



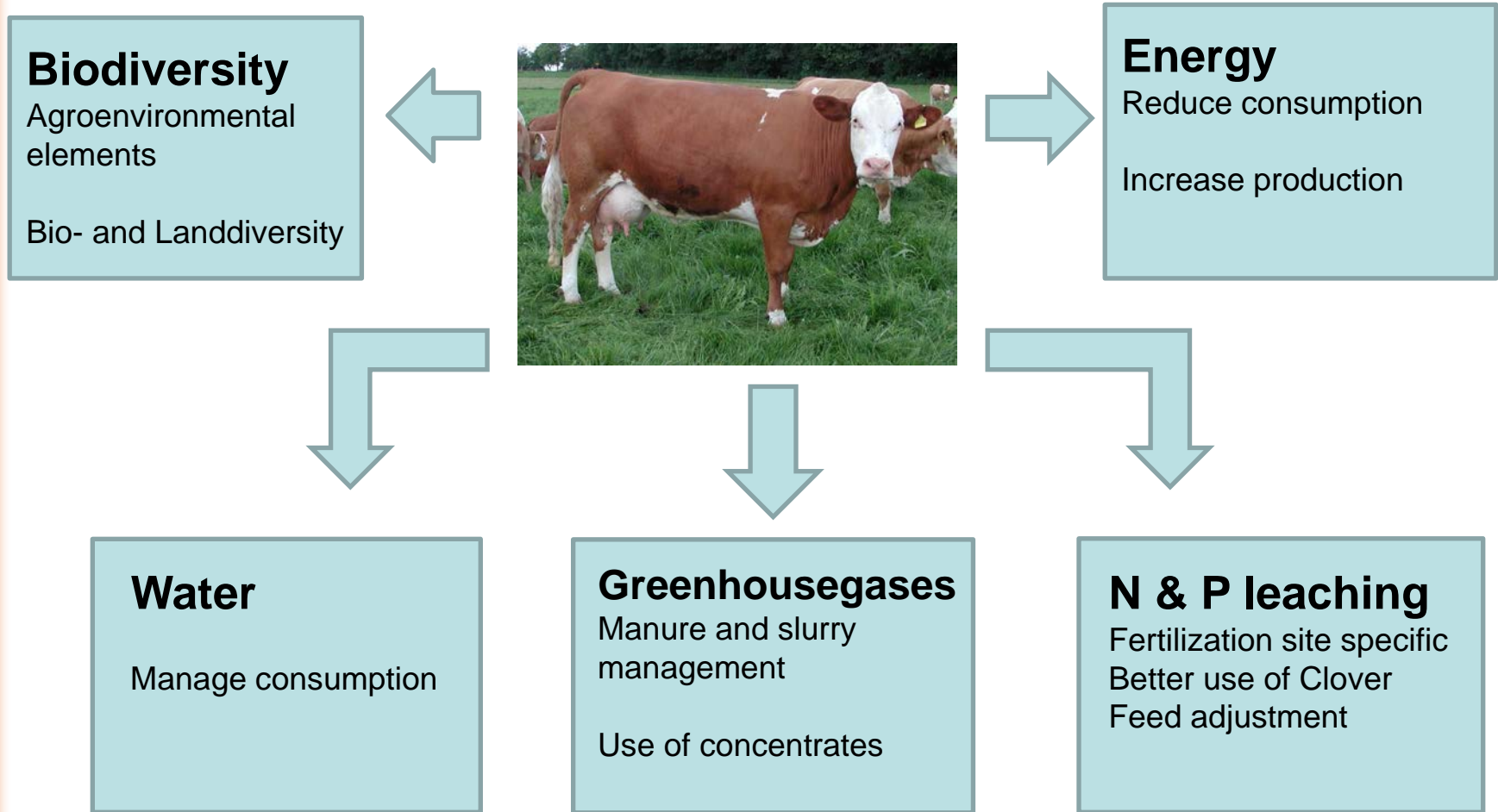
Environmental effects of dairy farming

- focusing the results of the EU-Dairyman project



Elsaesser, M. and T. Jilg, LAZBW Aulendorf (D)
Oenema, J., Wageningen UR (NL)

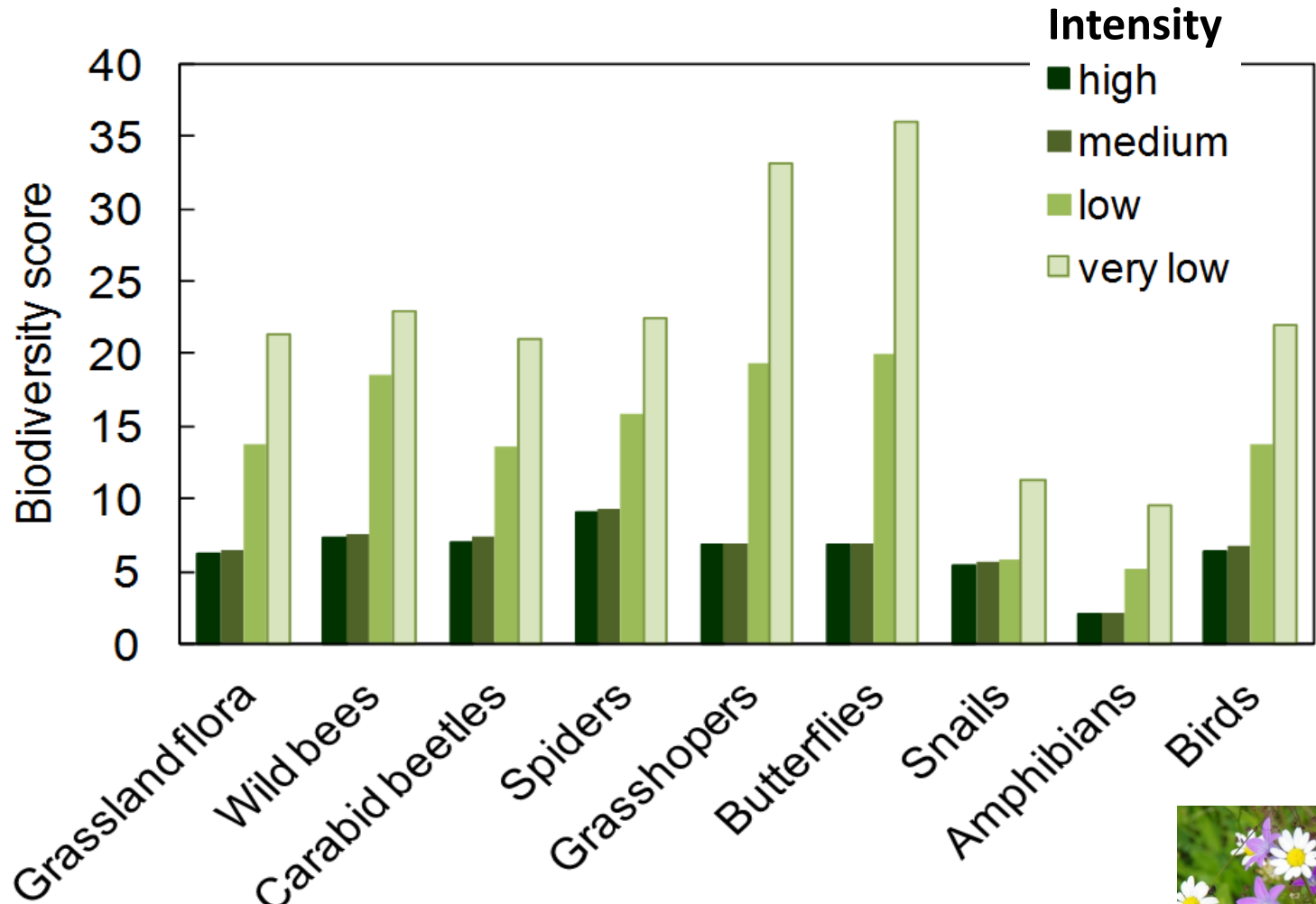
Dairy farming affects the environment



Livestock environment interactions are often diffuse and indirect and damage occurs at both the high and the low end of the intensity spectrum.

As an example: **Biodiversity**

Biodiversity is dependent of intensity in grassland systems (Results from SALCA-Biodiversity)



