Need to conciliate beef quality, farm efficiency, environment preservation and animal welfare

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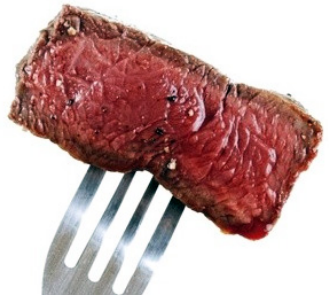
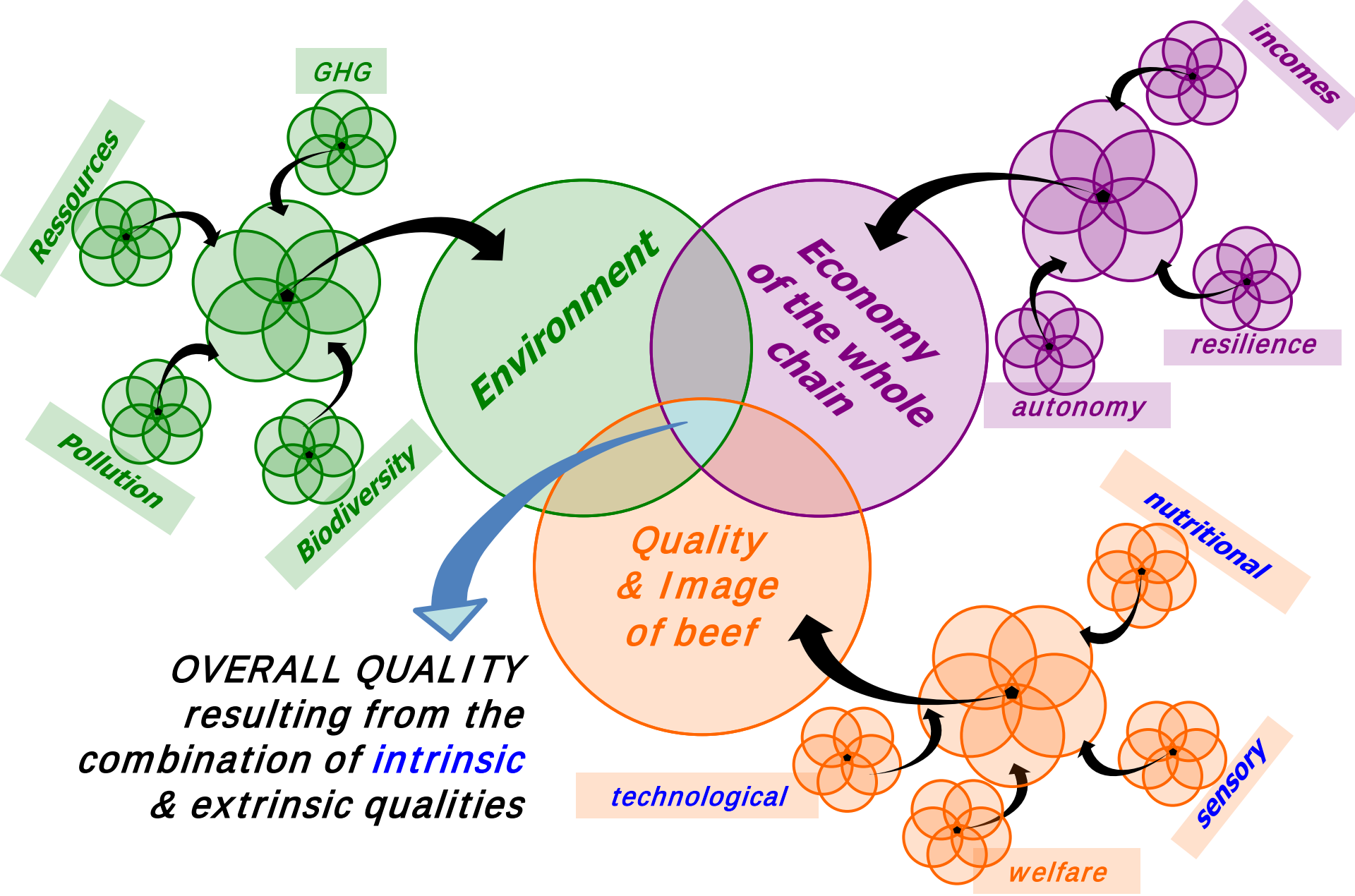
The definition of quality



Intrinsic quality refers to the characteristics of the product itself and includes sensory traits (e.g. tenderness, flavor, juiciness, overall liking), safety, healthiness, convenience, etc.

