AnimalChange

European Project n° 266018

WARSAW

APRIL 2014

BACKGROUND AND AIMS

The demand for livestock products is growing and climate change threatens food security and rural livelihoods.

Policies that are currently in place may prove insufficient.

Livestock systems are a significant contributor to greenhouse gases (GHG) but there is much uncertainty.

ANIMALCHANGE will for the first time provide a vision of the future of the livestock sector under climate change

Partners

European Research Institutes/Universities

1 - Institut National de la Recherche Agronomique – (France)

2 – Aarhus University (Denmark)

3 - Irish Agriculture and Food Development Authority (Ireland)

4 - Universidad Politécnica de Madrid (Spain)

5 - Aberystwyth University - Institute of Biological, Environmental and Rural Sciences (United Kingdom)

6 - Stichting Dienst Landbouwkundig Onderzoek (The Netherlands)

7 - Institute of Botany and Ecophysiology, Szent Istvan University (Hungary)

8 - Centre de coopération internationale en recherche agronomique pour le développement (France)

9 - Federal Department of Economic Affairs - Agroscope Swiss Federal Research Station (Switzerland)

10 - Scottish Agricultural College (United Kingdom)

11 - Commissariat à l'Énergie Atomique (France)

12 - International Institute for Applied Systems Analysis (Austria)

13 - INRA Transfert (France)

Animal production industries

14 - PROVIMI (The Netherlands)

15 - FertiPrado (Portugal)

Institutions from ICPC countries and international organisations

16 - Universidade Federal do Rio Grande do Sul (Brazil)

17 - Empresa Brasileira de Pesquisa Agropecuária (Brazil)

18 - Institut National de Recherches Agronomiques de Tunisie (Tunisia)

19 - Institut Sénégalais de Recherches Agricoles (Senegal)

20 - University of Pretoria (South Africa)

21 - International Livestock Research Institute (Kenya)

22 - AgResearch New Zealand – GHG Research Centre (New Zealand)

23 - European Federation of Animal Science (Italy)

24 - Food and Agriculture Organization of the United Nations (Italy)

25 - European Commission - DG Joint Research – Institute for Environment and Sustainability (Belgium)

Expected Outputs

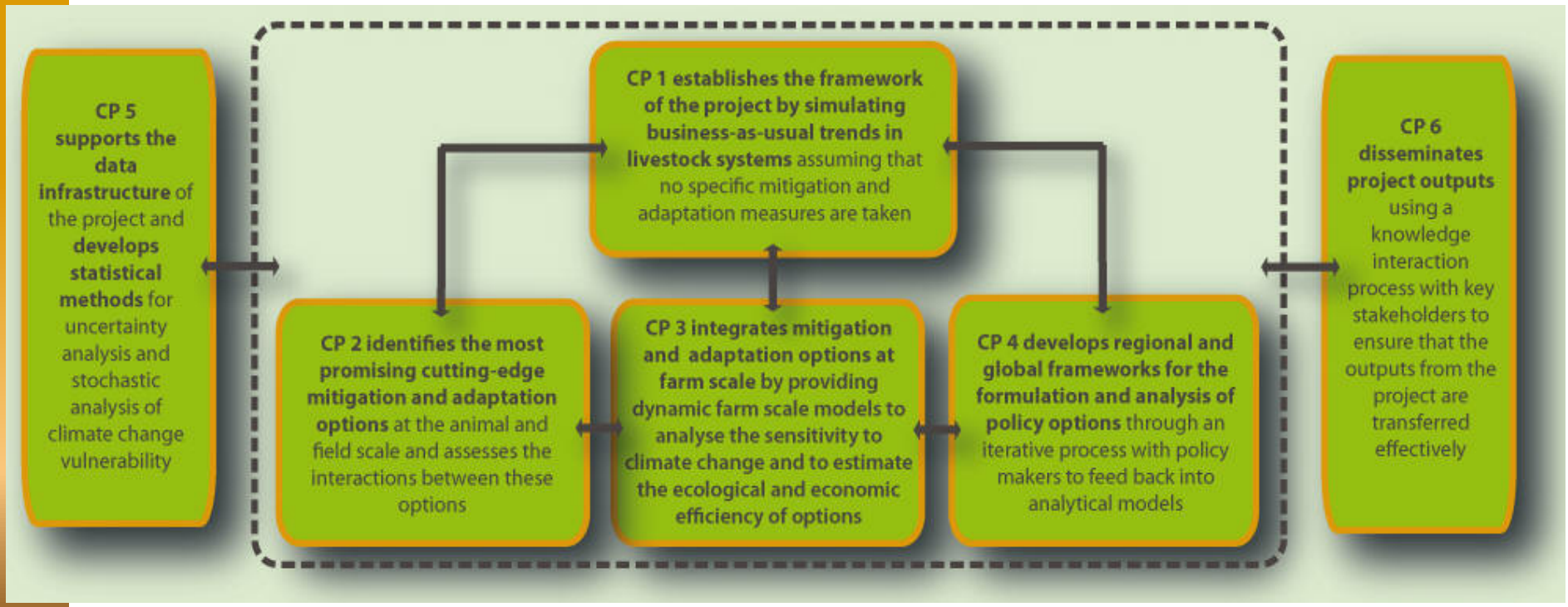
ANIMALCHANGE will provide a consistent suite of scenarios, models, assessments and policy support tools to:

- reduce uncertainties
- include climate variability as part of climate impact assessment
- provide cutting-edge technologies for mitigation and adaptation
- assess economic and societal costs and opportunities
- assess the vulnerability of livestock to climate change
- provide direct support to establish policies for mitigation and adaptation to climate change for the livestock sector
- reach out to stakeholders

The results will be applicable to wide range of systems and various end- users including farmers not only in Europe but also in Africa and Latin America.



Project Structure



Components

- **CP 1** establishes the framework of the project by ***simulating business-as-usual trends*** in livestock systems assuming that no specific mitigation and adaptation measures are taken.
- **CP2** identifies at the animal and field scale ***the most promising cutting-edge mitigation and adaptation options*** and assesses the interactions between these options.




- **CP 3** ***integrates mitigation and adaptation options at farm scale*** by providing dynamic farm scale models to analyse the sensitivity to climate change and to estimate the ecological and economic efficiency of various farm scale adaptation and mitigation measures.



Components

- **CP 4** ***develops regional and global frameworks for the formulation and analysis of policy options*** through an iterative process whereby the results from quantitative analyses will be discussed with policy makers and the outcomes fed back into the analytical models.



Components

- **CP5** supports the ***data infrastructure*** of the project and develops ***statistical methods*** for uncertainty analysis and stochastic analysis of climate change vulnerability.
- **CP6** will ***disseminate project output***



Dissemination

Using a knowledge interaction process with key stakeholders to ensure that the outputs from the project will be transferred effectively and be relevant to their needs

- Participative approach – Stakeholder Panel
- Annual workshops/symposia
  - Livestock, Climate Change and Food Security, Madrid, May 19 and 20, 2014



Dissemination

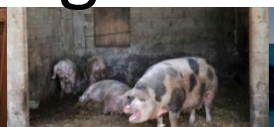
- Elearning and face to face training (GRA link)

http://www.gedulah.co.uk/e-learning/animalchange/Feed_management/feed_management_animal_scale_0-8.htm

- Regional workshops (link with GRA)
  - Budapest, 27- 28 October 2014
  - Kenya, December 2014
  - Senegal, January 2015
  - Brazil, February 2015

Support for young scientists to attend





Effective Dissemination

Research

Research Scientists ⟷ Stakeholders

Project Outputs
(Reports, Models, DSS)

RELEVANT OUTCOMES
(Env. Benefit, Competitive Industry, Policy support)

→ Financial Incentives
→ Legal Framework
→ Support and Capabilities

= Impact



www.animalchange.eu

An integration of mitigation and adaptation options for sustainable livestock production under climate change

- Homepage
- Project Programme
- Project Partners and links to their homapages
- Project Management and Advisory Structure
- Proceedings of Project Workshops and Symposia
- Forthcoming Events
- Contact us
- Related Projects
- AnimalChange Brochure - download here

ANIMALCHANGE Background, aims and outcomes

The demand for livestock products is growing and climate change threatens food security and rural livelihoods. Policies that are currently in place may prove insufficient. Livestock systems are a significant contributor to greenhouse gases (GHG) but there is much uncertainty.

