

The livestock revolution and implications for human health and disease

Delia Grace¹, Silvia Alonso¹, Barbara Szonyi¹ and Johanna Lindahl^{1,2}

¹International Livestock Research Institute, Nairobi

²Swedish University of Agricultural Sciences, Uppsala

Impact of Environmental Changes on Infectious Diseases

23-25 March 2015, Sitges, Spain



Today's talk

1. What is the livestock revolution and what is driving it?
2. What are its **benefits and risks?**



The livestock revolution

- 1970-Mid 1990s
- Demand-driven, unlike the green revolution

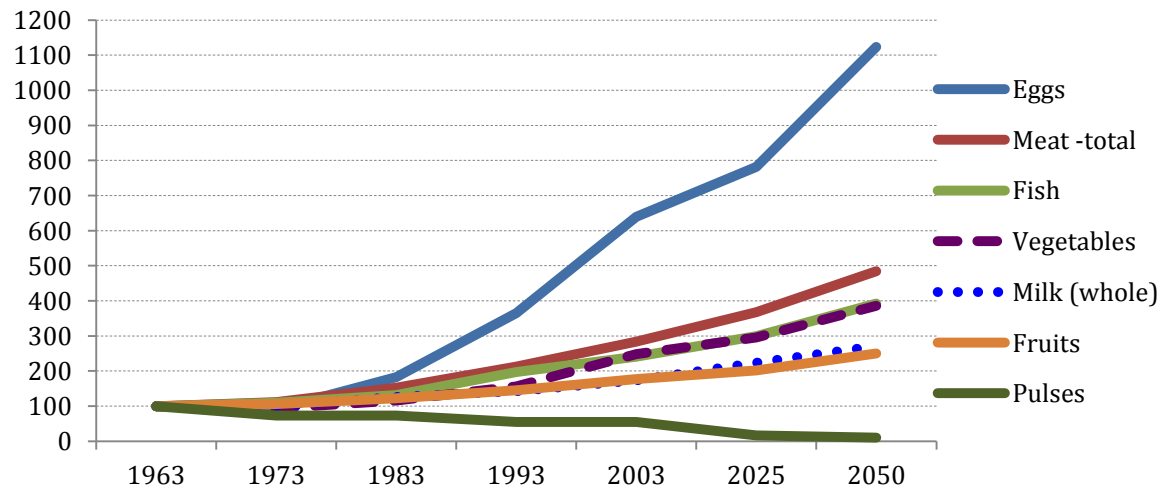
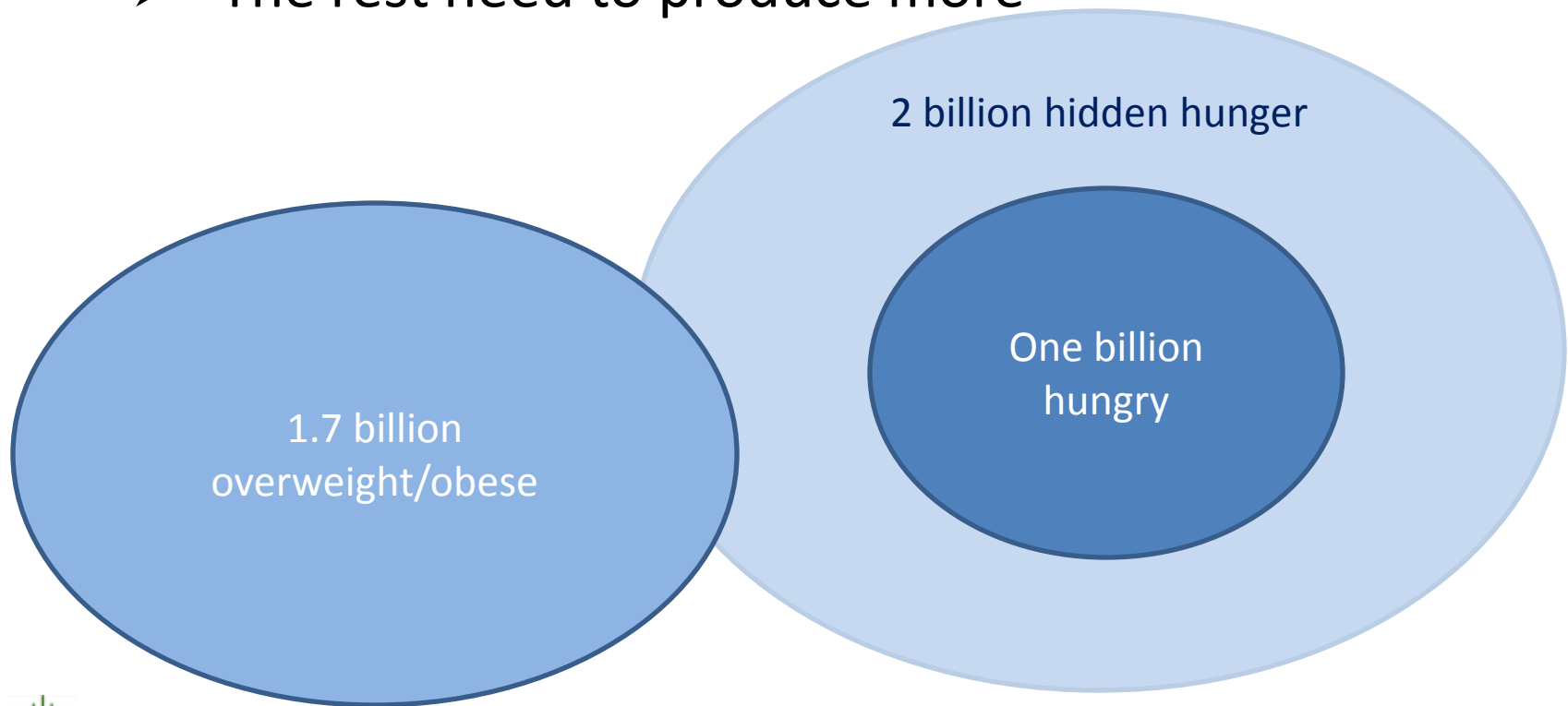


Figure 2: Increase in per capita consumption of perishables and pulses in developing countries with 1963 as index year (FAO, 2009).

7 billion people

- More and more people to feed
- More and more are not producing food
 - The rest need to produce more



7 billion people...

Density of Poor Livestock Keepers
Year 2010*

- **37 billion livestock**

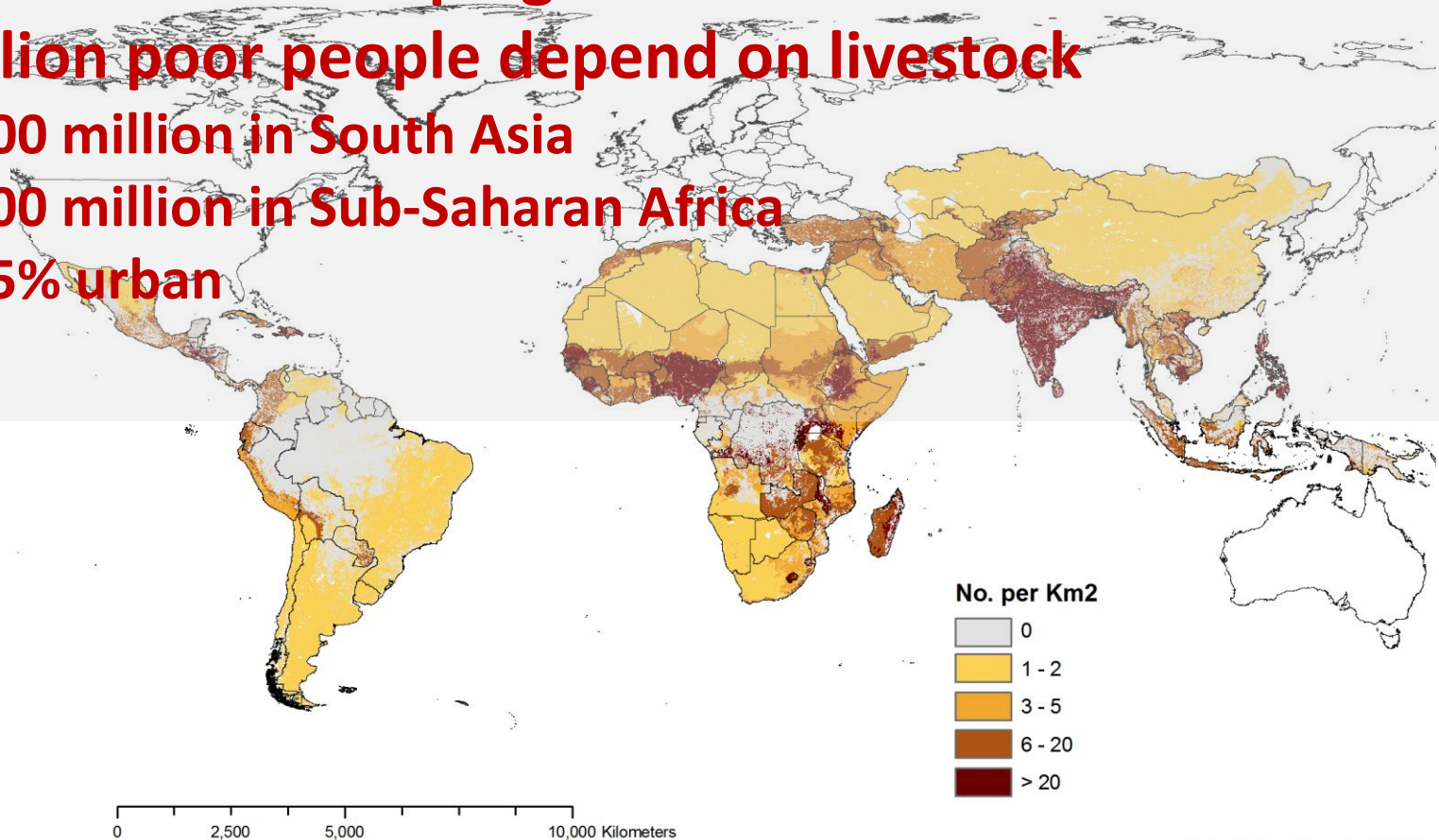
- **31 billion in developing countries**

