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Fakultät für Naturwissenschaften und Technik
Facoltà di Scienze e Tecnologie
Faculty of Science and Technology

How can animal science contribute to a sustainable and global animal production ?

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What is Sustainable Livestock Farming ?

Sustainable livestock production is “the efficient production of safe, high quality animal products, in a way that protects and improves the natural environment, the social and economic conditions of farmers, their employees and local communities, and safeguards the health and welfare of all farmed species”.

http://www.saiplatform.org/sustainable-agriculture/definition

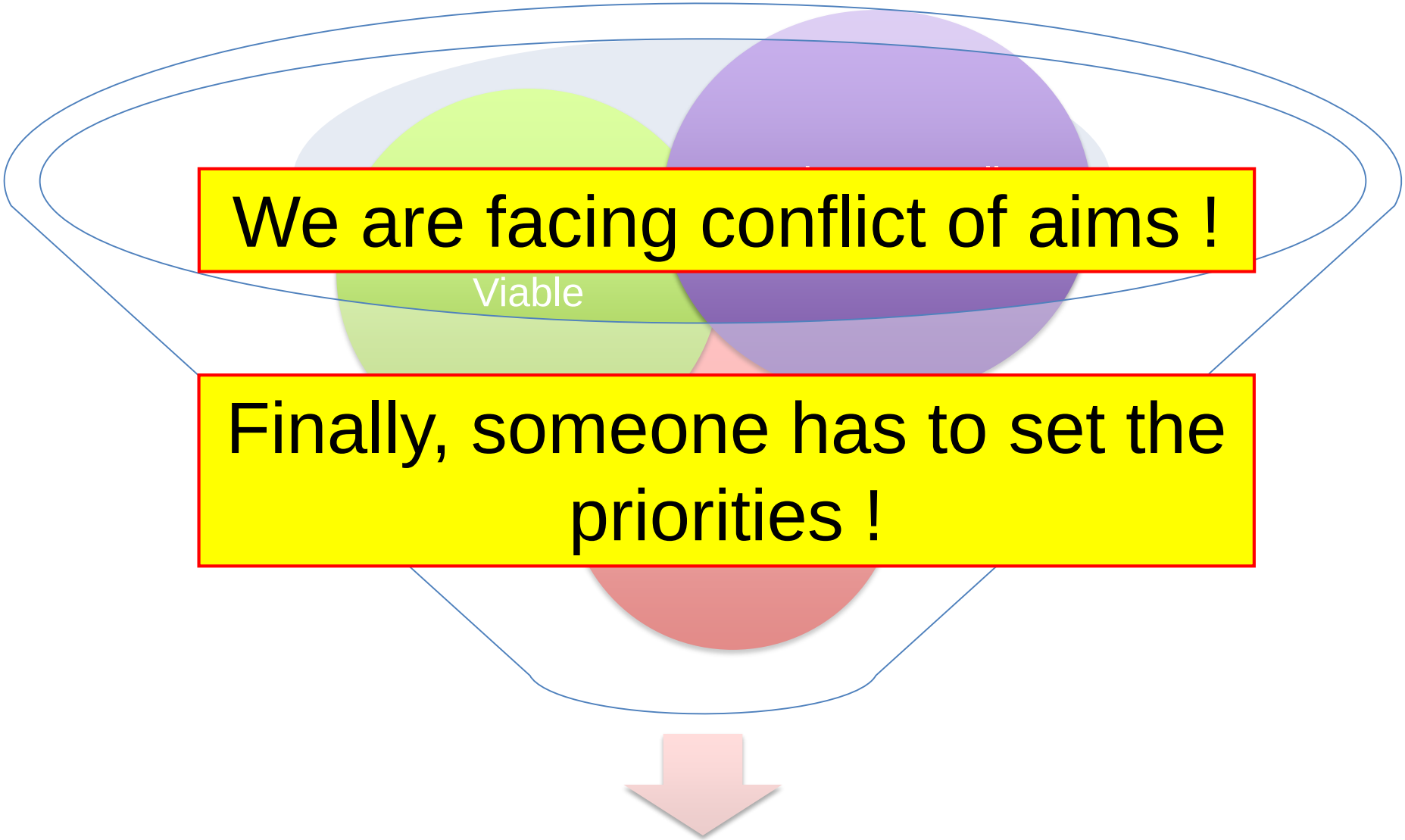
What is Sustainable Livestock Farming ?

Sustainable livestock production is “the efficient

Only those production systems which are accepted by the society will be „sustainable“ !

and safeguards the health and welfare of all farmed species”.

http://www.saiplatform.org/sustainable-agriculture/definition



Sustainable Livestock Farming

Overview

- What is the current situation ?
- How have we arrived there ?
- What actors are involved ?
- What are the challenges ?
- How can animal science contribute ?
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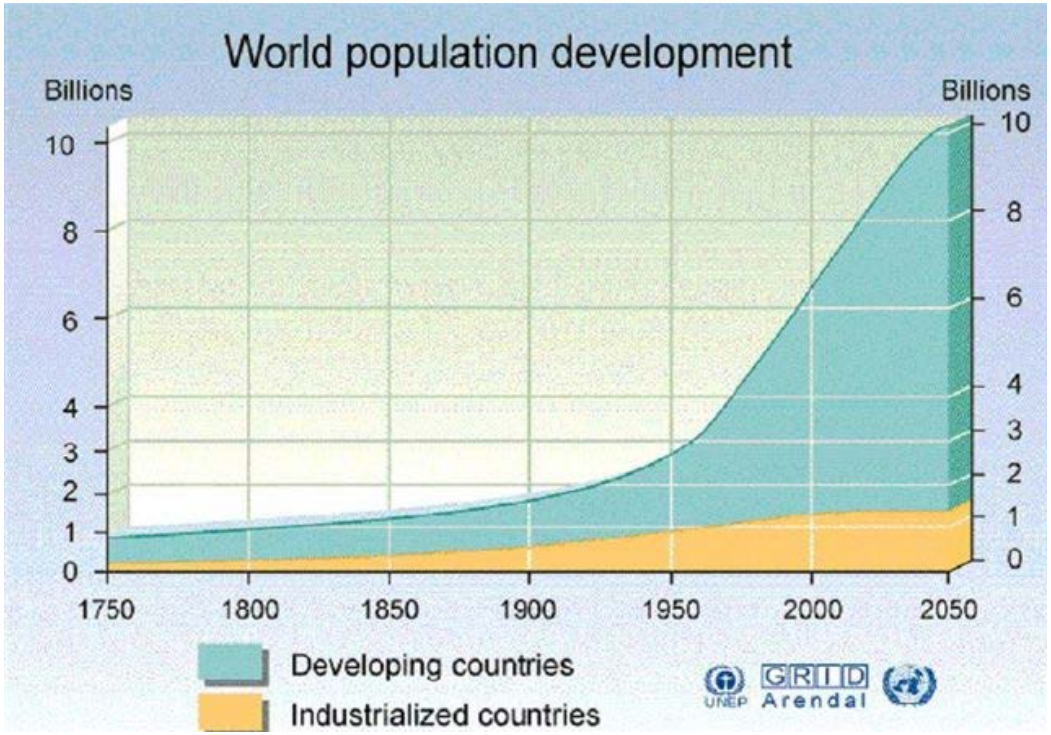
What is the current situation ?

The global population is 7.3 billion today.