ANIMALCHANGE will for the first time provide a vision of the future of the livestock sector under climate change.

ANIMALCHANGE will

- **Reduce uncertainties** concerning GHG emissions from livestock systems.
- **Include climate variability** as part of impact assessment.
- **Develop cutting-edge technologies** for mitigation and adaptation to climate change.
- **Assess economic and societal costs** of business as usual and of adaptation and mitigation scenarios.
- **Assess the vulnerability of livestock** to climate change and feedbacks on GHG emissions.
- **Provide direct support to set up policies** for mitigation and adaptation to climate change for the livestock sector.
- **Reach out to stakeholders** by organising symposia, training of scientists, technicians and policy makers and forming a network to alert stakeholders of project outputs and events

ANIMALCHANGE will use cutting edge techniques and mathematical modeling to achieve these outcomes.

The results will be applicable to wide range of systems not only in Europe but also in Africa and Latin America

LATEST NEWS

AnimalChange Symposium on "Livestock and climate change: options for mitigation and adaptation" at EAAP Bratislava, August 27 - 31.

Thursday 31 August

SEVENTH FRAMEWORK PROGRAMME

Related Projects www.animalchange.eu

- www.ruminomics.eu (close link to RMG network)

  Summer School Piacenza July 8-10
  (Metagenomics/Metabarcoding; Rumen Microbial Ecology; Developing New Tools)

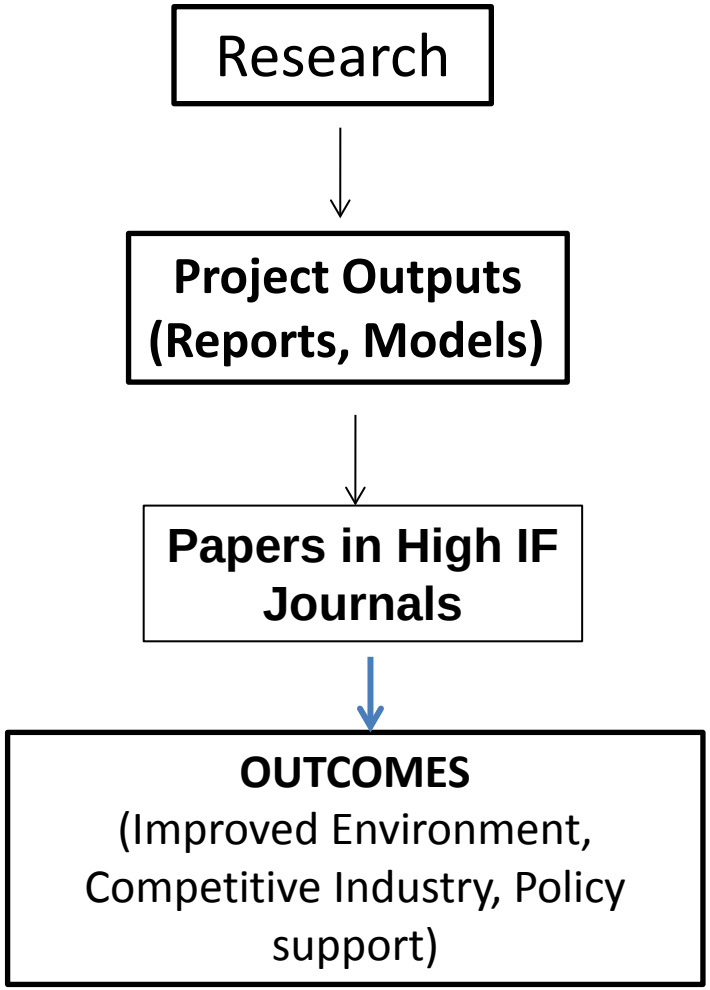
  Joint workshop with eco-fce and rmg, Aberdeen June 16th.

  How does the gut microbiota influence feed efficiency?

- www.eco-fce.eu
- www.solidairy.eu
- www.rednex-fp7.eu
- GplusE (new)

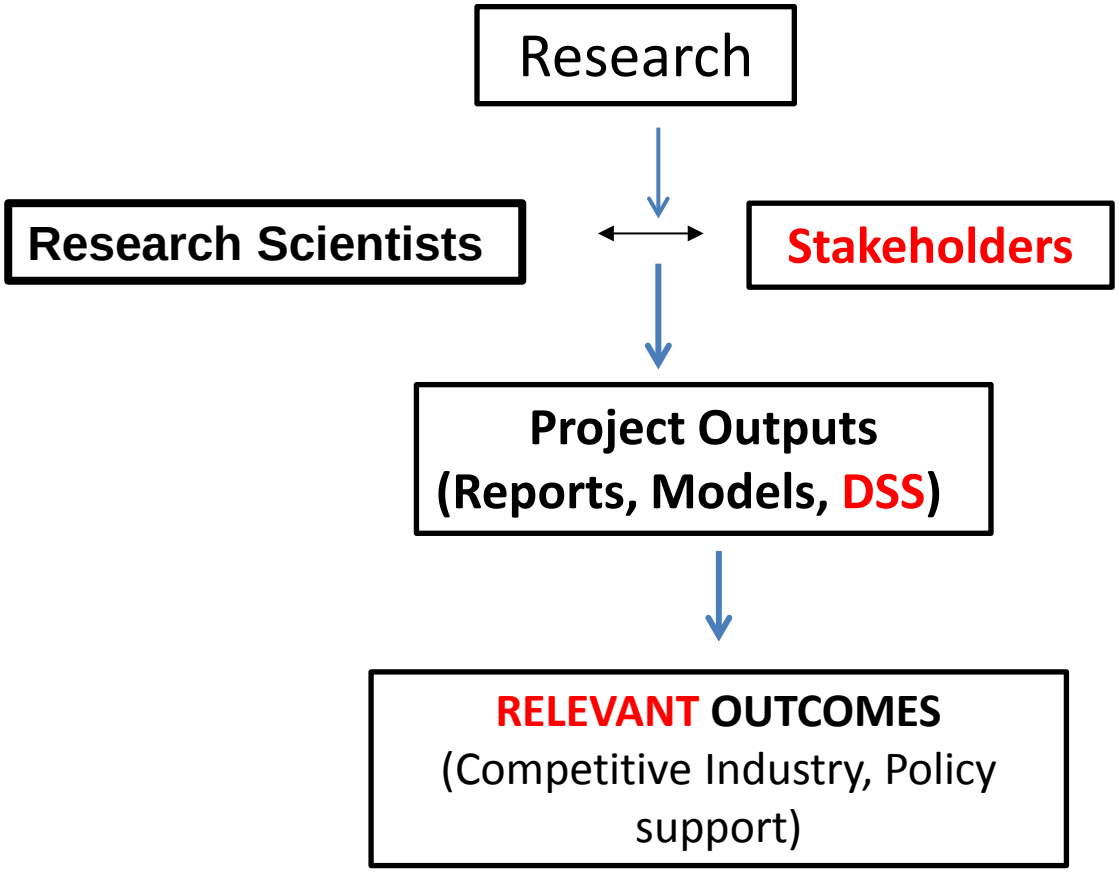


Project Dissemination and Impacts



Impact??

