# Agronomy – a pillar of sustainable development

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shortly INRA –Supagro!

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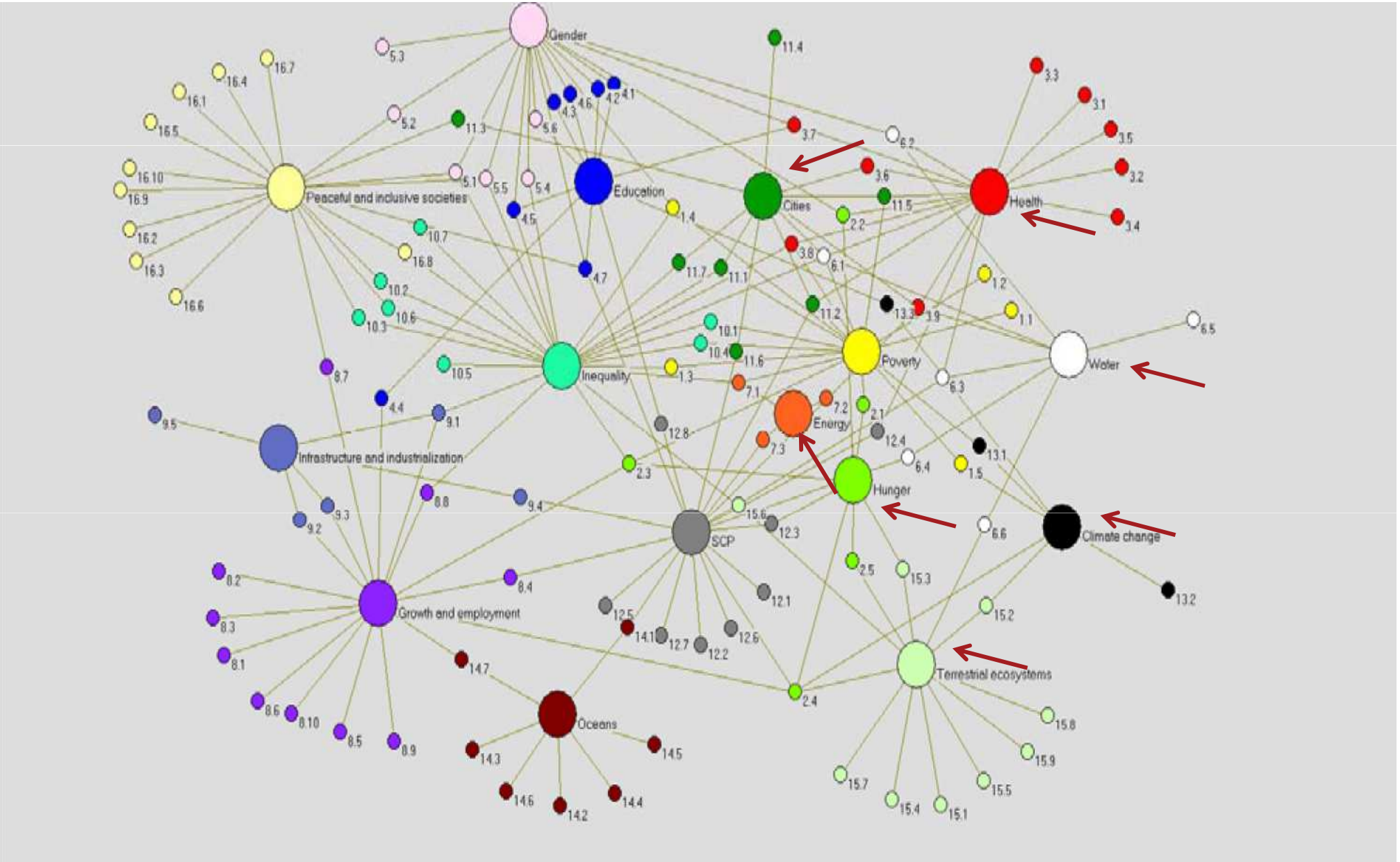
# Agronomy and the SDGs – all levels of development

# Sustainable Development Goals (SDGs)

- **2** - By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, **to safe, nutritious and sufficient food all year round**.
- **7**- By 2030, increase substantially the share of **renewable energy in the global energy mix**.
- **12** - By 2030, halve **per capita global food waste** at the retail and consumer levels and reduce food losses **along production and supply chains, including post-harvest losses**
- **13** - Improve education, awareness-raising and human and institutional capacity **on climate change mitigation, adaptation, impact reduction** and early warning.

# SDG linkages



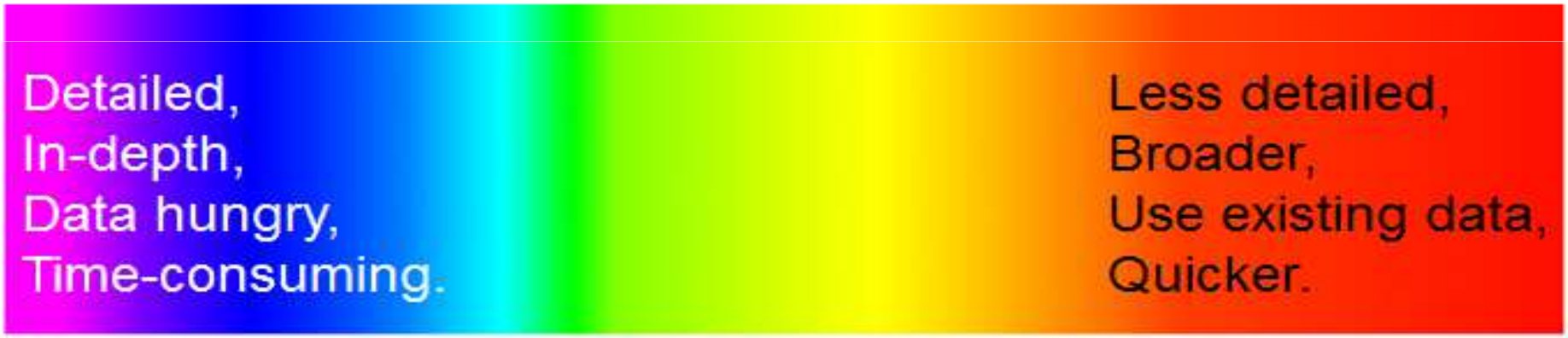
# Sustainability Indicators

An indicator is something that helps you

Understand where you are
Which way you are going
How far you are from where you want to be

