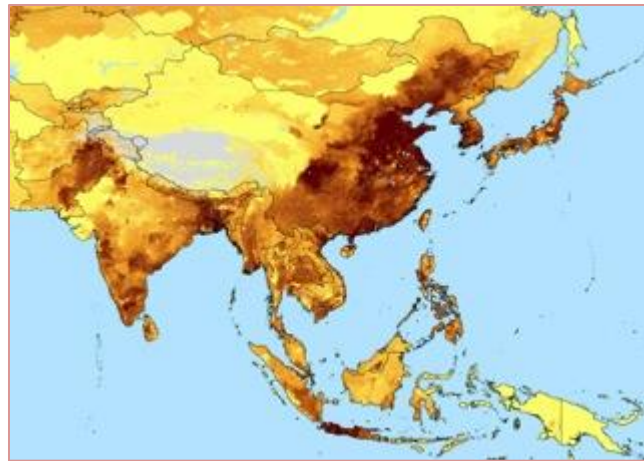


The global livestock sector: Trends, drivers and implications for society, health and the environment

Timothy Robinson,

William Wint, Giulia Conchedda, Giuseppina Cinardi, Thomas Van Boeckel,
Michael Macleod, Bernard Bett, Delia Grace & Marius Gilbert

Science with Impact – Annual Conference 2015 – BSAS/AVTRW/WPSA
Binks Building, University of Chester, 14-15 April 2015



GLOBAL
RESEARCH
ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

ILRI
INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE



CGIAR

bsas
british society of animal science



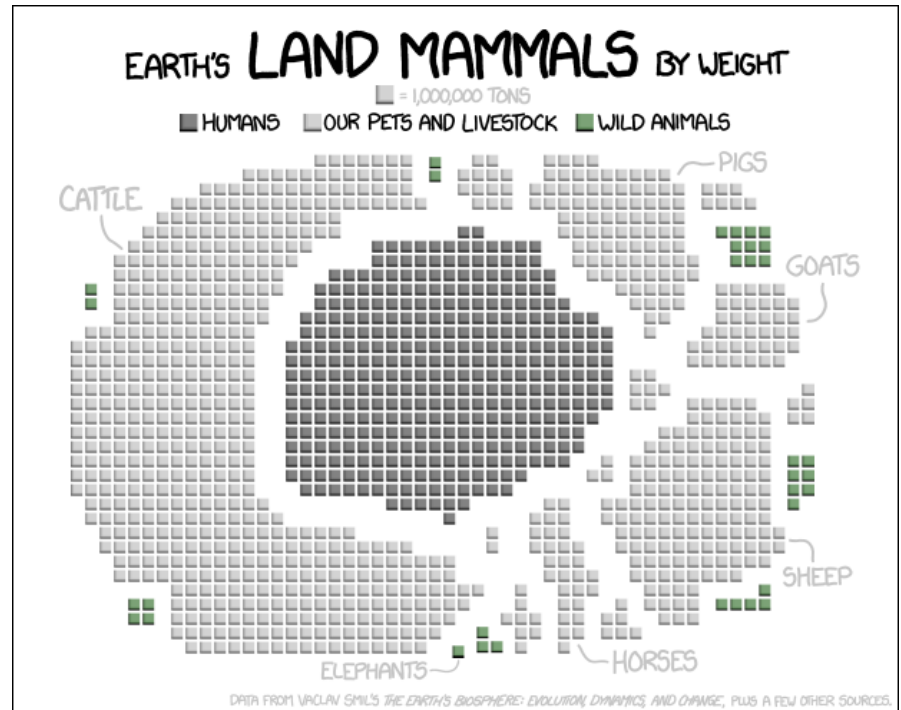
Overview



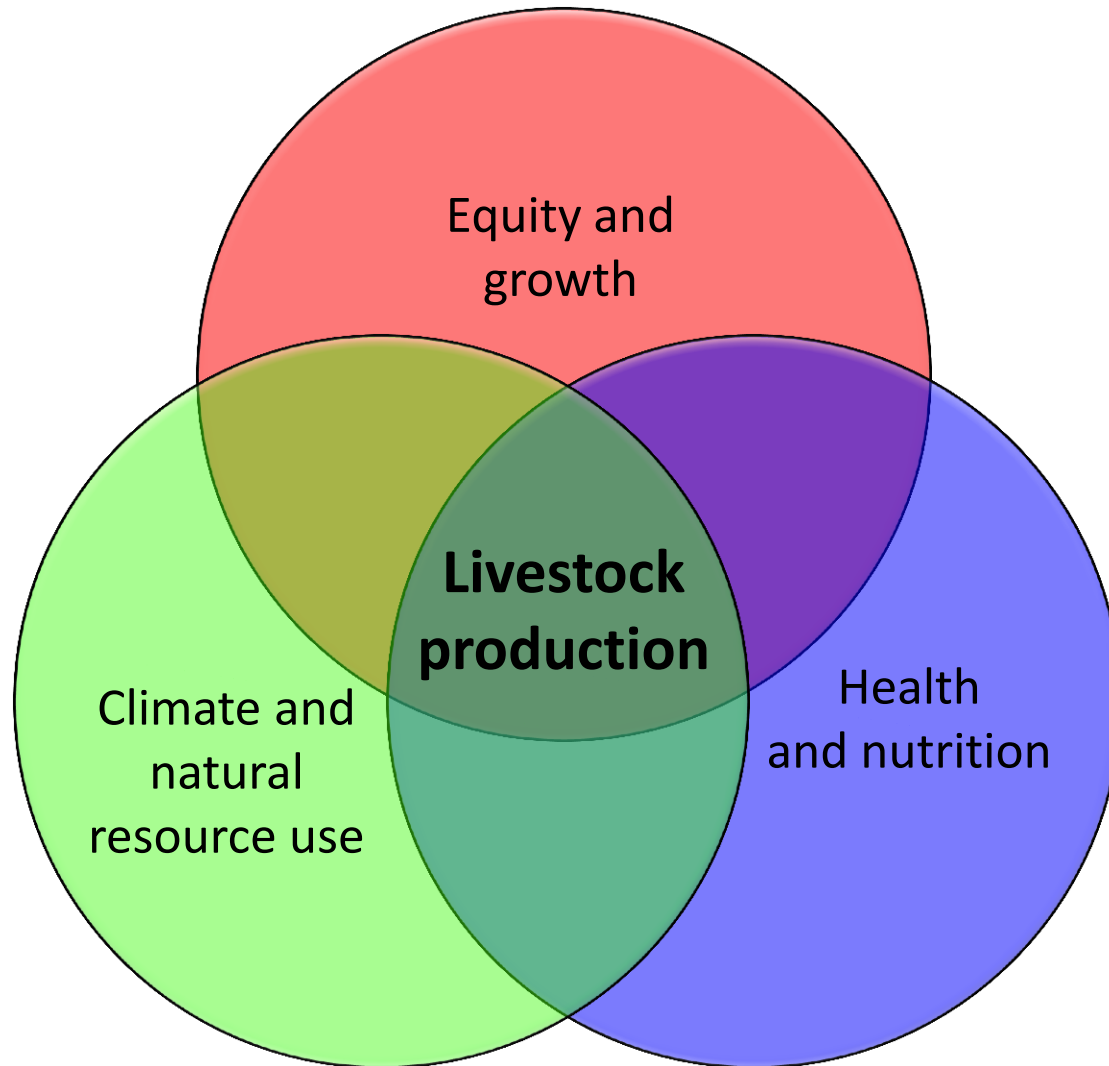
- The global livestock sector
- Trends and drivers
- Mapping livestock distributions and production systems
- Livestock and livelihoods
- Livestock, health and nutrition
- Livestock and the environment
- Bringing it all together:
Animal health and greenhouse gas emissions

The global livestock sector

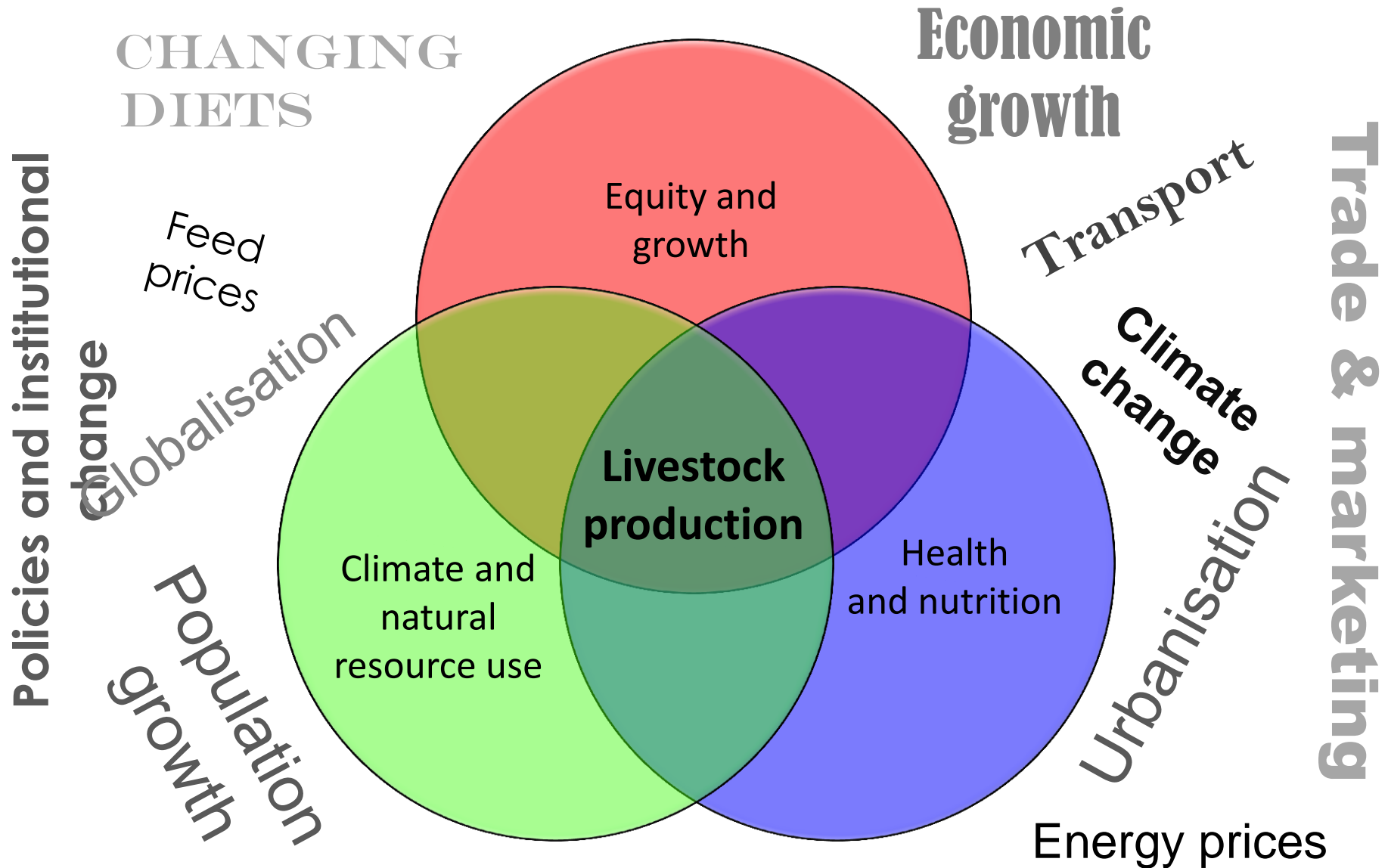
- Livestock numbers (FAOSTAT 2012)
 - 1.8 billion cattle and buffalo
 - 2.5 billion sheep and goats
 - 1.5 billion pigs
 - 30.6 billion poultry
- Sector accounts for 30% of the land surface
- 70% of all agricultural land
- 8% of human water use



The global livestock sector



The global livestock sector



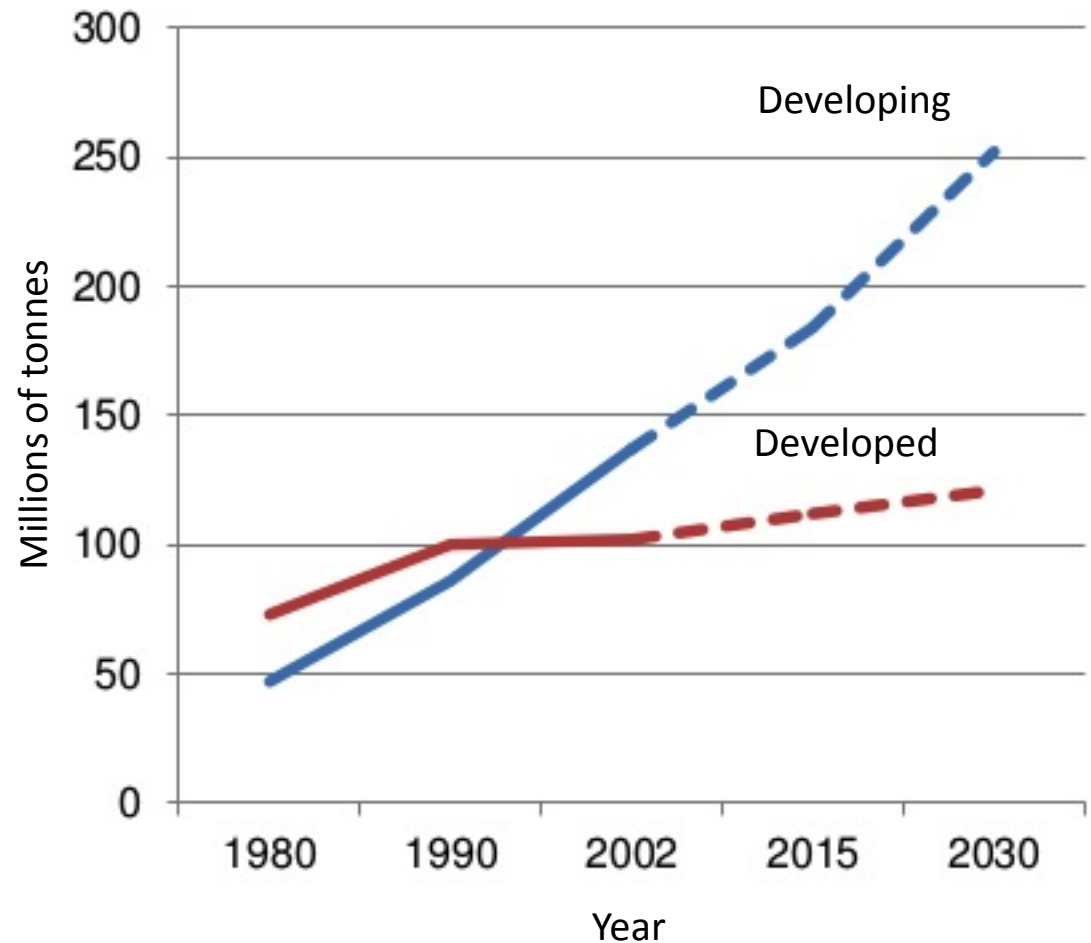
The changing livestock sector

- Demographic and social drivers
 - Population: + 32% or 9.6 billion people by 2050
 - Income growth: + 2% per year by 2050
 - Urbanization: 70% will live in cities by 2050
- Growth in demand for animal source foods
 - + 70% by 2050
 - + 200 million tonnes of meat
- Structural changes in the livestock sector
 - Shift from ruminant to monogastric
 - Intensification of production
- Impinges on global public goods
 - Poverty and growth
 - Health and nutrition
 - Climate and natural resources
- **Integrated approach to socially desirable livestock sector development**
- **Need reliable data and information to guide policy**



Livestock to 2030 – demand growth

Consumption of Animal Source Foods is increasing faster in developing countries than in developed countries

