

# ILRI Food Safety and Zoonoses India and Bihar

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# Why food safety and zoonoses?

1. Everyone needs to eat and wants to be healthy
2. Food-borne disease is common, costly and preventable
3. A new disease emerges every 4 months,  $\frac{3}{4}$  are zoonotic

# What do we work on?

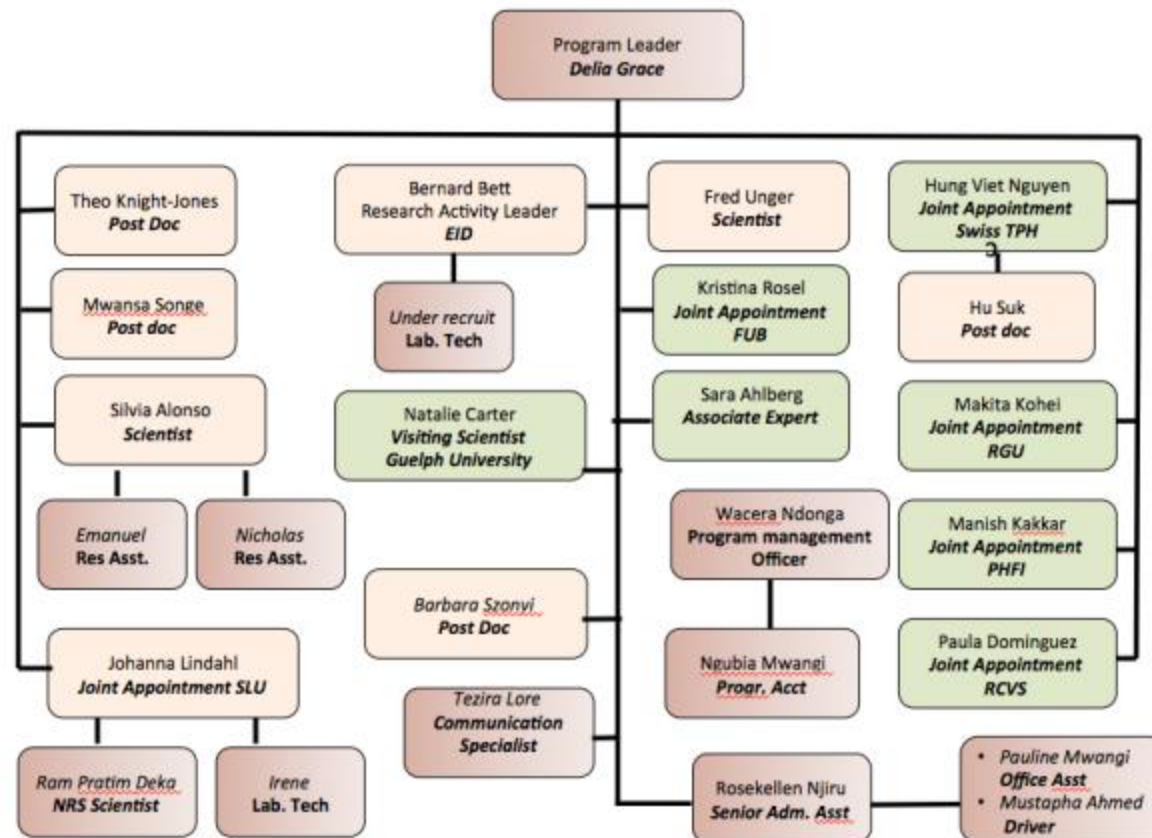
- Which livestock agendas are important in this program?
  - Safe food
  - Zoonotic diseases
  - Emerging infectious diseases
  - Animal health
  - Intensification and disease
    - Climate change and disease
    - Gender and health
    - Food safety and nutrition

# FSZ program geography

- East Africa, West Africa, Southern Africa, South Asia, Southeast Asia
- Kenya, Ethiopia, Tanzania, Uganda, Senegal, Zambia, Nigeria, Ghana, Mozambique, Cote d'Ivoire, Rwanda, Malawi
- Vietnam, Laos, Thailand, China, Indonesia, Cambodia
- India, Bangladesh
- Egypt

