Pest forecast

Climate, disease, poverty and One Health

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ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

World Agroforestry Centre

VETERINARIANS WITHOUT BORDERS
VÉTÉRINAIRES SANS FRONTIÈRES

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security
CCAFS

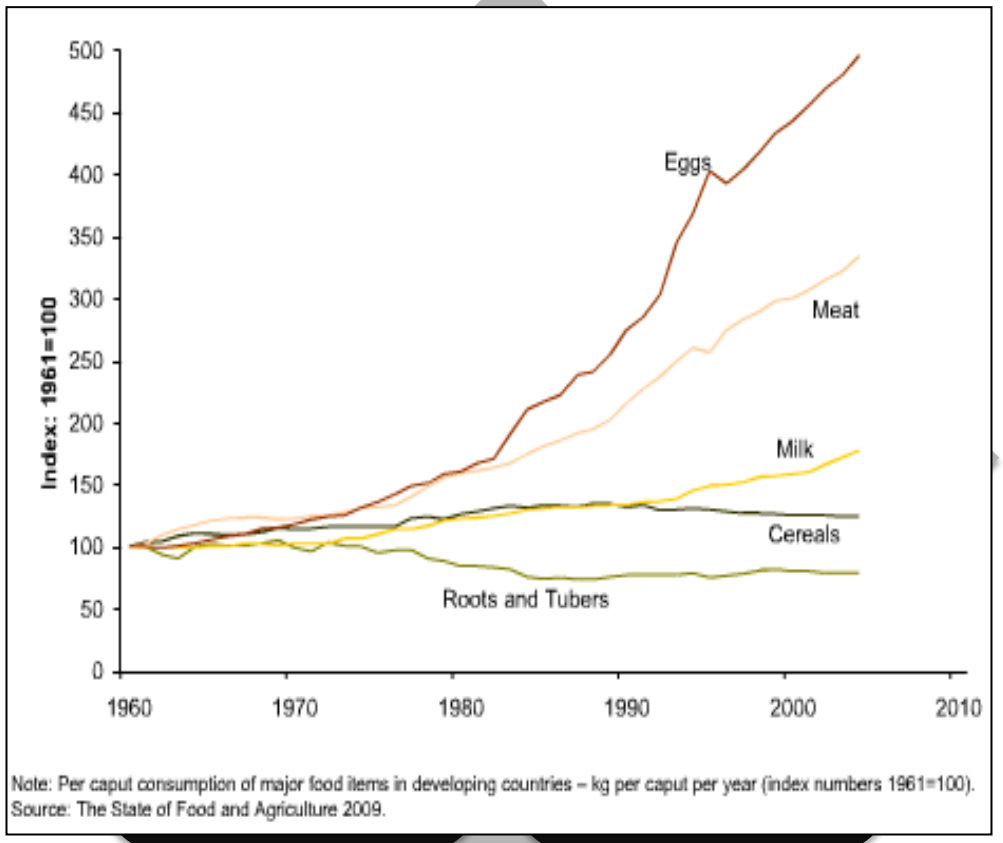
Global contexts – livestock domains

Feeding the world

(2.5 billion more to feed by 2050)

Climate change

(temperatures to rise by 1-3.5°C by 2100)



Note: Per caput consumption of major food items in developing countries – kg per caput per year (index numbers 1961=100).
Source: The State of Food and Agriculture 2009.

