Environmental and Socioeconomic LCA of Milk in Canada

Presentation of Results

Dairy Farmers of Canada

Les Producteurs laitiers du Canada

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Section 1: Context

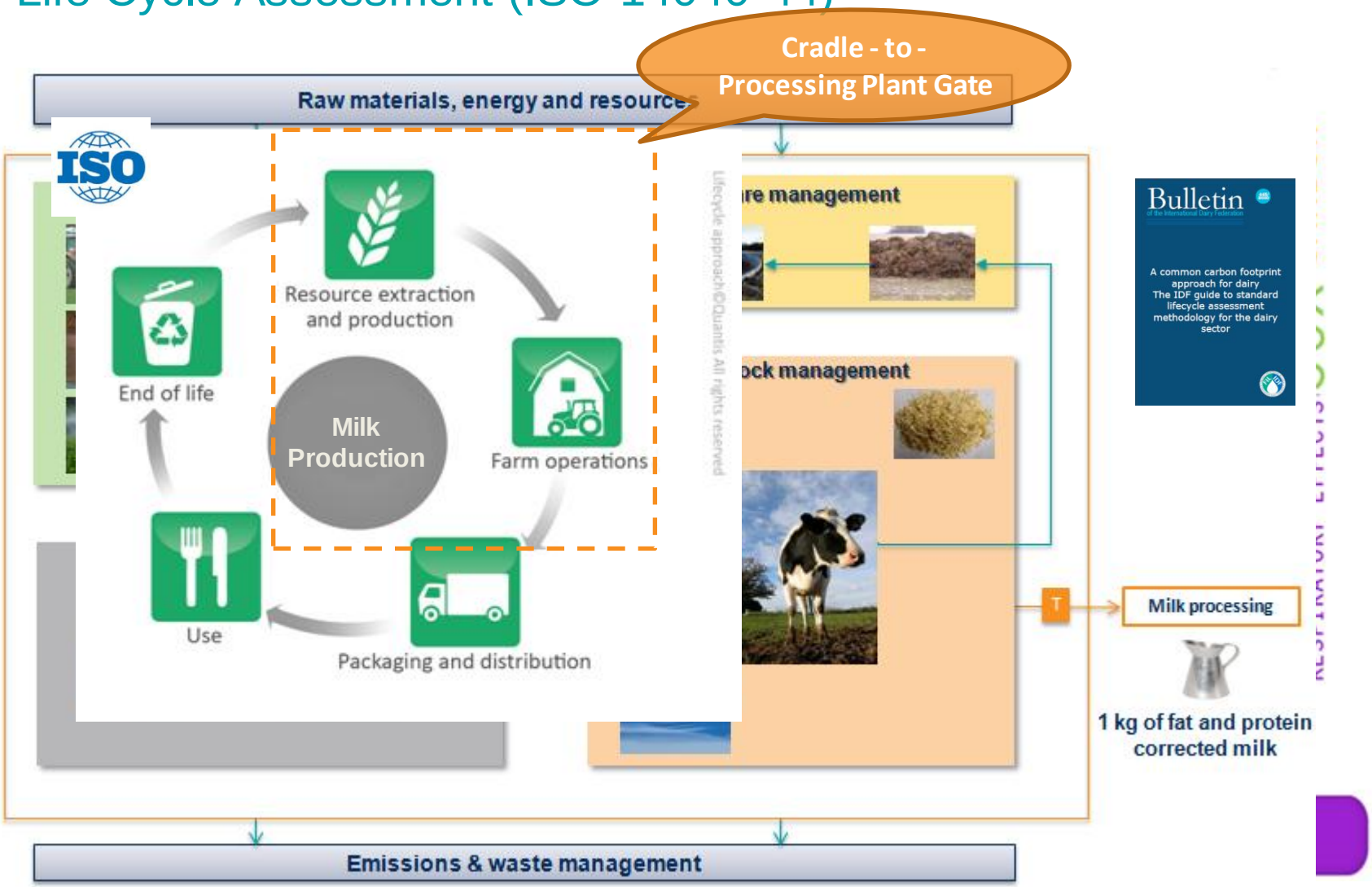
Context

- International efforts to account and reduce GHG emissions
- Consumer and media pressure towards environmental impact reduction
  - Additional pressure on livestock
- Dairy Research Cluster 1: over 100 collaborators in 46 projects over three years
- The Life Cycle Assessment (LCA) of Canadian milk - a first study to evaluate:
  - Environmental impacts beyond carbon
  - Socioeconomic aspects
  - Regionalized impact assessment

Objectives

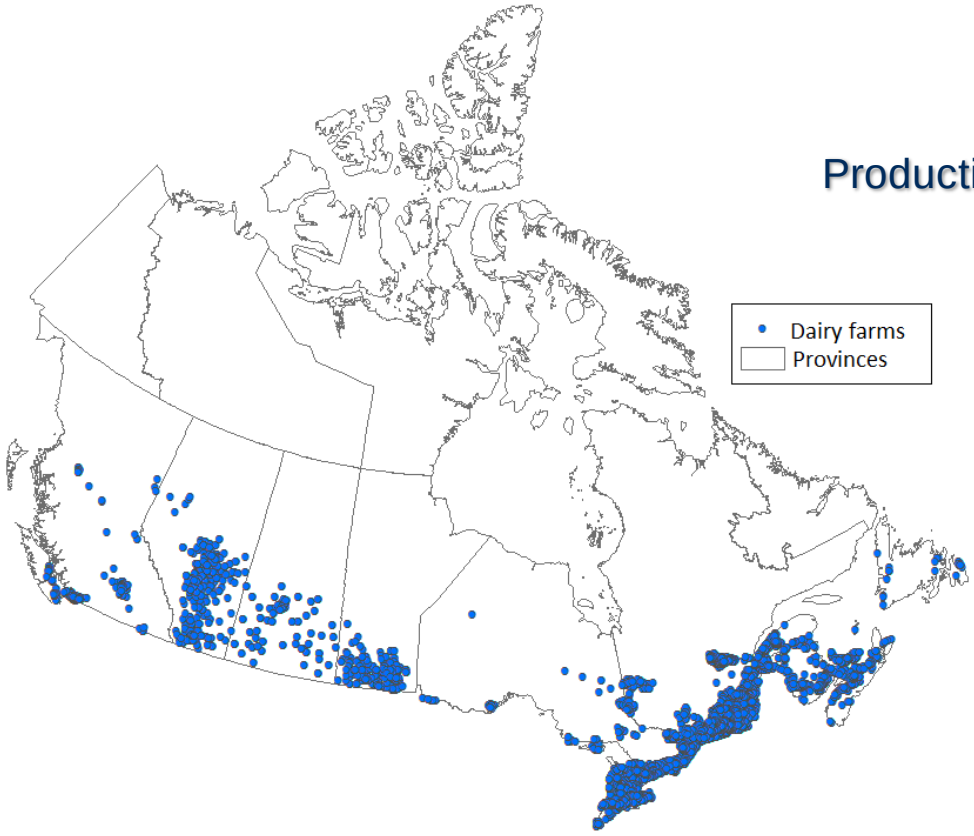
- Evaluate the environmental and socioeconomic impacts of dairy production in Canada
- Identify potential areas of focus for further improvements of the dairy sector's sustainability
- Provide the framework and the building blocks to support comparison and benchmarking

Life Cycle Assessment (ISO 14040-44)



Regionalization

- Accounts for regulatory and geographical variability across Canada

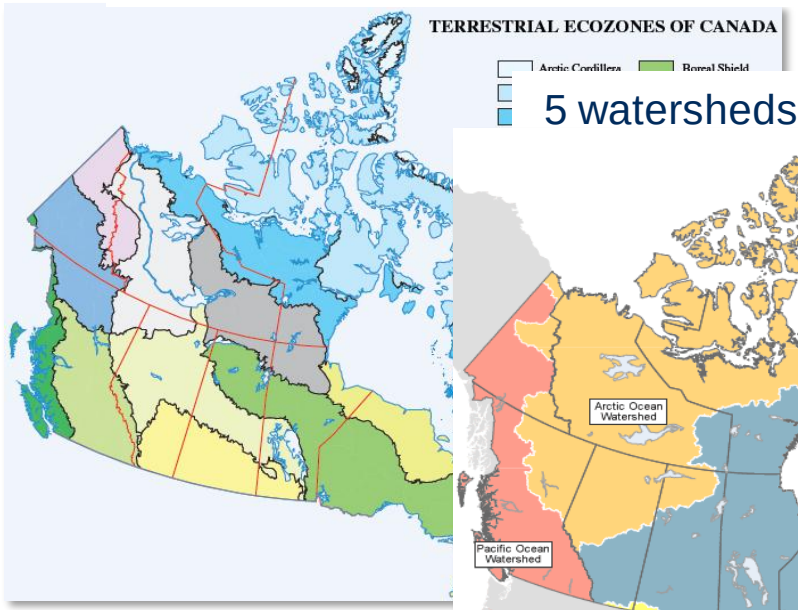


10 provinces
Production of 13 331 dairy farms

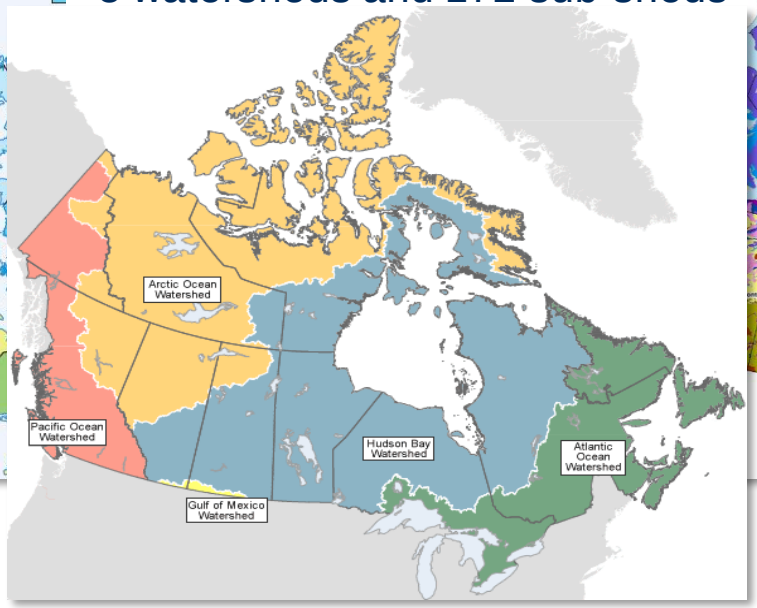
Regionalization

- Accounts for spatial variability across Canada : soils, climate, regions, etc.

