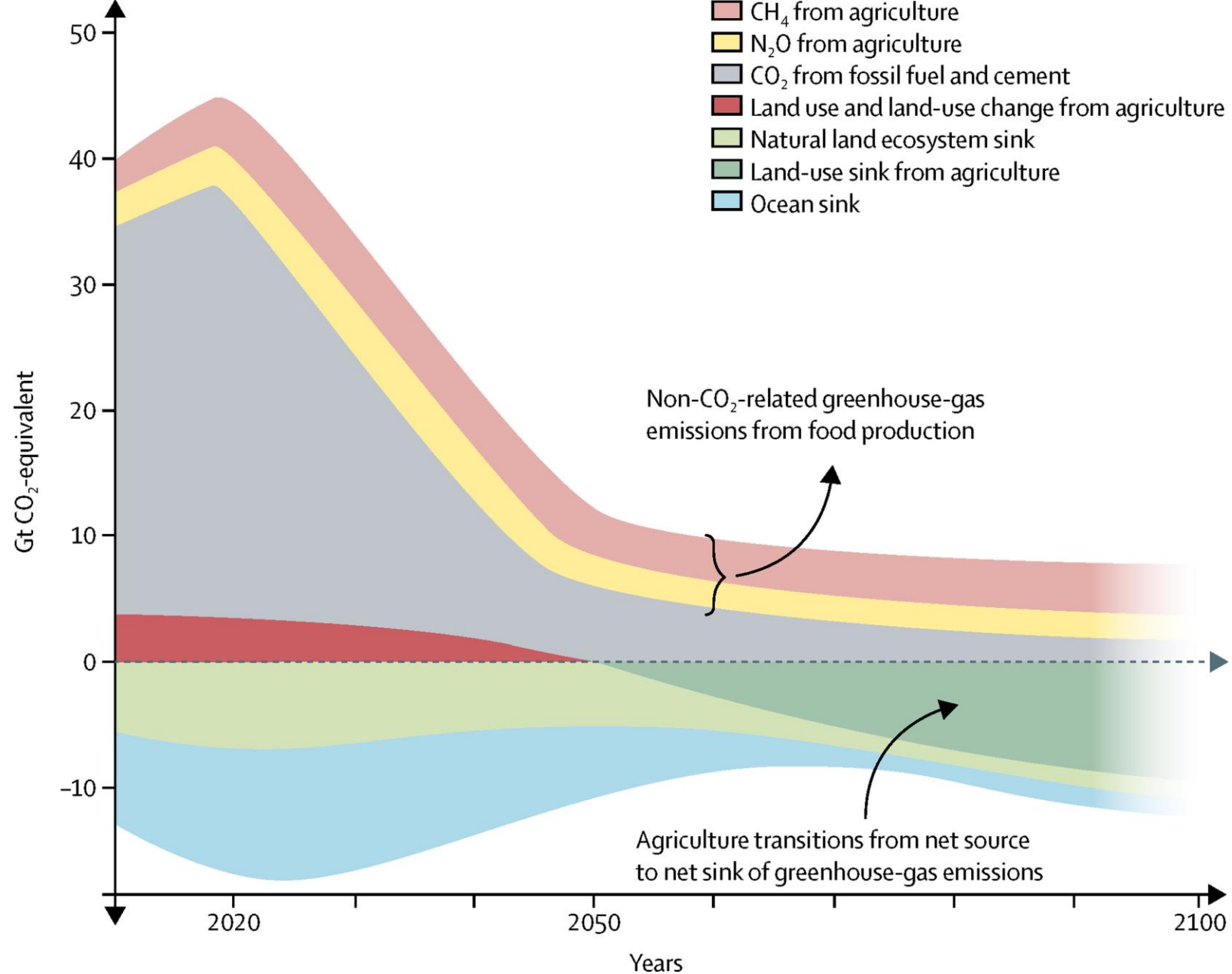


# **New Metrics for Comparative Advantage in Agricultural Production**

**CAPI Workshop**  
**Optimizing Land Use**  
Calgary, Alberta  
February 21-22, 2019

# Green Growth and GHG efficiency in production

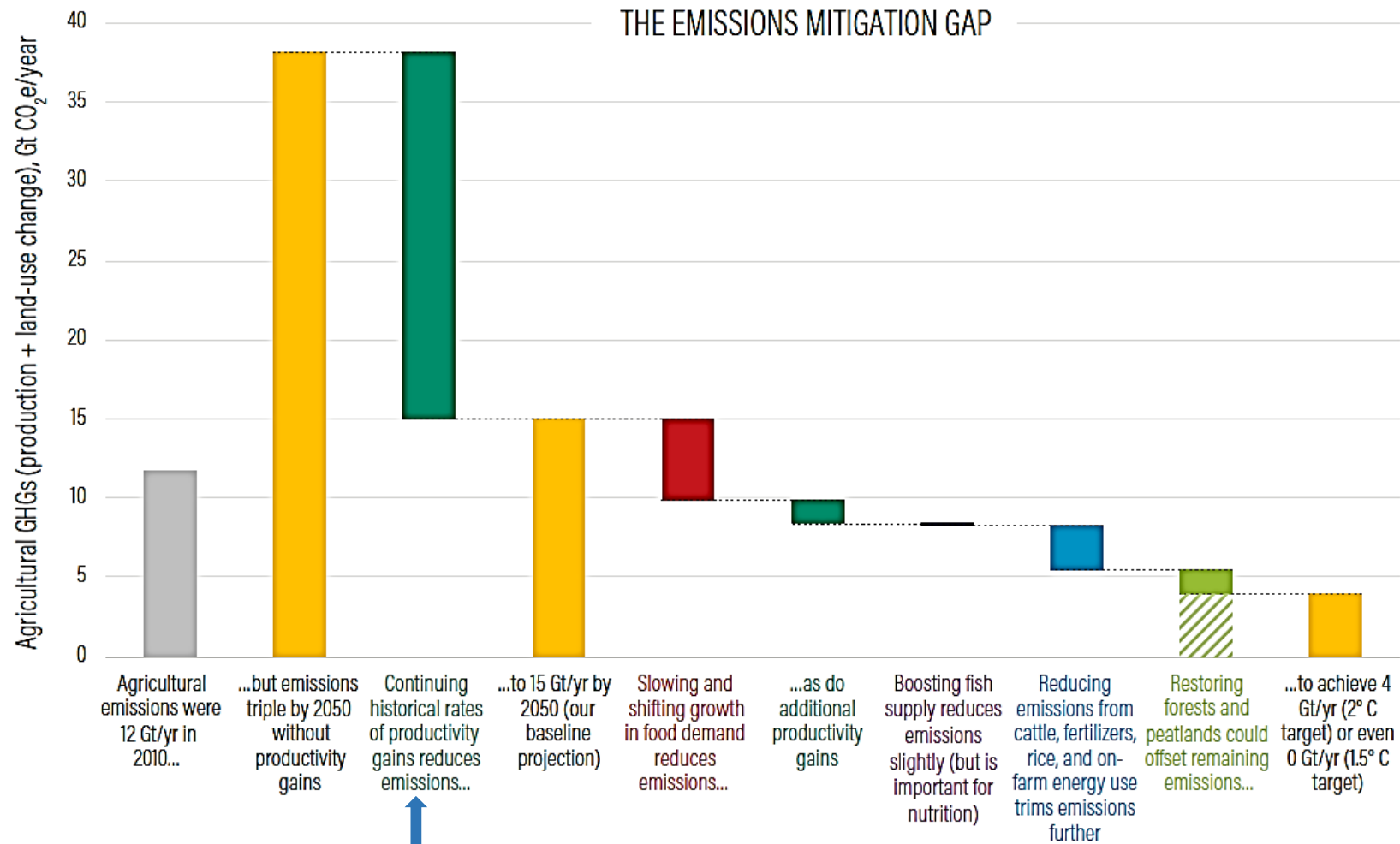
- World Resources Institute projects:
  - Food demand + 50% by 2050
  - Using current technologies = additional 593 Mha of agricultural land.
  - To keep global warming at 2<sup>0</sup>C, ag emission intensity must decline
- So How do we increase food production w/o increasing agricultural land while reducing GHG emissions from agriculture and storing carbon



**EAT Lancet projections of global emissions to keep warming below 2°C, aiming for 1.5°C**

Data from Intergovernmental Panel on Climate Change fifth assessment report (RCP2.6 data for nitrous oxide and methane) and Rockström and colleagues<sup>28</sup> (for fossil-fuel emissions, land use, land-use change, and forestry, and biosphere carbon sinks).

# Agriculture's potential contribution to the Paris objectives



Source: WRI, December 2018

↑ Largest impact from technological change which is lowering GHG intensity in production