Land use change

Urbanization/irrigation

Biodiversity change

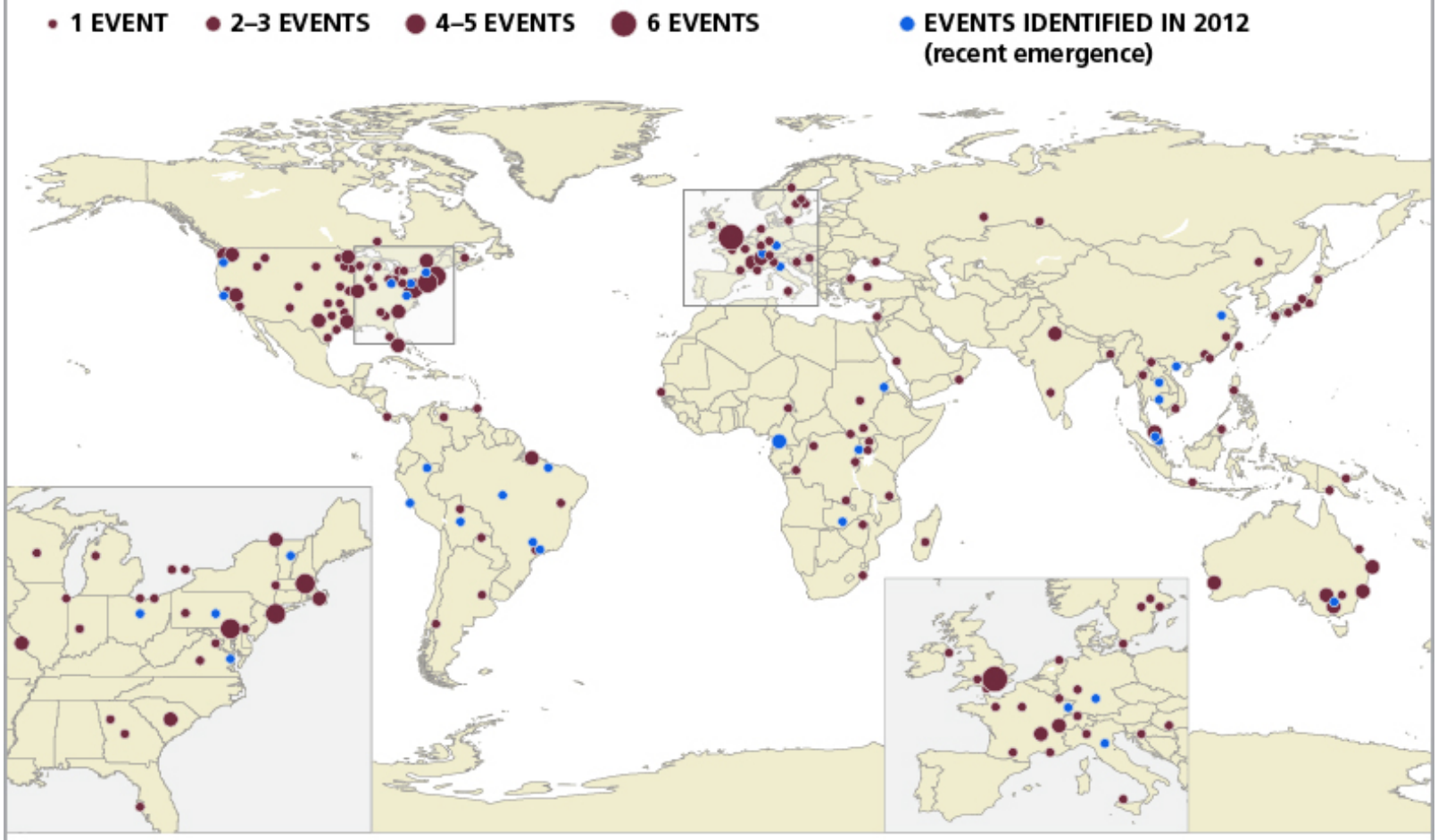
Environmental degradation

Adapted from Smith J 2011

Emerging Zoonotic Disease Events, 1940–2012

Potential Hotspots in US, Western Europe, Brazil, Southeast Asia

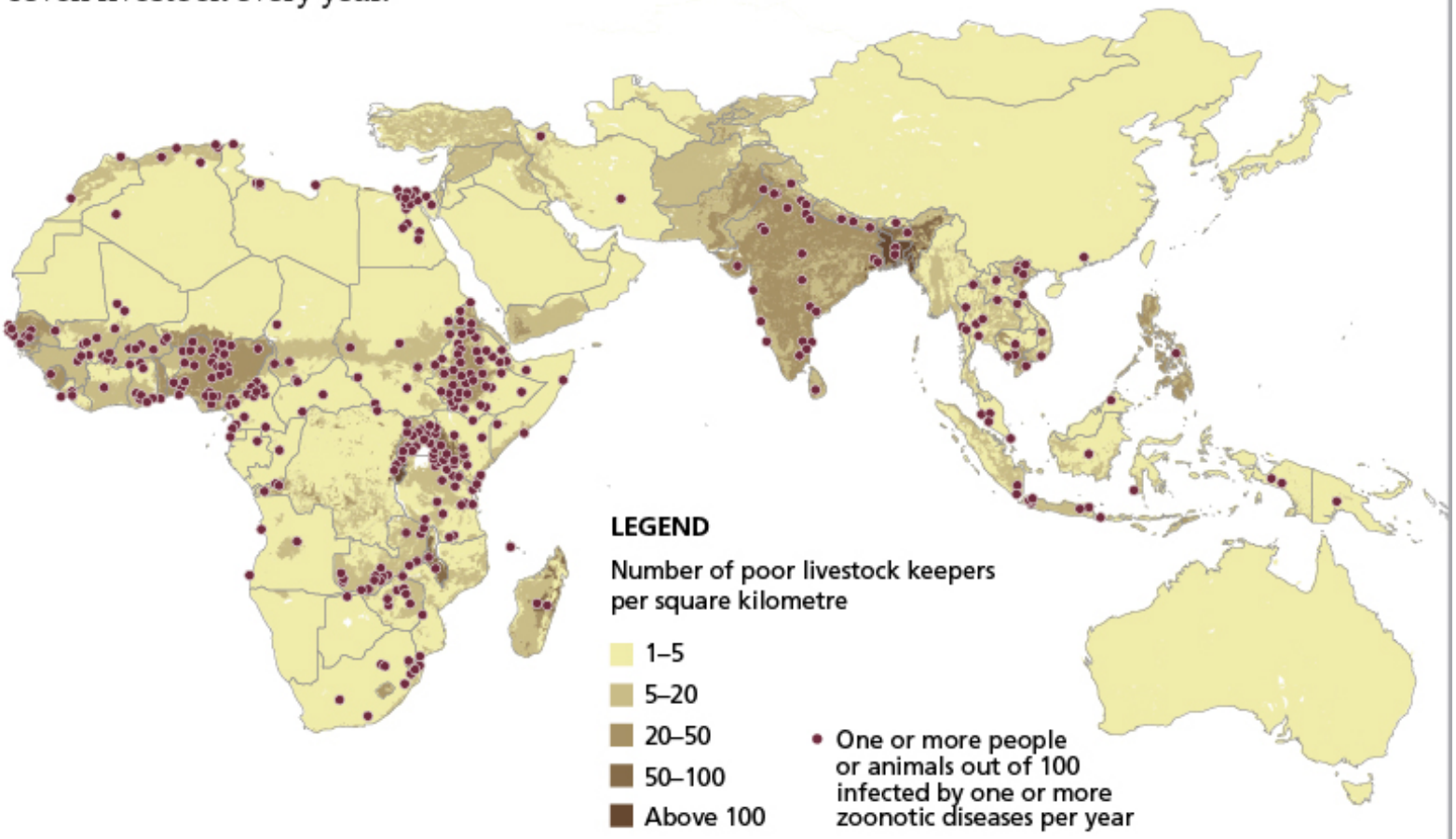
Most emerging human diseases come from animals. This map locates zoonotic events over the past 72 years, with recent events (identified by an ILRI-led study in 2012) in blue. Like earlier analyses, the study shows western Europe and western USA are hotspots; recent events, however, show an increasingly higher representation of developing countries.



Map by IOZ, published in an ILRI report to DFID: *Mapping of Poverty and Likely Zoonoses Hotspots*, 2012.