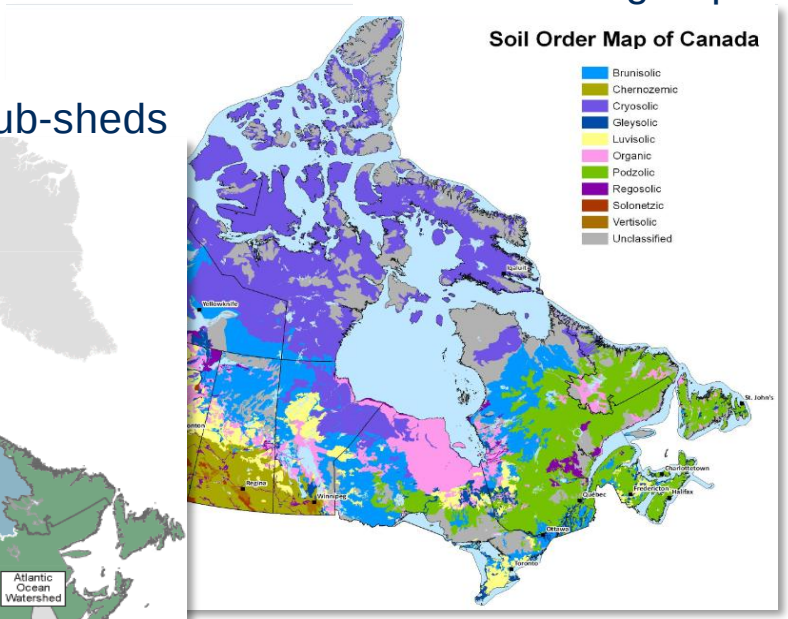
15 ecozones and 293 ecoregions



5 watersheds and 172 sub-sheds



11 soil order groups



Section 2: Results Environmental LCA

Canadian Milk Environmental Footprint

CARBON FOOTPRINT

1.01 kg CO_2e

- 1 kg: 6 km driven with a car
- All Dairy: Less than 2% of Canada's carbon footprint

1 kg of fat and protein corrected milk (FPCM)

- 1 kg: a 6 minute shower
- All Dairy: Less than 1 % of Canada's water consumption

WATER FOOTPRINT

61 L

- 1 kg of milk: 0.5 kg of wheat (1-2 breads)
- All Dairy: 2% of Canada's agricultural land

LAND USE

1.7 m^2

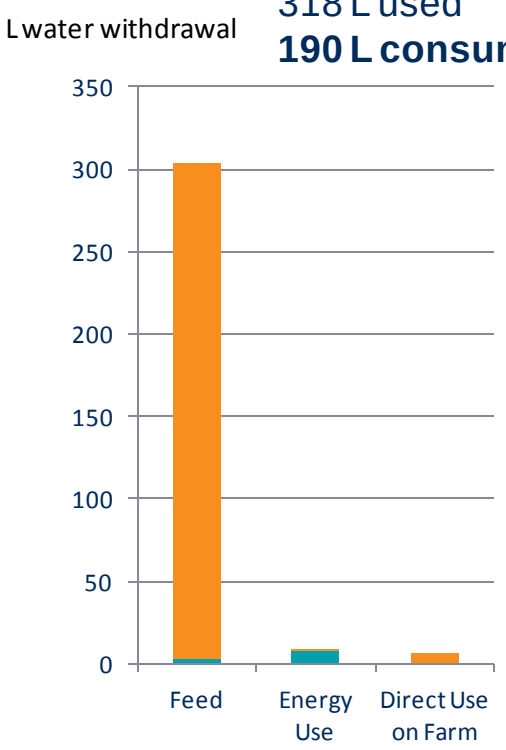
Impact on Water Withdrawal

WATER FOOTPRINT

61 L consumed

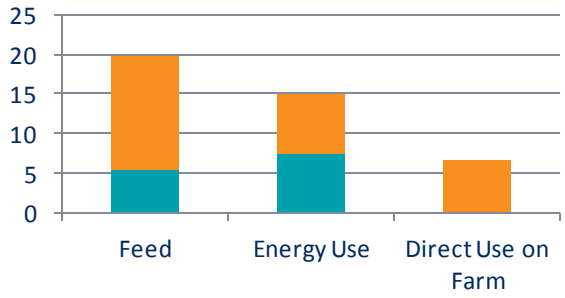
With Irrigation

318 L used
190 L consumed



- **Irrigation**, where applicable, is the main use of water
  - Variable by province and crops
- **Energy** production also consumes water

