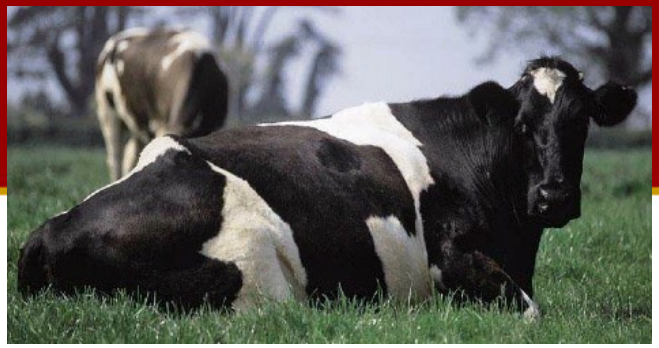
Climate-Smart Dairy and Dairy System Sustainability in the Context of the Sustainable Development Goals

Michel A. Wattiaux

Wattiaux@wisc.edu

Outline



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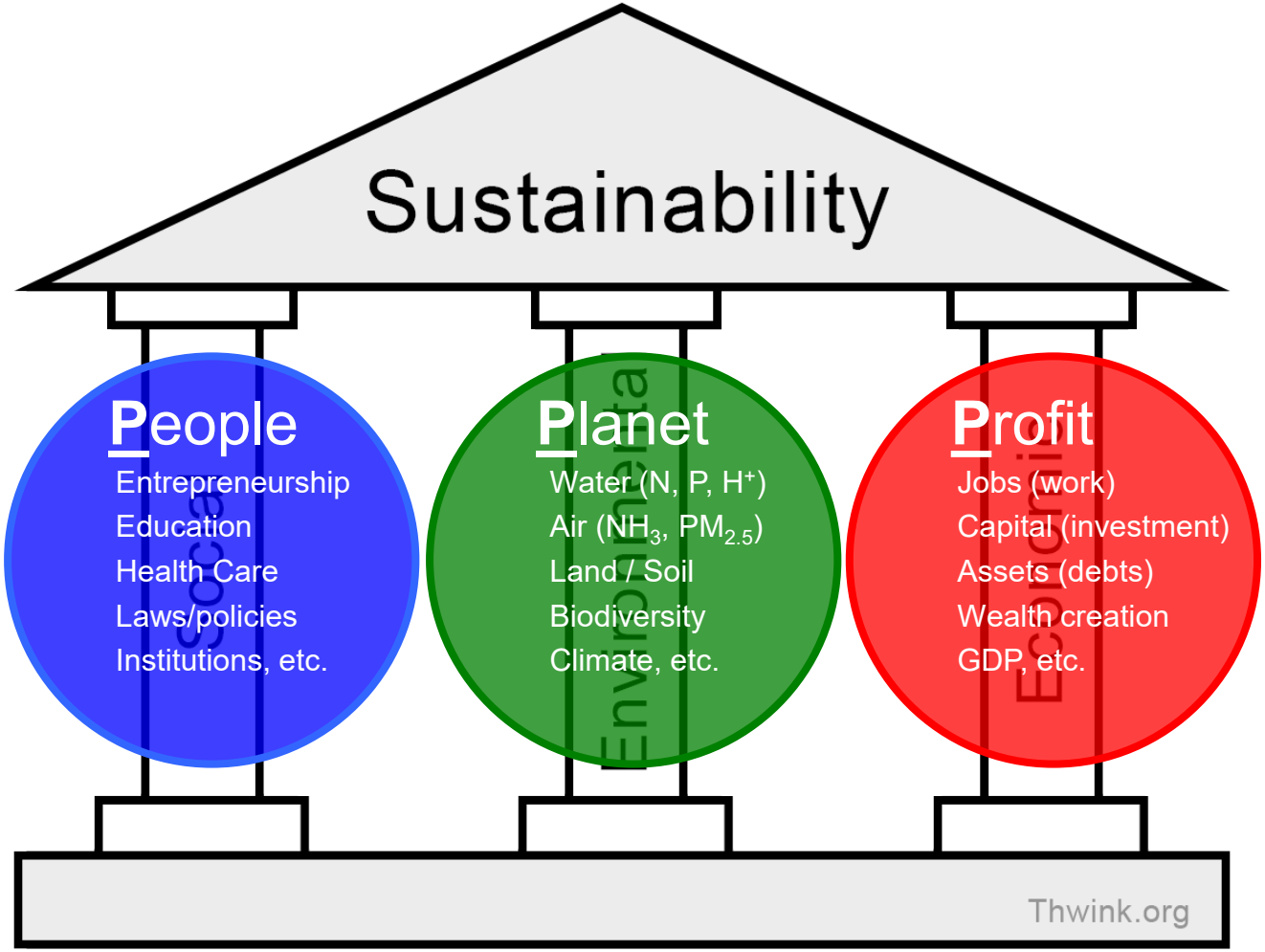
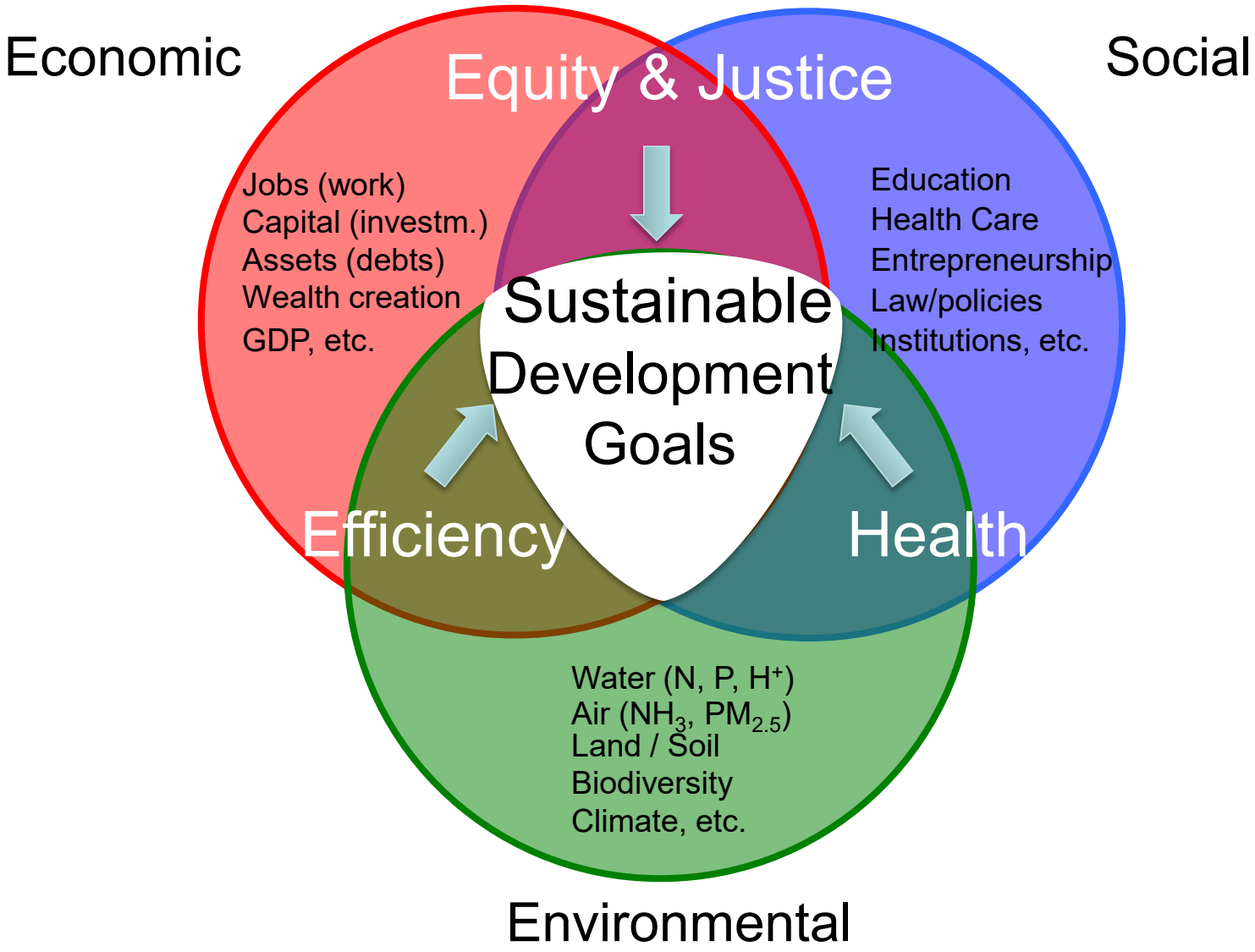
Sustainability



Sustainable Development



Sustainable Development Goals of the United Nations

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SUSTAINABLE AGRICULTURE

THE GLOBAL GOALS
For Sustainable Development

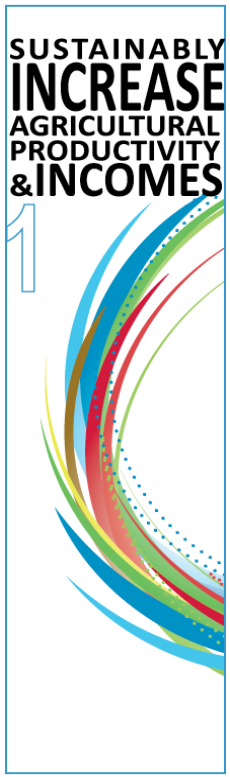
The global indicator framework includes **231 unique indicators.**