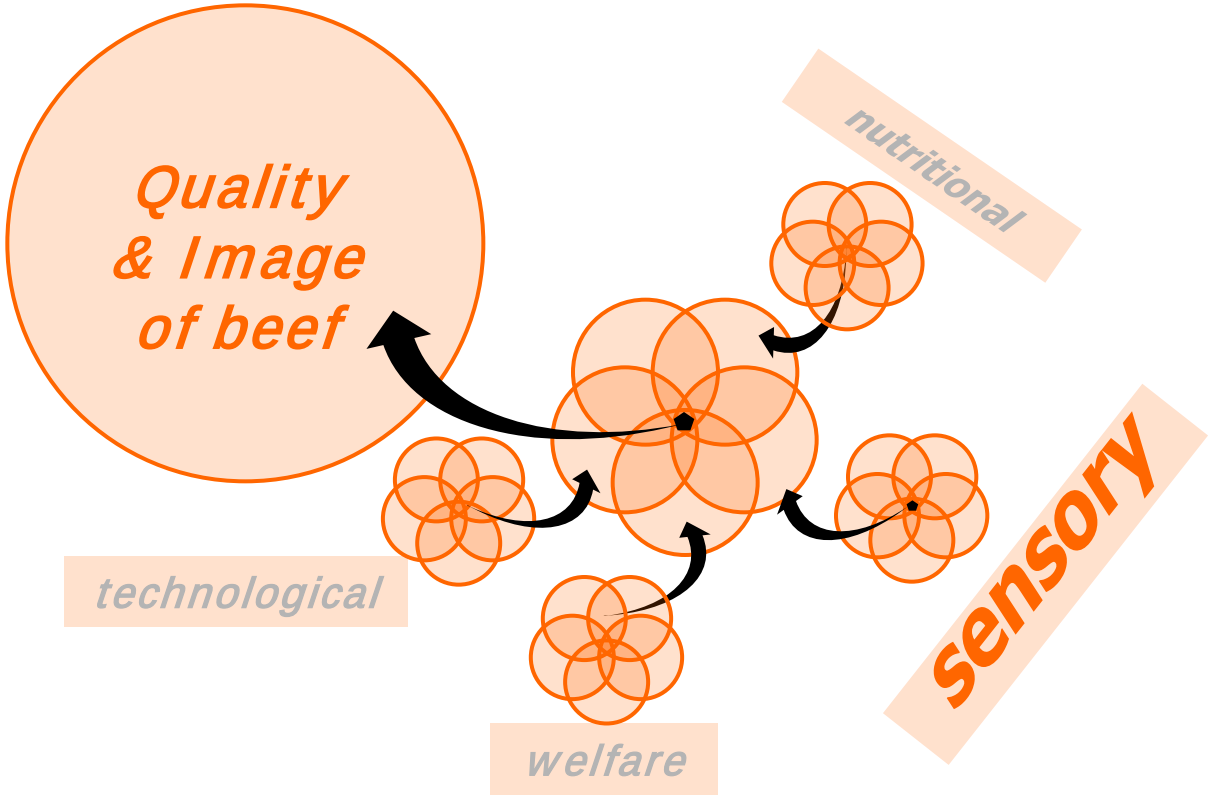
Extrinsic quality refers to traits which are associated with the product, namely (i) production system characteristics (from the animal to the processing stages including for example animal welfare, carbon footprint), and (ii) marketing variables (including price, brand name, distribution, origin, packaging, labelling, and traceability)

reviewed by Luning, Marcelis & Jongen, 2002; Grunert, Bredahl, & Brunso, 2004.



A global approach

Husbandry, slaughtering, ageing and cooking: combining criteria for a better prediction of sensory quality