Huguenin-Elie et al., 2012

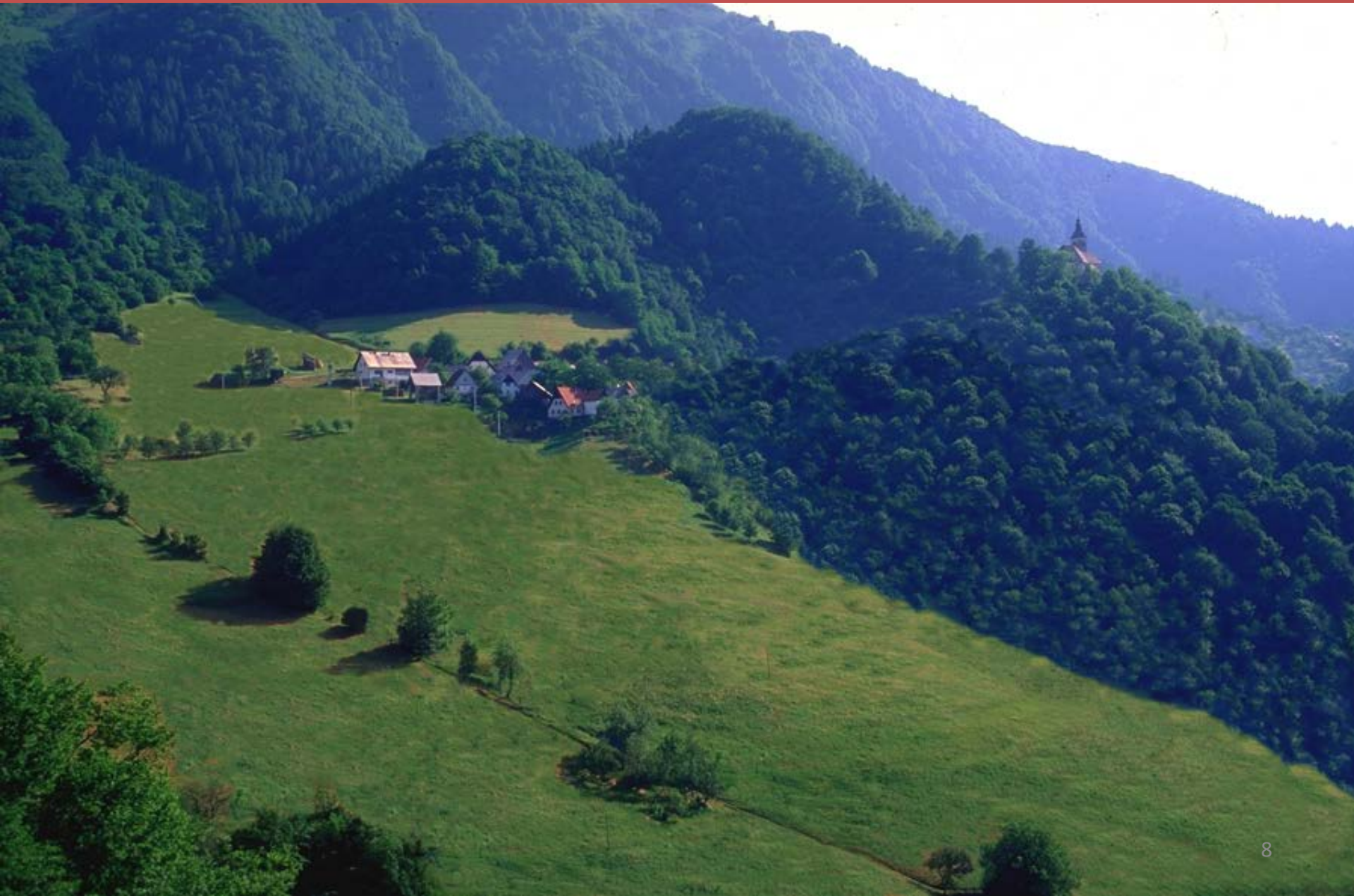


Dairyfarming determines landscape



Simulation of the Development of a Slovenian Mountain Landscape: (2) Meadow Landscape

© A.Kucan & T.Simonic, Ljubljana



An aerial photograph of a Slovenian mountain landscape. The scene is dominated by dense, lush green forests covering the hillsides. In the middle ground, a small village with several white houses and red-tiled roofs is situated on a grassy slope. To the right, a church with a prominent steeple is visible on a higher ridge. The background shows more forested mountains under a clear sky.

Decline of biodiversity if dairy farming disappears

The main questions are:

Can we realize nutrition maintenance for an increasing population with a production which takes care of the natural resources?

Sustainability – is it possible?

An answer can be:

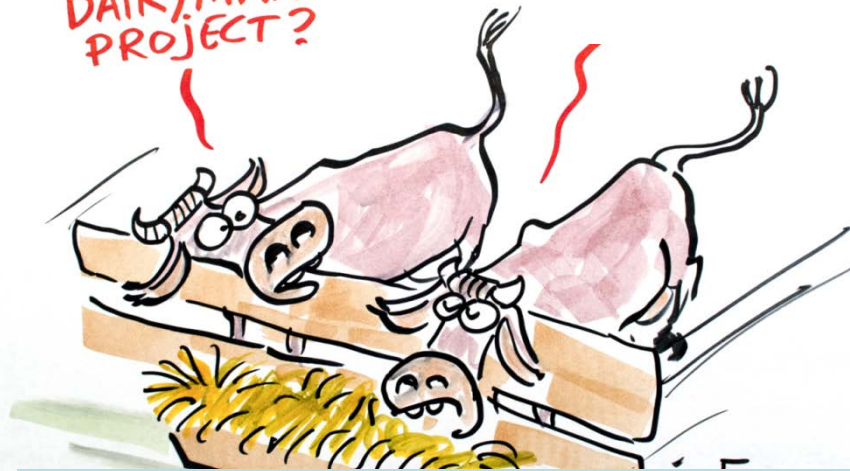
We have to use natural resources with higher efficiency!

There is a **lack of knowledge** and a **need to evaluate the existing dairy farming practices** under regard, that the standards required to protect the environment vary between countries and regions



Dairyman Project

HAVE YOU EVER
HEARD OF THE
DAIRYMAN
PROJECT?



