Carbon sub-index

Jonathan Herron and Laurence Shalloo

Corrin Mart
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Teagasc, AGRIC, Moorepark, Fermoy, Co Cork.
Phone: 025 42 306
Email: Laurence.shalloo@teagasc.ie

Teagasc Agriculture and Food Development Authority

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Department of Agriculture, Food and the Marine
Talmhaíochta, Bia agus Mara

GreenBreed

VistaMilk

Overview

- Greenhouse gas (GHG) modelling
- GHG emission weights
- The carbon sub index
- Future developments

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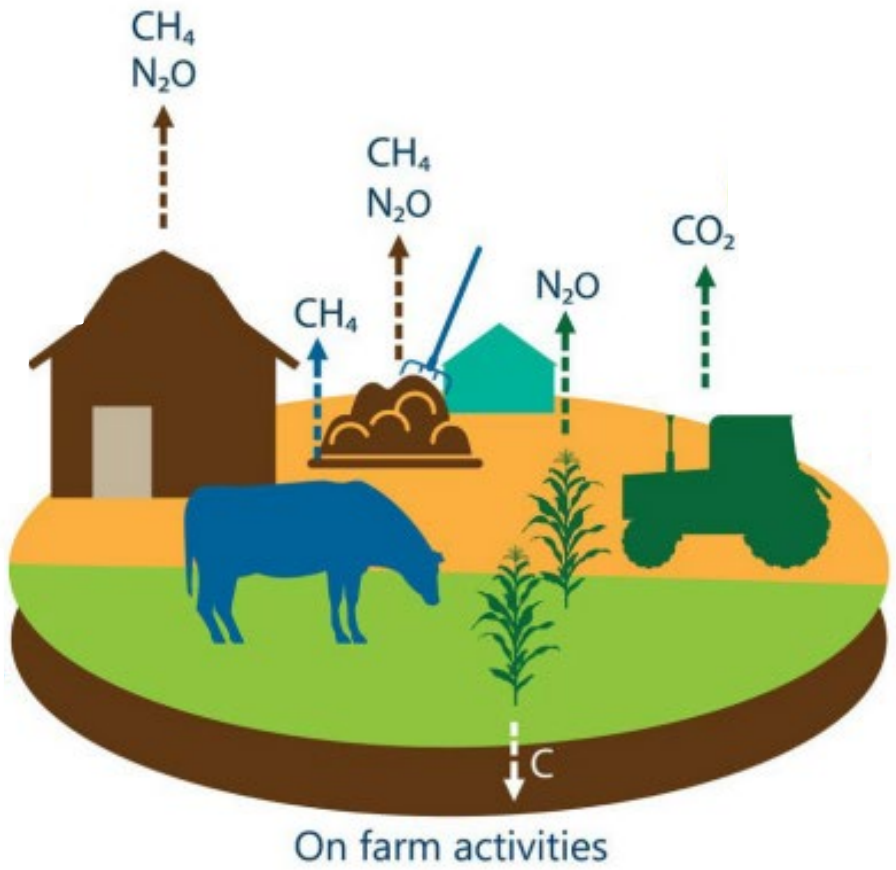
Modelling GHG emissions

- GHG emissions from agriculture
  - Numerous sources
  - Large variation in sources
- Models developed to replicate farm activities, nutrient flows and interaction within a farming system
- Models reflect three GHG emissions
  - Methane – CH_4
  - Nitrous Oxide – N_2O
  - Carbon Dioxide – CO_2



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Life cycle assessment of pasture-based dairy production systems: Current and future performance

Jonathan Herron,[1]* Donal O'Brien,[2] and Laurence Shalloo[1]
[1]Teagasc, Livestock Systems Research Department, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland P61 P302
[2]Teagasc, Environment, Soils and Land Use Department, Crops Environment and Land Use Research Centre, Johnstown Castle, Wexford, Ireland Y35 TC97

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A life cycle assessment of seasonal grass-based and confinement dairy farms

Donal O'Brien [a,b], Laurence Shalloo [a,*], Joe Patton [a], Frank Buckley [a], Chris Grainger [a], Michael Wallace [b]
[a] Livestock Systems Research Department, Animal & Grassland Research and Innovation Centre, Teagasc, Moorepark, Fermoy, Co. Cork, Ireland
[b] School of Agriculture, Food Science and Veterinary Medicine, University College Dublin, Belfield, Dublin 4, Ireland