Challenges and Opportunities

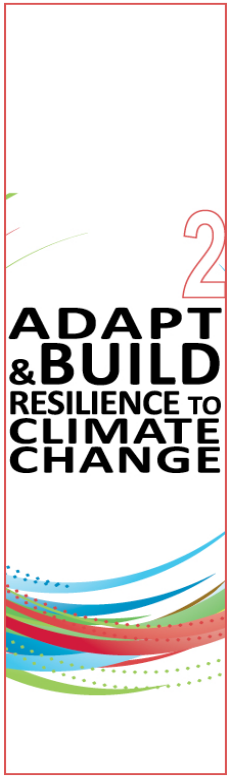
FAO, 2019)

Climate Smart Agriculture (CSA)

Food Security:
Sustainably increase productivity and incomes



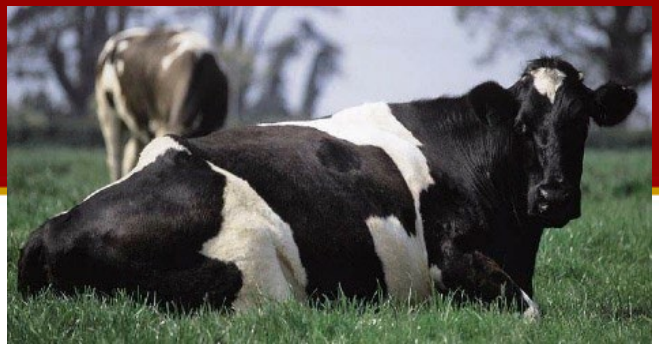
Adaptation:
Strengthen resilience to climate change



Mitigation:
Reduce and/or remove greenhouse gas emissions

FAO (2010; 2018)

Outline



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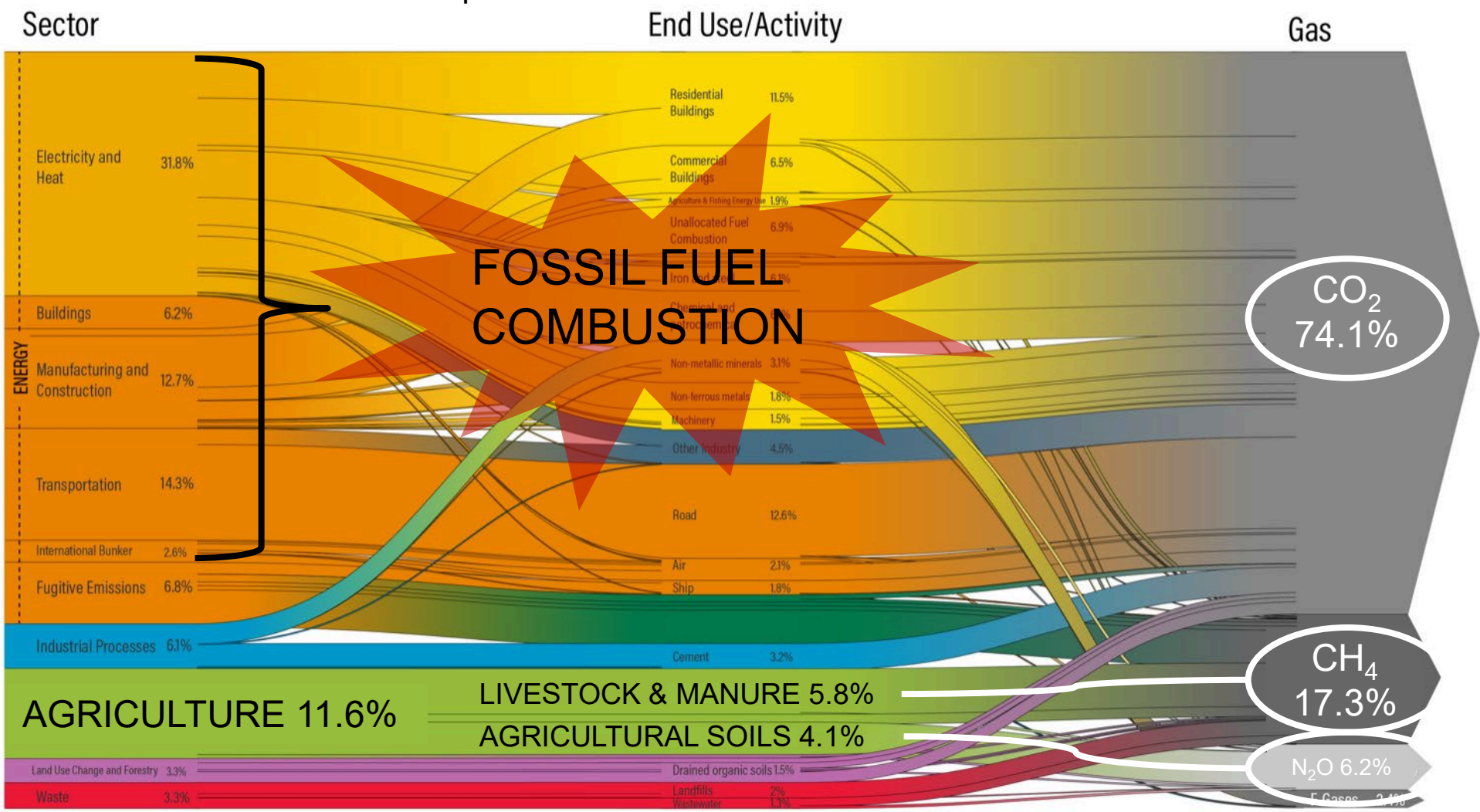
World Greenhouse Gas Emissions in 2019

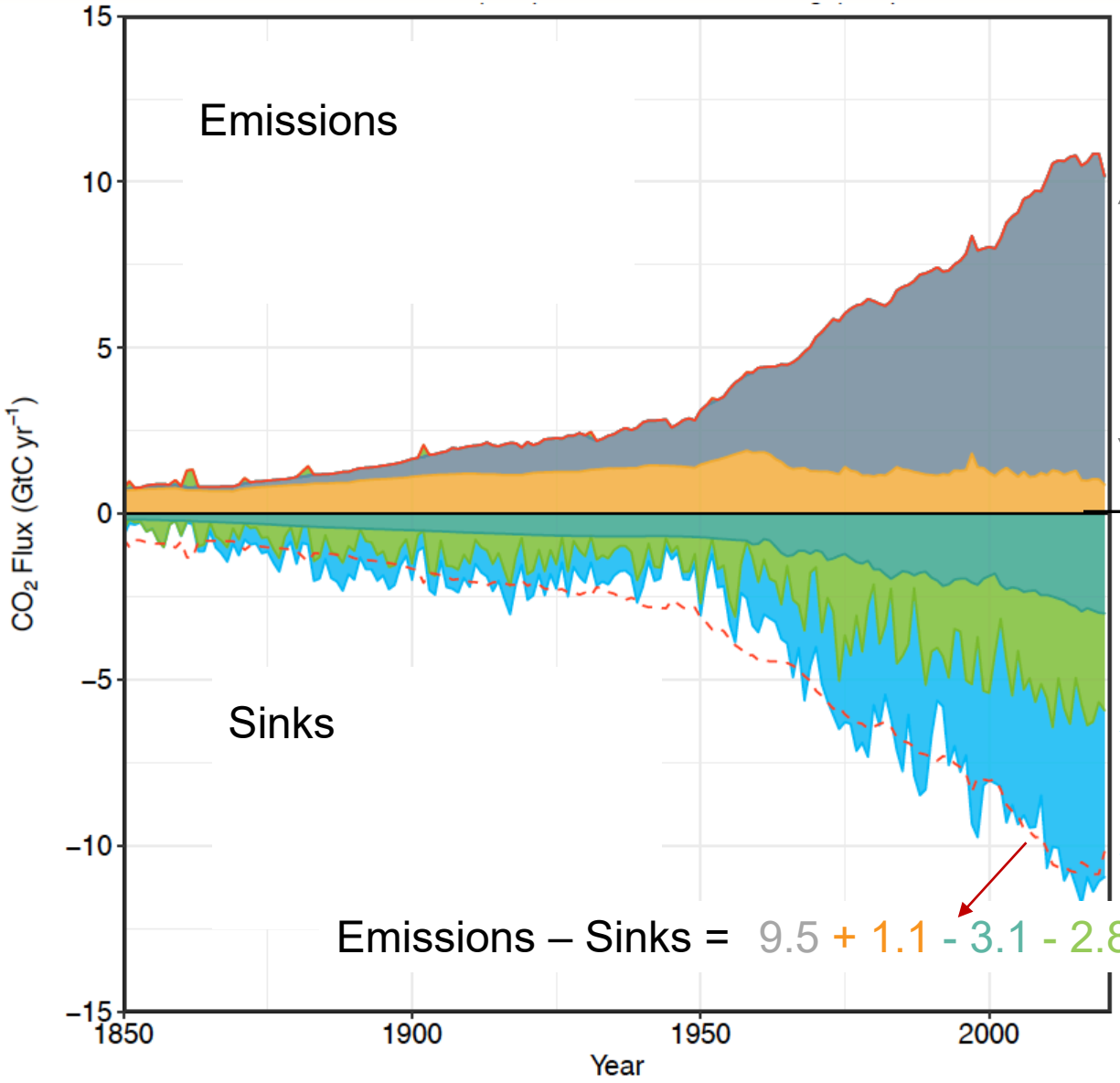
Total: 49.8 Gt $CO_{2\text{-eq}}$



WORLD RESOURCES INSTITUTE

Source: Climate Watch, based on raw data from IEA (2021), GHG emissions from Fuel Combustion, www.iea.org/statisitcs; modified by WRI

