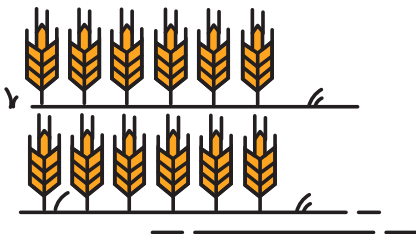
- The need to reduce greenhouse gas emissions is becoming urgent
- Countries have committed to hold warming to well below 2 degrees above pre-industrial levels, with efforts to limit it to 1.5 degrees
- To achieve this, every part of society will need to play a role in reducing emissions



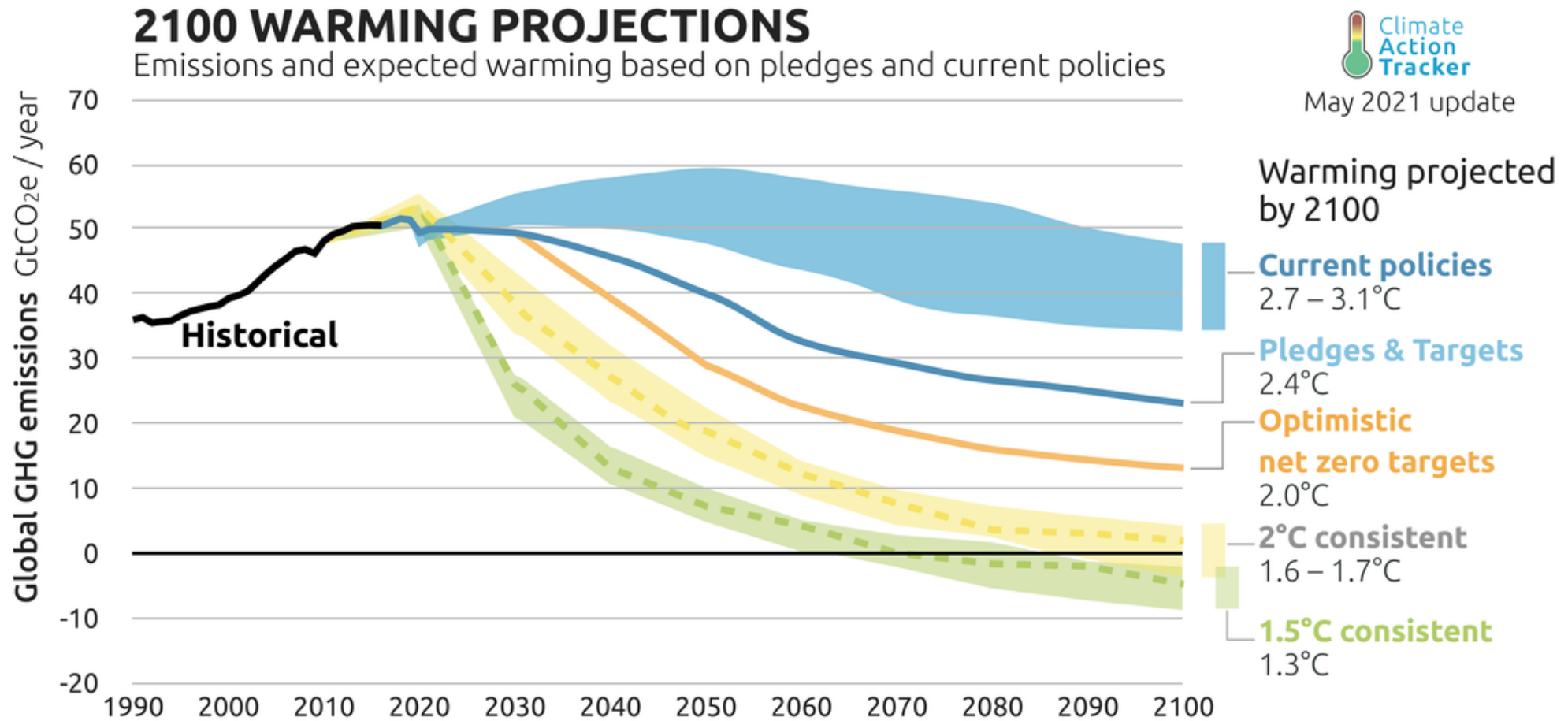


# Paris Agreement

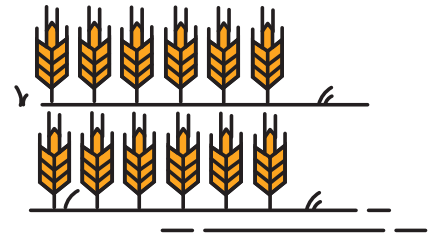
- The Government ratified the Paris Agreement in October 2016. The Agreement commits New Zealand to an ambitious target – to reduce emissions to 30% below 2005 levels by 2030 (*and adopt increasingly more ambitious targets in the future*)
- Agreed to reach net zero by 2050
  - Actually 73% of global emissions are currently covered by net zero targets
- For New Zealand to meet its commitments under the Agreement, changes would need to be made to the ETS and our other climate change policies and programs



# Warming Projections

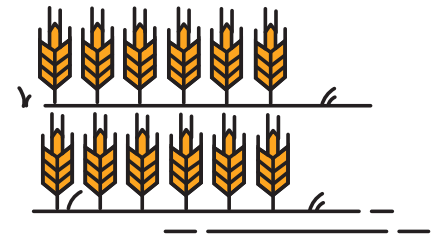


# Policy Position on Agricultural Emissions



# New Zealand ETS and Agriculture

- Farmers and producers are not currently included in the ETS
- The Climate Change Committee CCC advising how best to engage Agriculture into a carbon pricing mechanism which is New Zealand's primary policy for meeting the targets
- He Waka Eke Noa - Primary Sector Climate Action Partnership will support farmers and growers to protect, restore and sustain our environment and to enhance our well-being and that of future generations.



# He Waka Eka Noa



Supported by AgResearch, Scion, Manaaki Whenua, Fert Association, NZAGRC, PGGRC



## 5-YEAR PROGRAMME OVERVIEW

### WHAT

#### OUR VISION

Farmers and growers take action on climate change to protect, restore and sustain our environment and to enhance our well-being and that of future generations

#### OUR MISSION

We are working together to develop a framework by 2025 to equip farmers and growers to reduce on-farm agricultural greenhouse gas emissions and adapt to climate change, to enable sustainable food and fibre production for future generations

#### ON-FARM RESULTS

By 2025 all farmers and growers are:

- including climate change mitigation and adaptation in their farm business and environment plans.