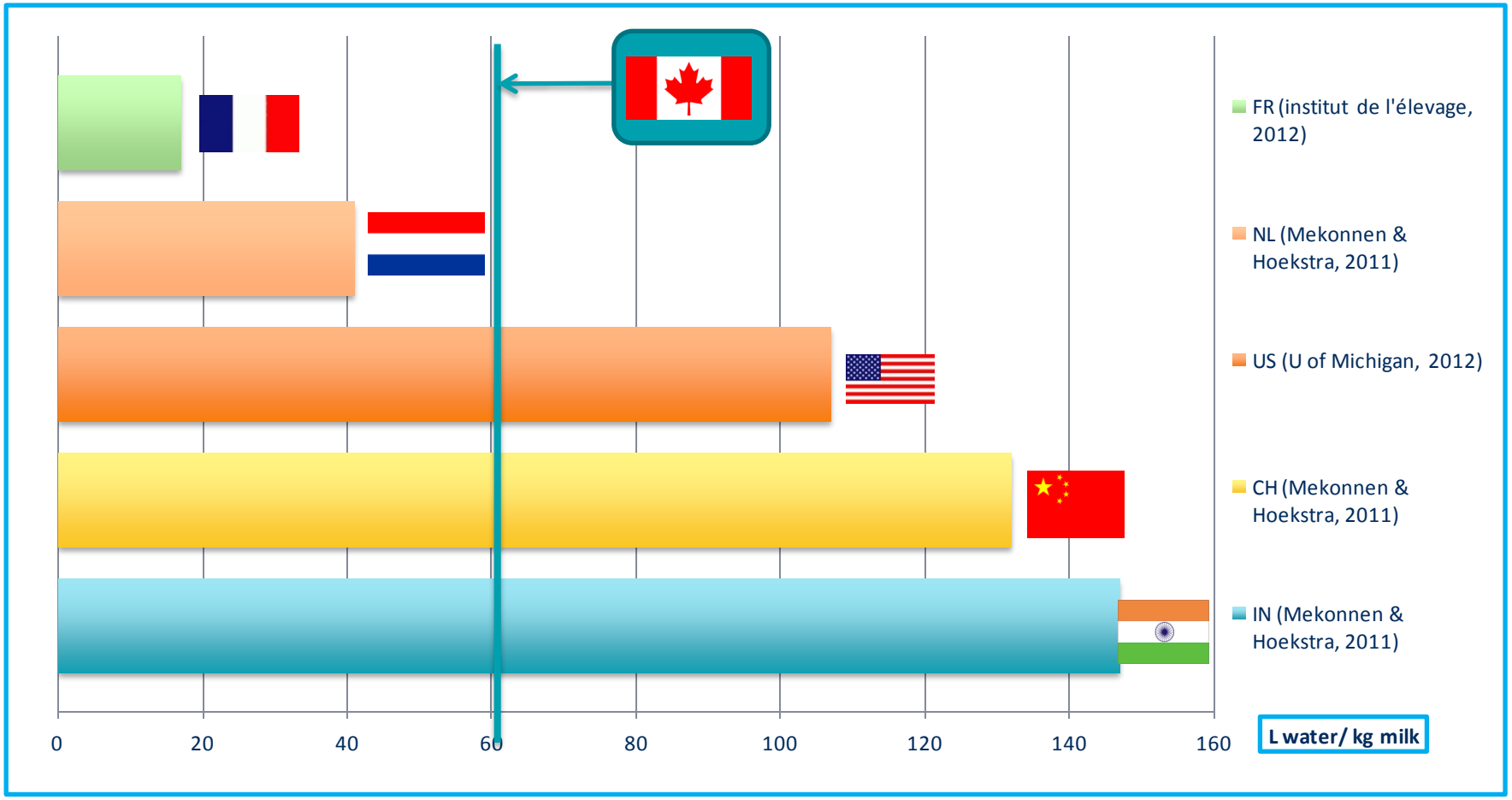
No Irrigation



41 L used
12 L consumed

Direct withdrawal
Cooling Water

Benchmarking – Water Footprint



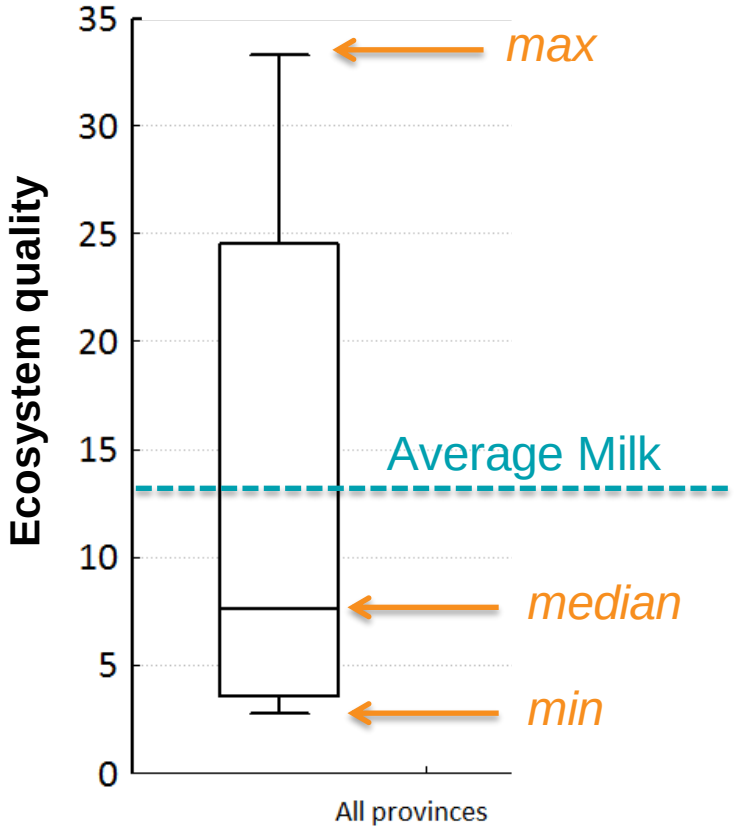
Impact on Ecosystem Quality

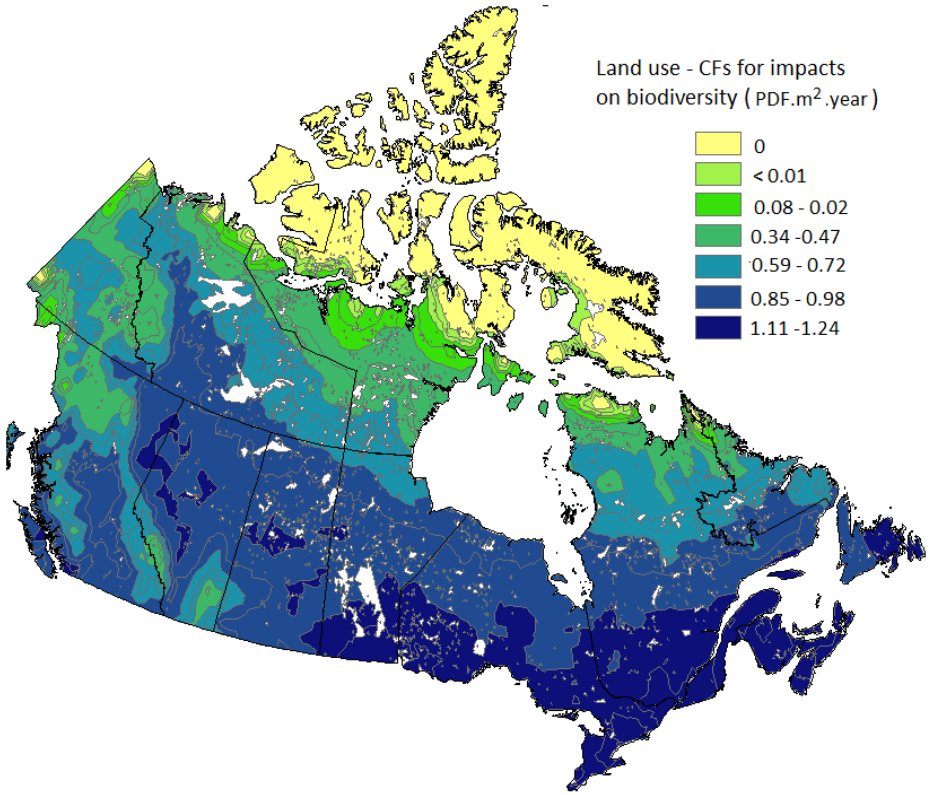
Main sources of **potential** impact are in Feed Production:

- **Phosphorus** fertilisation
  - Leaching from ground to water: eutrophication
- **Land** use
  - Potential impact on biodiversity
- **Mineral supplements**
  - Aquatic toxicity from leaching of spread manure

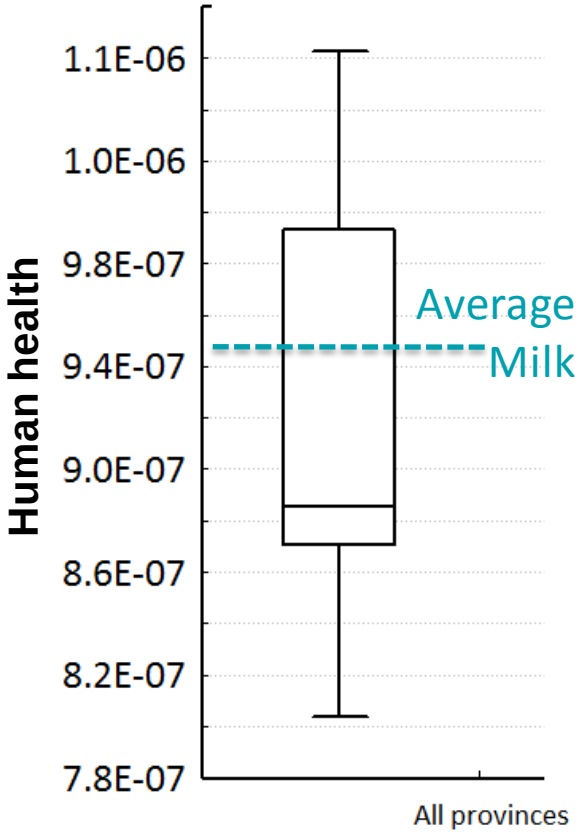
1.7 m²

Impact on Ecosystem Quality





Impact on Human Health



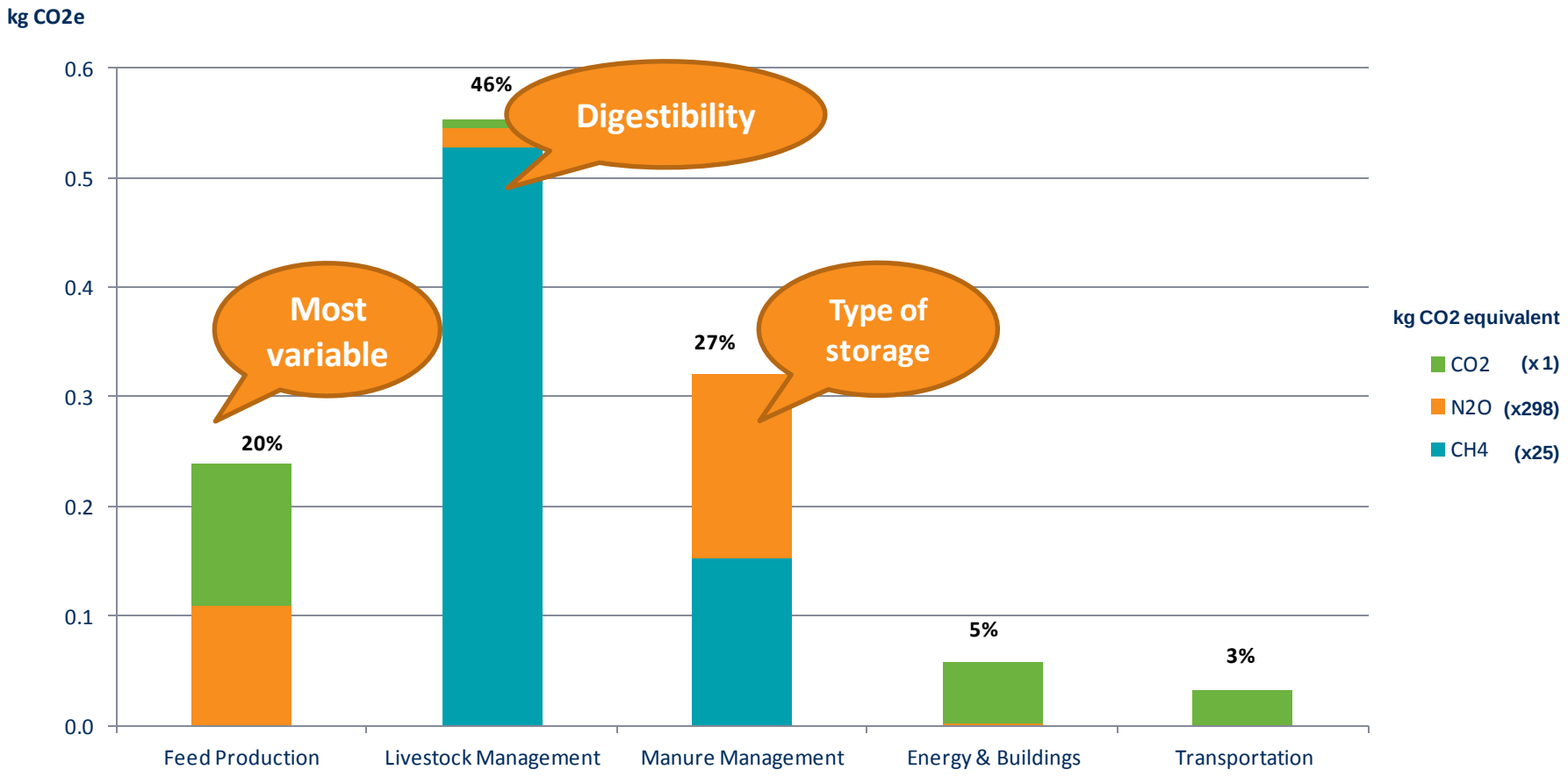
Main sources of impact are:

- **Ammonia** emissions:
  - N fertilisers, housing, manure
- **Energy** consumption:
  - Onsite and for electricity: NOx, SOx, Hydrocarbons
- **Potential toxicity** through bioaccumulation, from mineral supplements in feed (and manure spreading)

