UNIVERSITÀ DEGLI STUDI DI PADOVA

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Department of Agronomy Food Natural resources Animals Environment

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Environmental sustainability of integrated France-Italy specialized beef chain using LCA method

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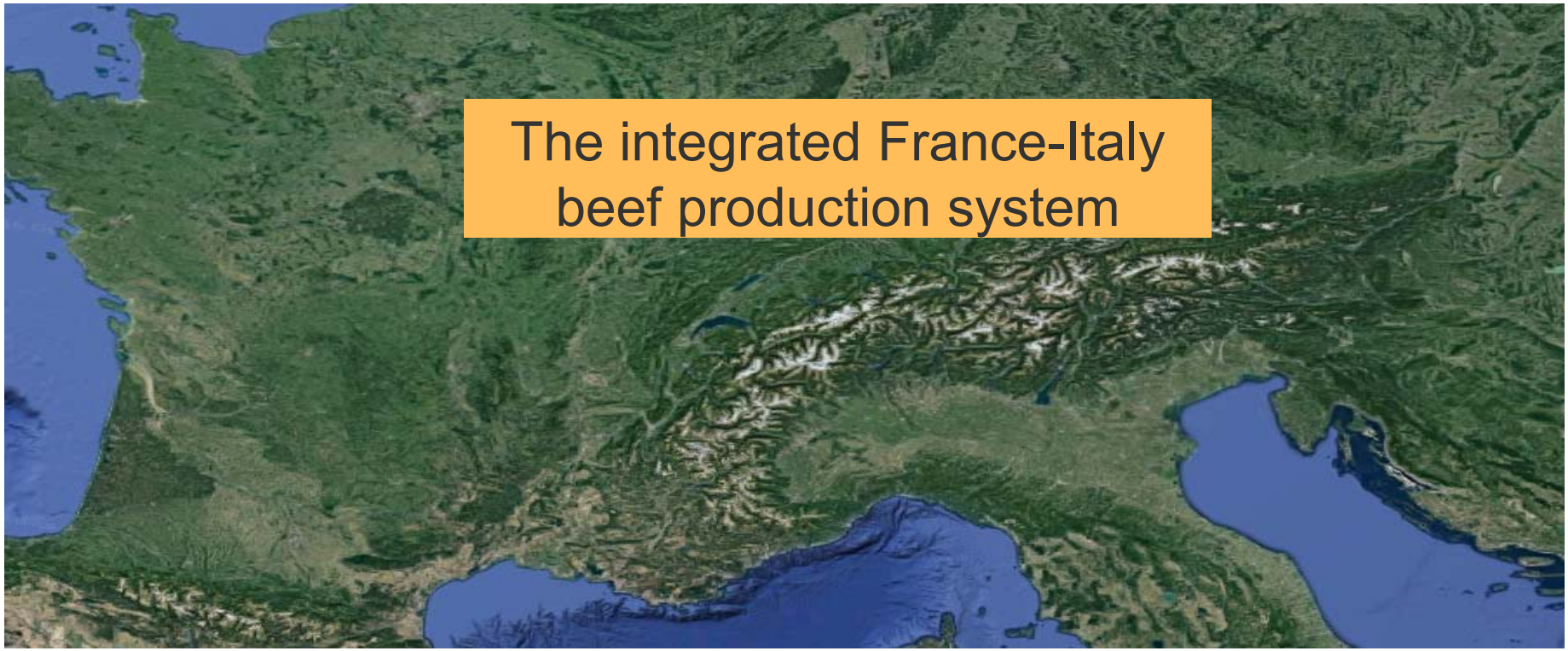
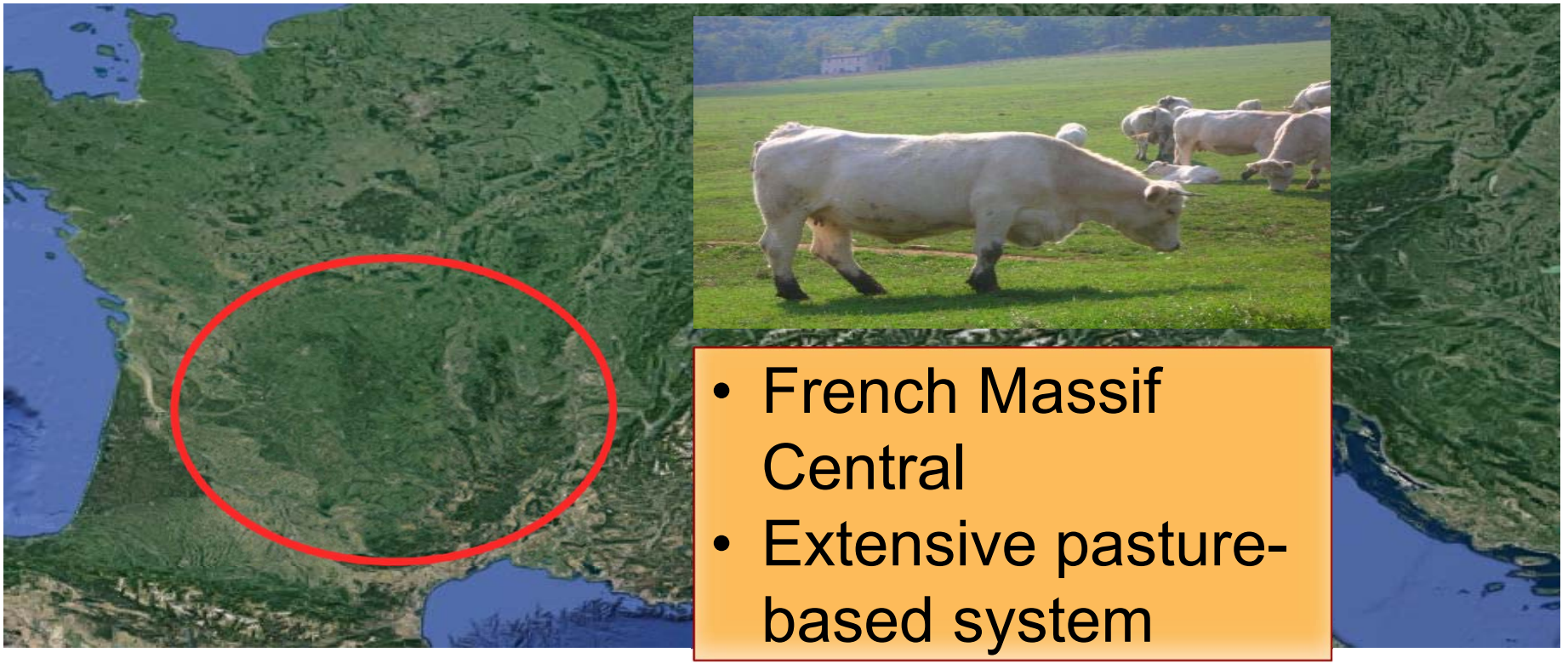
Introduction