- calculating their net greenhouse gas emissions and being incentivised to take action on climate change through an appropriate pricing mechanism for emissions.

### WHEN

#### 2020

- **MARCH:** Partnership established, and Joint Action Plan agreed
- **JUNE:** Workstreams underway
- **NOVEMBER:** Methods and definitions for calculating and reporting on emissions
- **DECEMBER:** Guidance on how to measure and manage emissions through farm planning

#### 2021

- **MARCH:** Discussion with farmers and growers on options for understanding and recognising on-farm sequestration (that is, the long-term storage of carbon for example in trees or soil)
- **MARCH:** Discussion with farmers and growers on options for a farm-level pricing mechanism for emissions
- **DECEMBER:** 25% of farmers and growers in NZ know their annual total on-farm emissions and have a written plan to manage emissions

#### 2022

- **FEBRUARY:** Partnership recommendations on farm-level emissions pricing mechanism and recognising on-farm sequestration presented to Government for consideration
- **DECEMBER:** 100% of farmers and growers in NZ know their annual total on-farm emissions

#### 2023

- **DECEMBER:** Pilot project testing a system for farm level emissions accounting and reporting completed

#### 2024

- **DECEMBER:** 100% of farmers and growers in NZ have a written plan to measure and manage emissions

#### 2025

- **JANUARY:** All farms in NZ using system for farm-level accounting and reporting of 2024 agricultural emissions at farm level

### HOW

#### WORKSTREAMS

Each workstream involves a team of industry, Māori and government participants collaborating to co-develop climate change knowledge, tools and support for New Zealand's farmers and growers

##### ✓ FARM PLANNING

- Develop a Farm Plan (FP) approach that:
- Establishes Good Farming Practice (GFP) principles for greenhouse gases that consider mitigation, sequestration, adaptation and adverse events
  - Integrates and enables co-benefits with other regulatory farm planning, industry assurance programme (IAP) and farm business needs, including freshwater
  - Is farmer focused and provides confidence in the application of the farm planning approach
  - Acknowledges the kaitiaki practices of Māori landowners (including Te Hau Ora o te Ao) and that responds to and maximises the opportunities for Māori landowner mixed use farming systems