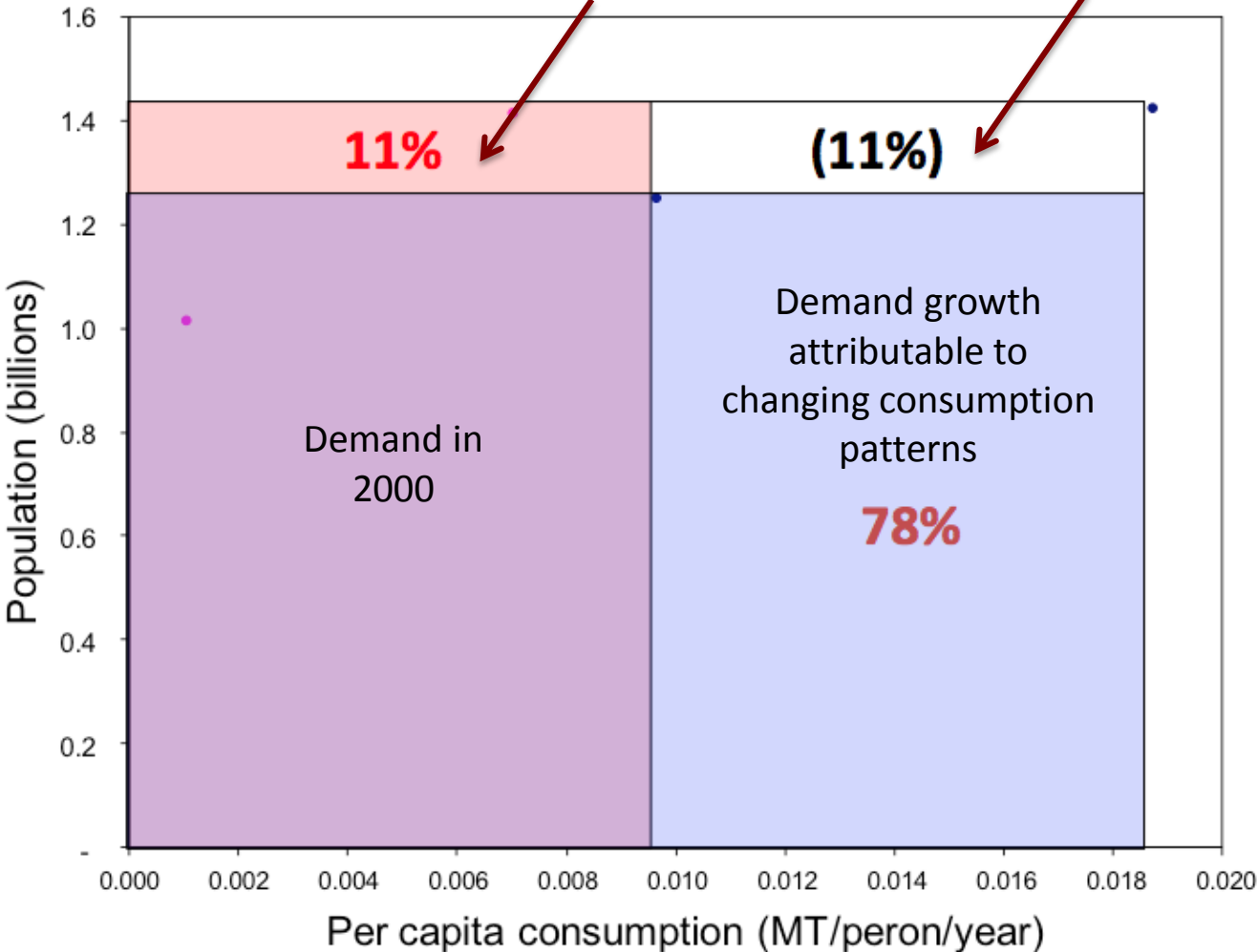


Disaggregating demand growth

Growth in poultry consumption in China to 2030

Demand growth attributable to population growth

Demand growth as a function of both



Implications for production

- Rural population growth

→ EXPANSION

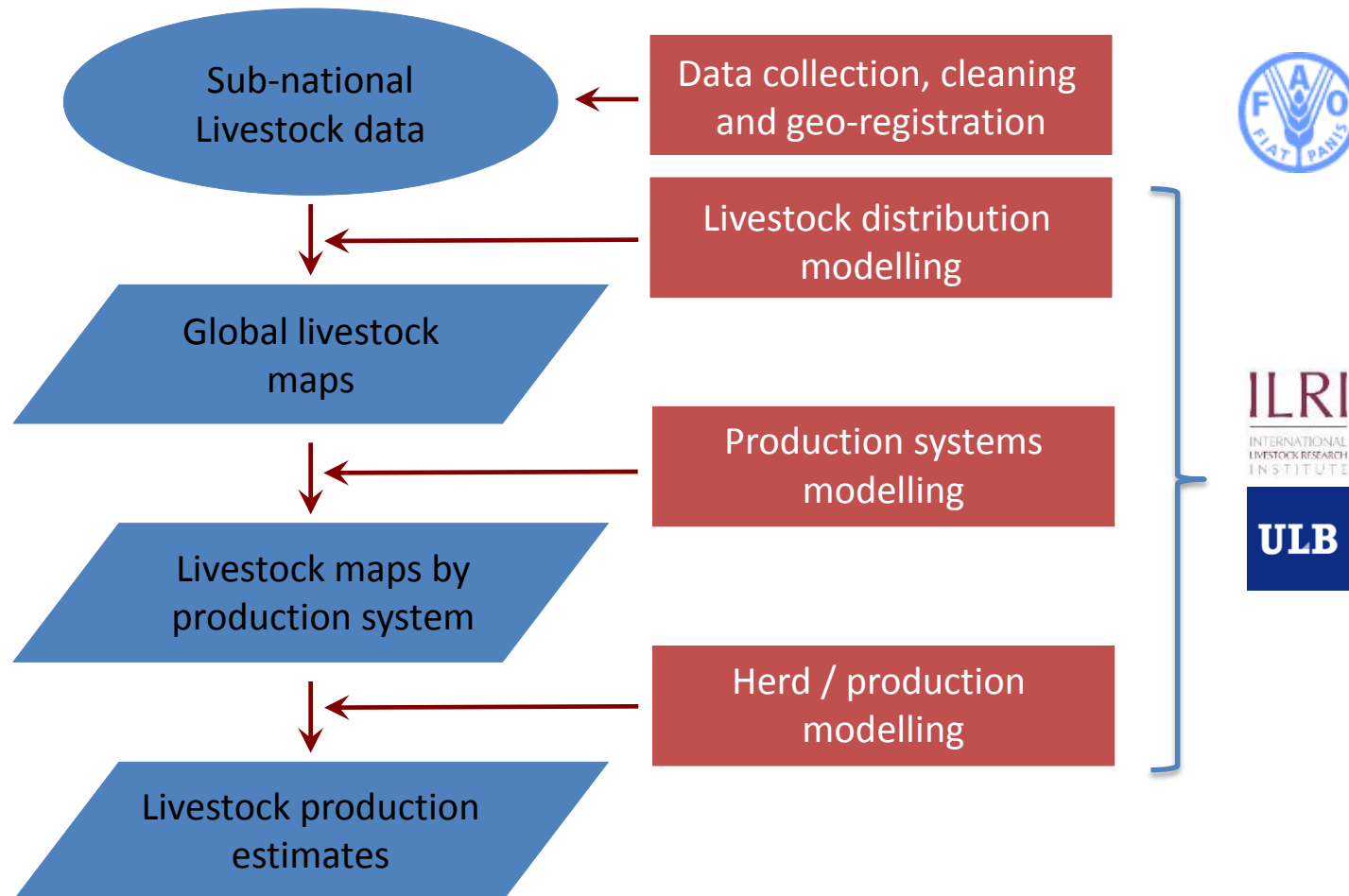


- Urban population growth
- Increasing wealth
- Changing consumption patterns

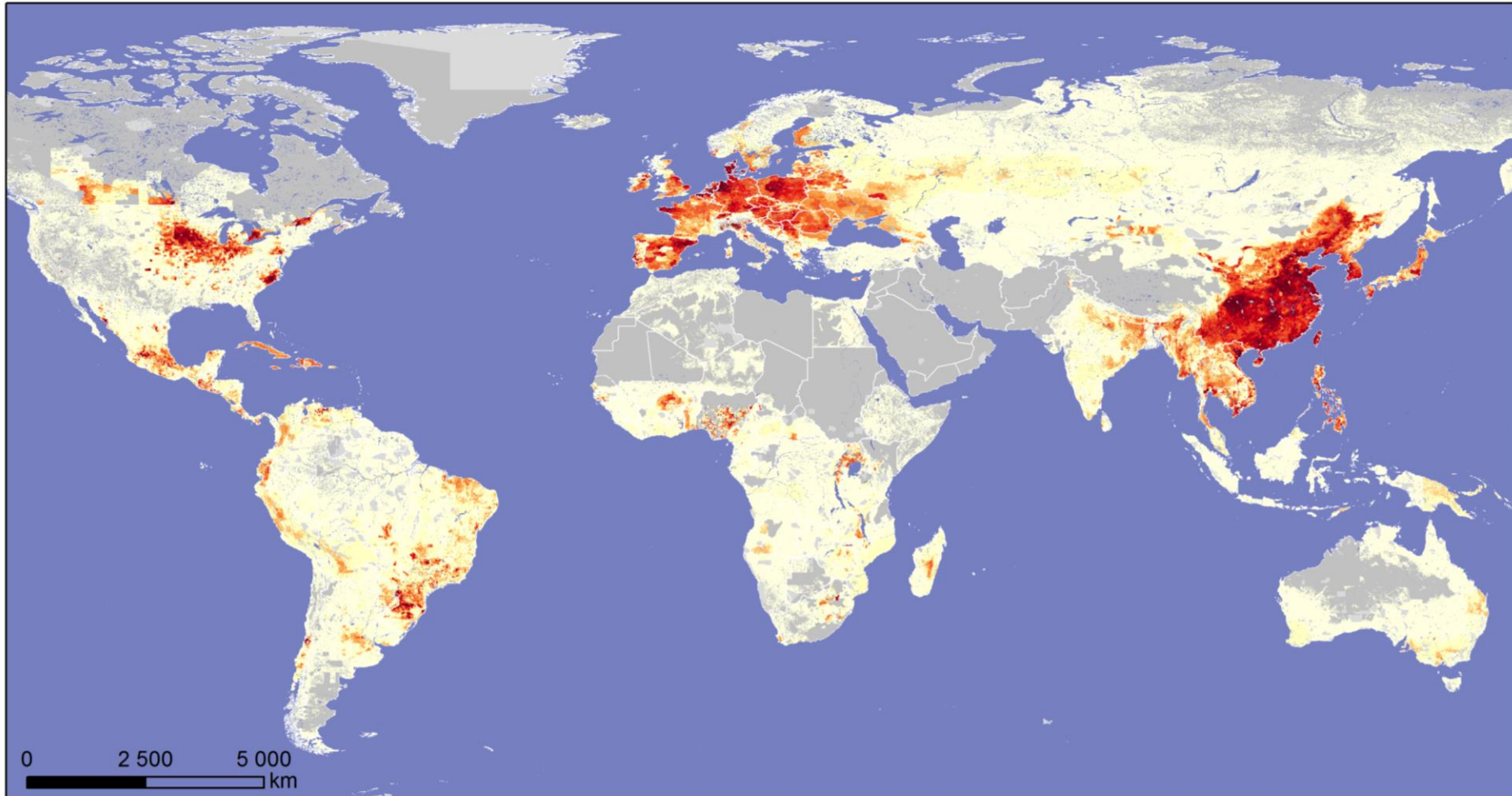
→ INTENSIFICATION



Livestock distribution and production



Global distribution of pigs



Pigs per square kilometre (2006)

Unsuitable

< 1

1 - 5

5 - 10

10 - 20

20 - 50

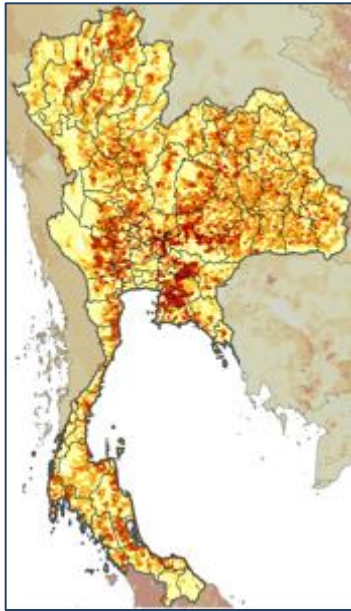
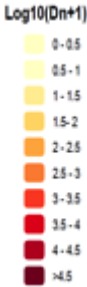
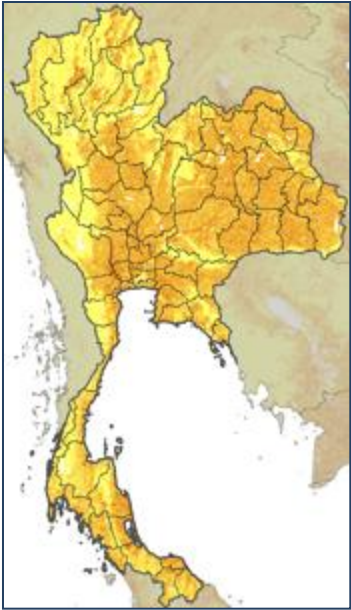
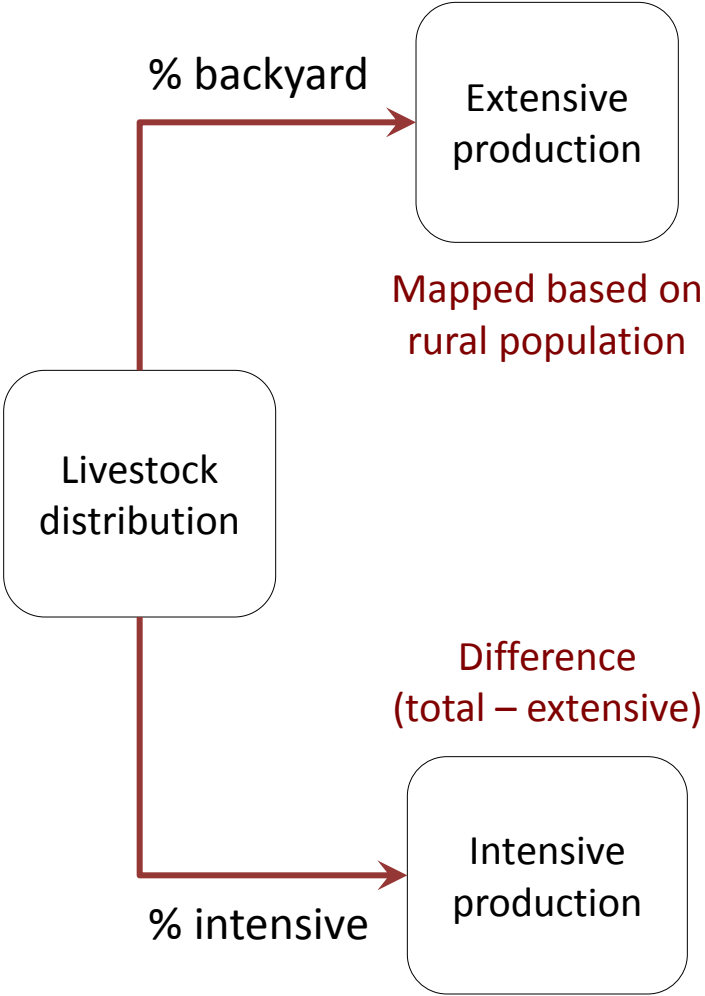
50 - 100