- **1 billion poor people depend on livestock**

- ✓ 600 million in South Asia

- ✓ 300 million in Sub-Saharan Africa

- ✓ 25% urban



*Update: March 2012

Bridging the gaps between demand and supply – global level

- 60% more food than is produced now will be needed
- 75% of this must come from producing more food from the same amount of land
- The higher production must be achieved while reducing poverty and addressing environmental, social and health concerns
- This greater production will have to be achieved with temperatures that may be 2–4 degrees warmer than today's



East Africa - gaps in food demand and supply

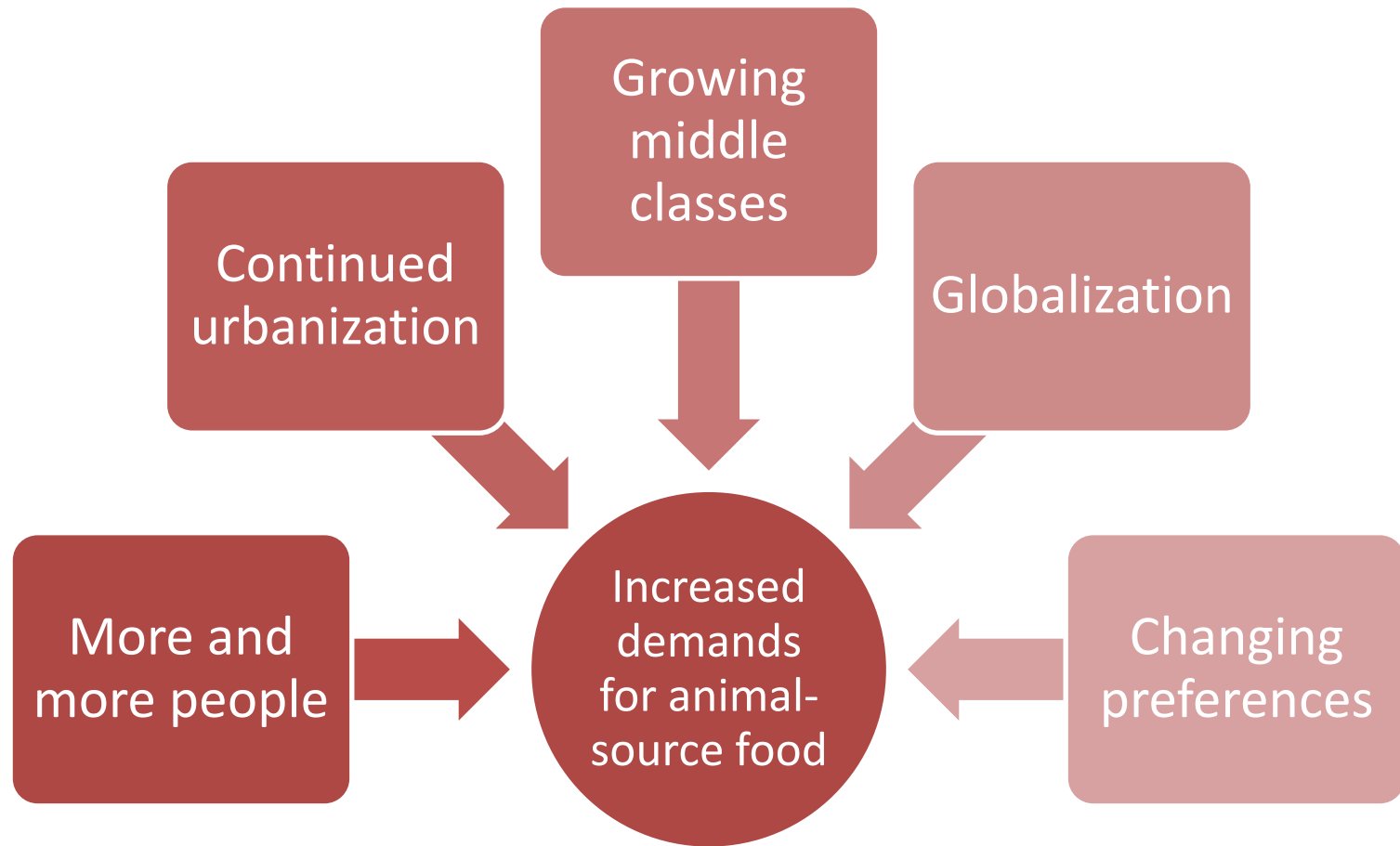
Agriculture – source of food and income for up to 90% of the population in the region

- Human population projected to increase by 2.55% per year [2007 – 2017]
- Projections to 2030: demand for meat will increase by 3.7% and milk – 2.7%
- Projected growth rates for livestock numbers, meat and milk production

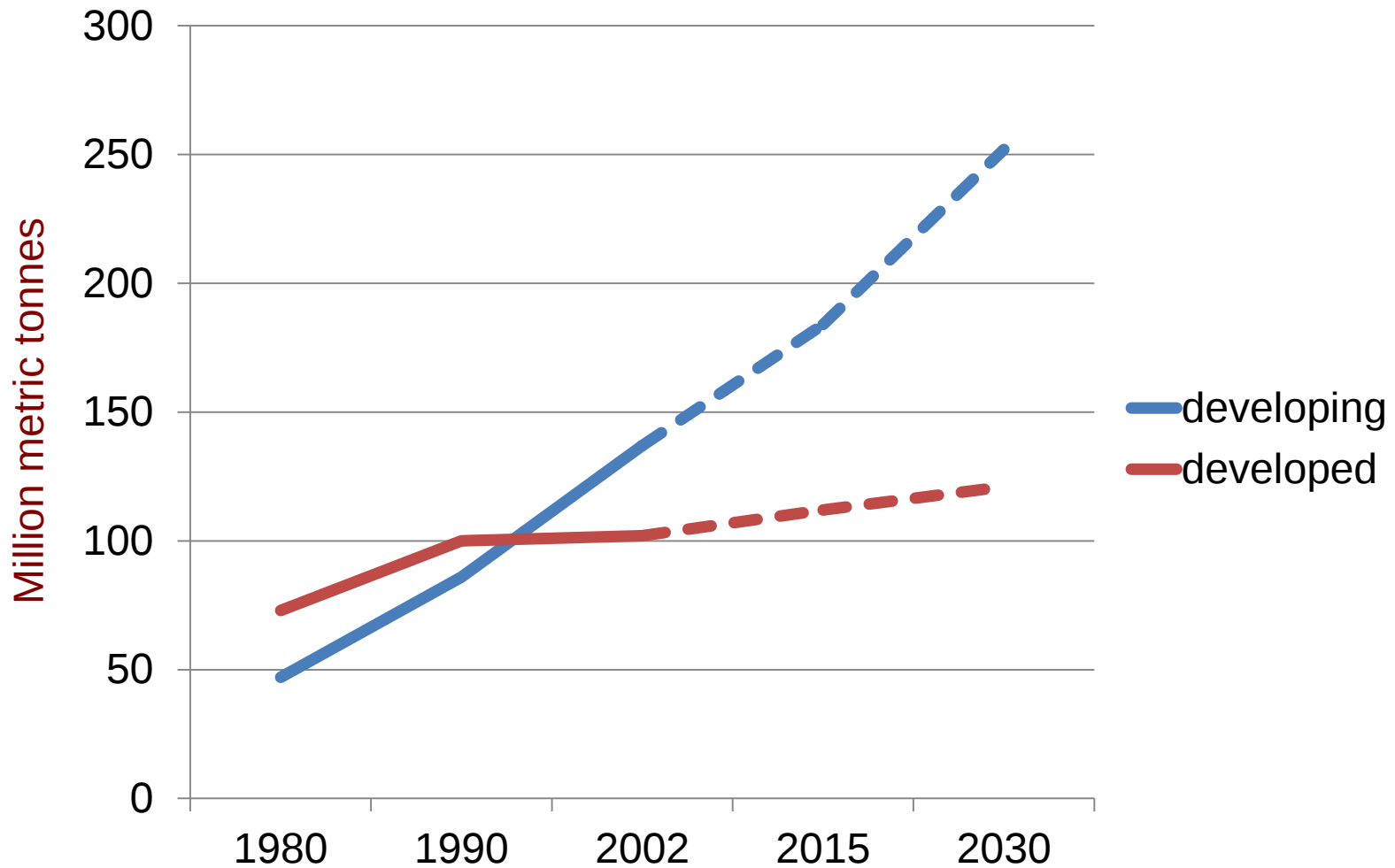
	Projected change
Total livestock numbers	1.41%
Total meat consumption	2.84%
Total milk production	2.95%

Source: FAO (2007)

Why increasing demands?