71% “out-posted”  
 53% female  
 33% developing country  
 25% Asian

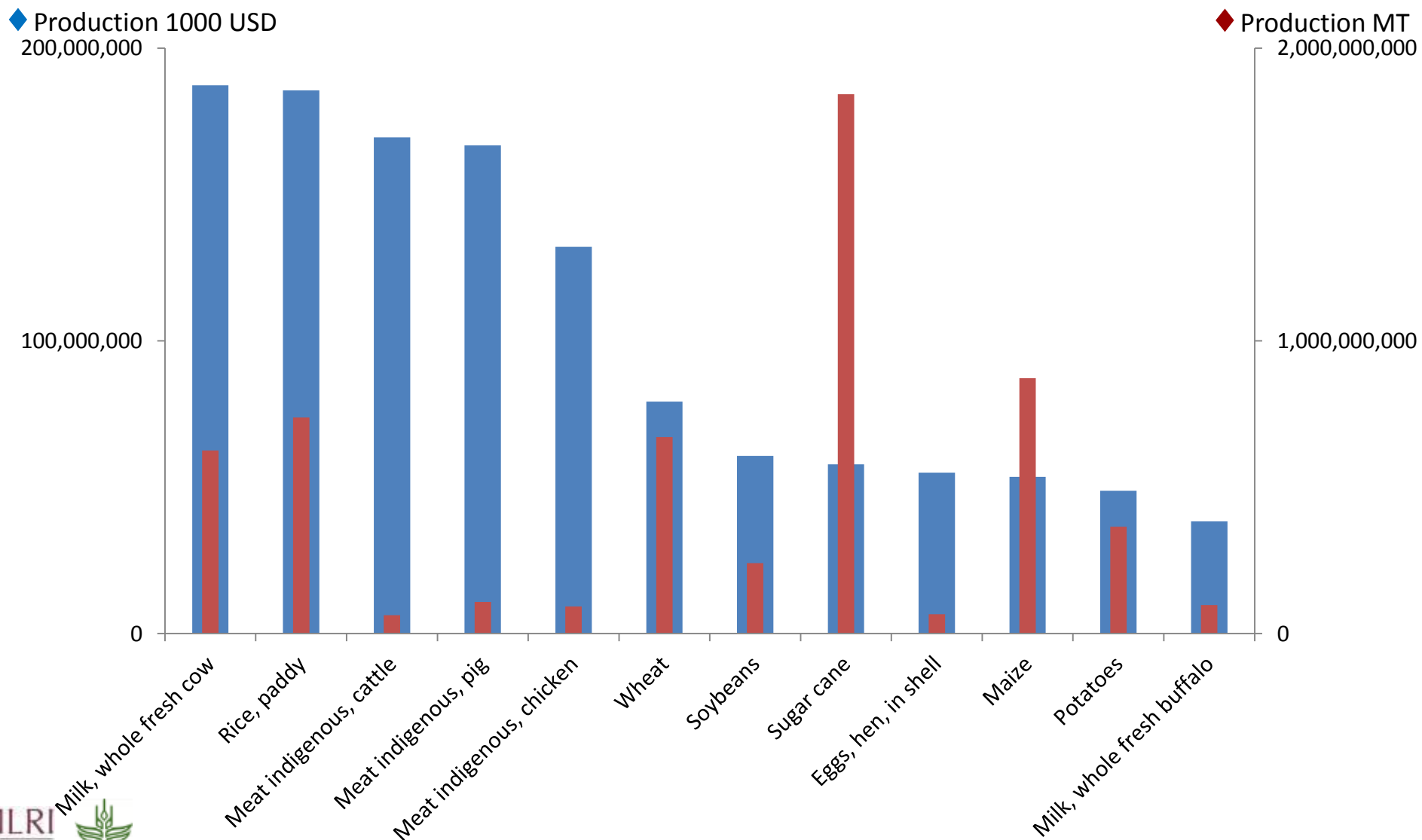
1 human nutritionist  
 1 food technologist  
 1 biologist  
 1 animal scientist  
 1 medical epidemiologist  
 12 veterinary epidemiologists  
 81 graduate fellows (54% f)



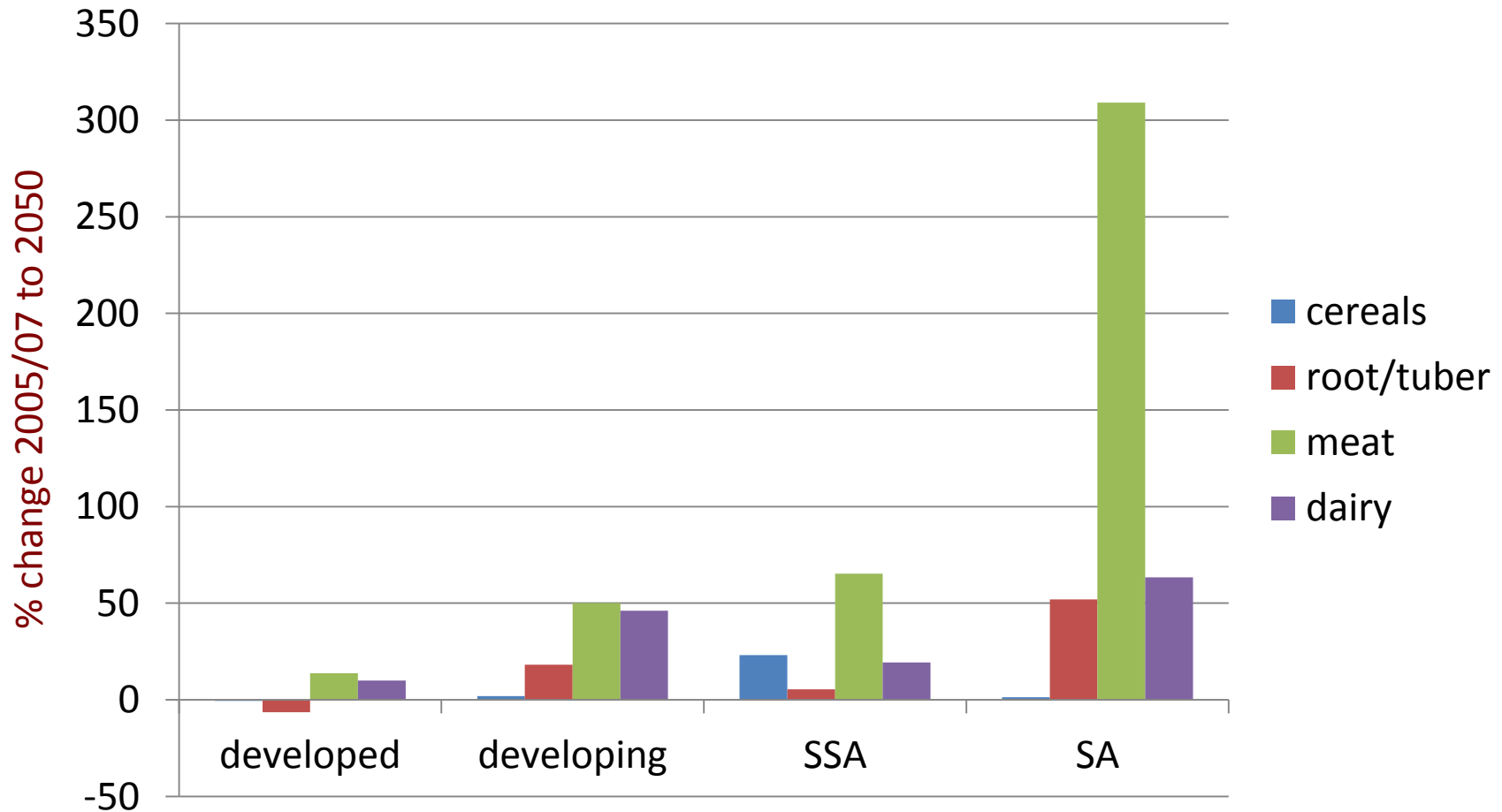
# What we know

1. Most food is sold in informal markets
2. Most health burden is due to biological hazards; chemical hazards and mycotoxins cause concern but there is less evidence for large health burdens
3. Most risky foods are un-boiled dairy products, vegetables grown in contaminated water or cross-contaminated from meat, and under-cooked meat
4. GAP for farmers successful at small-scale and for export; large-scale but domestic GAP less successful (Farmer Field Schools)
5. Training and certification of vendors successful at small-scale and some success at scale in Kenya and Assam