Effective Dissemination

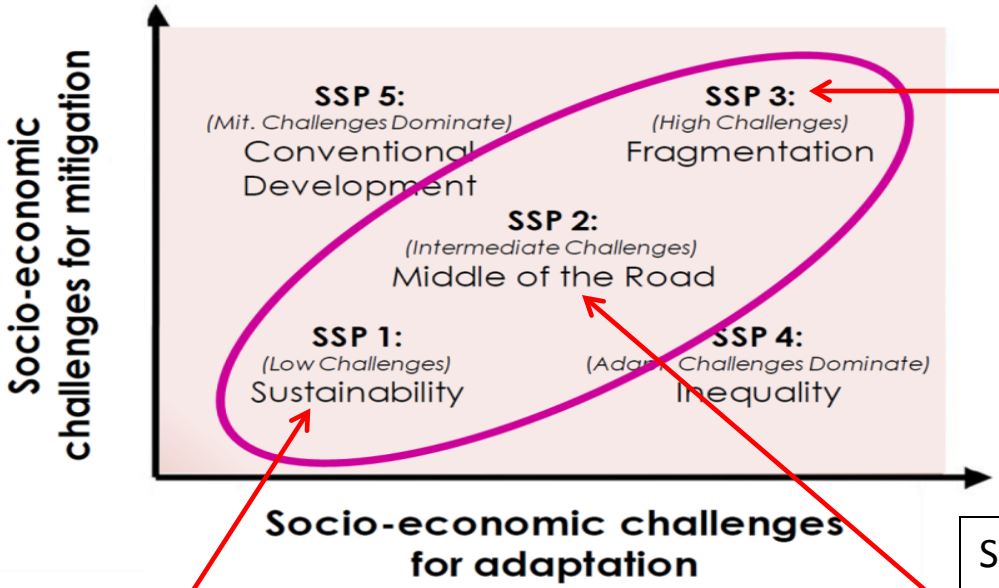


= Impact?

SCENARIO SETTING



CP2 IPCC AR5
Shared SocioEconomic Pathways (SSPs)



SSP3 is a fragmented world characterized by strongly growing population and important regional differences in wealth with pockets of wealth and regions of high poverty. Unmitigated emissions are high, low adaptative capacity and large number of people vulnerable to climate change. Impact on ecosystems are severe.

SSP1 is the sustainable world with strong development goals that include reducing fossil fuel dependency and rapid technological changes directed towards environmentally friendly processes including yield-enhancing technologies.

SSP2 is the continuation of current trends with some effort to reach development goals and reduction in resource and energy intensity. On the demand side, investments in education in not sufficient to slow rapid population growth. In SSP2 there is only an intermediate success in addressing vulnerability to climate change.



Scenarios- Feed Efficiency

Using these scenarios, we predict that over next 40 yrs

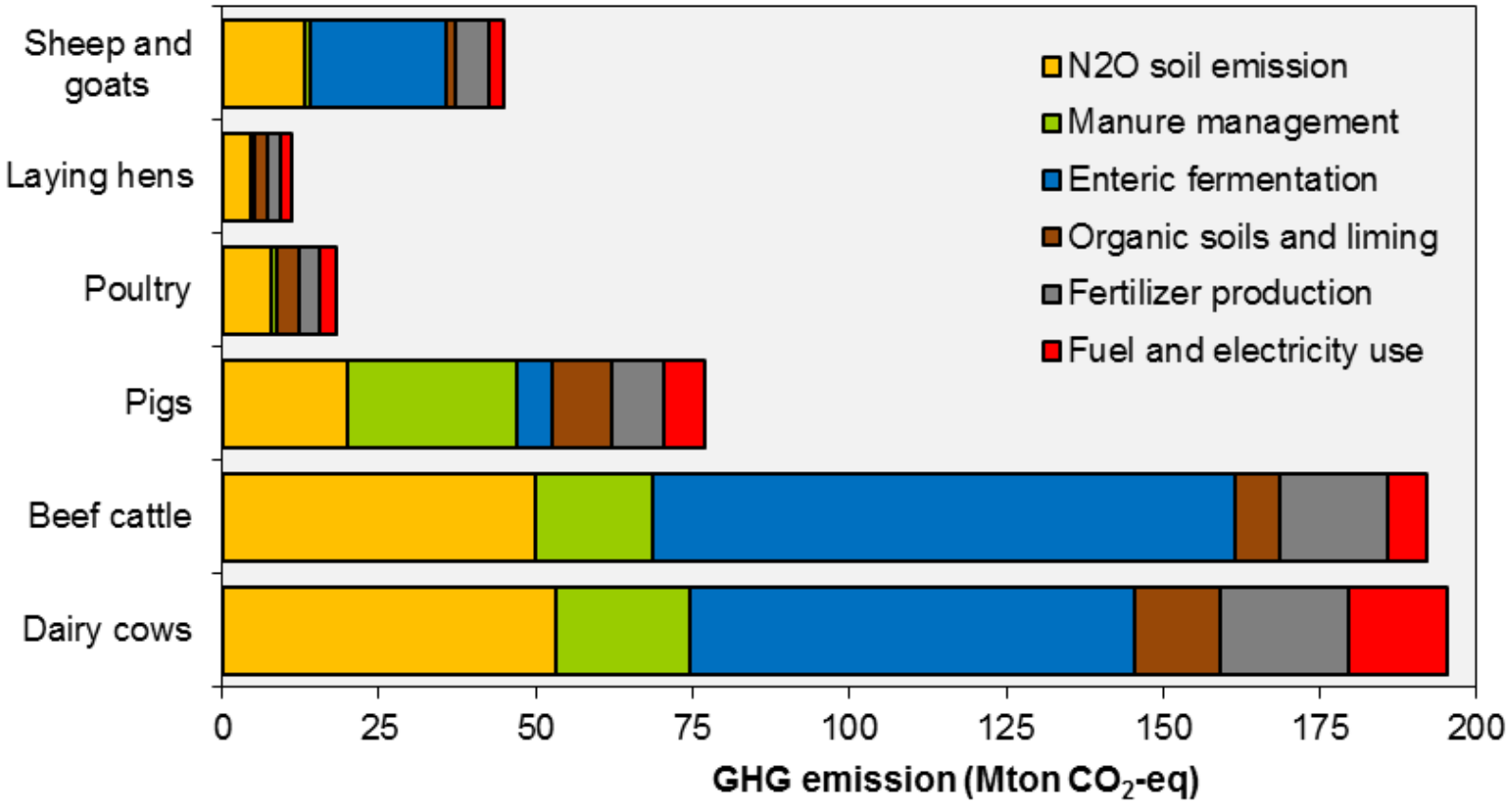
- Feed efficiencies continue to be higher in Europe than in Africa and Latin America
- There will be continued improvement in feed efficiency in the next 40 years across all species but particularly in pig and poultry in Africa and Latin America
- However this improvement is much reduced under the SSP3 scenario (fragmented world)