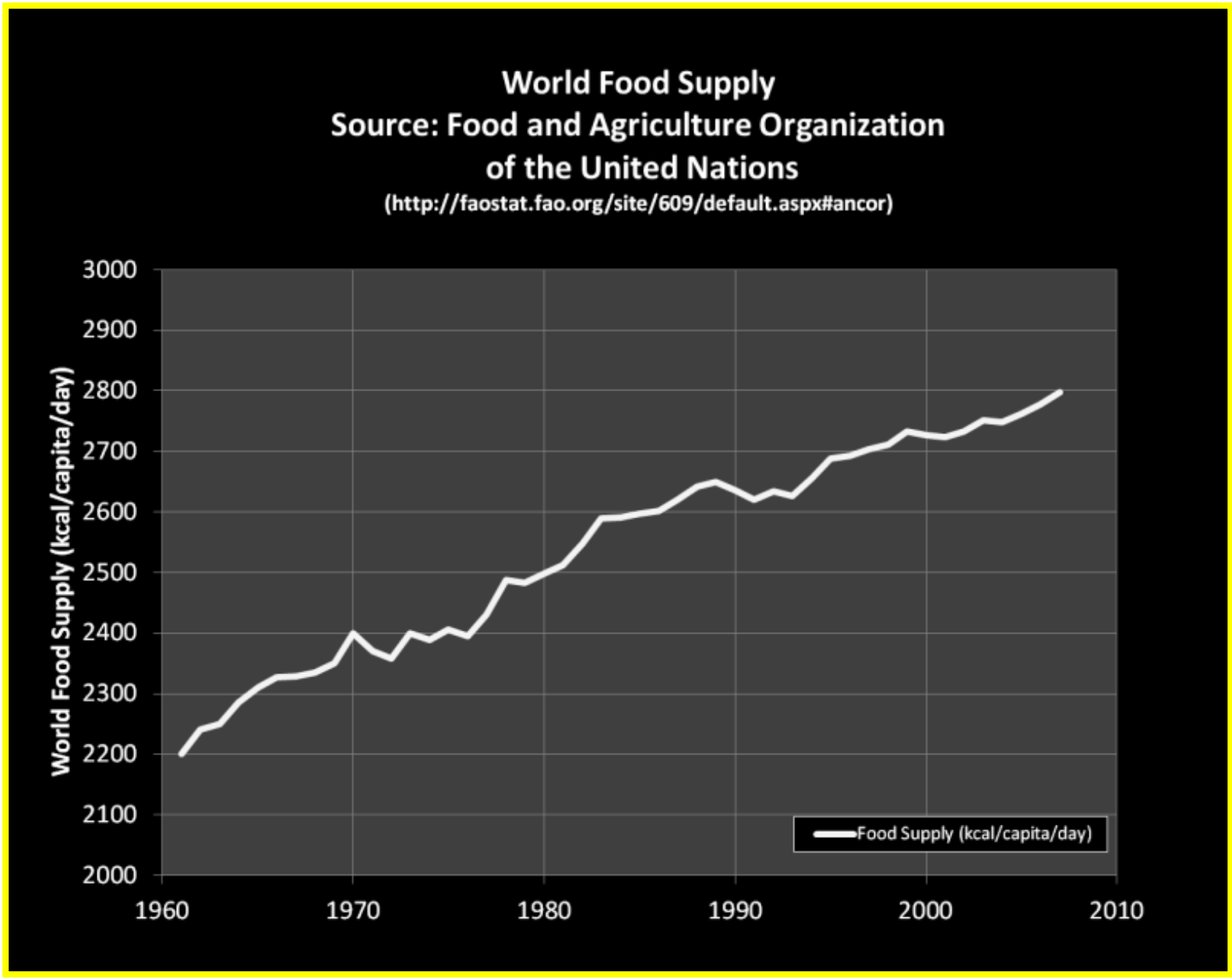


What is the current situation ?

The global population is 7.3 billion today.

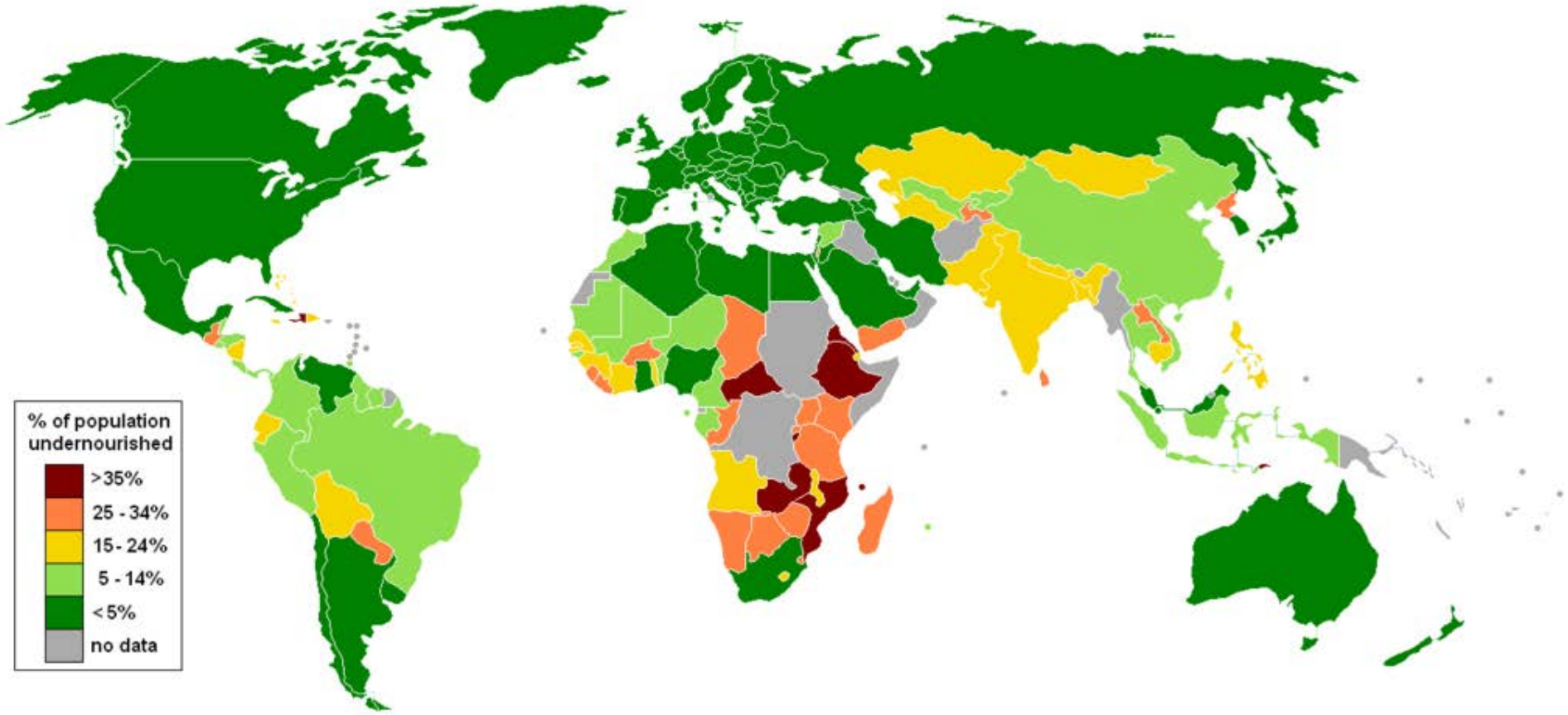
Global demand for animal products is expected to double in the next decades due to an increasing global population and global wealth.

Environmental issues and animal welfare is at the heart of a discussion about an “agricultural turn-around” and the future of farming in Europe.


World Food Supply
Source: Food and Agriculture Organization of the United Nations
(http://faostat.fao.org/site/609/default.aspx#ancor)
World Food Supply (kcal/capita/day)
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1960
1970
1980
1990
2000
2010
Food Supply (kcal/capita/day)

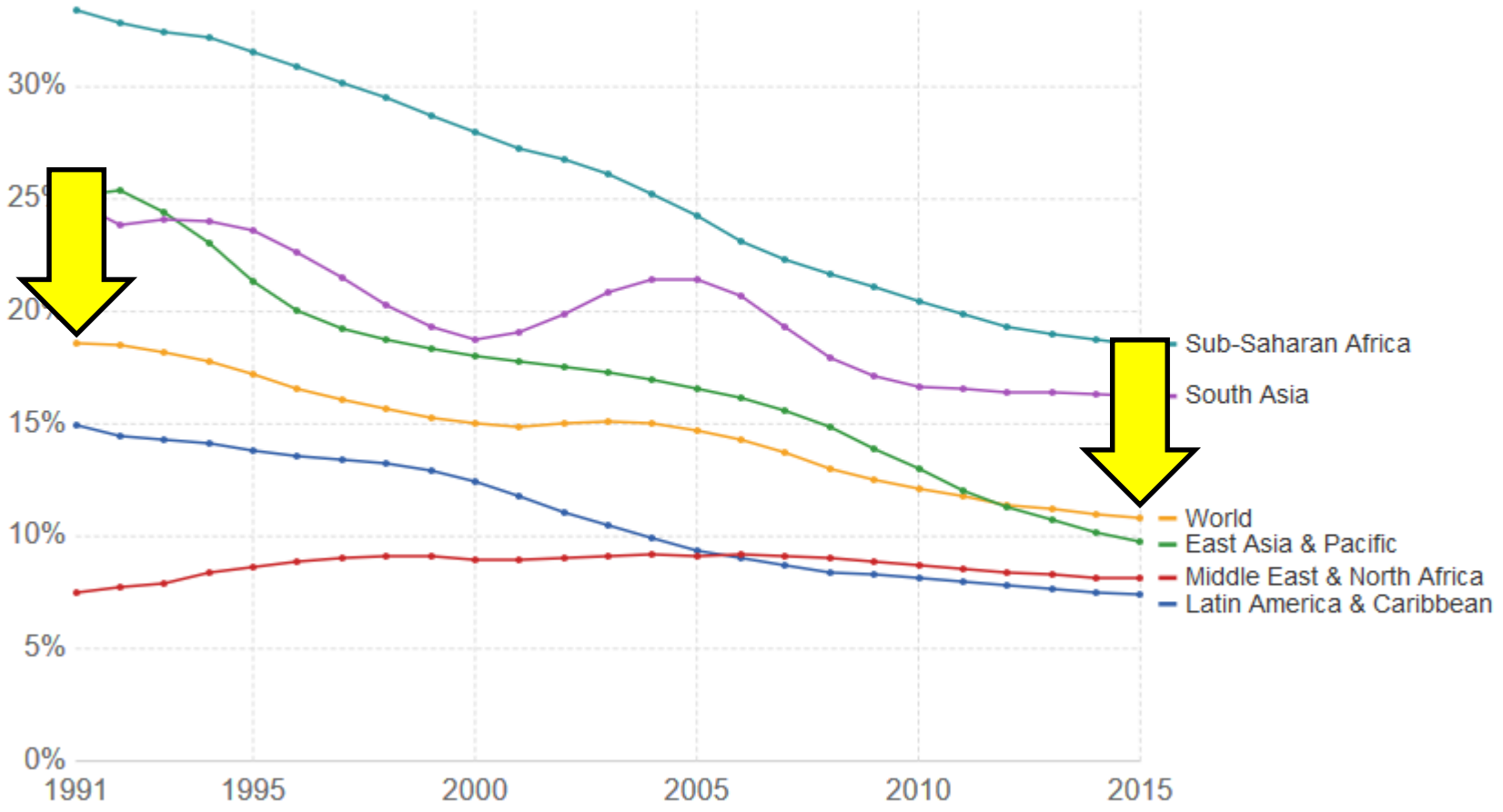
Percentages of Undernourished Human Population