# FAO statistics 2012



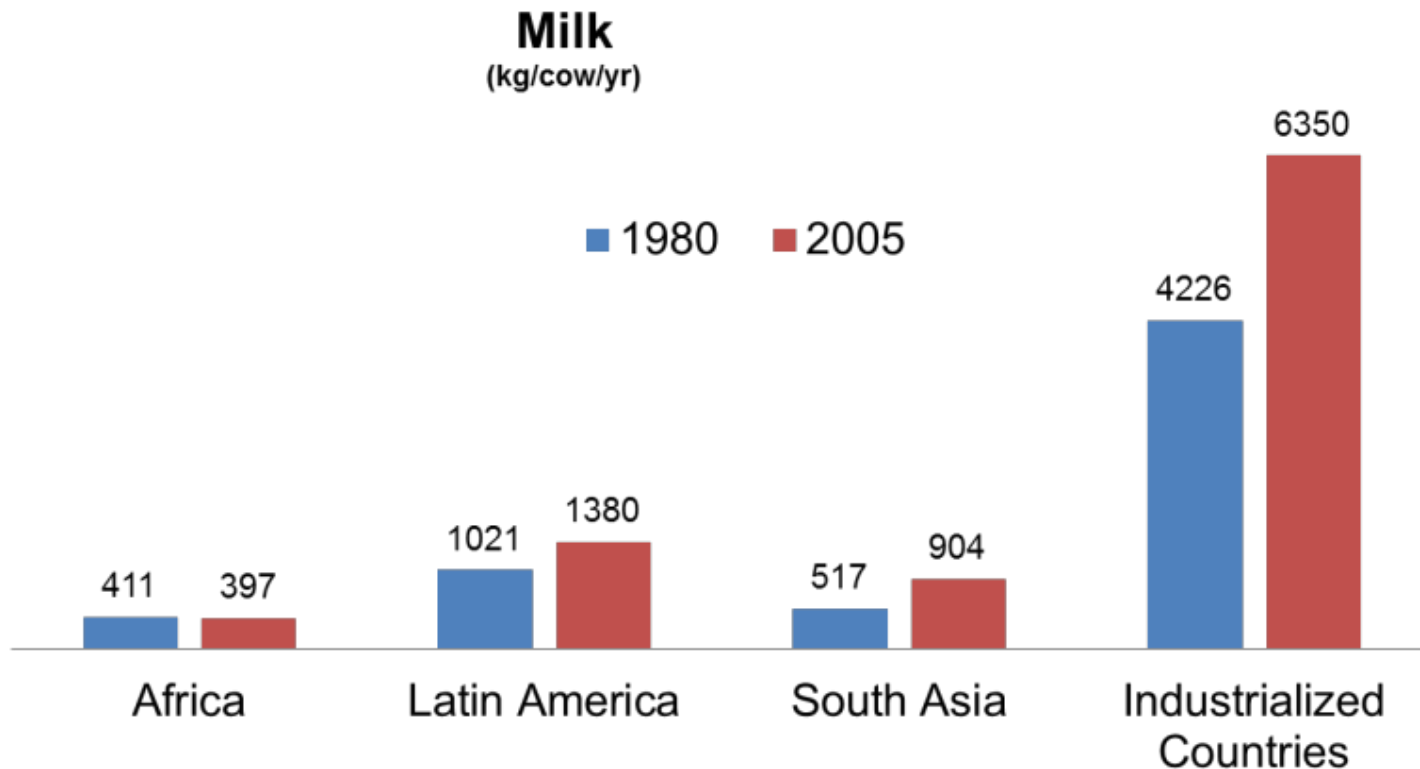
# Change in global and regional demand for food: Livestock and other commodities





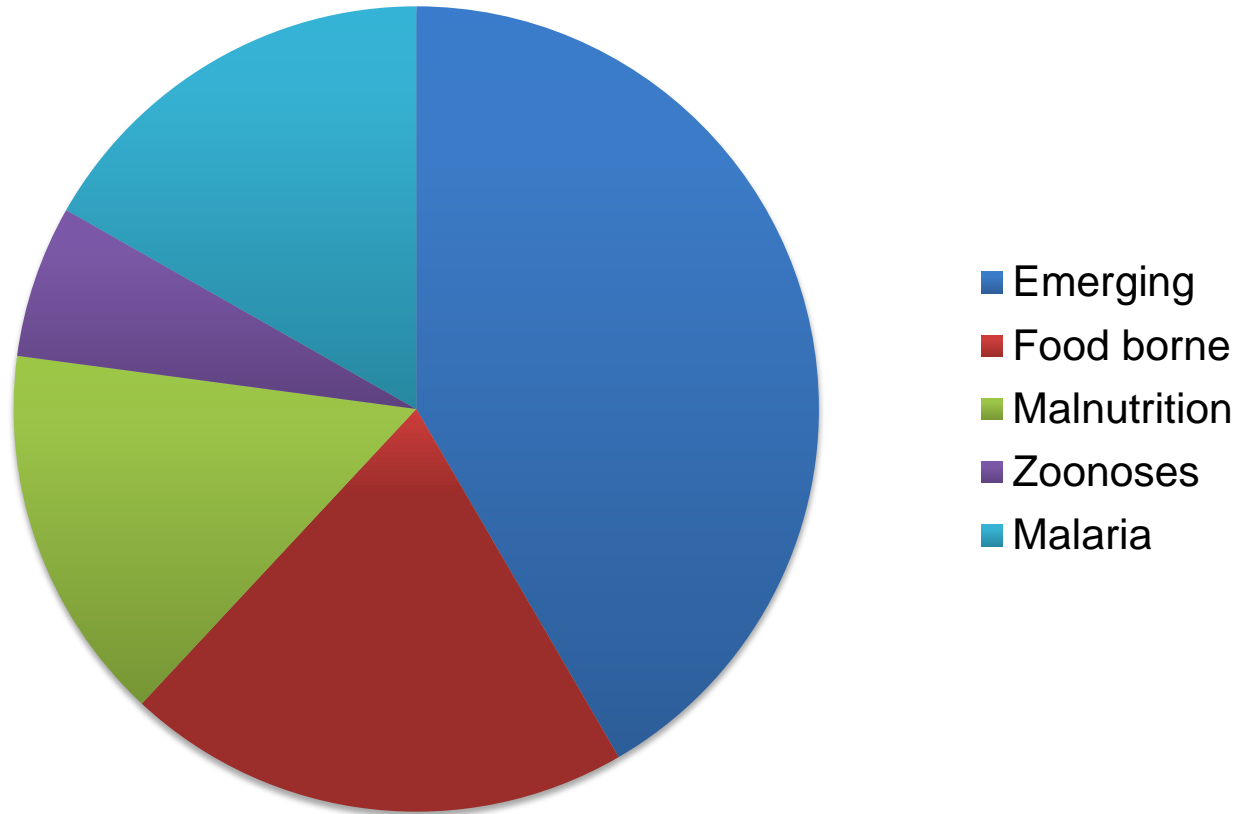
# Big productivity gaps -largely due to poor animal health