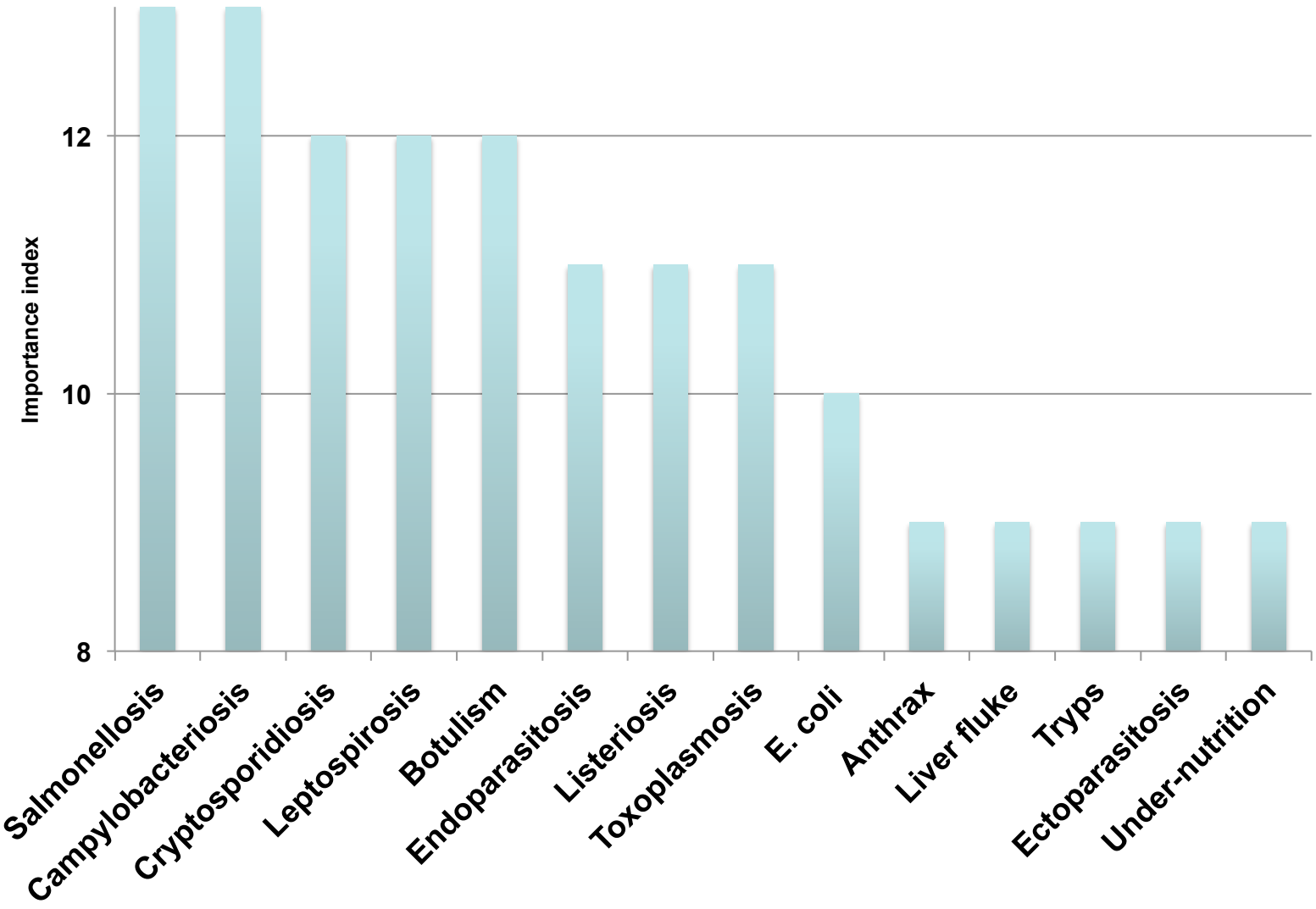
Greatest Burden of Zoonoses Falls on One Billion Poor Livestock Keepers

An ILRI study shows that zoonotic diseases are major obstacles in pathways out of poverty for one billion poor livestock keepers. The diseases mapped cause 2.3 billion human illnesses and 1.7 million human deaths a year. In poor countries, the diseases also infect more than one in seven livestock every year.