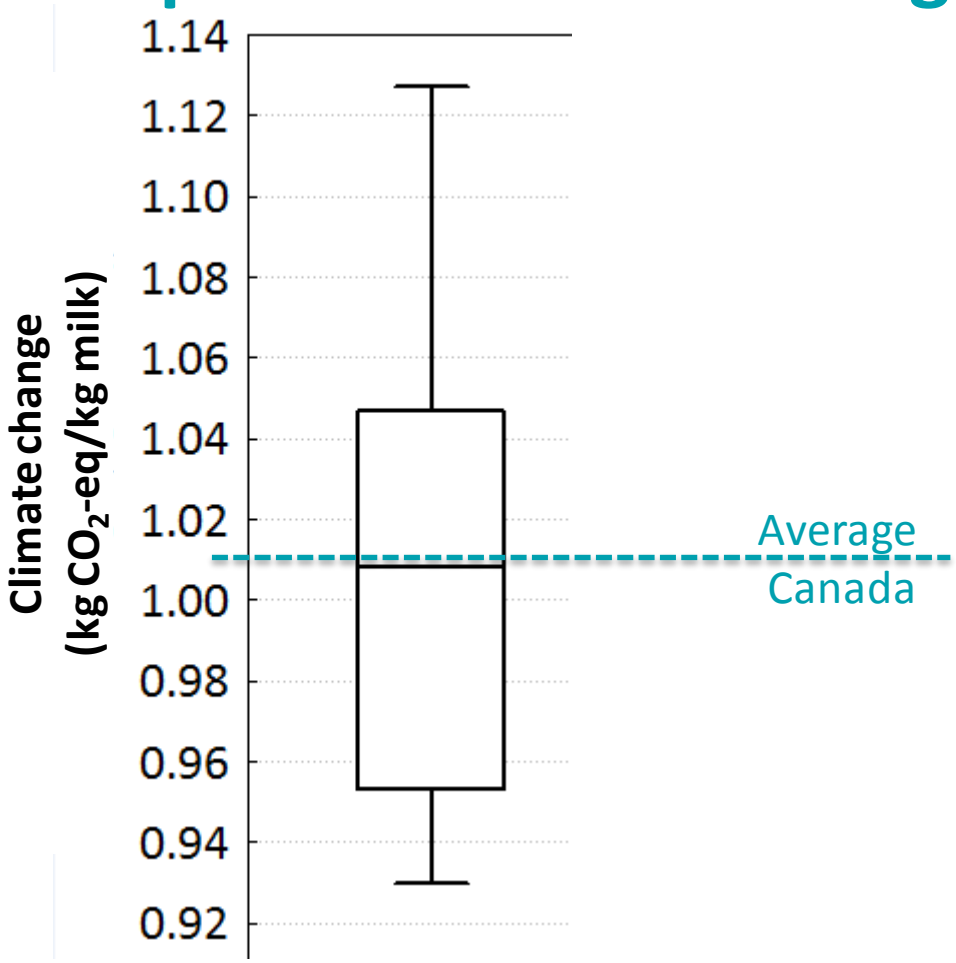
Impact on Climate Change

CARBON FOOTPRINT

1.01 kg CO_2e

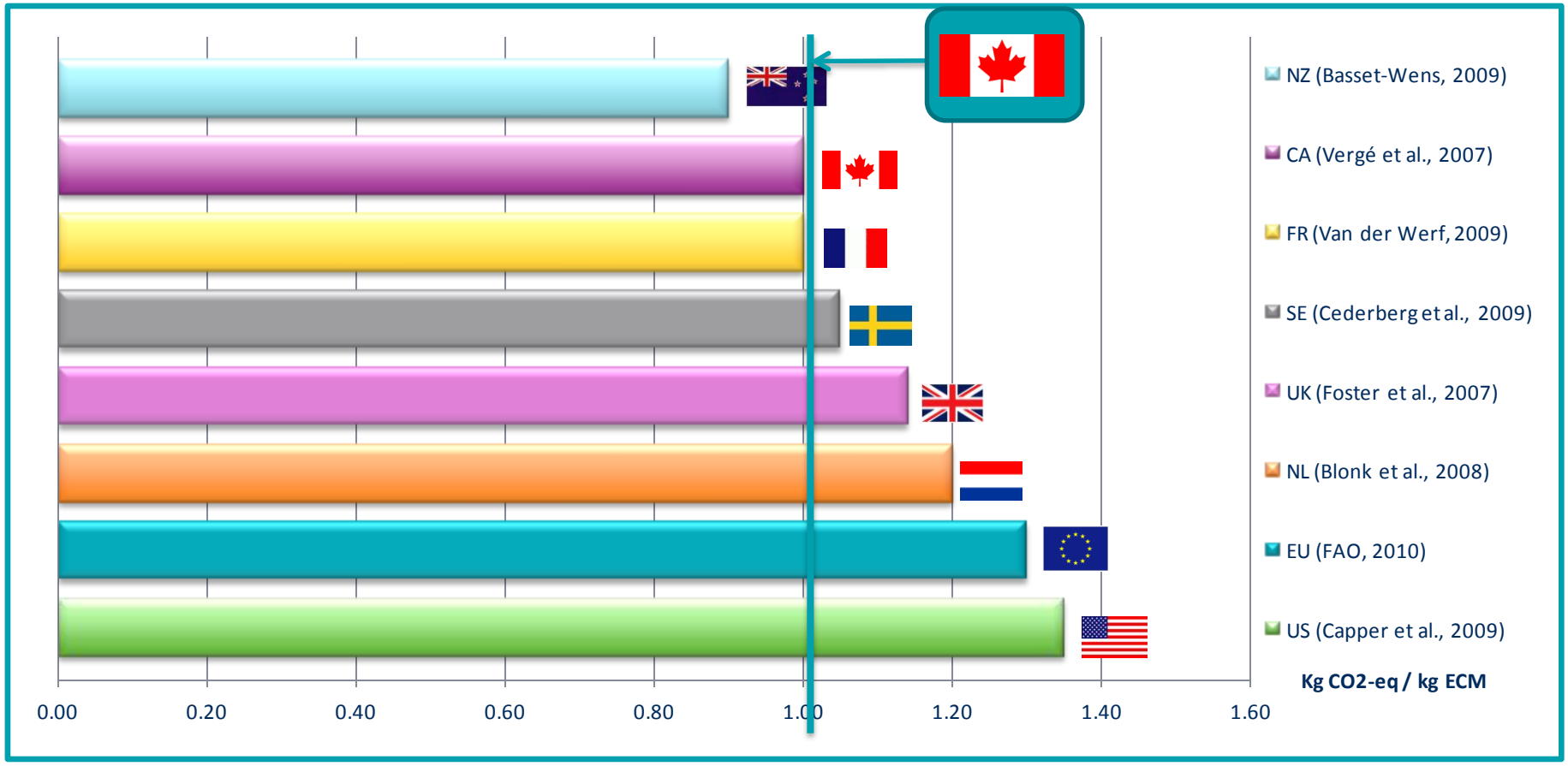


Impact on Climate Change

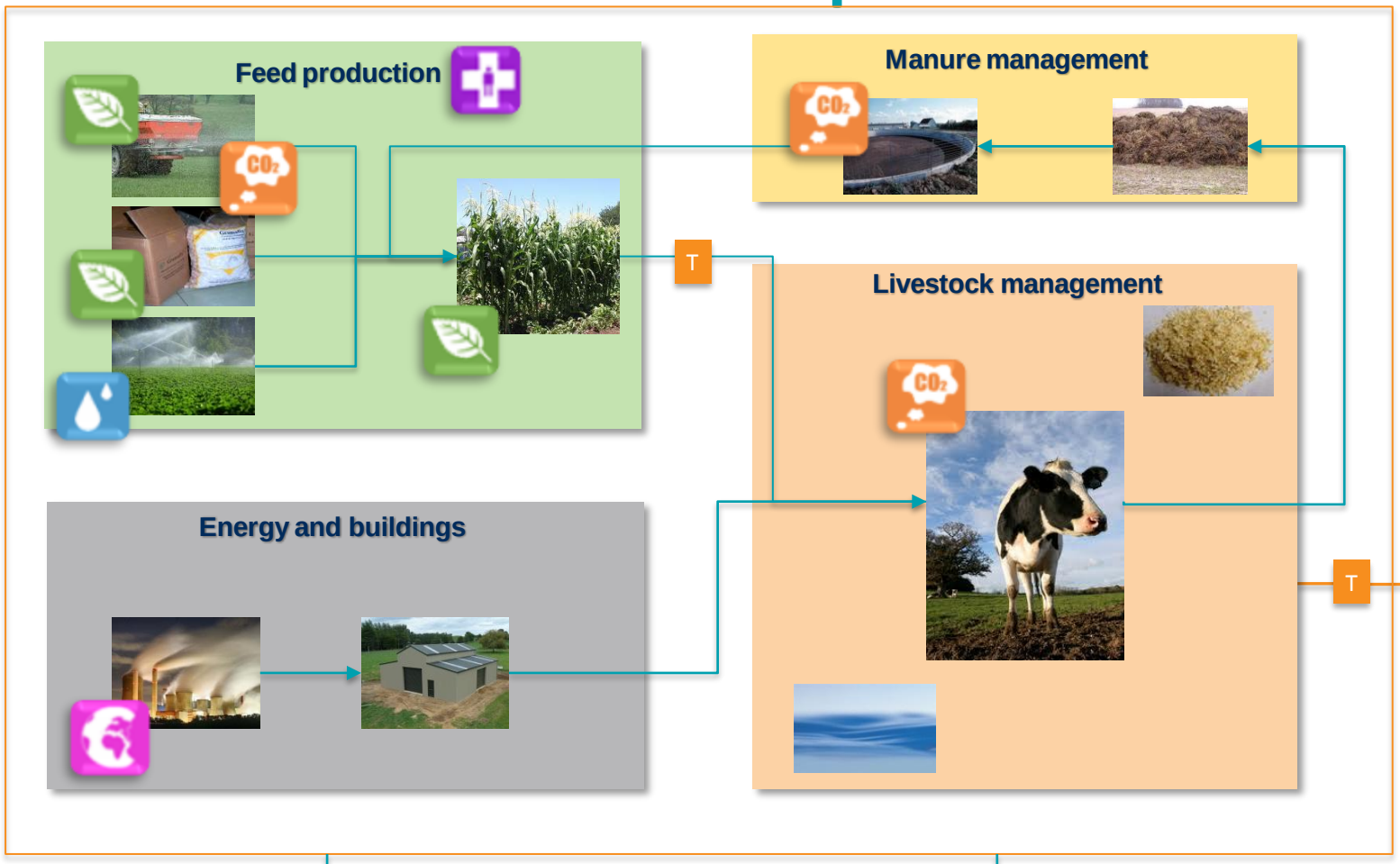


- Sources of variability:
  - N_2O emissions from fertilisers and manure are lower in Western provinces
  - Manure and fertilizer spreading concentrations and techniques
  - Feed ratios
  - Manure Storage
  - Grid mix for electricity

Benchmarking – Climate Change



Main Contributors to Impact



Water Withdrawal | Climate Change | Ecosystem Quality | Human health | Natural Resources

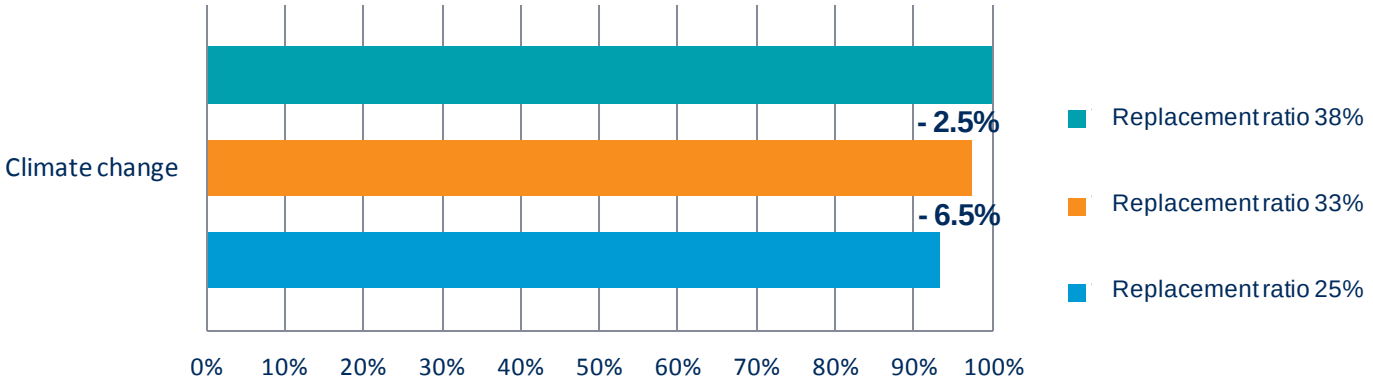
Low Footprint Management Practices

- Less fertilization (choice of crops), or less impacting fertilizers (choice of fertilizers)
- Use of by-products in rations (fraction of the impact)
- Increased digestibility (concentrates and fresh forage)
- Lower replacement ratio
- Use of a covered manure structure

What if… ?