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



*Steinfeld et al. (2006)*

# Agriculture imposes large burdens on human health



**Three million deaths** a year are agriculture associated  
One quarter of all deaths from infection are agriculture associated  
Almost all of these occur in developing countries

# Agriculture imposes large burdens on human health

## Zoonoses and FBD kill 2.2 million a year

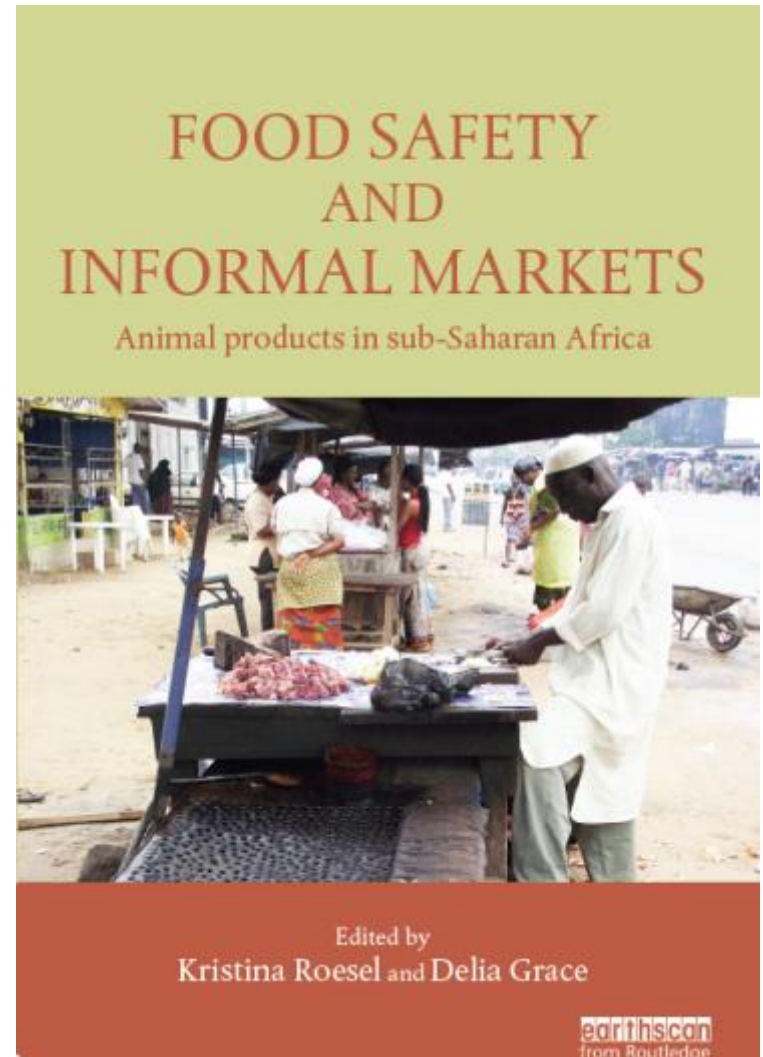
- 2.4 billion people sick
- 2.2 million people dead
- more than 1 in 7 animals affected