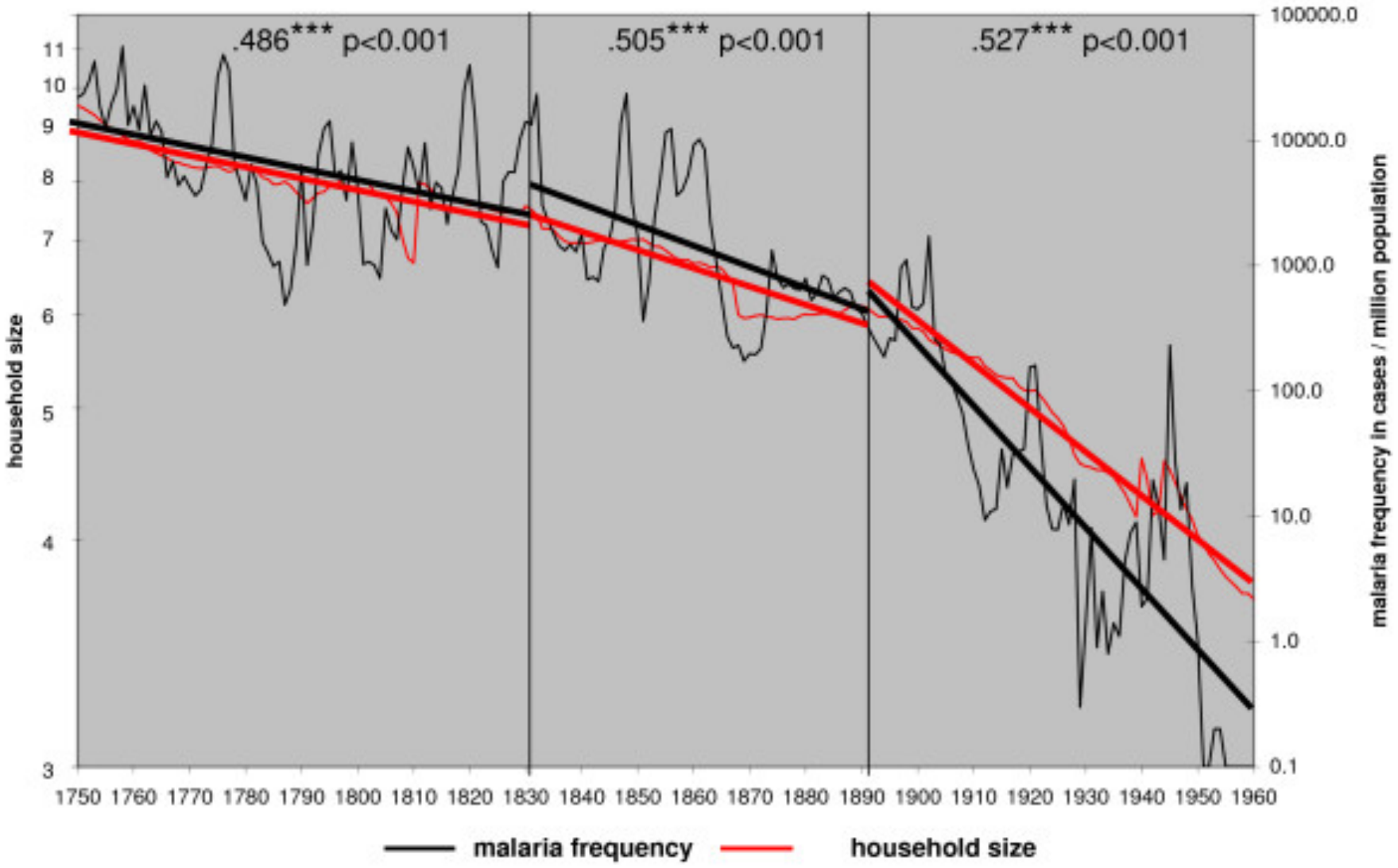


Map by ILRI, from original published in an ILRI report to DFID: *Mapping of Poverty and Likely Zoonoses Hotspots*, 2012.

Climate sensitive zoonoses & poverty



Malaria in Finland



Hulden& Hulden, *Malaria Journal* 2009, **8**:94

One health for forecastable disease

One Health

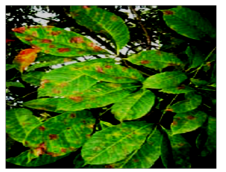
Animal/Plant – Human – Environmental Health