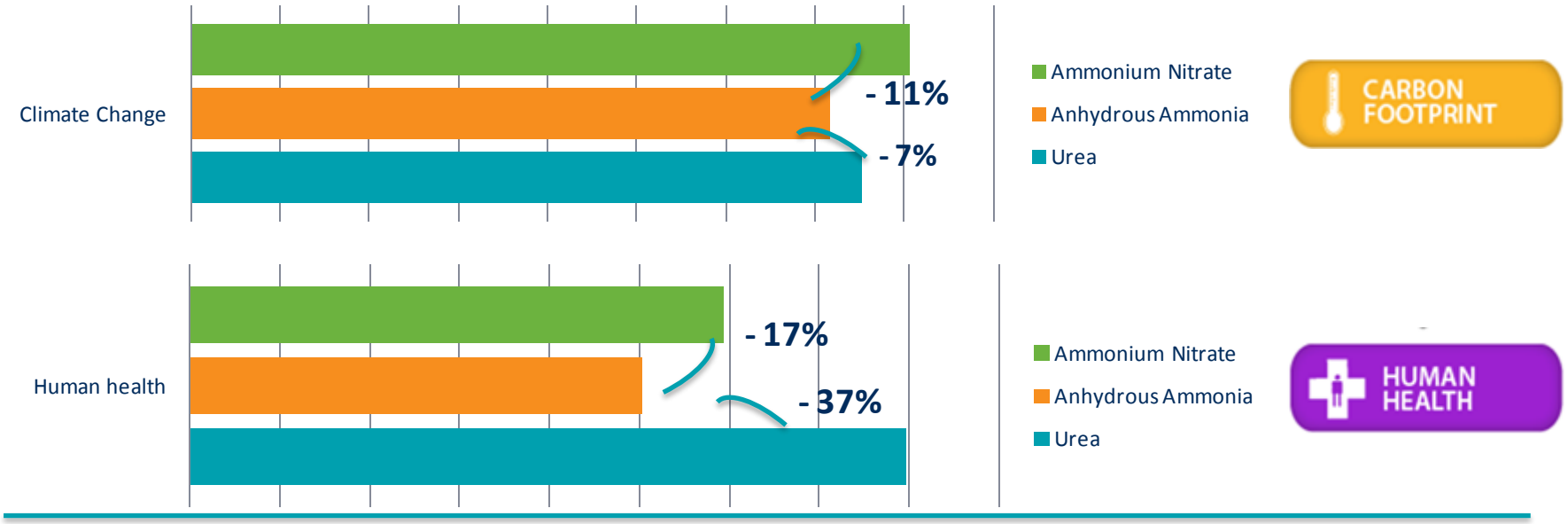
- Replacement ratio (Culling)
  - From 2 lactation cycles to 3 +
- Fertilization
  - Choice of synthetic fertilizer
- Feed production & Diet
  - Fat supplements
- Manure Management
  - Liquid to Solid
  - Liquid lagoon to Liquid with crust

Sensitivity Analysis: Rate of Remplacement



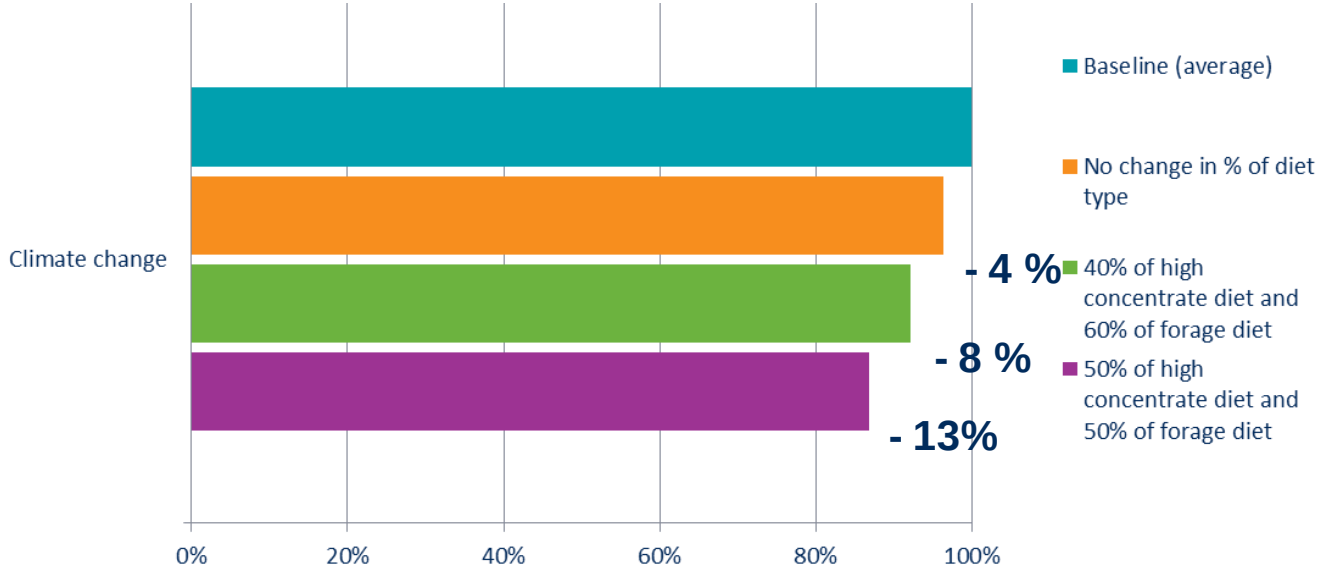
- Replacement ratio
  - Average practice: after two to three lactation cycles (ratio 38%)
  - Tested practice: after three or four lactation cycles
    - Reduces replacement cows and their feed, manure, enteric fermentation

Scenario Analysis: Choice of Fertilisers



- If all fertilisation was achieved with a single fertiliser (for demonstration)
  - Injected anhydrous ammonia performs better in all categories
  - Urea, easier to spread, has less impact than ammonium nitrate in CO2, but emits more ammonia after spreading
- Limiting factors: spreading equipment availability, mixing, cost

Scenario Analysis: Enteric Fermentation



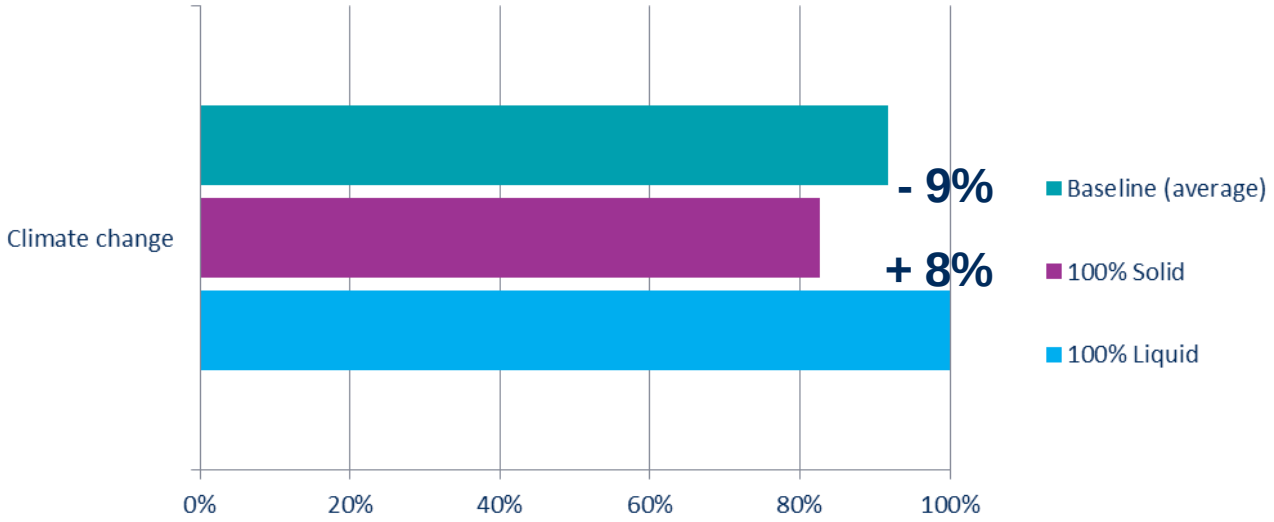
Fat content of diet emissions

CH4

Limiting factors:

- Quantity of fat (lipid) that can be fed to cattle
- Cost of adding more high concentrate feed in the diet

Scenario Analysis: Manure Management

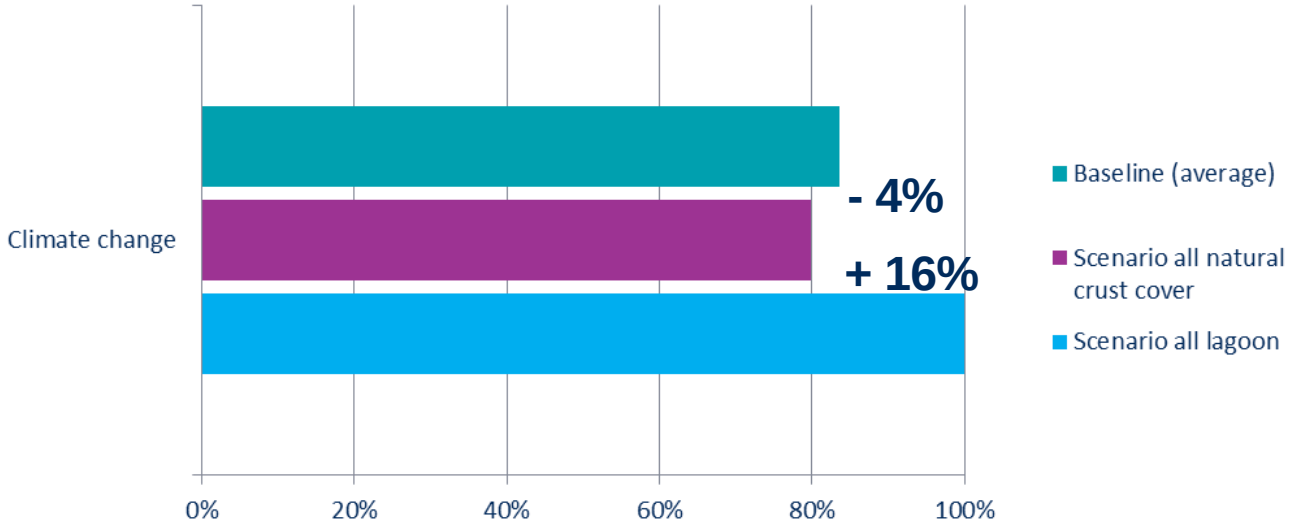


Impact of liquid management **>** Impact of solid management

Limiting factors:

- Cost of changing the storage structure and spreading mechanism

Scenario Analysis: Manure Management (Liquid)



Impact of uncovered anaerobic lagoon **>** Impact of natural crust cover

Limiting factor:

- Cost of changing the storage structure or adding a cover

Section 3: Results Socioeconomic LCA

The economic contribution is well-known

More than 50,000 direct jobs…

… and over 127,000 jobs overall

5.5 B$ in farm receipts

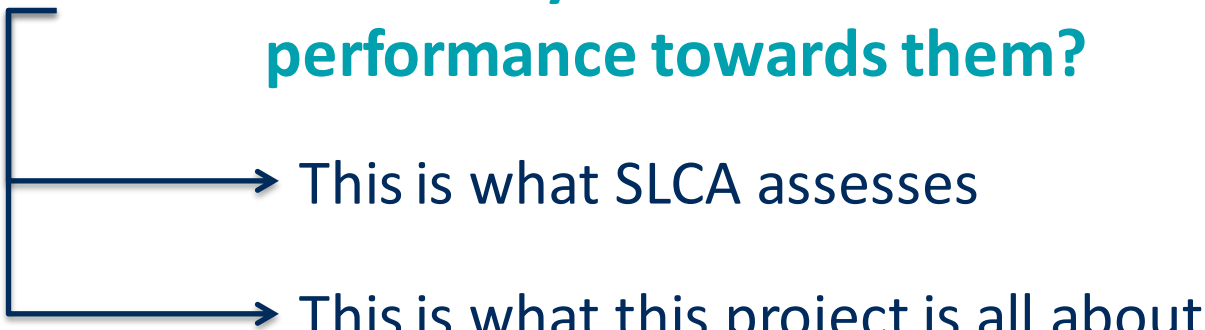
225 M$ in direct tax revenue…

… and nearly 1.4 B$ in overall tax revenue

What about the socioeconomic performance?

- You are also – individually and collectively – **corporate citizens**
- Your behaviours affect your surrounding – and distant – stakeholders

What is the dairy sector's socioeconomic performance towards them?



The SLCA perspective

- A brand new assessment tool (2009)

- **Assesses behaviours** – not processes
  - By identifying the organizations involved all along a product's life cycle
  - By referring to a list of **issues of concern**
  - Related to five main **stakeholder categories**

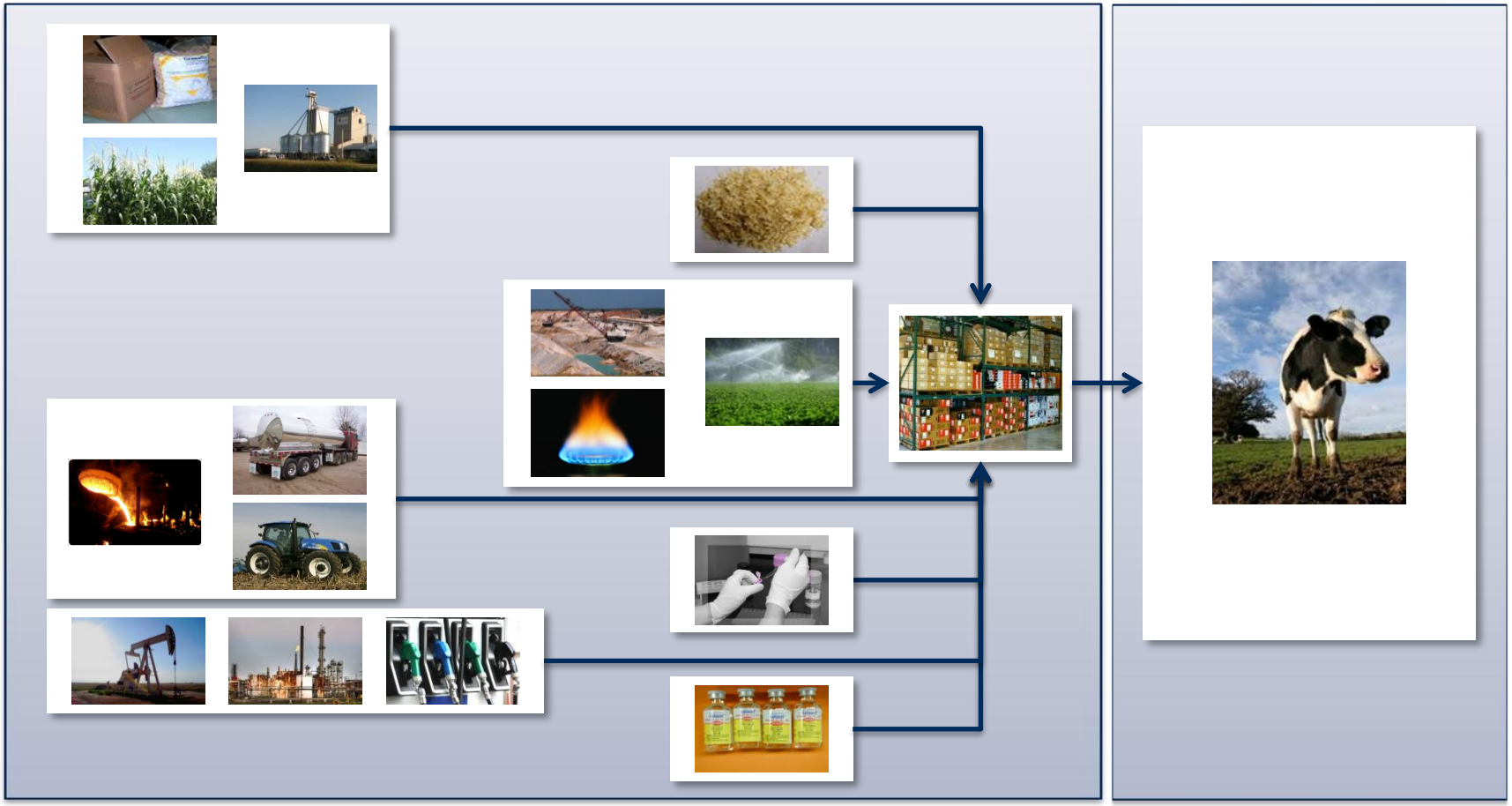
Specific objectives

- To identify the relevant specific **groups of stakeholders**
- To develop a set of specific **socioeconomic indicators**
- To **assess the socioeconomic performance** of the Canadian dairy sector
- To **interpret the results** and to provide recommendations

A cutting edge assessment methodology – the first of its kind

A brand new perspective focusing on the dairy sector's level of social engagement

Two assessment frameworks



POTENTIAL HOTSPOTS ANALYSIS | **SPECIFIC ANALYSIS**

Two frameworks – Two deliverables

- Framework #1
  - Focus on the **dairy farms** and their **Boards**
  - Assess their **socioeconomic performance**
  - Use of site-specific data

First deliverable

An assessment of the degree of social engagement of the Canadian dairy farms toward their stakeholders

Four-level evaluation scale

Committed behaviour	A leading socially responsible behaviour (best practices)
Proactive behaviour	An in-between socially responsible behaviour
Compliant behaviour	A normal and minimally expected behaviour
Risky behaviour	A behaviour that may have negative consequences