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A systems approach to quantify greenhouse gas fluxes from pastoral dairy production as affected by management regime

D.K. Lovett [a,*], L. Shalloo [b,c], P. Dillon [c], F.P. O'Mara [a]

Life Cycle Assessment

Goal

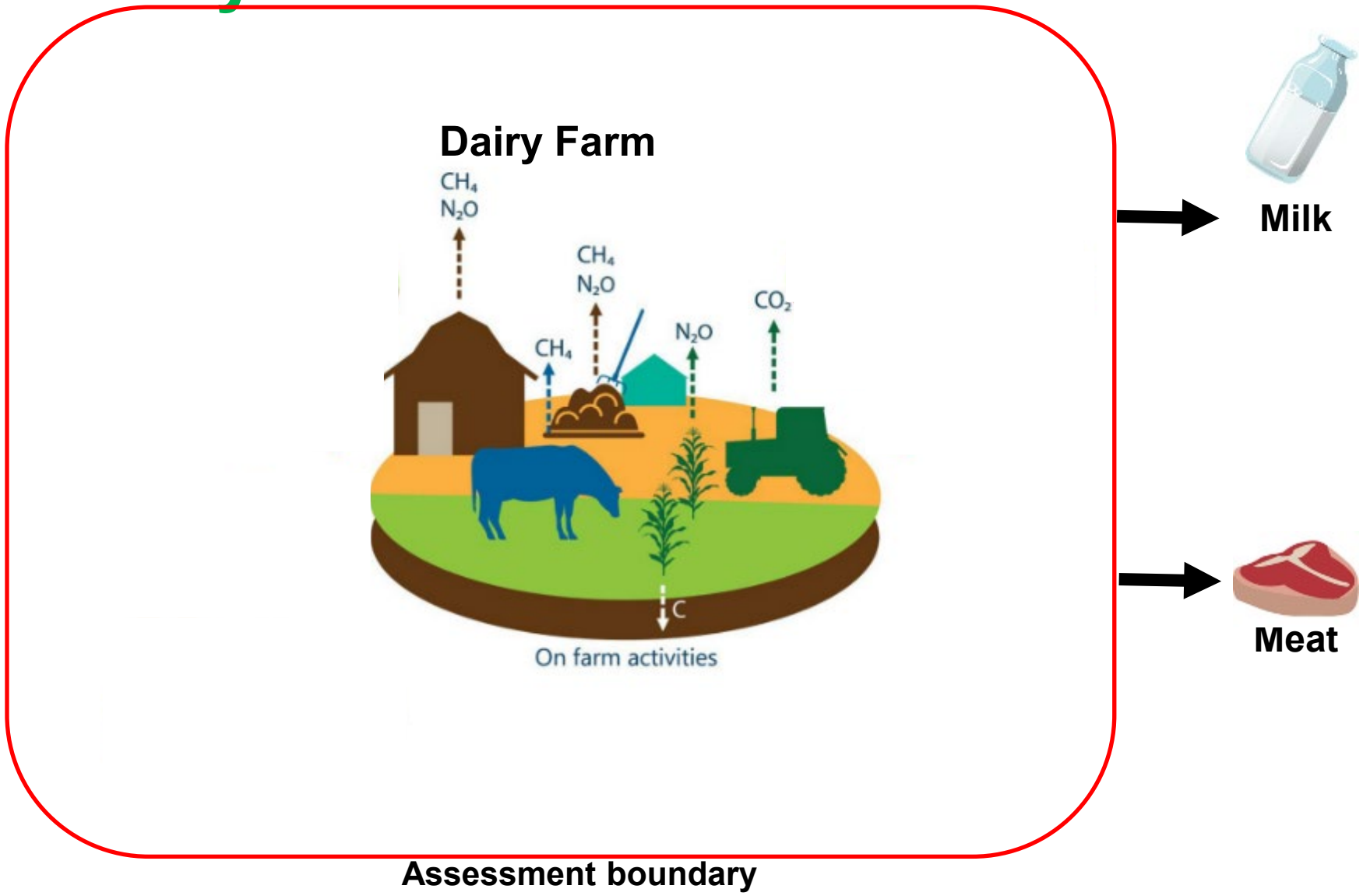
To calculate GHG emissions released from a dairy farm

Scope

Cradle to farm gate – all GHG emission up to point product leaves the farm.