**EU-Interreg IVb North
WestEurope**

Dec. 2009 – Aug. 2013

**Objective of Dairyman:
Definition, measurement and
improvement of the conditions of
sustainable dairy farming in NWE**

Participating Regions

7 countries, 14 partners

NorthWestEurope

Northern Ireland

The Netherlands

Ireland

Flanders

Nord-Pas-de Calais

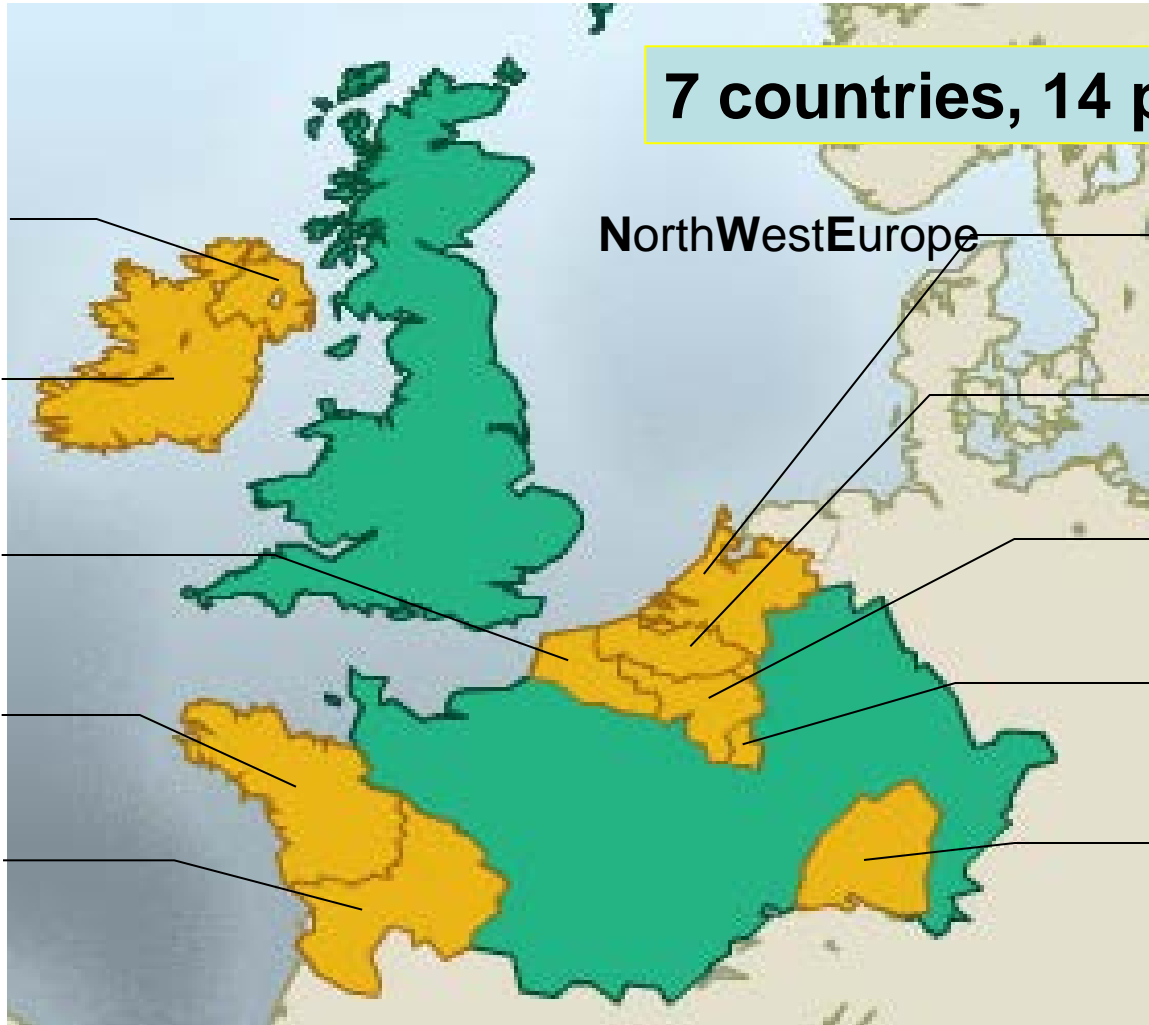
Wallonia

Bretagne

Luxemburg

Pays de la Loire

Ge: Baden-Württemberg

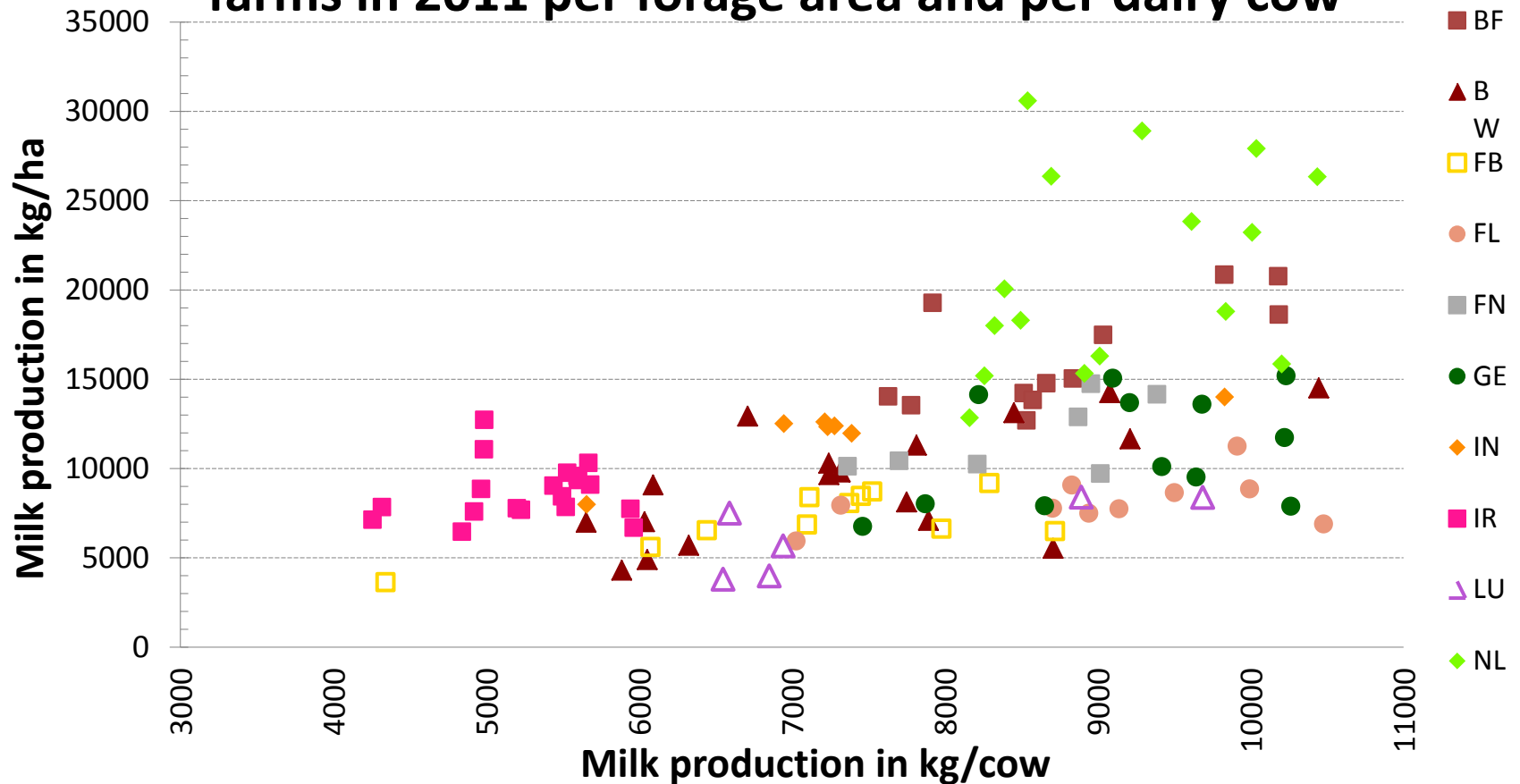


We installed a Pilot Farm Network in Dairyman

- 127 Dairy farms in NWE
- Data collection from 2009 – 2012 after consistent rules should allow comparisons between regions in economy, ecology and social aspects

Pilot farm characteristics

Annual milk production in the Dairyman pilot farms in 2011 per forage area and per dairy cow



Realisation in the network:

The environmental indicators are not of the same relevance in all regions!

Environmental Priorities in the Dairyman regions

| | BF | BW | FB | FL | FN | GE | IN | IR | LU | NL |
|----------------------|----|----|----|----|----|----|----|----|----|----|
| Air quality | | | | | | | | | | |
| ammonia | 4 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 5 |
| GHG | 4 | 5 | 3 | 3 | 1 | 2 | 5 | 5 | 2 | 3 |
| Water quality | | | | | | | | | | |
| Nitrate | 5 | 5 | 5 | 4 | 4 | 3 | 2 | 1 | 4 | 3 |
| Phosphorus | 4 | 2 | 3 | 2 | 1 | 2 | 5 | 3 | 3 | 5 |
| Pesticides | 3 | 4 | 4 | 4 | 3 | 1 | 1 | 1 | 2 | 3 |
| Soil quality | | | | | | | | | | |
| Erosion | 3 | 3 | 2 | 1 | 5 | 2 | 1 | 1 | 3 | 1 |
| Fertility | 3 | 4 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 |
| Biodiversity | 2 | 3 | 3 | 4 | 3 | 4 | 3 | 1 | 4 | 2 |

Index: 5 = very high relevance; 1 = low relevance

Critical points of environmental aspects

| | Energy demand | | Global warming pot. | | Eutrophication pot. | | Terr. Ecotoxicity | |
|------------------------|---------------|----------|---------------------|----------|---------------------|----------|-------------------|----------|
| | Mean | St. dev. | Mean | St. dev. | Mean | St. dev. | Mean | St. dev. |
| Buildings, equipment | | | | | | | | |
| Machines | | | | | | | | |
| Energy carriers | | | | | | | | |
| Fertilisers/ nutrients | | | | | | | | |
| Pesticides | | | | | | | | |
| Purchase of feedstuffs | | | | | | | | |
| Purchase of animals | | | | | | | | |
| Animal emissions | | | | | | | | |
| Other inputs | | | | | | | | |

(After Baumgartner et al., 2011)

Presented by O. Huguenin-Elie, T. Nemecek, S. Plantureux, P. Jeanneret and A. Lüscher, EGF Lublin, 2012

1. Balancing minerals

(farmgate balances)

Input

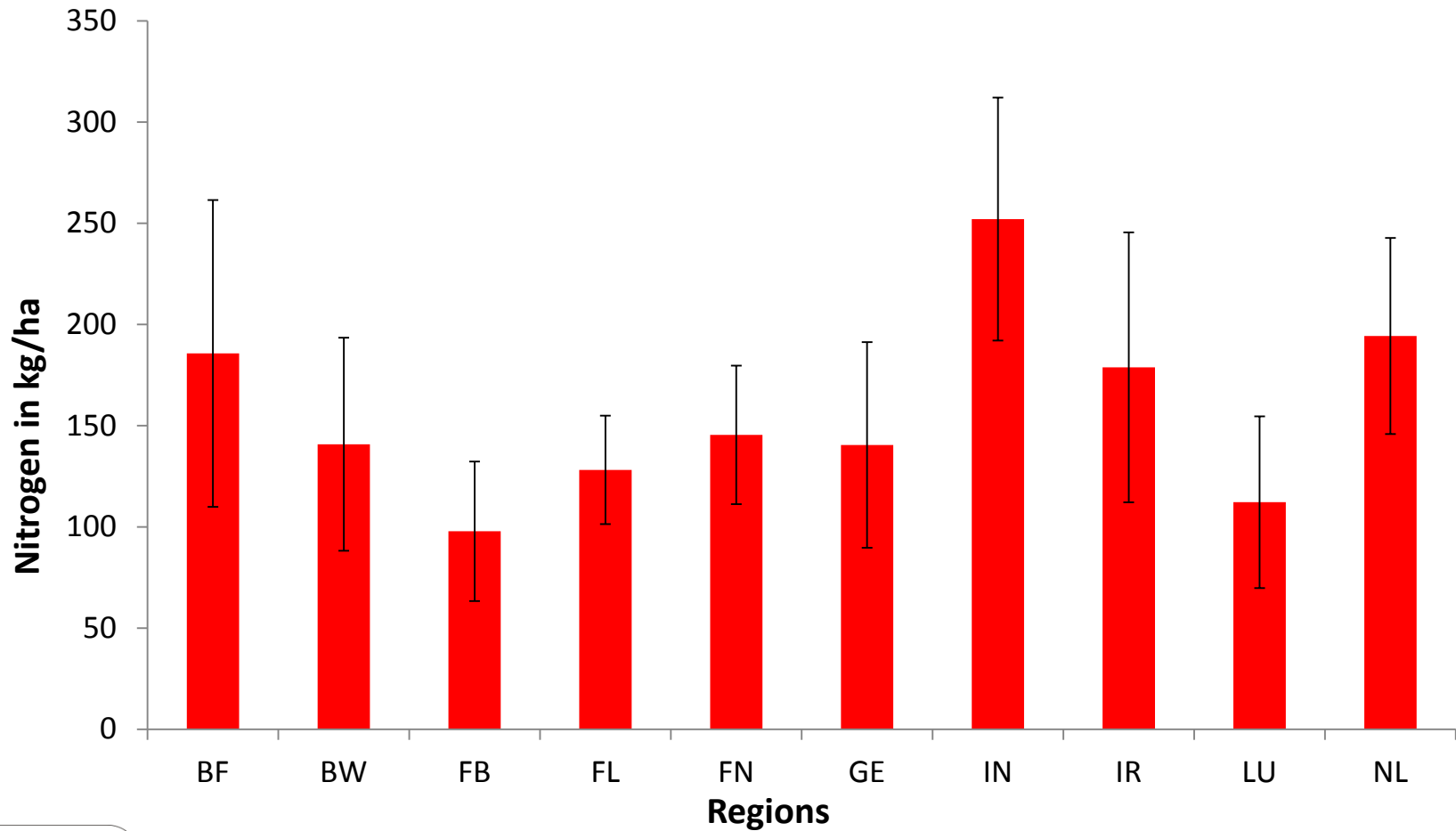
- Concentrate feed
- Roughage feed
- Mineral fertilizer
- Organic fertilizer
- Fixation legumes
- Atmospheric deposition