PREDICTIONS OF GHG



GHG emissions from livestock production in EU-27



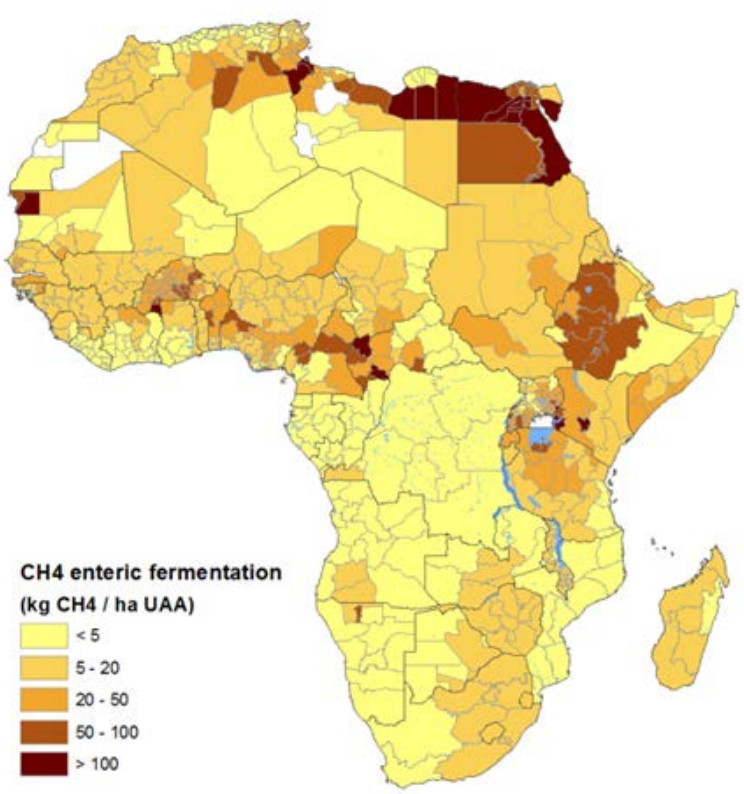
Improved predictions of GHG

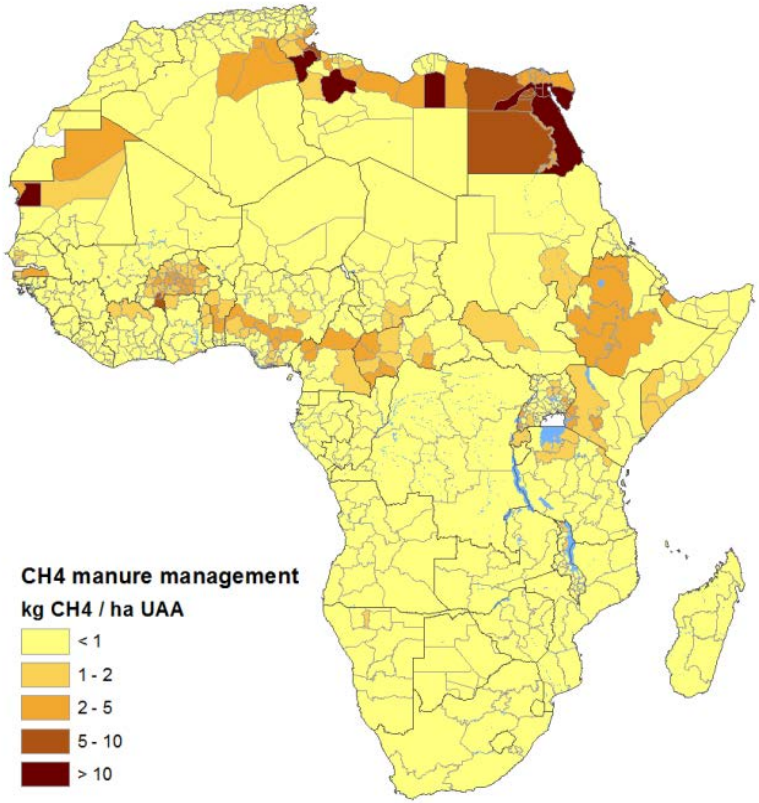
Using improved prediction models and recent reviews

- Pig and Poultry production in the EU 27 produces markedly less GHG (Mtons CO_2 eq) than Dairy and Beef
- The difference is mainly due to higher soil N_20, and enteric fermentation (CH_4) in Dairy and Beef
- These estimates suggest that Livestock Systems contribute about 10% of EU 27 total output
- There are differences between countries but these are particularly marked for other regions of the world (Africa) related to the intensity of production.



CH_4 from fermentation (l) & manure management (r) at regional level for 2008 (calculated by MITERRA-World)





Source: D3.2 by Lesschen et al. (2012)

GRASSLAND

Adaptation from grass mixtures

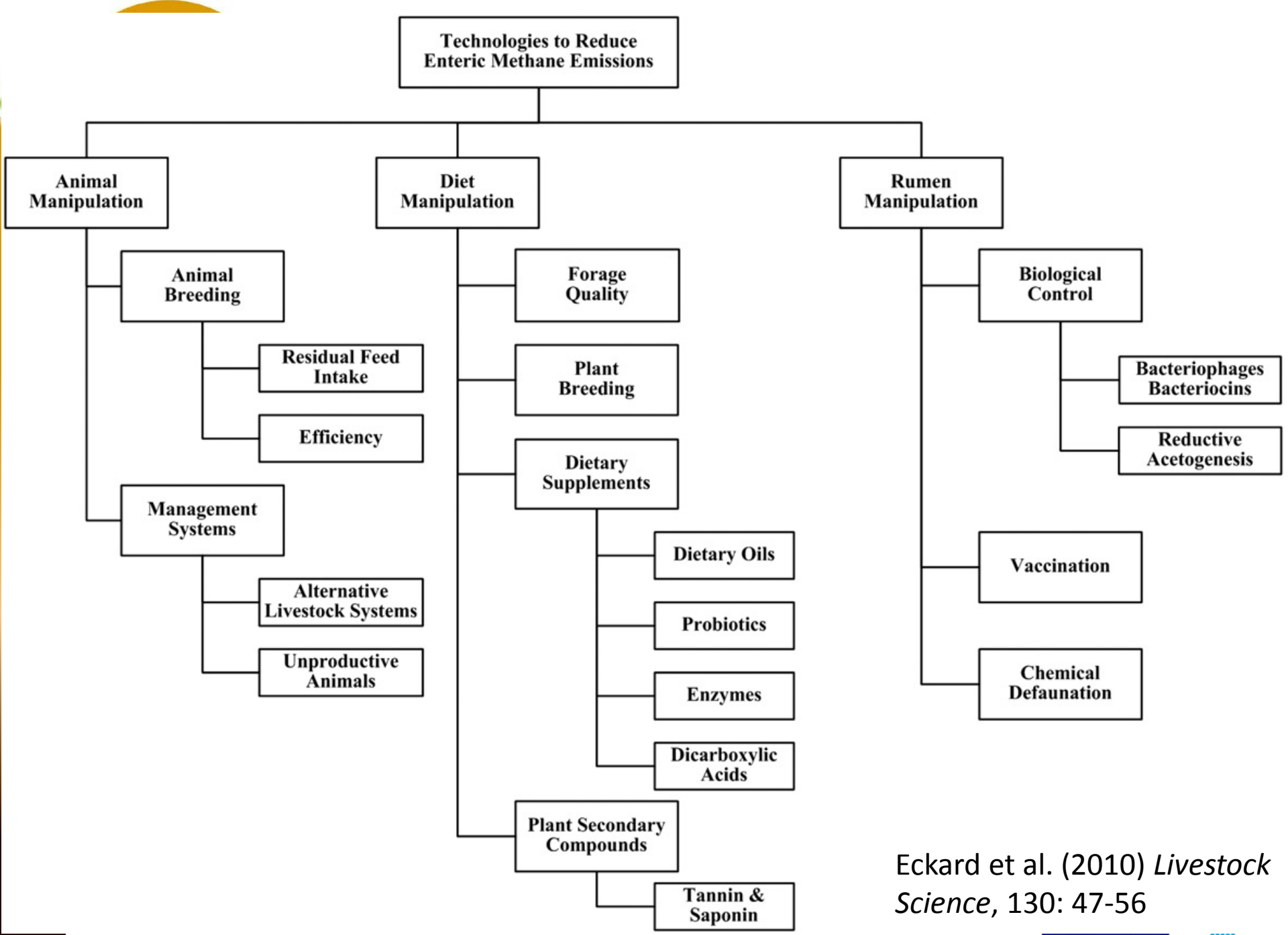
Lusignan, France (INRA)

Vaiamonte, Portugal (Fertiprado)

- Common experiment established
- Potential of mixing new cultivars and species
- Big variability between Mediterranean and temperate origins

Mitigation Strategies

A WIDE RANGE OF MITIGATIONS



Eckard et al. (2010) *Livestock Science*, 130: 47-56

Exploring mitigation strategies

Traditional reviews

- Qualitative evaluation
- Ignores differences in statistical power

Project is conducting Meta-analysis

- Quantify effectiveness
- Quantify variability
- Explore moderating factors

In ruminants, the most effective dietary strategies include increasing starch based concentrates, inclusion of lipids, the use of tannin containing forages and improving forage quality (eg Grass silage)
Animal breeding strategies are effective and some chemical inhibitors such as Nitrates show promise

FARM AND REGIONAL SCALE

Development of farm scale models that can be used in practice to predict impact of diet/management changes on GHG output-
The Farm AC model