One in seven humans is undernourished (FAO, 2015).



Share of the population that is undernourished

This is the main FAO hunger indicator. It measures the share of the population that has a caloric intake which is insufficient to meet the minimum energy requirements necessary for a given individual. Data showing as 5 may signify a prevalence of undernourishment below 5%.

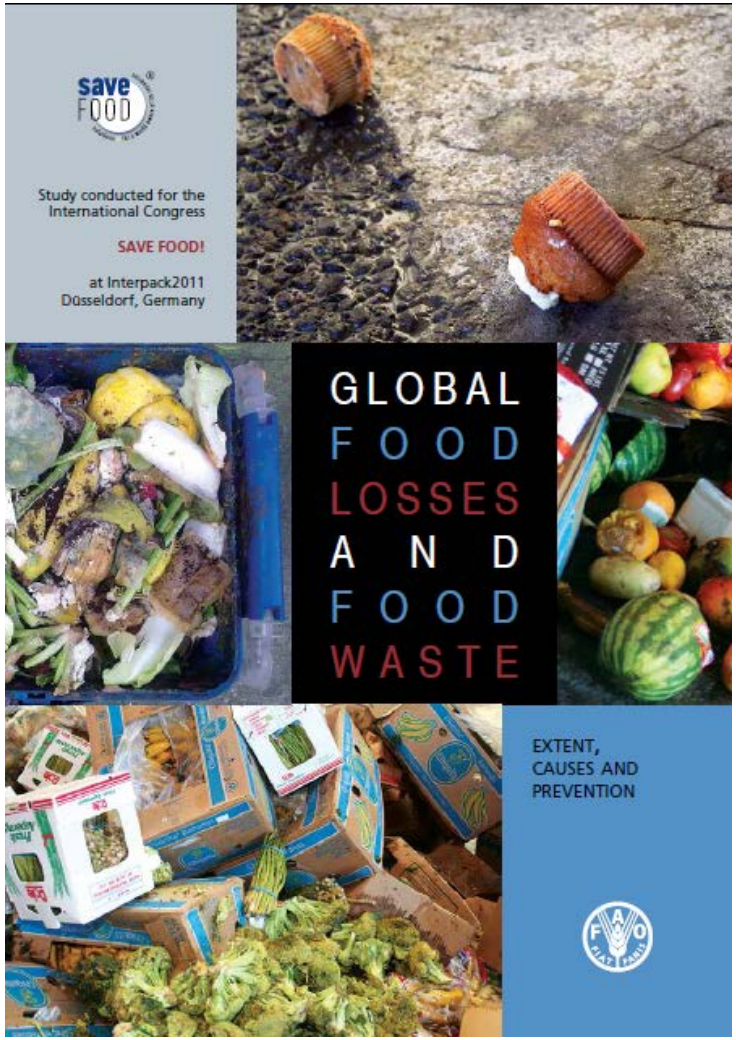


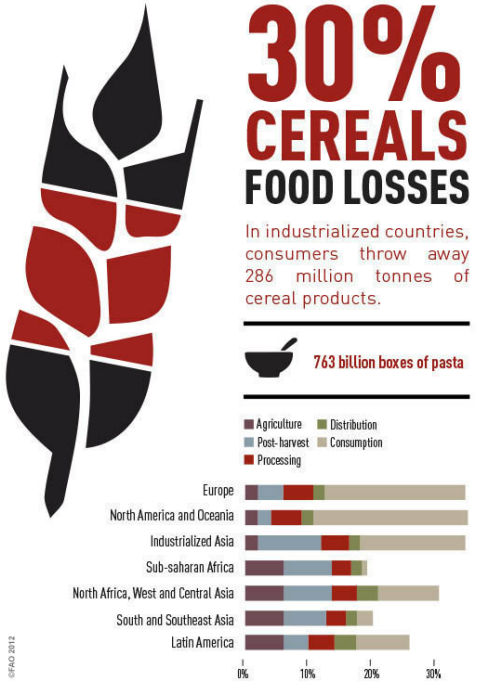
Source: World Bank

OurWorldInData.org/hunger-and-undernourishment/ • CC BY-SA

Note: Developed countries are not included in the regional estimates since the prevalence is below 5%.

1/3 of produced food is lost or wasted





Source: FAO

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How we have arrived here ?

Technologies supported the increase of food production.

What influenced the application of new technologies ?

- Investments
- Culture
- Infrastructure
- Society

} Western societies

Examples of succesfully applied technologies in livestock

- Biotechnologies: Artificial insemination, Embryo transfer
- Unifeed
- Computerized systems
- Vaccines, Antibiotics
- Milking technology
- Refrigerating systems
- Genetic evaluation
- Molecular techniques, Genomic application
- ...

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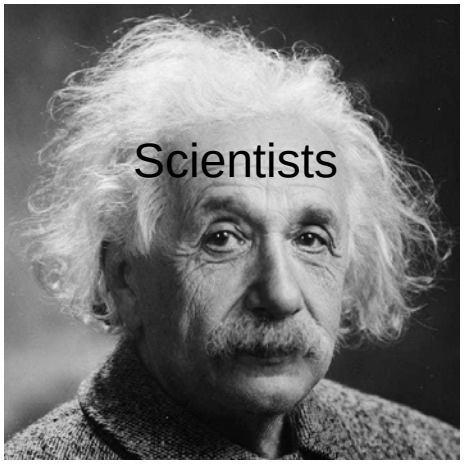
Involved actors