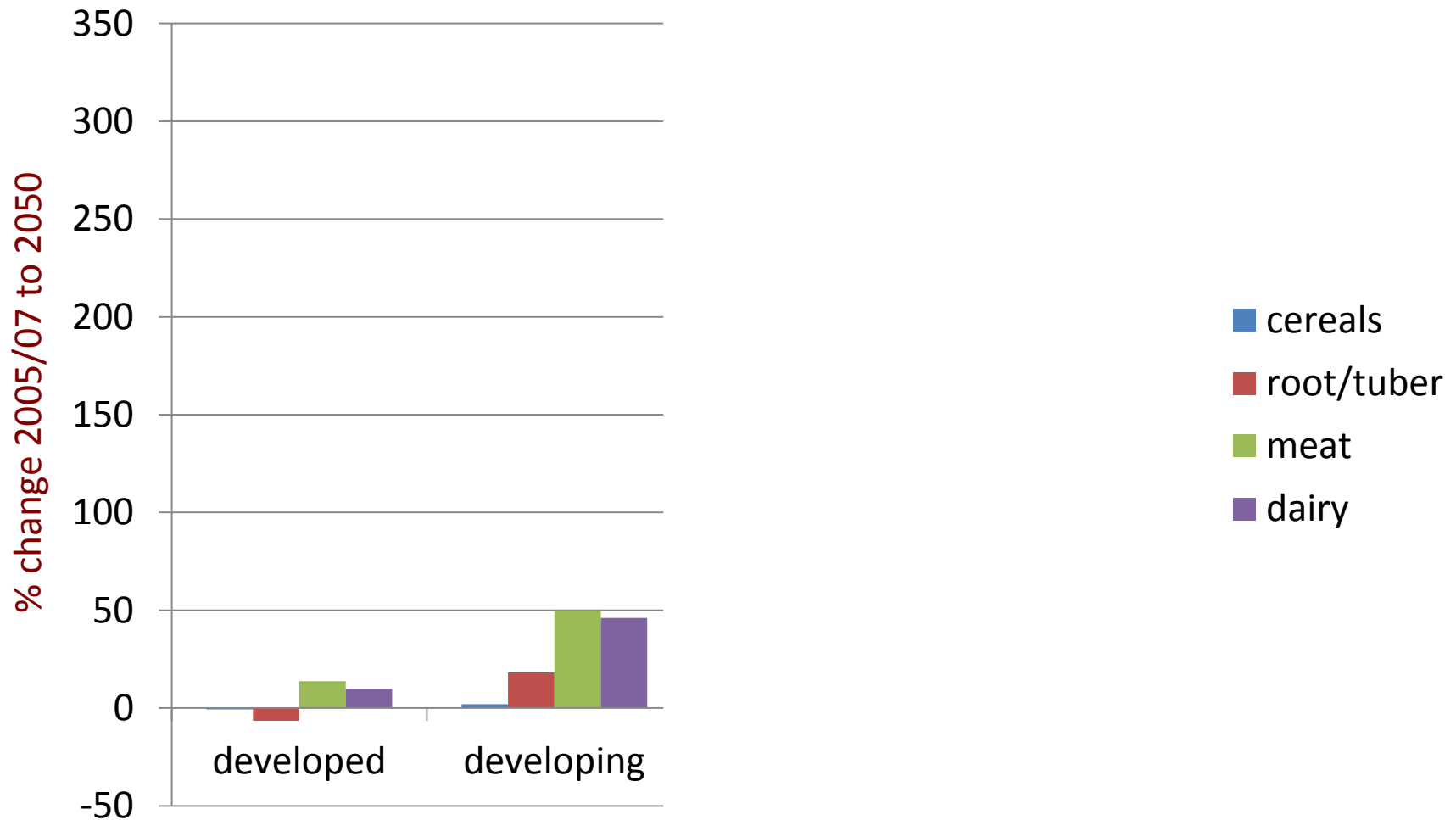


Gains in meat consumption in developing countries are outpacing those of developed

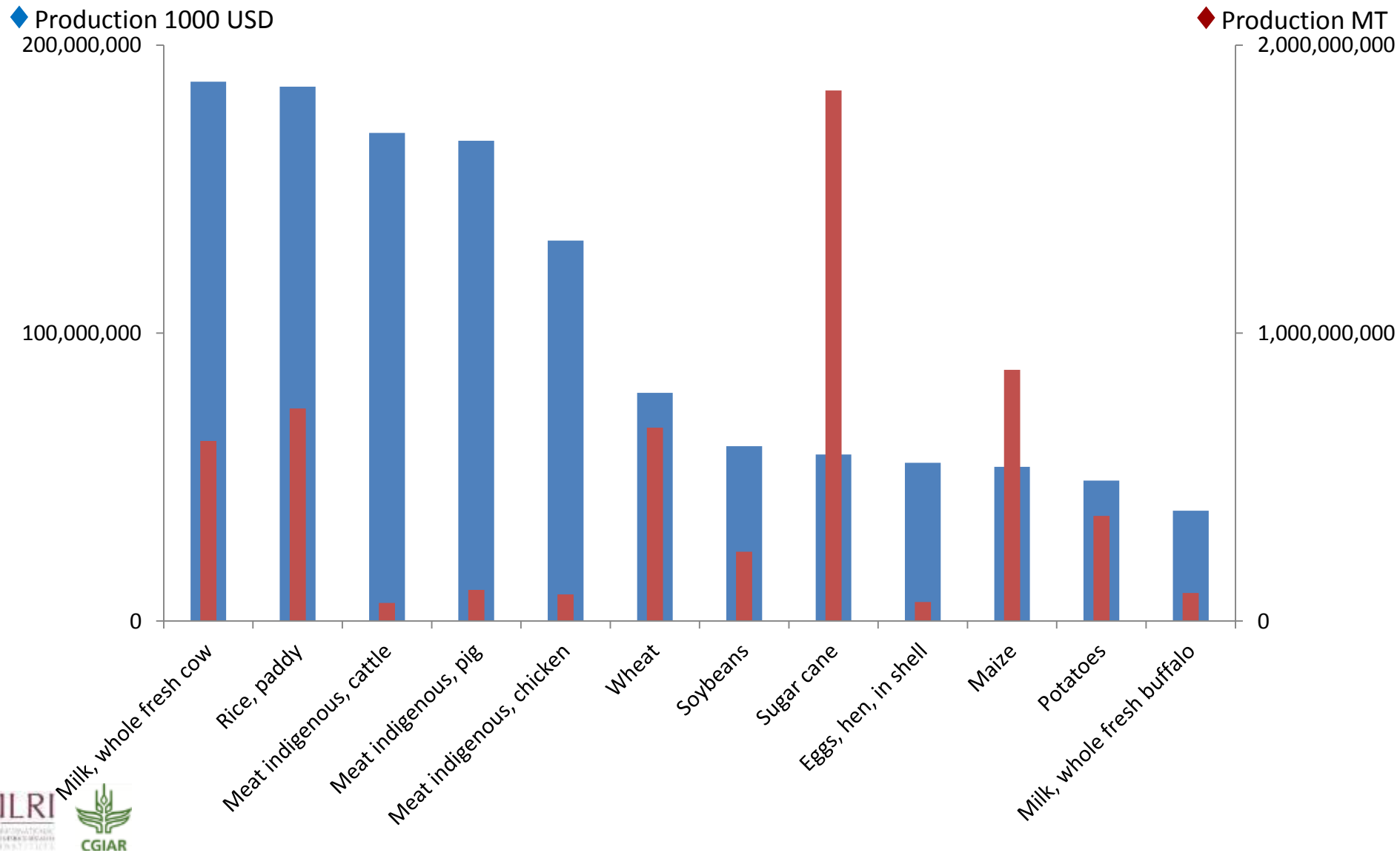


FAO (2006)