## Zoonoses & FBD cost \$84 billion a year

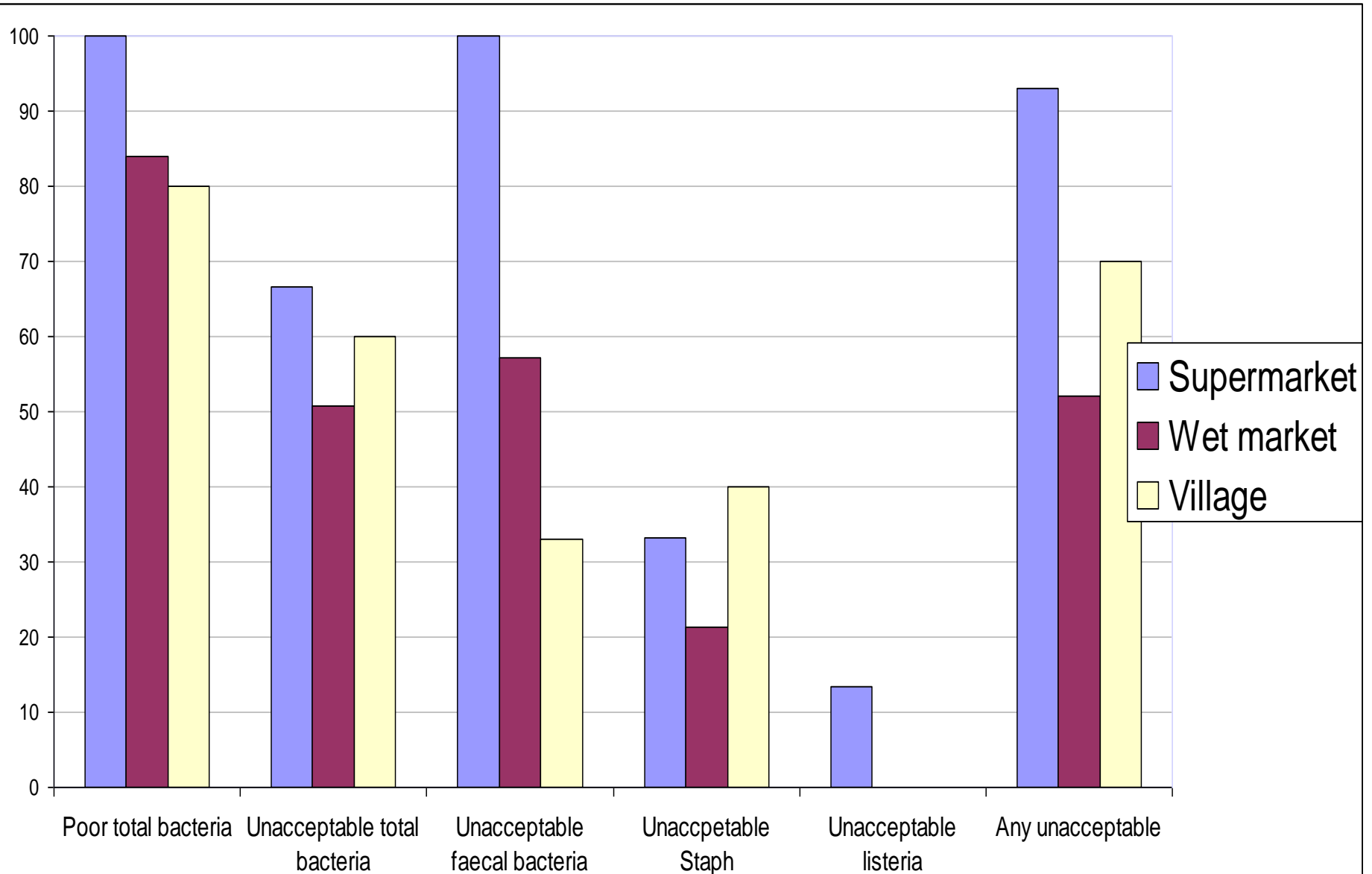
- \$9 billion in lost productivity
- \$25 billion in animal mortality
- \$50 billion in human health costs

# Evidence for food safety

- 90% of animal products are produced and consumed in the same country or region
- 500 million smallholders produce 80% of food in poor countries. 43% of the workforce are women



# Compliance : Formal often worse than informal



# Food-borne diseases

- Food-borne diseases are very important
- 1.4 million children die every year of diarrhoea
- The majority is food and water-associated
- Animal-source food over-represented as a cause



# Risks and benefits with dairy

## Pathogens from the cow and from the milk

- *Mycobacterium bovis*
- *Brucella* spp.
- *Bacillus anthracis*
- *Salmonella*
- EHEC
- *Streptococcus* spp.
- *Staphylococcus aureus*
- *Clostridium* spp.
- *Listeria* spp.



# Risks and benefits associated with dairy: What else is in the milk?

- Antibiotic residues
  - Frequently detected
- Pesticides
  - High percentage of milk samples
- Mycotoxins (aflatoxins)
  - Detected in many milk samples, sometimes high levels