# Regions are not equal in GHG efficiency

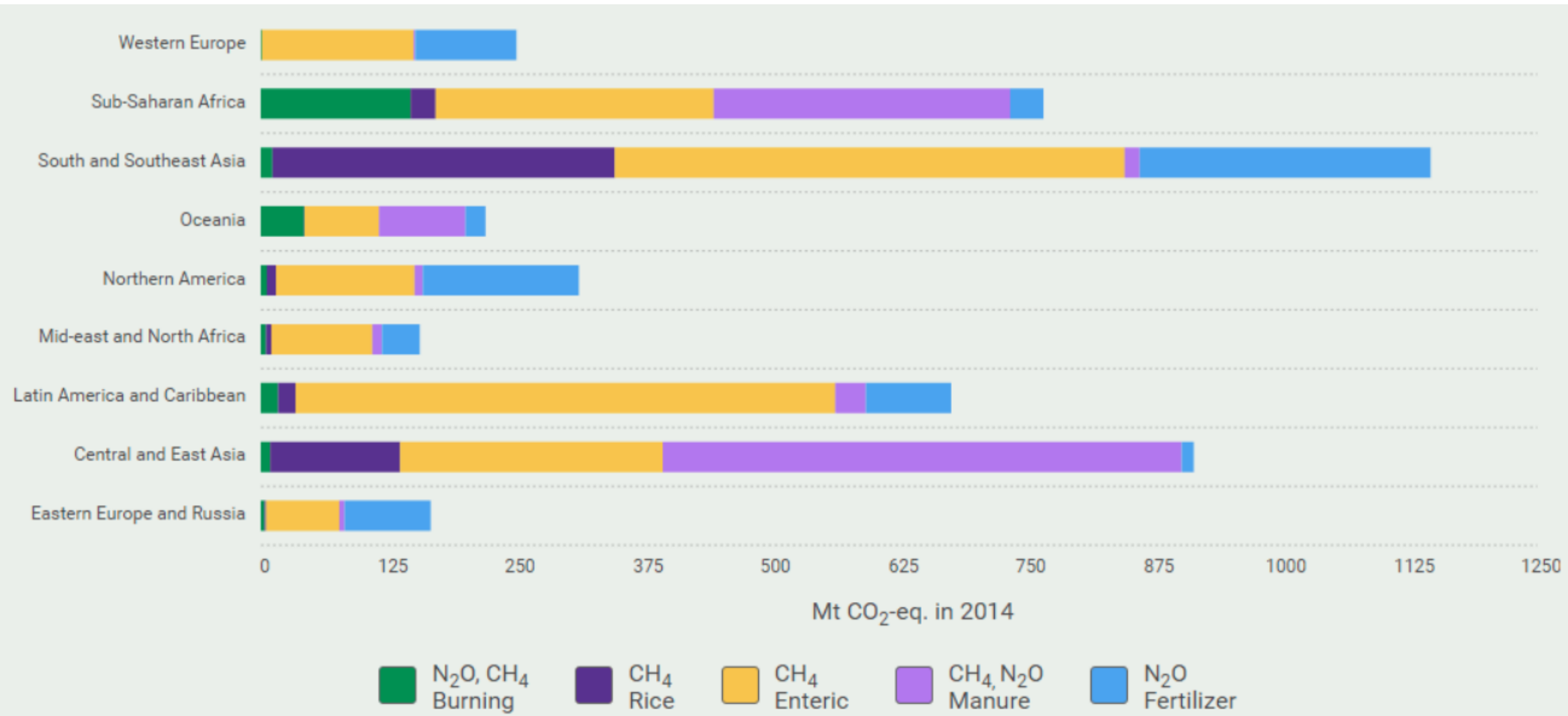
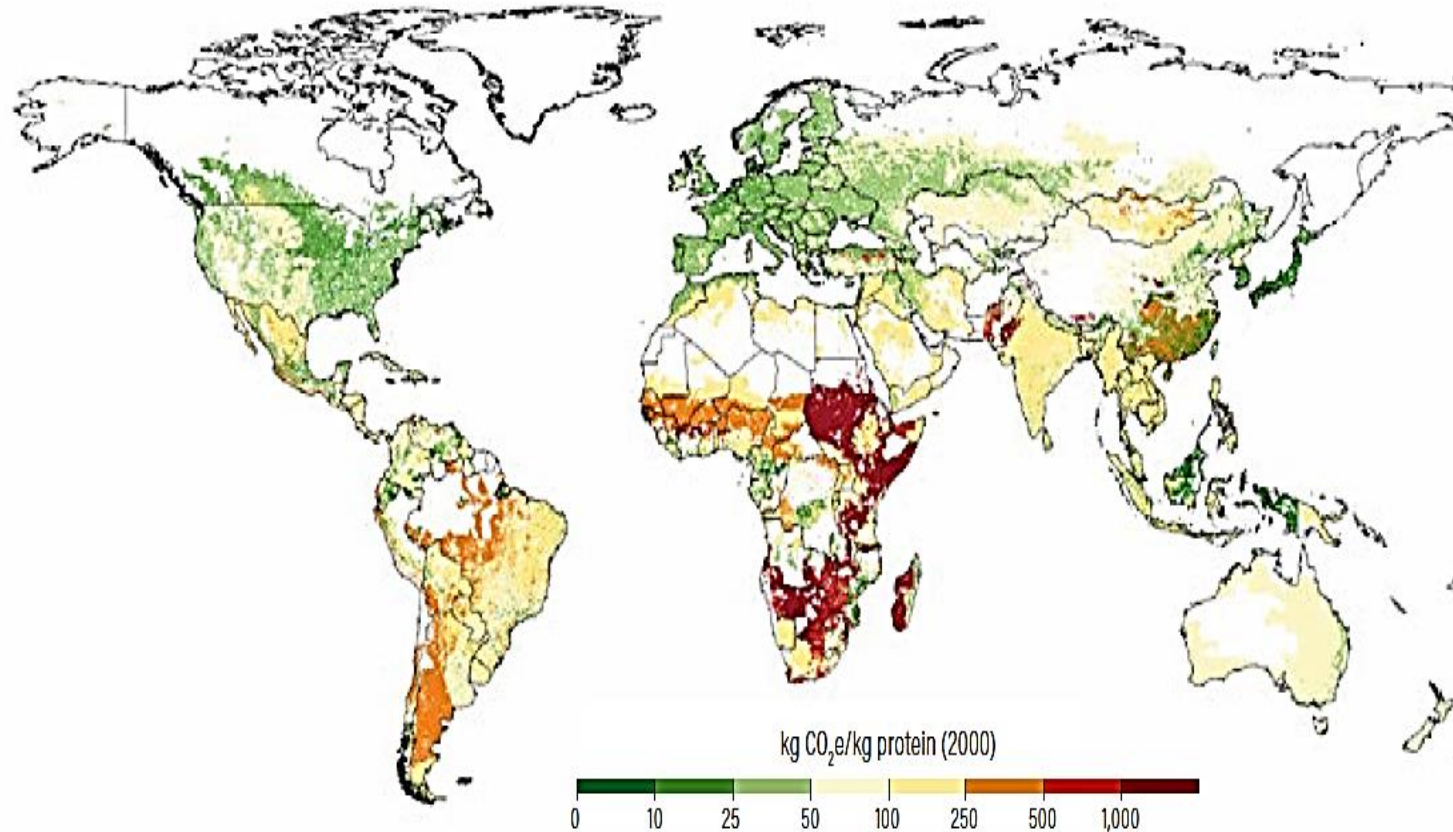