Change in global and regional demand for food: Livestock and other commodities



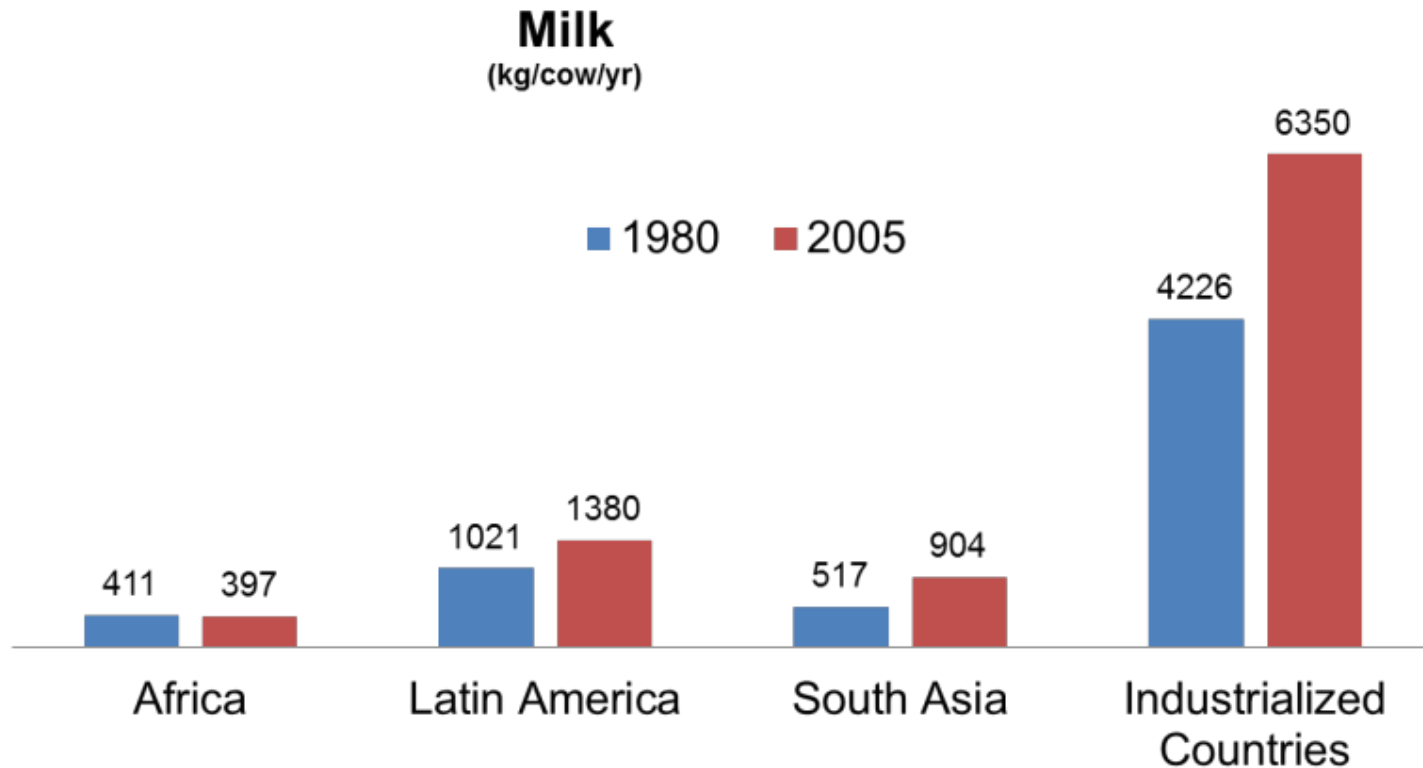
FAO statistics 2012



Big productivity gaps

-largely due to poor animal health, inadequate feed and low genetic potential

Some developing country regions have gaps of up to 430% in milk

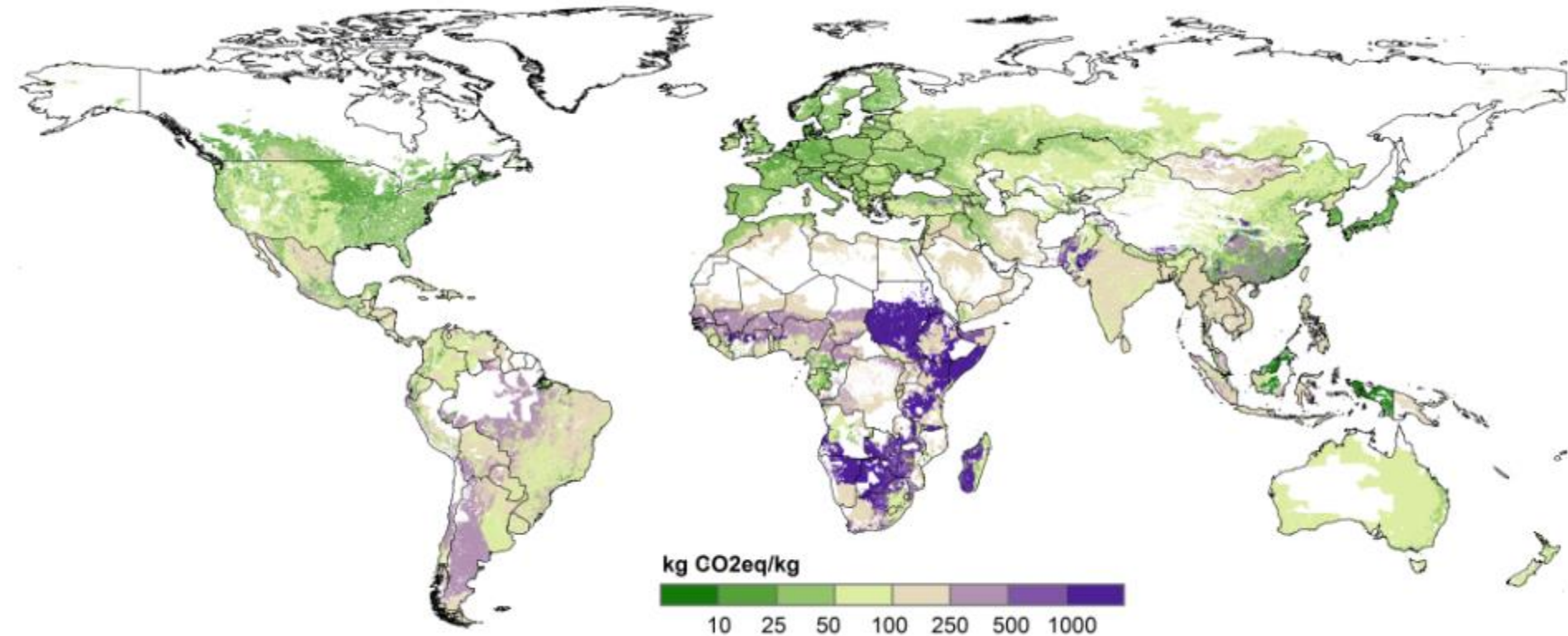


Steinfeld et al. (2006)

Major benefits seen

- Increased profits
- Growth of off-farm income
- Reduction in greenhouse gases per unit of animal-source food produced
- Intensive units can maintain higher biosecurity
- Separates animals from humans
- Increased incomes may render people less vulnerable to disease

Example: Greenhouse gases



GHG per kg of animal protein produced

Herrero et al. (2013)

Improving production- not always rocket science

- Training in Assam, Northeast India, hygiene measures to make milk less contaminated
- Trained farmers reported less diseases and higher milk production ($p < 0.001$)



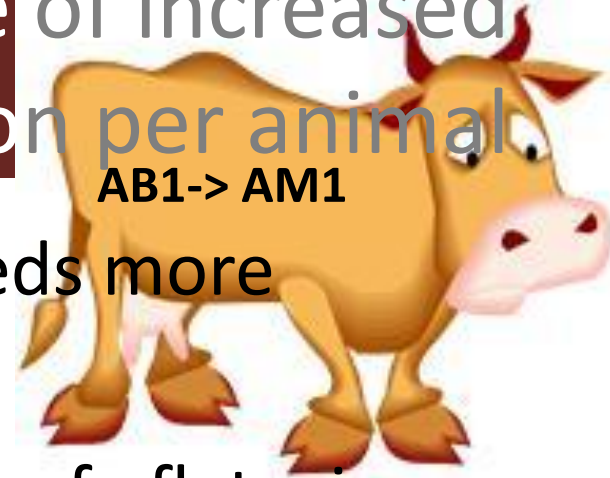
	Average milk production in liters per cow and day 2 years ago/before ILRI training	Average milk production in liters per cow and day now
Trained farmers	7.0 (range 2.5-10)	7.8 (range 3-15)
Untrained farmers	7.3 (range 2.5-14)	6.8 (range 2.5-14)

- No difference in *Brucella* prevalence

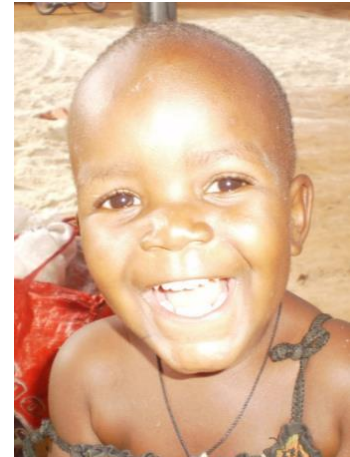
Aflatoxins are produced by moulds
growing on cereals

Down side of increased production per animal

AB1-> AM1



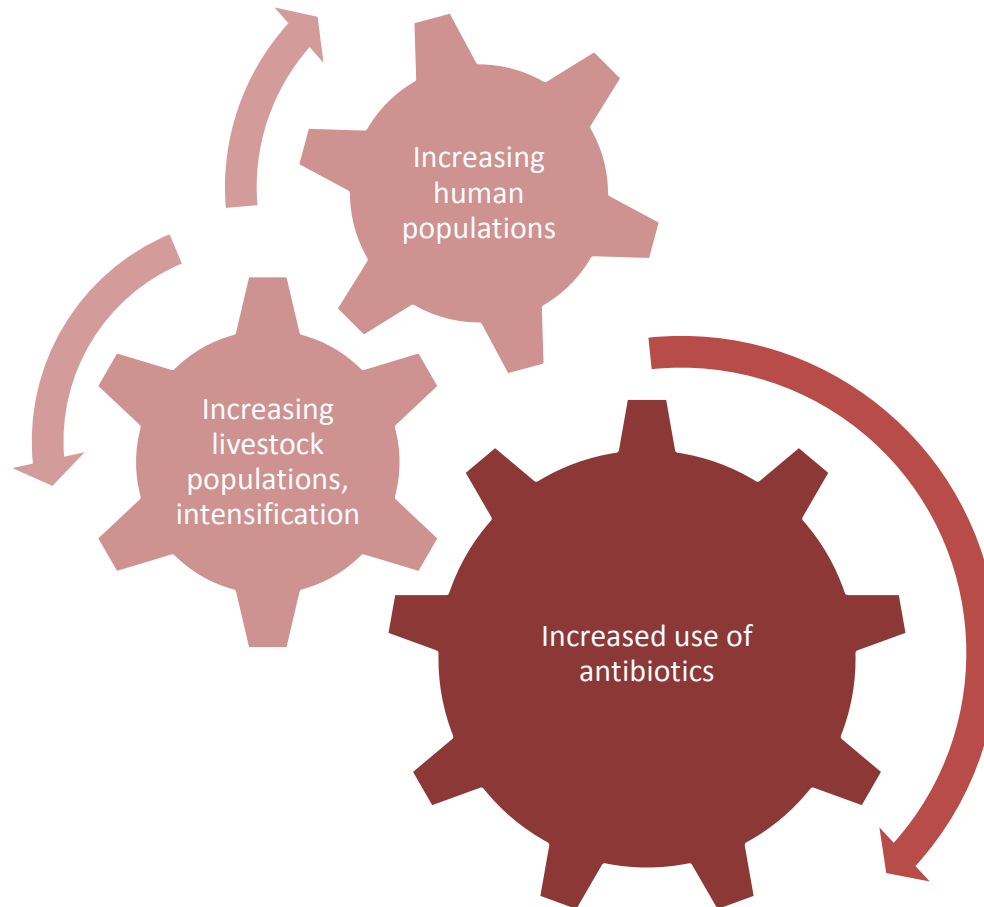
- More high-producing animals needs more concentrates
- Concentrates can have high levels of aflatoxins
- High-producing cattle also transfers a higher proportion to their milk
- Milk is often targeted to children and pregnant women
- Aflatoxins are associated with immunosuppression and stunting