Farm AC

Farm: 67891 Select farm
67891
Scenario 1

Farm AC

1/15/2013
Nicholas John Hutchings

Farm | Rotation | Yield | Ruminants | Non ruminants | Manure | Balance | Result

Rotation name: Cereal — **Soil type:** Clayey Sandy Soil (> 40% fine sand) (JB 4) — **Irrigation:** Rainfed — **Area:** 80 Ha

Crop	Product	Area (ha)	Cover crop	
Spring barley	Spring barley	20	Cruciferous	Delete crop
Oat	Oats	20	None	Delete crop
Winter wheat	Wheat	20	None	Delete crop
Spring barley	Spring barley	20	None	Delete crop

New crop | Save rotation | Delete rotation

Rotation name: Grassland — **Soil type:** Coarse Sandy Soil (JB 1) — **Irrigation:** Rainfed — **Area:** 20 Ha

Crop	Product	Area (ha)	Cover crop	
Permanent grass	Grass, 12-15 cm	20		Delete crop

New crop | Save rotation | Delete rotation

Rotation name: 9 — **Soil type:** Coarse Sandy Soil (JB 1) — **Irrigation:** Rainfed — **Area:** 0 Ha

Crop	Product	Area (ha)	Cover crop	
Spring barley	Spring barley	0	Grass/Seedgrass	Delete crop
Rotational clover grass	Clovergrass, 12-15 cm, 60% clover	0	None	Delete crop
Oat	Oats	0	Grass/Seedgrass	Delete crop
Rotational clover grass	Clovergrass, 20-25 cm, 20% clover	0	None	Delete crop

New crop | Save rotation | Delete rotation

New rotation

CP4 – Regional scale and support to sustainable policy development

This component takes information from the other workpackages in the project and the main activities will take place over the next years of the project

Comparison of Tier Models- Enteric Fermentation (CH_4)

Model	Inputs needed
IPCC Tier 1	No of animals
	Type of Animal
	Emission Factor
Dutch Tier 3	-dry matter intake
	-volatile fatty acids (and lactic acid) in diet
	-NDF, degradable NDF, total starch, degradable starch, soluble sugars
	-N content, ammonia N in diet, indigestible protein rate of degradation of starch and protein

Improved Inventories

- Inventories and methodology need to be improved.
- Many of the mitigations studied by this project (and others) will not demonstrate any reductions under Tier 1 (and 2)
- More complex Tier 3 are needed but this depends on amount and quality of data (see Tier 3 for enteric fermentation.

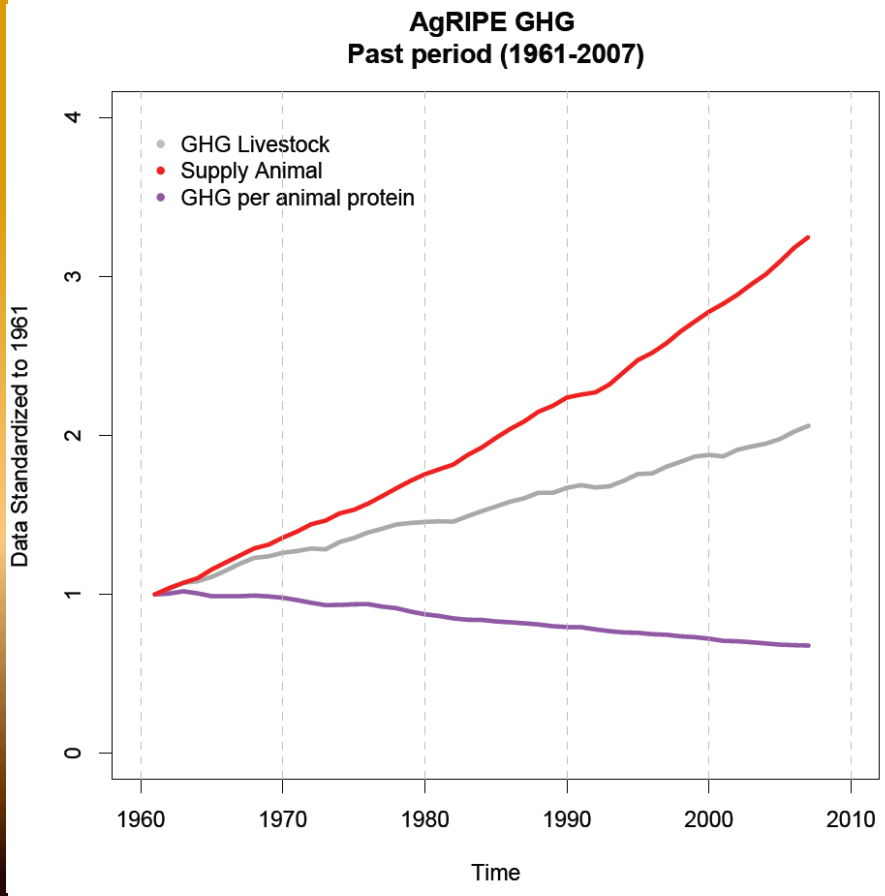
Stakeholder Platform

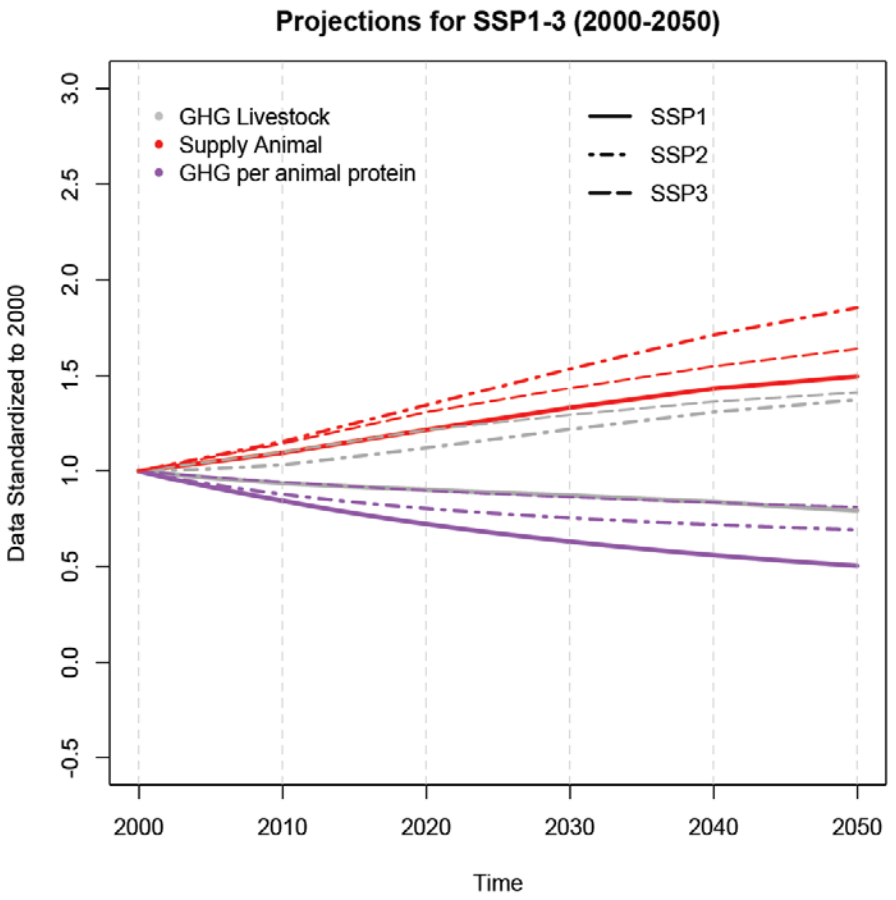
(IMS is a member)

- Represent the interests of the stakeholders in the project;
- Provide WP leaders with feedbacks and advice on the relevance of the project outputs,
- Agree with WP leaders the implementation plans for project outputs;
- Assist the project in dissemination activities,
- Provide the external advisory board and project coordinator with an annual report of activities in Component 6 (Dissemination)



Past and future changes in GHG emissions from livestock







Scenarios- GHG

- GHG ***per unit of product*** has declined steadily over the past 50 years
- In the next 40 years this reduction is predicted to continue under SSP1 and 2 but
- A decline is predicted in SSP3 (fragmented world)
- The highest livestock product prices are also predicted under SSP3