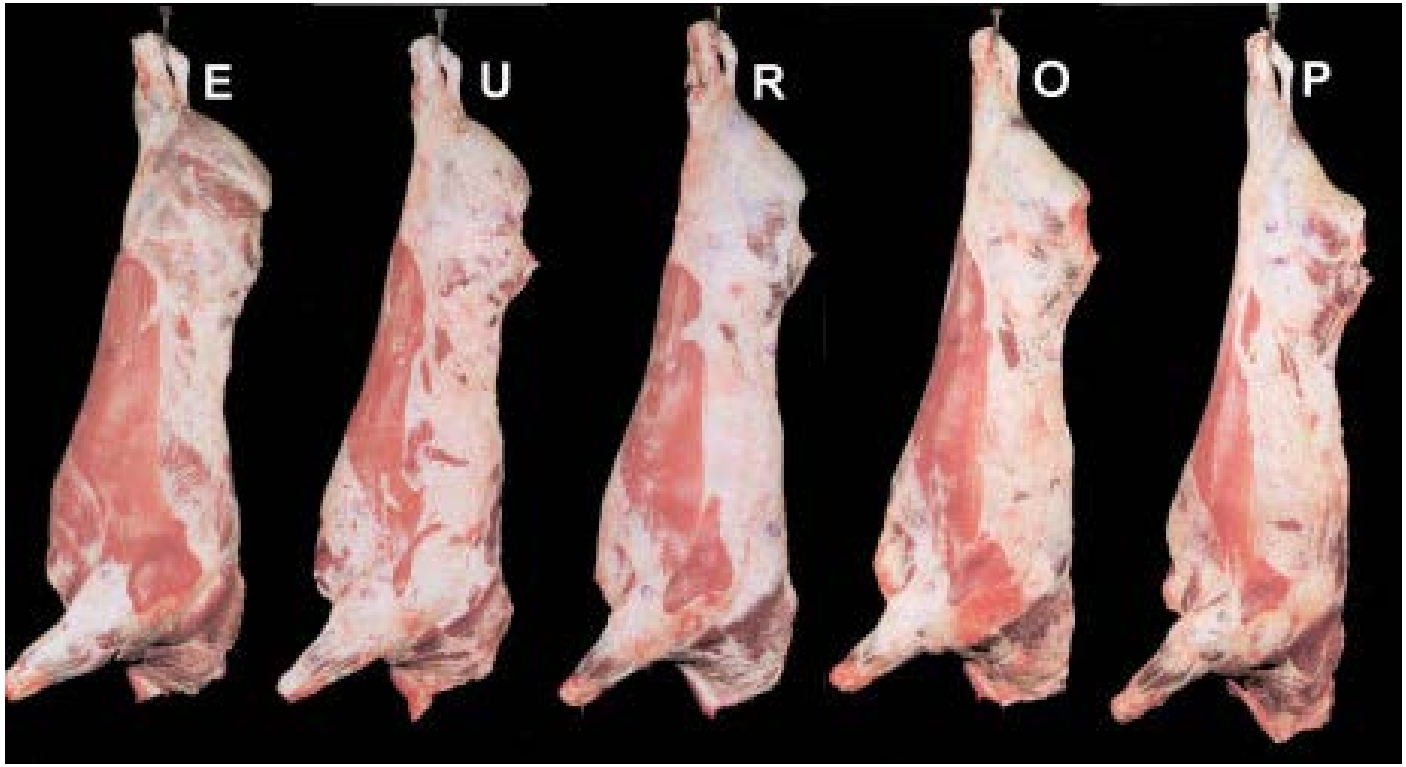


Different beef grading schemes

Country Scheme	Europe EUROP	S. Africa S. Africa	Canada Canada	Japan JMGA	S. Korea Korea	USA USDA	Australia MSA
Grading unit	**Carcass**						**Cut**
Pre slaughter factors							HGP implants & Bos Indicus
Slaughterfloor	**Carcass weight and sex**						
	Conformation Fat cover	Dentition Ribfat	Conformation				Electrical stimulation Hang
Chiller			**Marbling score** **Meat Colour** **Fat colour and fat thickness** Texture	**Eye muscle area** Meat Brightness Fat luster Fat texture Fat firmness Rib thickness	Texture Firmness Lean maturity	**Ossification score** Meat texture Ribfat Kidney fat Perirenal fat	**Fat thickness** Hump weight Ultimate pH
Post chiller							**Ageing time** **Cooking method**

Polkinghorne, Thompson, Meat Science, 2010, 86, 227-235.

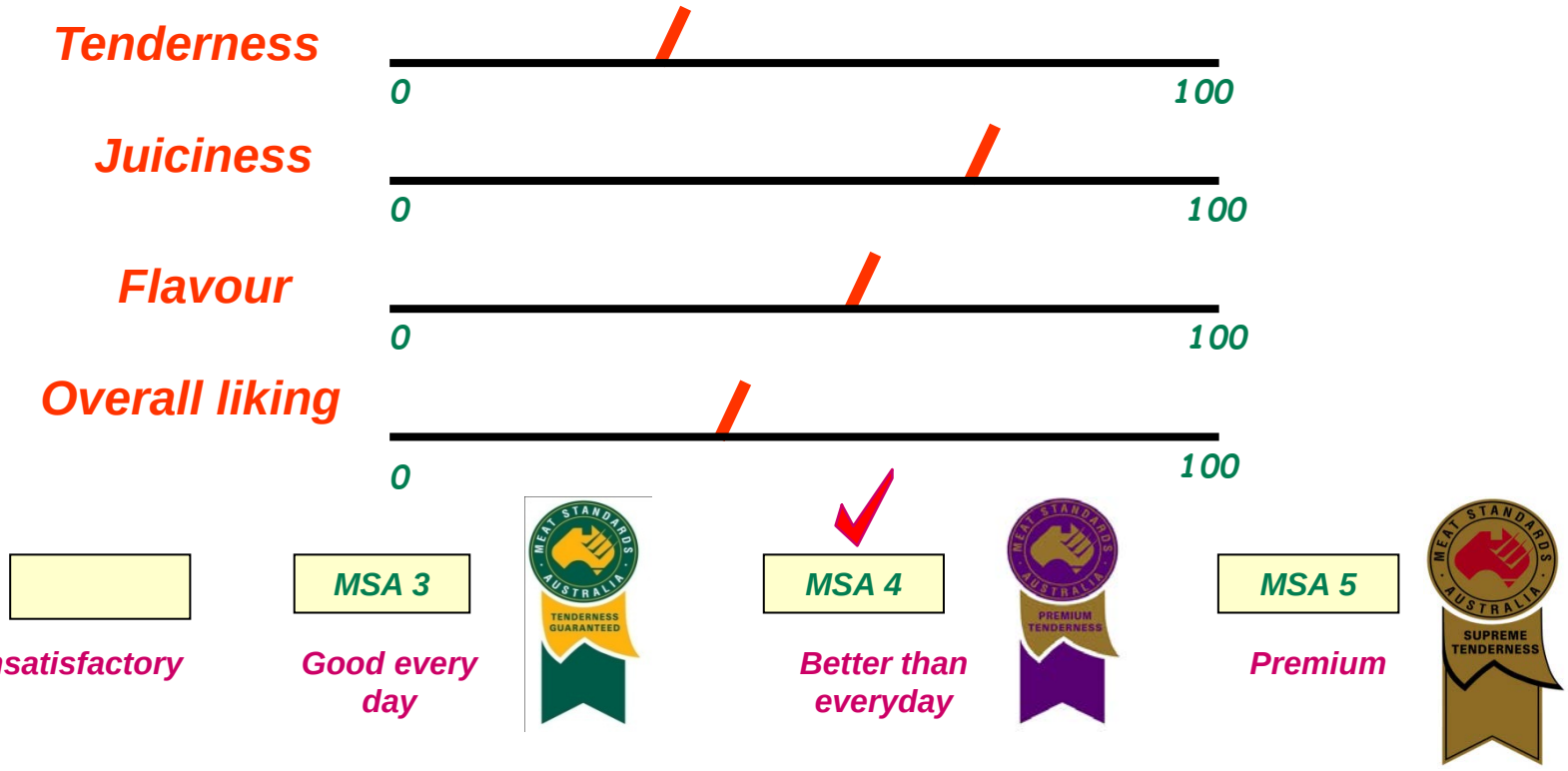
The EUROP system for carcass conformation



However, consumers do not eat carcasses!