Negative health consequences

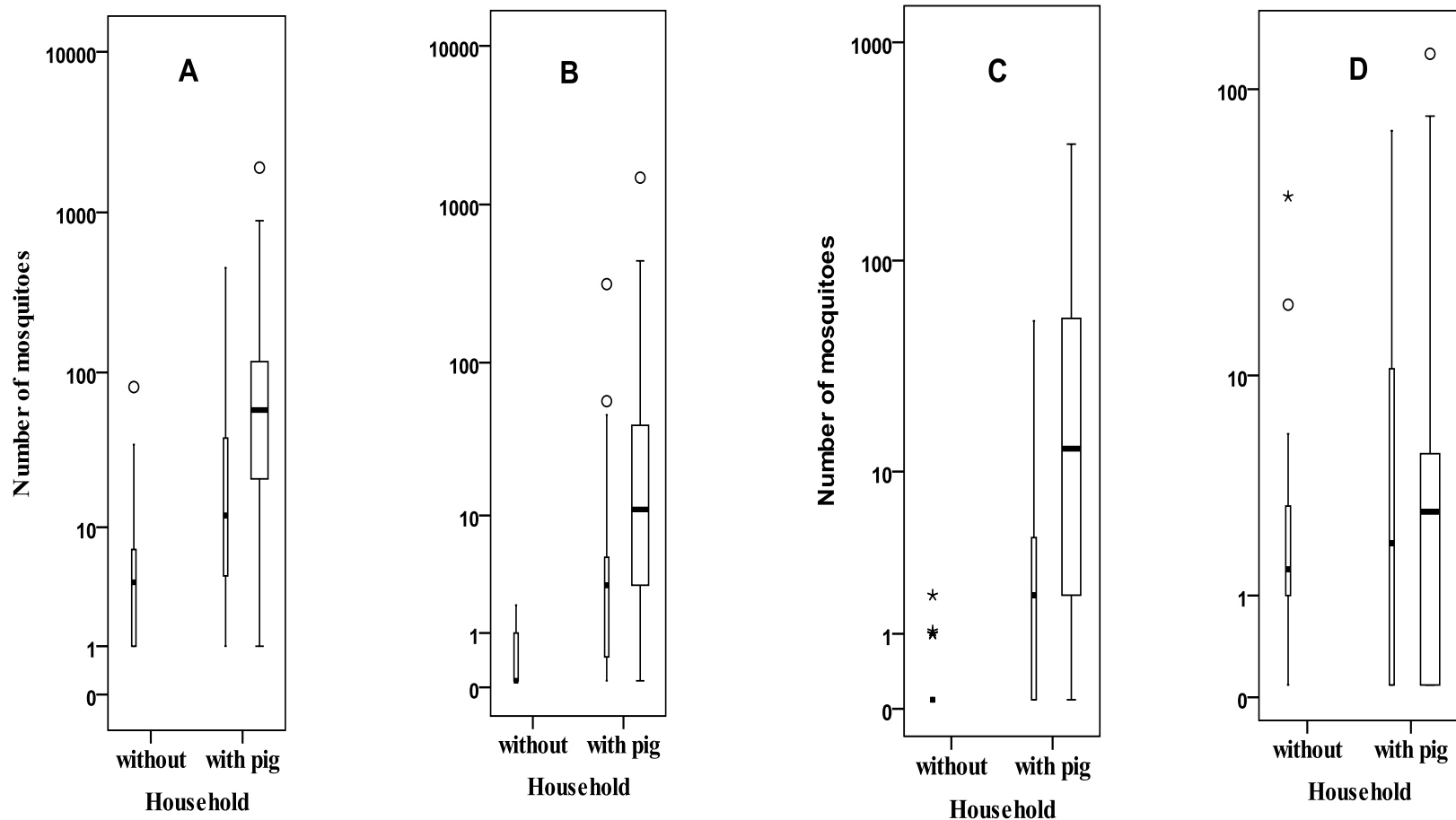


- Increase in food-borne disease
- New diseases emerging from animals and jumping species to humans
- Shifts in the dynamics of vector-borne diseases
- Increase in non-communicable diseases associated with over-consumption of livestock products
- Resistance to drugs transferring to pathogens that affect humans
- Environmental changes; over-grazing, wildlife conflicts etc.



More antibiotic residues, more resistance,

Example: Shifts in mosquito dynamics



Graphs showing the mosquitoes collected in households with and without pigs in Ninh Kieu district, Can Tho city, Vietnam.

Collections made close to humans are shown with thin boxes and collections close to pigs are shown with thick boxes.

A; total number of mosquitoes, B; *Culex tritaeniorhynchus* C; *Culex gelidus* D; *Culex quinquefasciatus*.

Circles depict outliers > 1.5 x the interquartile range and stars extreme outliers > 3 x the interquartile range.

Food safety issues

- Animal-source food perishable and susceptible
- New habits and foods



Lack of food safety...

- Imposes a burden on already struggling farmers and other value chain actors
- Deviates the attention from increasing production and commercialization
- Requires investments ... increase in prices:
 - Good for actors
 - Less good for poor consumers

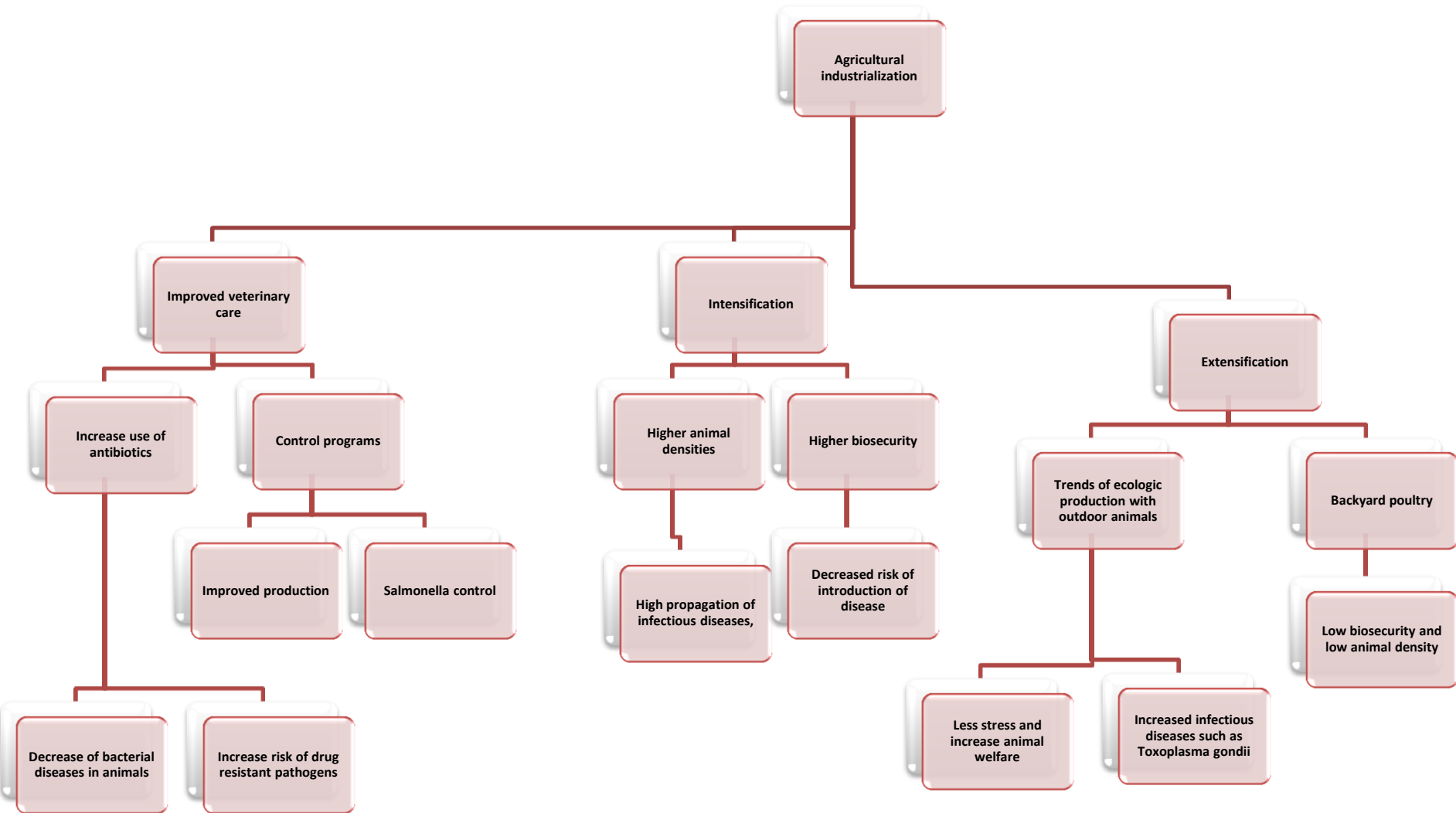


Andrea Minetti

Benefits with increasing demands

- Increasing markets for livestock production
- Livestock by the poor
 - Economic investments
 - Use common pastoral lands
 - Increased revenues- better for women than crops
- Livestock for the poor
 - Provide draught power and fertilizers
 - Even small amounts consumed improve nutrition

One action, multiple results



Example: Artificial insemination



- More exotic breeds; high production
- Loss of indigenous breeds; less resistance

- Reduced transport of boars to sows; less disease spread
- If a boar has a venereal infection, it gets spread to many

Urban agriculture?

More than 50% urban population

Increasing in both developed and developing countries

It involves approximately 800 million people and produces 15-20% of the food in the world

Economically crucial for many poor smallholders throughout the world

People often live in close proximity to their animals



Good and bad with urban agriculture?

- Closeness to the market
- Possibility to use urban wastes and waste water
- Women can combine it with household work
- It is an opportunity to provide food for the family and an extra income
- Local markets with living and dead animals
- Lacking sanitation
- Living in close proximity to the animals kept
- High density of people and animals

Or bringing the food to the cities?