WP2 Highlights (Period 1)

Task 2.5: Detailed modelled livestock scenarios

D2.2: Preliminary scenarios of the developments in agricultural commodity markets, livestock production systems, and land use and land cover

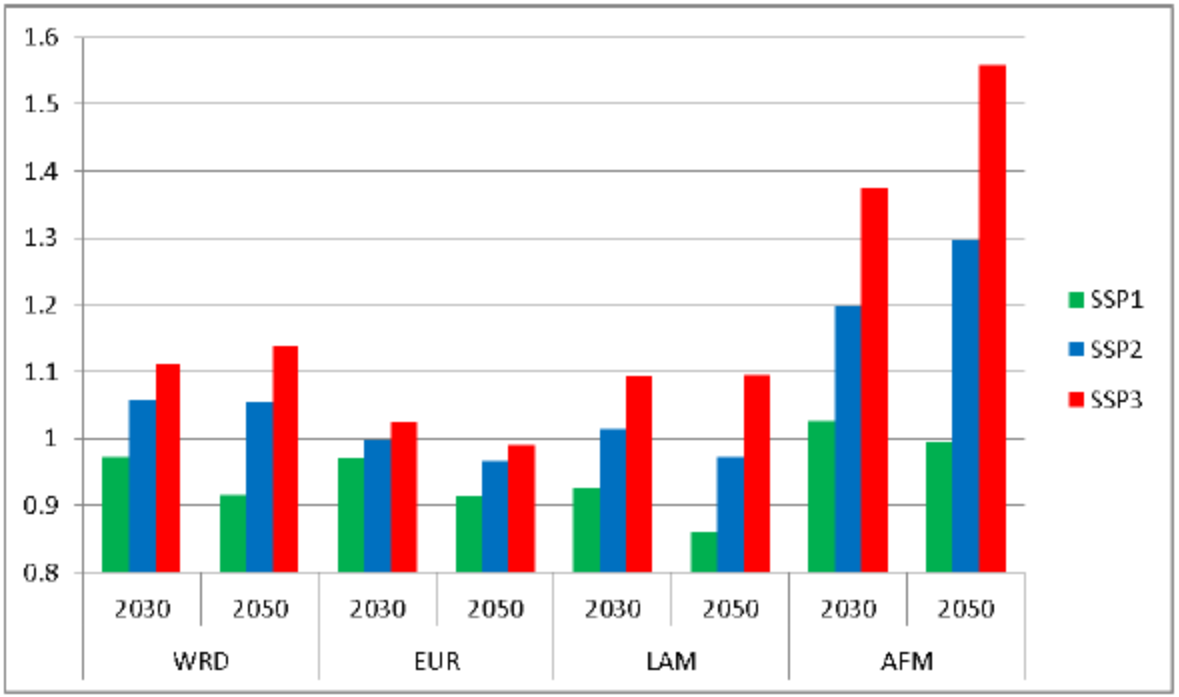
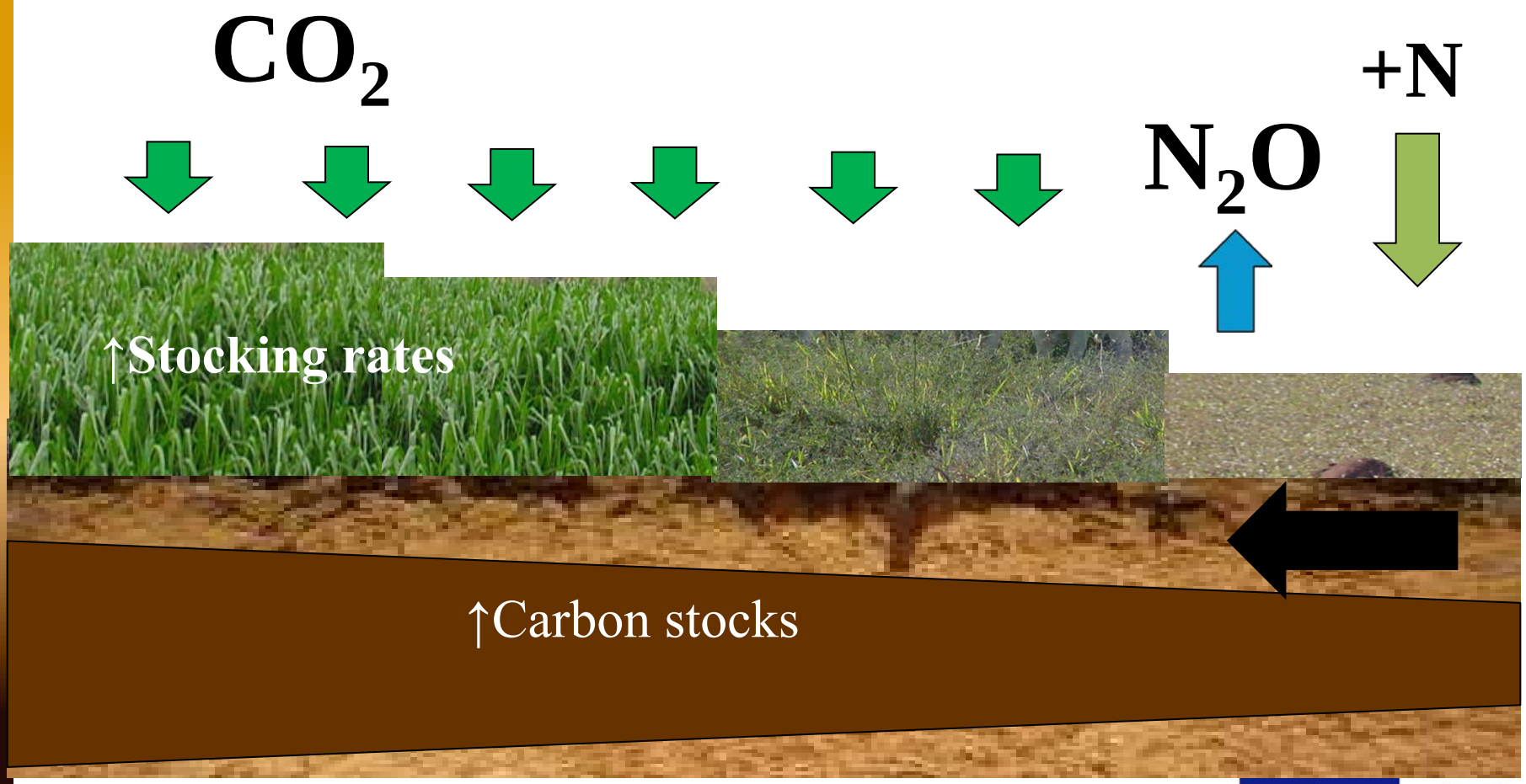
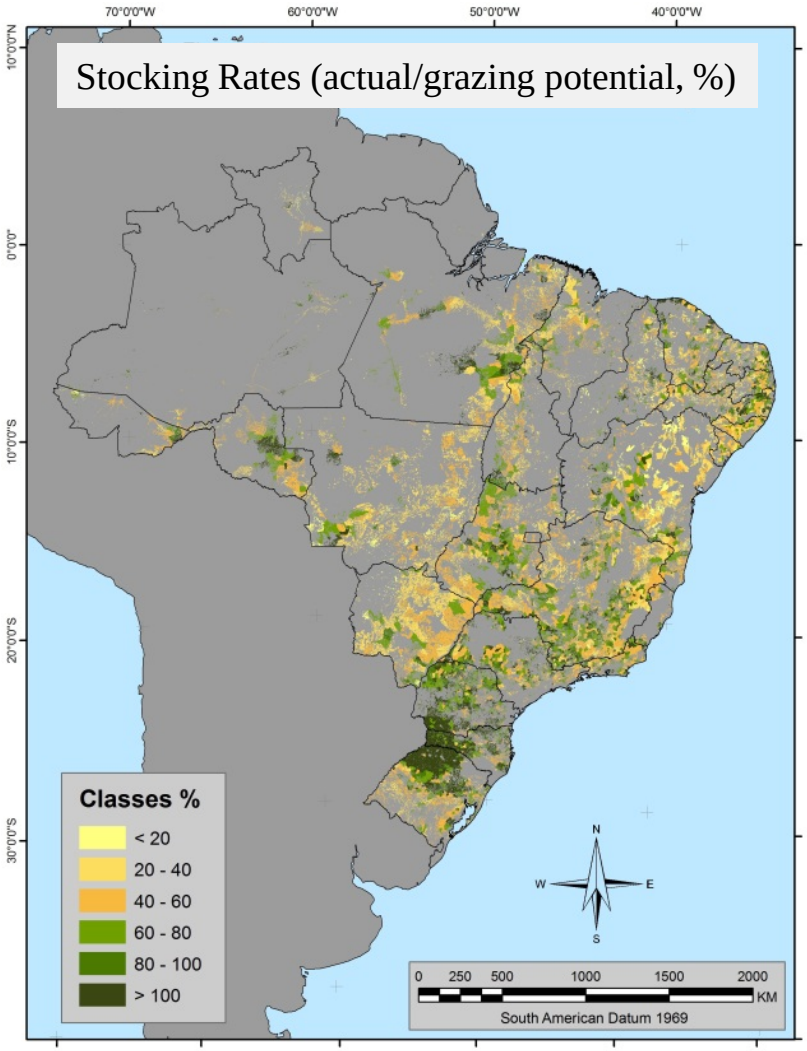