Annual Global Carbon Budget 1850-2021



2021

"Release"

9.5 Fossil CO_2

1.1 Net Land-use Change

3.1 Land

2.8 Ocean

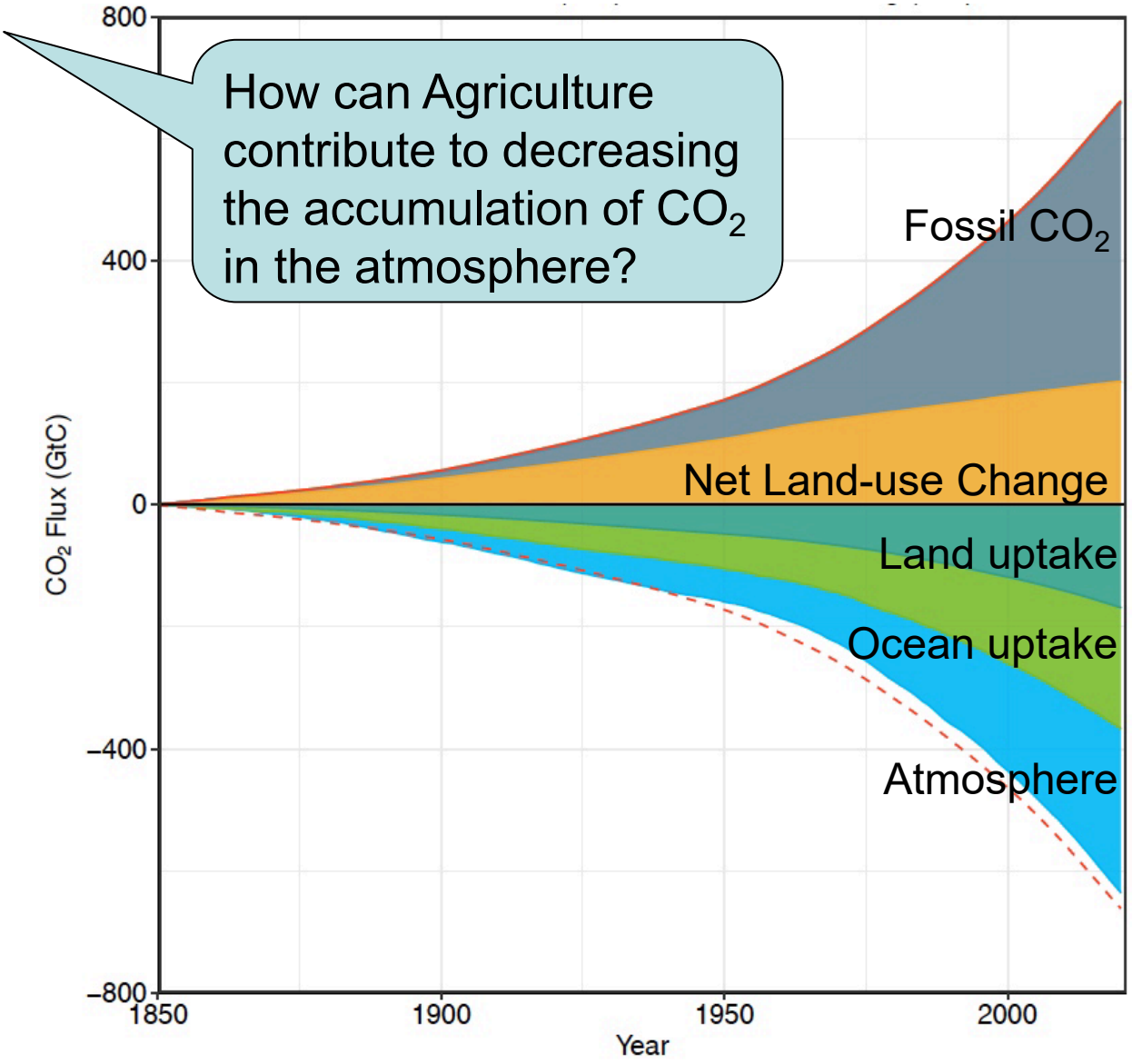
"Uptake"

5.1 Atmosphere

Emissions – Sinks = 9.5 + 1.1 - 3.1 - 2.8 = 4.7 Atmosphere "predicted"

Friedlingstein et al. 2022; Earth Syst. Sci. Data, 14:1917-2005.

Cumulative Global Carbon Budget 1850-2021



"Climate-Smart Agriculture"

Use / Produce Renewable Energy

Reduce Emission

Capture/Sequestration

Friedlingstein et al. 2022; Earth Syst. Sci. Data, 14:1917-2005.

SDG 13: Climate Action

SDG 13 urges national governments to integrate climate change measures into national policies, strategies and plans to combat climate change and its impact.

As one of the 8 indicators of this goal, indicator 13.2.2. refers to [reduction of] total emission of greenhouse gases per year (UN-SD, 2022)

World Dairy Sector between 2005 y 2015

+11%	Miking cow number
+15%	Milk production per cow (productivity)
+30%	World milk supply
-11%	Milk carbon footprint (2.8 vs 2.5 kg $CO_{2\text{-eq}}$/kg)
+18%	Total emission of $CO_{2\text{-eq}}$

Total emission of $CO_{2\text{-e}}$ if cow productivity had not changed ..... **+38%**

FAO &GDP, 2018: https://www.fao.org/3/CA2929EN/ca2929en.pdf.

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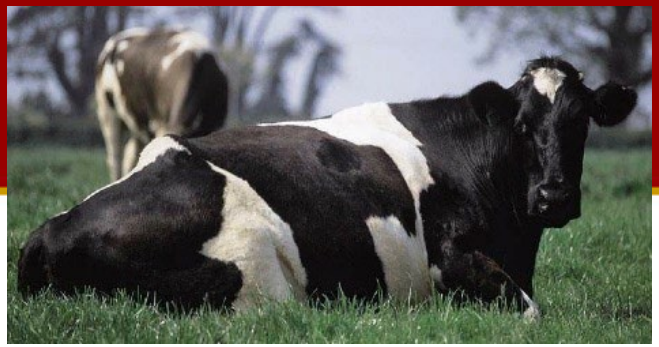

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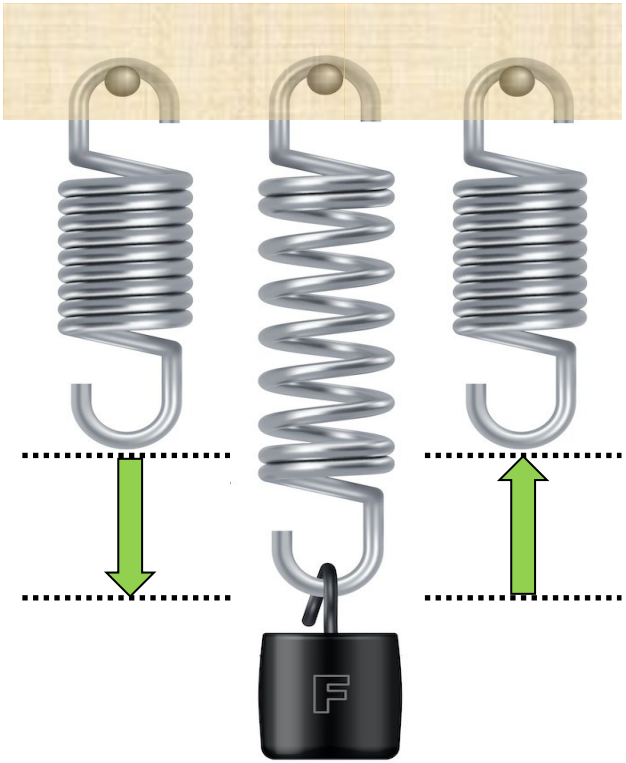
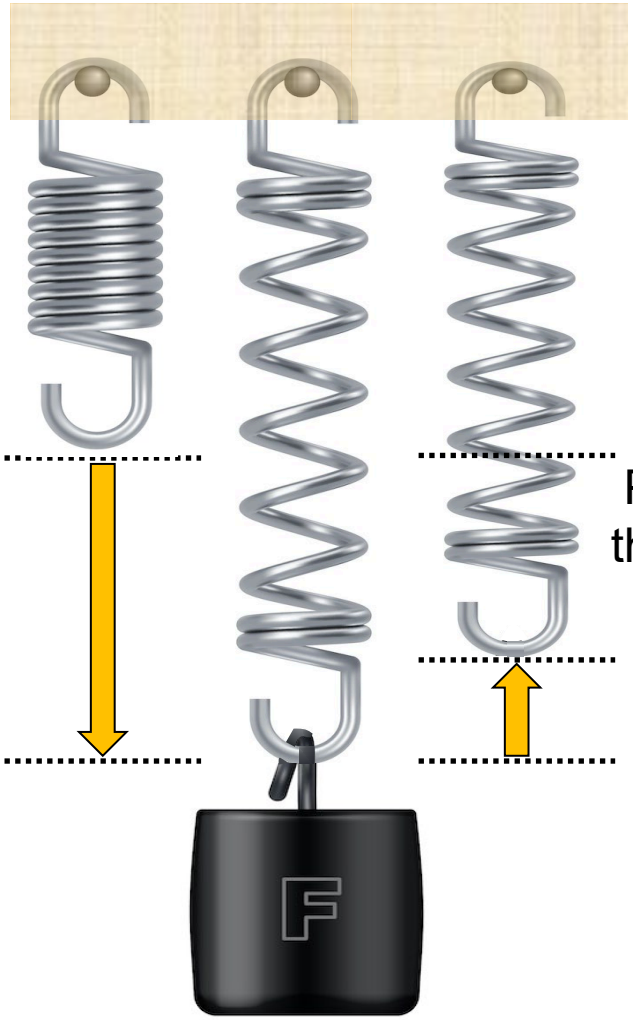
Resistance to Change: Physics Analogy