Figure 10 | Inefficient beef production systems result in far higher greenhouse gas emissions per unit of meat output

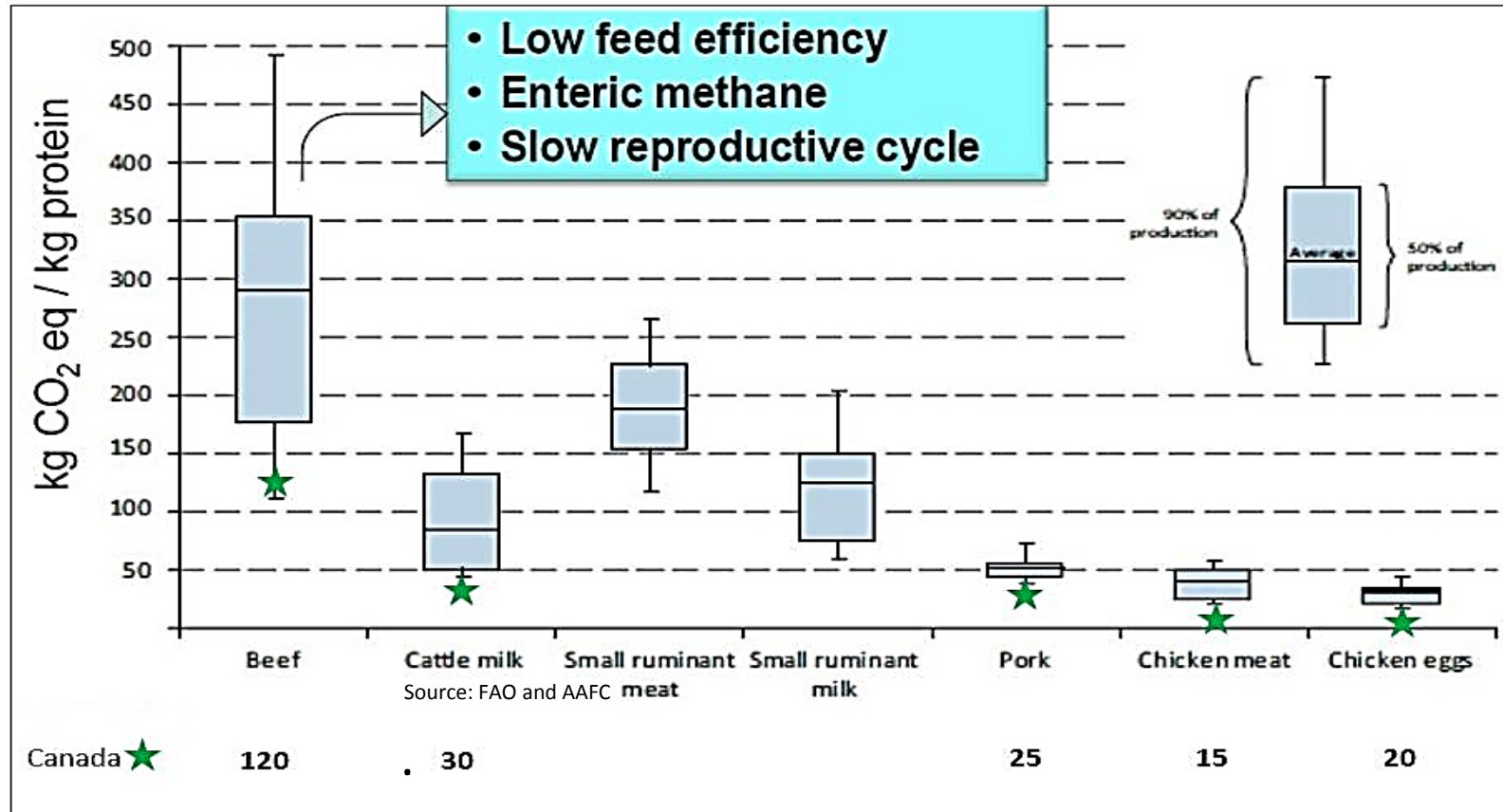


Source: Herrero et al. (2013).