- Large production units outside urban areas
 - Need for transporting
- Lack of infrastructure and cooling facilities
 - Need for transporting live animals
- Live animal markets
 - Risk of disease transmission



Livestock and the risk of diseases



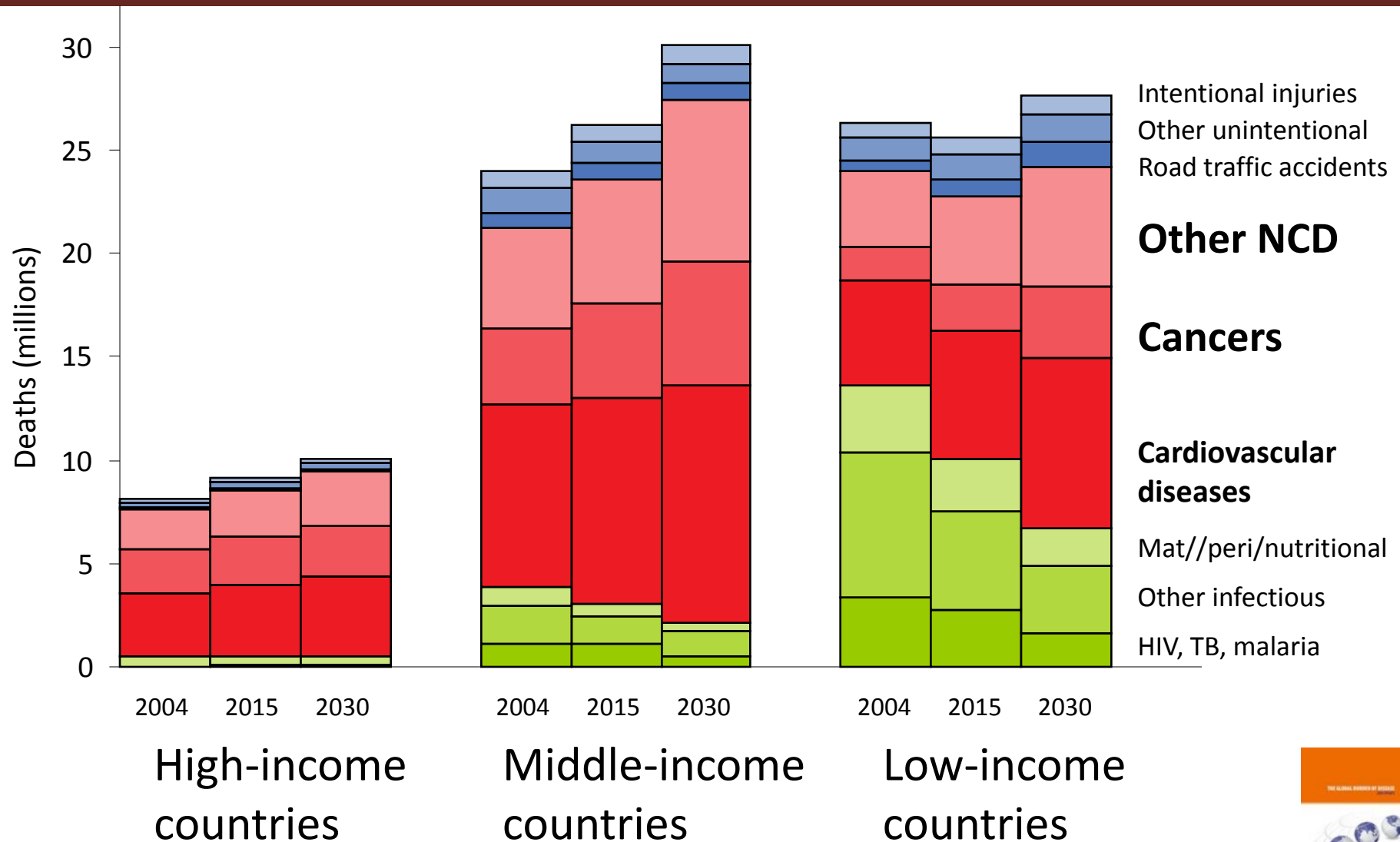
ZOONOSES and livestock disease

*58% of human
pathogens are
zoonotic*

(Woolhouse et al. 2005)

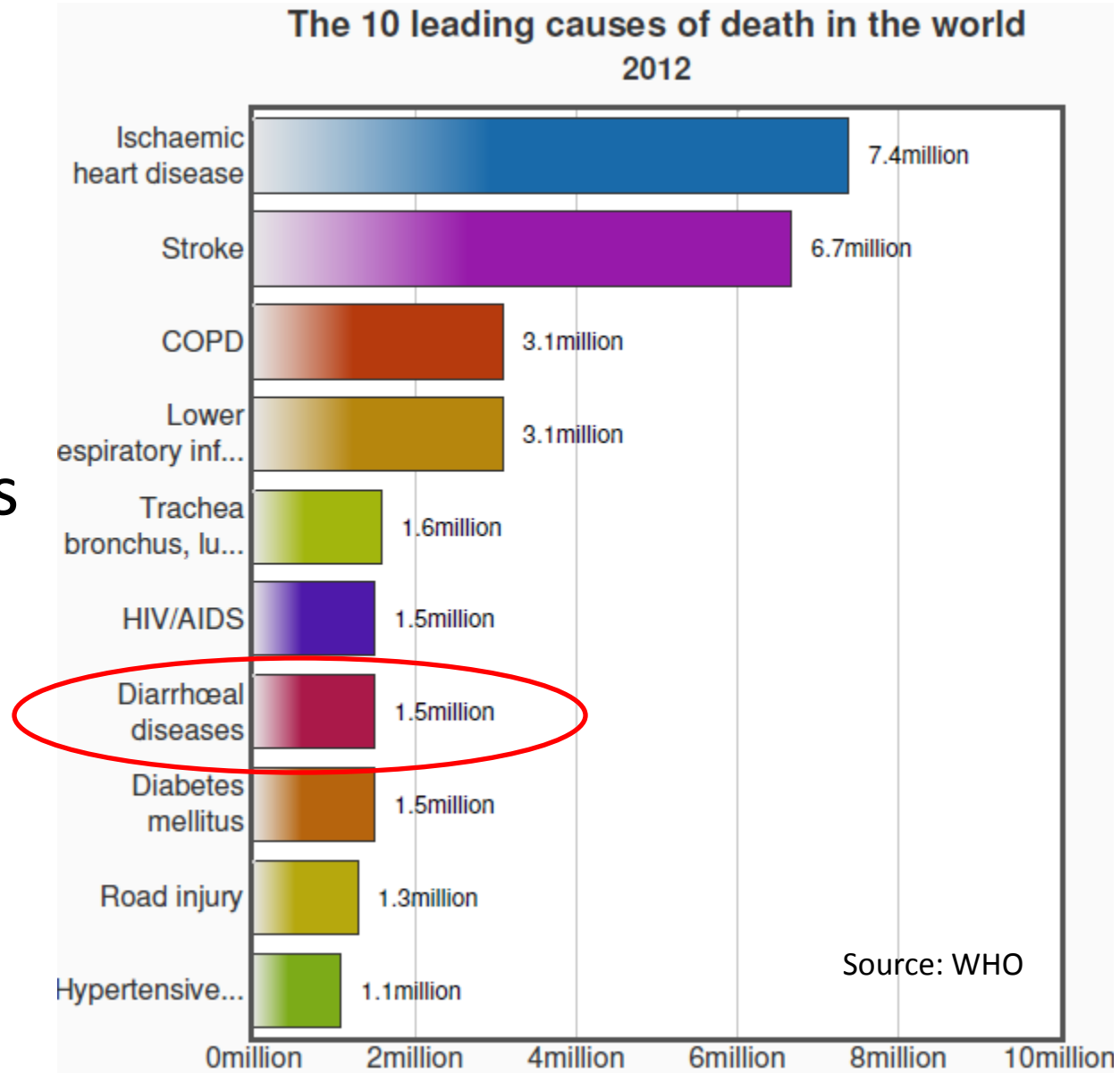
- **Endemic disease**
(diseases of poverty)
Neglected tropical diseases
- ***“Endemic epidemics”***
- **Emerging disease**
75% zoonotic