The Meat Standards Australia (MSA) system

MSA moved from a carcass pathways to a cuts based grading scheme



Meat Quality score (MQ4) (0-100 scale) =

0.3 tenderness + 0.1 Juiciness + 0.3 Flavor liking + 0.3 Overall liking

Meat Standards Australia (MSA)

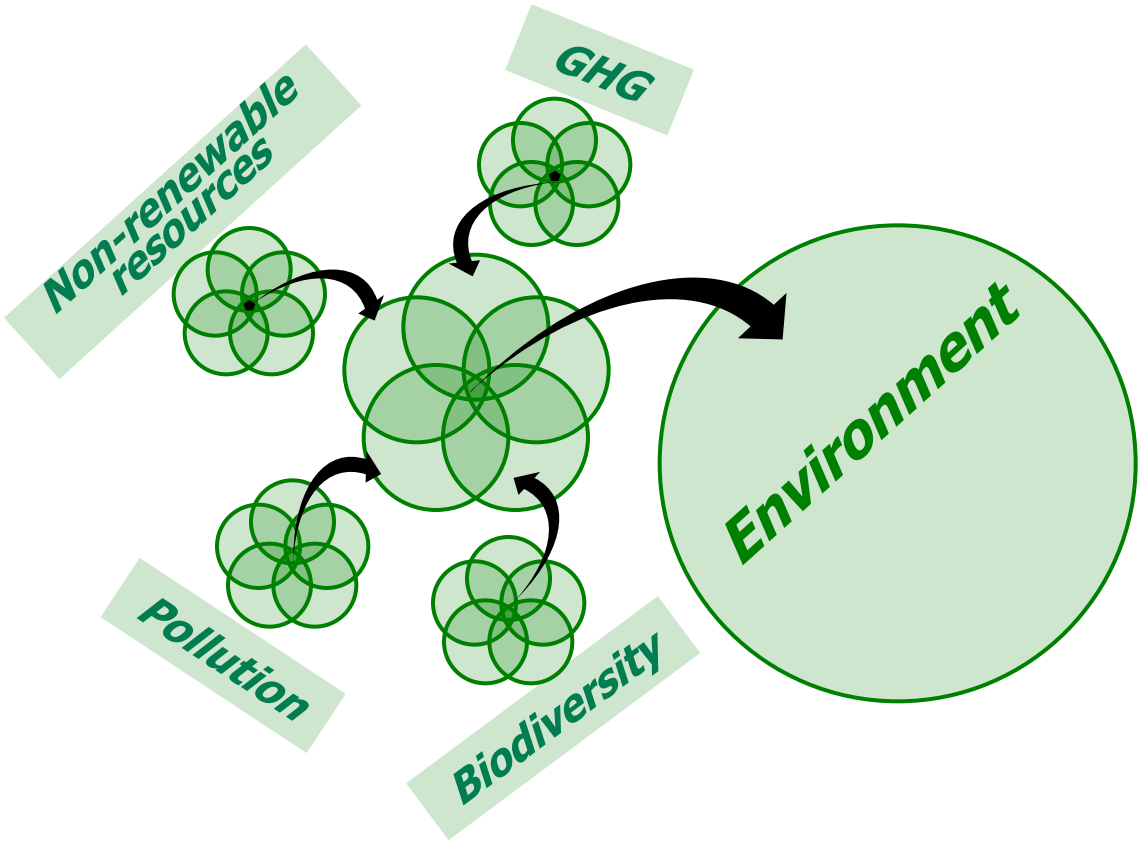
MSA2000model®

Hang (AT/TC/TS/TX)	AT
Sex (M, F)	m
Est.% Bos Indicus	0
Hump Height cms	0
Hot Std Carc Weight	250
USDA Ossification	140
Milk Fed Vealer Y/N	n
USDA Marbling	130
Days Aged (min 5)	5
Quarter Point Ribfat	12
Ultimate pH	5.50
AUSMEAT Meat Col.	2
Saleyard? (Y, N)	n
Wght/App.Maturity	0.86

Cut Description	Muscle Reference	Days Aged	Grilled Steak	Roast Beef	Stir Fry	Thin Slice	Cass-erole	Corned Beef
Tenderloin	TDR062		5	4	5			
Cube Roll	CUB045		3	3	3			
Striploin	STR045		3	3				
Oyster Blade	OYS036		4	3				
Bolar Blade	BLD096		3	3				
Chuck Tender	CTR085			3	3			
Rump	RMP131		3	3	3	3		
Point End Rump	RMP231		3	3	3	4		
Knuckle	KNU099		x	3	3	3	3	
Outside Flat	OUT005			x	x	3	3	3
Eye Round	EYE075		x	3	3	3	3	x
Topside	TOP073		x	x	x	3	3	
Chuck	CHK078			3	3	3	3	
Thin Flank	TFL051				3		3	
Rib Blade	RIB041				3			
Brisket	BRI056				x	3	3	x
Shin	FQshin						3	

Palatability grade

Feeding practices: comparison of three contrasting bull-fattening systems used in France



Comparison of three contrasting diets

⇨ *Blond d'Aquitaine young bulls*

% concentrate → / % forages →	35 % 65 % corn silage	50 % 50 % hay	86 % 14 % wheat straw,
	Per kg of body weight gain		
greenhouse gas (GHG) emissions in kg eq-CO_2	**4,74**	**4,56**	☺ **3,75**
Including enteric methane	*2,23*	*2,23*	*0,84*
Energy consumption eq-MJ	☺**13,0**	**18,7**	**19,8**
Eutrophication potential g eq-PO_4^{3-}	**18,6**	☺**15,8**	**20,8**