Output

- Milk
- Animals (meat)
- Organic manure
- Plant products

Balance: input – output = surplus

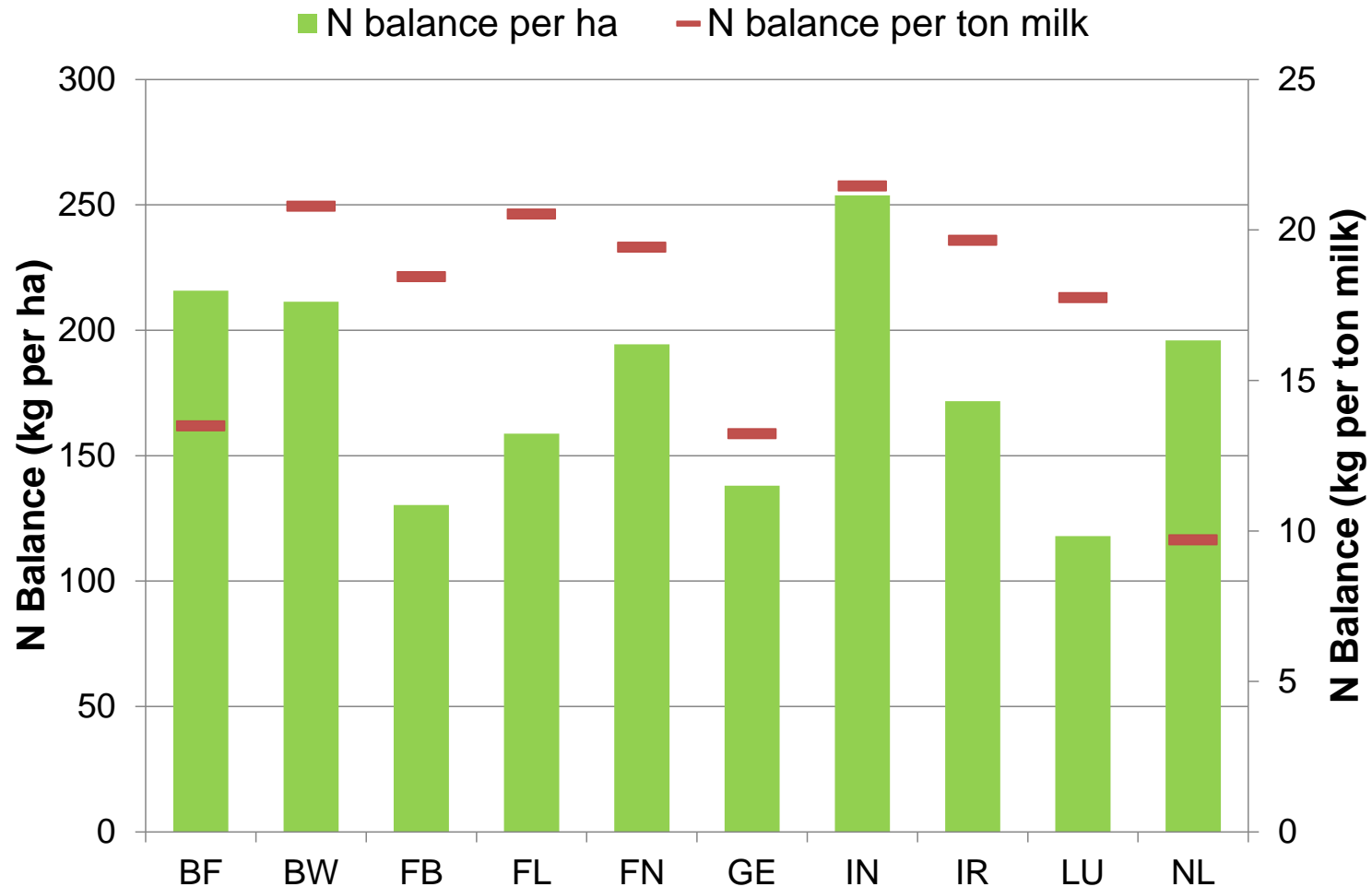
Pilot farms – Nitrogen Balance kg/ha (average 2009 – 2011)



What does this mean for the sustainability of dairy farming in a region?

- Are the values high?
- or are they too high?
- Are they not to avoid?
- Do we have the right references?

Nitrogen: Balance per ha and balance per ton milk

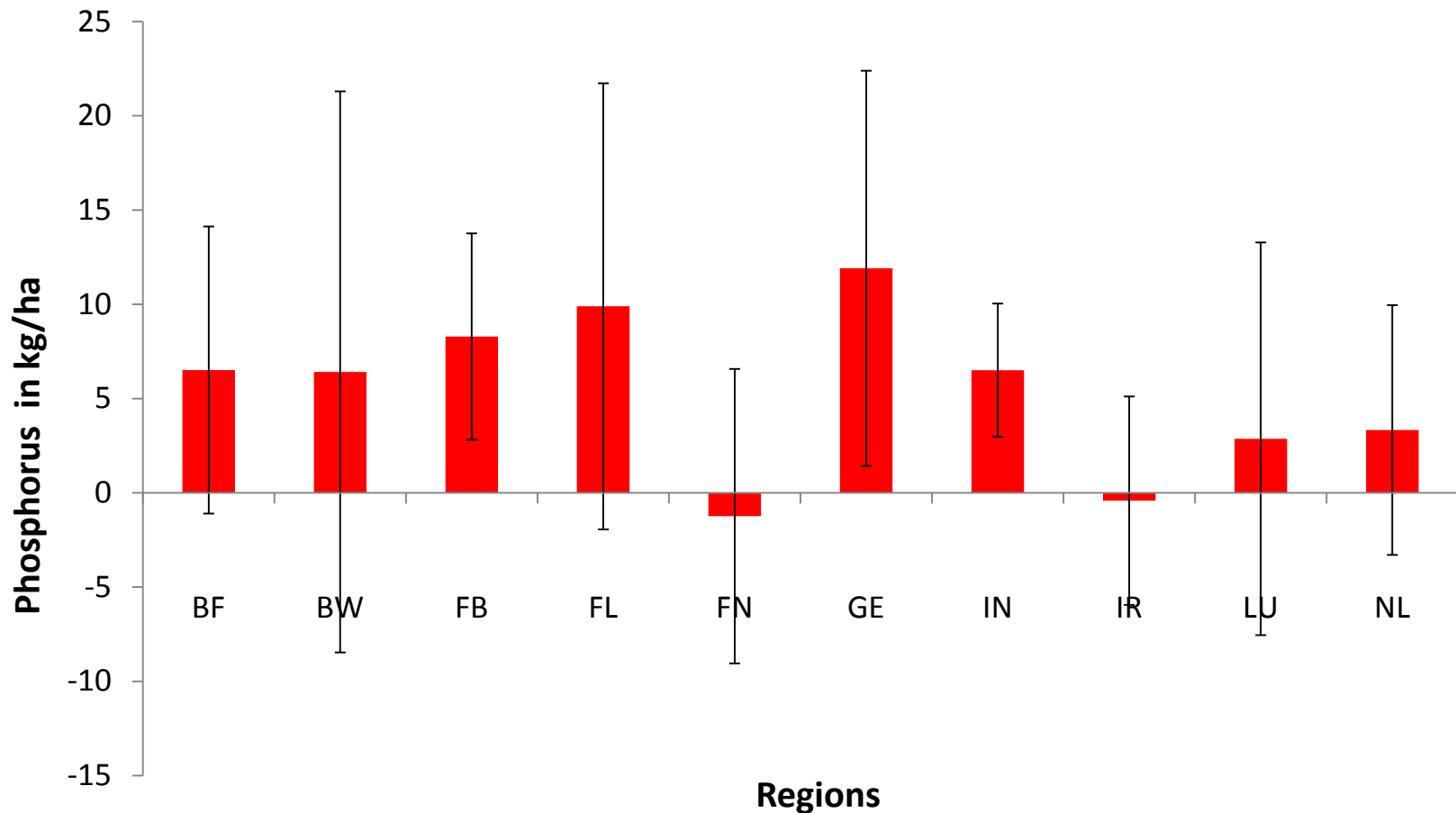


Oenema et al., 2012

www.interregdairyman.eu

Pilot farms – Phosphorus Balance kg/ha

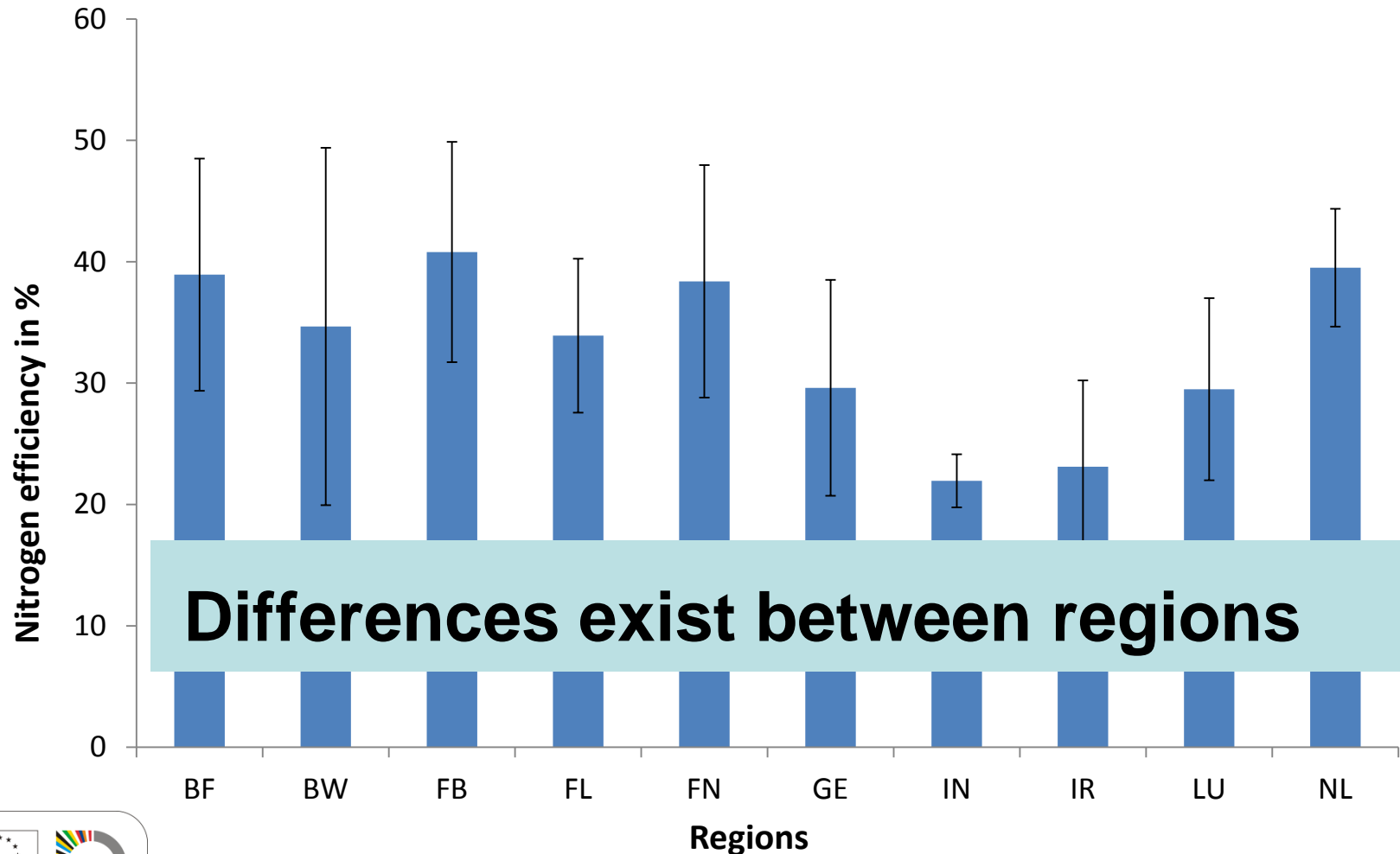
(Average 2009 – 2011)