100 - 250

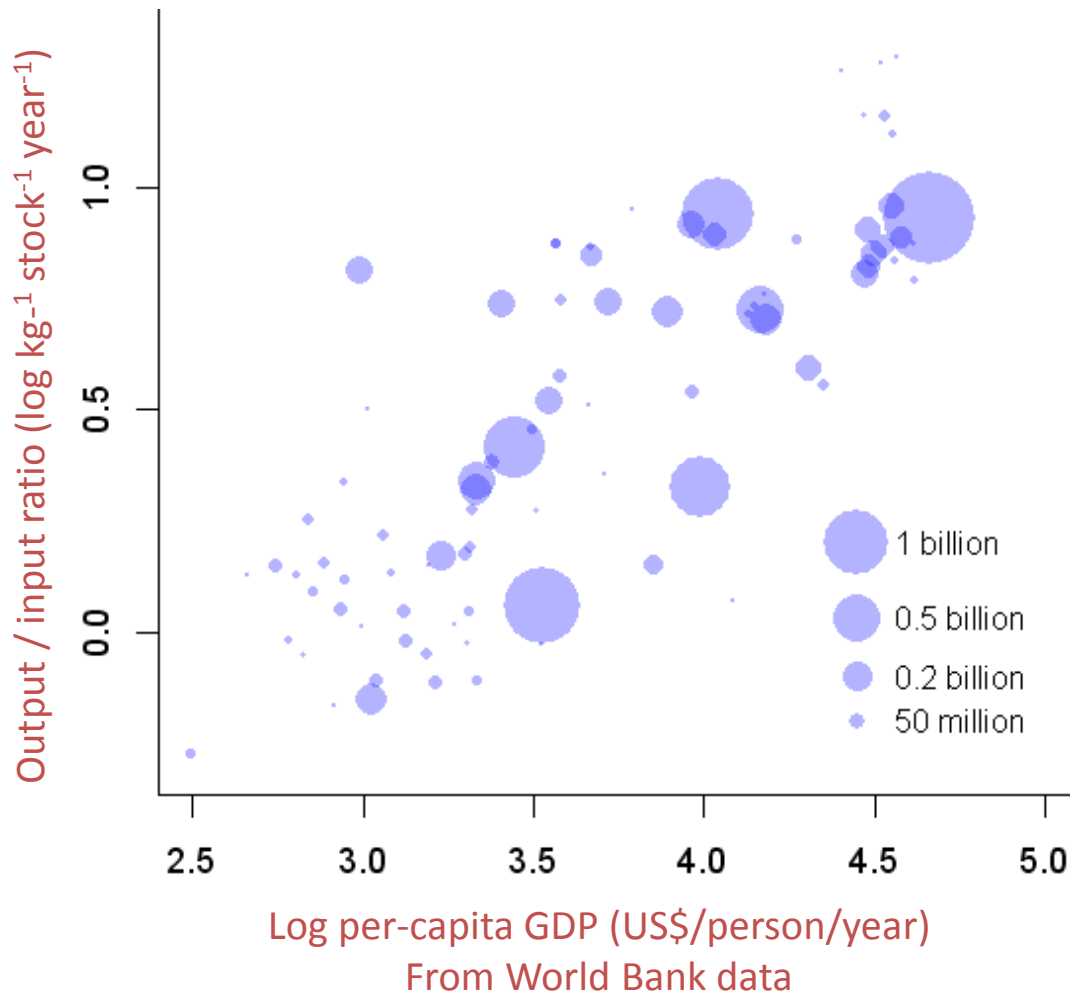
> 250

Source: Robinson et al. (2014)

Monogastric production systems

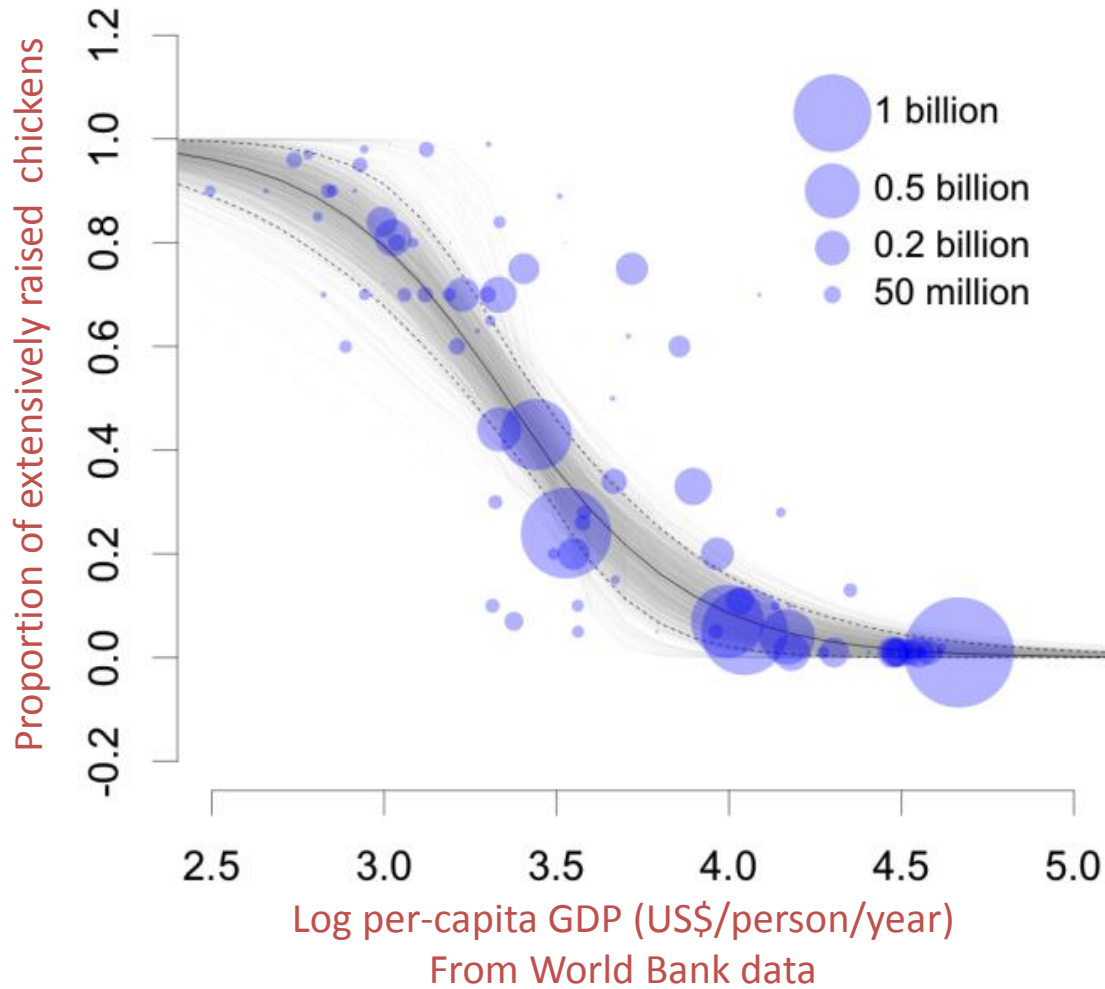


Chicken systems



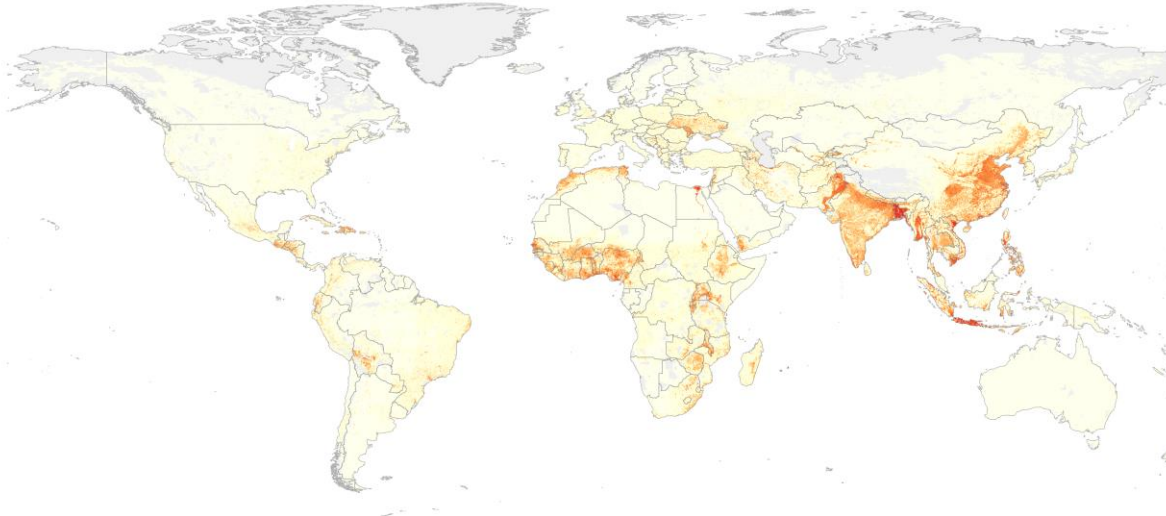
Source: Gilbert et al. (under review)

Chicken systems

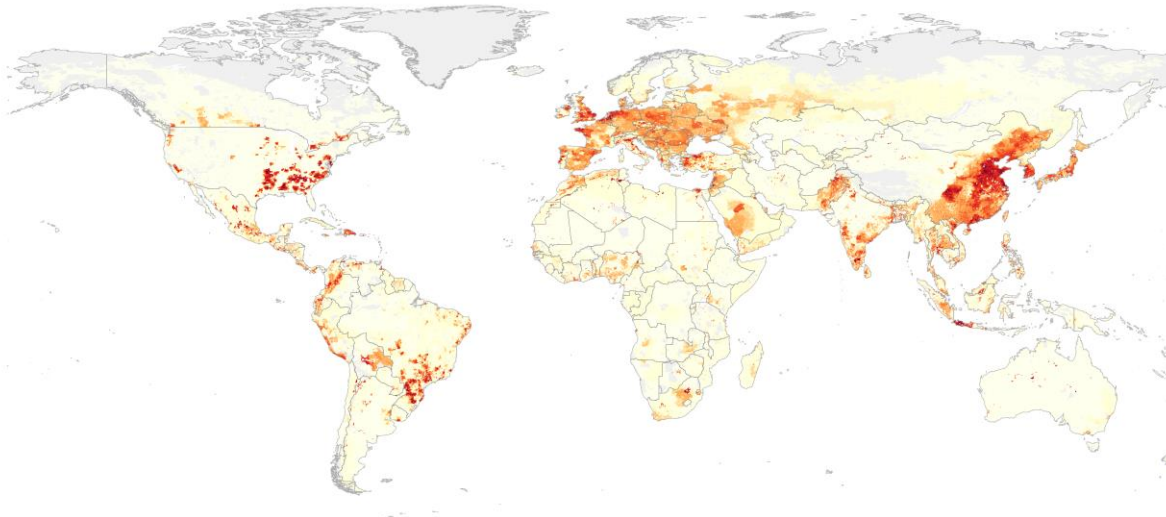


Source: Gilbert et al. (under review)

Chicken systems



Extensive chicken production



Intensive chicken production



<http://www.livestock.geo-wiki.org>

Geospatial Land Cover Validation at Geo-Wiki

geo-wiki.org/Application/Index.php

GEO-Wiki LIVESTOCK

Livestock

Homepage t.robins@cgiar.org Logout

Global Cattle 2006

Don't show any overlays

Livestock distributions

- Cattle (2006)
- Chickens (2006)
- Ducks (2006)
- Pigs (2006)
- Sheep (2006)
- Goats (2006)

Show legend Yes No

Livestock systems

- Ancillary Layers
- Geocoding

Download

- Cattle (654MB) metadata
- Chickens (749MB) metadata
- Ducks(574MB) metadata
- Pigs (543MB) metadata
- Goats (681MB) metadata
- Sheep (721MB) metadata

Models training data

Legend: Global Cattle 2006

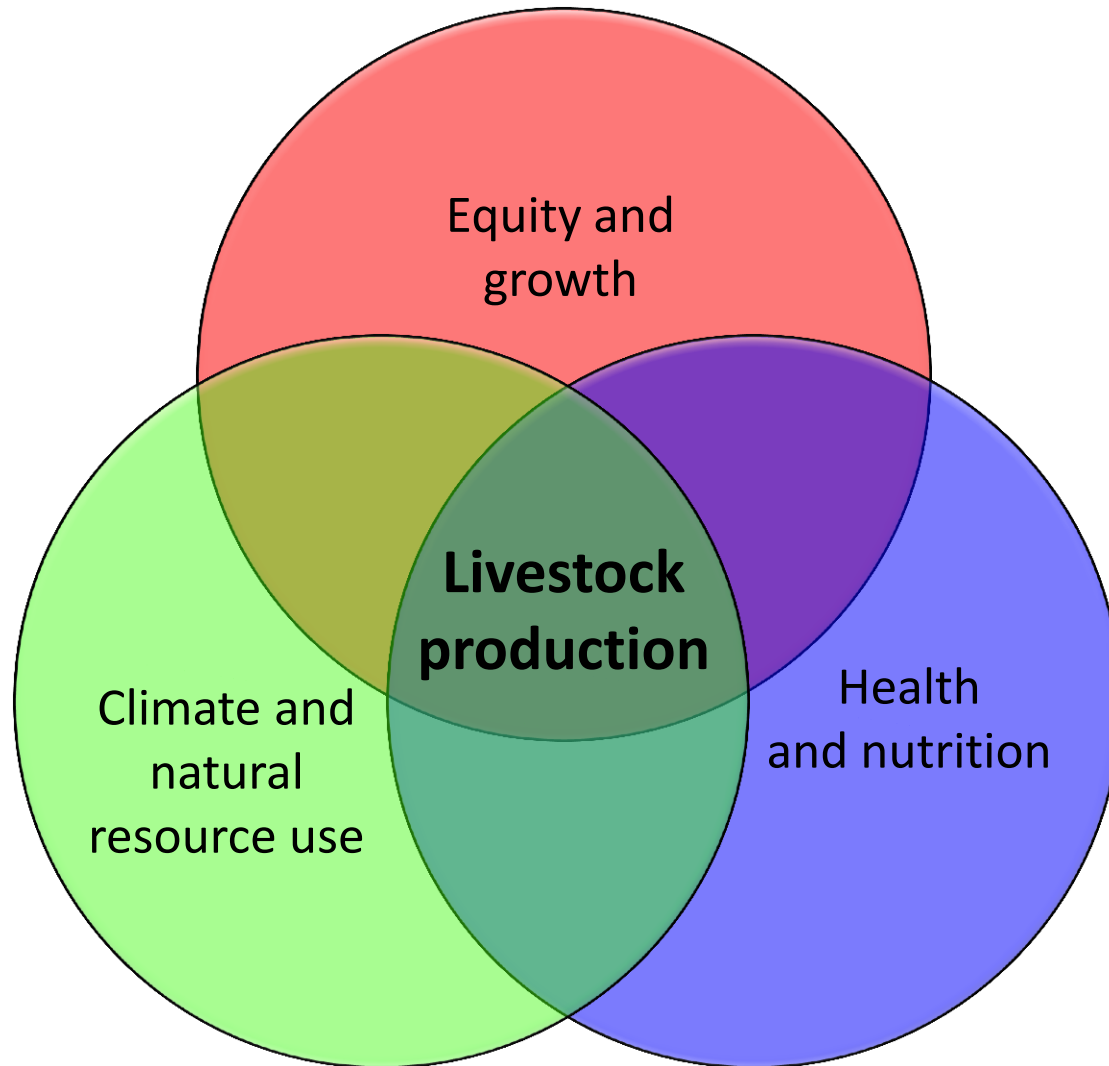
- < 1 cattle/km²
- 1 - 5 cattle/km²
- 5 - 10 cattle/km²
- 10 - 20 cattle/km²
- 20 - 50 cattle/km²
- 50 - 100 cattle/km²
- 100 - 250 cattle/km²
- > 250 cattle/km²