Mortality: global projection, 2004-2030



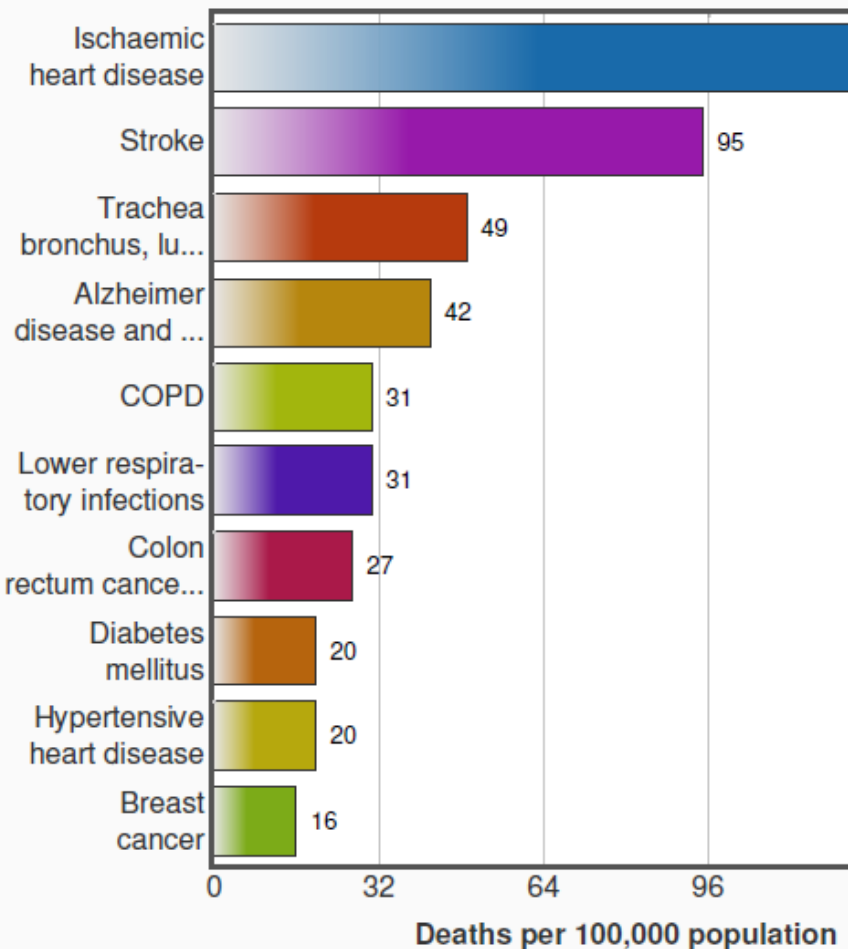
Infectious diseases

- Neglected
- Mainly affecting poor communities
- Chronic morbidity

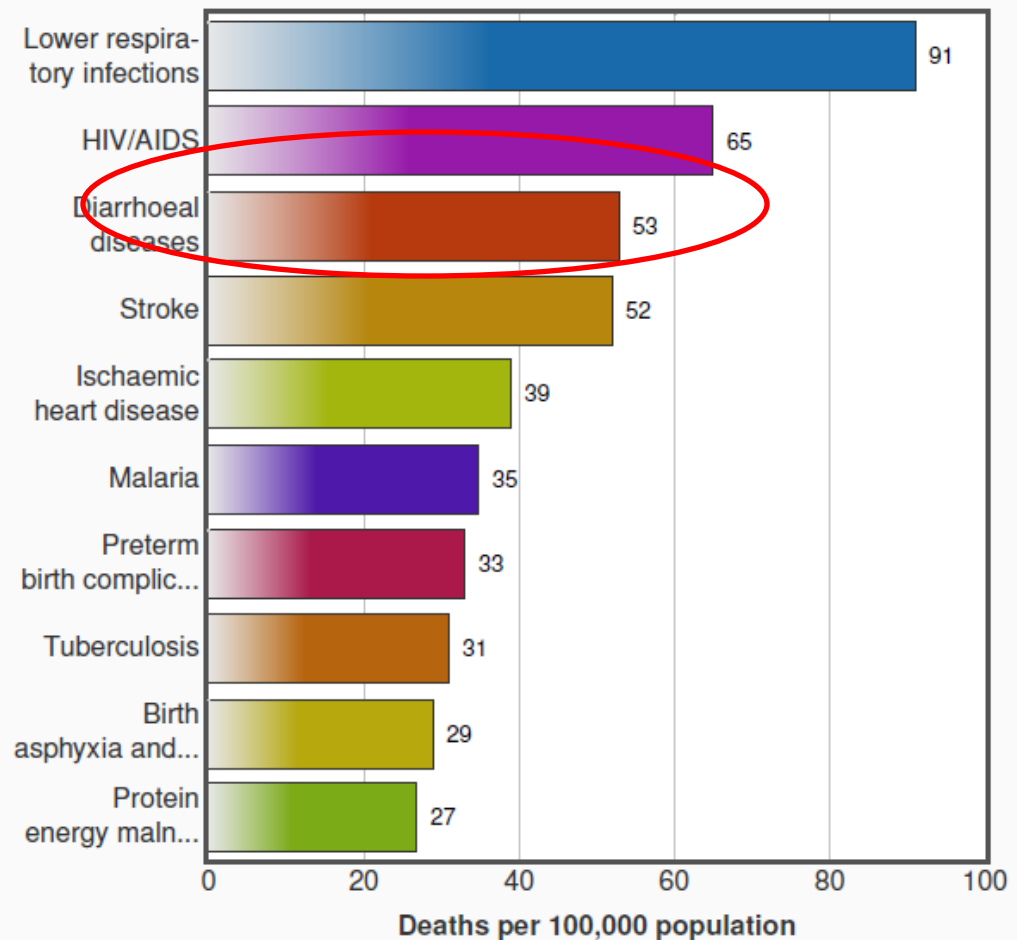


Endemic disease (neglected zoonoses)

Top 10 causes of death in high income countries
2012



Top 10 causes of death in low-income countries
2012



Source: WHO

Costs of zoonotic disease

- Zoonoses sicken 2.4 billion people, kill 2.2 million people and affect more than 1 in 7 livestock each year
- Cost \$9 billion in lost productivity; \$25 billion in animal mortality; and \$50 billion in human health

LEGEND

Number of poor livestock keepers per square kilometre

- 1-5
- 5-20
- 20-50
- 50-100
- Above 100

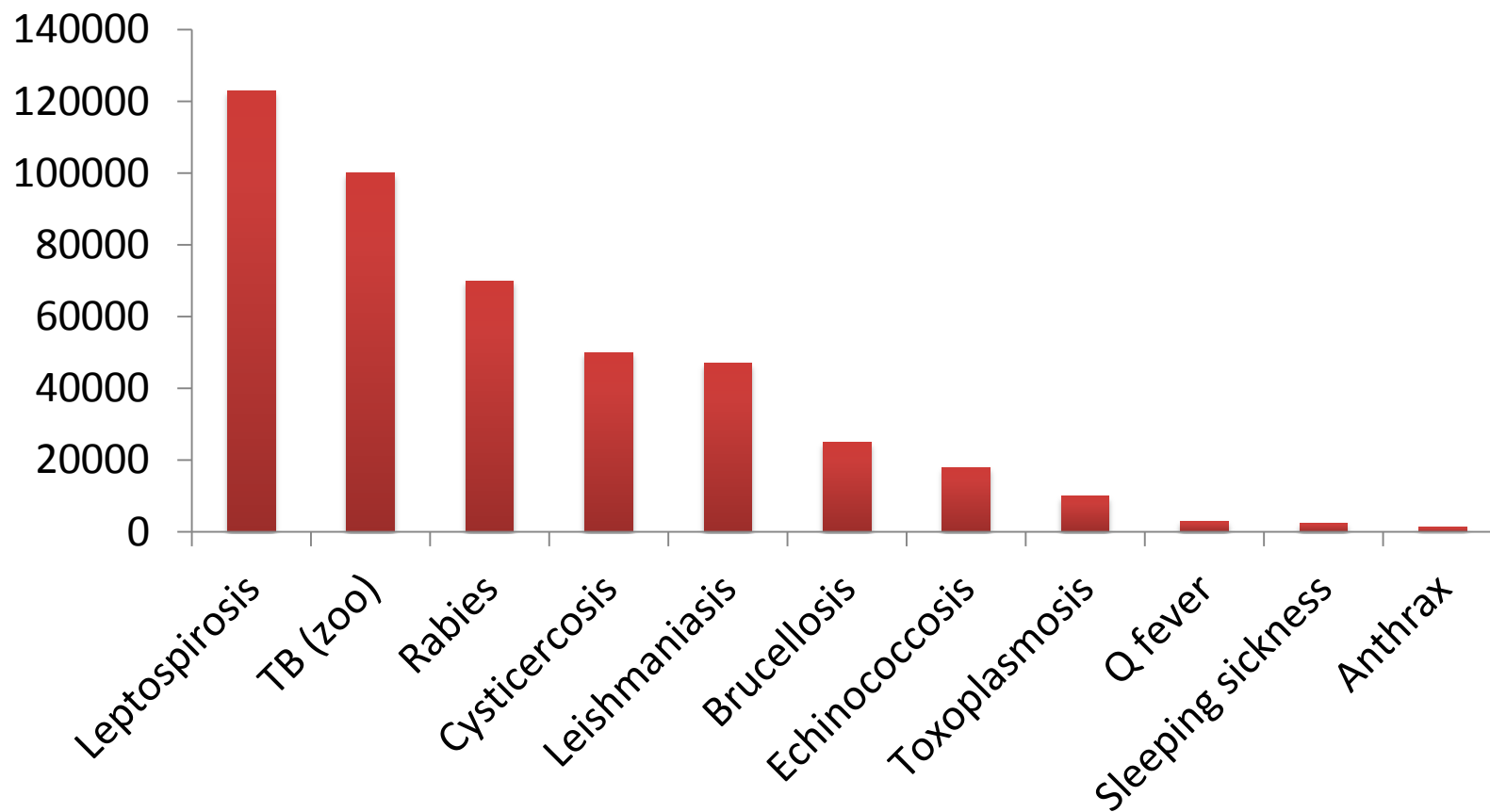
- One or more people or animals out of 100 infected by one or more zoonotic diseases per year

Top zoonoses (multiple burdens)

