

Life Cycle Inventory of the Galician dairy sector



Almudena Hospido
Chemical Engineering Department
School of Engineering
University of Santiago de Compostela



**4th International
Conference on Life
Cycle Assessment in
the Agri-food sector
(6-8 October 2003)**

1. Why performing a LCI of the Galician dairy sector?

2. Data Collection

i. Farms

ii. Dairies

3. Future Outlook

1. Why performing a LCI of the Galician dairy sector?

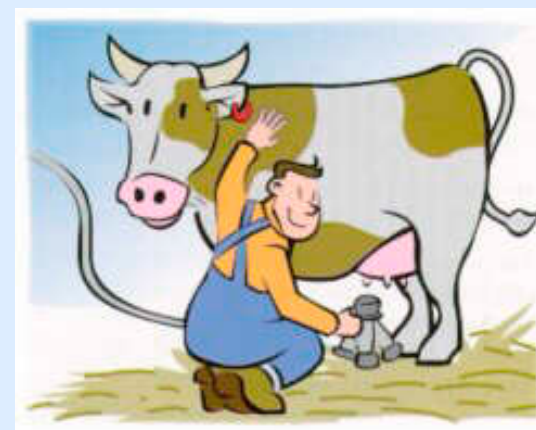
1. Why ...?

Dairy sector is essential for our local economy



Surface: 29,575 km²
Population: 2,737,370

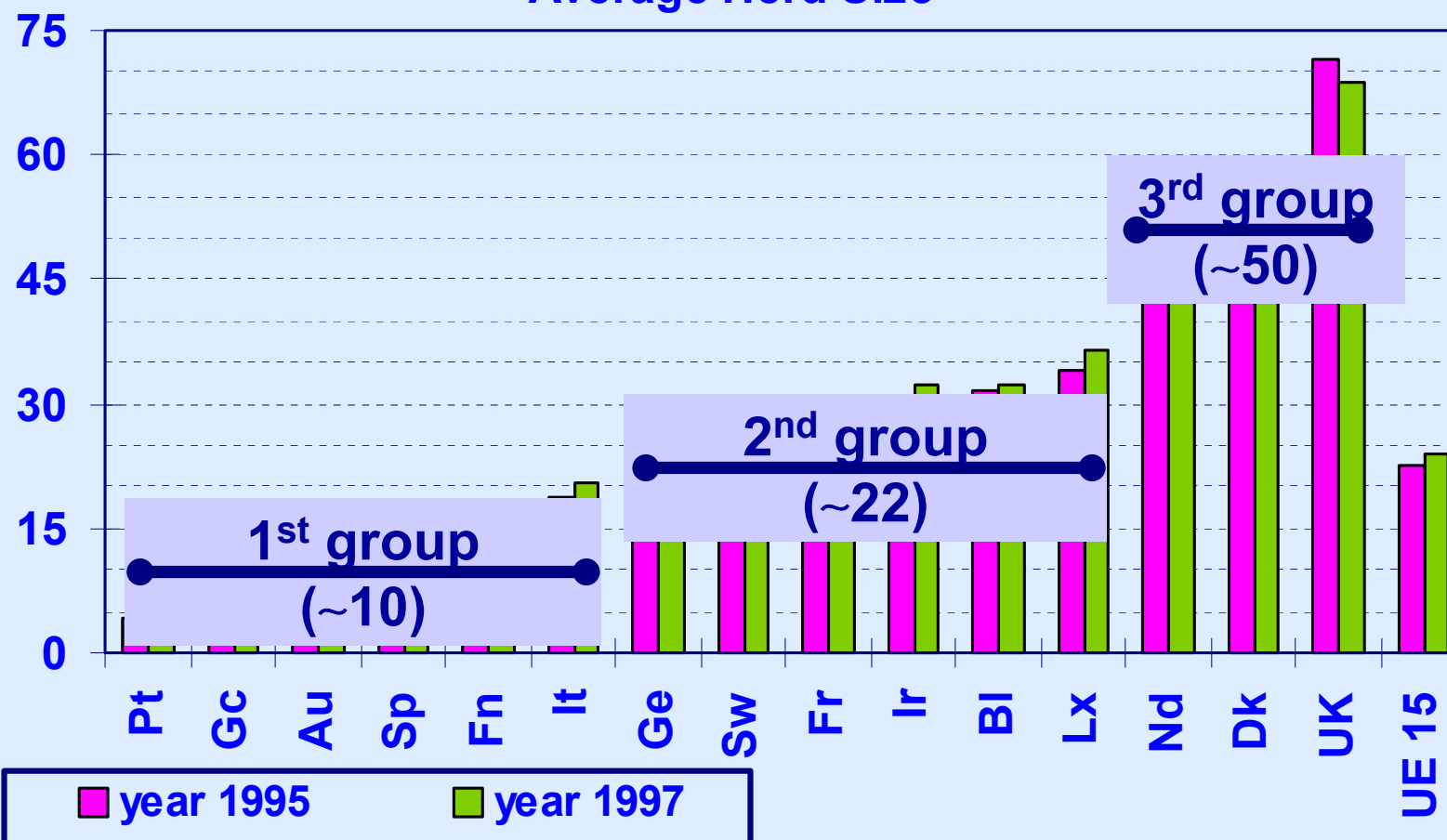
1/4 million (~9%)
of the Population



~ 30% of the total Final Agrarian Production

LCA studies available

-- Average Herd Size --

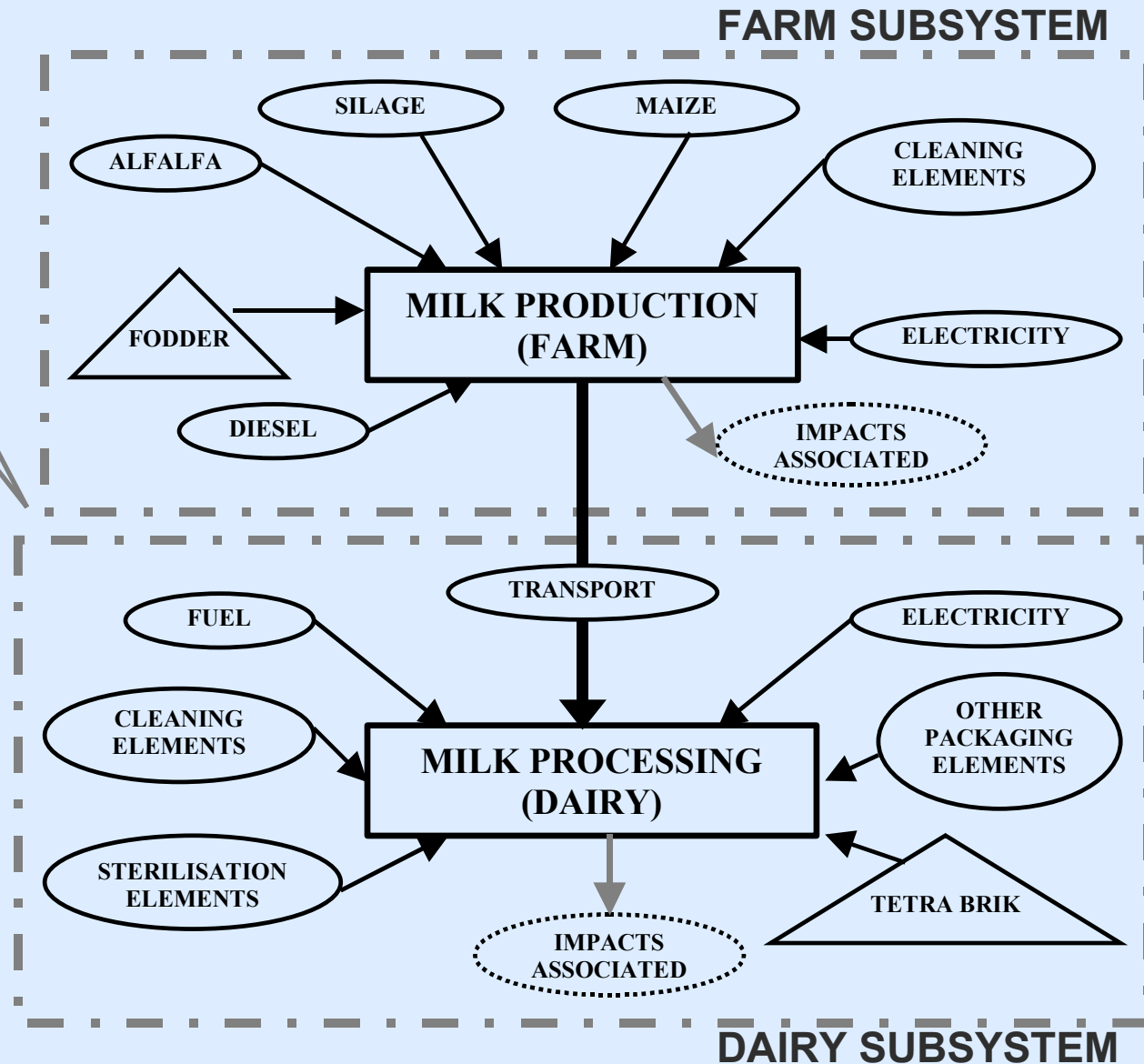
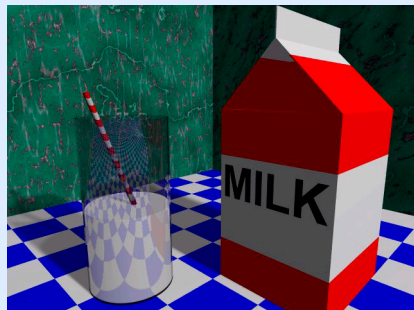