Type of emissions

- **Animal emissions**
- General farm emissions



EBI - Environmental footprint of the Next Generation Herd

- Trial conducted in Kilworth research farm
- Elite EBI cows 10% lower GHG/kg FPCM than National average
- Difference caused by replacements and kg MS

  €10 increase in EBI = 1% less CO_2-eq kg / kg FPCM

- **No difference in Total Emissions**
- 2030 **25%** reduction target based on **Total Emissions**

	Elite (€181)	NatAv (€80)
CO_2-eq, tonnes / ha	**16.2**	**16.3**
FPCM, kg	**16879**	**15326**
CO_2-eq, kg / kg FPCM	**0.96**	**1.06**

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Greenhouse gas emissions and nitrogen efficiency of dairy cows of divergent economic breeding index under seasonal pasture-based management

B. Lahart,[1,2] L. Shalloo,[1] J. Herron,[1] D. O'Brien,[3] R. Fitzgerald,[1] T. M. Boland,[2] and F. Buckley[1]*
[1]Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, P61 C996, Ireland
[2]School of Agriculture and Food Science, University College Dublin, Belfield, Dublin 4, D04 N2E5, Ireland
[3]Crops, Environment, and Land Use Research Centre, Teagasc, Johnstown Castle, Co. Wexford, Y35 TC97, Ireland

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Economic Breeding Index

- Expected average profit (€) per lactation of daughters relative to the base cow
- **The weighting on each trait in a breeding objective is called the economic value**
- **Economic value**
  - Change in profit per unit change in the trait under investigation holding all other traits constant
- **Derived from the Teagasc Moorepark Dairy systems bio-economic model (MDSM)**
- **The EBI is routinely updated where necessary**
  - EU policy changes (quota abolishment)
  - Price of products (e.g., milk) change
  - Costs of production (e.g., fertilizer) change
- **Current EBI sits where land is limiting and feed is purchased onto the farm**

Carbon Sub-Index

Economic value

Change in profit per unit change in the trait under investigation holding all other traits constant

Carbon Value

Change in total emissions per unit change in the trait under investigation holding all other traits constant

- **All traits have an emissions value**
  - Traits that increase feed intake - increase emissions
  - Traits that reduce feed intake or change diet reduce emissions
- **Total carbon value is converted to an economic value by a price per tonne of carbon**

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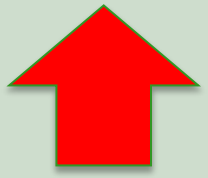
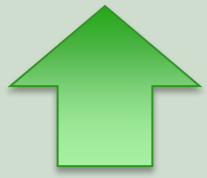
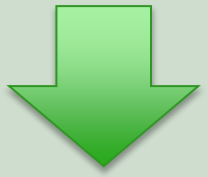
Carbon Sub-Index

Trait	Profit	GHG emissions
Milk, kg		
Fat, kg		
Protein, kg		
Carcass weight, kg		
Survival, %		
Live weight, kg		
Calving interval, days		
Days to slaughter %		

Index will favour cows that are more fertile and are slightly lighter (i.e., lower maintenance cost) => makes biological sense. But, need to also consider this in context of beef coming from the dairy herd?