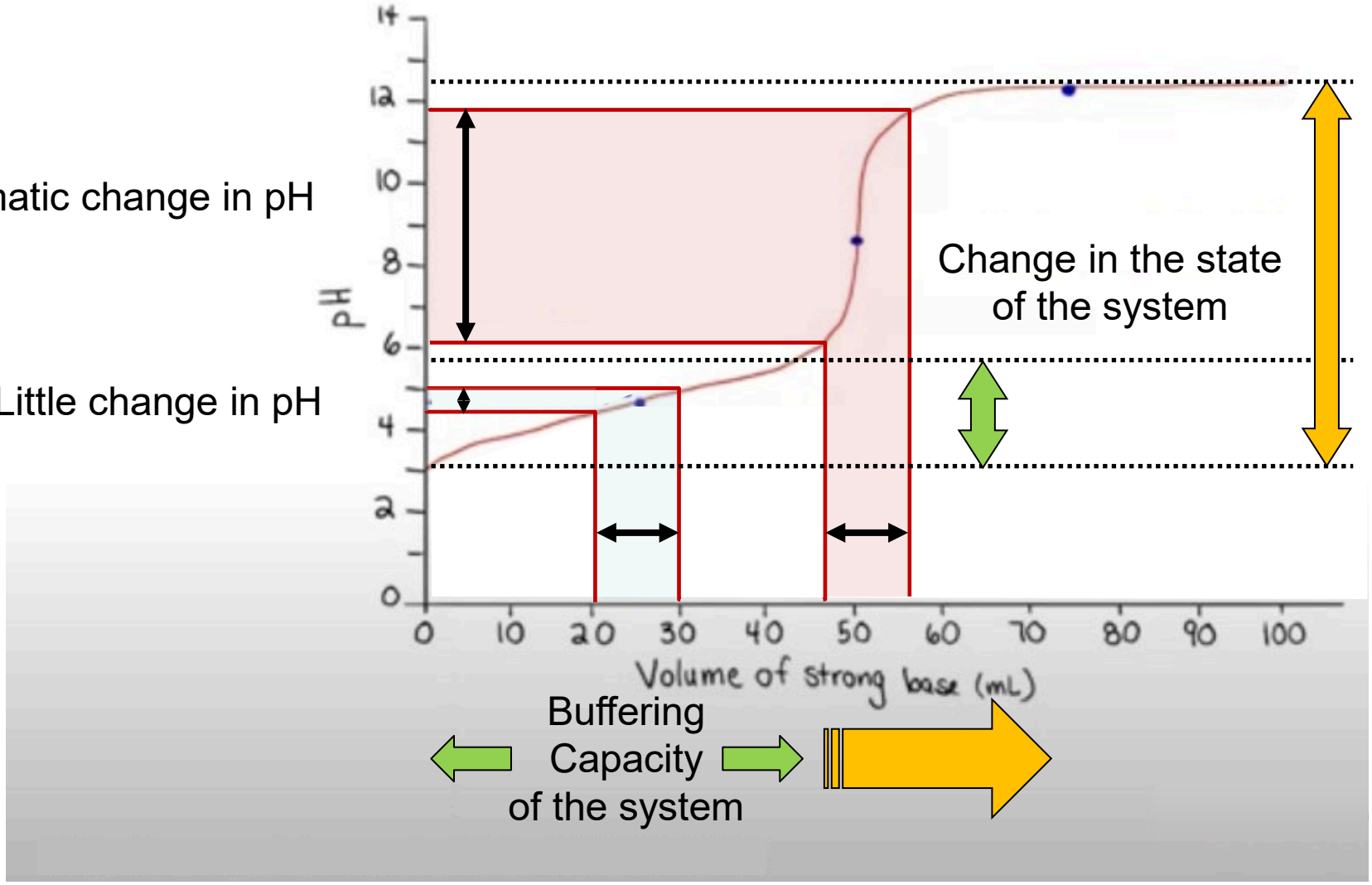
Permanent change in the state of the system (coiled spring)

Icon Source: https://www.freepik.com/

Resistance to Change: Chemistry Analogy

Dramatic change in pH

Little change in pH



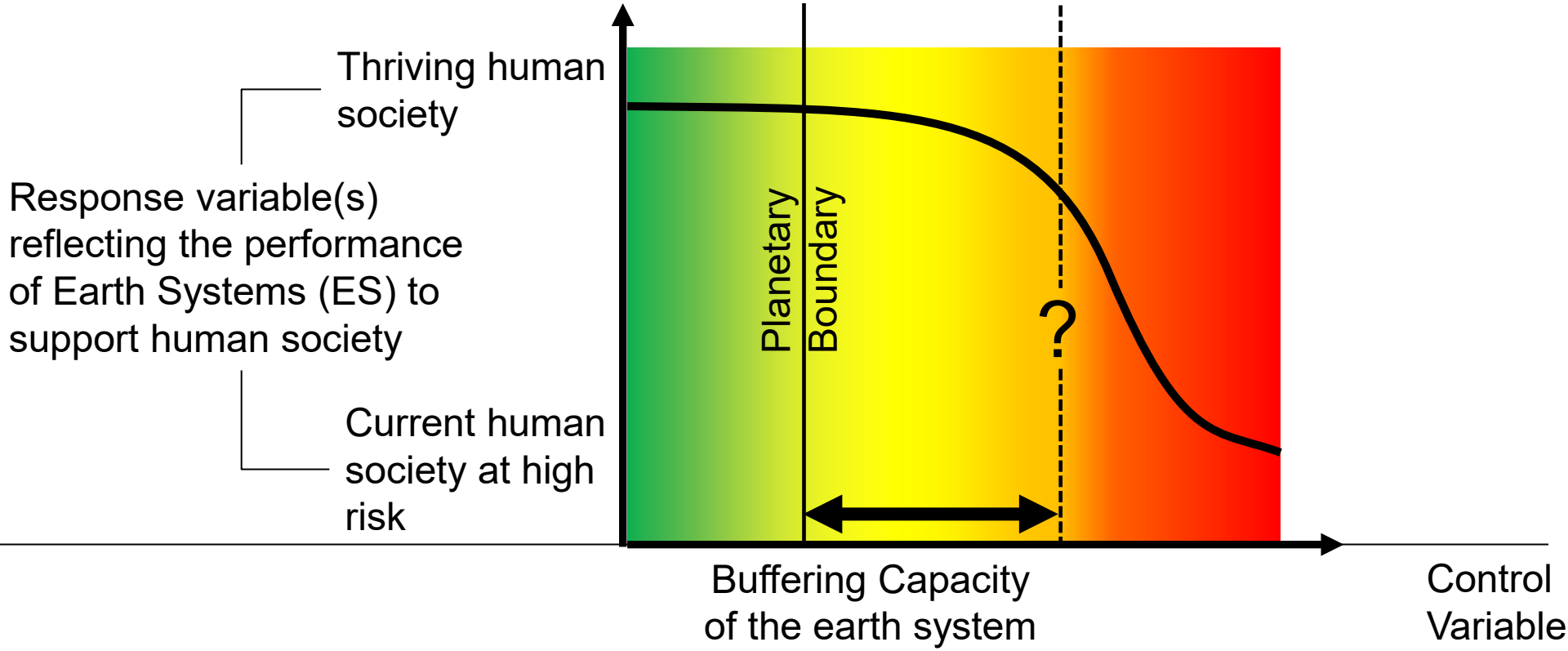
Titration curve from: https://www.youtube.com/watch?v=Fu5Z9AQW-kM

Planetary Boundaries (Guiding Human Development on a Changing Planet)

Safe operating space

Zone of uncertainty (increasing risk of impacts)

Dangerous level (high risk of serious impacts)



"Time for humans to change behavior before it's too late"