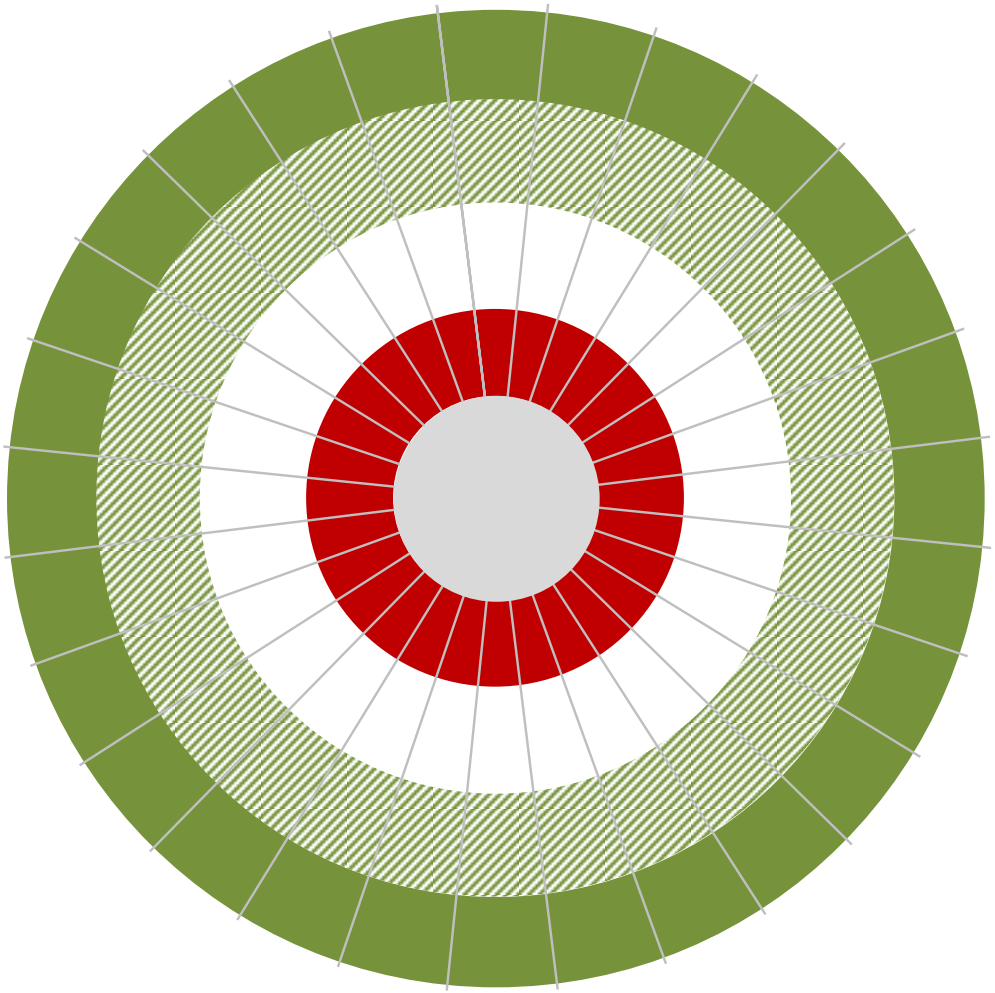
Use of **Benchmarks**

An example

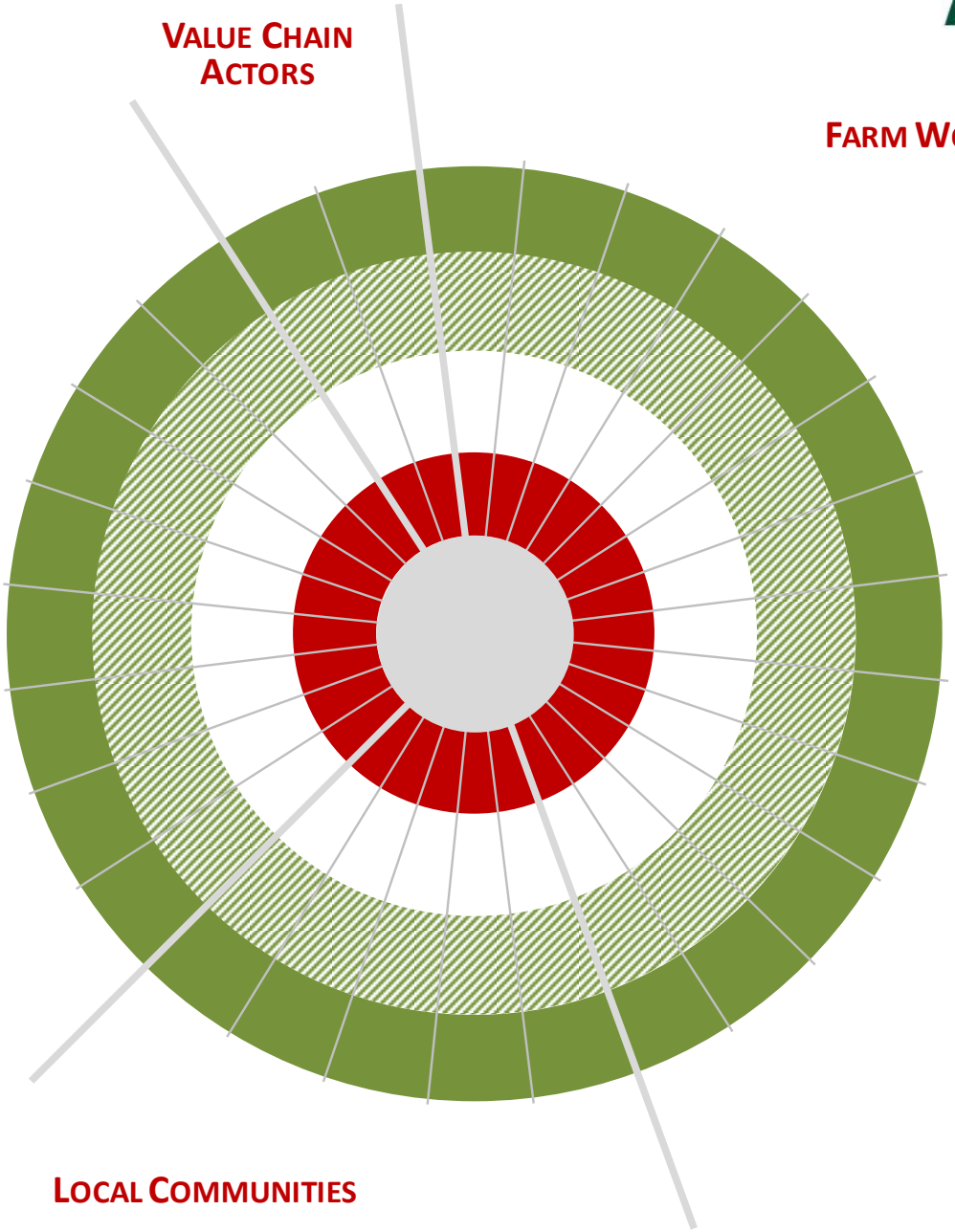
FARM WORKERS	
Salary and contribution to fringe benefits	
Average hourly wage	☐ The average hourly wage of regular workers is **=** the province's legal minimum wage rate