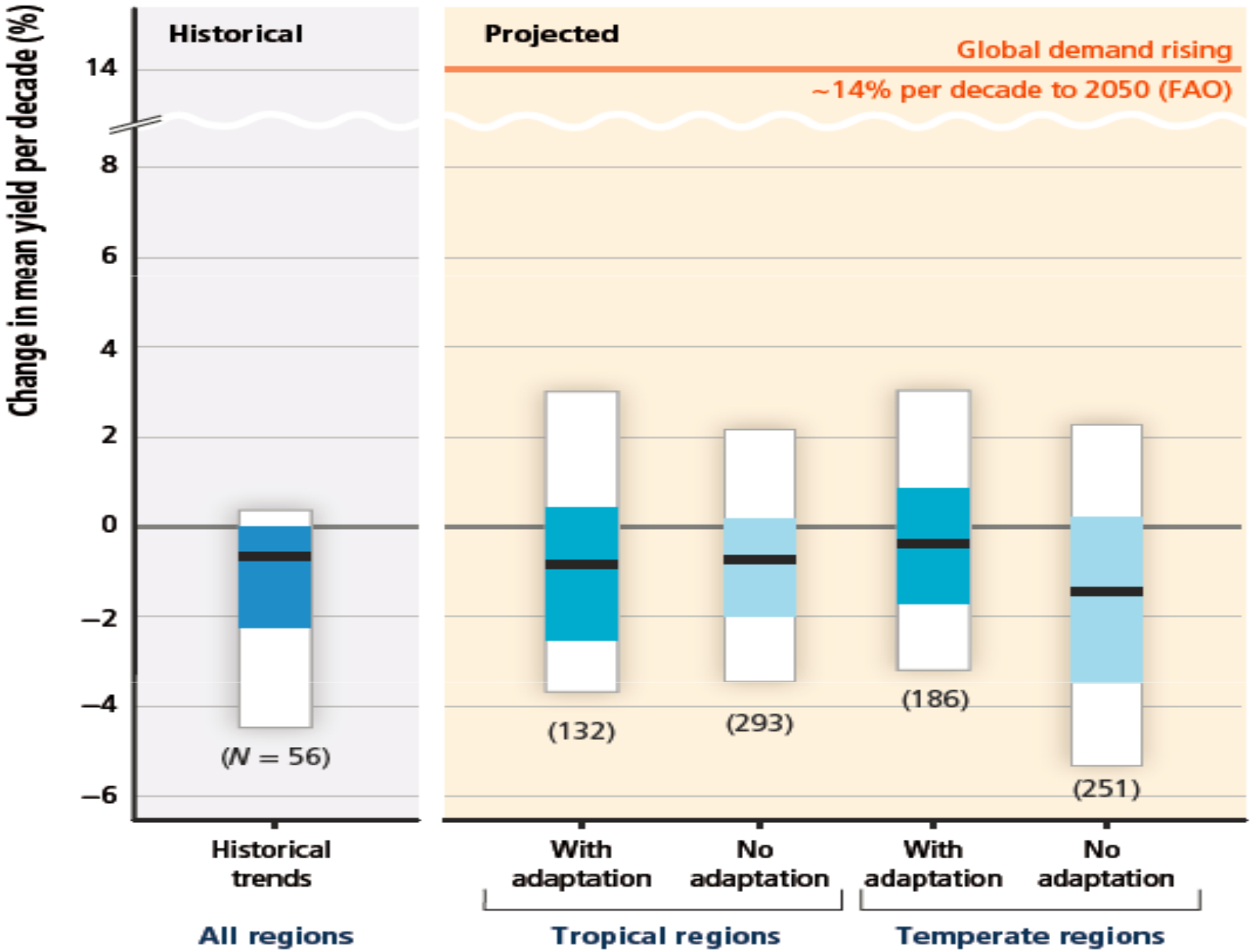
# Indicators - objectives

- Simplify descriptions of complex reality
- Allow better communication with non-specialists
- Illustrate trends in longer time series
- Build a common basis for discussion
- Identify priorities in decision-making