Rockström et al., 2009; Steffen et al, 2015

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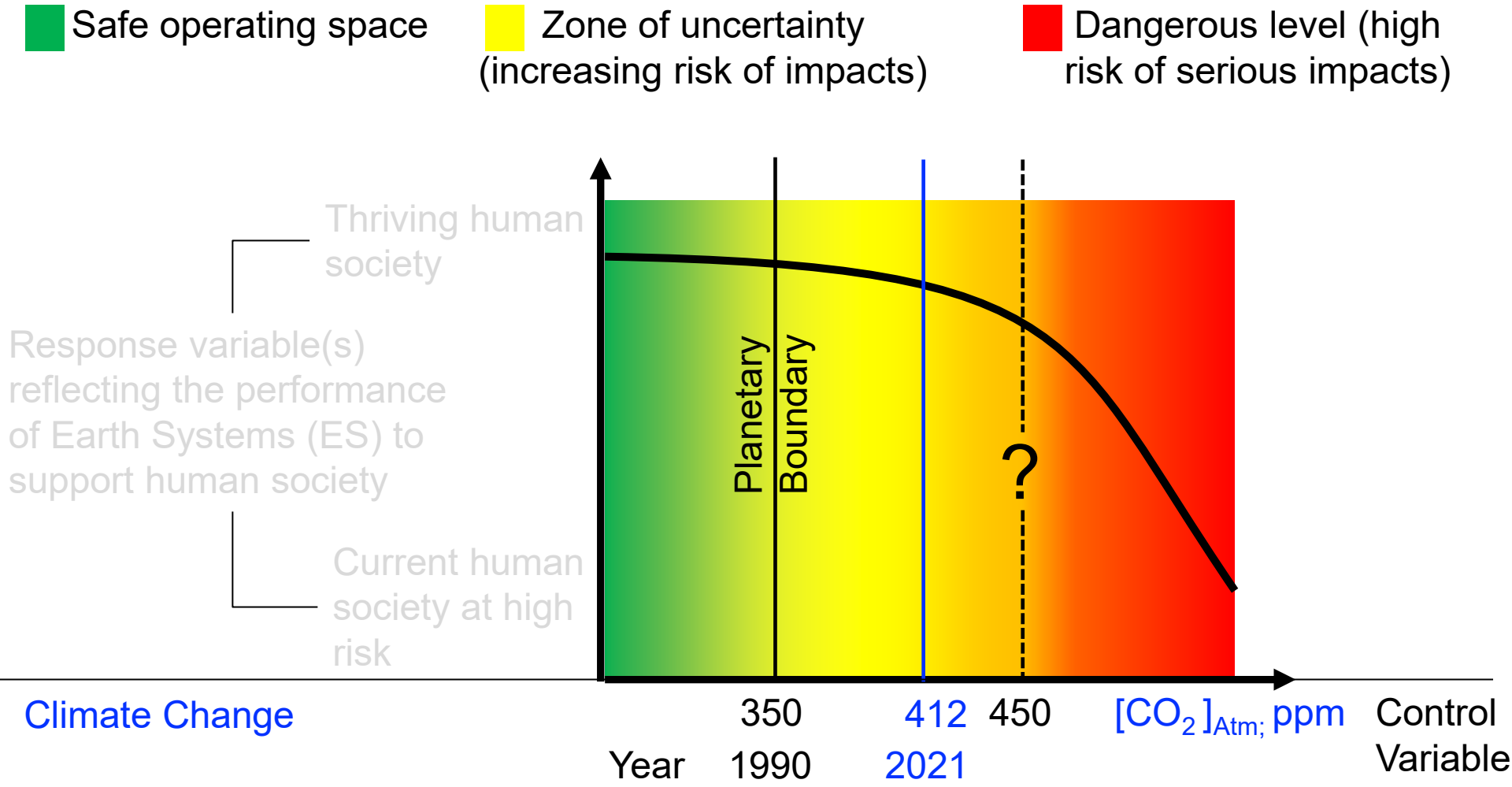

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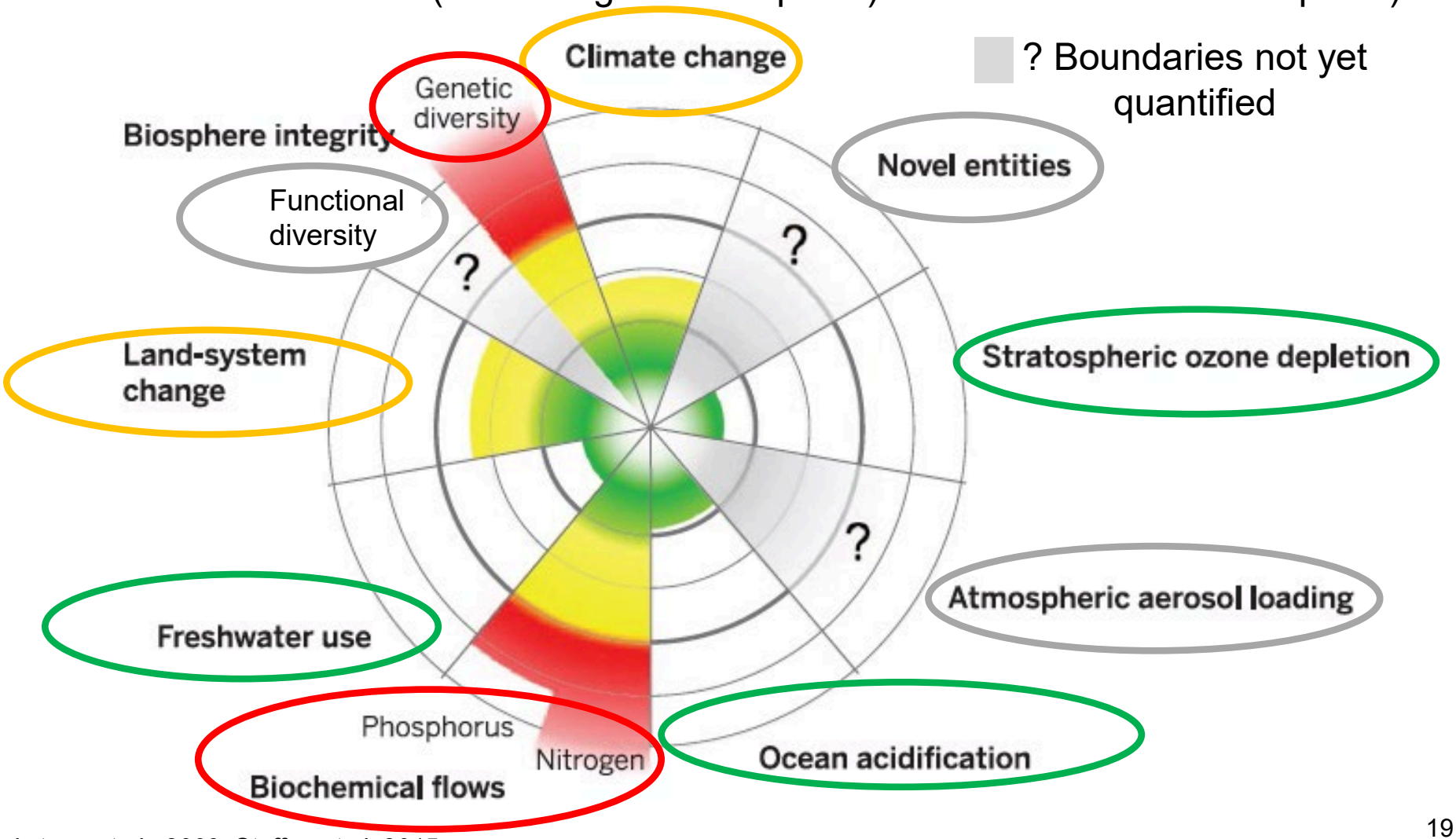
Zone of uncertainty (increasing risk of impacts)

Dangerous level (high risk of serious impacts)

? Boundaries not yet quantified



Rockström et al., 2009; Steffen et al, 2015

Not Everyone Contribute Equally!

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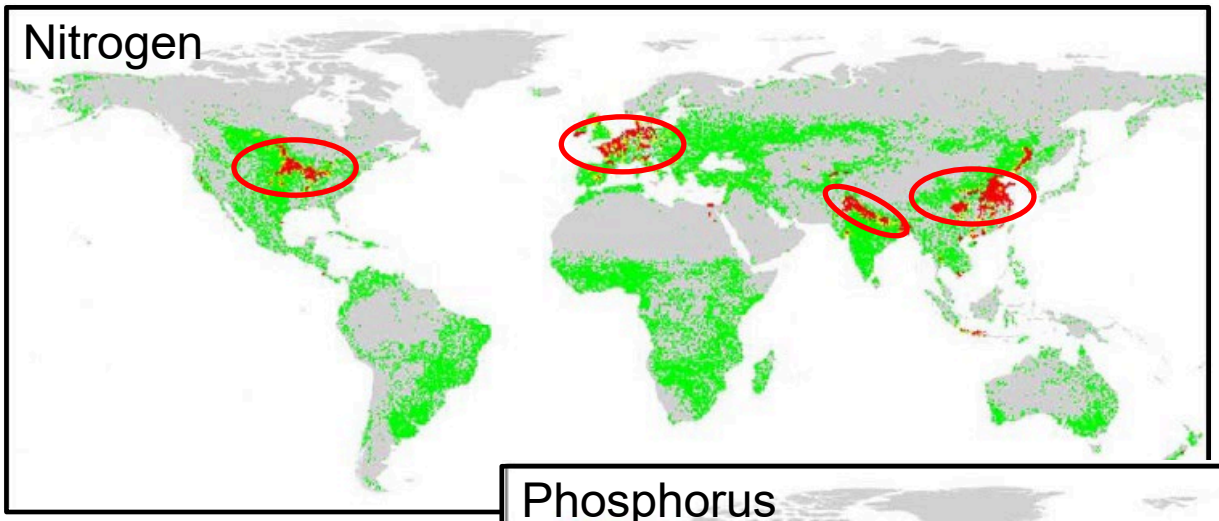