2. Data Collection

2. Data collection

System

Functional Unit:
1 litre of packed milk



Characteristics of our Inventory

- 1. Case-by-case \Rightarrow Real data**
- 2. Bibliographic data: Reports and data base from LCA Software**
- 3. Allocation rules:**
 - i. Economic allocation at Farms**
 - ii. No allocation at Dairies**

The Recession Process

Year 1982

109,284 operative farms

Year 2001

1,159 farms forced to close

Year 2002

1,435 farms forced to close



Year 2002

24,910 operative farms
(22.8%)

2. Data Collection. FARMS

	Farm A	Farm B	Farm C
Location	Portomarín (LUGO)	Carballedo (LUGO)	Sarria (LUGO)
Annual Prod. (L)	228,286	353,725	427,050
Number of Cows (In Milking)	50 (23)	60 (38)	67 (50)
Average Yield (Litres per cow and year)	9,925	9,309	8,541



2. Data Collection. FARMS

INPUTS from the TECHNOSPHERE

	(UNIT)	Farm A	Farm B	Farm C	Average	S.D.
Silage	g	700	314	641	552	208
Maize	g	262	588	598	483	191
Fodder	g	464	423	385	424	40
Alfalfa	g	45	176	214	145	89
Detergent	mL	0.87	0.36	0.82	0.68	0.28
Acid solution	mL	0.07	0.05	0.16	0.09	0.06
Disinfectant	mL	0.52	1.33	0.30	0.72	0.54
Linchpin	unit	-	7.8E-05	4.9E-05	6.4E-05	2.1E-05
Diesel	mL	3.77	3.59	3.72	3.69	0.09
Electricity	Wh	38.1	57.8	36.4	44.1	11.9

INPUTS from the NATURE

	(UNIT)	Farm A	Farm B	Farm C	Average	S.D.
Water	L	3.81	4.18	-	3.99	0.26

-- POINTS OF CONSUMPTION --

Milking System Cleaning .

Milking Room Cleaning .

Tank Room Cleaning .

Floor Cleaning .