2. We have to look at the efficiency of resource use

Efficiency is calculated as relation of nitrogen output (plants, milk, meat) to total nitrogen input

Pilot farms – Nitrogen Efficiency (average 2009 - 2011)



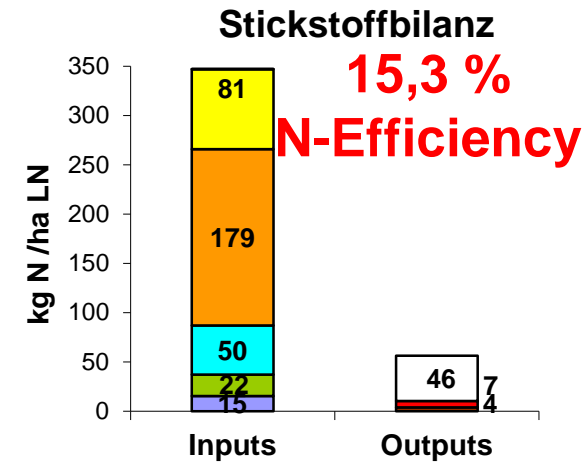
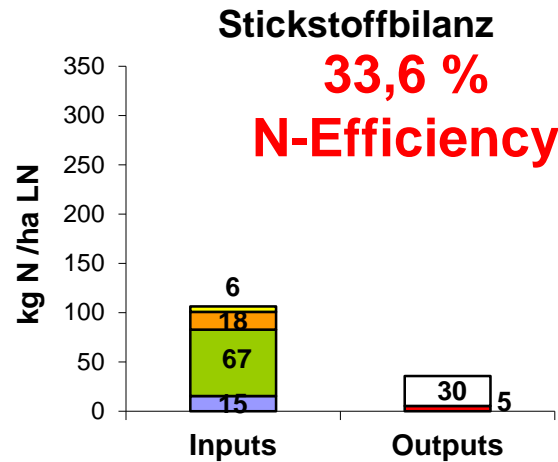
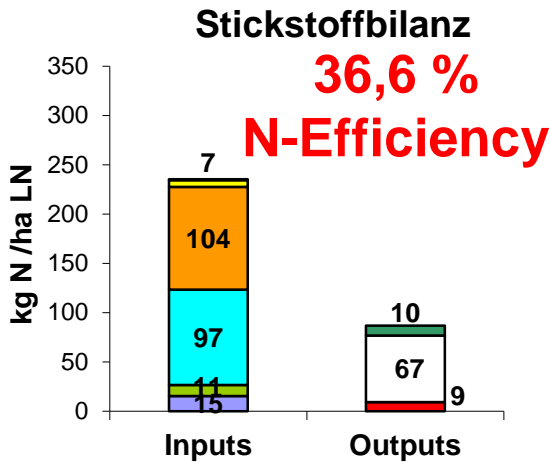
Differences exist between farms in regions

(Region: Baden-Württemberg, 2008/09)

Farm A: 148 kg N/ha

Farm B: 70 kg N/ha

Farm C: 290 kg N/ha



N-delivery from manure after EU-Nitrate directive

Animal manure

169 kg

Animal manure

132 kg

Animal manure

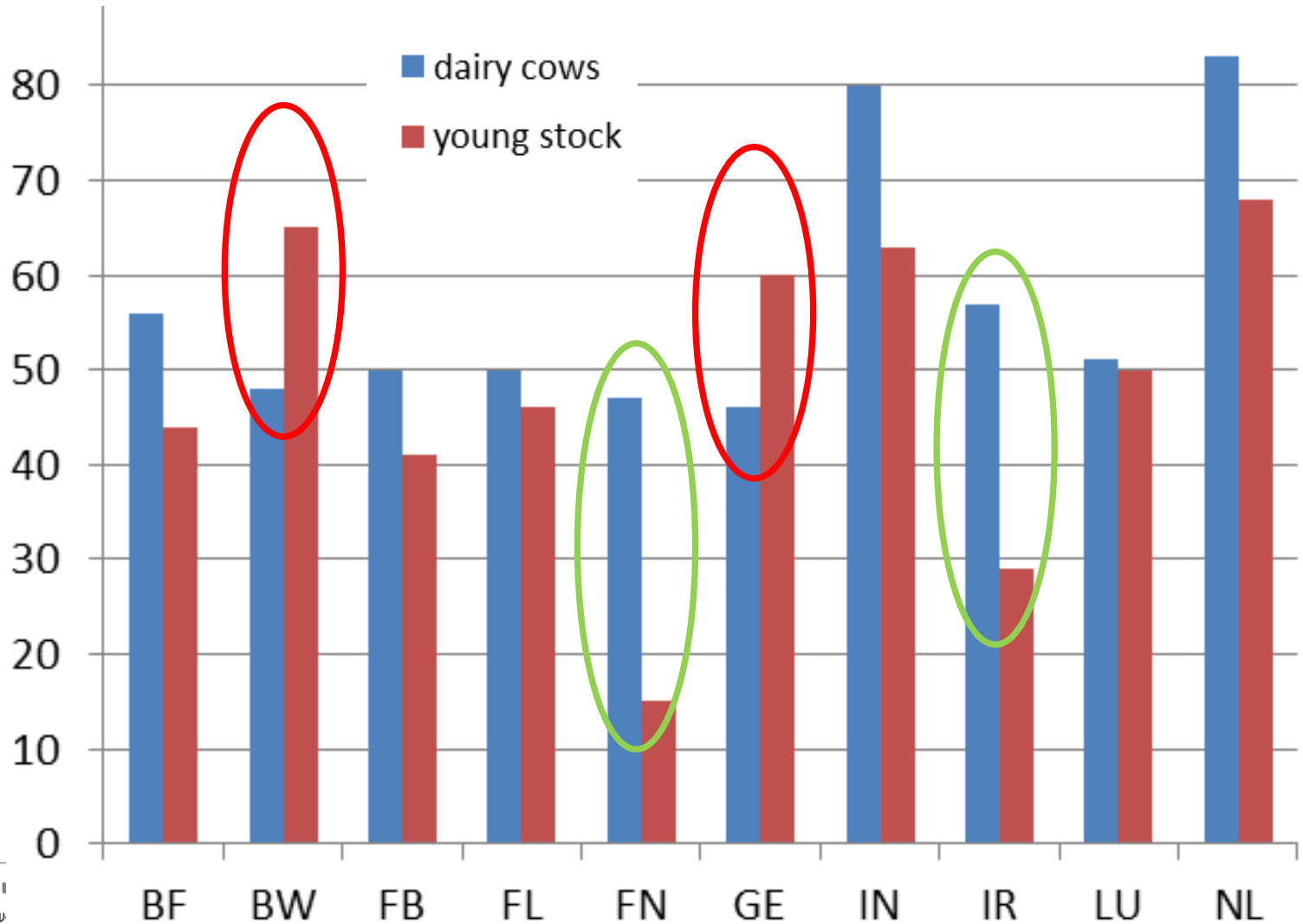
168 kg

Increase of N-efficiency?

Reduce Input / Increase Output:

- Reduction of young stock
- Export of farm yard manures
- Suitable fertilizer use
- Reduction of purchased concentrates (e.g. more cultivation of homegrown protein plants)
- Formulation of diets acc. to real analysed nutrient contents
- Milk production, manure, crops