Image Landsat
US Dept of State Geographer
© 2014 Google
© 2014 ORION-ME

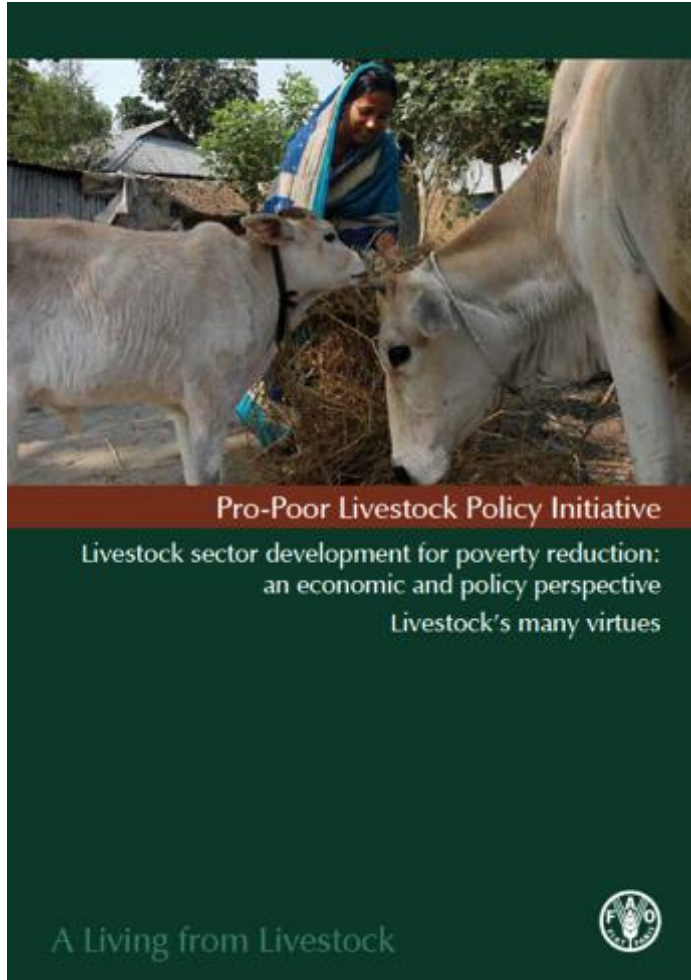
Google earth
Terms of Use

eye alt: 4184.63 mi

The global livestock sector

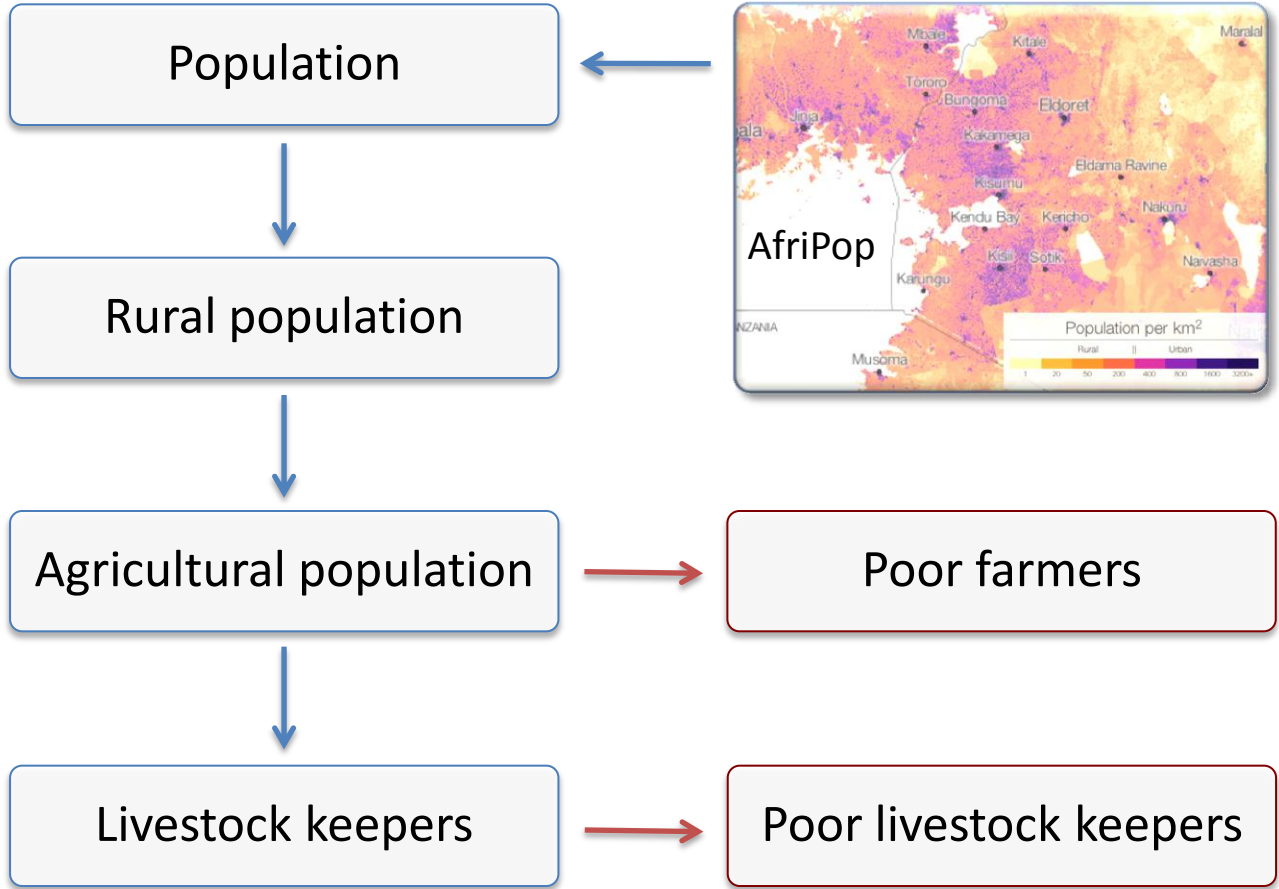


Livestock and livelihoods

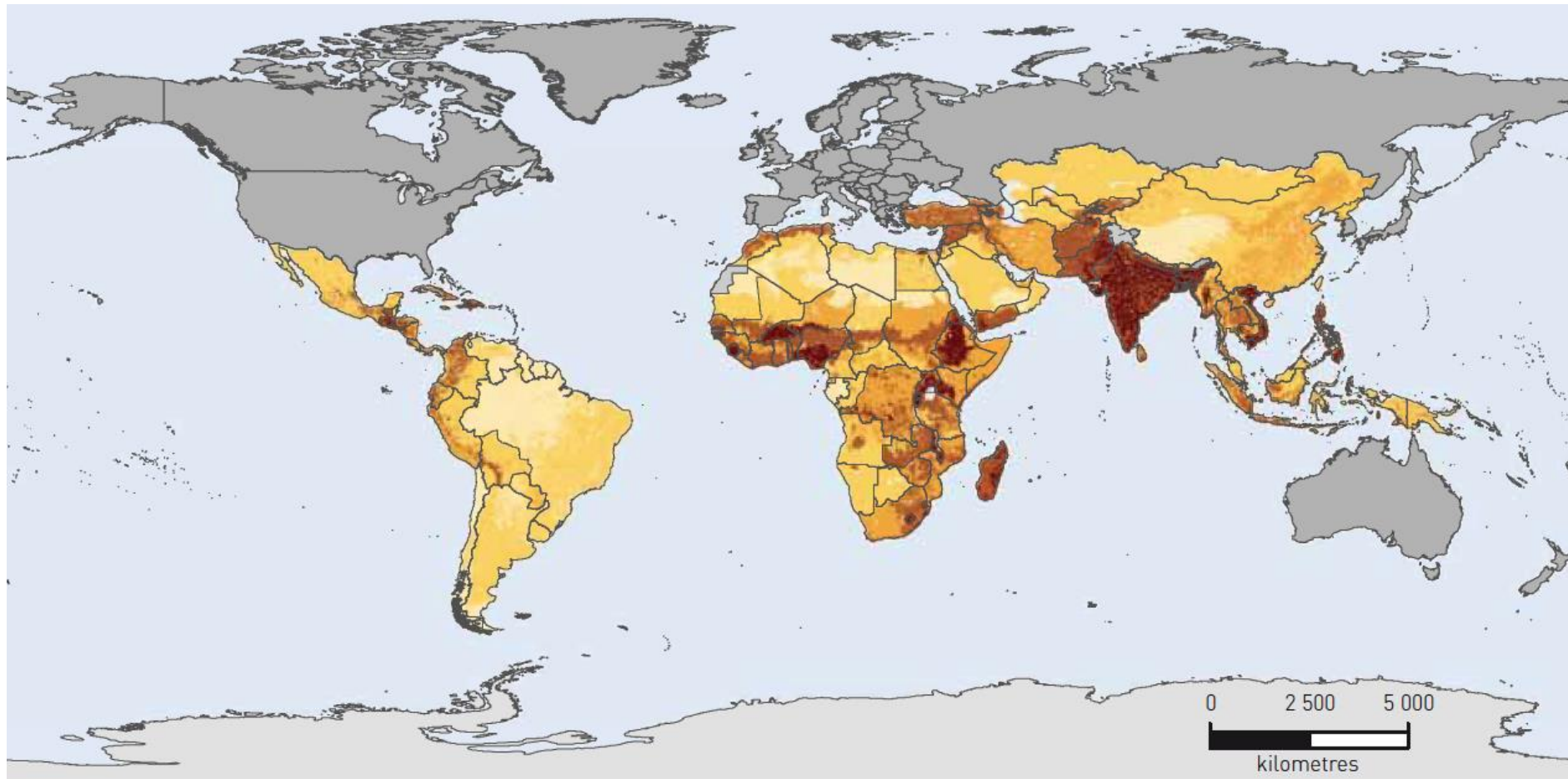


- Value of livestock sector c. \$1.4 trillion
- Account for 40% of agricultural GDP
- Employs 1.3 billion people
- Provides 17% of calories and 26% of protein, globally
- Provides valuable micronutrients to the poor
- Provides livelihoods for 800 million poor small-holders
- Contribute nutrients and traction for mixed farming
- Utilises primary production of no direct value for human consumption
- Serves as a bank, and insurance against hard times (e.g. drought)

Livestock and livelihoods



Livestock and livelihoods



Poor livestock keepers per km²



Poor Livestock Keepers
National, rural poverty lines

Source: Robinson et al. (2011)

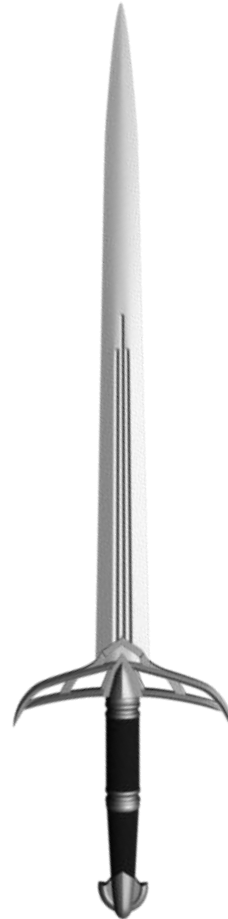
Livestock, health and nutrition



- **Nutrition**
 - Positive: Hunger, malnutrition, stunting, cognitive impairment
 - Negative: Obesity and associated health risks
- **Diseases**
 - Food-borne diseases
 - 39% OIE diseases are zoonotic
 - Aflatoxin poisoning
 - Antimicrobial resistance
- **Poverty**
 - Poor people are less healthy
 - Livestock contribute to livelihoods and resilience
 - Economic losses from endemic diseases of production
- **Climate change**
 - Reduced food security
 - Heat waves, floods and droughts
 - Changing VBD risks

Nutrition: the double-edged sword

- We live in a world more than with 800 million hungry and 165 million stunted children
- Animal-Source Foods provide 17% of calories and 26% of protein
- Animal-Source Foods provide valuable micronutrients to the poor



- Over one third of all adults across the world – 1.46 billion people – are obese or overweight
- Between 1980 and 2008, the numbers of people affected in the developing world more than tripled, from 250 million to 904 million
- Diets are changing with income rises in developing countries, shifting from starch to meat, milk, fats and sugar, fruit and vegetables

Livestock are key to both sides

Nutrition: the double-edged sword

Obesity is one of the top three social burdens generated by human beings



But to what extent is livestock consumption contributing?

- Overeating
- Physical inactivity
- High-fat diets (ASF)
- Diets high in refined carbohydrates
- Sugared soft drinks
- Excessive alcohol consumption

Obesity causes some 5% of global deaths

Diseases related to livestock farming

- More than 2 billion are sickened each year from the food they eat
 - Millions more die from zoonotic diseases that emerge from, or persist in, agricultural ecosystems
 - Diseases recently emerged from animals make up 25% of the infectious disease burden in least developed countries and kill one in ten people who live there
- We have proven agricultural interventions which can tackle the diseases associated with agriculture
- \$25 billion invested in zoonotic disease control would bring benefits worth \$125 billion

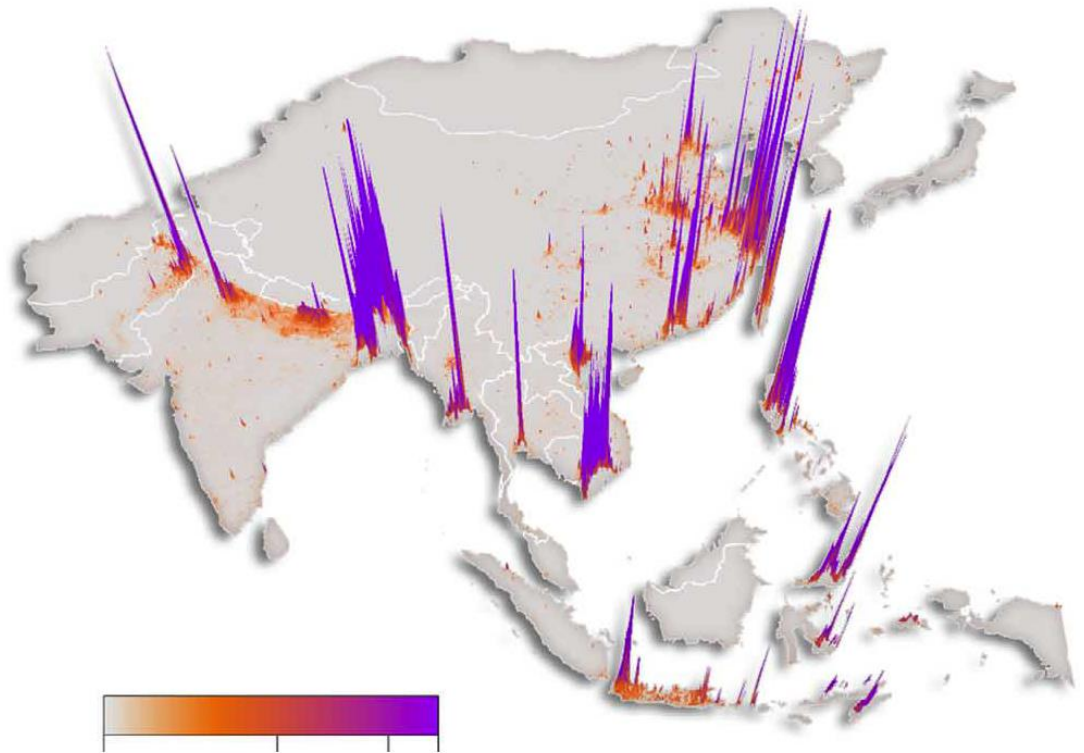


(Source: Grace 2012)

Emerging diseases – Avian Influenza



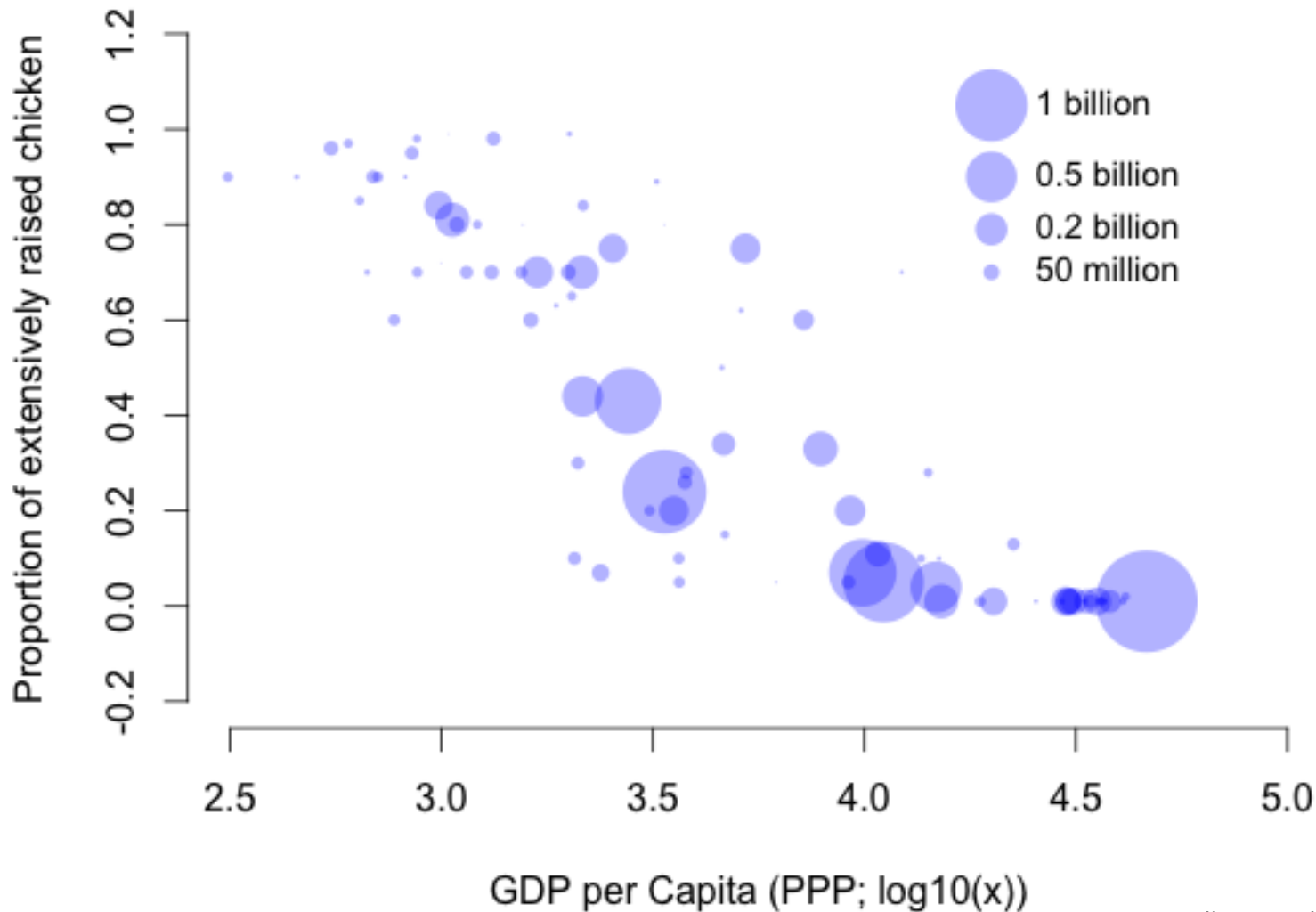
H7N9 risk prediction



Source: Gilbert et al. (2014)