Introduction



- French Massif Central
- Extensive pasture-based system

Introduction

- North-East Italy
- Use of total mixed rations (maize silage and concentrates)

Aim

This study aimed to analyse the sustainability of the integrated France-Italy beef production system through **Environmental impact indicators**, computed according to Life Cycle Assessment method

- Global warming potential
- Acidification potential
- Eutrophication potential
- Cumulative energy demand
- Land occupation
- Land occupation due to human-competitive feedstuffs

LCA definition

- 73 Charolais breed fattening batches (i.e. animals homogeneous for origin, finishing herd and Italian fattening period) reared during 2014
  - 4882 heads
  - born from November 2012 to April 2013 and from November to December 2013
  - 14 North-Eastern Italy intensive fattening farms
- The reference unit was the fattening batch.
- Functional unit: 1 kg of body weight (BW) sold (at the end of fattening period).

System boundaries

- **Cradle-to-farm gate** boundary
  - Impacts from **calf's birth** to the **end of the fattening period**
- A single fattening batch → many suckler cow-calf farms
  - a complex and high data-demanding system

3 Italian clusters

3 groups of French farms selling calves with similar characteristics of the correspondent Italian cluster

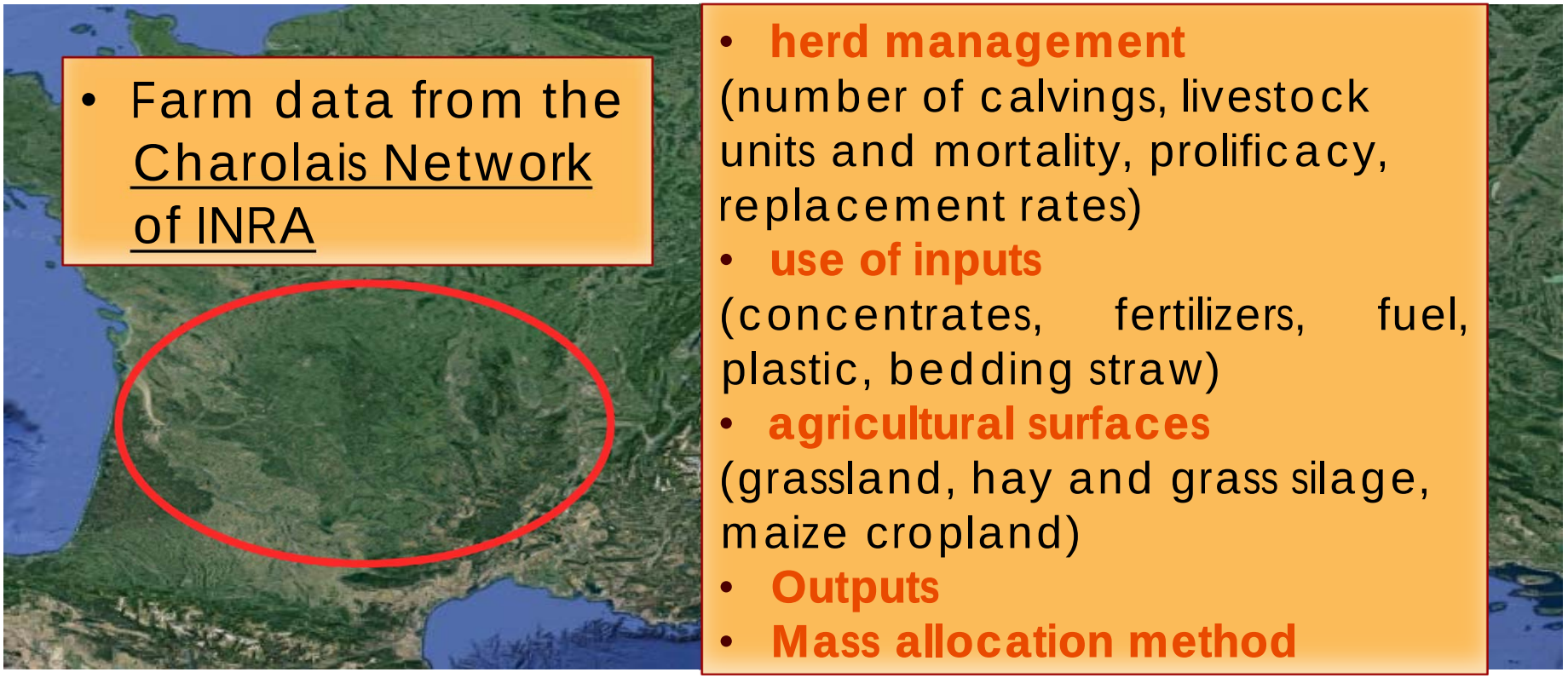
ITA

Cluster Analysis of Italian batches
- Calving date, BW and age at sale to Italy

FRA

Farm data from Charolais Network database of INRA

Data collection: France



- Farm data from the Charolais Network of INRA

- **herd management** (number of calvings, livestock units and mortality, prolificacy, replacement rates)
- **use of inputs** (concentrates, fertilizers, fuel, plastic, bedding straw)
- **agricultural surfaces** (grassland, hay and grass silage, maize cropland)
- **Outputs**
- **Mass allocation method**