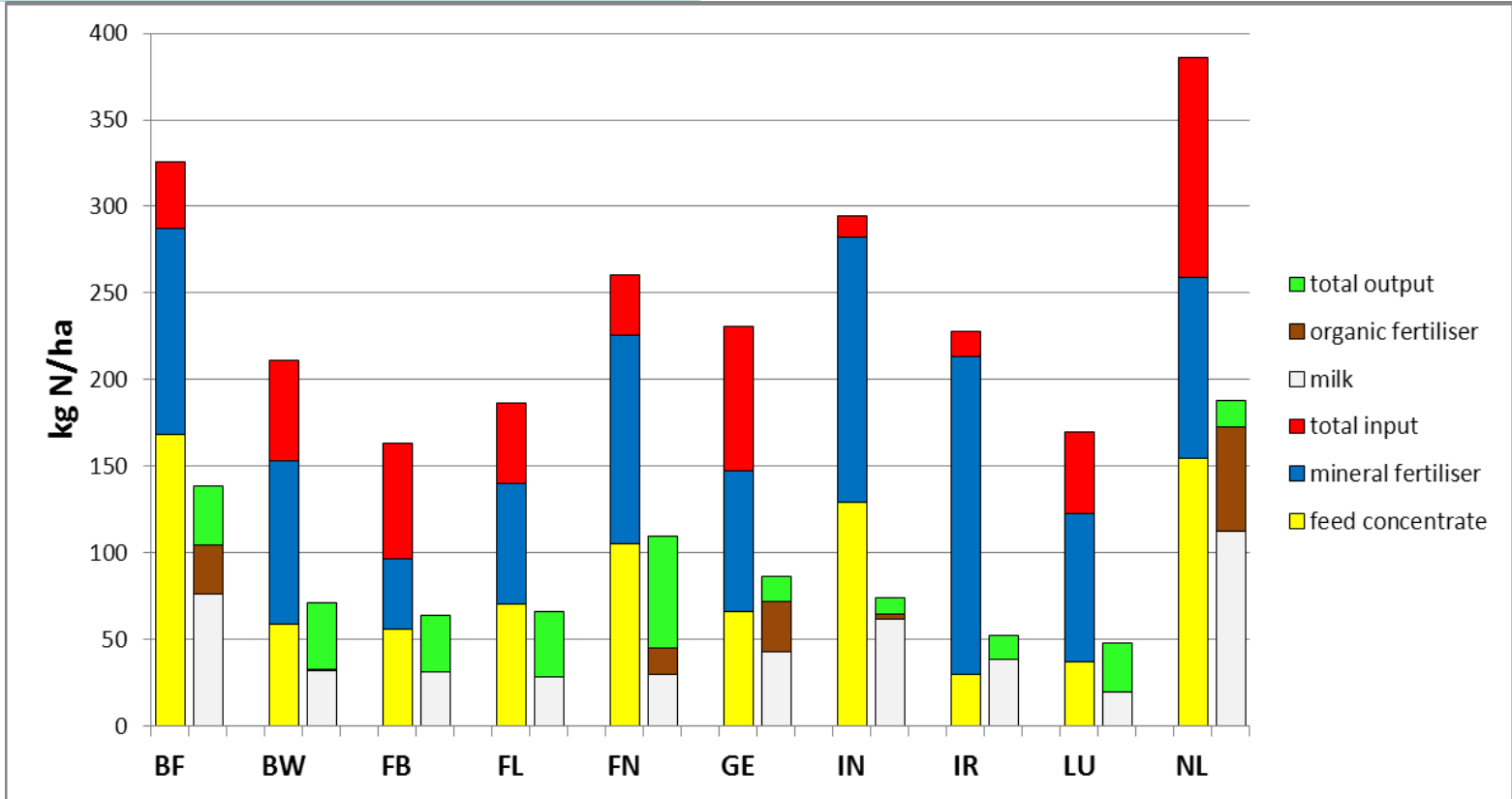
Average herd size of dairy-farms



Nitrogen Balance in the Dairyman pilot farms (Average 2009 – 2011)

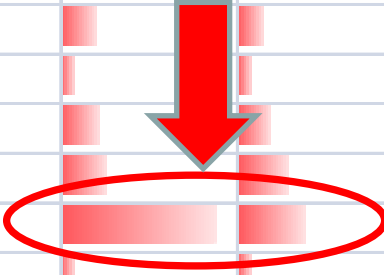


N input and output



Critical points of environmental aspects

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| Animal emissions | | | | | | | | |
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After Baumgartner et al. 2011

Presented by O. Huguenin-Elie, T. Nemecek, S. Plantureux, P. Jeanneret and A. Lüscher, EGF Lublin, 2012

3. Green House Gases (GHG):

On farm emissions

- CH₄ from animal and manure
- N₂O from manure storage
- N₂O from application organic manures and chemical fertilizer, and of grazing excreta)
- N₂O and CO₂ from land use and land use change
- CO₂ from energy use

Off farm emissions (production and transport)

- Purchased chemical fertilizer
- Purchased feed

Pilot Farms - Greenhouse Gases

2006 IPCC Guidelines for National Greenhouse Gas Inventories

Methodology: IPPC 2006

<http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>

Volume 4



Volume 4 Agriculture, Forestry and Other Land Use

Two methods:

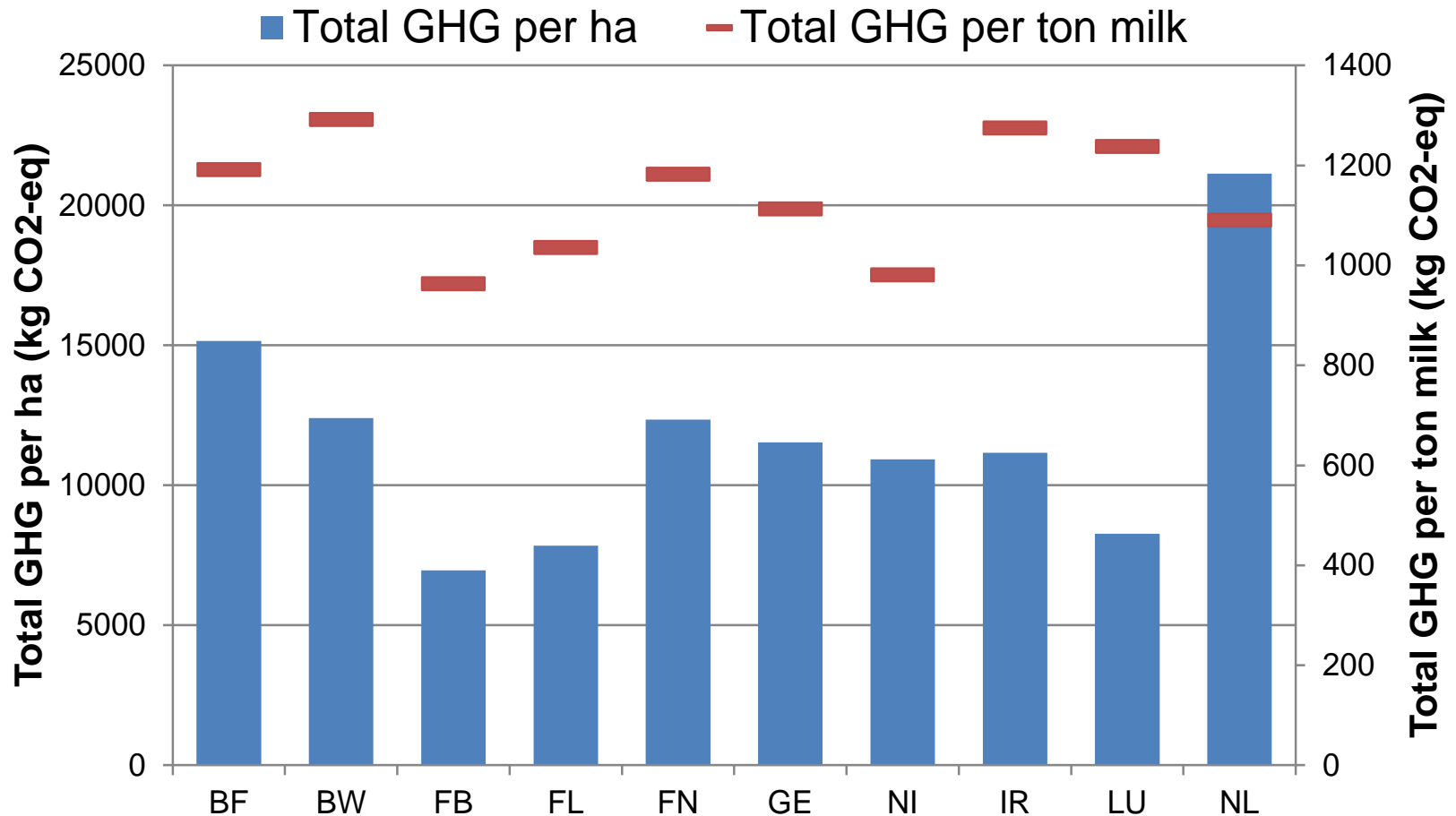
Tier 1 (very 'general'; fixed values)

Tier 2 (more 'country specific')

Transparent excel file

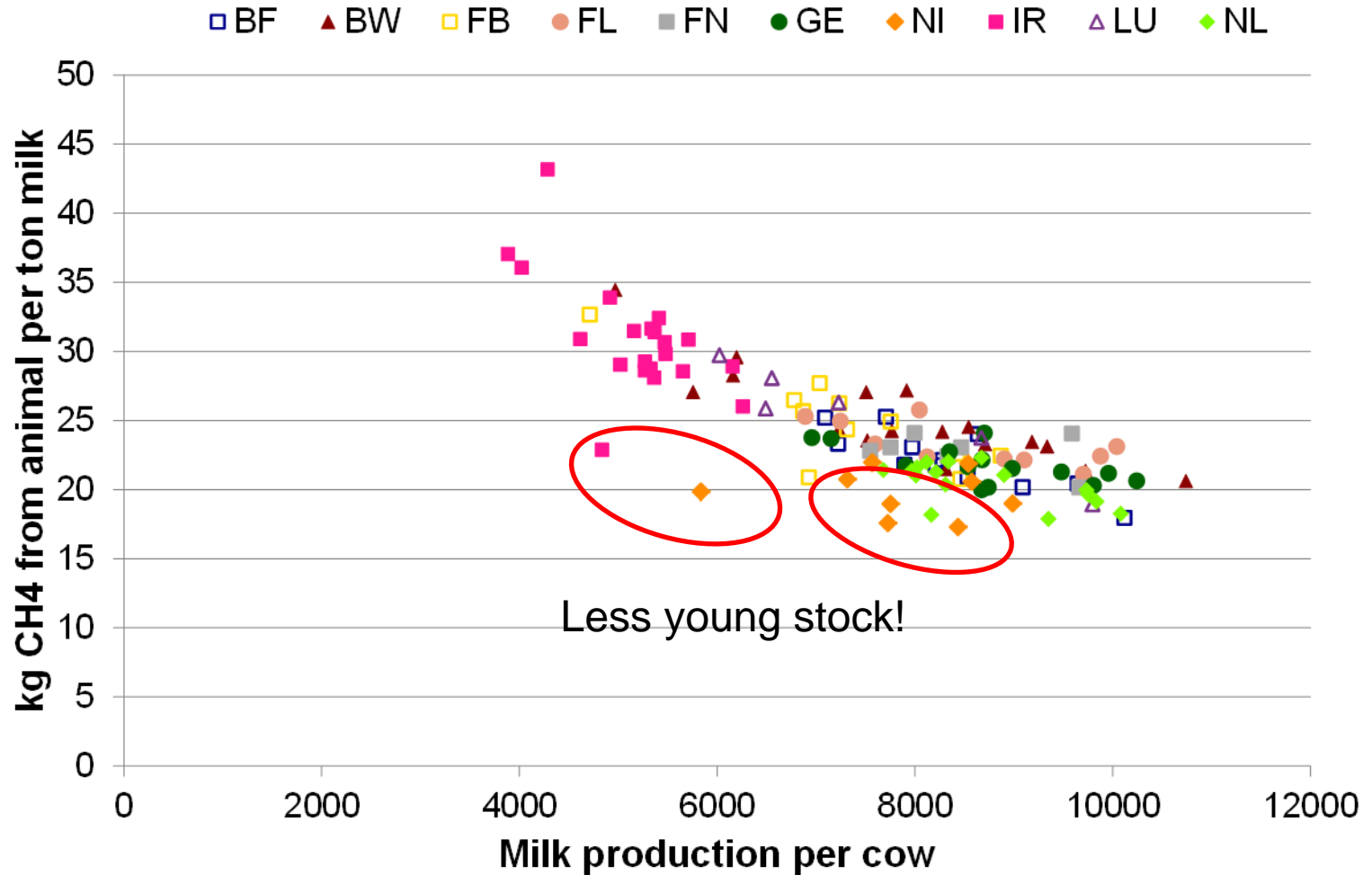
Needs input from a dairy farm

Total greenhouse gas emissions in pilot farms (2010) allocated to dairy component