CIVIL SOCIETY

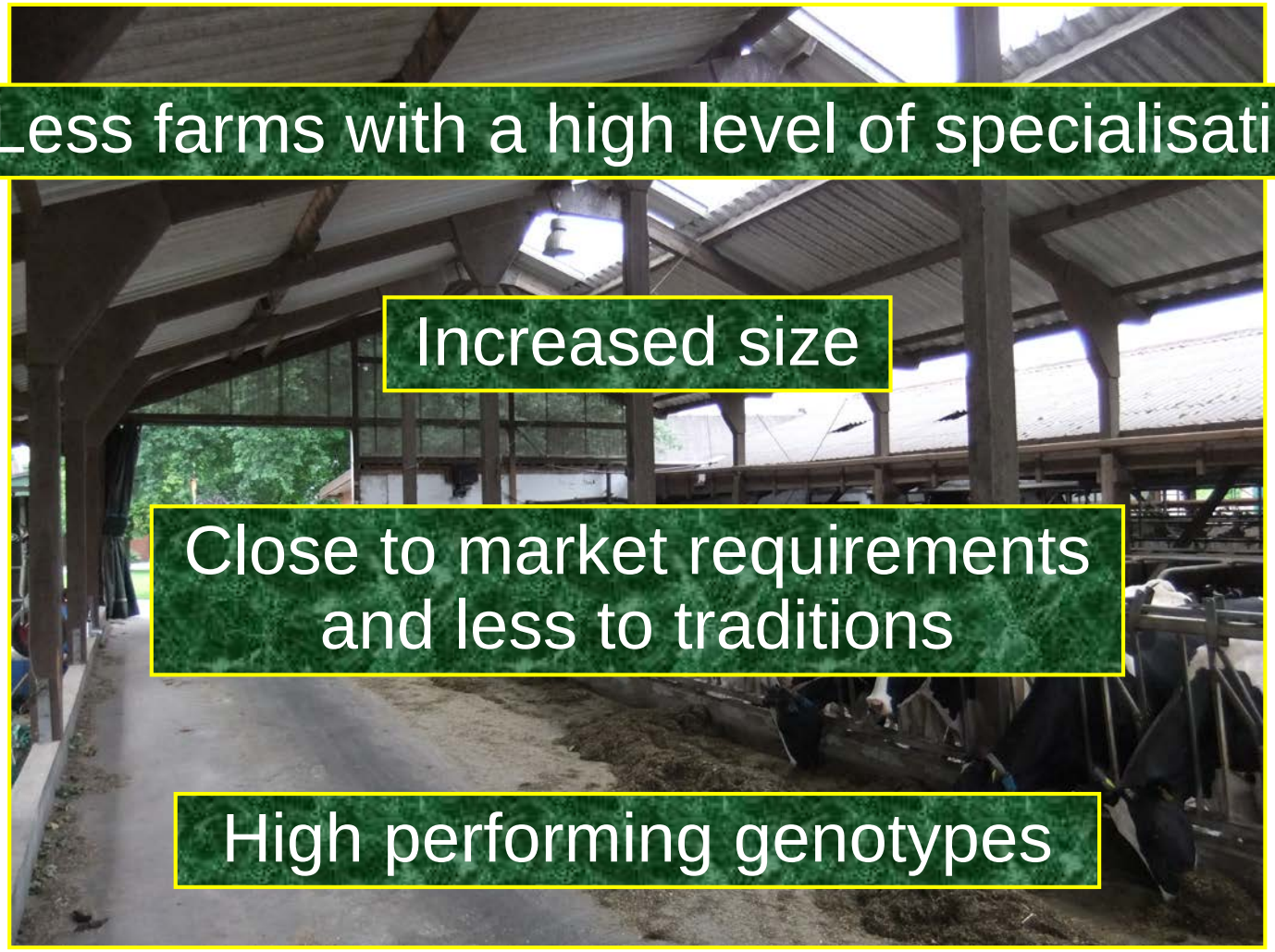
NGO
NETWORK



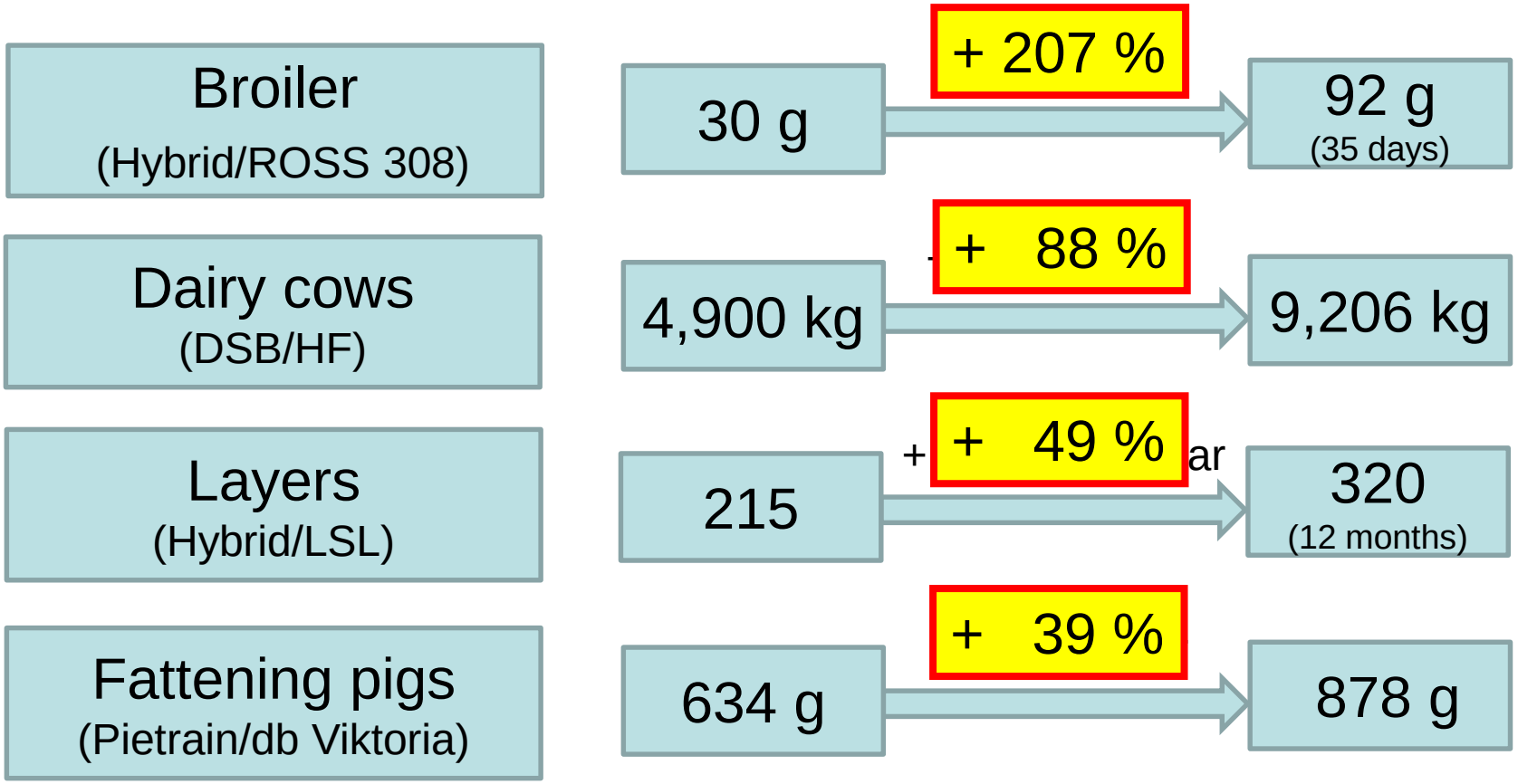
THE INDUSTRY

The development of the involved actors

Farms in Europe



Increase of performance between 1970 and 2014



Industry


Fewer global actors
Strong lobbying to policy makers
World standardization of products
High request of production efficiency
Important impact on livestock farming