Intensification trajectories

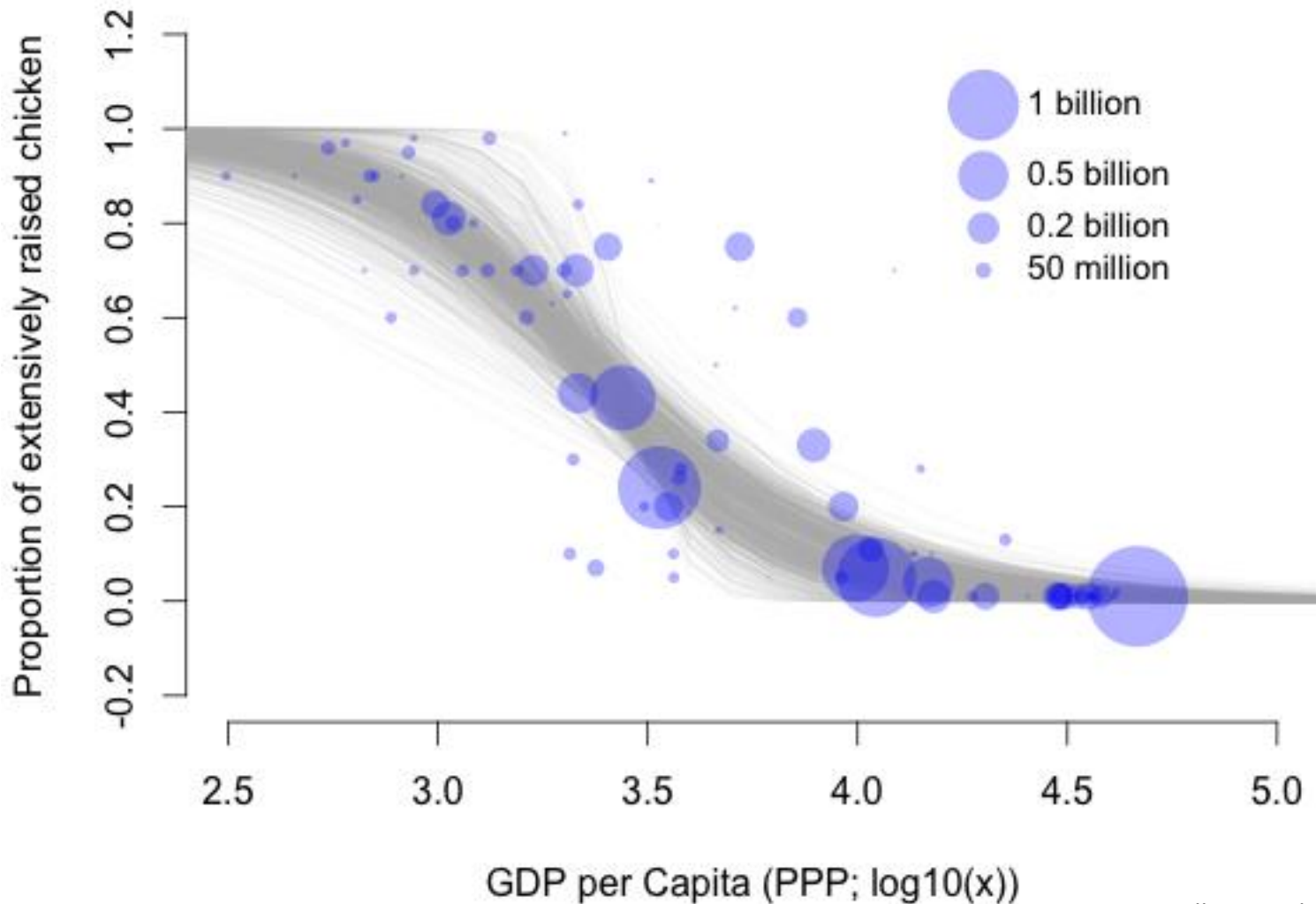
Data mining extensive and intensive chicken production



Source: Gilbert et al. (under review)

Intensification trajectories

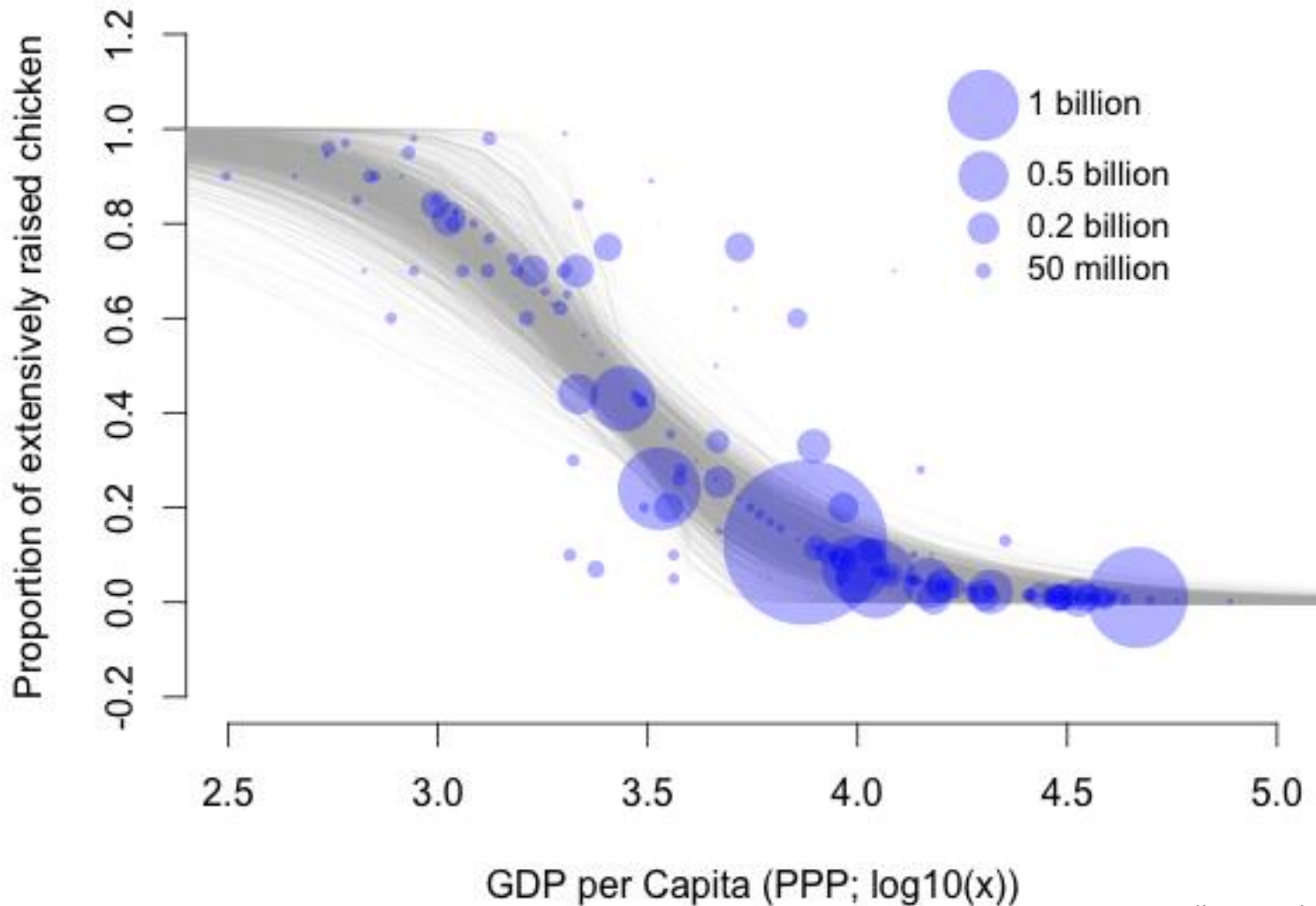
Creating bootstrapped models



Source: Gilbert et al. (under review)

Intensification trajectories

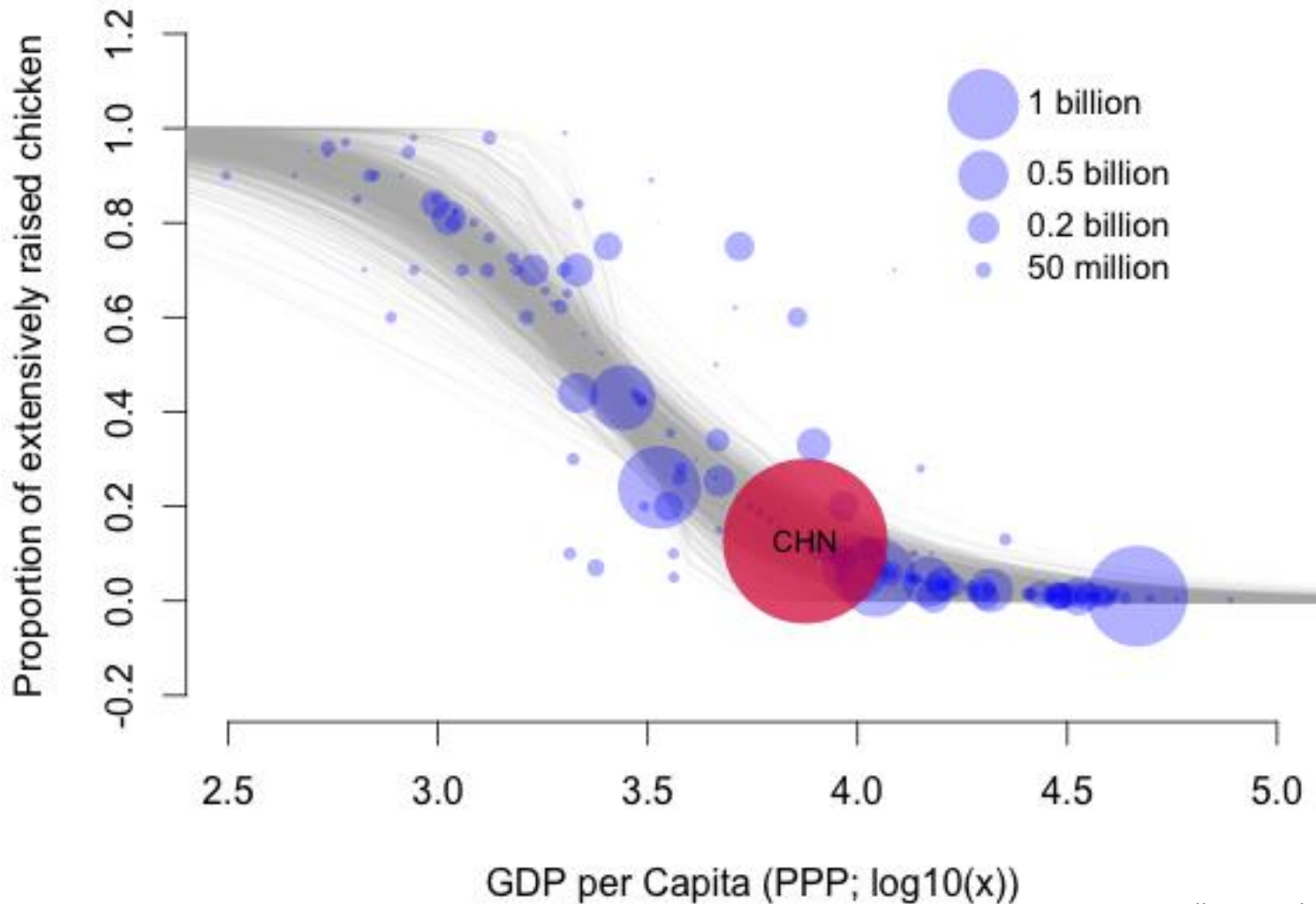
Applying models to all countries



Source: Gilbert et al. (under review)

Intensification trajectories

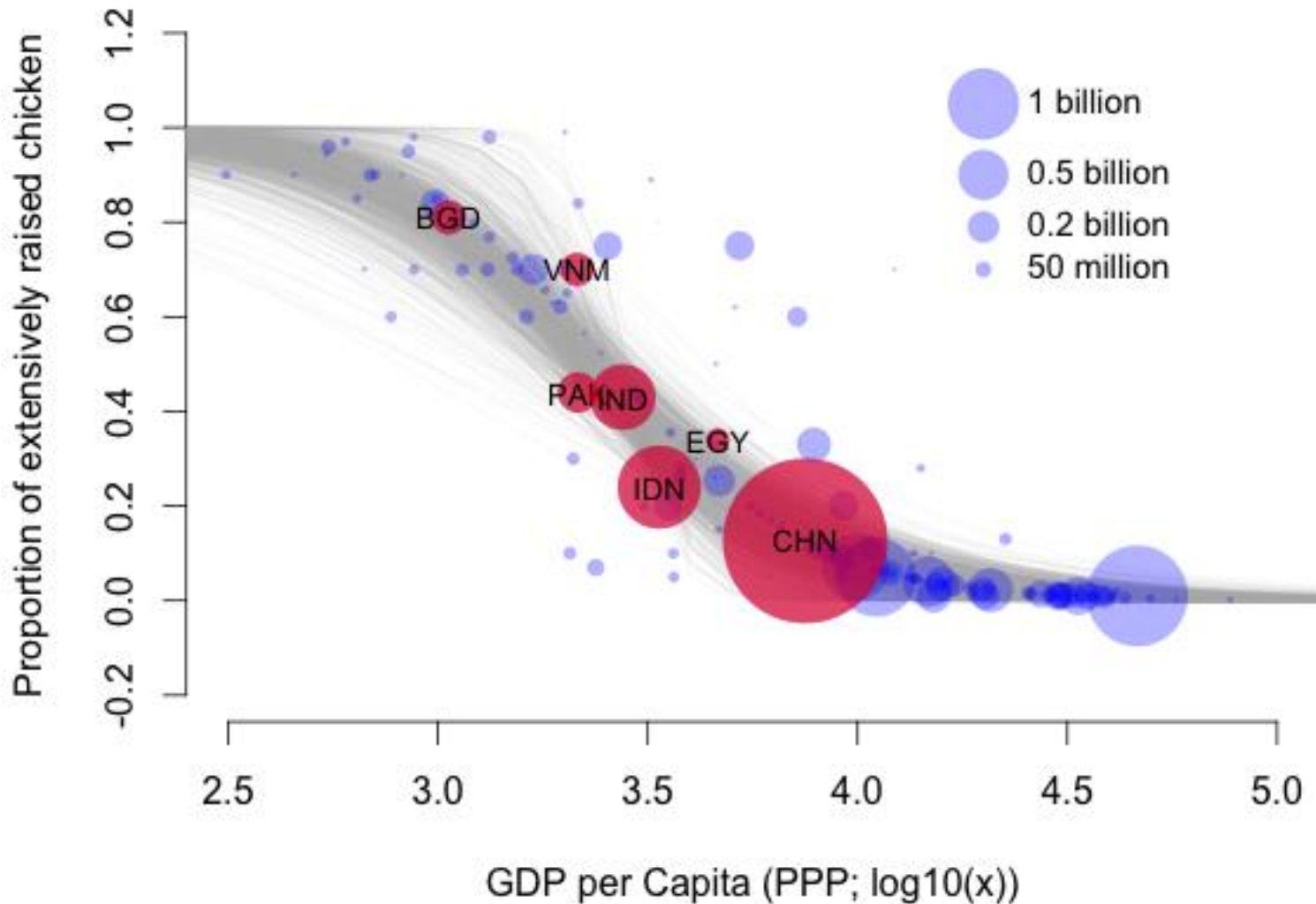
Here is China...