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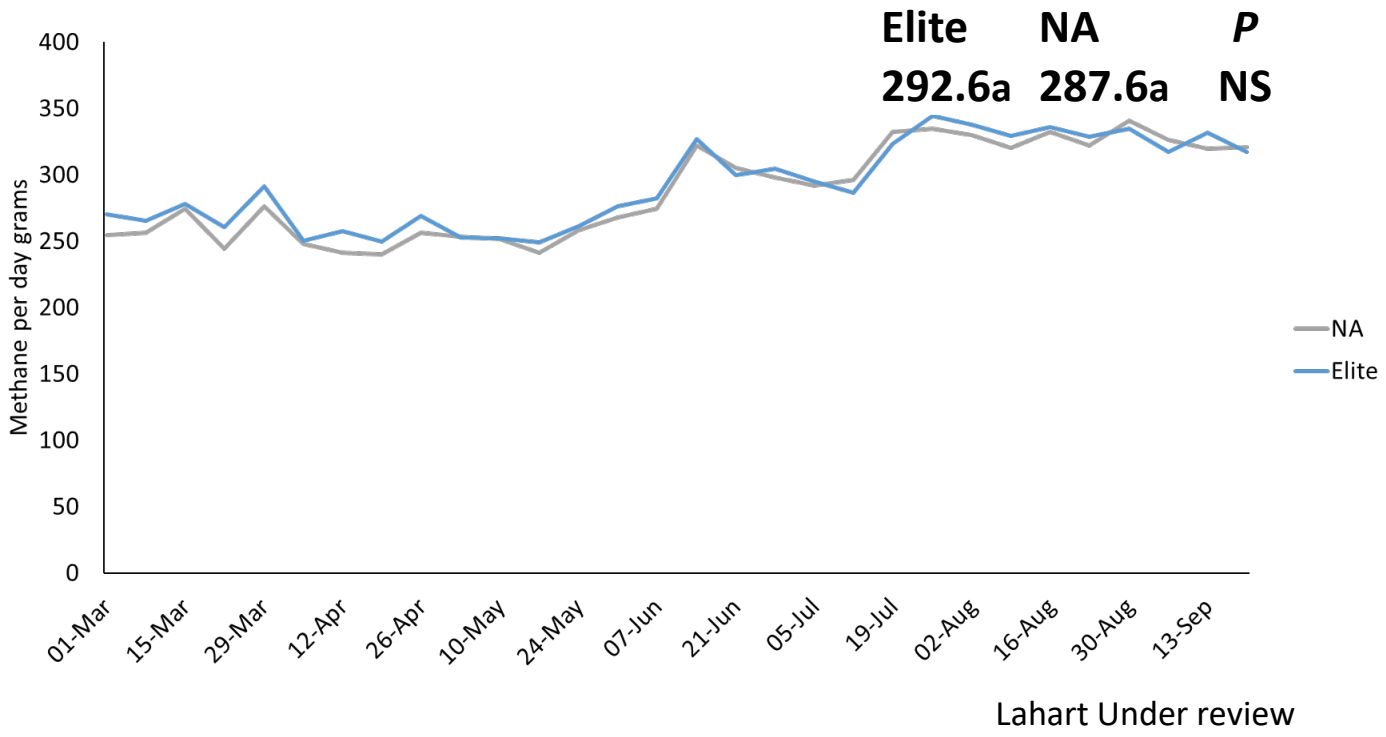
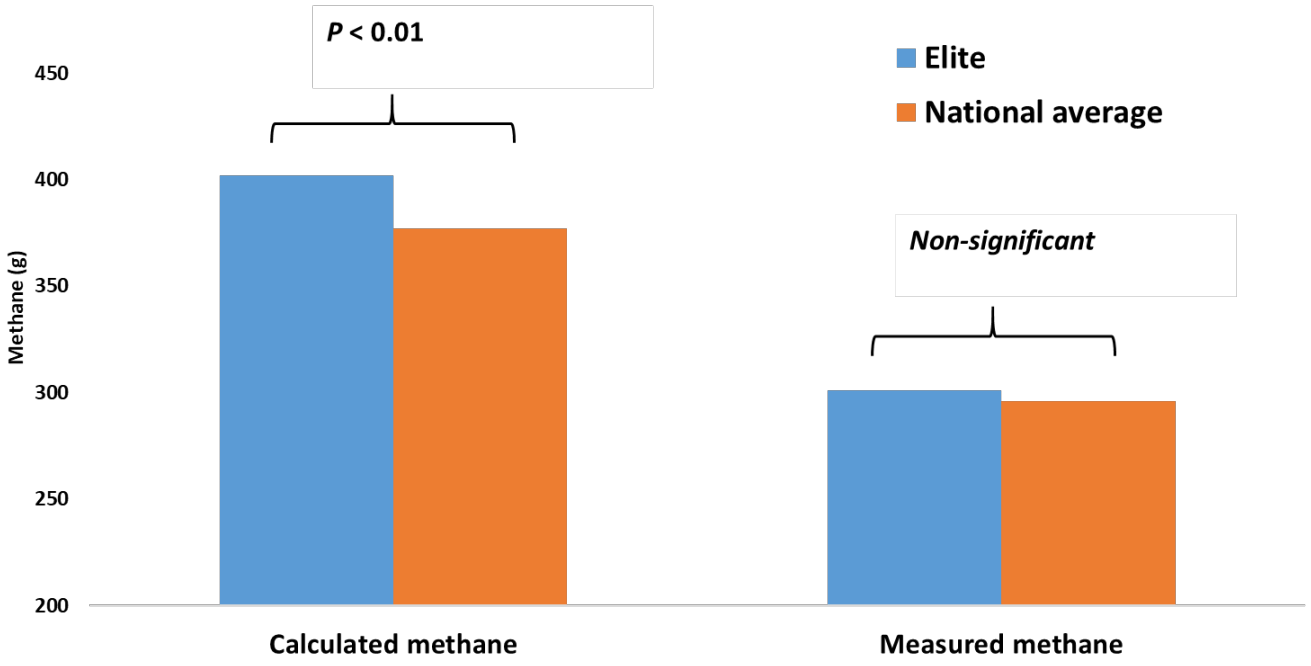
Methane per cow per day