Each diet has different advantages and disadvantages

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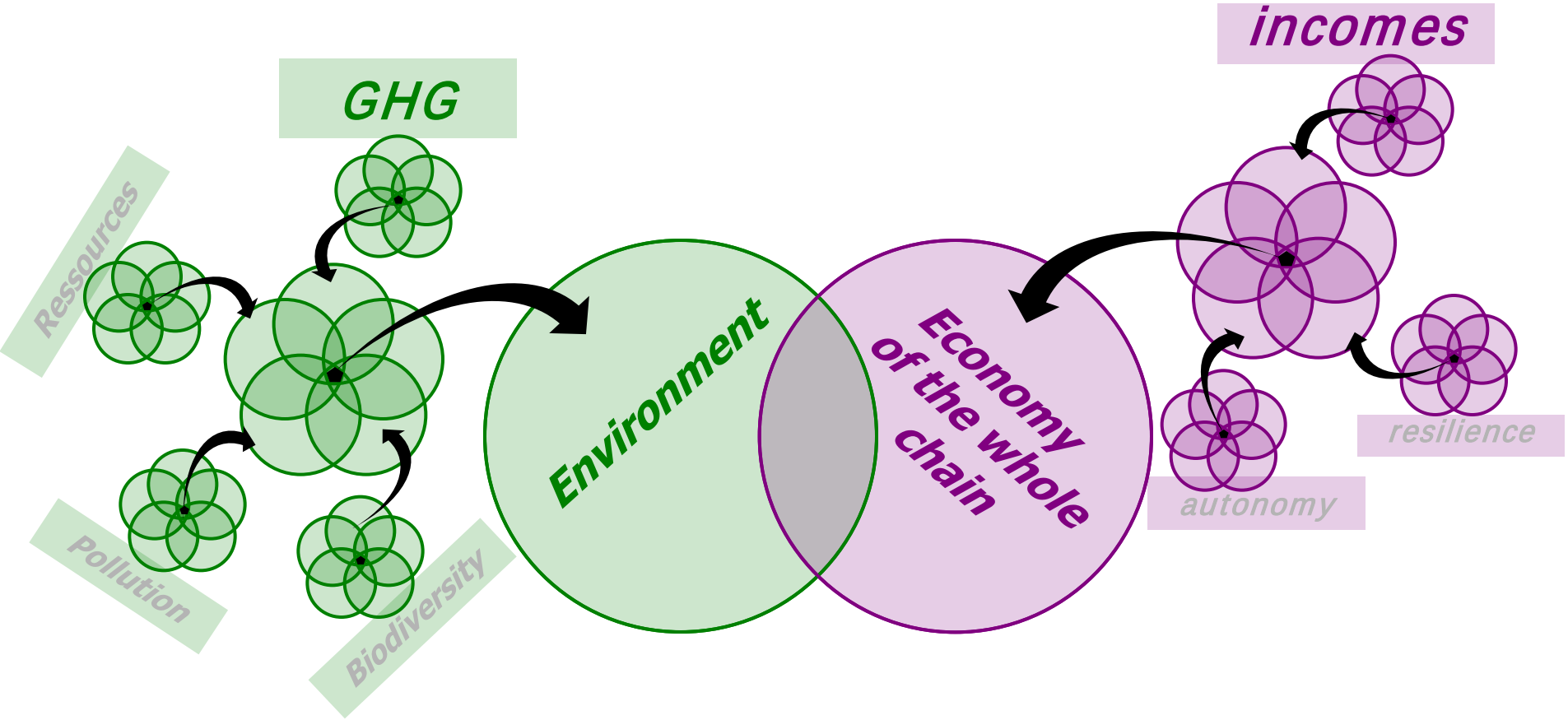
Doreau et al, 2011; Nguyen et al, 2012

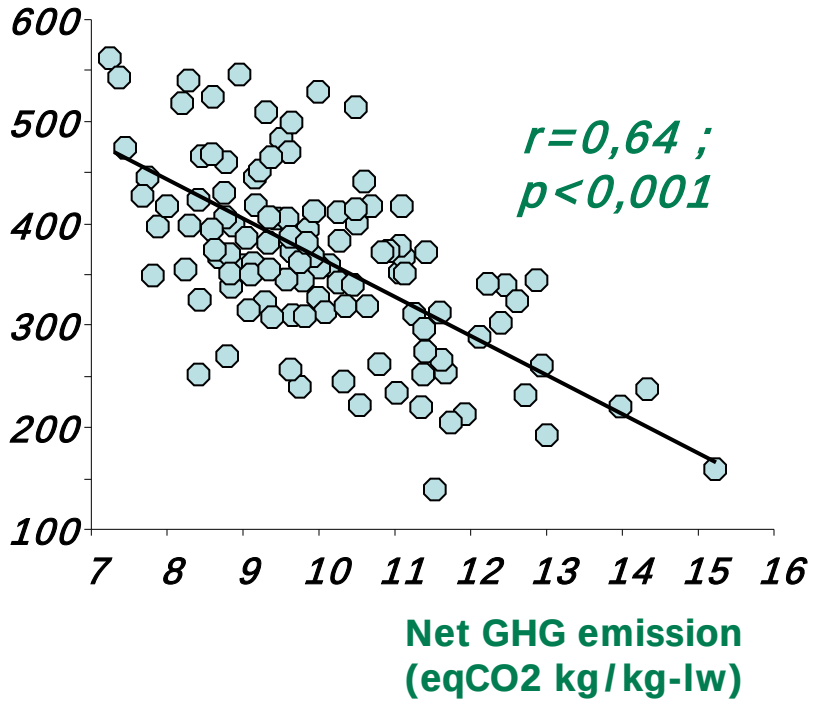
Husbandry practices : win-win relationships between environmental and economic issues



Feeding practices and beef quality

⇨ 59 farms in the Charolais area from 2010 to 2011.