Pilot farms – Methane emissions

Methane emissions in relation to the milk production per cow



4. How to reach improvements?

Farm development plan - Example

Pilotfarm Thomas Steele, Northern Ireland



Farm development plan of a pilotfarm



| | OBJECTIVES | ACTIONS | INDICATORS (UNITS) | TARGETS AND BASELINES | | | |
|----------------------------|------------------------------|--|---|-----------------------|------|--------|--------------------------|
| | | | | Target | 2010 | 2011 | Achieved |
| S O C I A L | More free time | <ul style="list-style-type: none"> Automation with increased IT utilization Contract out silage cutting and slurry spreading | <ul style="list-style-type: none"> Reduced work hours (hr/week) Increased vacation (days/year) | 60 | 66 | 63 ✓ | 50% |
| | | | | 20 | 15 | 17 ✓ | 50% |
| E C O | Enhanced income from farming | <ul style="list-style-type: none"> Avoiding feed wastage to low yielding cows Select sires with high £PLI, Fertility Index Installation of heat recovery system | <ul style="list-style-type: none"> Feed efficiency (Kg conc/l) Cow replacement rate (%) Energy use (kW/cow/yr) | 0.29 | 0.32 | 0.29 ✓ | 100% |
| | | | | 25 | 37 | 28.9 ✓ | 68% |
| | | | | 300 | 378 | 393 x | system not installed yet |
| E N V | Reduce CH4 emissions | <ul style="list-style-type: none"> Increase forage quality and digestibility Improved in-heat detection efficiency | <ul style="list-style-type: none"> Forage quality (ME) Calving interval (days) | 12-13 | 12.8 | 12.0 ✓ | 100% |
| | | | | 400 | 418 | 410 ✓ | 44% |

**Greenhouse
gases**

**Energy
consumption**

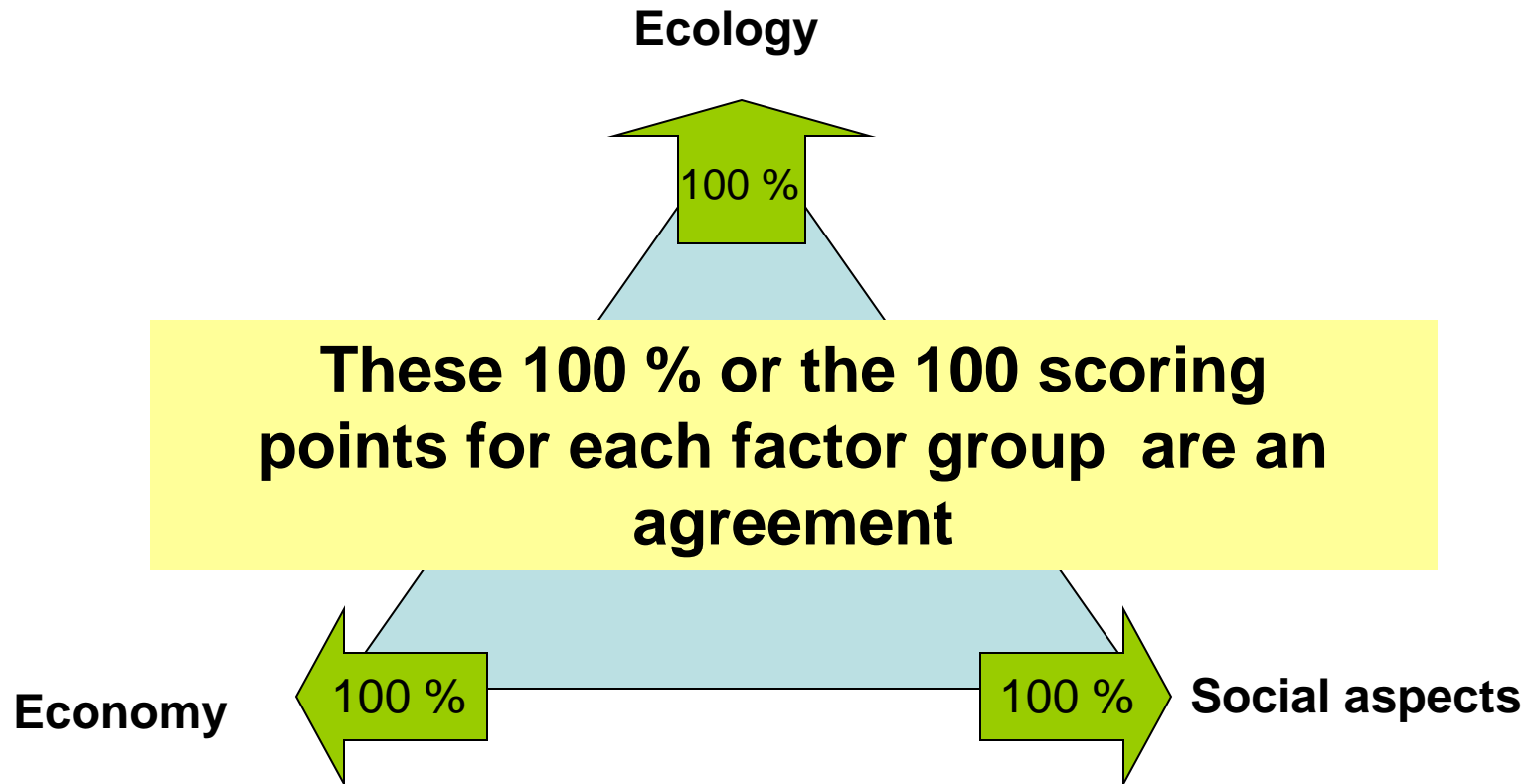
**Clean water and
air**

Biodiversity

**Don't look at single
indicators.
Environmental aspects
of dairy farming should
be looked at as a whole**



Development of farms as a whole – Dairyman Sustainability Index (DSI)



Indicators ...

... were validated by a group of Dairyman partners as a convention for the evaluation of pilot farms

... are selected as factors which are already collected

and:

the DSI-System is an integrative tool in order to compare the Dairyman pilot farms but it is not a tool measuring the „true and real sustainability“