Policy makers

Decisions about trading

Selective but decreasing support to farming systems

Animal Welfare and Health, Environmental rules

Consumers and civil society

Increase in population size

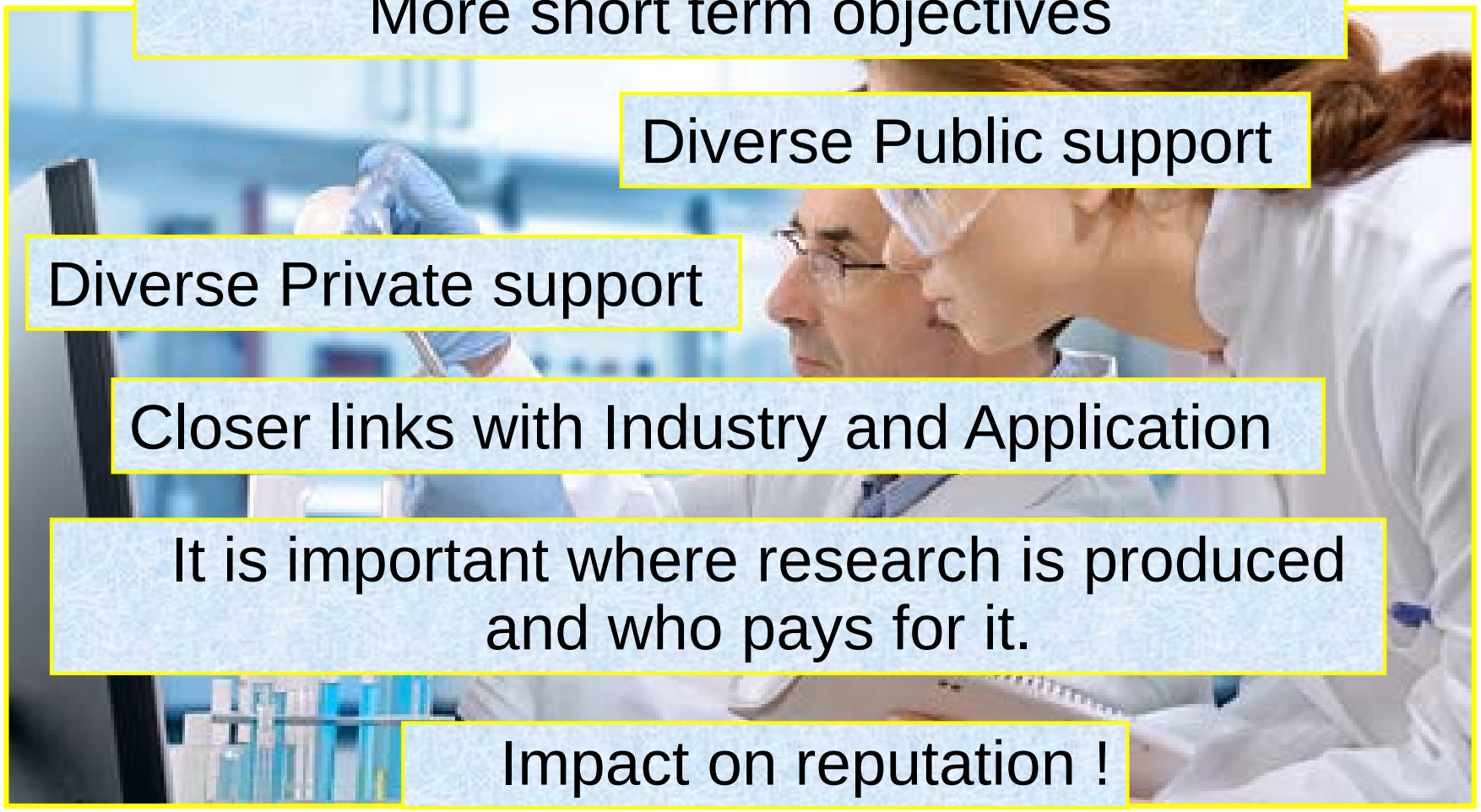
In imal products

Changing habi veloped world
(e.g. vegetar imal welfare

Habits -based

NGOs have a powerful influence on policy makers and consumers and therefore to farmers and industry

Research



More short term objectives

Diverse Public support

Diverse Private support

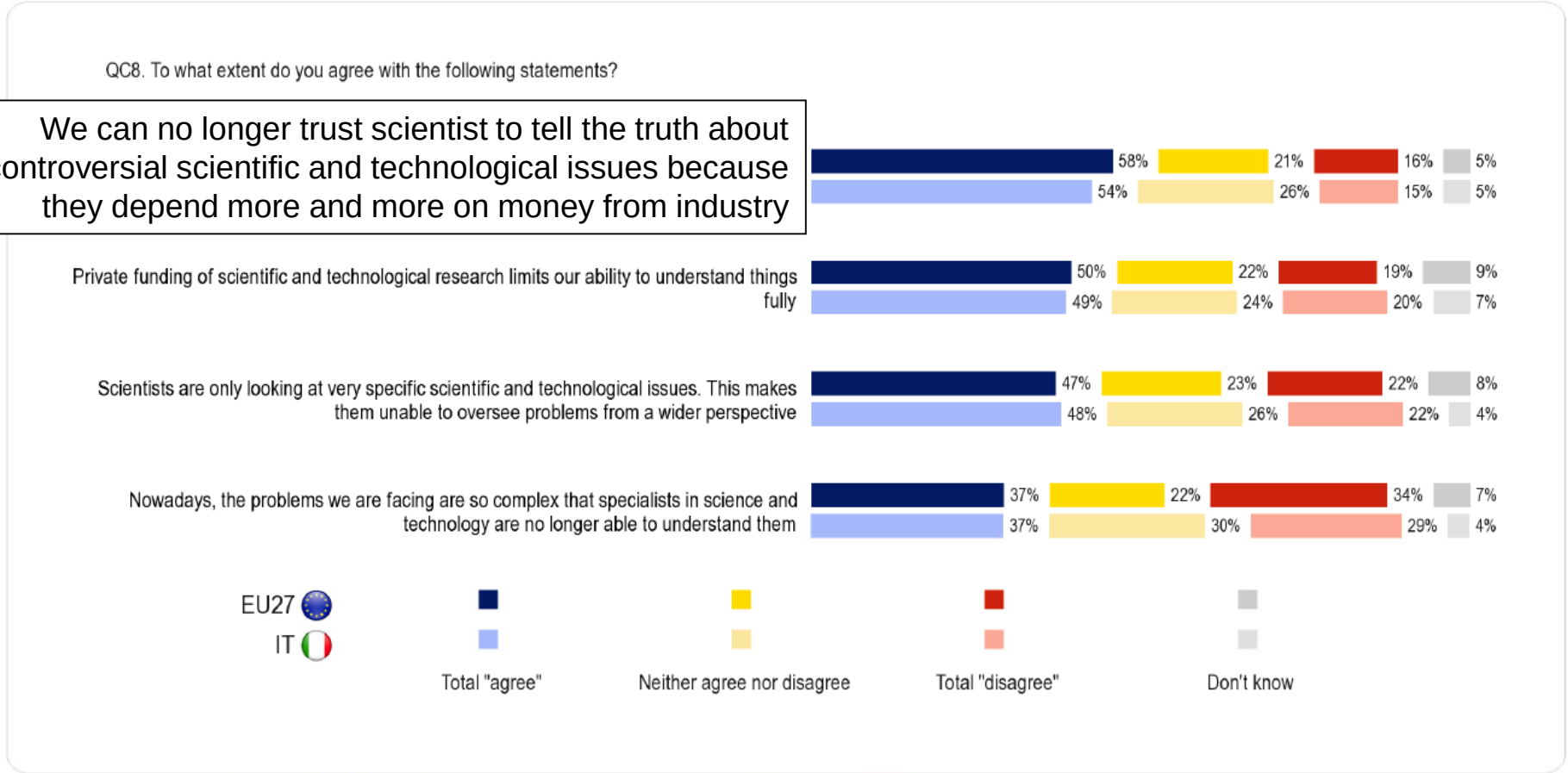
Closer links with Industry and Application

It is important where research is produced and who pays for it.

Impact on reputation !

How is the image of science and technology ?

Image of Science and Technology



EUROBAROMETER 73.1
RESULTS FOR ITALY

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The major challenge is …..

to satisfy the increasing global request of animal products for low prices and ….

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to meet at the same time the societies constraints regarding environment and animal welfare !

The current (and future) social, technical and economic situations do not favourite a single solution.

The challenges for a sustainable production

- Lack of application of technologies
- Environment / Regional concentration / Climate change
- Feedstuff scarcity
- Animal health and welfare (e.g. drug use and resistance)
- Image of animal farming in the society
  - e.g. Farm size („Industrial livestock production“)

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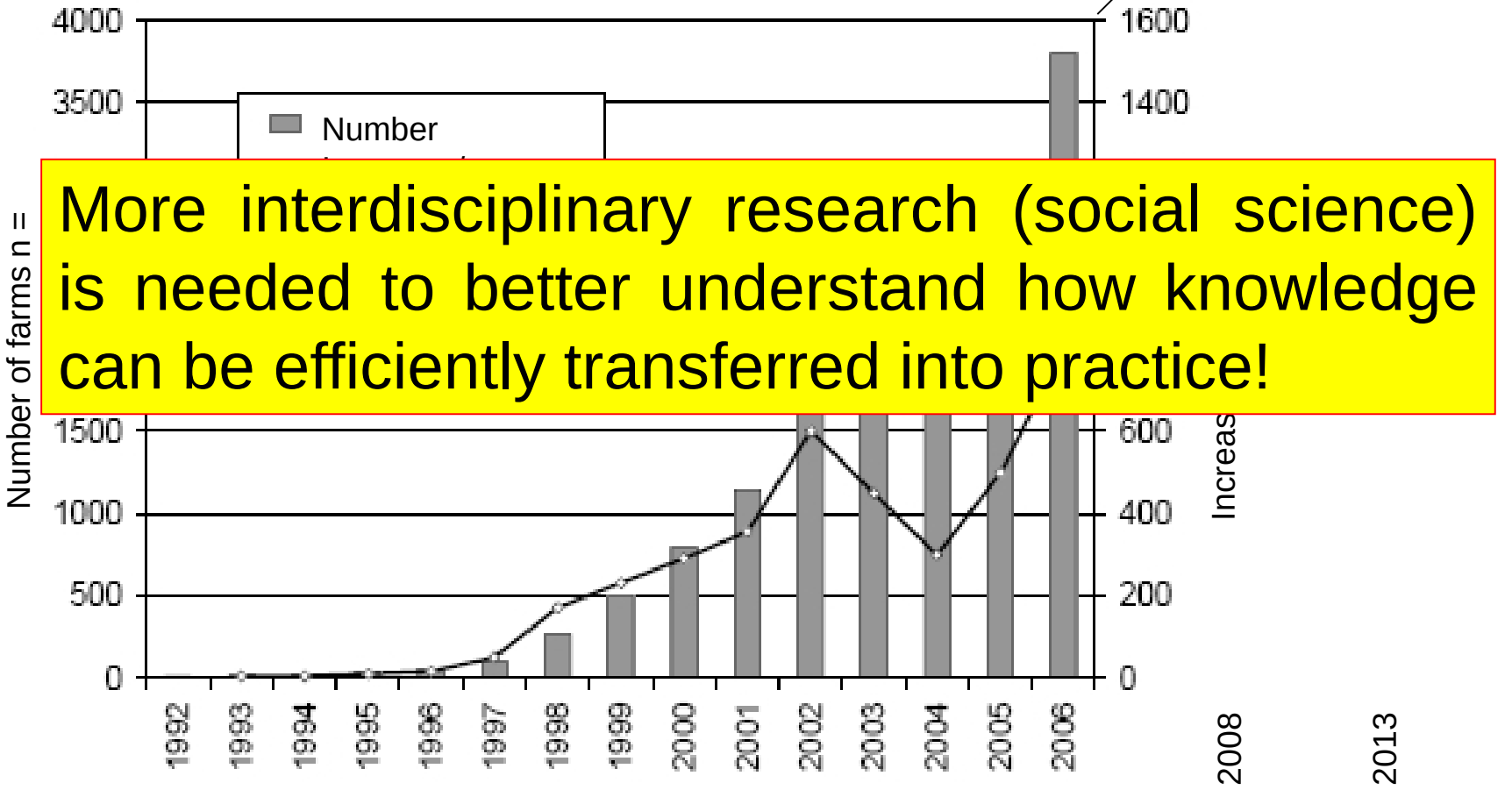
2013: 17,000