Bovine gross margin
("€/UGBb" = €/LU)



Win-win relationships:

Farms

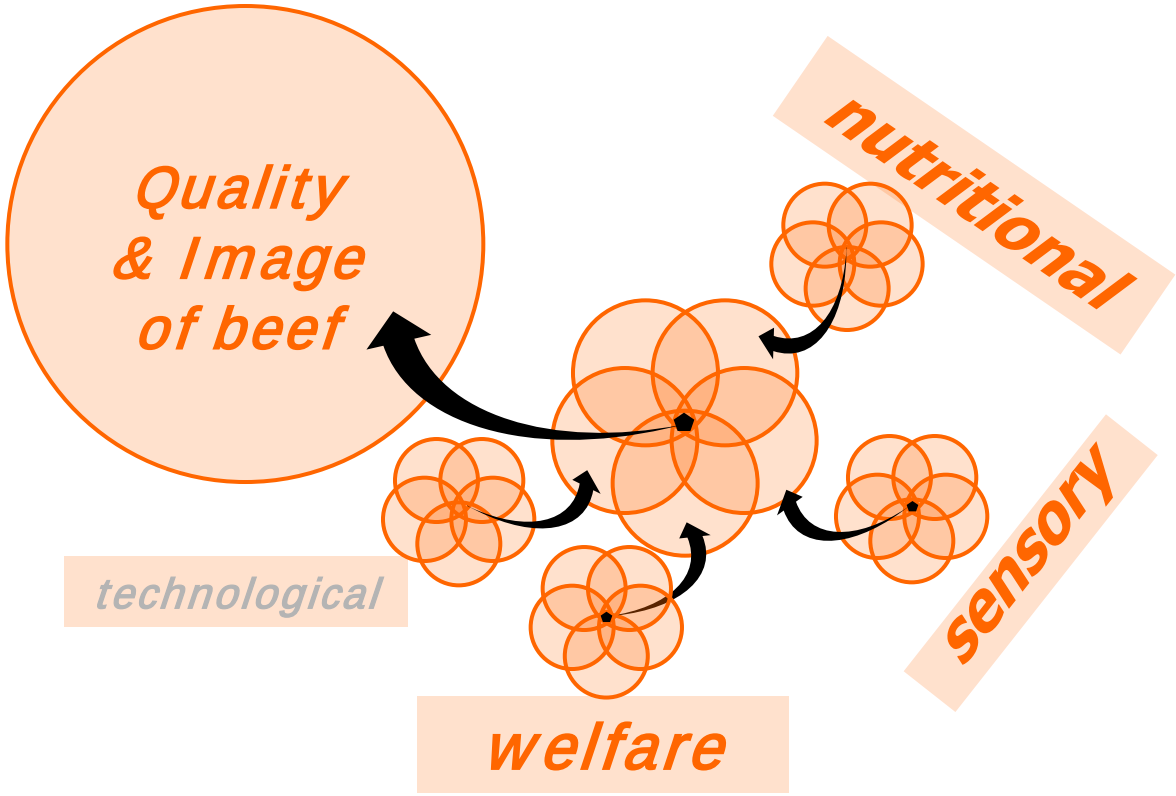
- the most efficient on an economic basis
- are also the most efficient for low GHG emissions

High variability :