##### ✓ EMISSIONS REPORTING

- Develop criteria, methodologies and definitions to:
- Build the awareness of farmers and growers of their on-farm greenhouse gas emissions and sequestration rates by 2022
  - Build a farm-level accounting and reporting system that supports a farm-level pricing mechanism by 2025

##### ✓ ON-FARM SEQUESTRATION

- Design a simple and cost-effective programme that:
- Enables New Zealand farmers and growers to understand and be recognised for the sequestration that is happening on their farm
  - Drives behaviour change by empowering farmers to increase sequestration (or prevent carbon losses) on their farms, resulting in improved greenhouse gas emission profiles; broad environmental benefits

##### ✓ EMISSIONS PRICING

- Design a farm-level pricing mechanism, that forms part of a broader behaviour change framework within He Waka Eke Noa, that:
- Incentivises farmers and growers to reduce greenhouse gas emissions within New Zealand's agricultural sector
  - Contributes to reducing greenhouse gas emissions from the agricultural sectors towards meeting New Zealand's targets under the Climate Change Response Act
  - Supports productive, internationally competitive and sustainable New Zealand agricultural and horticultural sectors

##### MAORI AGRIBUSINESS

A cross-connecting workstream that integrates Māori perspectives into He Waka Eke Noa to ensure relevance and delivery to Māori farmers, landowners, and land entities

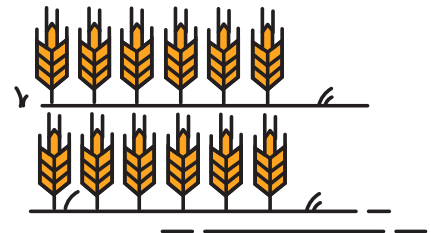
##### EXTENSION

Details to be confirmed



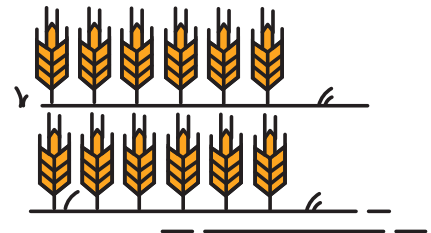
# Milestones

- Initial milestones focussed on awareness raising.
- Later milestones focus on reporting to underpin a pricing system



# Target Policy Areas

- Reduce methane emissions from livestock
- Reduce nitrous oxide emission from synthetic fertiliser application





# Milestones

## Farm Planning

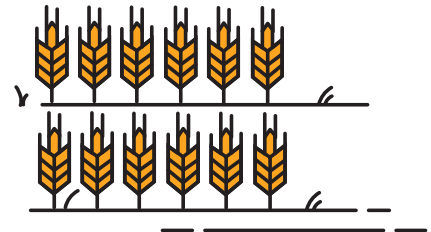
- Guidance for GHG by Jan 2021
- 25% of farms with GHG in farm plans by 1 Jan 2022
- 100% of farms with GHG in farm plans by 1 Jan 2025

## Emissions Reporting

- 25% of farms know their GHG numbers by 31 Dec 2021
- 100% of farms know their GHG numbers by Dec 2022
- Farm level accounting and emissions reporting system in place by 2025

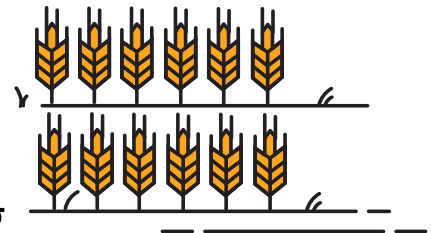
# Questions being considered

- How are **different agricultural GHGs** treated?
- How to recognise and reward **early adopters**?
- How to **estimate and report emissions**?
- How will **on-farm sequestration** be recognised?
- Can farmers form **groups or clubs** for emissions?
- Considerations when **setting a price** for emissions?
- How should **revenue generated** be used?
- How do we recognise the unique characteristics of **Māori land/Matauranga Māori/Tikanga Māori**?