# Connecting agronomy to policies – how?

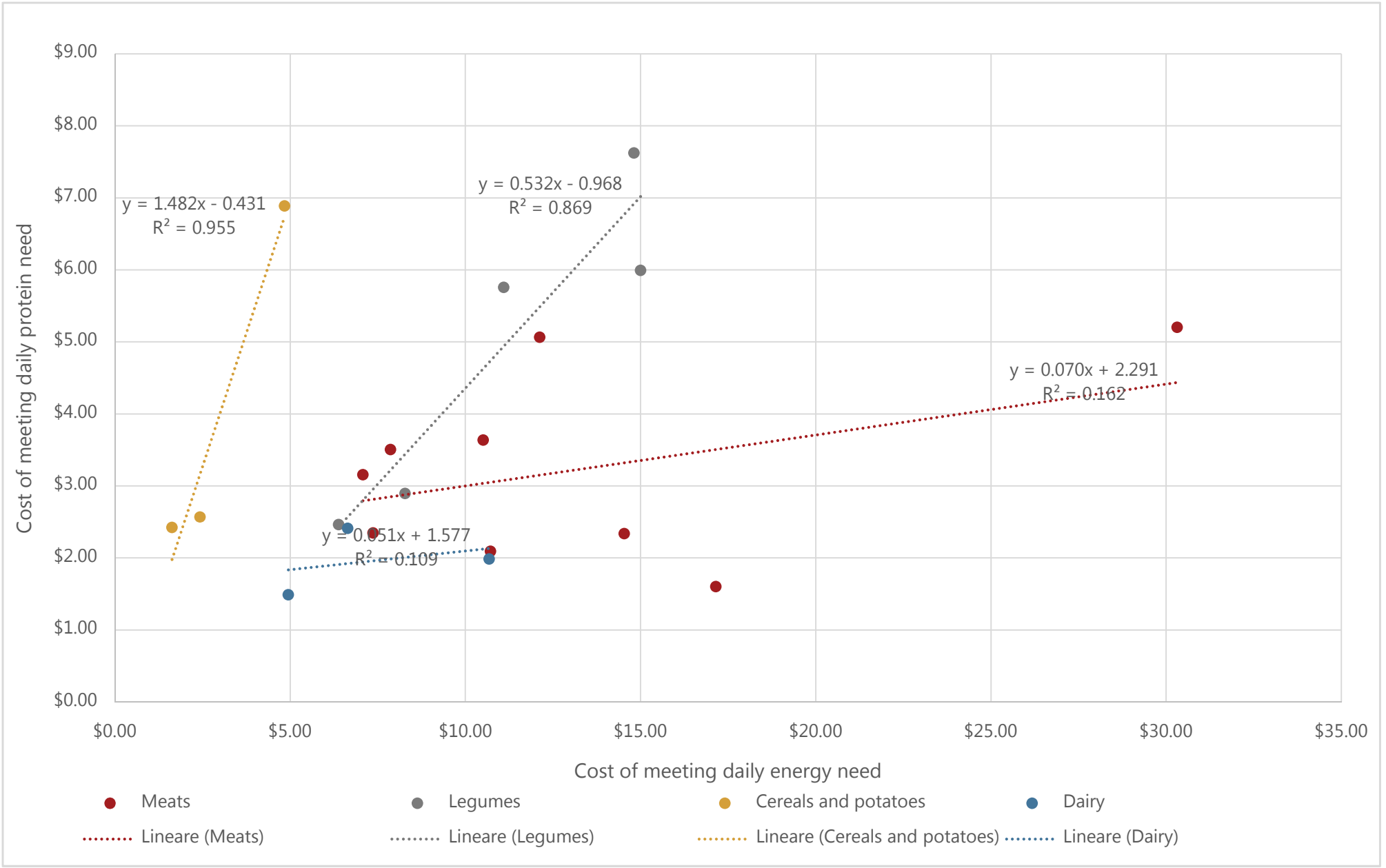
- Models
- Experiments
- Case-studies
- Arguments and logic
- Scenarios
- Evidence-based discussions




SDG - 2

Porter et al, 2014

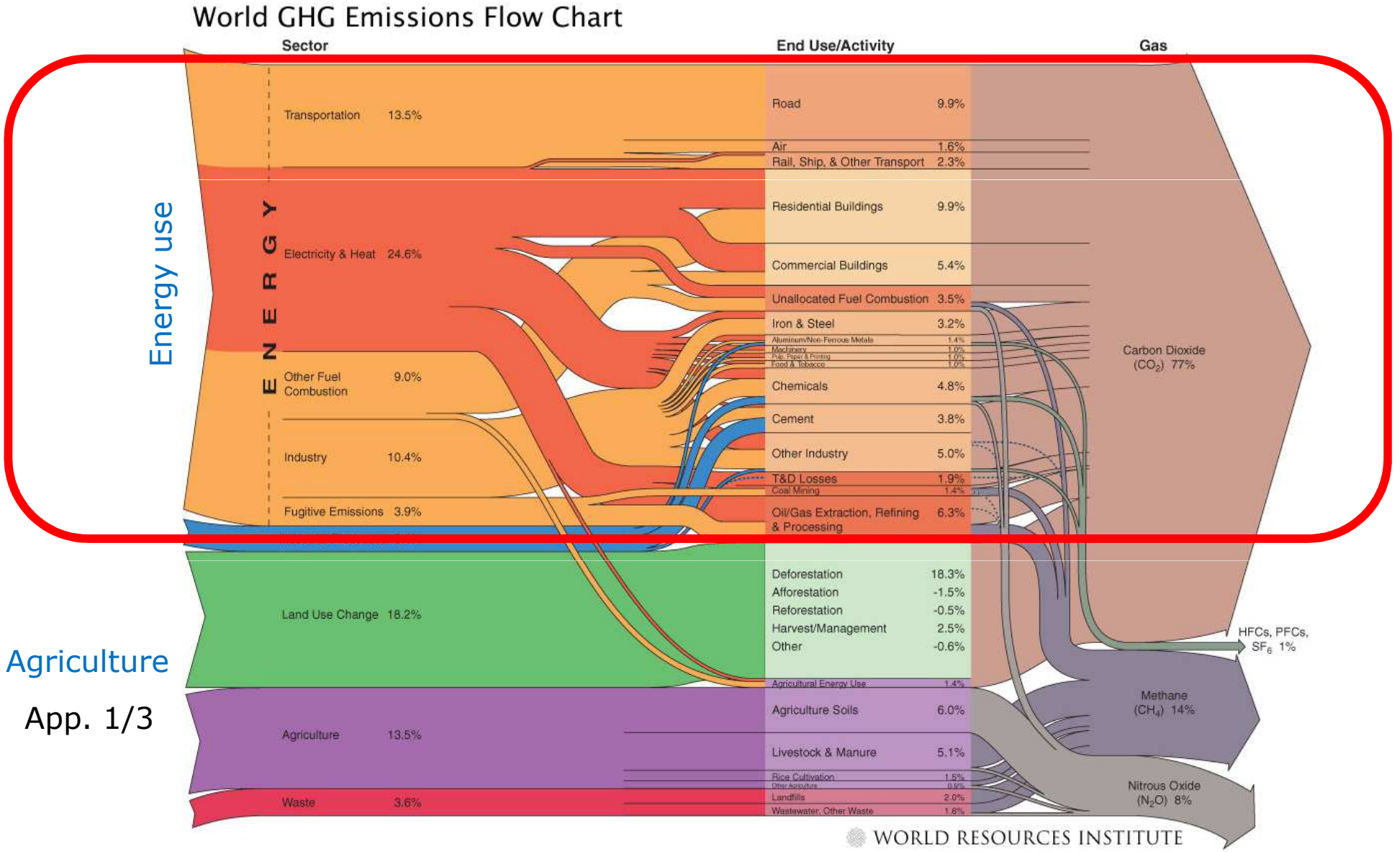
# Cost of daily energy and protein needs – New Zealand