Data collection: Italy

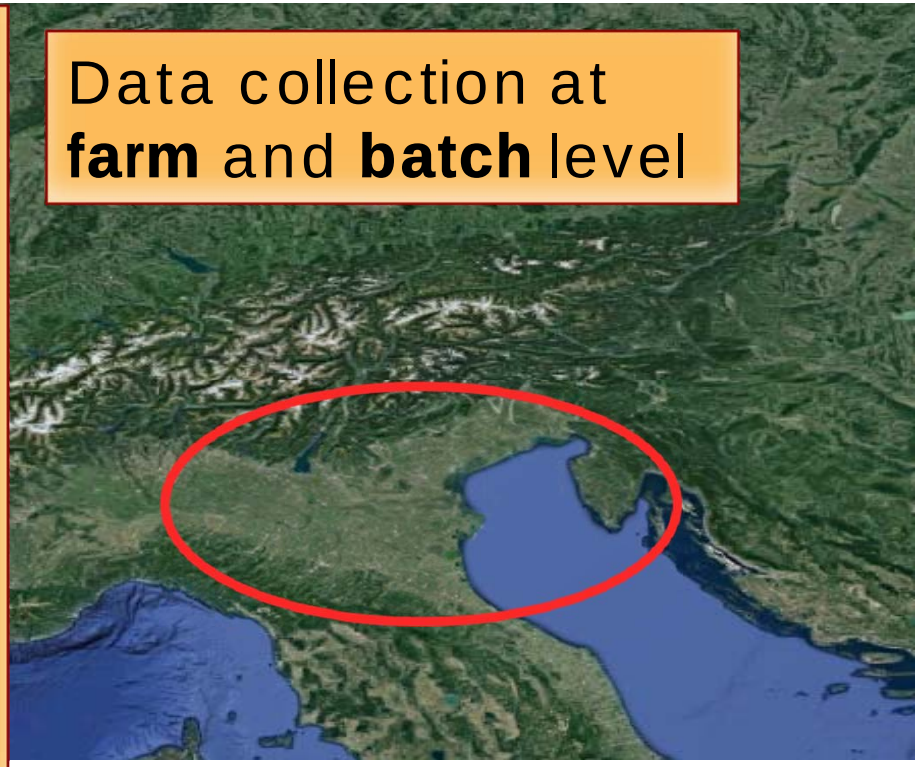
Batch level

- Number of animals
- BW and dates
  - Sale from France
  - Arrival in Italy
  - End of the fattening period

- Feed intake, diet composition, chemical analysis → monthly samples

Farm level

- Agricultural inputs, land and yields
- Industrial materials
- Bedding materials
- Manure management



Computation of impacts

Impact category	References
Global warming potential	IPCC (2006) Sauvant et al. (2011) : - feed intake (%BW) - % of concentrates in the diet
Acidification potential	IPCC (2006)
Eutrophication potential	Vértes et al. (1997) Nemeck and Kagi (2007)
Cumulative energy demand	IPCC (2006) Ecoinvent 3.1 (Ecoinvent Centre, 2014), Agri-footprint 1.0 databases (Blonk Agri-footprint, 2014)
Land occupation	On-farm data Ecoinvent 3.1 (Ecoinvent Centre, 2014), Agri-footprint 1.0 databases (Blonk Agri-footprint, 2014)

Impact factors for agricultural and materials → Ecoinvent and Agri-footprint databases