...ruminant systems have greater potential to improve, as suggested by the wide range in productivities across countries. The GHG emissions that result from producing each kilogram of beef—a good proxy for all aspects of productivity—are far higher in some countries than in others.

As printed on WRI, 2018

# Huge variation in global GHG efficiency in animal protein - Canada among the most efficient



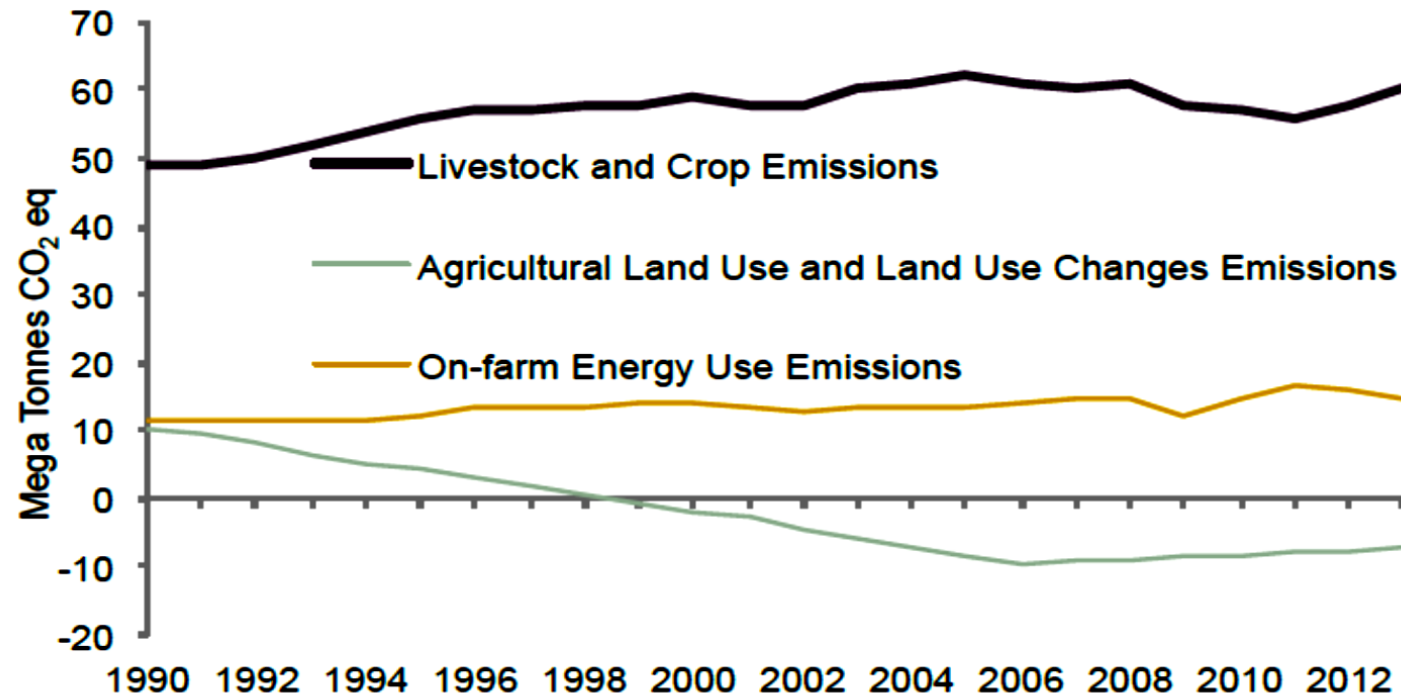
“Just discouraging a farmer from efficiently producing beef would hurt the climate because some less efficient farmer would likely produce the beef anyway.”