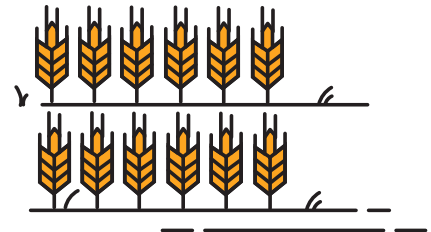
# He Waka Eke Noa Timing

- Farms need to have a GHG number by the end of 2022 if:
  - they are 80ha or more, or
  - have a dairy supply number, or
  - are a cattle feedlot as defined in freshwater policy
- Around 11,000 farmers already have a GHG number for their farm
- He Waka Eke Noa is working to develop the farm-level emissions pricing system for 2025, including recognizing on-farm sequestration

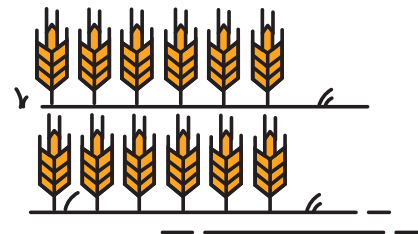


# He Waka Eke Noa Timing

- Preliminary recommendations for the pricing system, including recognising on-farm sequestration, will be shared more broadly with farmers and growers by industry partners in November 2021
- In March 2022 He Waka Eke Noa will present recommendations to Ministers