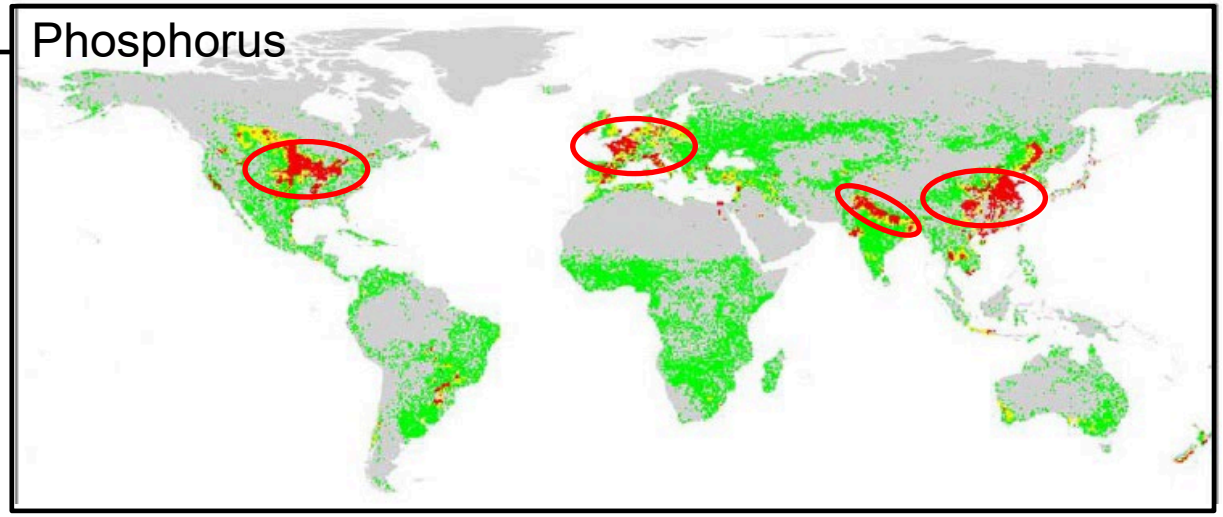

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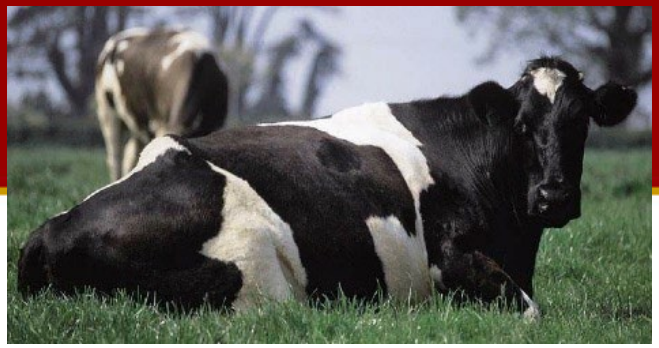

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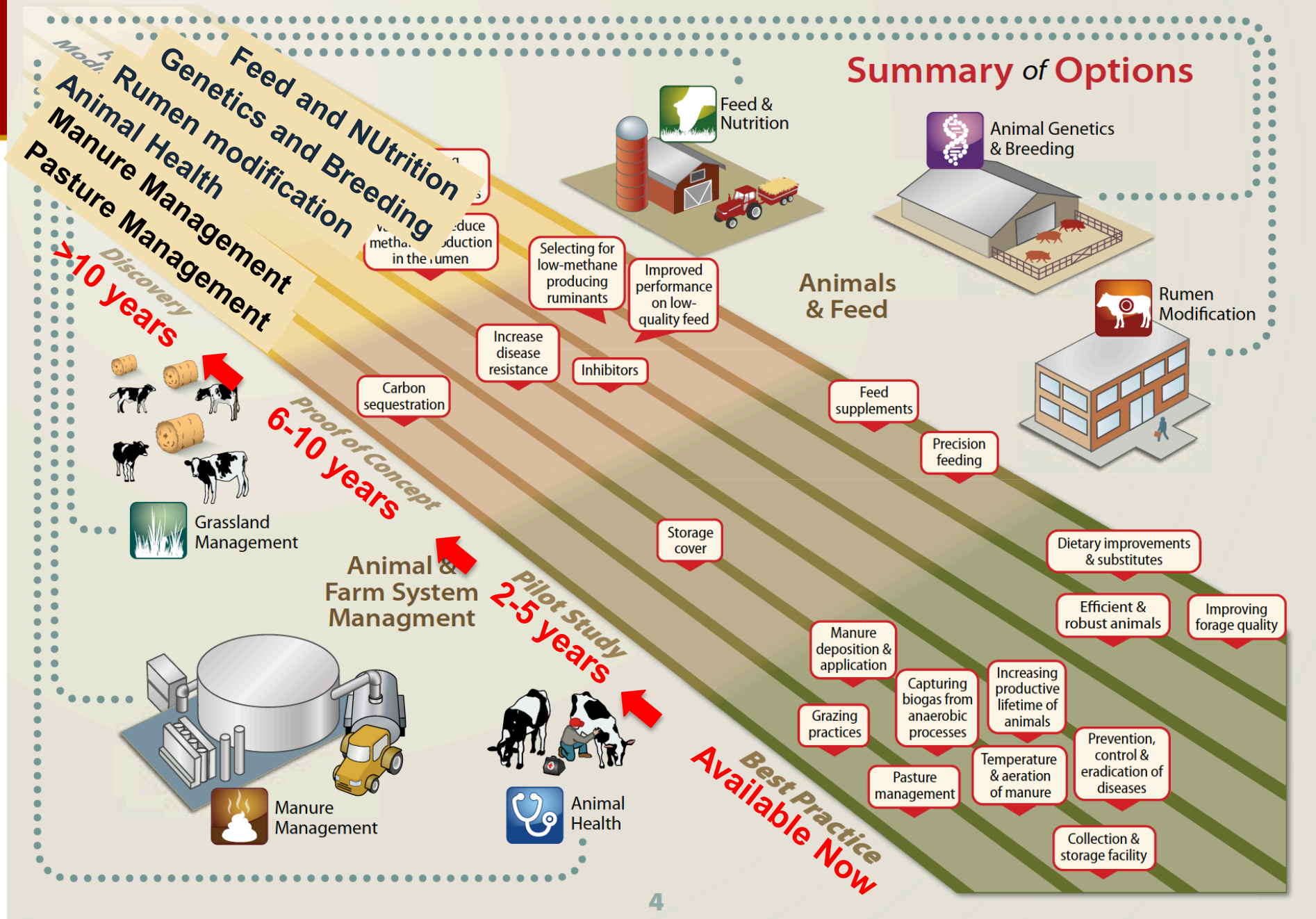


Source: Global Research Alliance: Reducing greenhouse gas emissions from livestock: Best practice and emerging options (2015)

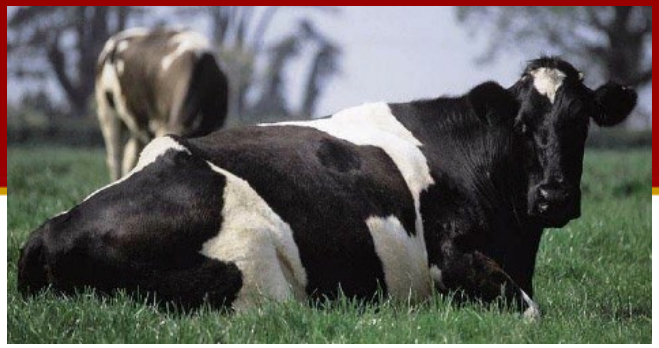
Options to Reduce Emissions

N_2O	CH_4	N_2O CH_4	CO_2 N_2O
✓ Fertilization	✓ Nutrition	✓ Solid / Liquid	✓ Tillage
✓ Diversity	✓ Breeding	✓ Storage time	✓ Rotation
✓ Legumes	✓ Reproduction	✓ Processing	✓ OM
✓ Genetics	✓ Health	✓ Nutrient Mgt	
✓ Grazing			

Options to Reduce Emissions

Auto-Sufficiency
Balance
Recycling

Outline



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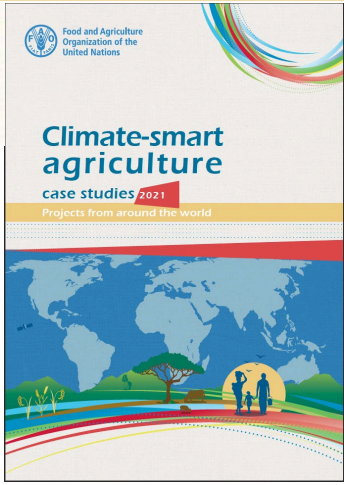
Climate-Smart Dairy: The Swiss Case Study

Switzerland – piloting a goal-oriented farmer payment system for climate-smart milk production



- Dairy production contributes ~ 4.3% of national emission.
- Switzerland's 2020 emission target was:
  20% below 1990 levels (a target that was missed!).

- Nestlé aims to achieve zero net emission by 2050.
- Public-Private partnership (government; processor, producers, and university).
  - Swiss dairy farmer's income is far below national average.
  - Adopting climate-smart practices can in the short run cause a reduction in income.
  - What are the most appropriate/relevant practices (in the Swiss context)?
  - How to make the program "fair" (i.e., farm-size neutral)?
- Program included temporary goal-oriented premium payments program.