T. Searchinger, Forbes, December 13, 2018



# ... and in crops

## Emission Trends by Category, 1990-2013

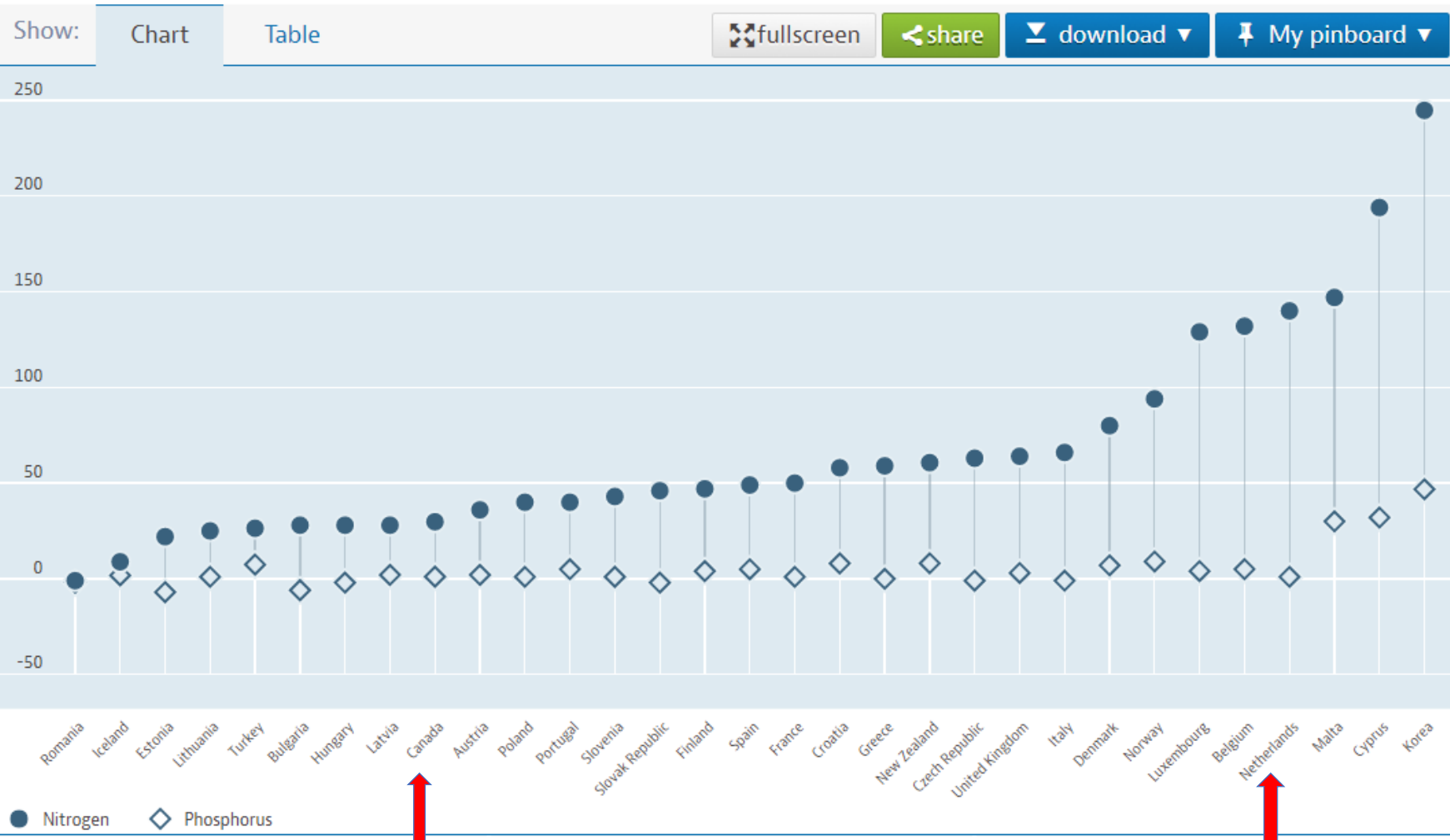


Source: Environment Canada, National Inventory Report 2015 and Natural Resources Canada, National Energy Database, 1990-2012..