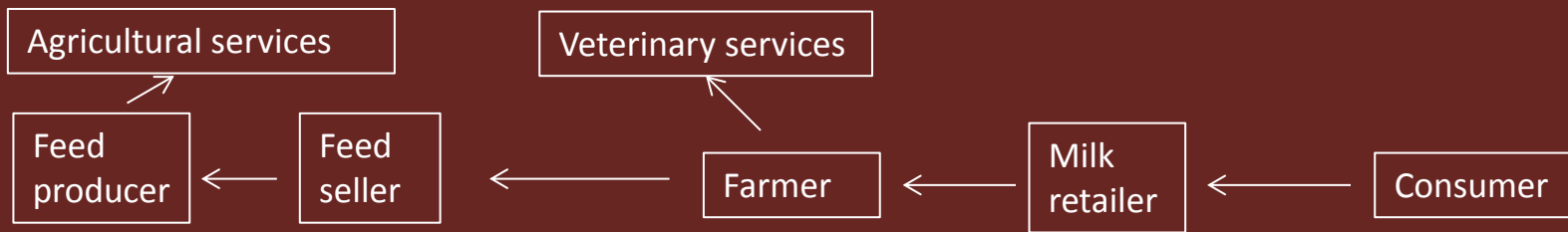


# Aflatoxins- Food safety outside the ASFs

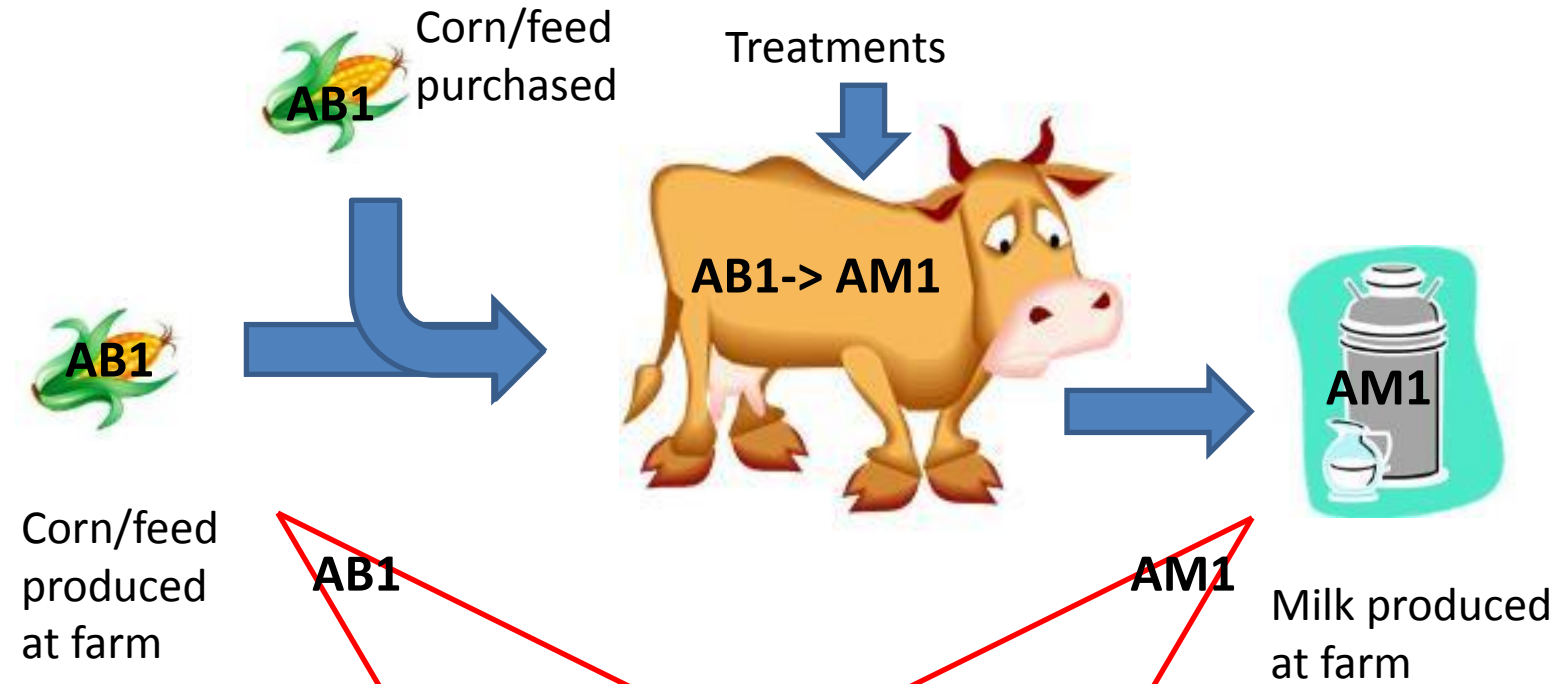
- Acute outbreaks can claim 100s of lives (Kenya outbreak 2004-05, 150 known fatal cases)
- 4.5 billion people chronically exposed (estimate by US CDC)
  - Cancer
  - Immunosuppression
  - Stunting