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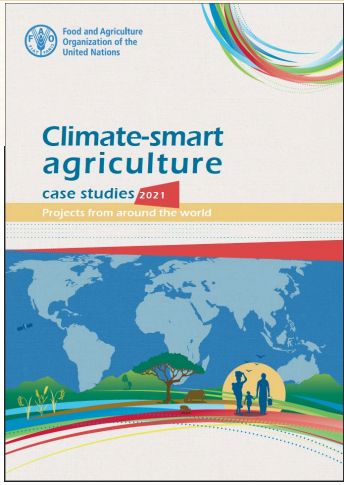
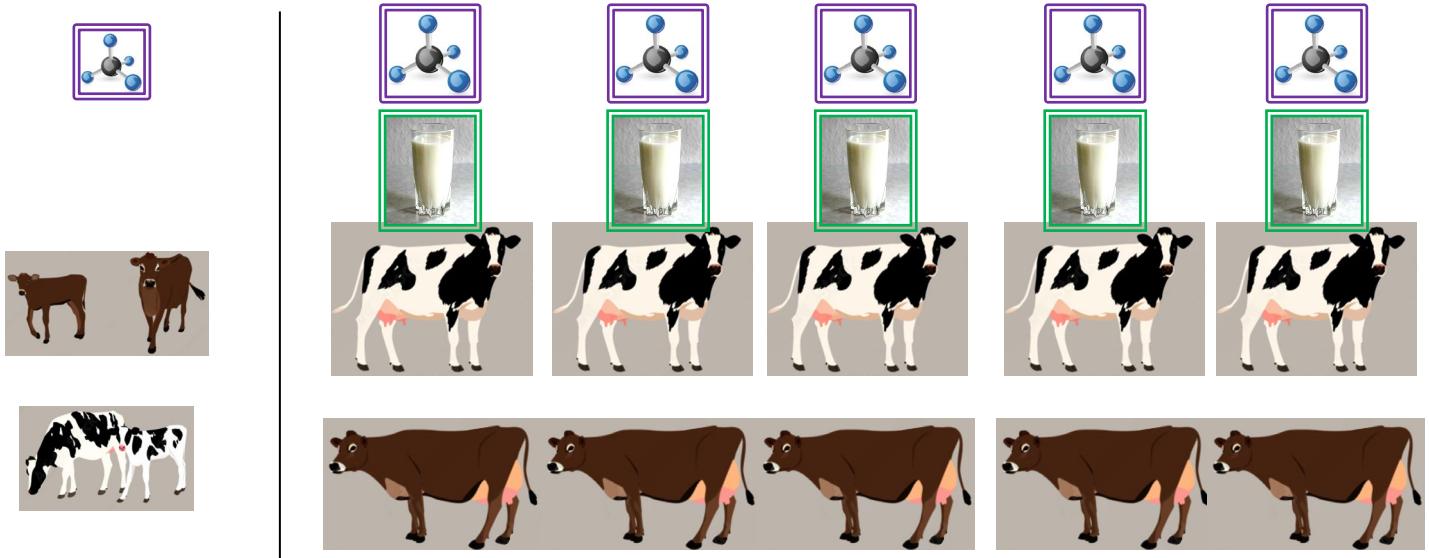


Farmers individually choose from a set of GHG reduction measures that best suit their situation:

1. Increase the number of lactation per cow:

Reduce the share of nonproductive animals in the herd.



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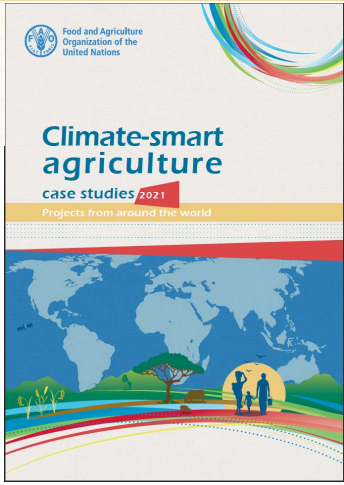
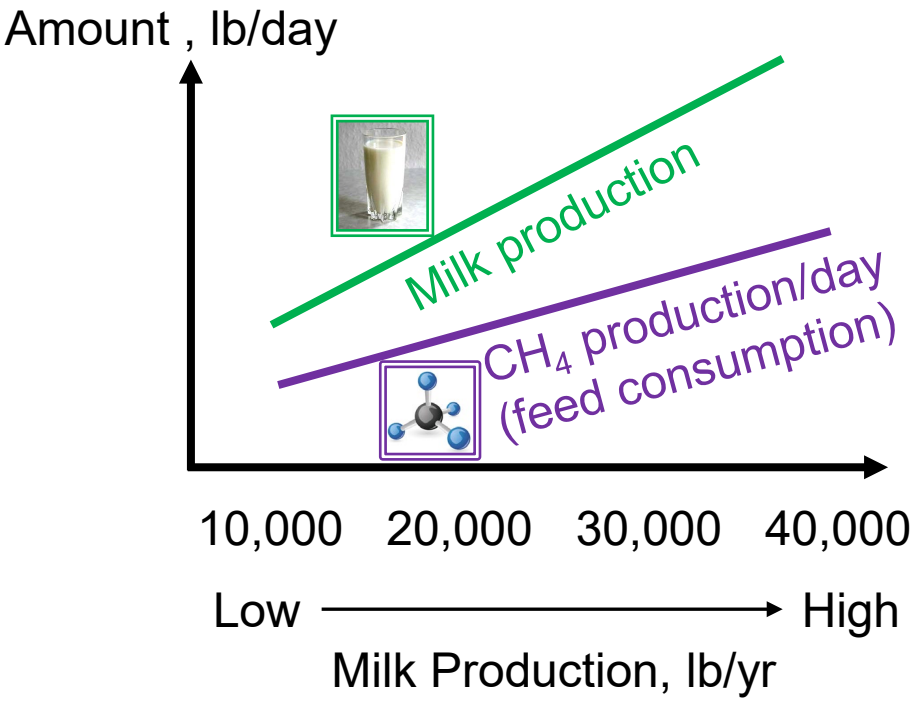
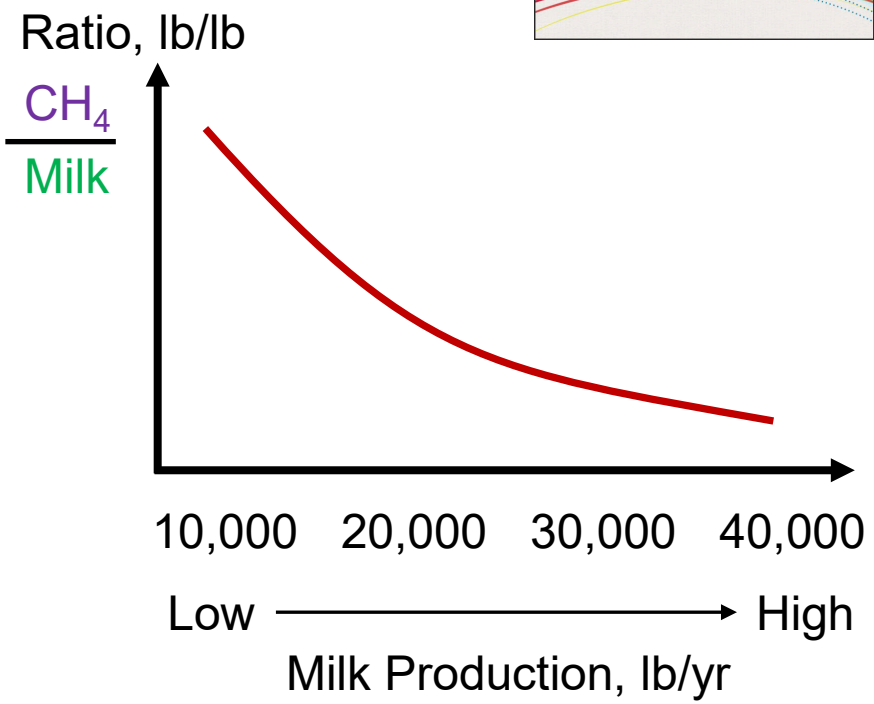


Farmers individually choose from a set of GHG reduction measures that best suit their situation:

2. Increase the lifetime performance (kilo of milk per life day).





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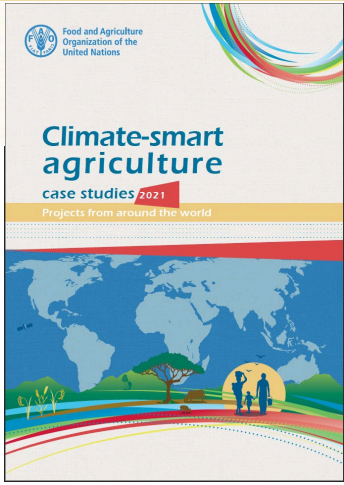
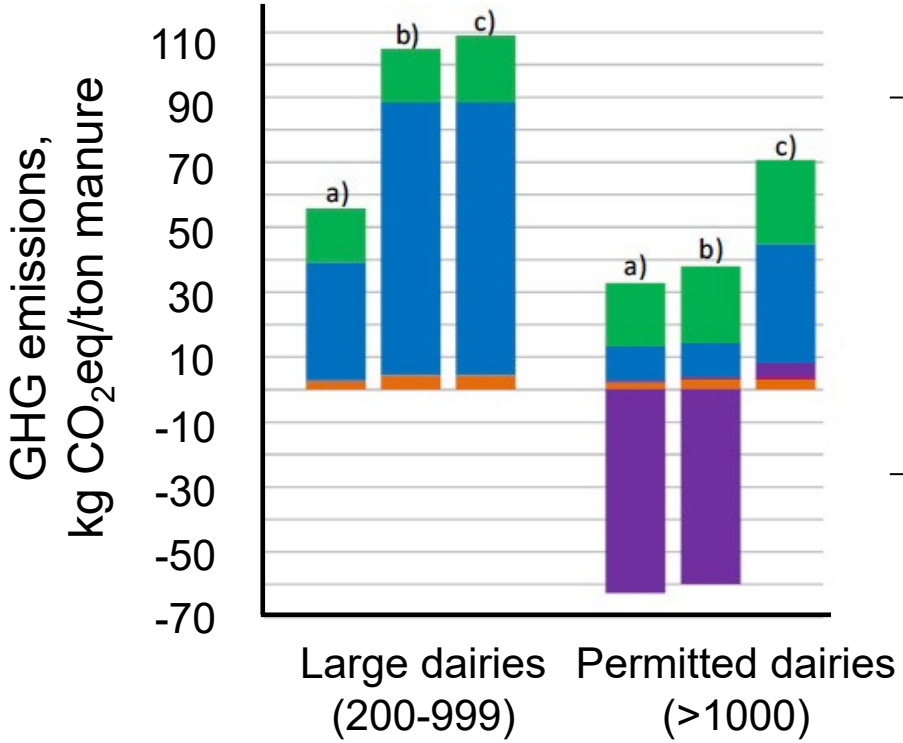