Measure methane

- **No significant difference** in g CH_4 per day emitted by **Elite** cows and **National Average** EBI cows

Methane (CH_4) per cow per day



Lahart Under review

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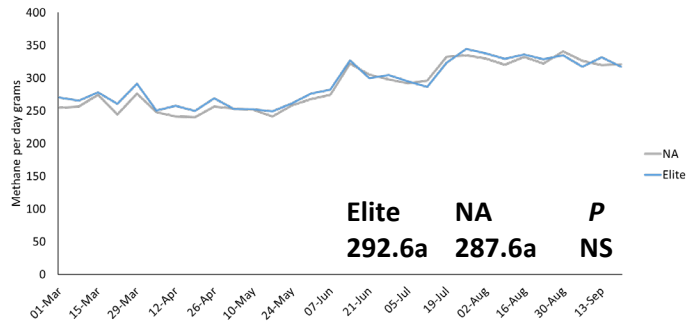

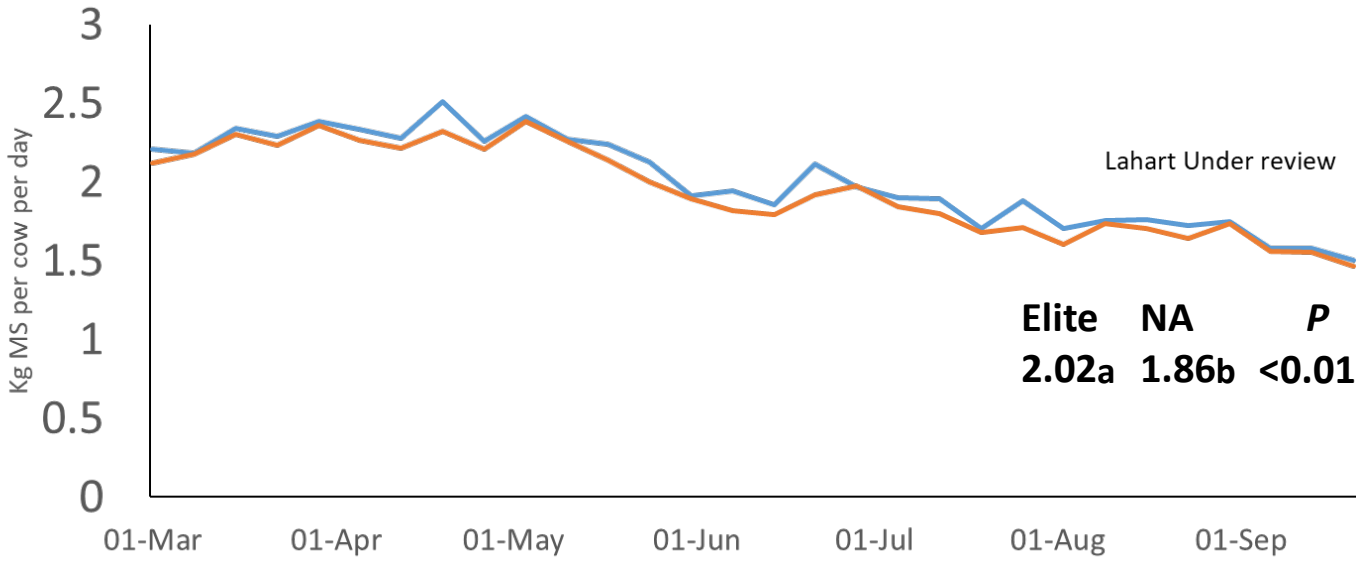

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- Calculated CH_4 **18%** greater than Measured CH_4
- Elite produce **8%** more kg MS, similar CH_4 per day

- **Further research needed**

Summary

- One of the first countries in the world to directly take account of emissions in the index
- Focused on **Total Emissions** and not emissions intensities
- Increases economic weight of traits that reduce emissions
- Reduces economic weight on traits that increase emissions
- Carbon sub-index will reflect 10% of the index
- Direct towards a more efficient animal and system