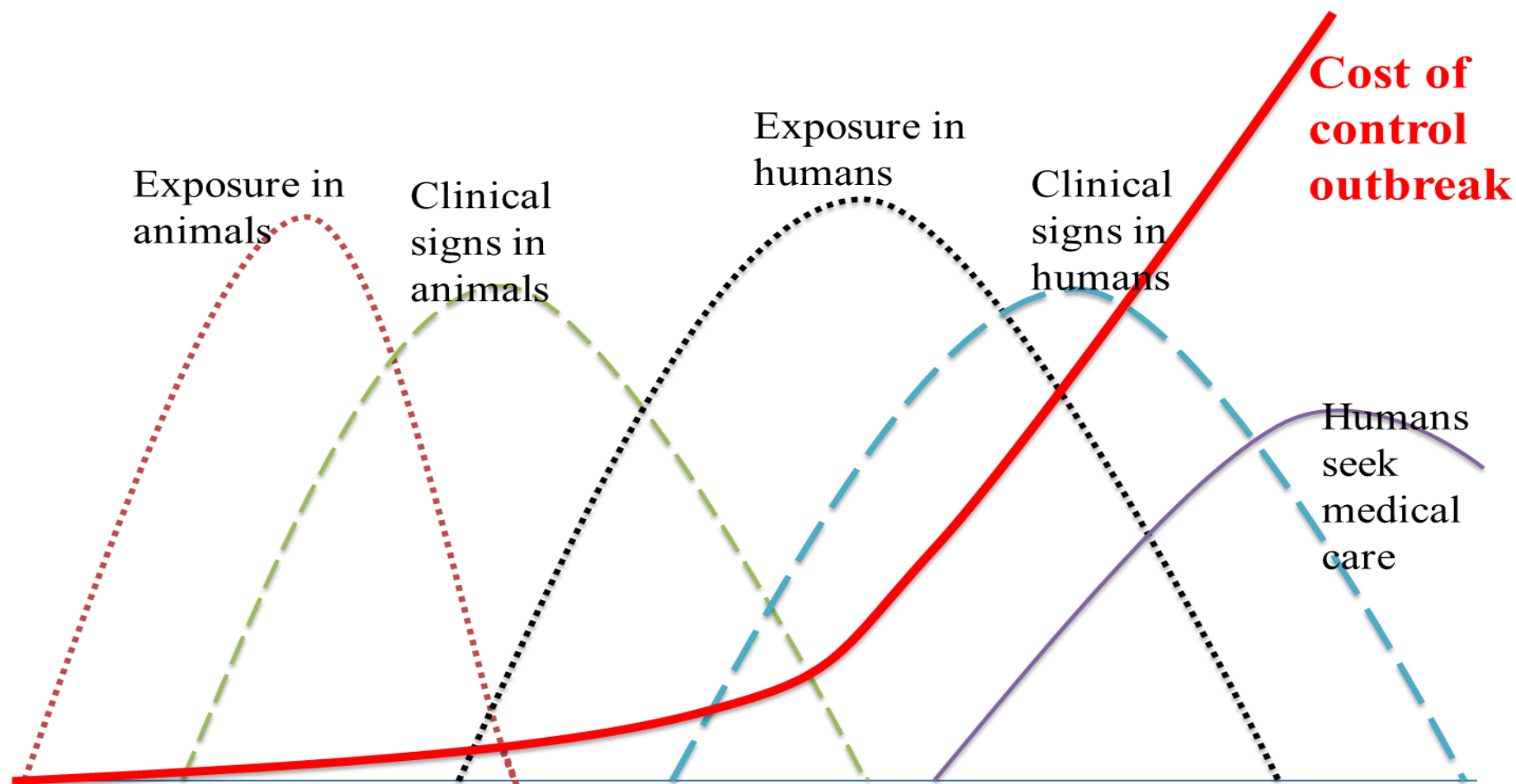
- Assessed 56 zoonoses from 6 listings:
responsible 2.7 billion cases, 2.5 million deaths
- Top 13 responsible for 2.2 billion illnesses and most deaths
 - Wildlife interface
 - 9 have a major impact on livestock- affect 1 out of 7
 - All 13 amenable to on-farm intervention

Zoonoses

Deaths - annual



Timely detection and response



Adapted from IOM (2009)

15

Benefits of controlling zoonoses in animals and along the value chain

- Credible economic cost benefit studies (n=13)
 - Average benefit cost ratio 6:1
 - Median 4:1
 - Range 1.1-19.8

Developing countries	3.7
Developed countries	7.4

- Implies \$85 billion losses could be averted by \$21 billion expenditure



The business case for One Health

Author:

Delia Grace¹

Affiliation:

¹International Livestock
Research Institute, Nairobi,
Kenya

Correspondence to:

Delia Grace

Email:

d.grace@cgiar.org

Postal address:

PO Box 30709, Nairobi, Kenya

How to cite this article:

Grace, D., 2014, 'The
business case for One
Health', *Onderstepoort
Journal of Veterinary
Research* 81(2), Art. #725

This article outlines a pathway to develop the business case for One Health. It describes the origin and development of One Health and then identifies five potential areas where One Health can add value and reduce costs. These are: (1) sharing health resources between the medical and veterinary sectors; (2) controlling zoonoses in animal reservoirs; (3) early detection and response to emerging diseases; (4) prevention of pandemics; and (5) generating insights and adding value to health research and development. Examples are given for each category along with preliminary estimates of the potential savings from adopting the One Health approach. The literature reviewed suggests that one dollar invested in One Health can generate five dollars worth of benefits and a global investment of US\$25 billion over 10 years could generate benefits worth at least US\$125 billion. Conservation implications: the time has come to make the bigger case for massive investment in One Health in order to transform the management of neglected and emerging zoonoses and to save the lives of millions of people and hundreds of millions of animals whose production supports and nourishes billions of impoverished people per annum.

Introduction

This article is based on an invited keynote presentation given at the Southern African Centre for

Burdens of disease

- DIRECT Human Health / Animal Health impact
- Economic consequences

Inability to work
~~Resources devoted to treatment~~
Take care of sick family members



- Productivity
- Investments on agriculture
- Adoption of modern technologies
-



- Social impacts

WOMEN – Reduced availability for agr. tasks
(decreased production, less opportunities for women)
CHILDREN – Taken out of school

Burdens of disease

Economic burden on country

- Decrease GDP from livestock
- Trade bans
- Challenges to achieve economic development from agriculture

Unwillingness to pay for prevention

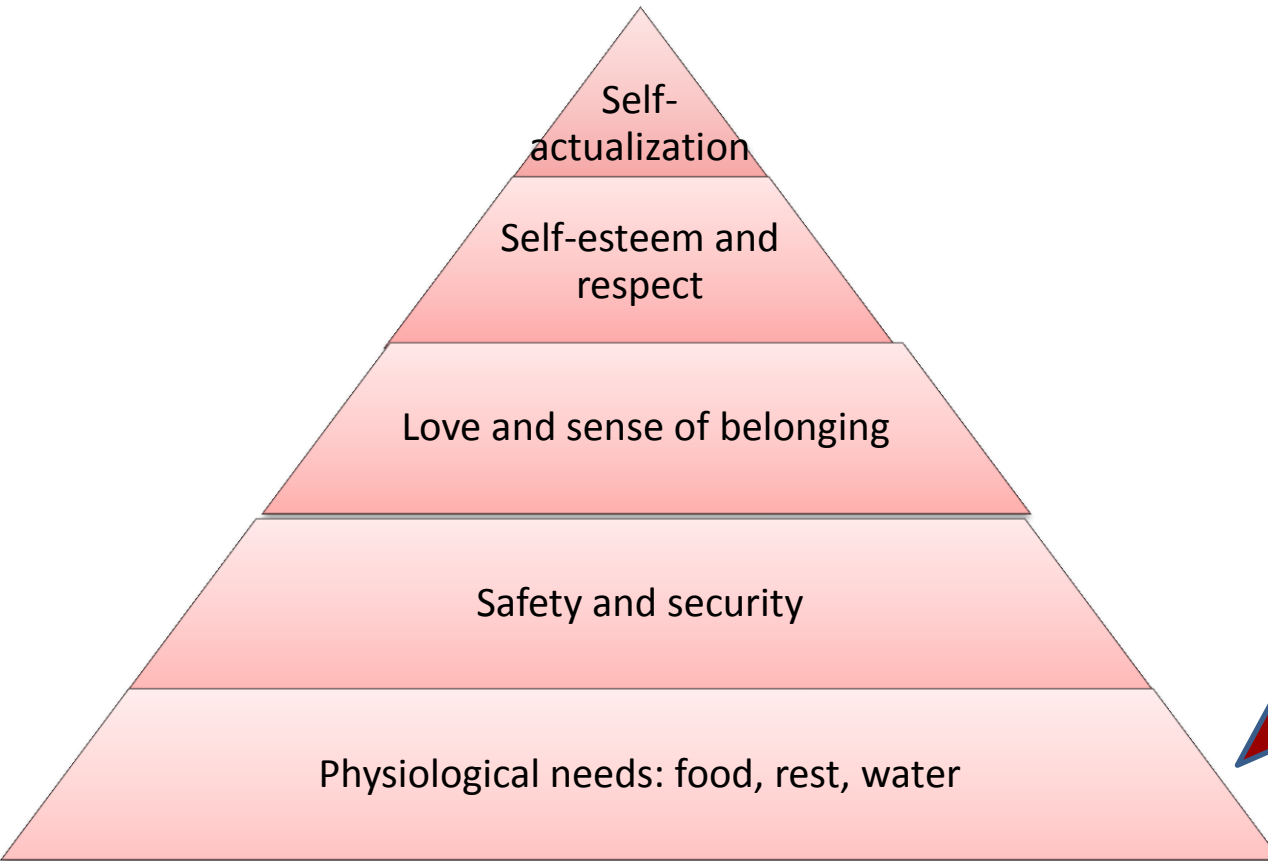
How much did you spend last year on the following health protection (Kenya shilling)?

	Mosquito nets	Vaccines & routine clinic visits for kids	Boiling or other water treatment	Insurance (annual fee)	Other health prevention
Mean	762	254	6.8	0.9	586
Range	0-3150	0-5000	4 households paid between 150-600	220 households paid nothing, one household paid 200	0-6000

How much did you spend last year on the following health prevention for animals?

	Deworming	Vaccinations (to prevent not to treat)	Tick and fly treatments	Insurance (annual fee)
Mean	928	437	599	0
Range	0-11000	0-5000	0-5000	Not existing

Why we must remember this:



Hierarchy of needs according to Maslow.

If this is not fulfilled, nothing else will be prioritized

Conclusions 1

- The livestock revolution has benefitted poor farmers both by increased incomes and improved nutrition
- It has brought along risks, including food safety issues and disease emergence
- This process is not over yet
 - More mouths to feed



Conclusions 2

- Not the livestock revolution predicted by Orwell
- But still not a situation where all people are equally equal regarding a secured access to safe food

Acknowledgements

CGIAR Research Program on
Agriculture for Nutrition and Health

Thanks to:

Ram Deka and students in Assam

Bernard Bett and DDDAC team



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ILRI is a member of the CGIAR Consortium

Box 30709, Nairobi 00100 Kenya

Phone +254 20 422 3000

Fax +254 20 4223001

Email ilri-kenya@cgiar.org

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