DSI: Parameters and Scoring

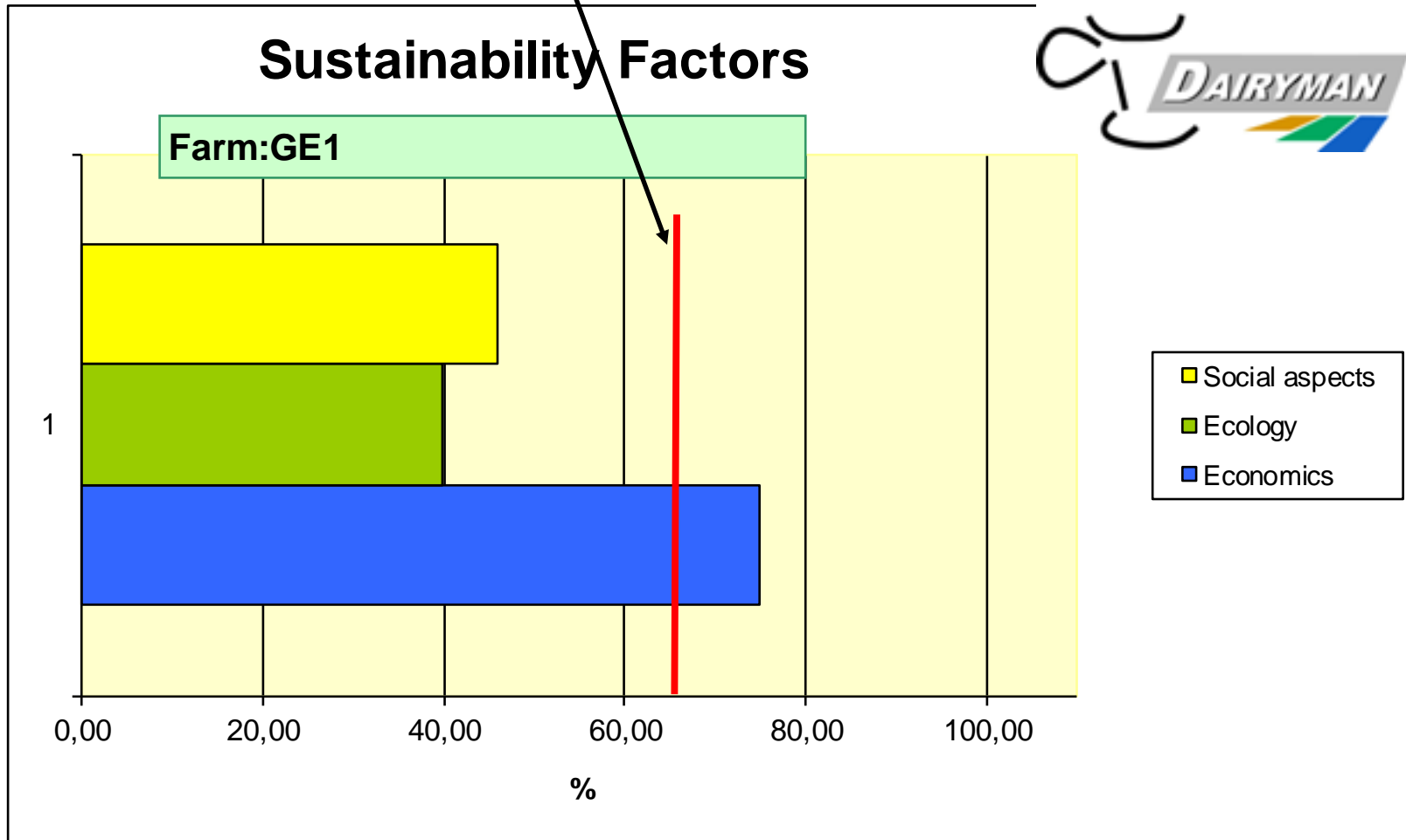
Economy

Ecology

Social aspects

| | | | | | |
|--------------------------------|-------------|---------------------|-------------|--------------------|-------------|
| Income/kg milk | 16% | N balance/ha | 15% | Education | 22% |
| Income/fLU | 34% | N balance/kg milk | 11% | Working conditions | 42% |
| Total farm income | 22% | N efficiency % | 13% | Continuity of farm | 16% |
| Dependency on subsidies | 10% | P balance/ha | 11% | Social role/image | 20% |
| Exposure to price fluctuations | 18% | P balance/kg milk | 8% | | |
| | | P efficiency % | 10% | | |
| | | Agri-env. pay./farm | 10% | | |
| | | GHG emissions | 22% | | |
| | | | | | |
| | 100% | | 100% | | 100% |

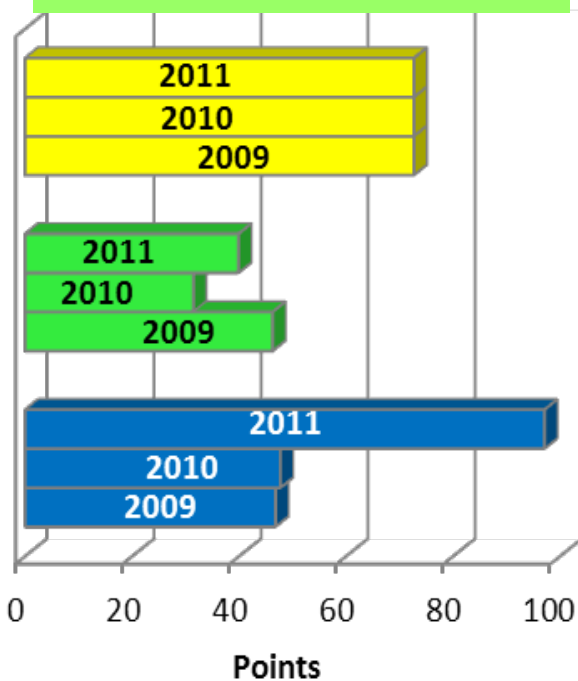
Target line (66% of implementation)



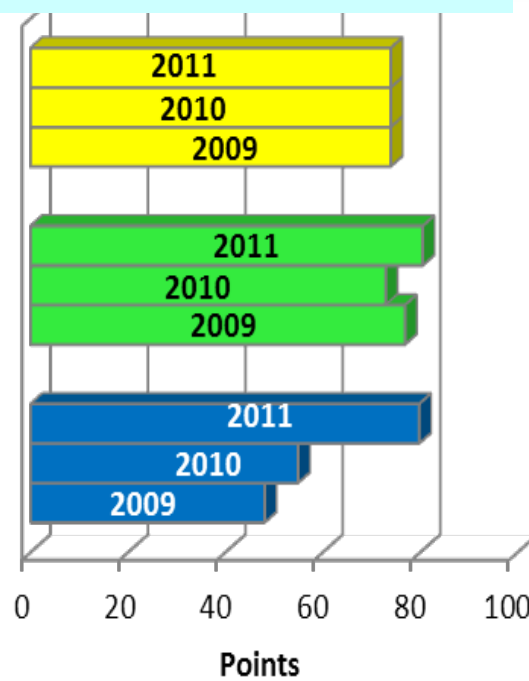
The DSI makes development of „sustainability“ visible on farm or regional scale



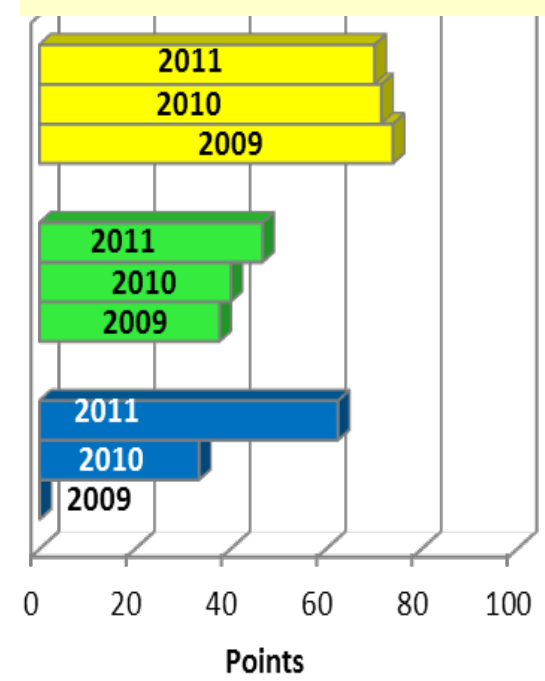
Farm A



Farm B



Farm C



Dairy farming can be more in line with the environment ...



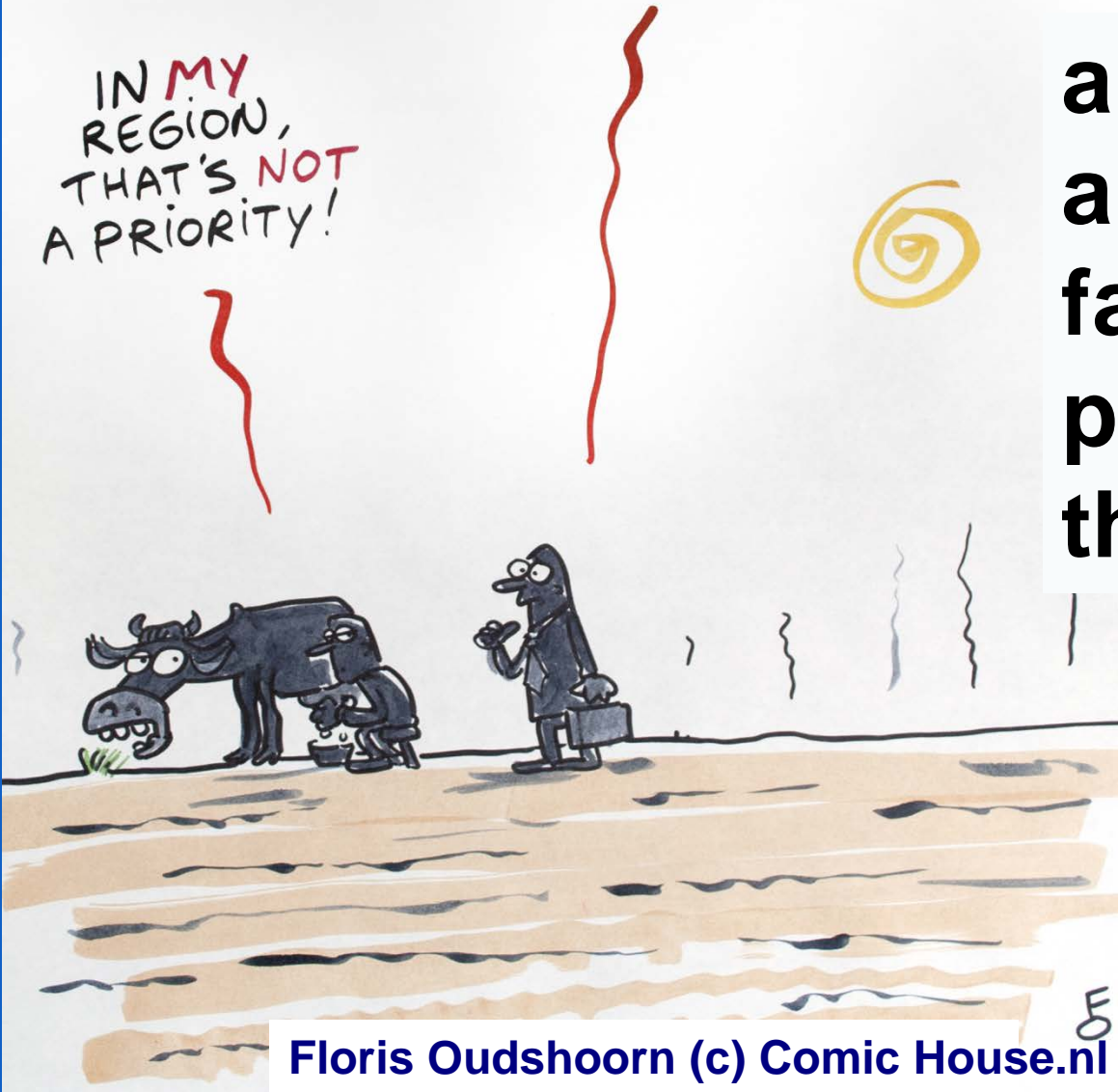
- If we use natural resources gently and more efficiently
- If the essential intensification can be realized under sustainability rules
- If we are able to use the existing variability in farm performances as a high potential for improvement for which individual development plans are needed
- If we evaluate environmental friendly measures in whole farm systems and under regard of regional conditions.

FROM AN ENVIRONMENTAL
POINT OF VIEW, YOUR DAIRY
FARM IS NOT **SUSTAINABLE!**



IN **MY**
REGION,
THAT'S **NOT**
A PRIORITY!

and if we are
able to change
farming
practices before
they change us.





Thank you for listening!

Thank you to EU Interreg IVb and Ministry of Ländlicher Raum Baden-Wuerttemberg for financial support



Thank you to all Dairyman partners

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