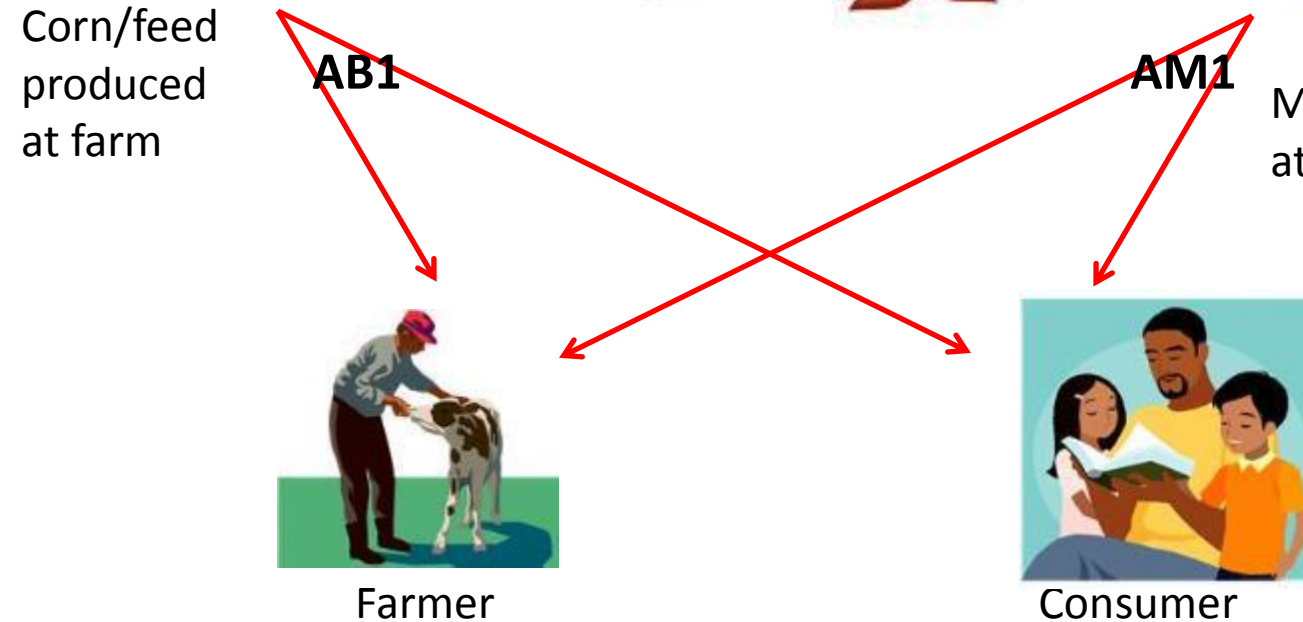
Economic flow



Aflatoxin flow



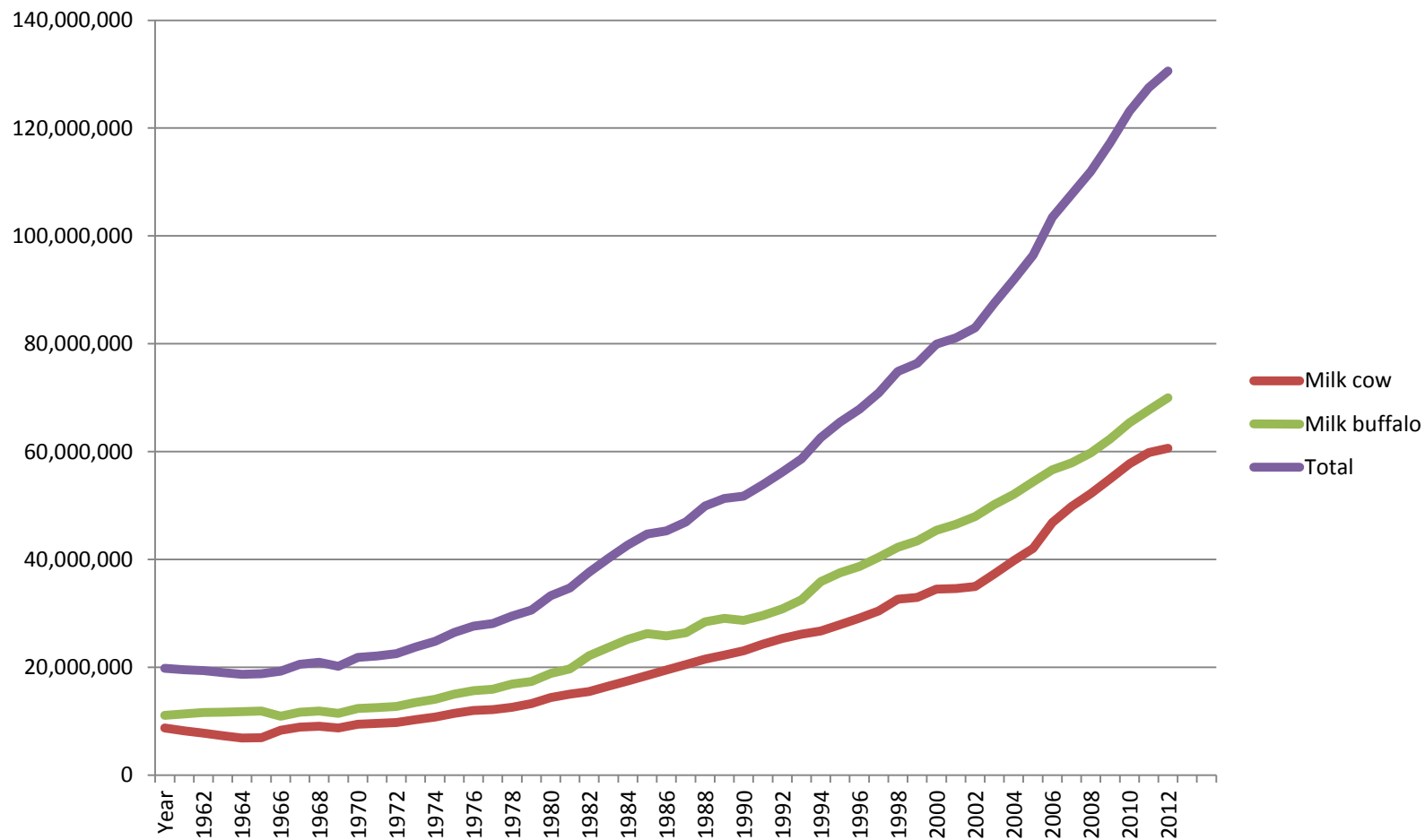
Human exposure



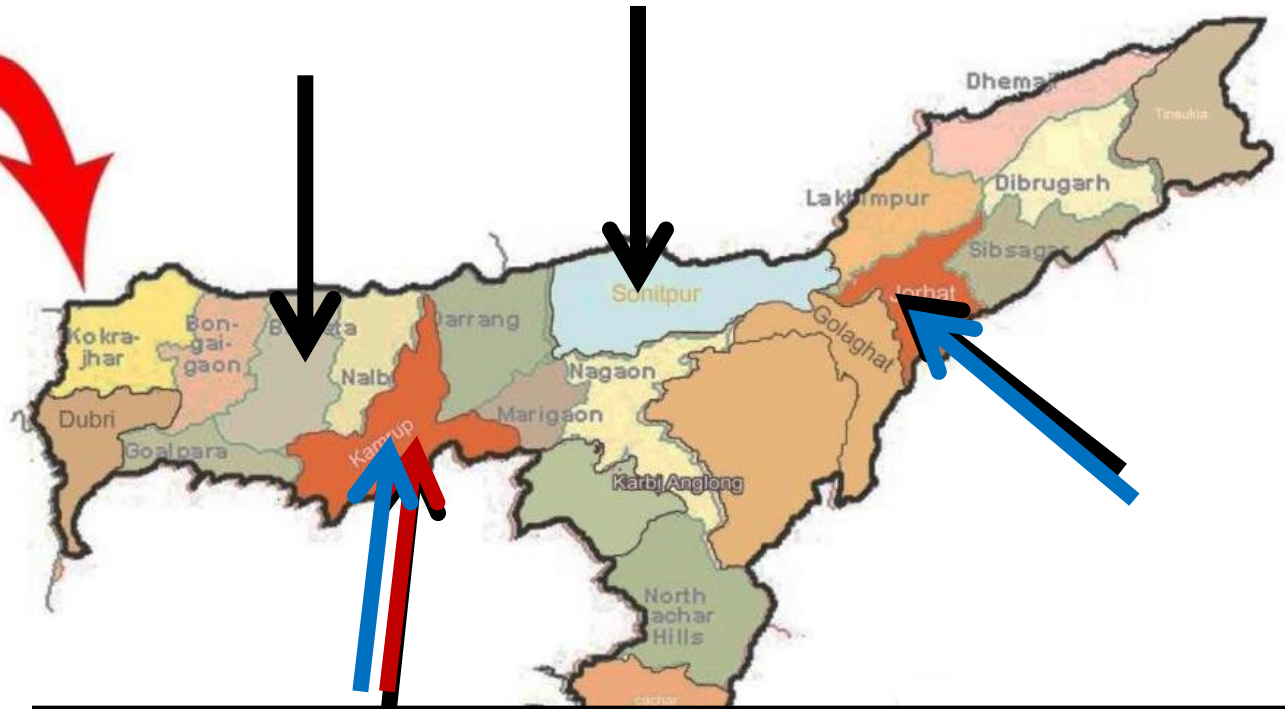
# Food safety work in India

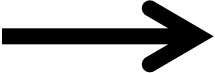


- Focus on the dairy value chain
- Agriculture-associated diseases

# The White Revolution



# Project 1: The Assam study



-  2009
-  2009-2011
-  2012

	Producer	Traders	Total
2009	405	175	580
2012	161	226	387
<b>Total</b>	<b>566</b>	<b>401</b>	<b>967</b>