A transparent and evolving assessment method

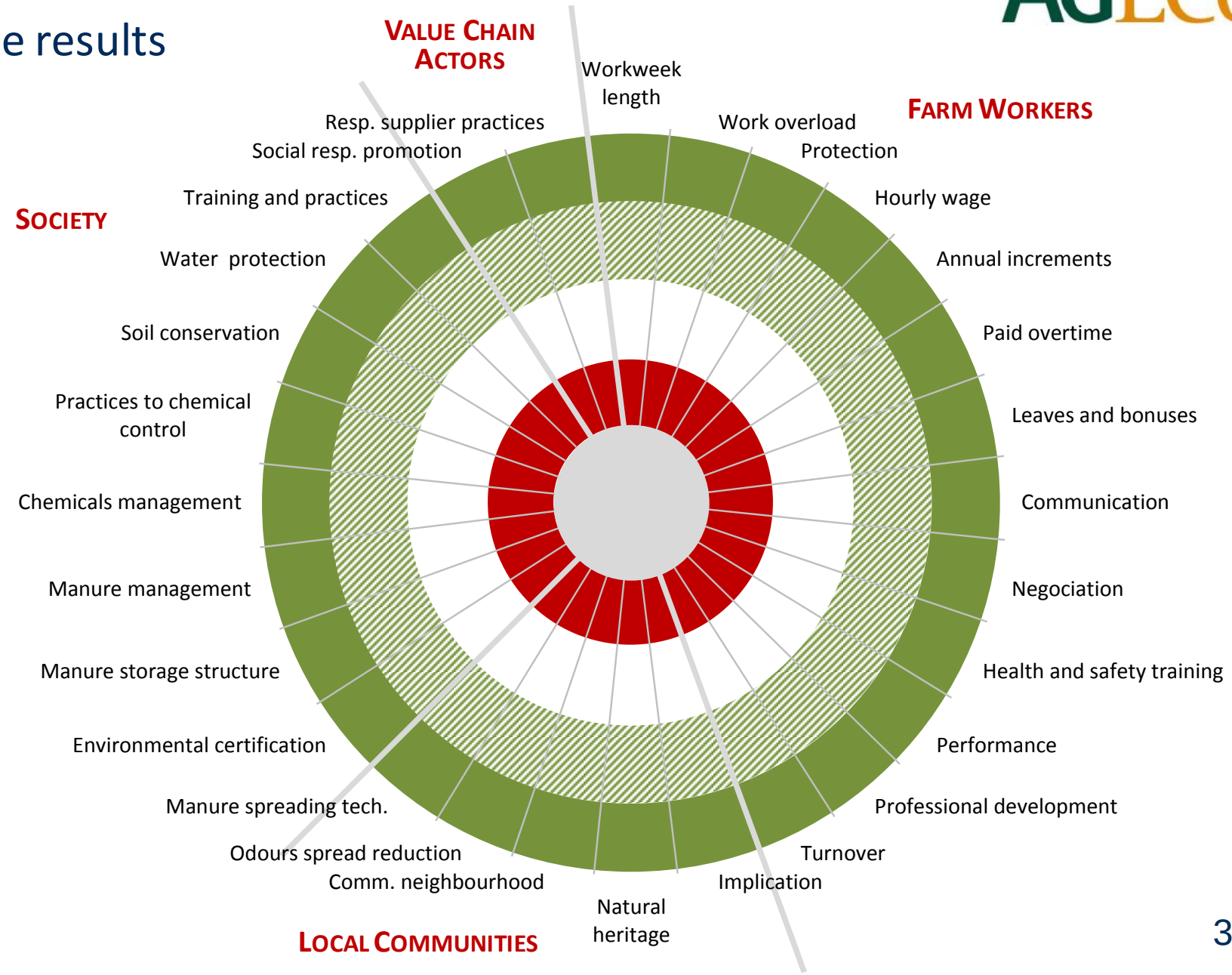
The results at the **farm level**



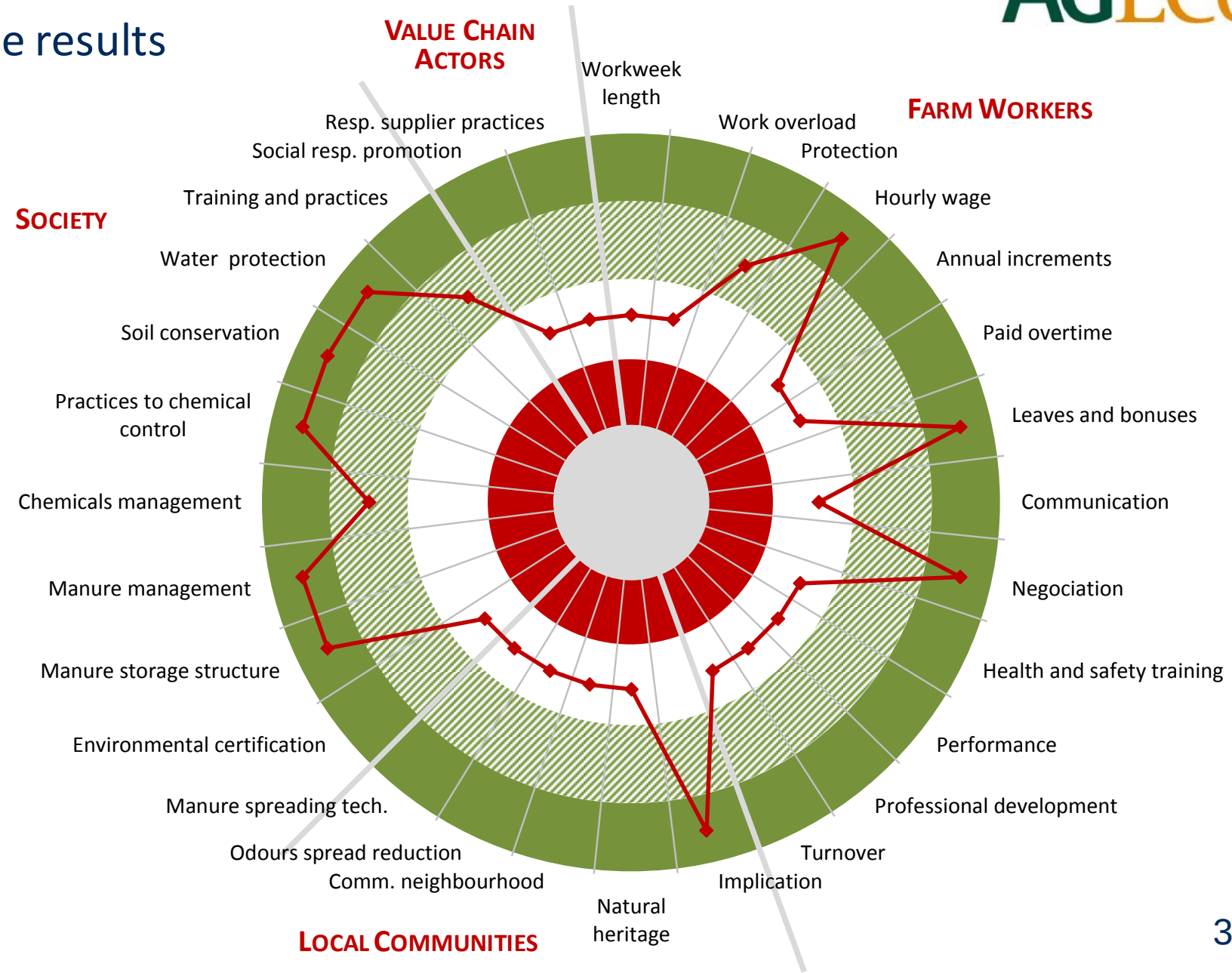
The results


VALUE CHAIN ACTORS
FARM WORKERS
SOCIETY
LOCAL COMMUNITIES

The results


VALUE CHAIN ACTORS
Workweek length
Work overload
FARM WORKERS
Protection
Hourly wage
Annual increments
Paid overtime
Leaves and bonuses
Communication
Negociation
Health and safety training
Performance
Professional development
Turnover
Implication
Natural heritage
LOCAL COMMUNITIES
Comm. neighbourhood
Odours spread reduction
Manure spreading tech.
Environmental certification
Manure storage structure
Manure management
Chemicals management
Practices to chemical control
Soil conservation
Water protection
Training and practices
Social resp. promotion
Resp. supplier practices
SOCIETY

The results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Beyond the average performance

- A committed behaviour?
  - Some may not have adopted that practice – yet

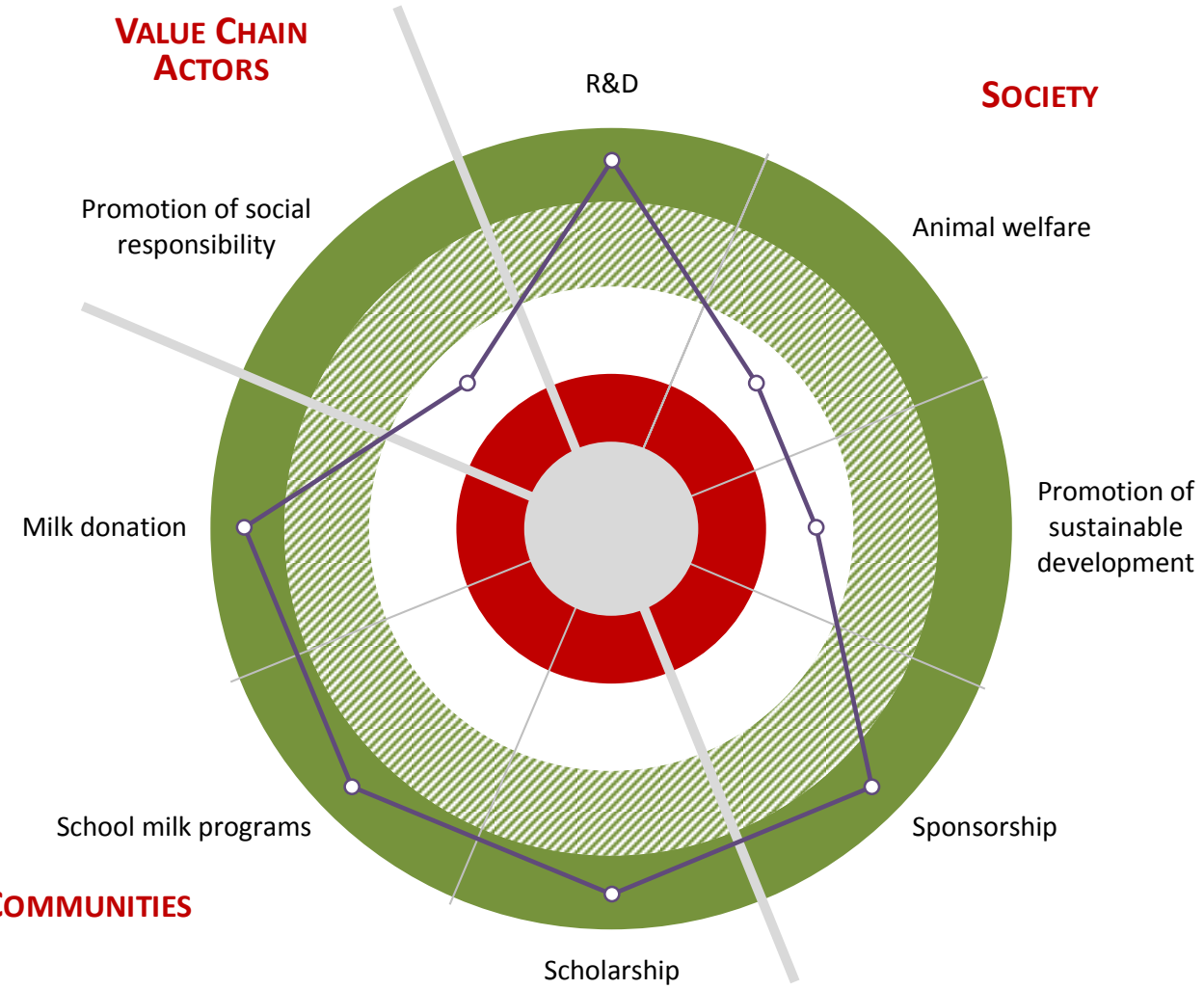
13% of farmers are not yet involved in their community

- A compliant behaviour?
  - Many can be already proactive or committed

22% of farmers have practices minimizing the spread of odours

There is always room for improvement

Results at the **Board level**



Highlights

- Canadian dairy sector is socially committed towards stakeholders
  - **Producers** have socially responsible environmental practices, are involved in their community and provide working conditions that go beyond labour standards
  - **Dairy boards** invest in their community and society

- But there is room for further improvements

At the farm level

- Going beyond the salary issue?
- More practices to minimize odours?
- More socially responsible procurement criteria?

At the Board level

- More engagements - formal?
- More diversified partnerships?
- More support and supervision in regards to animal welfare?

Two frameworks – Two deliverables

- Framework #2
  - Identify the possibility of encountering **risky behaviours** among your upstream suppliers
    - Those providing fertilizers, pesticides, etc.
  - Use of generic data

Second deliverable

A preliminary overview of the social risks found among the sector's supply chains

Main findings

- Most supply chains show **low social risk**
  - But there are some socially troubling practices occurring upstream in your supply chains – beyond your first-tier suppliers
    - Corruption, unsafe working conditions, non-respect of indigenous rights, unfair competition, etc.

Is it your responsibility?

→ From a social responsibility/LCA perspective – **Yes**

→ From a business/market perspective – **Yes**

Walmart's supplier sustainability survey

- Five (5) questions out of 15 concern "People & Community"
  1. Do you know **the location** of 100% of your suppliers?
  2. Do you evaluate the **quality of production** of your business partners?
  3. Do you have a process for **managing social compliance**?
  4. Do you work with your supply base **to resolve social compliance issues**?
  5. Do you invest in **community development** activities?

Your are part of the supply chain

Section 4: Conclusions

Insights

- Overall good performance – environmental and socioeconomic
- Important commitment to environmental practices
- Mostly, low risk supply chain

- Possibility of better tracking of fertilisation practices at the farm, improved manure storage
- Provide guidelines on feed based on impact
- Promote socially responsible behaviour to improve average socioeconomic performance among farmers, organisations, and eventually, suppliers

LCA helps clarify the big picture and understand how to improve the global performance

A roadmap for an ongoing commitment

A comprehensive assessment tool

To assess your current and future practices

To enhance your individual and collective socioeconomic and environmental performance

To communicate it to your customers and partners

An evolving benchmark

A committed behaviour today will lead to a compliant one tomorrow

A risk management approach

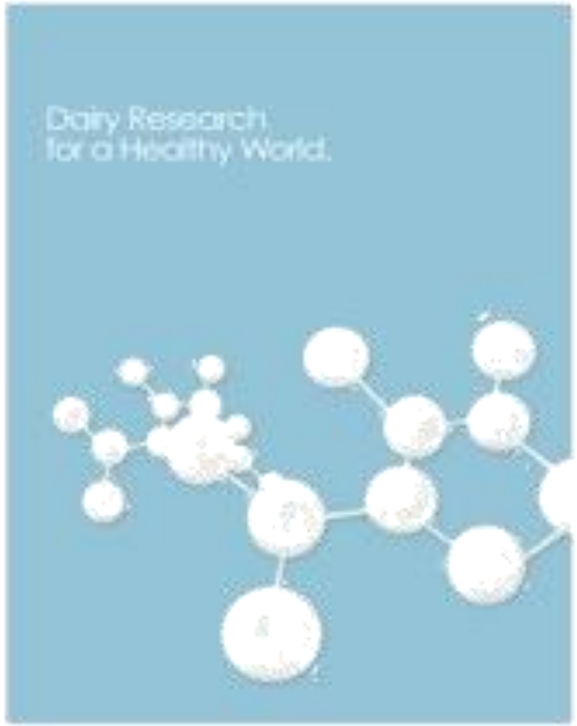
Identify your social and environmental hotspots

Anticipate social and market expectations

What's Next

- Communicating results
- Comparing the environmental performance of milk with nutritional alternatives
- Dairy Research Cluster 2:
  - Farm specific calculation tool to help guide decisions
    - Integrating the results of Dairy Research Cluster 1
  - Developing advanced modeling to allow and understand agricultural alternatives, based on geographical context and tradeoffs
  - Evaluating the costs of Ecological Goods and Services

Thanks to the sponsors and collaborators!



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