Cow Consumption = Urine

Waiting Room Cleaning

Grill Cleaning

Wa ste wa te r TO NATURE

TO THE MANURE DEPOSIT

2. Data Collection. FARMS

OUTPUTS to the TECHNOSPHERE

	(UNIT)	Farm A	Farm B	Farm C	Average	S.D.
PRODUCTS						
Raw Milk	L	1.00	1.00	1.00	1.00	0.00
[Meat]	g	11.8	7.63	6.32	8.59	2.88

OUTPUTS to the NATURE

	(UNIT)	Farm A	Farm B	Farm C	Average	S.D.
TO AIR						
Methane	g	10.5	11.2	12.2	11.3	0.9
TO WATER						
Wastew	L	-	1.13	-	1.30	-
COD	g/L	-	7.15	-	7.15	-
TSS	g/L	-	2.35	-	2.35	-

NOTE! Manure has not been considered

2. Data Collection. DAIRIES

INPUTS from the TECHNOSPHERE

	(UNIT)	Dairy A	Dairy B	Dairy C	Average	S.D.
Transport	kgkm	210	233	401	281	104
Raw Milk	L	1.20	1.10	1.02	1.11	0.09
Tetra-Brik	unit	1.02	1.00	1.01	1.01	0.01
H ₂ O ₂	g	0.35	-	0.40	0.38	0.03
Cardboard	g	16.8	-	7.72	12.3	6.42
Film	g	0.18	-	2.06	1.12	1.33
HNO ₃	g	0.66	0.39	1.51	0.85	0.58
NaOH	g	1.63	1.76	2.46	1.95	0.45
Fuel	g	8.62	5.52	10.06	8.06	2.32
Electricity	Wh	57.2	35.4	45.8	46.1	10.9
Floculant	g	-	0.86	0.41	0.63	0.32

INPUTS from the NATURE

	(UNIT)	Dairy A	Dairy B	Dairy C	Average	S.D.
Water	L	4.41	-	1.94	3.18	1.74

2. Data Collection. DAIRIES

OUTPUTS to the TECHNOSPHERE

(n.p. = no pertinent)

	(UNIT)	Dairy A	Dairy B	Dairy C	Average	S.D.
PRODUCTS						
Pack Milk	L	1.00	1.00	1.00	1.00	0.00
WASTE TO TREATMENT						
Cardboard	g	-	0.31	0.38	0.34	0.05
Film	g	-	-	0.78	0.78	-
Used T-B	unit	-	3.0E-03	1.2E-02	7.5E-03	6.4E-03
Wastewater	L	-	n.p.	1.94	1.94	-

OUTPUTS to the NATURE

	(UNIT)	Dairy A	Dairy B	Dairy C	Average	S.D.
TO WATER						
Wastewater	L	-	0.24	n.p.	0.24	-
TO SOIL						
Sludge	g	-	53.0	27.9	40.5	17.7
TO AIR						
SO ₂	g	-	0.19	0.21	0.20	0.01
NO ₂	g	-	3.47	10.18	6.83	4.75
CO	g	-	3.82	0.45	2.14	2.39

3. Future Outlook

1. To complete the Inventory at the farm level

More Farms ...	Farm D	Farm E
Location	Frades (A CORUÑA)	Pastoriza (LUGO)
Annual Production (L)	819,800	187,710
Number of Cows (In Milking)	105 (90)	33 (25)
Average Yield (L/c·y)	9,109	7,508

Manure Application \Rightarrow Emissions to Air and to Water

2. Ecological Milk

- **Ecological Agriculture**



Since 1997

- Year 1996: 0 bovine farms in Galicia
- Year 1996: 9 bovine farms in Spain
- Year 2002: 12 bovine farms in Galicia
(7-8 of them for MILK production)
- Year 2002: 29 bovine farms in Spain

3. Global assessment according to sustainability



**Thank you!!! Gracias!!! Mange
Tack!!!**



**www.usc.es/biogrup
ahospido@usc.es**



**4th International
Conference on Life
Cycle Assessment in
the Agri-food sector
(6-8 October 2003)**