Source: Gilbert et al. (under review)

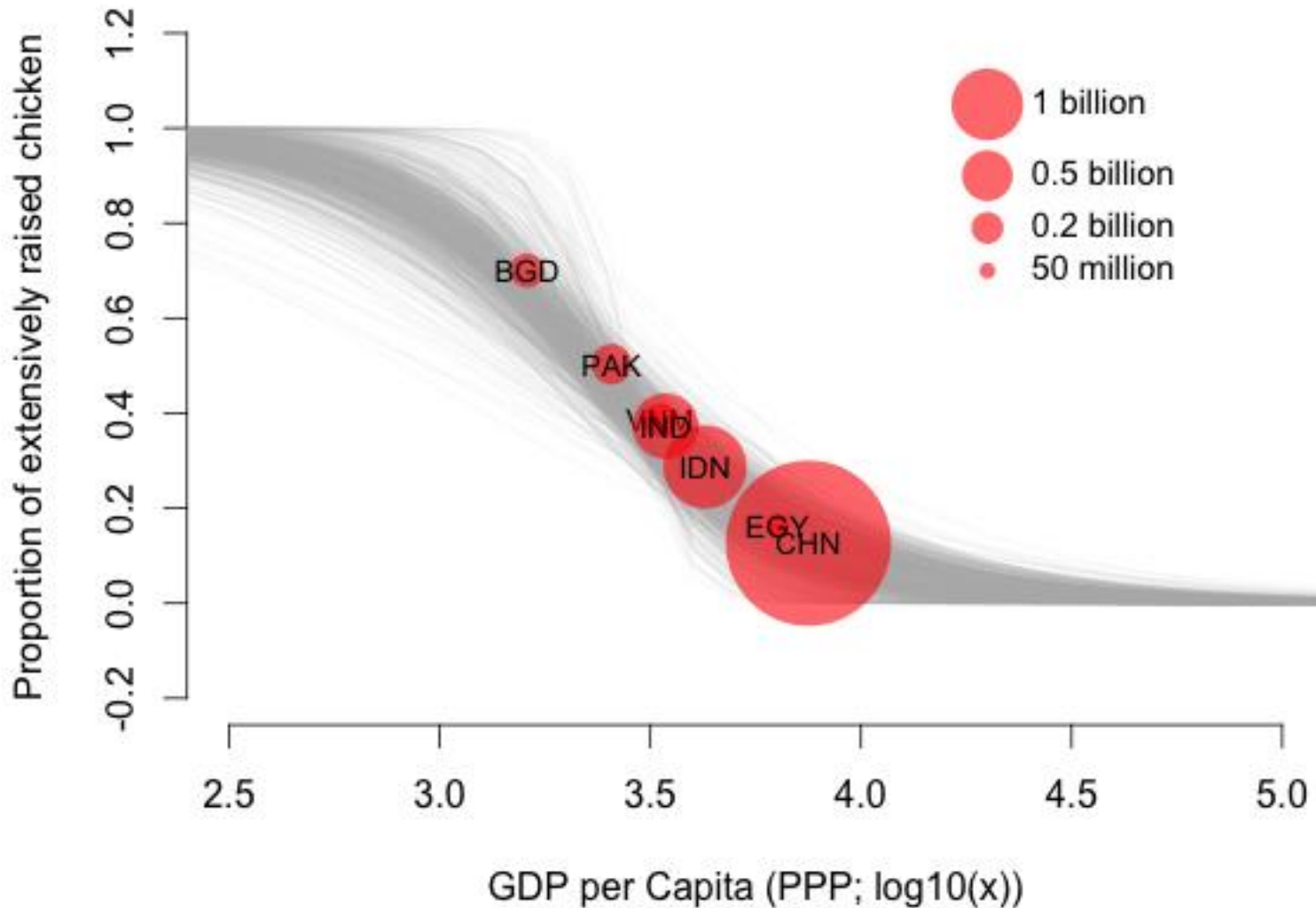
Intensification trajectories

... and several other important countries for AI in humans



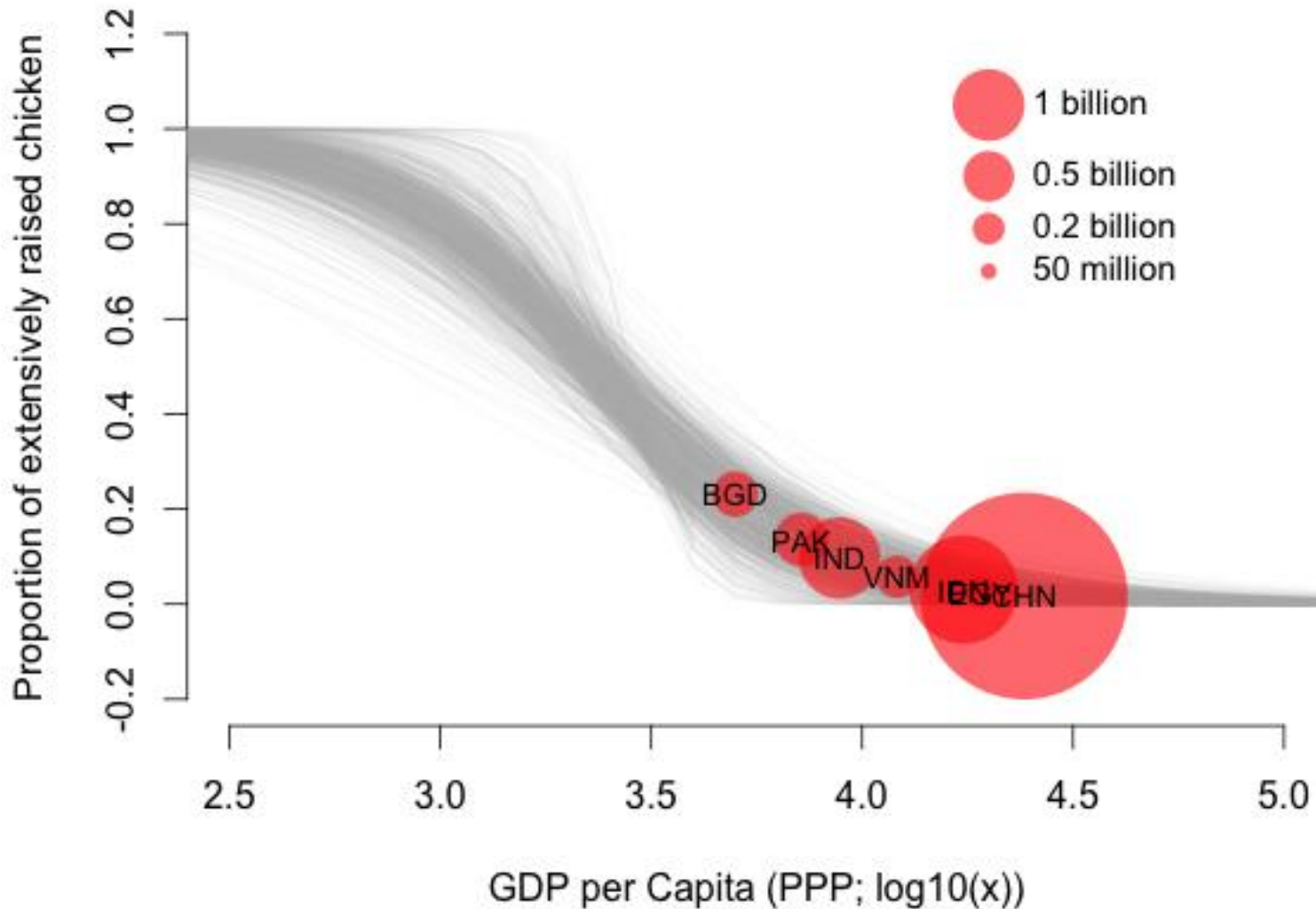
Intensification trajectories

Focus on these countries, standardized to 2010 data



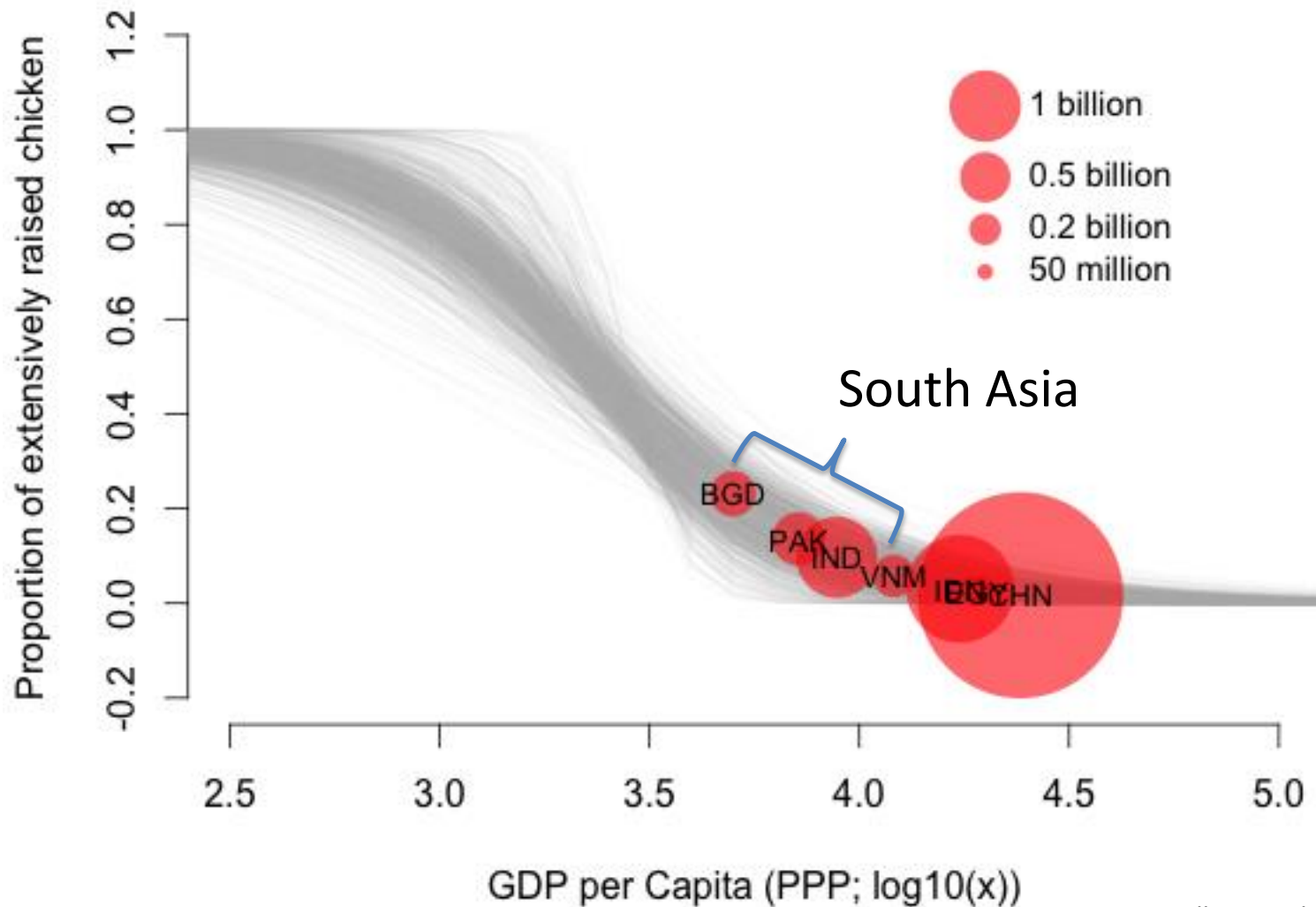
Intensification trajectories

Focus on these countries, standardized to 2030 FAO projections



Intensification trajectories

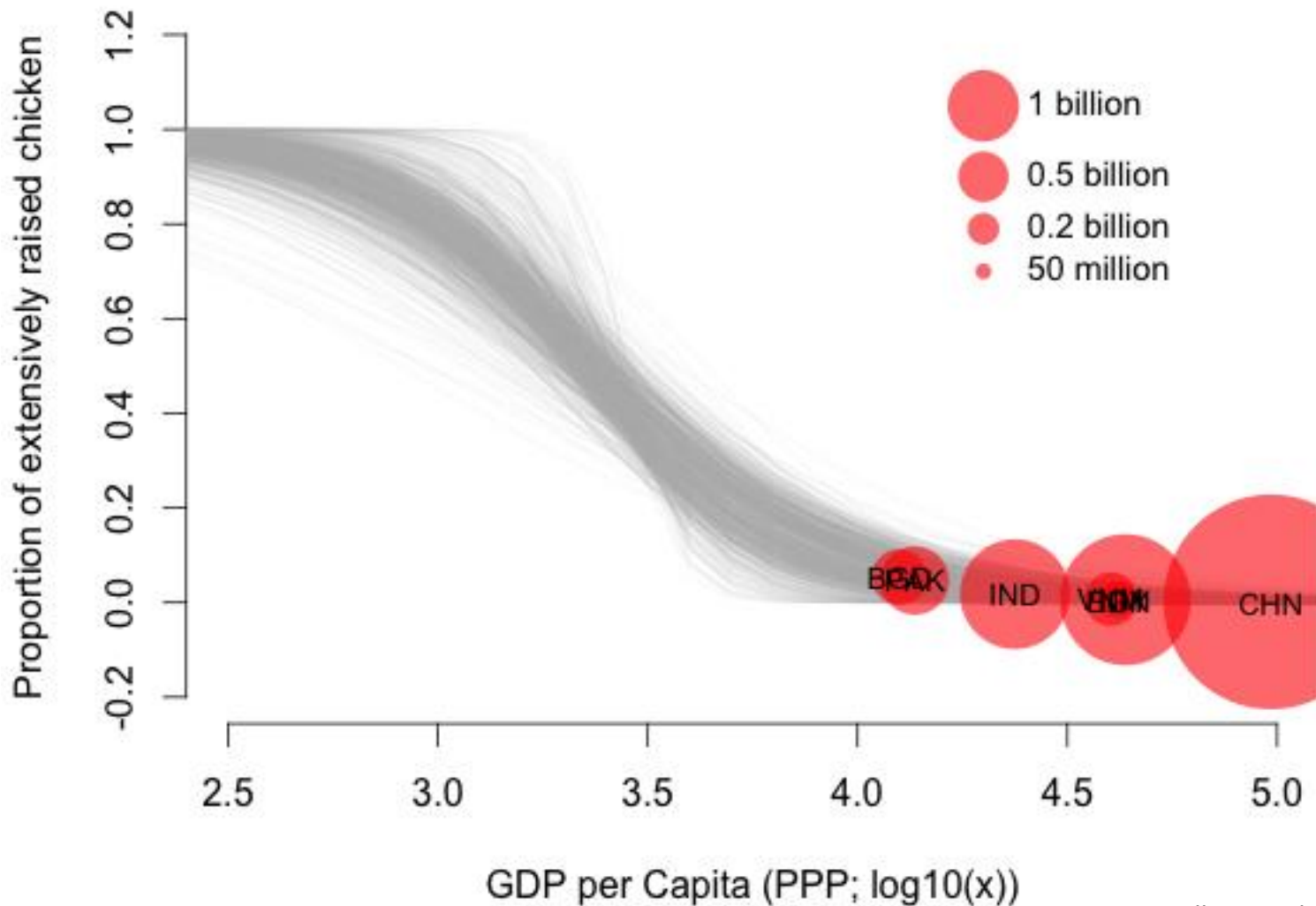
Focus on these countries, standardized to 2030 FAO projections



Source: Gilbert et al. (under review)