SDG - 2

Coles et al, 2016

# Energy-based emissions




Energy use

Agriculture

App. 1/3

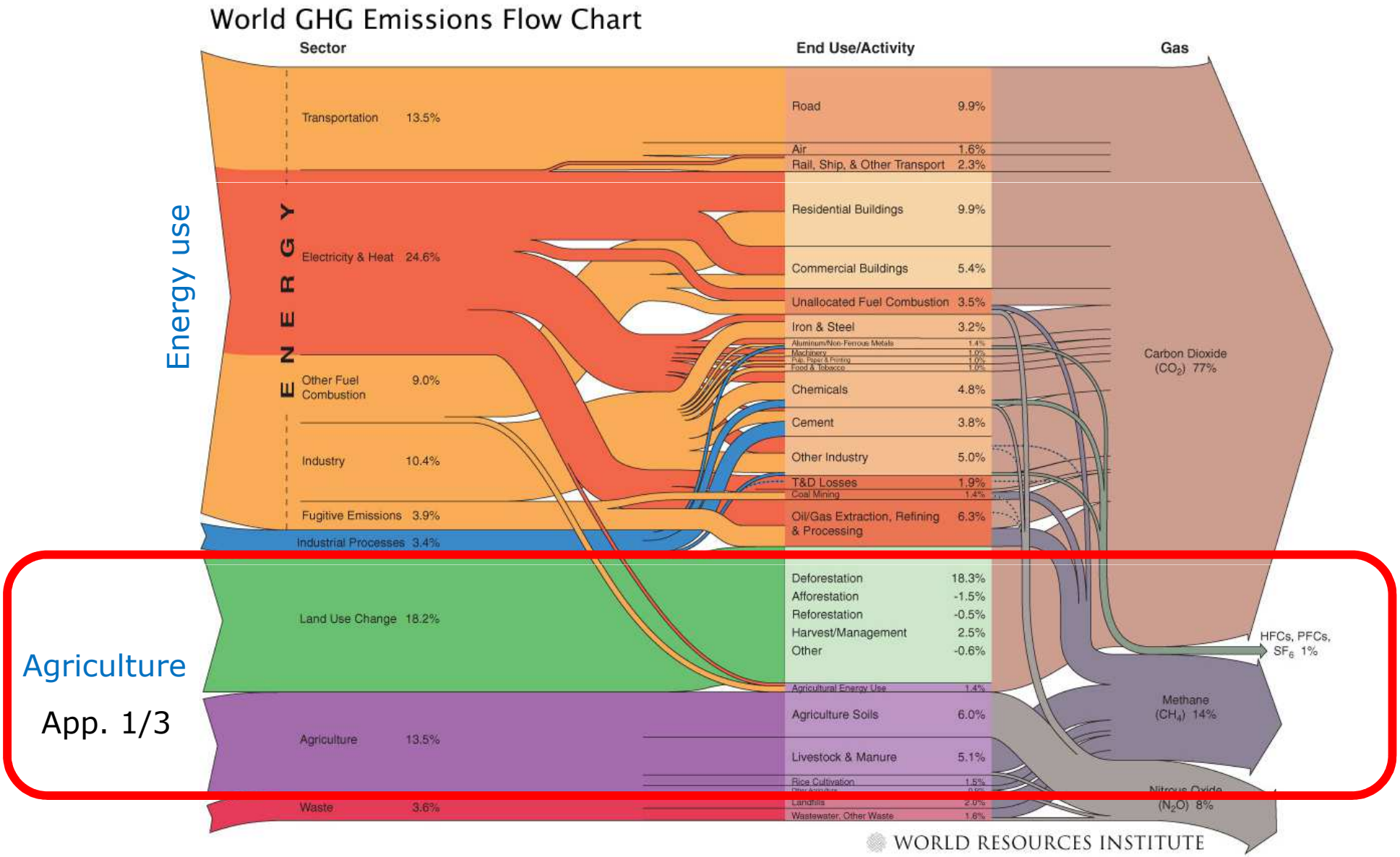
# The Kaya Identity – UNFCC/IPCC

$$\frac{GHG}{ENERGY} \times \frac{ENERGY}{GDP} \times \frac{GDP}{POPULATION} \times POPULATION = GHG$$