Figure 19: Livestock product price index compared (2000 = 1).

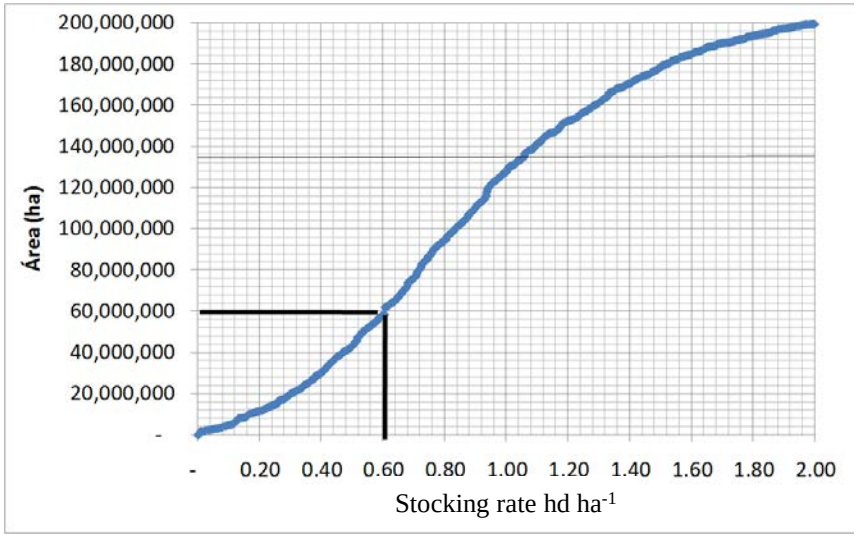
Tropical pasture intensification: Soil Carbon Dynamics and Nitrogen impacts



WP6 – Evaluating pasture intensification

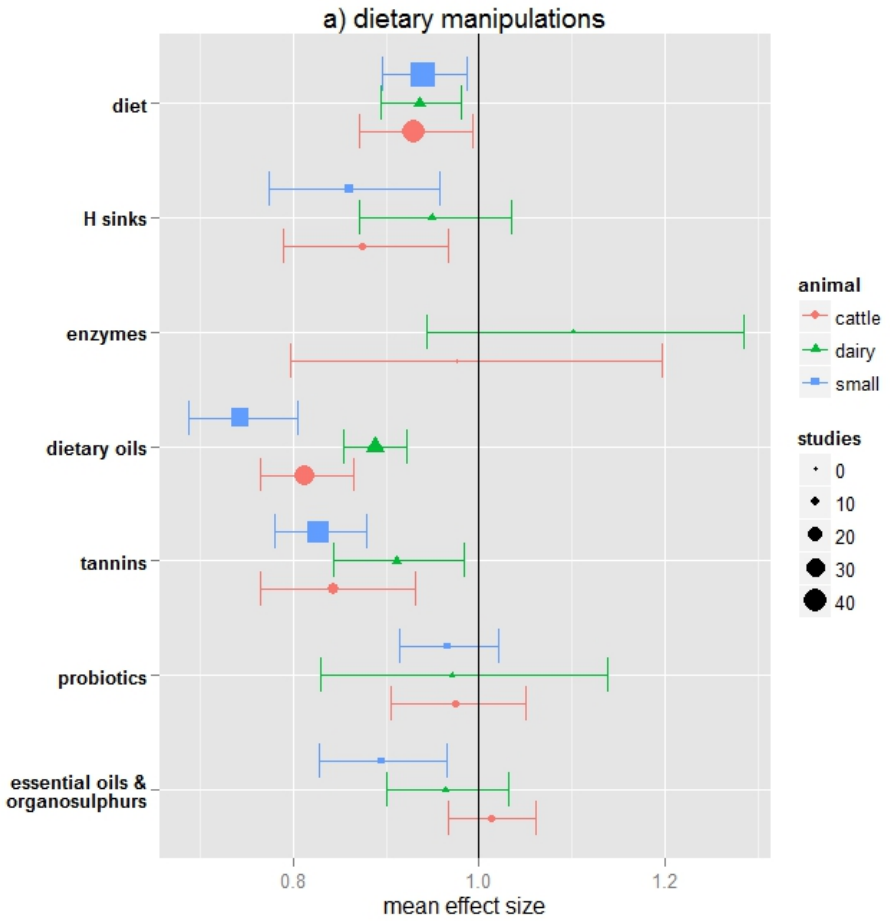


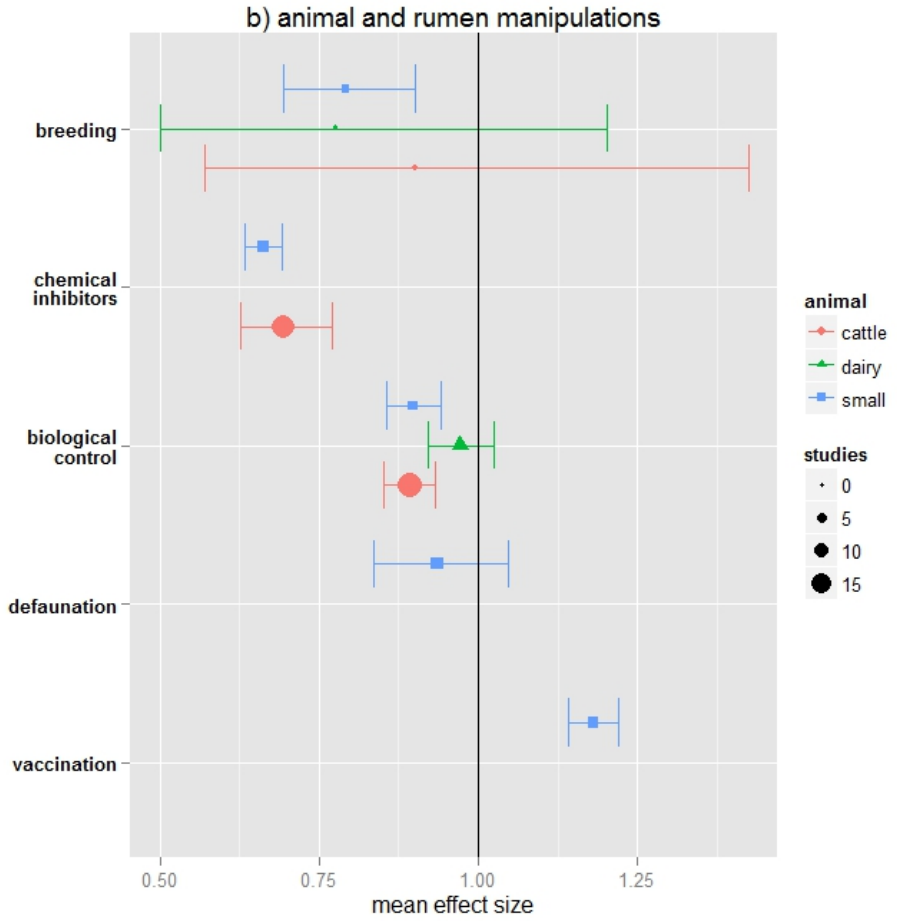
Are there enough low productivity grasslands suitable for improvement?