Results: descriptive statistics of productive performances

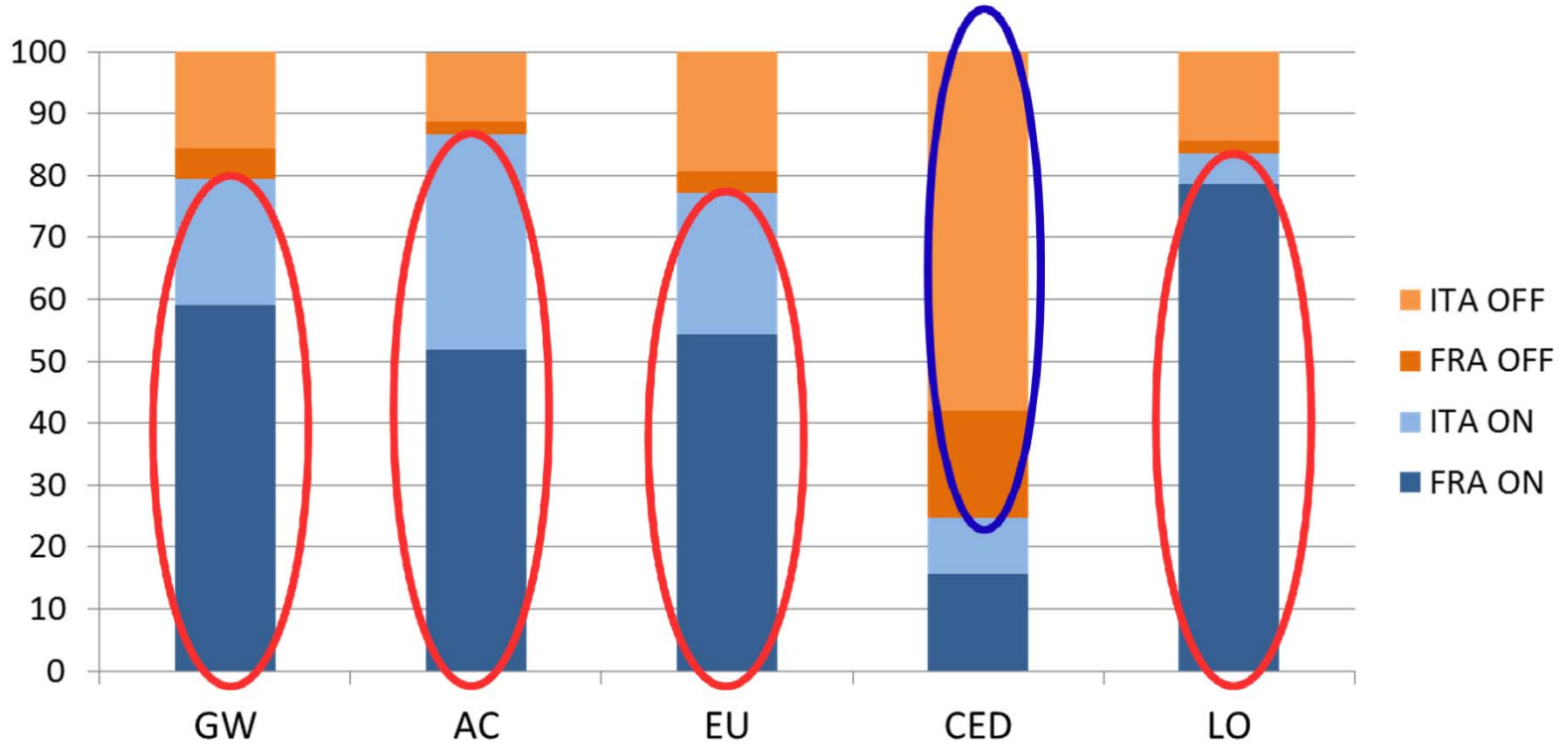
Variable	Unit	Mean	SD
Batch size	heads	66	33
BW at sale form France	kg/head	405	13
Initial BW	kg/head	387	13
Final BW	kg/head	731	19
ADG	kg/day	1.52	0.09
Length of fattening	days	226	11
DMI	kg DM/head/day	10.6	0.5

BW: body weight, ADG: average daily gain, DMI: dry matter intake

Results: descriptive statistics of sustainability indicators (per 1 kg BW)