| Fuels | Sectors | Services |
|---|---|---|

Scale independent - deconstruction

# Non–energy emissions




Agriculture

App. 1/3

# JRP's Simple Land-Use Identity (KPI)

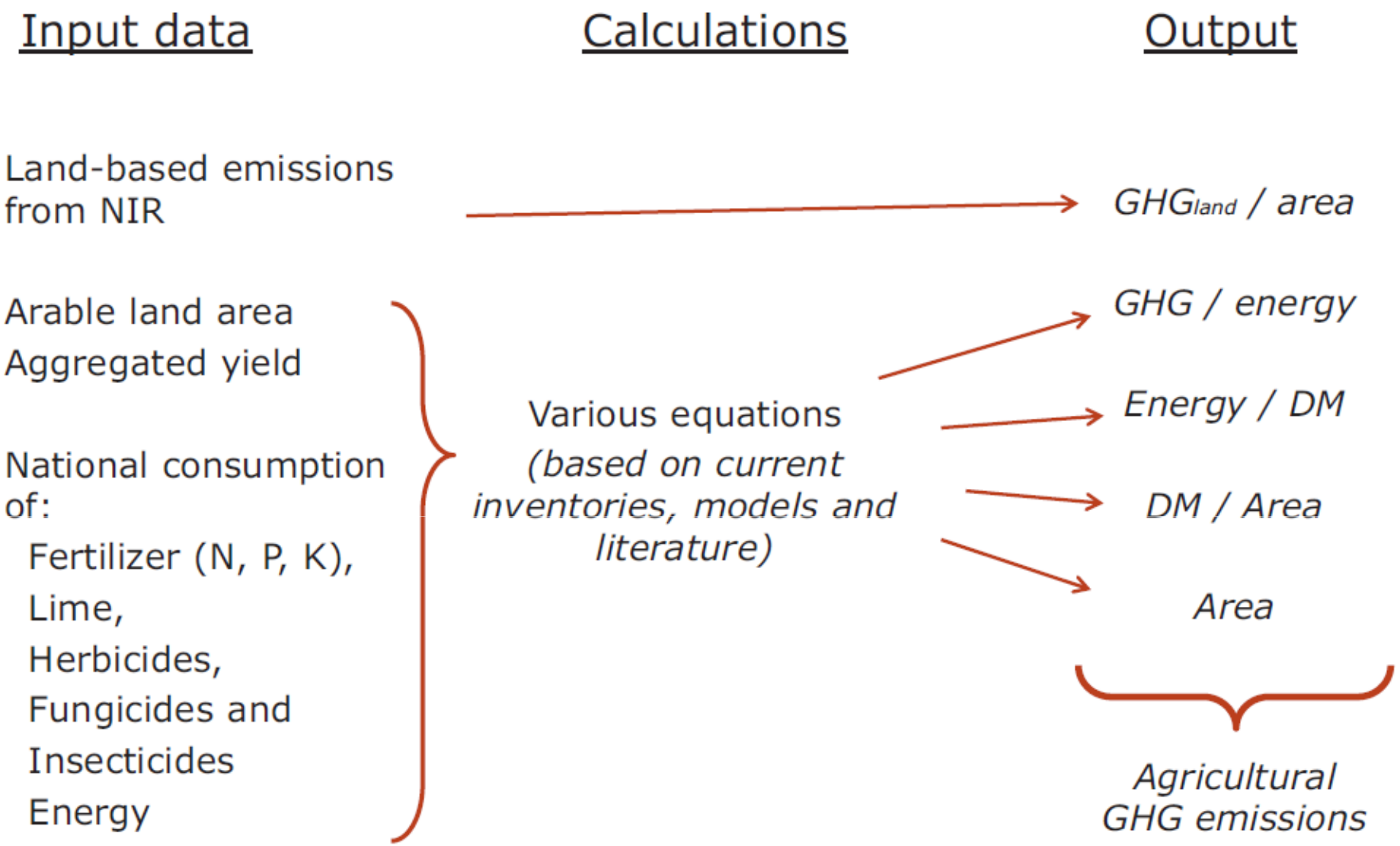
$$\frac{\text{YIELD}}{\text{AREA}} \times \frac{\text{ENERGY}}{\text{YIELD}} \times \frac{\text{GHG}}{\text{ENERGY}} \times \text{AREA} = \text{GHG}$$