- from 7 to 15 for GHG emissions
- from 150 to 550 for gross margin

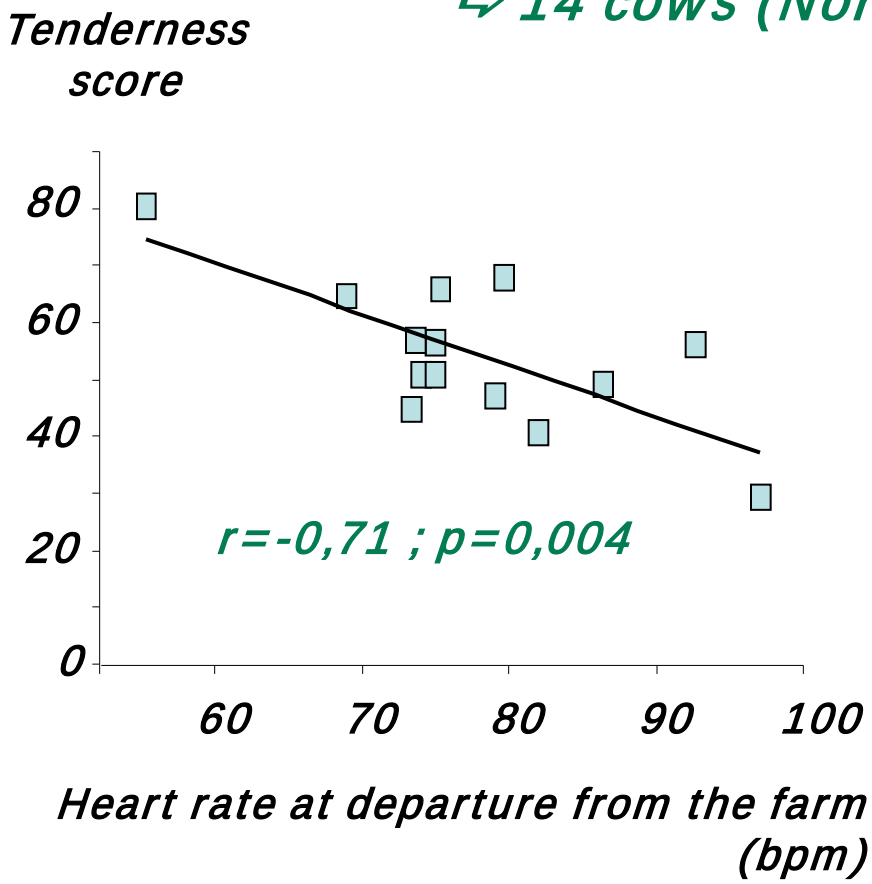
Veysset et al., 2013

Husbandry and slaughtering: win-win strategies to optimise both welfare, nutritional value and tenderness



Stress at slaughter and beef quality

⇨ *14 cows (Normand breed)*



Win-win relationship:

Cows

- with the lowest stress

low heart rate before slaughtering

- provide the most tender beef

Terlouw et al., 2012

Feeding practices and beef quality

cows (Normand breed): Linseed supplementation

↗ 18:3 n-3 content in muscles

☺ Higher PUFA content

☹ Higher susceptibility to FA oxidation
Negative impact on sensory quality

Stress at slaughter

Beef less red &
Potential off-flavour

Redness	15,5	
Redness + antioxidants	19,0	☺ Protection against oxidation

Win-win relationships:

Simultaneous addition of linseed and antioxidants produce beef of better quality :

➔ better stability of PUFA
➔ better stability of colour

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Gobert et al., 2008 ; Parafita et al., 2008 ; Bauchart et al, 2009

How to combine different criteria of quality?

1. **Analysis by an expert:** done by traditional butchers. Not transparent, not exhaustive and also not consistent across experts.

2. **Minimum requirements (= thresholds)**
   easy to understand and implement but rough evaluation (good *vs* bad).

3. **A ranking system** from best (rank 1) to worst (rank n), and a summation of the ranks: this is only a 'relative' judgment, comparing alternatives among themselves, and not an 'absolute' assessment.

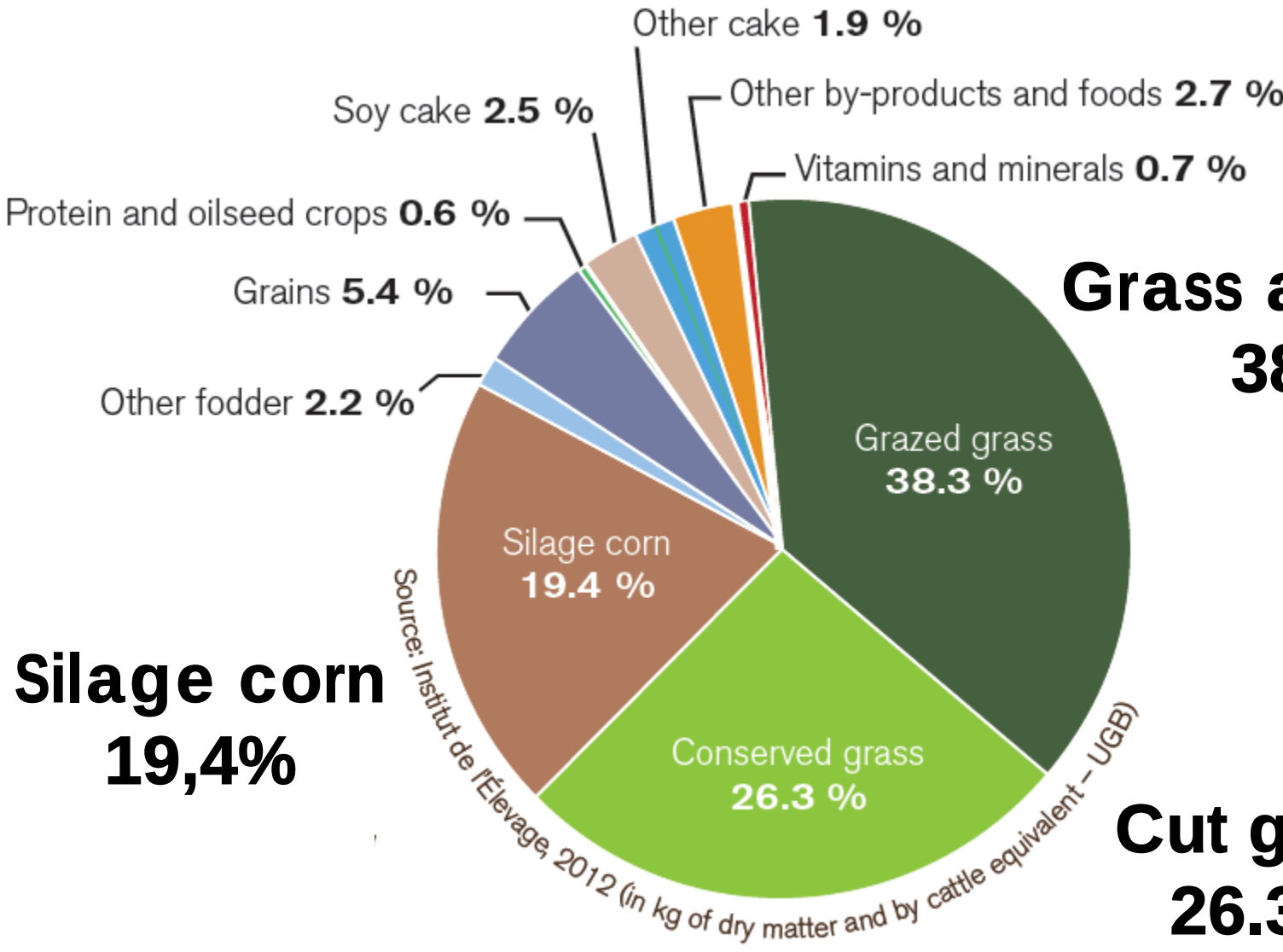
4. **Conversion of quality traits into value-scores**
   (e.g. quantitative information on a common scale) which are then compounded (e.g. the MSA system for sensory analysis based on a weighted sum).