Number of Automatic Milking System

2008: 14,000



More interdisciplinary research (social science) is needed to better understand how knowledge can be efficiently transferred into practice!

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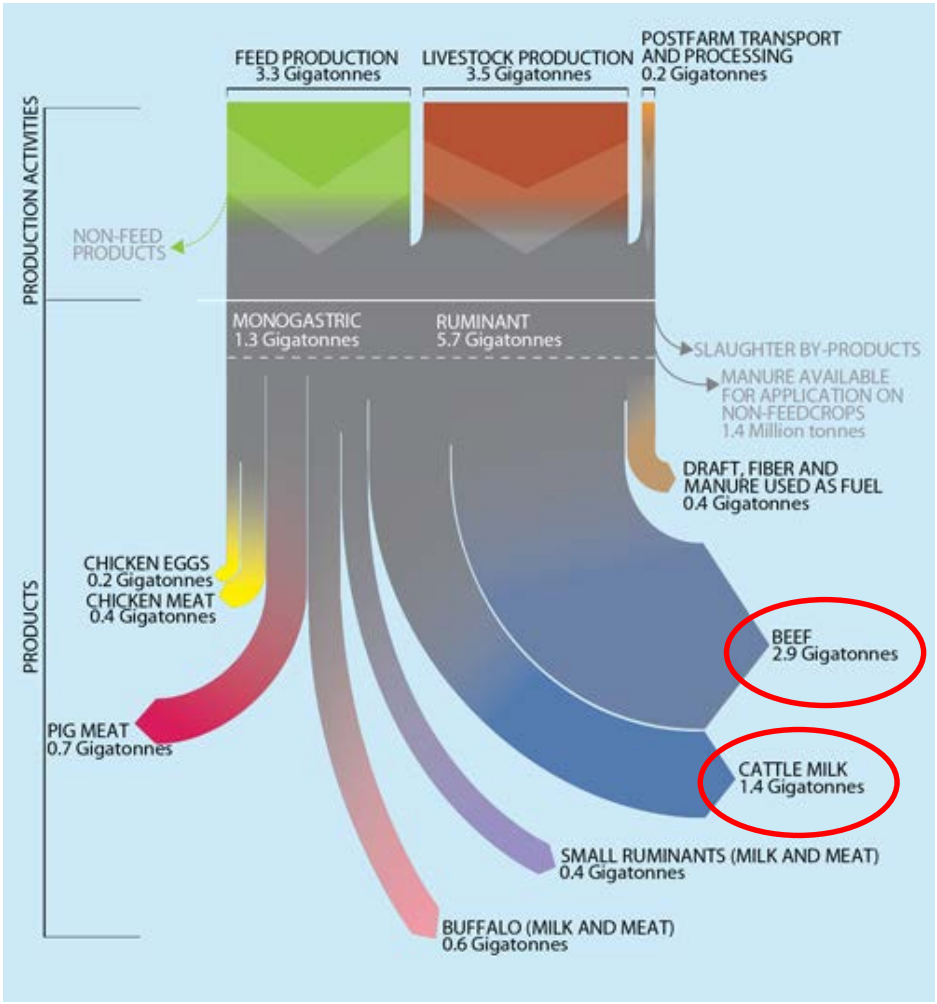
What is the current situation ?

- Livestock contributes about 14.5% (7,100 $MtCO_2$/year) of the total GHG emissions, exceeding that from transportation.



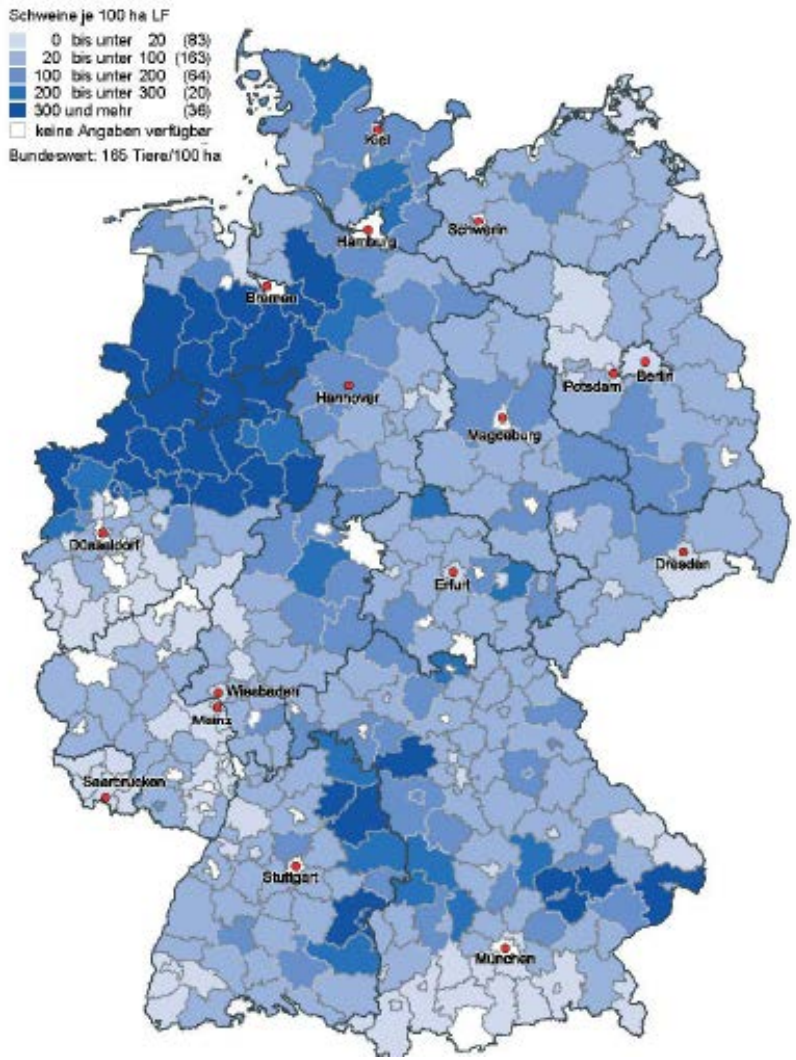
What is the current situation ?