Intensification trajectories

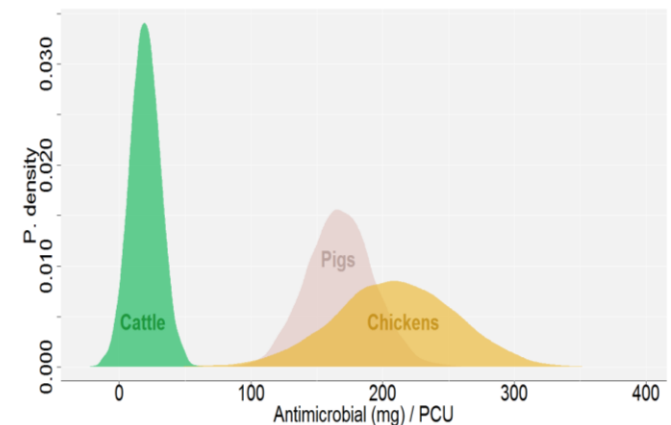
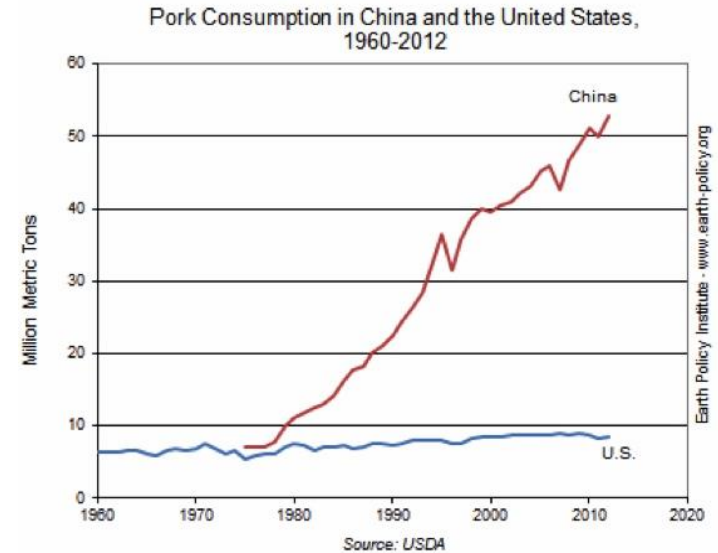
Focus on these countries, standardized to 2050 FAO projections



Source: Gilbert et al. (under review)

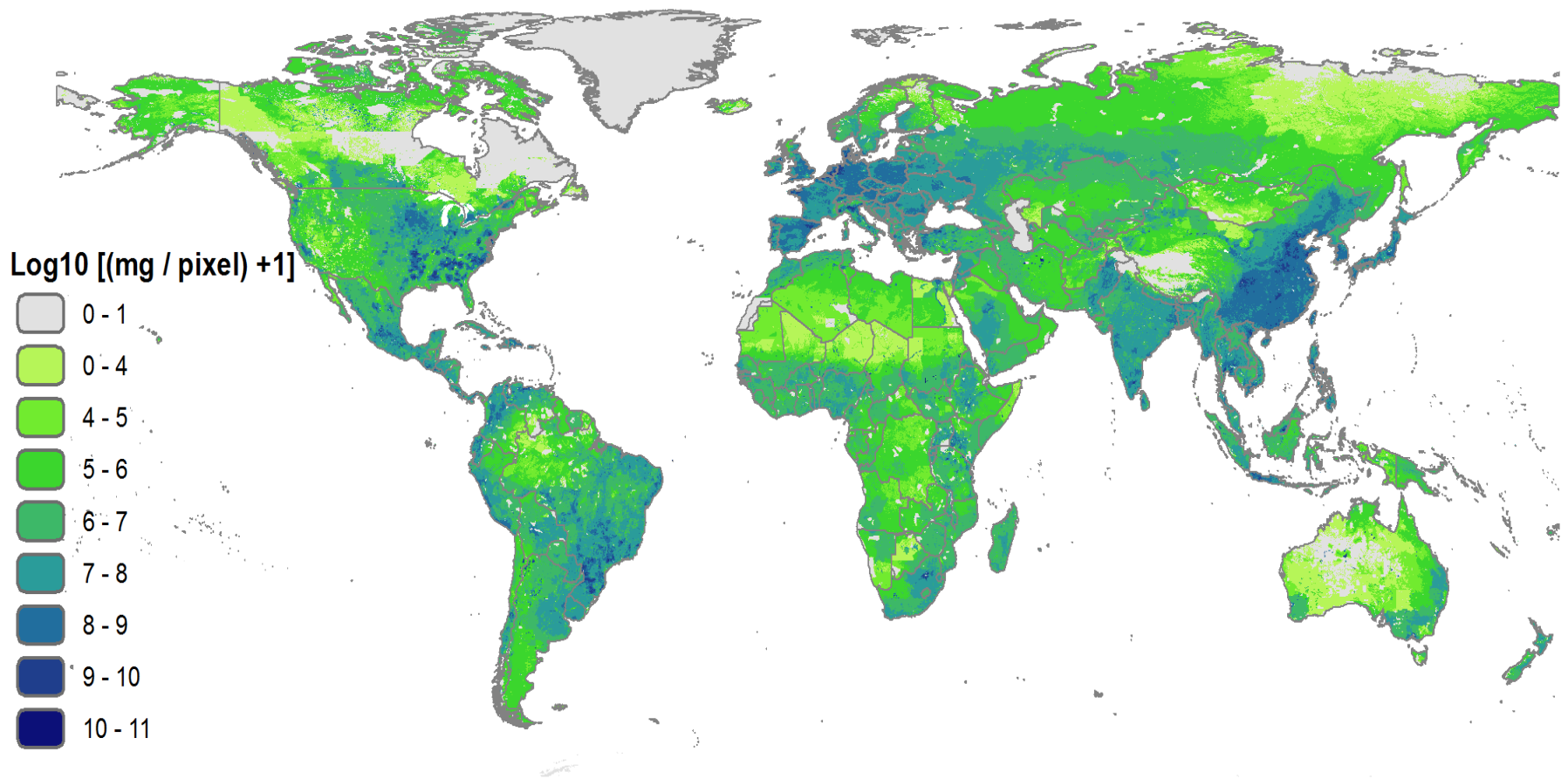
Antimicrobial resistance

- USA: at least 2 million people get drug-resistant infections each year, and at least 23,000 die from them
- USA: 80% of antimicrobial sales are in the agricultural sector
- Total consumption in the livestock sector in 2010 estimated at 63,151 tons
- Global antimicrobial consumption will rise by 67% by 2030
- It will nearly double in BRICS (Brazil, Russia, India, China, and South Africa) countries
- China's livestock industry by itself could soon be consuming almost one third of world's available antibiotics



Antimicrobial resistance

Global antimicrobial use in food animals (mg per 10km pixel)



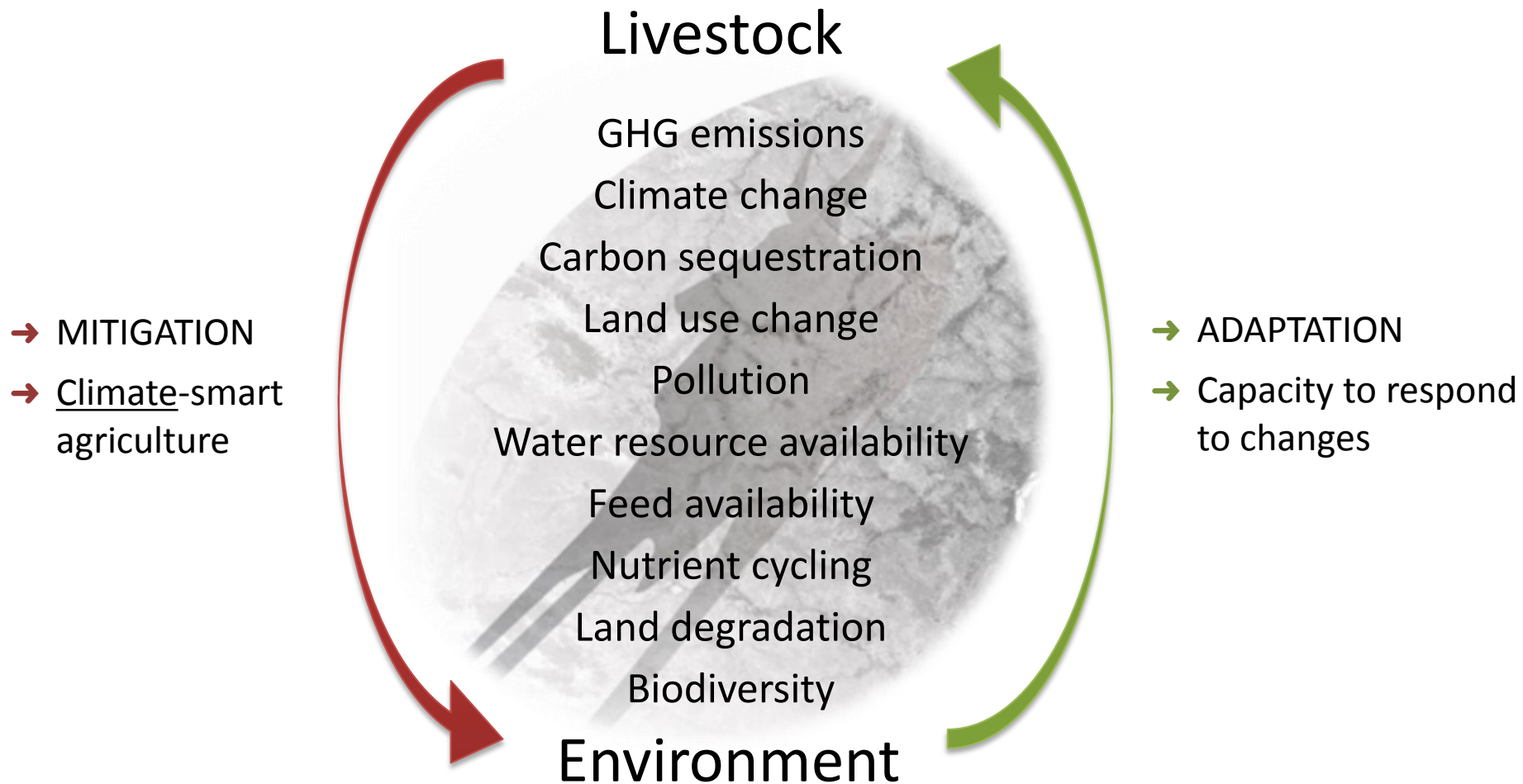
Source: Van Boeckel et al. 2015

Antimicrobial resistance

- The European Union banned the use of antibiotics to boost animals' growth in 2006
 - There is a 'voluntary' ban in the USA
 - Chick-fil-A, McDonalds and Costco stopping antimicrobial use in the production chain
-
- ➔ Concerted action – multi-stakeholder platforms
 - ➔ Strengthen the evidence base linking agricultural use to AMR in the medical sector
 - ➔ Appropriate approaches in different settings – poor countries may not have the 'resilience' or 'capacity' of Europe in withstanding a blanket ban, for example

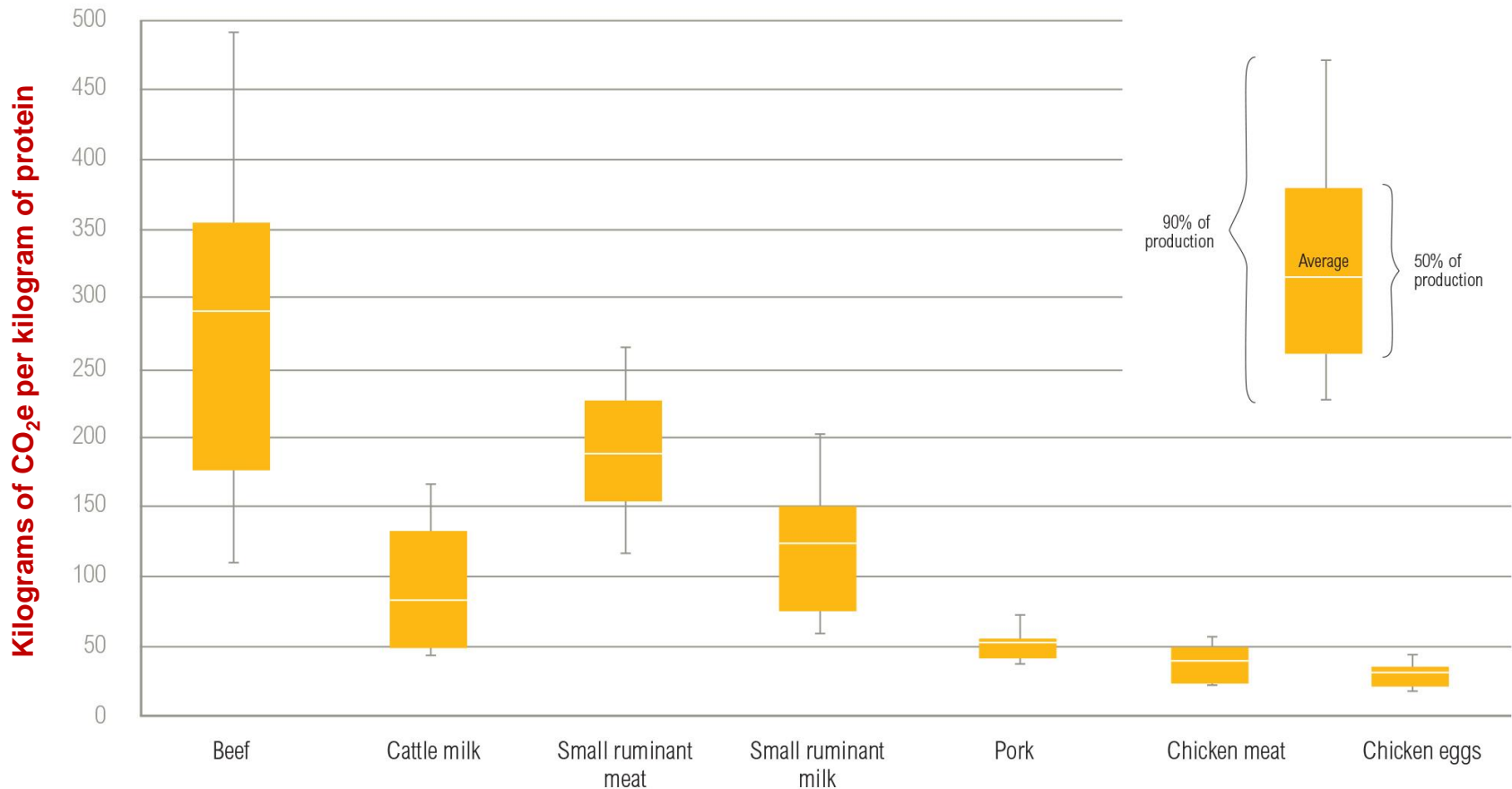


Livestock and the environment



Contribution to climate change

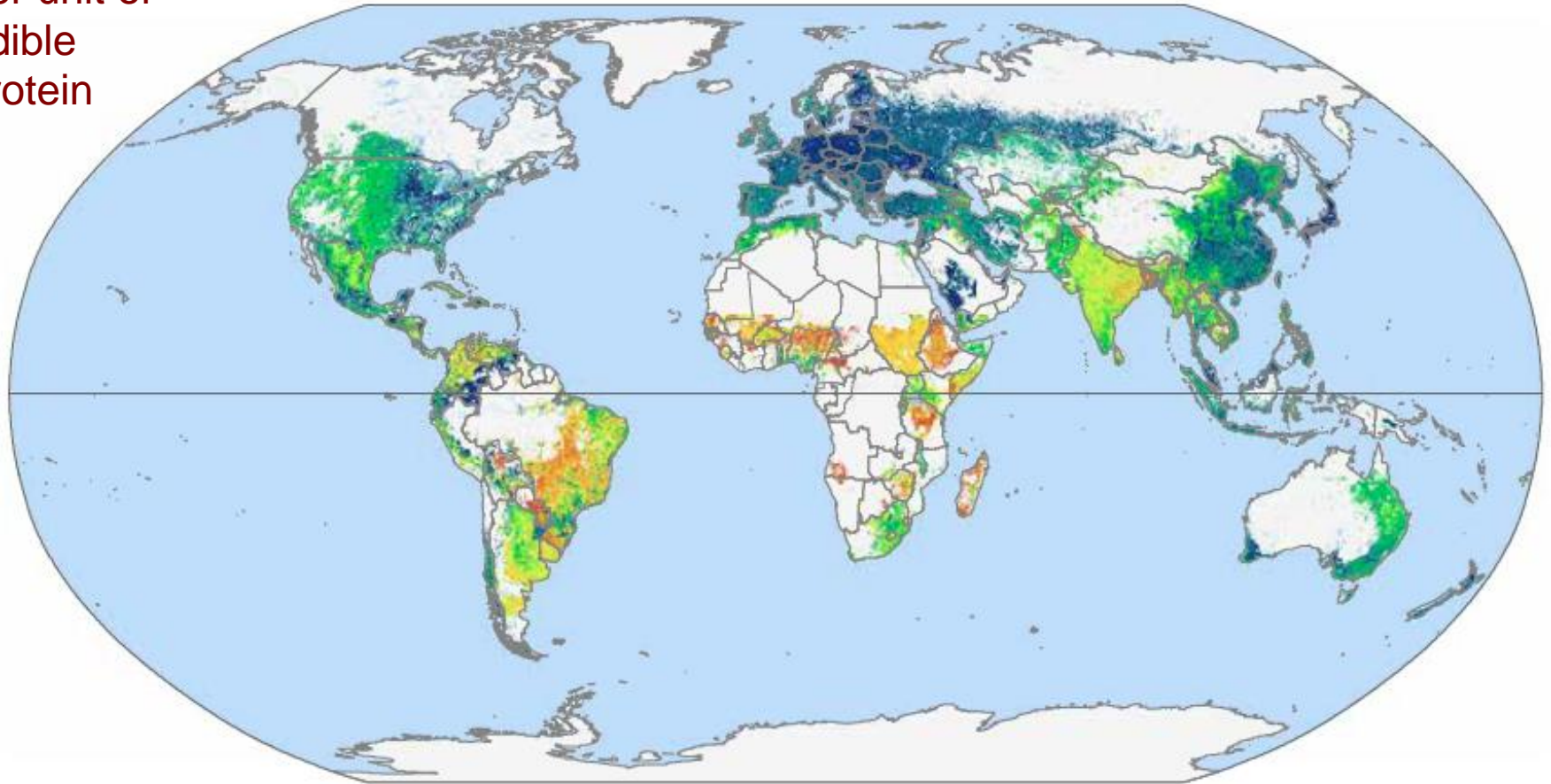
- 14.5% of all anthropogenic GHG emissions
- Beef production generates 6 times more GHG emissions per unit of protein than pork, chicken and eggs