Etc.

Conclusions about multicriteria approaches

- ✓ **Consumer satisfaction** when eating beef involves a complex response based on **objective** and **emotional** assessments of the product.
- ✓ **Scientific research** must provide **methods** to predict, in a reliable manner, intrinsic and extrinsic quality traits of beef.
- ✓ **Combining intrinsic and extrinsic** quality traits by relevant and new methods is a key driver for the future.

Example of pasture-based systems

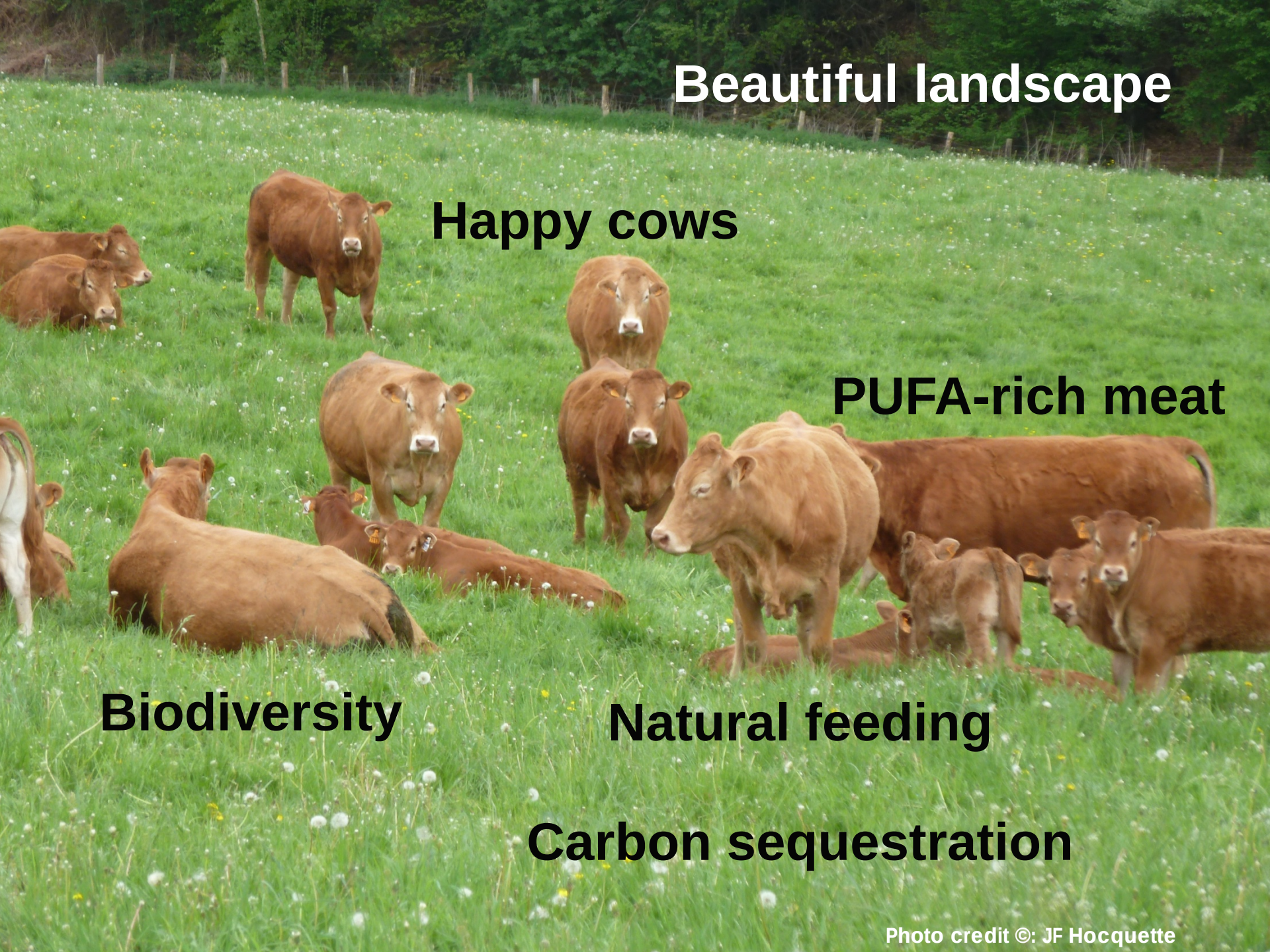


Grass at pasture 38.3%

Silage corn 19,4%

Cut grass 26.3%

About 80% of feed of herbivores are forages in France


Beautiful landscape
Happy cows
PUFA-rich meat
Biodiversity
Natural feeding
Carbon sequestration
Photo credit ©: JF Hocquette