Impact category	Unit	Mean ± SD
Global warming potential	kg CO_2-eq	13.0 ± 0.7
Global warming potential (570 kg C/ha of grassland C sequestration; Soussana et al., 2010)	kg CO_2-eq	9.9 ± 0.7
Acidification potential	g SO_2-eq	199 ± 14
Eutrophication potential	g PO_4-eq	60 ± 4
Cumulative energy demand	MJ	32 ± 4
Land occupation	m^2/year	19.2 ± 0.7

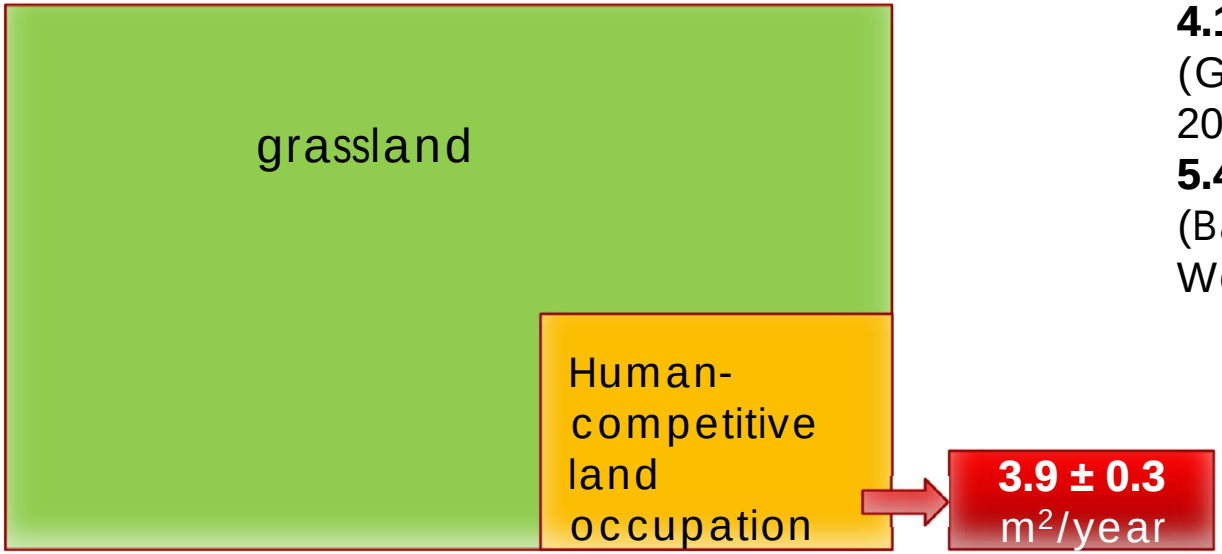
ON- vs OFF-farm



Grass vs crop land occupation

Land occupation per 1 kg BW

Integrated France-Italy beef sector: **19.2 m²/year**



3.9 ± 0.3 m²/year

Pig sector
4.1 m²/year
(Gonzales-Garcia et al., 2015)
5.4 m²/year
(Basset-Mens and van der Werf, 2005)

Conclusions

- The integration between pasture-based suckler cow-calf farms in France (Massif Central) and cereal-based fattening farms of northern Italy allows the **optimisation of the use of the resources offered by different agro-ecosystems for beef production**.
- The environmental impact of the integrated France-Italy beef sector was within the range found in literature, although the diversity of methodology did not enable an accurate comparison.
- The land occupation found was greater than those of monogastric production, but the human-competitive share was similar.

Thank you for your attention

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Calves characteristics per Italian cluster

Cluster	N batches	BWS (kg)		ADG (kg/d)		Age (days)		Birth date	
		Mean	SD	Mean	SD	Mean	SD	Min	Max
Early Winter	12	405	9	1.33	0.05	271	10	1-nov-13	20-dic-13
Mid Winter	32	406	14	1.18	0.08	306	24	17-dic-12	25-feb-13
Late Winter	29	405	13	1.05	0.10	344	29	27-feb-13	10-apr-13