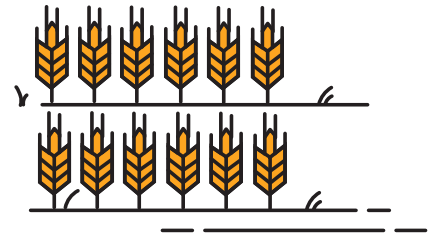


# Calculating on-farm emissions

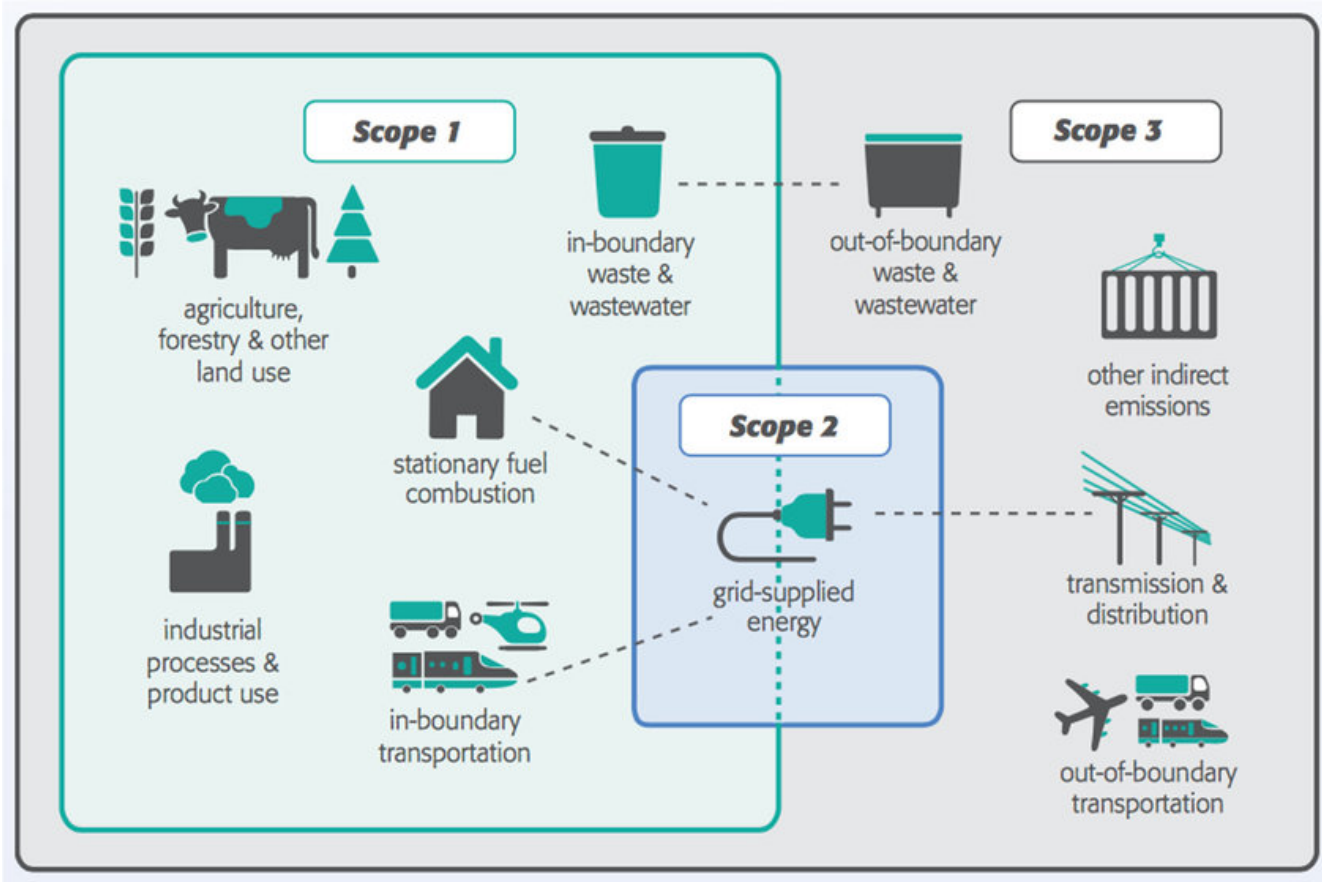


# Understanding farm emissions

- To reduce emissions, farmers will need to quantify their farm's emissions, understand what drives these emissions and be able to assess options for reducing them



# GHG Emissions Activities



Scope 1: Direct Emissions (e.g livestock emissions)

Scope 2: Indirect Emissions from Purchased Electricity

Scope 3: Indirect Emissions from 3<sup>rd</sup> party sources (not owned or operated by your organisation) e.g Waste to Landfill, third party transport of products)

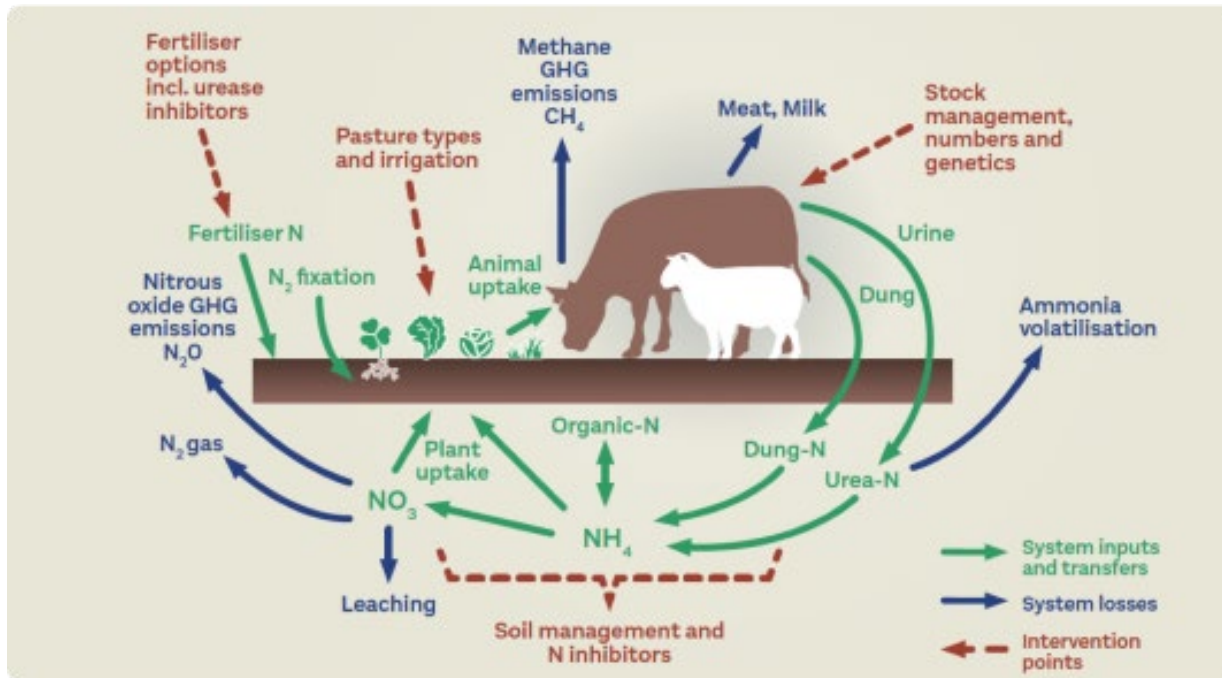
# Inventory vs Footprint

Inventory	Footprint
Scope 1 and 2	Scope 1, 2 and 3
Often for regulatory reporting  (He Waka Eke Noa) and is likely to be a subset of Scope 1	Wider scope for voluntary reporting and understanding the wider influence of your businesses activities  (Carbon Zero/Carbon Neutral/Carbon Reduce products)