Production Technology Fuels

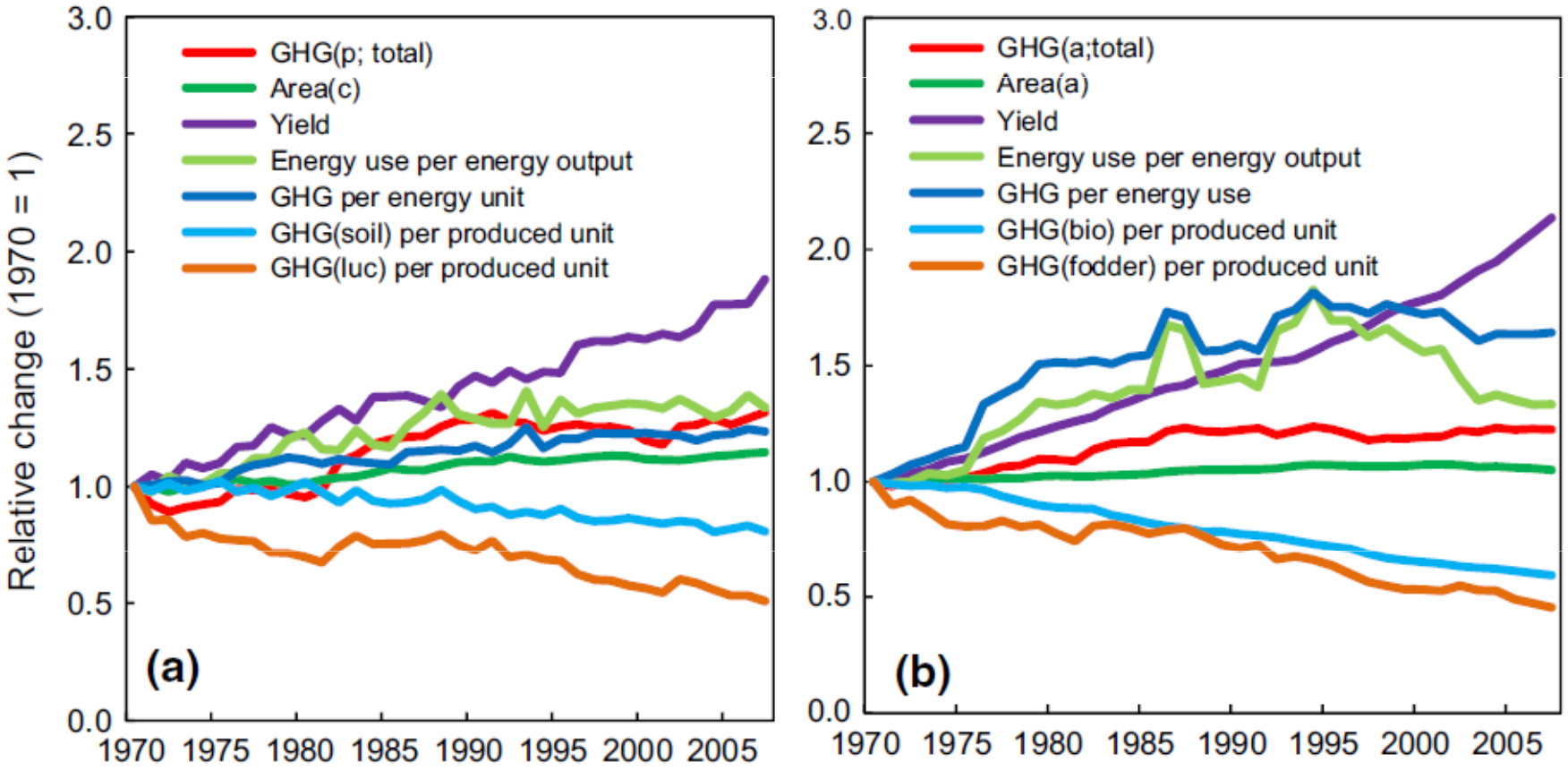
SDG - 7

Porter, 2009

# GHG Emissions



# Decoupling – per unit area? per unit product?




SDG – 7, 13

Bennetzen et al, 2015

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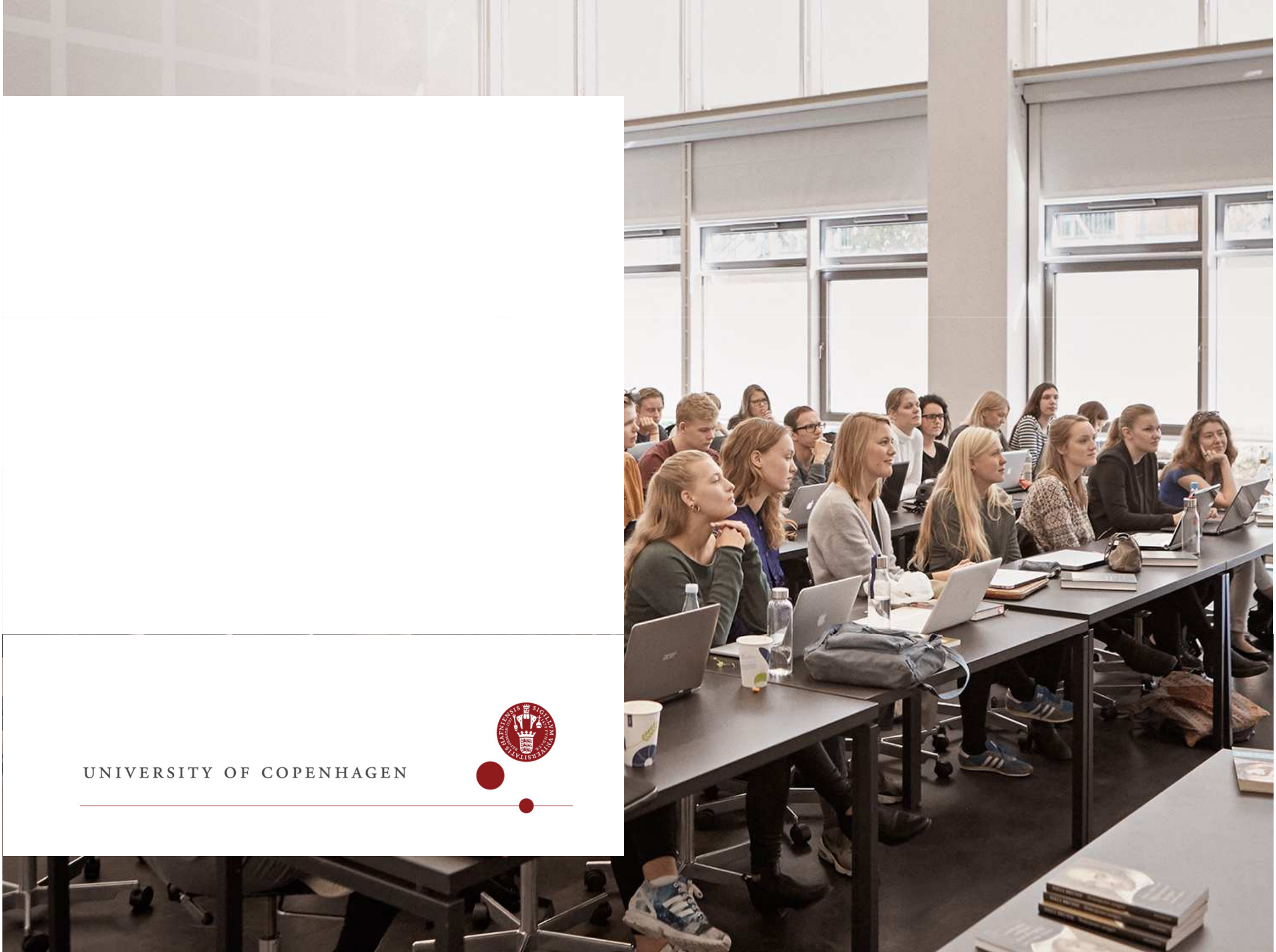