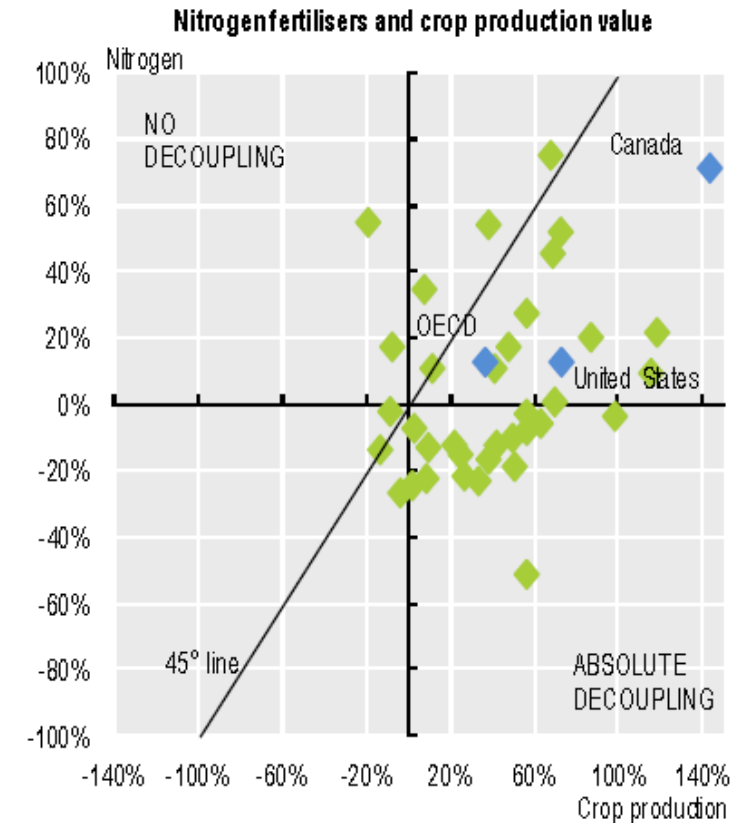


# Canada is also one of the lowest users of fertilizers

Nutrient Balance Nitrogen / Phosphorus, Kilograms/hectare 2014

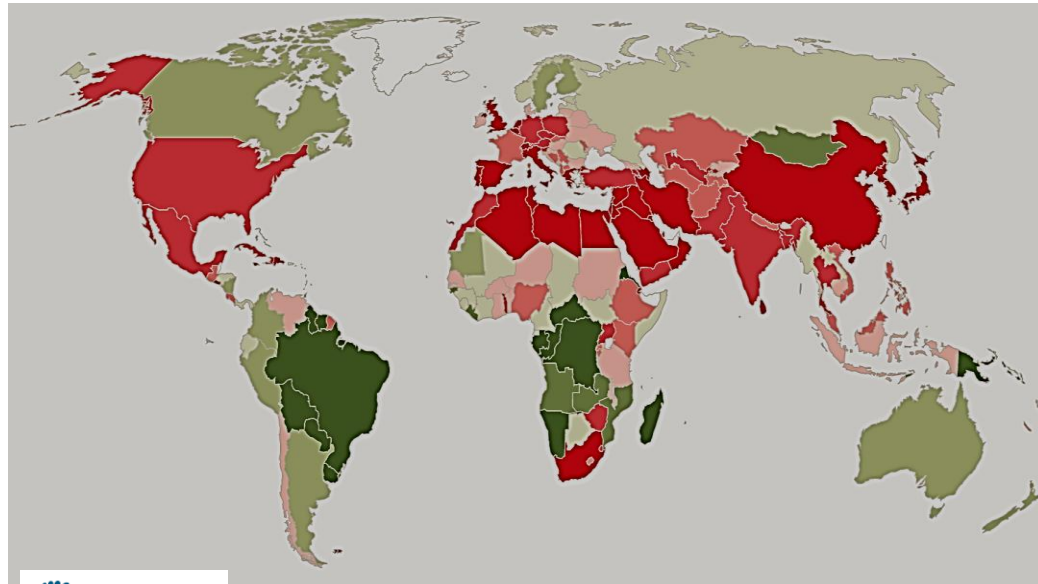


Country wide averages miss  
GHG variations across regions  
Same data two different stories



# Currently there is an imbalance between the location of biocapacity surplus and virtual exports of water

And top ten exporters and importers of ground water depletion embedded in food trade



**BIOCAPACITY CREDITORS**  
BIOCAPACITY GREATER THAN FOOTPRINT

**BIOCAPACITY DEBTORS**  
FOOTPRINT GREATER THAN BIOCAPACITY

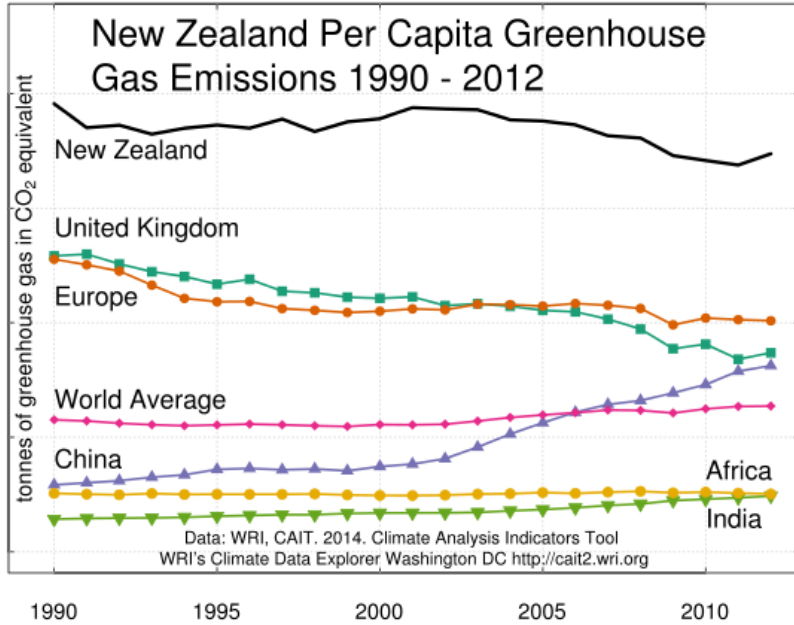


From  
Environmental science: Eating ourselves dry  
Maite M. Aldaya  
*Nature* 543, 633–634 (30 March 2017) | doi:10.1038/543633a