# GHG Emissions from Farming Systems

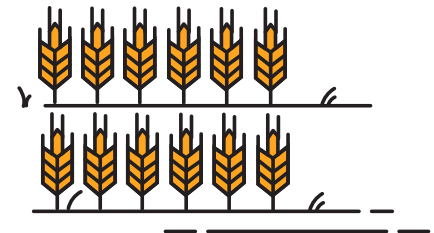


Greenhouse gas (GHG) emissions include:

- Biological emissions like methane and nitrous oxide — these are mostly from ruminant animals like sheep and cattle
- Emissions from fertilizer application
- Carbon dioxide — mostly as a by-product of energy use and transport

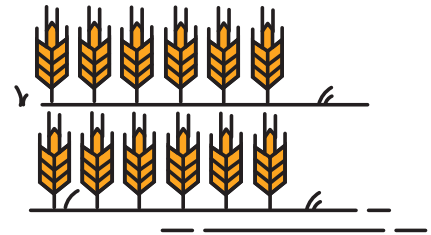
# How are emissions calculated?

- Direct measurement at the farm scale is not currently possible
- Proxies are used instead
  - stock numbers
  - feed and stock characteristics
  - fertilizer application rates
  - management characteristics



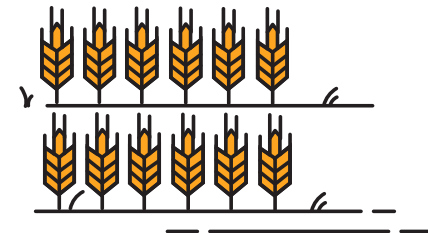
# Review of tools

- <https://hewakaekenoa.nz/tools-and-calculators/>



# Tools that meet minimum requirements

	Dairy	Sheep & Beef	Deer	Horticulture	Arable
Alltech	✓	✓			
E2M	✓	✓			
Farmax	✓	✓	✓		
Fonterra	✓				
Hort NZ				✓	
MfE	✓	✓	✓	✓	✓
Overseer	✓	✓	✓	✓	✓
ProductionWise (FAR)					✓
B+LNZ GHG Calculator		✓	✓		
Farm emanage (Toitū + Overseer)	✓	✓	✓		✓

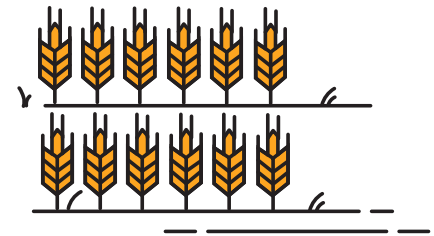


<https://www.agmatters.nz/topics/know-your-number/>



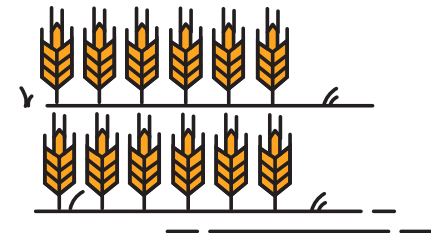
# Variation in GHG Output Figures between the models

- Farm level GHG emissions are driven by three key factors:
  - Amount of dry matter (DM) eaten, or the DMI
  - Amount of protein in the diet (%N)
  - Amount of nitrogen (N) fertiliser applied
  
- Of these, the main driver is the amount of dry matter eaten



# Variation in GHG Output Figures between the models

- The Review of Models highlights that different tools can give different outputs at this stage, due to a combination of differing assumptions:
  - around drymatter and energy utilisation,
  - nitrogen content of forages, and
  - assumptions made by the model operator on the farm system
- Most of the models have in-built DMI/utilisation/ME values, and it would appear that they are not necessarily aligned between models
- Most have % N factors relating to forages, and again it would appear these are not necessarily aligned between models
- The end result is that the differences between results of different models will vary depending on the assumptions around DMI, ME, and % N levels



# Case Study - Comparison

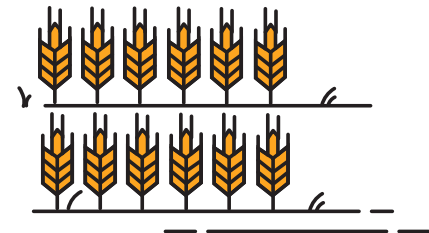
Source	Overseer	Beef and Lamb
Methane (t CO <sub>2</sub> e)	2,661	2,421
Nitrogen Dioxide (t CO <sub>2</sub> e)	775	630
<b>Total</b>	<b>3,436</b>	<b>3,051</b>