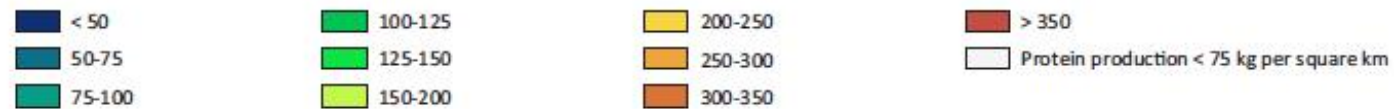
Source: Gerber et al. (2013)

Livestock emissions

per unit of
edible
protein



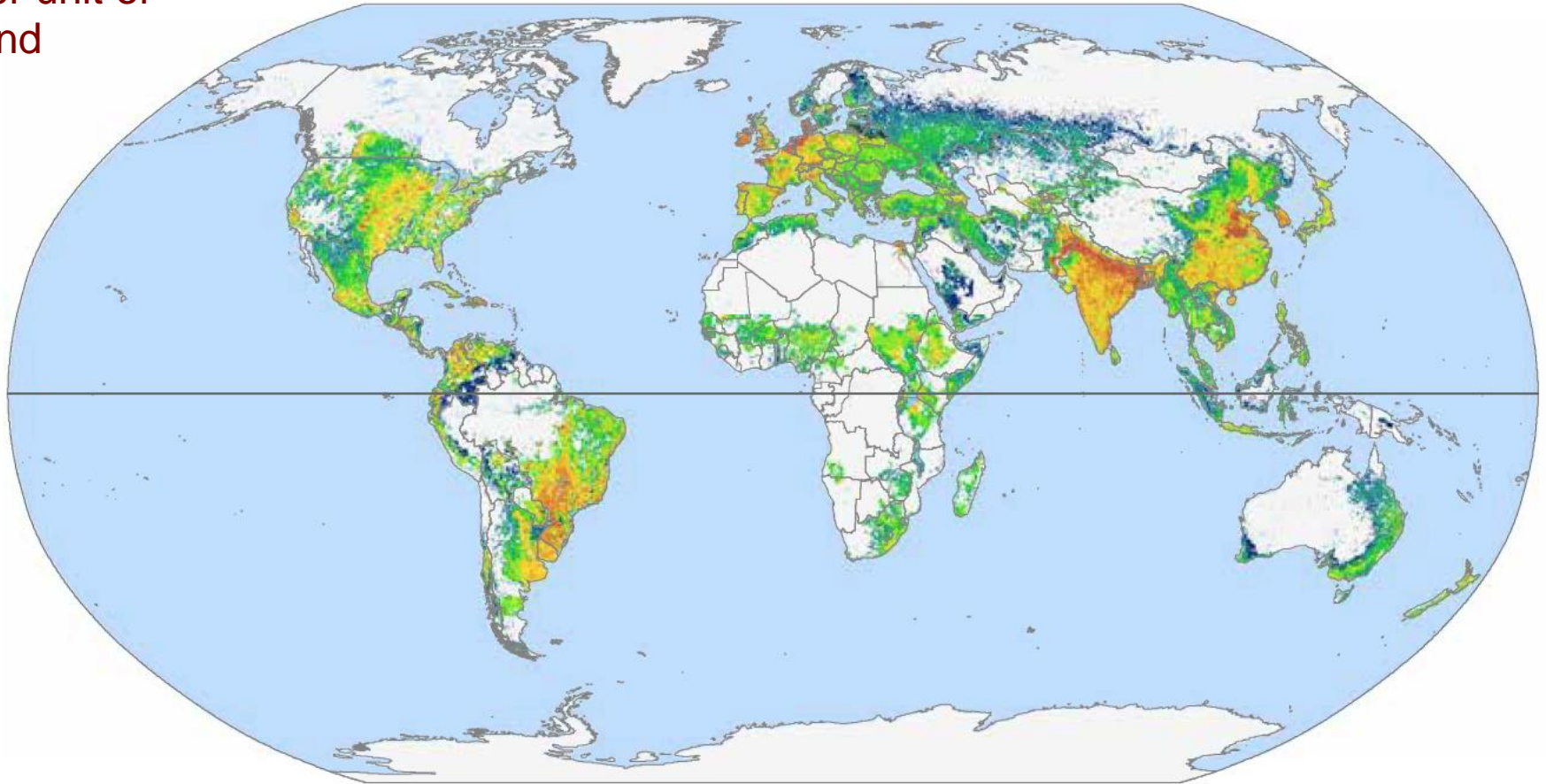
Kg of CO₂ equivalent per kg of edible protein



Source: Gerber et al. 2013

Livestock emissions

per unit of
land



Tonnes of CO₂ equivalent per square km

< 10

25 - 50

100 - 250

> 500

10 - 25

50 - 100

250 - 500

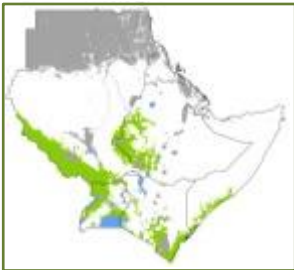
Protein production < 75 kg per square km

Bringing it all together

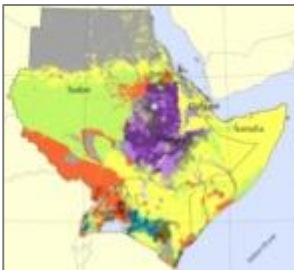
Cattle density



Tsetse distribution



Production systems



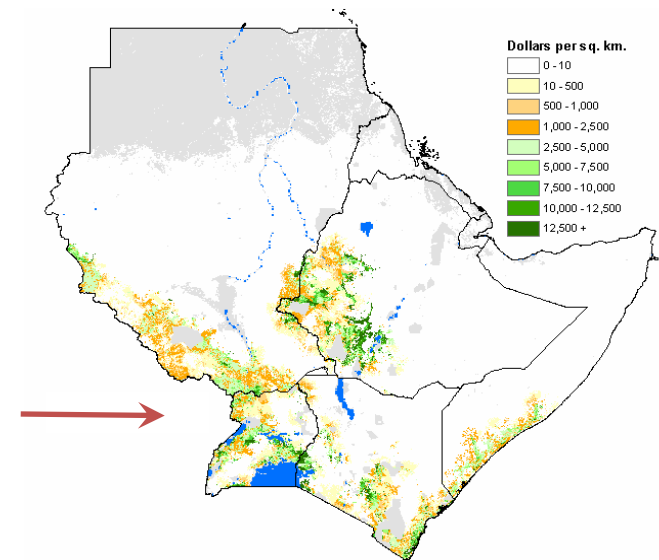
Herd model

Burden of disease
Herd growth and spread
Value of production

Economic benefits per animal (US\$)

Cattle production system	Pastoral	Agro-pastoral	Mixed farming (general)	Mixed farming (Ethiopia)
Low oxen	63	82	90	102
Medium oxen	–	98	122	135
High oxen	–	118	152	161
High dairy	–	142	148	–

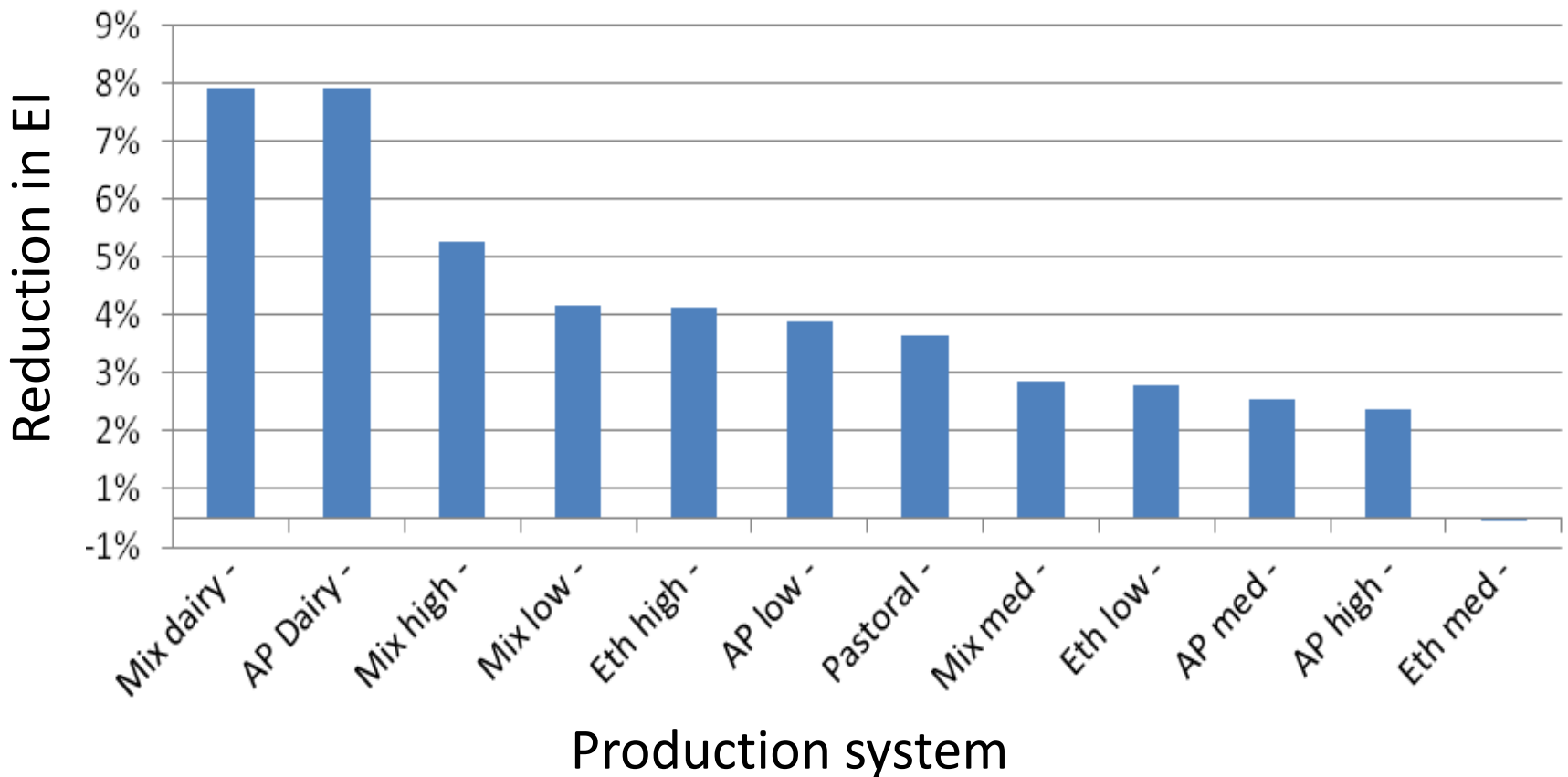
Economic benefits over 20 years of trypanosomosis removal



Source : Shaw et al. (2014)

Results

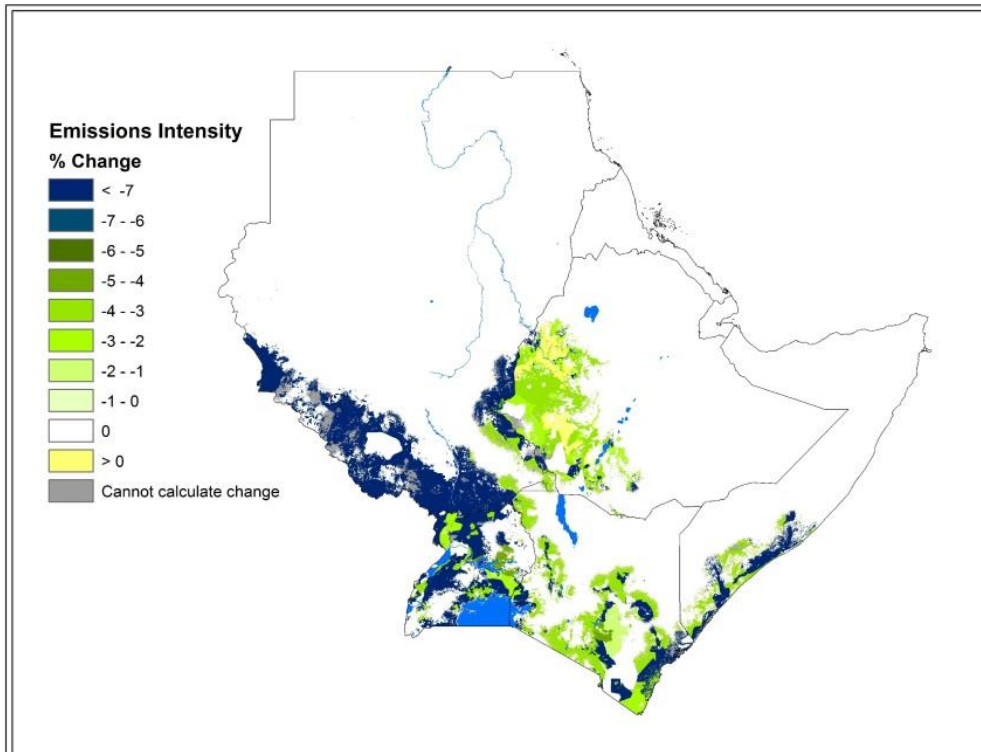
Decrease in emissions intensity arising from trypanosomosis removal



Source: MacLeod et al. (submitted)

Results

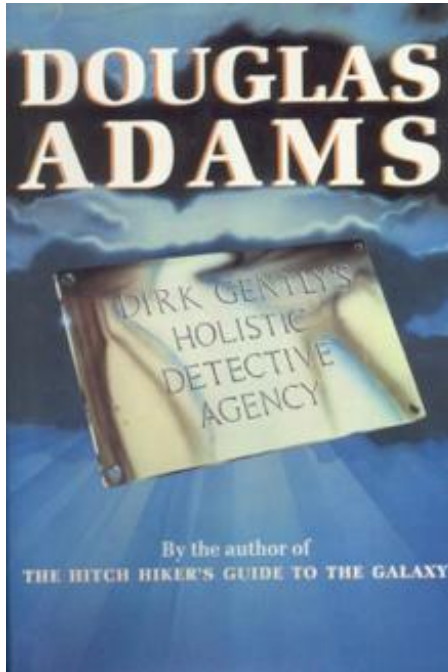
% change in emissions intensity



- Removal of trypanosomosis leads to significant increases in production and emissions across all the systems
- Production increases by more than emissions so EI decreases
- The biggest decrease in EI is in the high yield dairy systems
- Demonstrates a clear link between improving productivity and decreasing EI

In conclusion

'The fundamental interconnectedness of all things'



- Rapid demand growth for Animal Source Foods – particularly in developing and emerging economies
- The response of the livestock sector to this growth has major implications for global, interconnected, public goods
- This calls for integrated solutions to guide sector development along a sustainable pathway
- These are global issues and require global responses

Thank You !