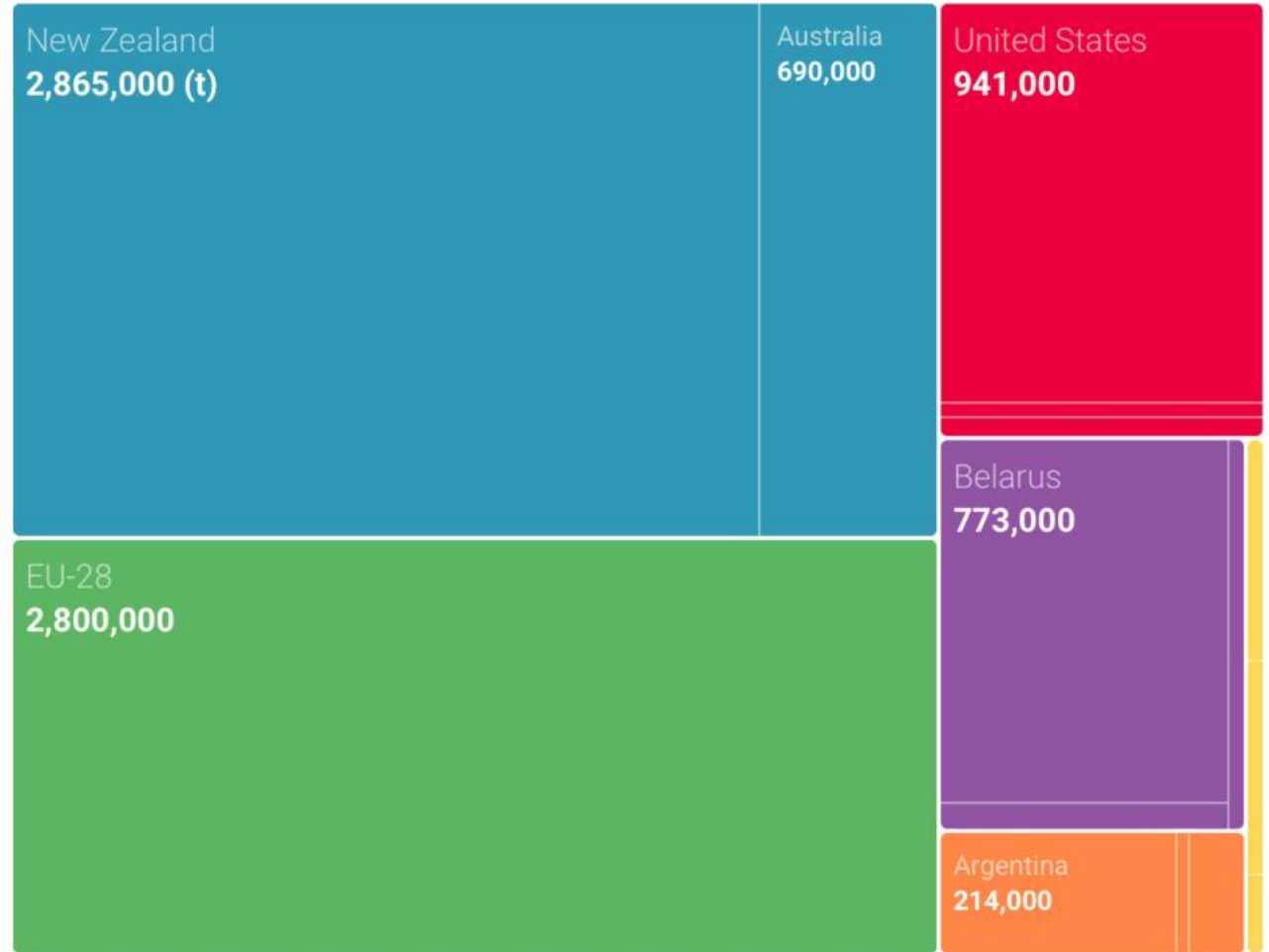


Globally 11% of all food traded internationally relies on groundwater depletion.

# Difficult to solve the problem if we count the wrong things

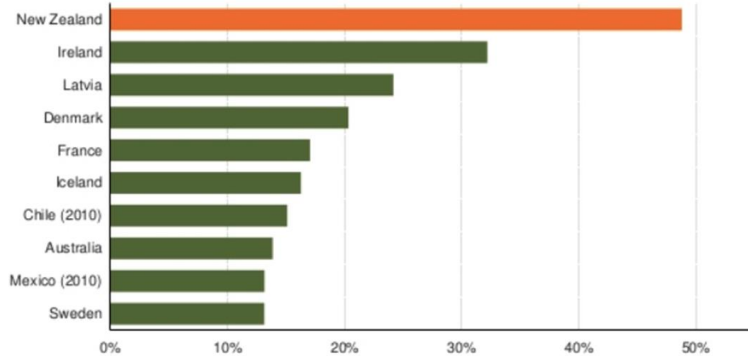


New Zealand is the world's largest exporter of milk



## The highest share of agriculture in GHG emissions in the OECD

Contribution of agriculture to GHG emissions, top ten OECD countries, 2014



Oceania EU (Europe Union) North America Europe South America Asia Data: USDA PS&D, Gro Intelligence

[www.gro-intelligence.com](http://www.gro-intelligence.com)

Source: MIE (2016), *New Zealand's Greenhouse Gases Inventory 1990-2014*; OECD (2016), "Greenhouse gas emissions by source", *OECD Environment Statistics* (database).

**Emissions and sustainable food production are global issues. What is the best way of securing global commons?**

**How can we make GHG intensity a part of the calculation of comparative advantage, which determines the location of production and trade flows?**

**The first step would seem to be better metrics and greater global transparency around the critical value of carbon sinks with highly productive agriculture managed with low CO<sub>2</sub>e and water intensity. That would be a good start in repairing a global market failure.**