- Approximately – 13% difference



# Tool Review – Treatment of Sequestration

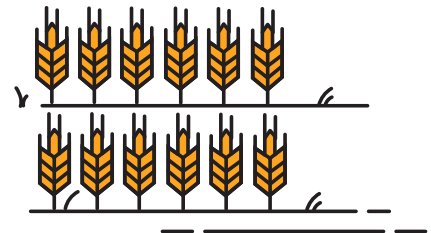
- The varied approaches to accounting for sequestration used by emissions tools will generate some confusion amongst farmers
- Tools that use a non-ETS aligned approach cannot be relied on to give an accurate estimate of sequestration that would be “counted” should the farmer enter the ETS
- In addition, having different approaches to calculating sequestration between the ETS and emissions calculation tools may cause some confusion and/or expectations amongst farmers about the worth of farm vegetation under the future pricing scheme being developed by He Waka Eke Noa





# Forest Sequestration

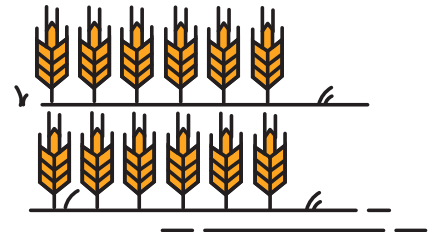
- Both Toitū farm emanage and B+LNZ GHG Calculator include sequestration from forestry
- ProductionWise illustrates how much forestry would be needed to offset the farm emissions, based on the MPI carbon lookup tables
- Alltech, MfE, and OverseerFM also incorporate sequestration components, and Farmax is shortly to release an update which includes forestry sequestration



# Tool Review – Treatment of Sequestration

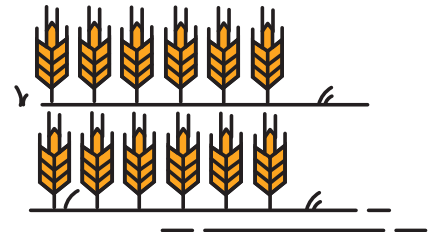
Using forestry as an offset to farm emissions is a complex area, with several other factors needing to be understood:

- Under the Zero-Carbon Act, methane cannot be directly offset by forestry sequestration, although all the models infer this is the case
- An offset is possible, via a transactional process; the carbon credits from the forestry sequestration could be sold and the funds raised then used to pay any methane tax
- It is understood that He Waka Eke Noa is considering other approaches



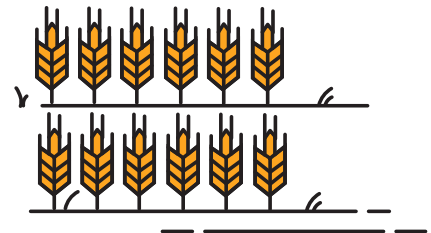
# Tool Review – Treatment of Sequestration

- If carbon credits from forestry sequestration are sold, they then cannot be directly used for offsetting, or vice versa.
- In other words, there is potential for “double dipping”, and currently only the Toitū process takes this into consideration.
- These aspects may well be beyond the scope of the current models/calculators to handle
  - the emphasis to understand these remains with the landowner and their advisors.



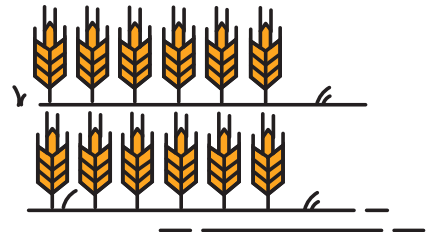
# Forest Sequestration

- Offsetting farm emissions via forestry sequestration is likely to be an important component of land managers' GHG management
- The key “rules” around sequestration within New Zealand currently are established within the Emissions Trading Scheme (ETS)
- He Waka Eke Noa is working on a programme to measure and recognise on-farm carbon sequestration which could include indigenous forestry and other woody vegetation on-farm which isn't currently accounted for in the ETS



# What do I do with the Number?

- The purpose of the model is to calculate the relevant biological GHG emissions for the farm
- Identifying mitigations/farm system change/offsetting is beyond the scope of the models
- Falls within the realm of an advisor to take the figures generated and provide suitable advice as to the measures the farmer may need to take



# Thank You