# Connecting wealth, population, consumption and GHG emissions

**Kaya identity**
(Raupach & Field, 2004)

$$GHG_{kaya} = \frac{GHG}{energy} \times \frac{energy}{GDP} \times \frac{GDP}{capita} \times population$$

**KPI**
(Bennetzen et al, 2012)

$$GHG_{KPI} = \frac{GHG}{energy} \times \frac{energy}{drymatter} \times \frac{drymatter}{area} \times area$$

**Diet demand**

$$Demand = \frac{animalprot.}{totalprot.} \times \frac{totalprot.}{calorie} \times \frac{calorie}{capita} \times population$$

**Diet supply**

$$GHG = \frac{GHG_{bio}}{energy_{bio}} \times \frac{energy_{bio}}{animalpop.} \times animalpop.$$

SDGs 2, 7, 12, 13

From

Euphytica 17 (1968): 385–403

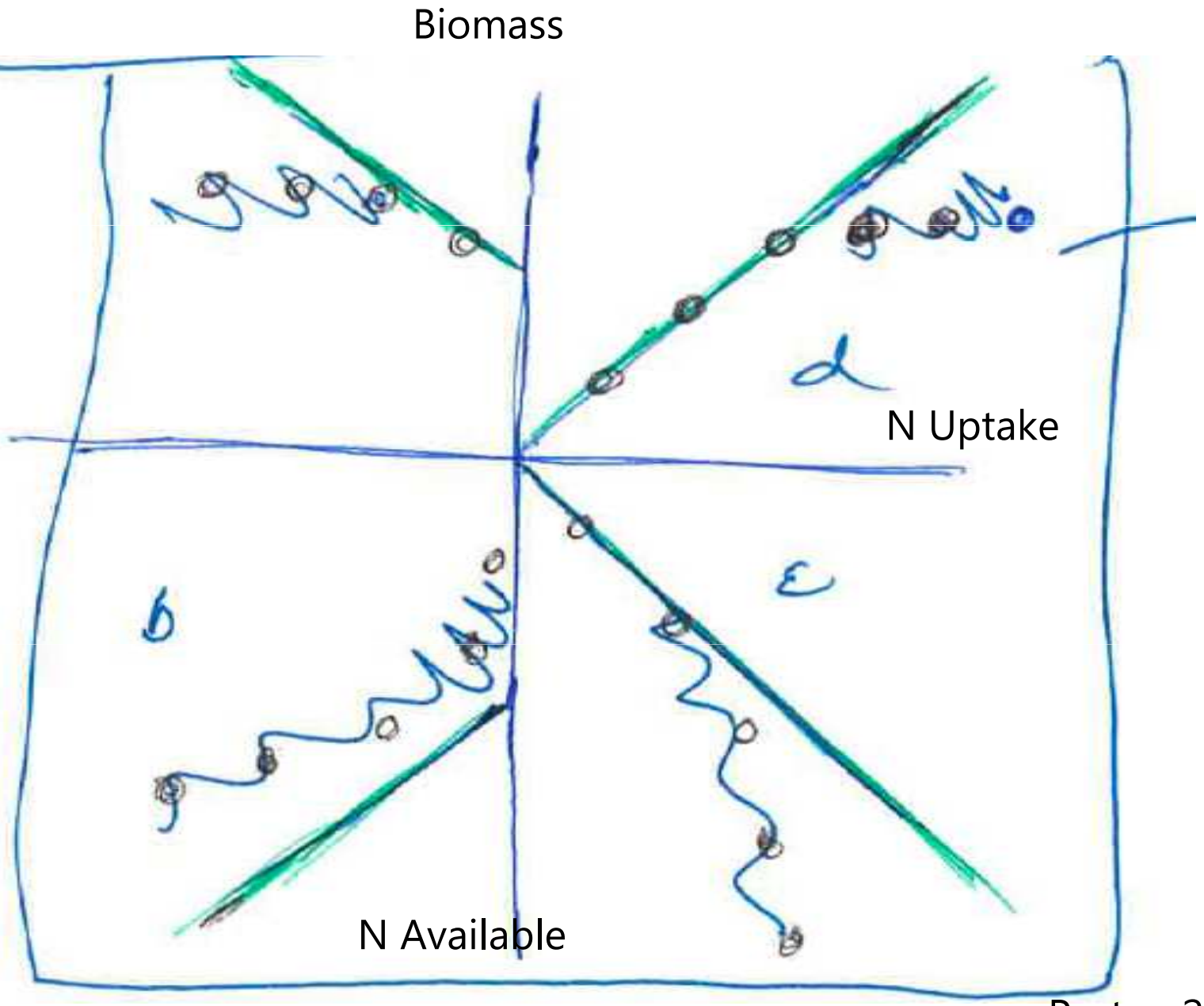
# THE BREEDING OF CROP IDEOTYPES

C. M. DONALD

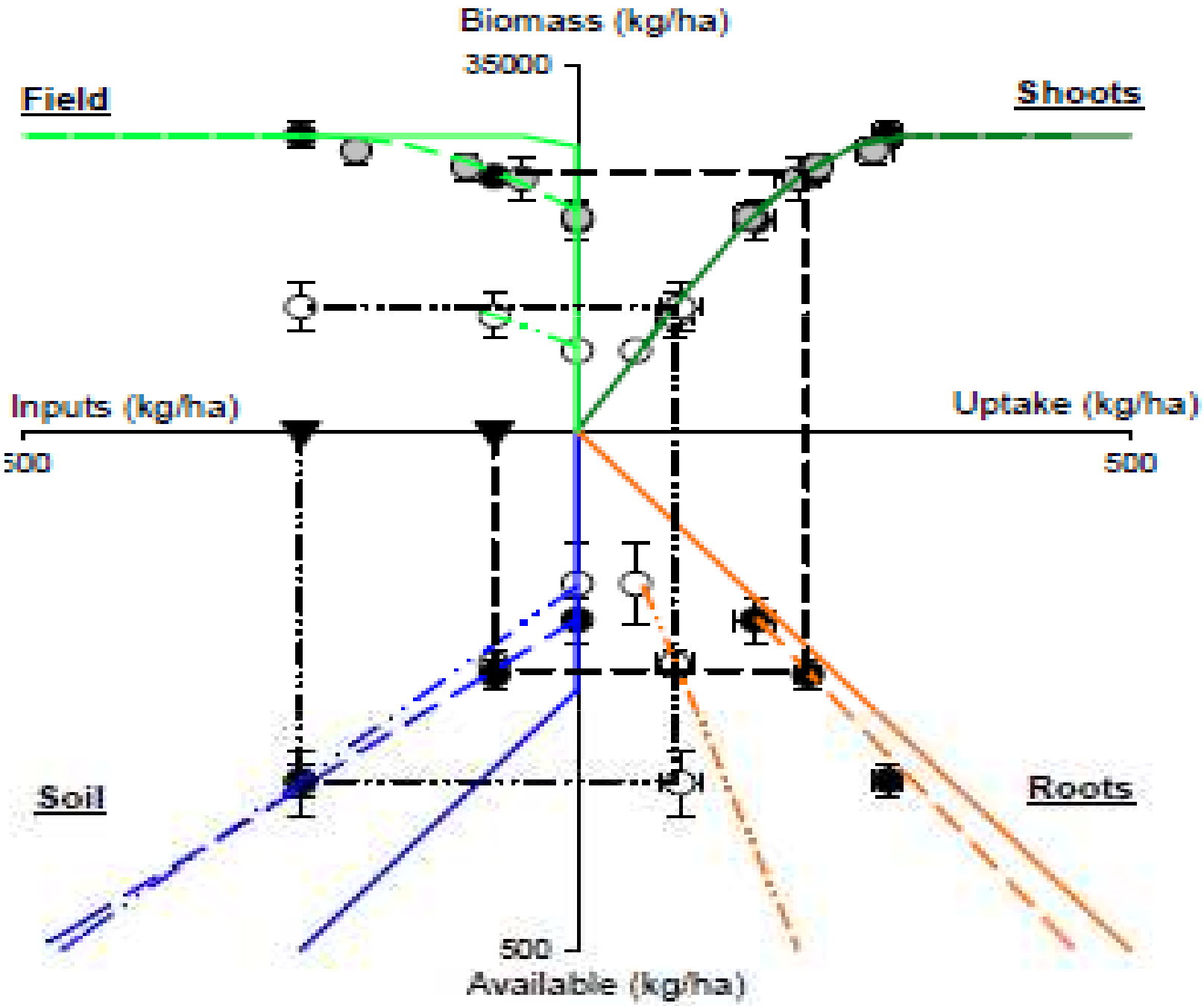
To

# THE DEVELOPMENT OF CROP IDEO-SYSTEMS

# A back of the envelope idea.....




Porter, 2013




Brown et al., 2016

# The really BIG questions – for SDGs, the planet and climate change

- How do we link the global economic system to the global ecological system?
- The global economic system is based on the flows of C, the global ecological system is based on maintaining stocks of C?
- How do we value the preservation of C stocks higher than the use of C?
- How does agronomy fit into this?

# 4 per 1000 – valuing C stocks

- Idea that C can be stored raises the question of how to value C.
- How to link planetary ecology with economics. This is not really happening at the moment.
- Need a macro-economic solution to a macro-ecological issue – currently we have micro-policies.

- Value C stocks rather than flows – ie moving onto a C standard for the valuation of currencies.
- The value of a currency depends on the stocks of C (fossil and non-fossil) that a country has.
- Rich countries would then be those with large C reserves and this would promote C stocks.

# Conclusions

- Agronomy is the bedrock of many of the SDGs – concerned with food and nutritional security, GHG balances, renewable energy, food systems.
- Food and nutritional security – can agronomy expand to deal with food systems?
- Identities provide a means to examine trade-offs and links between SDGs and policy.
- We need a macro-economic solution to the biggest macro-ecological threat to human beings – 'clim-enomics'.
- SDG13 for agronomists – we have missed two generations of agronomic education.

# Thanks


- A big thank you to the Italian agronomy scientists who produced the EJA special issue on long-term data sets in Italy.

- Eskild Bennetzen
- Pete Smith
- The Climate and Food Security Group at Copenhagen.