# Can diseases be transmitted from dung?

Believe diseases can be transmitted from dung	
<b>Producers</b>	
2009	2.7% (11/404)
2012	37.2% (60/161) <sup>***</sup>
Trained (2012)	69.8% (37/53) <sup>***</sup>
Untrained (2012)	21.3% (23/108)
<b>Traders</b>	
2009	1.1% (2/175)
2012	47.1% (106/225) <sup>***</sup>
Trained (2012)	63.9% (78/122) <sup>***</sup>
Untrained (2012)	27.2% (28/103)

Comparison between 2009 and 2012 survey  
Comparison between trained and untrained 2012  
Comparison between 2009 and untrained 2012



# Can diseases be transmitted by milk?

Believe diseases can be transmitted from milk	
<b>Producers</b>	
2009	13.0% (52/401)
2012	35.4% (57/161) <sup>***</sup>
Trained (2012)	64.2% (34/53) <sup>***</sup>
Untrained (2012)	21.3% (23/108)
<b>Traders</b>	
2009	9.1% (16/175)
2012	41.5% (93/224) <sup>***</sup>
Trained (2012)	64.8% (79/122) <sup>***</sup>
Untrained (2012)	13.7% (14/102)

Comparison between 2009 and 2012 survey  
Comparison between trained and untrained 2012  
Comparison between 2009 and untrained 2012



# Which diseases can be transmitted?

	Tuberculosis	Food poisoning/ gastrointestinal disease	General disease symptoms (fever, cough, cold)	Worms
<b>Producers</b>				
2009	3.5% (14/405)	18.3% (74/405)	0.3% (1/405)	4.7% (19/405)
2012	8.7% (14/161)**	36.0% (58/161)***	11.2% (18/161)***	9.3% (15/161)*
Trained (2012)	18.9% (10/53)***	64.2% (34/53)***	20.8% (11/53)**	9.4% (5/53)
Untrained (2012)	3.7% (4/108)	22.2% (24/108)	6.5% (7/108)***	9.3% (10/108)
<b>Traders</b>				
2009	4.0% (7/175)	9.7% (17/175)	0% (0/175)	2.9% (5/175)
2012	13.7% (31/226)***	42.9% (97/226)***	11.5% (26/226)***	4.0% (9/226)
Trained (2012)	23.8% (29/122)***	61.5% (75/122)***	20.5% (25/122)***	6.6% (8/122)*
Untrained (2012)	1.9% (2/104)	21.2% (22/104)**	1.0% (1/104)	1.0% (1/104)

Comparison between 2009 and 2012 survey  
 Comparison between trained and untrained 2012  
 Comparison between 2009 and untrained 2012



# What do you use most often to wash your hands?

- Traders
  - Untrained: 74% answered soap
  - Trained: 92% answered soap ( $p < 0.001$ )
- Producers
  - Untrained: 53% answered soap
  - Trained: 92% answered soap ( $p < 0.001$ )



# Some specks of dirt in the milk are not harmful

- Traders
  - Untrained: 37.5% agree
  - Trained: 28% agree
- Producers
  - Untrained: 58% agree
  - Trained: 77% agree (p=0.046)



# You can tell if milk is safe to drink

- Traders
  - Untrained: 96% agree
  - Trained: 89% agree
- Producers
  - Untrained: 96% agree
  - Trained: 77% agree ( $p < 0.001$ )



# Improving production – not always rocket science

- Follow up in 2014
- 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

# Project 2: Peri-urban milk production

- Can we affect the incidence of bovine tuberculosis?
- Can we affect the prevalence of antibiotic residues?
  
- Evaluate the risks
- Identify risk practices
- Pilot interventions



# Risk mitigation at the human-livestock interface

- It is possible to change people's perceptions and habits but difficult to assess the effect
- Farmers at high risk for zoonoses
- Milk is a risk product
- Assess the risks, mitigate the risks, increase the profits

# *Mycobacterium bovis*

- Tuberculosis can be caused by 2 types of bacteria:  
*Mycobacterium tuberculosis* and *Mycobacterium bovis*
- Chronic disease in both humans and animals
- Fatal
- Difficult to treat
- Best method is to stop the spread

# Antibiotic residues

- Unregulated antibiotic
- Risk for antibiotic residues in the milk: there is no testing and no control
- The problem: residues or resistance





# Study design

## 1. Estimate the burden

- Estimate the prevalence of *Mycobacterium bovis*, *Brucella abortus*, *Coxiella burnetii*, *Listeria monocytogenes* infection among livestock in smallholder dairy farms in peri-urban areas
- Describe and quantify antibiotic use and associated levels of milk production, including testing of pooled milk samples for antibiotic residues

## 2. Design an intervention and pilot it!

# Study sites



# Project 3: Animal health in Bihar

- Bihar is one of the poorest and least developed states
- Common farm size: 1-3 dairy cows or buffaloes
- 3-5 litres of milk
- Little is known about the limitations to the dairy production

# Scoping study about the animal health problems

- Collecting morbidity and mortality data
  - Including mastitis and antibiotic resistance
- Production and cost estimates
- Serology for selected diseases
  - Brucellosis, leptospirosis, Q fever, haemorrhagic septicaemia
- Special focus on brucellosis
  - Evaluation of rapid tests
  - Molecular testing

# Finding the best bet interventions

- Identify the limitations
  - Risk factors
- Identify what is feasible
- Pilot
- Evaluate sustainability and long-term effects



# Other potentially upcoming projects

- Pig production in Meghalaya
- Small ruminants value chain

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