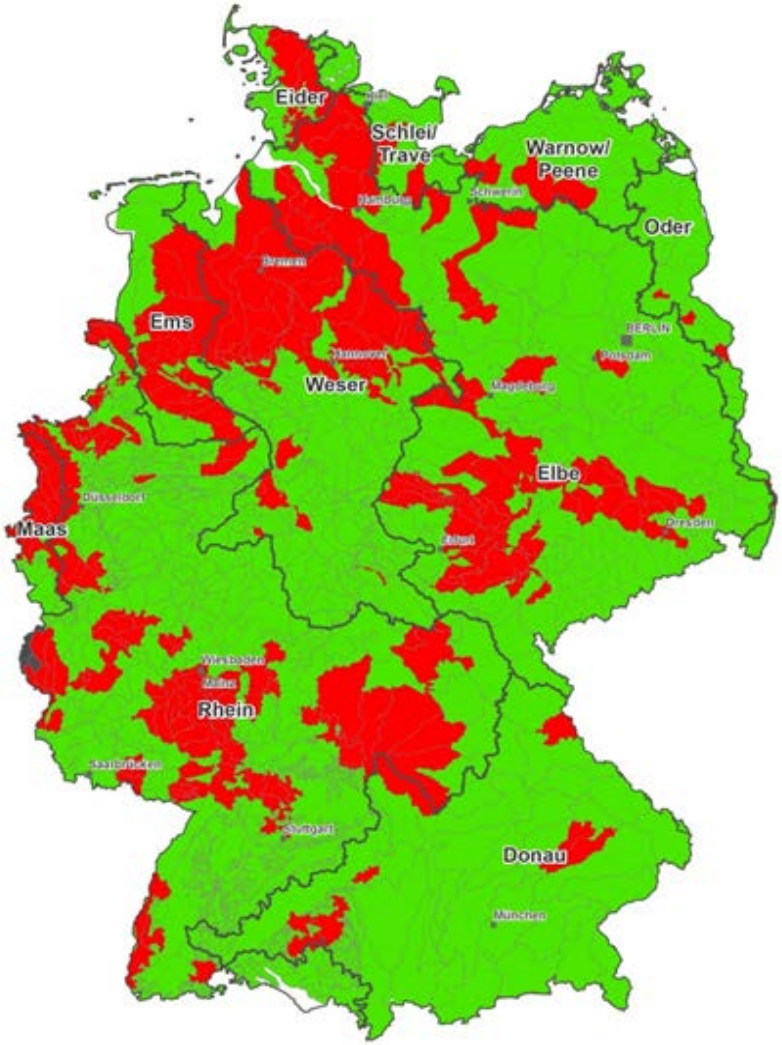
- Agricultural nitrogen surpluses show a declining trend, thereby potentially reducing environmental pressures on soil, water and air.
- Many countries, however, still maintain a large surplus.

Nitrate load in ground water

positive situation (< 50 mg Nitrate/l)

negative situation (SRU, 2015)





What is the problem with animal health and welfare ?

Some examples

1. Layers
2. Dairy cows

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The laying hen and bone fractures in relation to the husbandry system (Sandilands at al., 2007)

	Conventional cage	Furnished cage	Free-range	Barn
Farms, n = (100 animals/farm)				
Birds with bone fracture (%)				

Birds examined after depopulation (24 farms) for bone fractures.

The laying hen and bone fractures in relation to the husbandry system (Sandilands at al., 2007)

	Conventional cage	Furnished cage	Free-range	Barn
Farms, n = (100 animals/farm)	8	4	9	3
Birds with bone fracture (%)	49	43	54	68

53 % of the animals had at least one fracture!!!!

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	Conventional cage	Furnished cage	Free-range	Barn
Fa… ani…				
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Genotype ? Performance ?

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Some examples

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Frequency of disease and performance level of dairy cows from test herds in Brandenburg (Roffeis and Waurich, 2013)

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	No. of diseases per cow and year			Healthy animals
Performance 100-days Milk-kg	Total	Udder	Locomotor system	%
< 3,000	2.98	0.52	0.91	13.0
3,000 – 3,500	2.90	0.53	0.94	11.9
3,500 – 4,000	3.10	0.60	0.93	10.6
> 4,000	3.48	0.61	1.12	8.6

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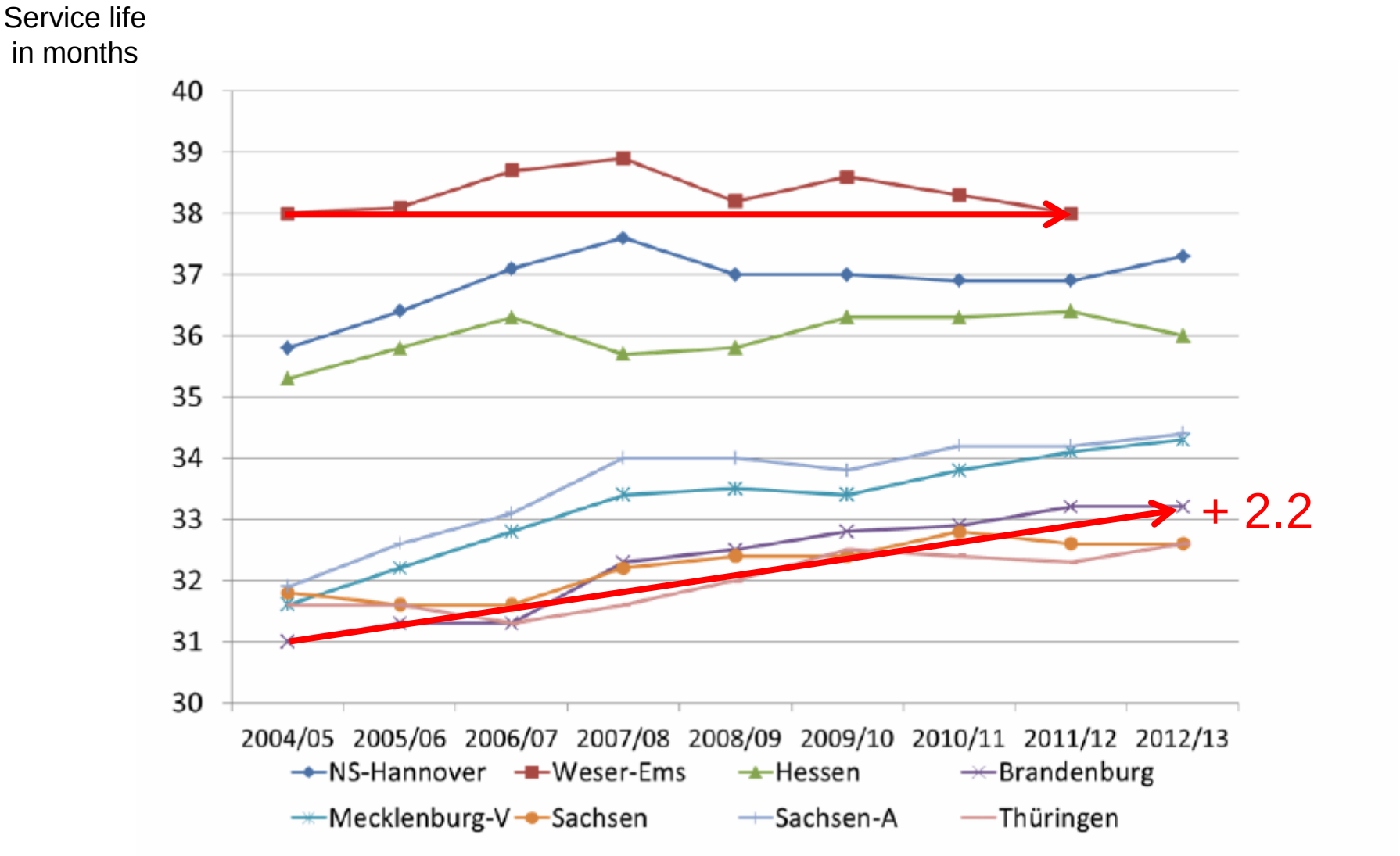
The average age of Holstein-Friesian cows is about 5.4 years (slightly more than two lactations)(Römer, 2011).