Farmers individually choose from a set of GHG reduction measures that best suit their situation:

3. Manure bio-digestion (i.e., CH_4 as a source of renewable energy).



Sources of emission

- Field application
- Storage: MANURE PIT/LAGOON
- Transport
- Processing: BIODIGESTION
- Collection

Emitting Scenarios:

a) low emitting
b) reference
c) high emitting

Aguirre-Villegas et al. (2014)

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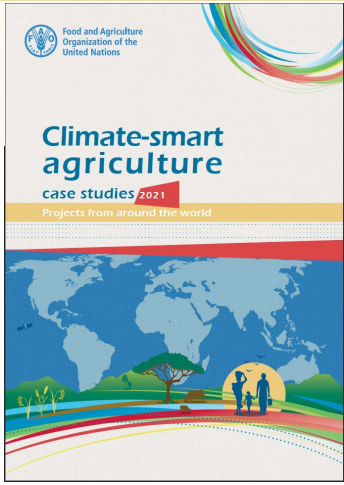

Farmers individually choose from a set of GHG reduction measures that best suit their situation:

4. Couple dairy-beef-production by using dual-purpose breeds and sperm sexing (i.e., dairy beef)

Carbon footprint of meat is considerably higher than carbon footprint of milk.

Carbon footprint of dairy beef is considerably lower than carbon footprint of specialized beef.

Increasing the production of dairy beef will reduce carbon footprint of meat supply.

Faverdin et al., (2022)

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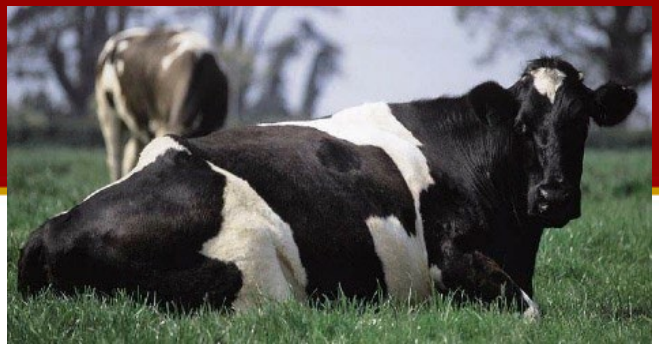

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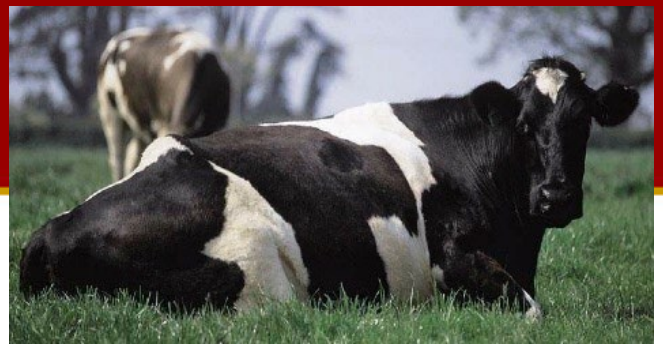

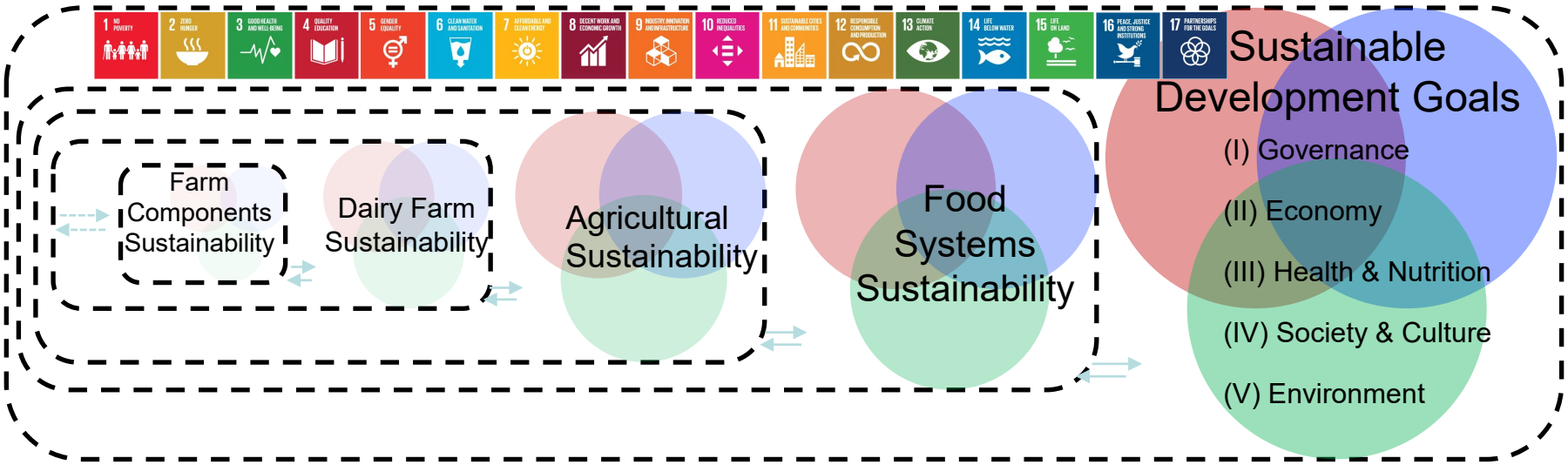

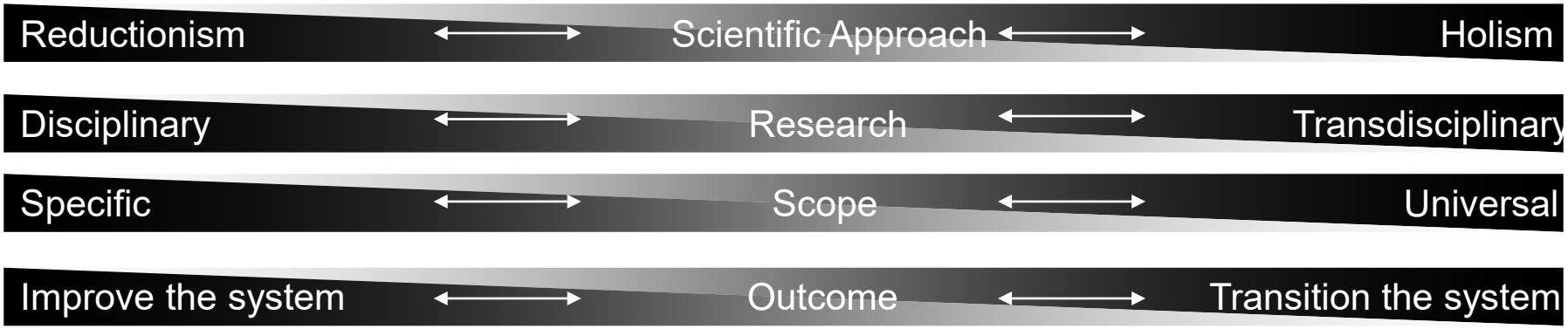

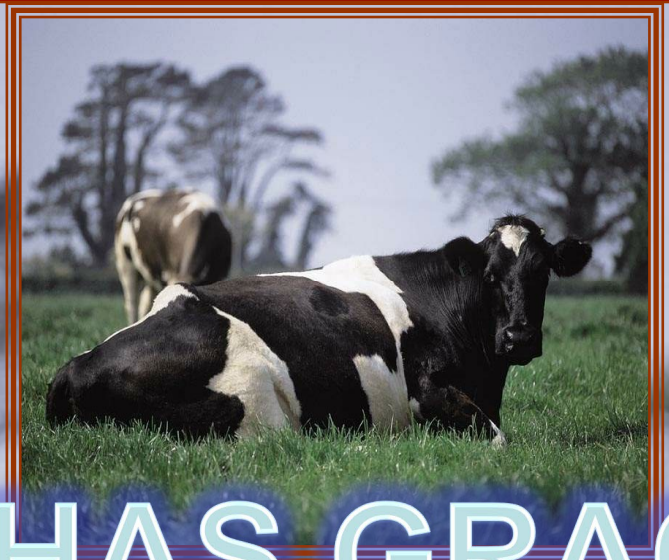

¡ MUCHAS GRACIAS !