C sequestration and CH_4 are key issues

Average and range of responses in GHG Meta Analysis



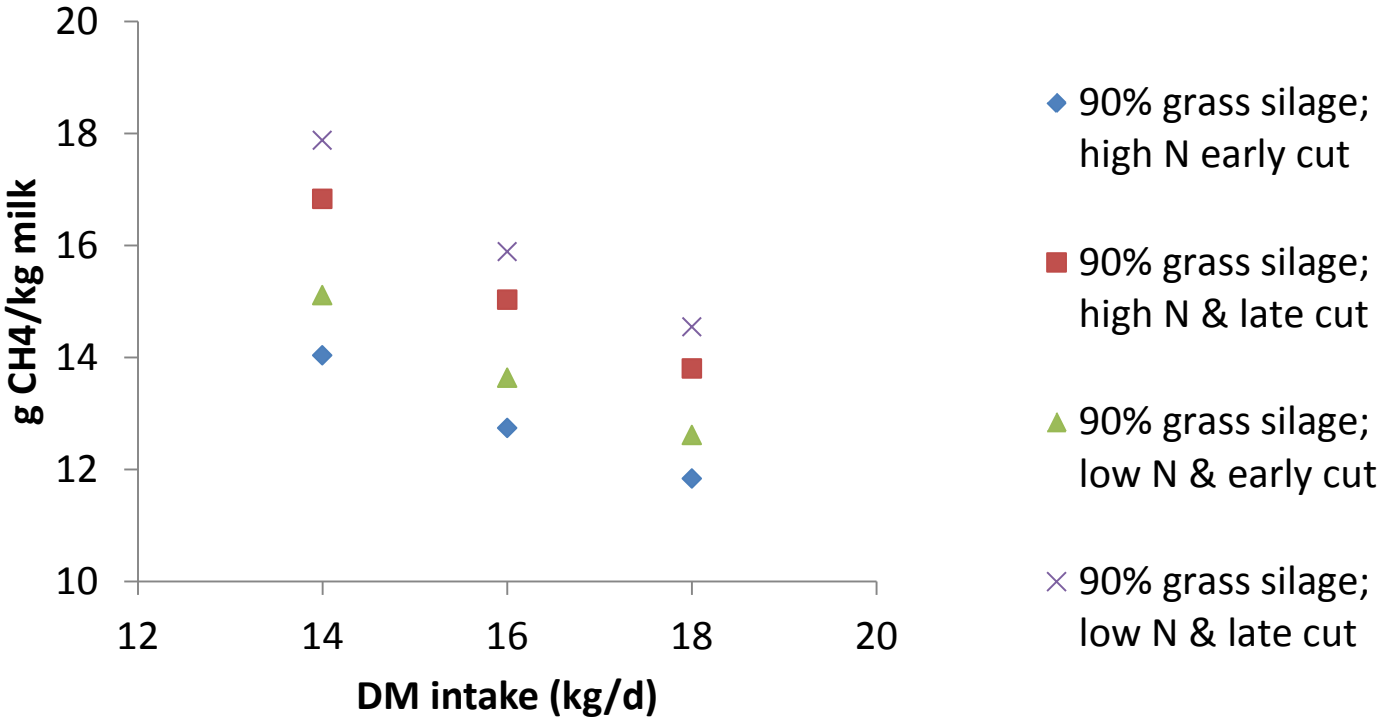


Enteric CH_4 in g/kg milk

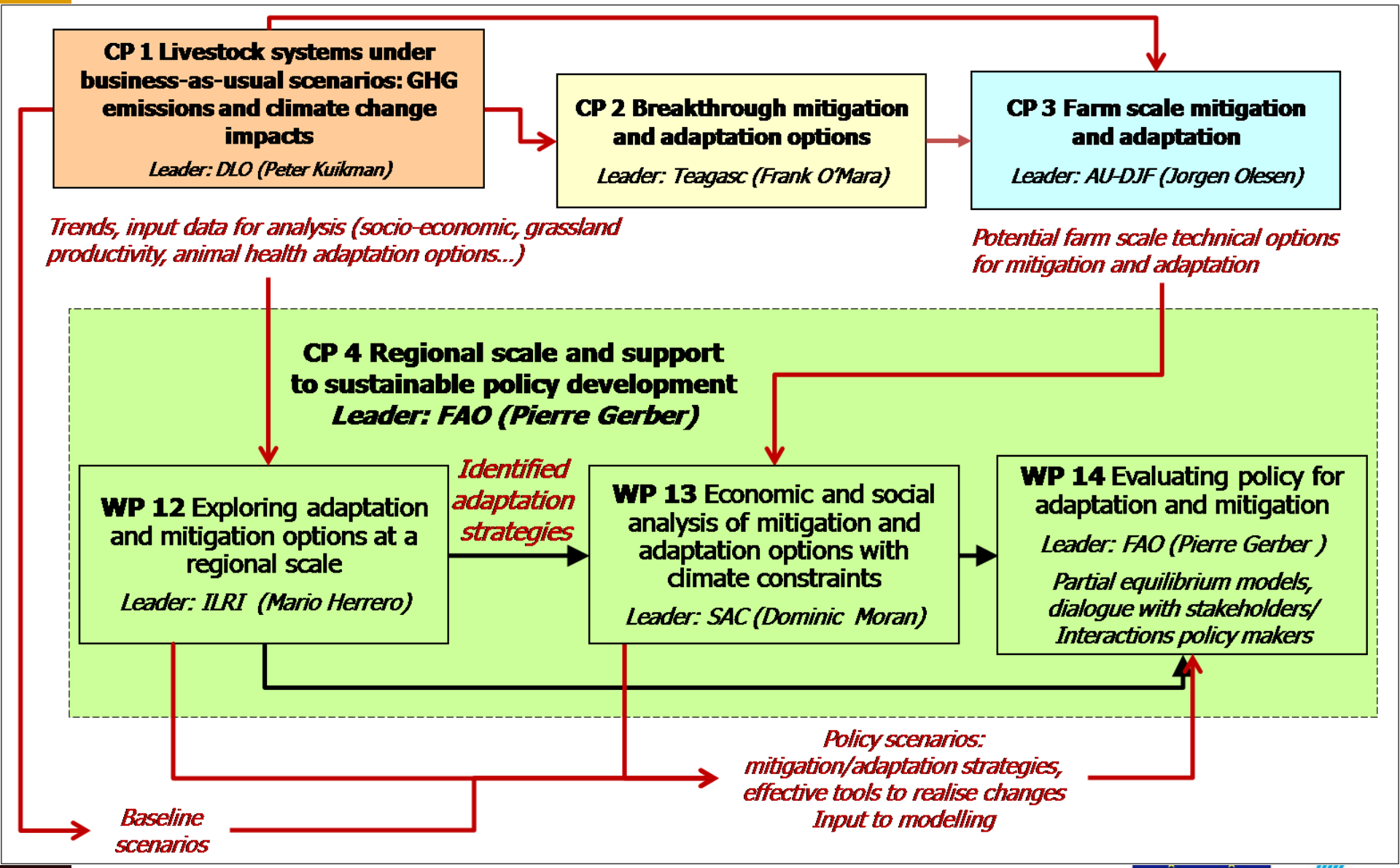
Effect extremes in grass silage qualities

90% grass silage in dietary DM

25% less CH_4 with high N & early cut vs. low N & late cut



CP4 in AnimalChange



CP4 is guided by a policy committee

- 2 meetings per year
- One with sessions with stakeholder platform members (incl IMS) - next October 30th