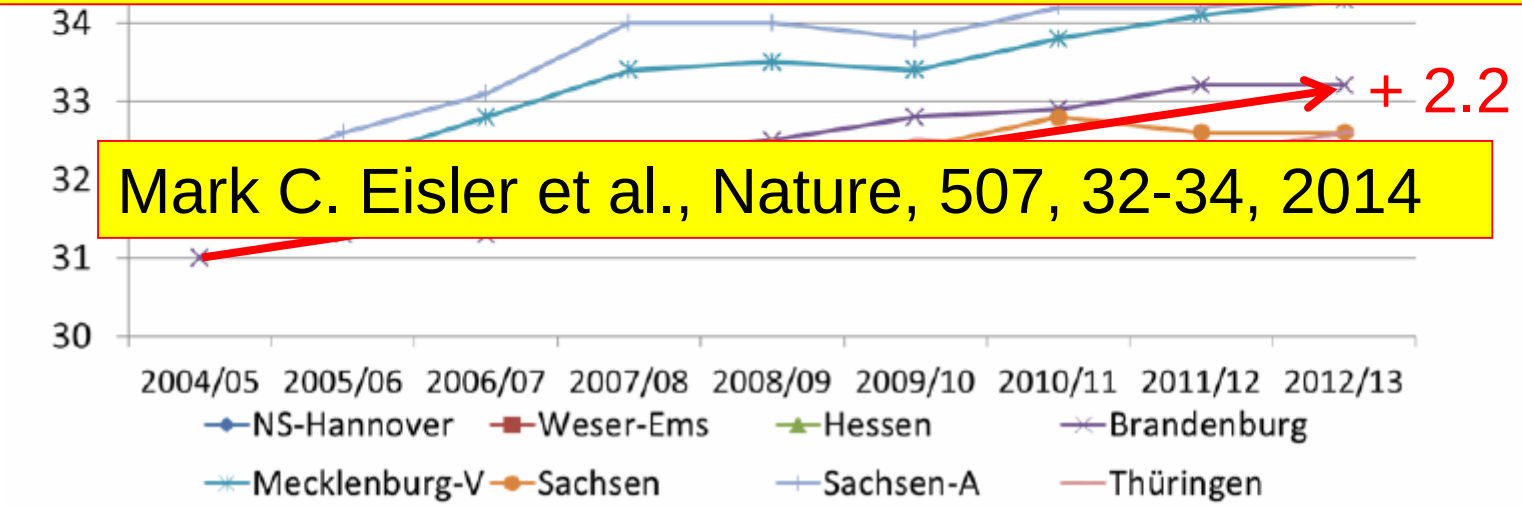
Development of the service life (length of productive life in months from first calving to culling) on the phenotypic level in Germany (Annual report of ViT, Verden)



Development of the service life (length of productive life in months from first calving to culling) on the phenotypic level in Germany (Annual report of ViT, Verden)

Service life in months

"The quest for 'intensification' in livestock farming has thundered ahead with little regard for sustainability and overall efficiency (the net amount of food produced in terms of inputs such as land and water) !"



Mark C. Eisler et al., Nature, 507, 32-34, 2014

How can Animal Science contribute ?

1. Assessment of Life-cycles → tune livestock policies to socioeconomic and geographic environments.
2. Reducing environmental footprint → research in genetics, feeding, management and husbandry.
3. Research about the improved use of livestock in different regions by using local resources, breeds and feedstuffs → produce tangible evidence to convince local farmers.
4. Sustainably managed grazing → increase biodiversity, maintain ecosystem services and improve carbon capture by plants and soil.

Reducing environmental footprint

1. Management / Husbandry:
   - Adopting management practices to keep animals healthy and increase welfare (e.g. by reduce overgrowding, hygiene programs).
   - Technical solutions to reduce emissions.
   - Enhancing diversity (e.g. adapted breeds) within animal production systems to strengthen their resilience.
2. Feeding:
   - Adopt smart supplements e.g. which encourage microbes in the rumen to grow quickly and to provide better nutrition or/and to alter the rumen microbial population to use nitrogen and energy more efficiently (Lee et al., 2009).

Reducing environmental footprint

3. Genetics:
   - Optimizing the metabolic functioning. E.g. breeding for reduced Methane production (heritability = 0.3, Pszczola et al., 2017).
   - Implementation of new functional traits.
   - Selection for profitable animals under different production systems (Scollan et al., 2006).

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How can Animal Science contribute ?

1. Society education: disseminate broadly the outcomes of accurate research activities

From a scientific point of view, there is little or no relation between animal welfare and farm size!

(e.g. Gieseke et al., 2015; Meyer-Hamme et al., 2015)

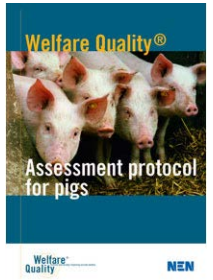
Dairy cattle

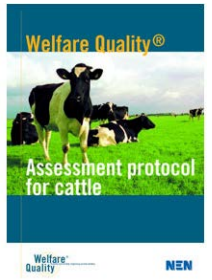
Repeated farm visits.

Trait	1	2	3	4
Dairy cows, n =	< 100	100 - 300	300 - 500	> 500
Farms, n =	8	17	7	7
Mean no. of cows	69	174	384	924
Min – Max	47 - 90	105 - 285	330 - 483	575 - 1582

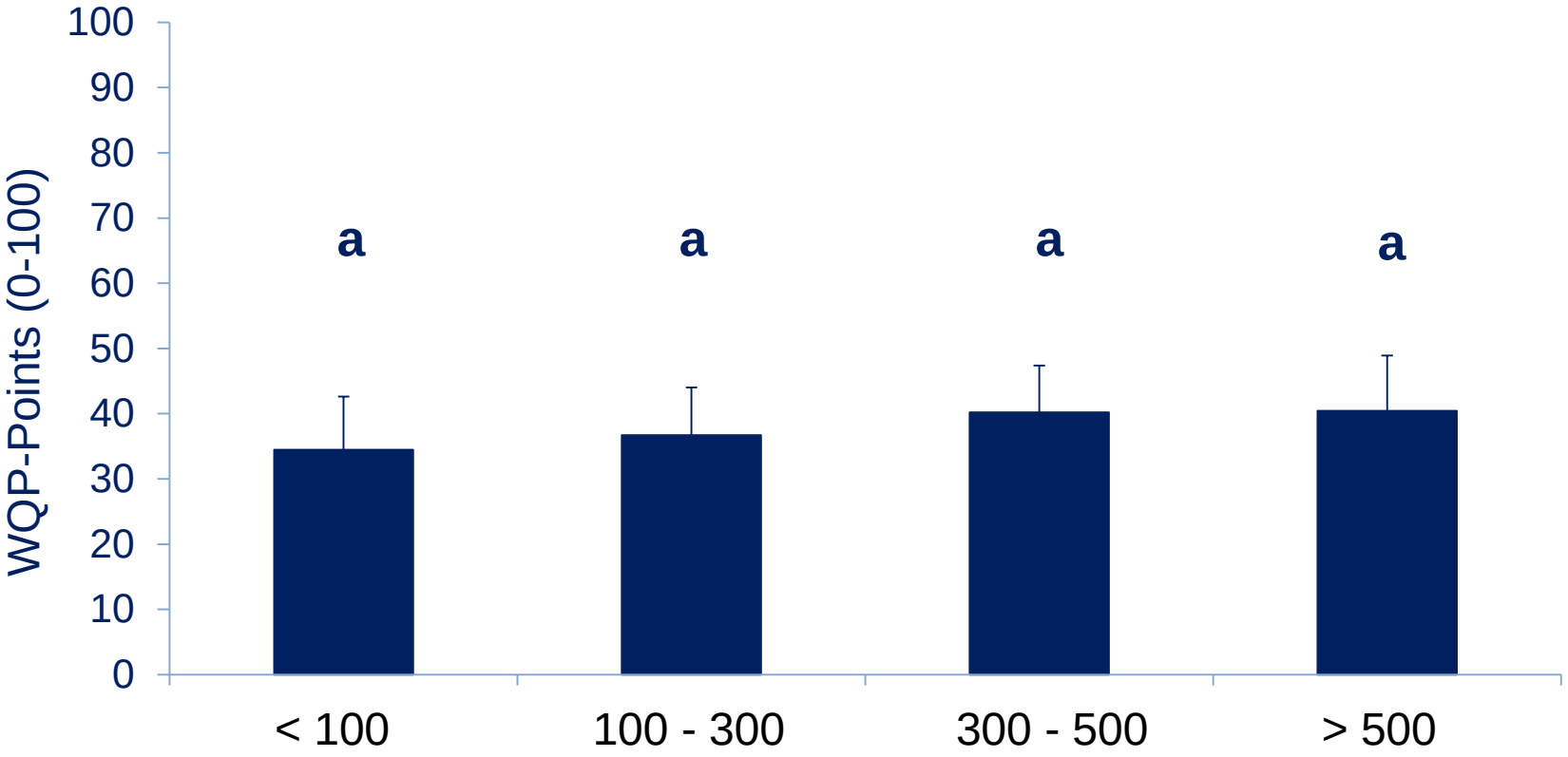
(Gieseke et al., 2015)

Welfare Quality® Assessment Protocol





Results – Dairy cows



Scores increased in tendency with farm size.

(Gieseke et al., 2015)

How can Animal Science contribute ?

1. Society education: disseminate broadly the outcomes of accurate research activities.
2. Support the discussion on food security by putting forward scientific facts.
3. Lobbying for and strengthening specific research funds to answer food security problems.
4. Face and solve the problems: improvement of husbandry (production) systems, animal welfare and health.

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Conclusions

- Science and research should predict and guide the reality and not being behind.
- When referring to Livestock Production, the future is not a fixed time but a dynamic and changeable period.
- Different situations in different environments.
- It is extremely important to predict societies constrains and economic and environment conditions → conflicting goals!
- The interaction of different scientific fields is essential!

There will be no one-size-fits-all solutions.

Thank you very much for your attention!