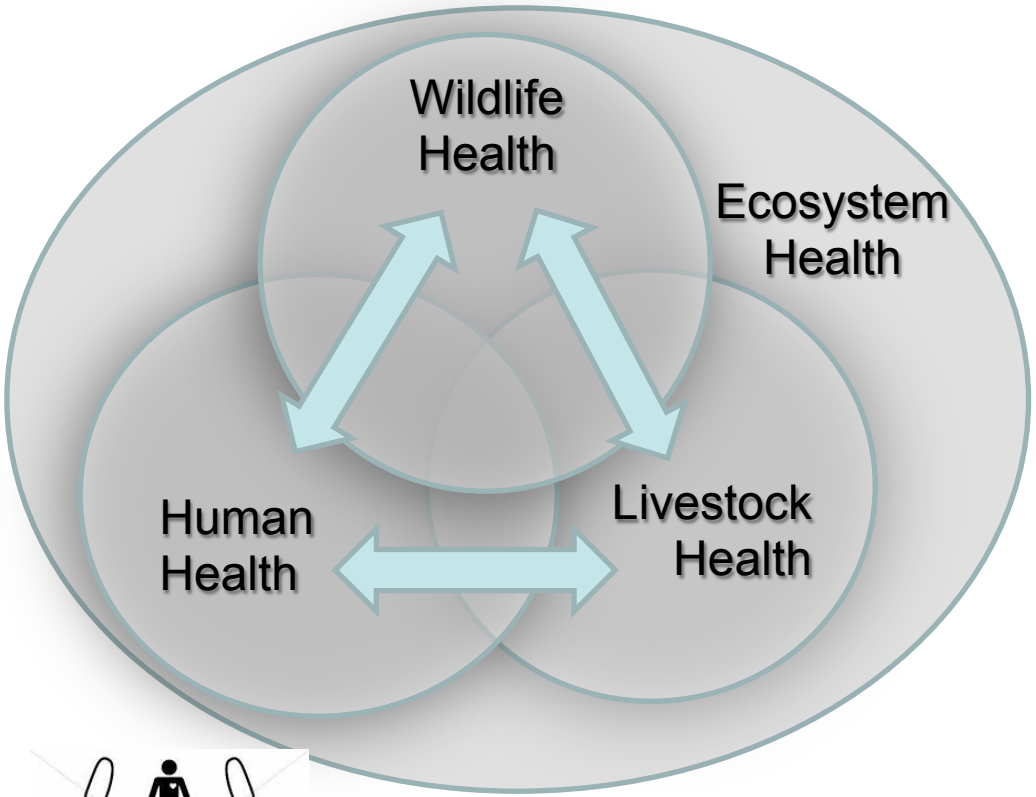
Focus hazards and risks

- Zoonoses and FBD

- Aflatoxin in maize

- Rubber leaf disease

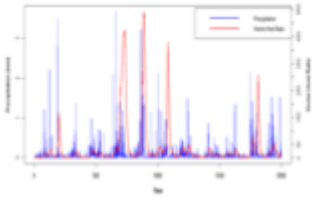




Early Warning and Forecasting System concept

Met-Data

Model development: Forecast, mapping



Decision support tools

Notification to farmers

Public and Farmers

Climate sensitive diseases data
- Surveillance system
- Field survey

Responses
- Vaccination
- Harvesting
- Selling

Adapted from ICRAF (2014)

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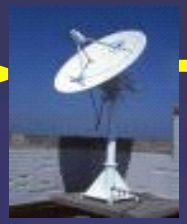
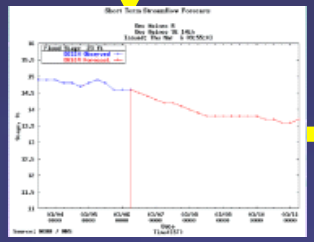
End-to-End Early Warning and Forecasting System for Rubber fall

Met-Data



Communication



Forecast

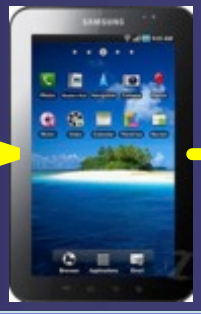
Decision Support

Notify

Coordinate

Farmers

Field-Data



AFLATOXIN

A Fungal Toxin Infecting the Food Chain

Persistent high levels of aflatoxins—naturally occurring carcinogenic byproducts of common fungi on grains and other crops—pose significant health risks to animals and humans in many tropical developing countries.

Chronic exposure to aflatoxins leads to liver cancer and is estimated to cause as many as 26,000 deaths annually in sub-Saharan Africa. This infographic depicts the ways that aflatoxins persist throughout the food chain. At each level, research can help understand how to manage risks.

Susceptible Crops

Field crops infested with aflatoxin

Poor Storage

Toxins increase during storage

Animal Consumption

Animals and dairy are infected from contaminated feed

Impact on Dairy Production

Livestock produce less, loss of income and food

Human Consumption

Humans consume toxins in staple foods and dairy products

Impact on Human Health

Consumers experience liver cancer, poisoning

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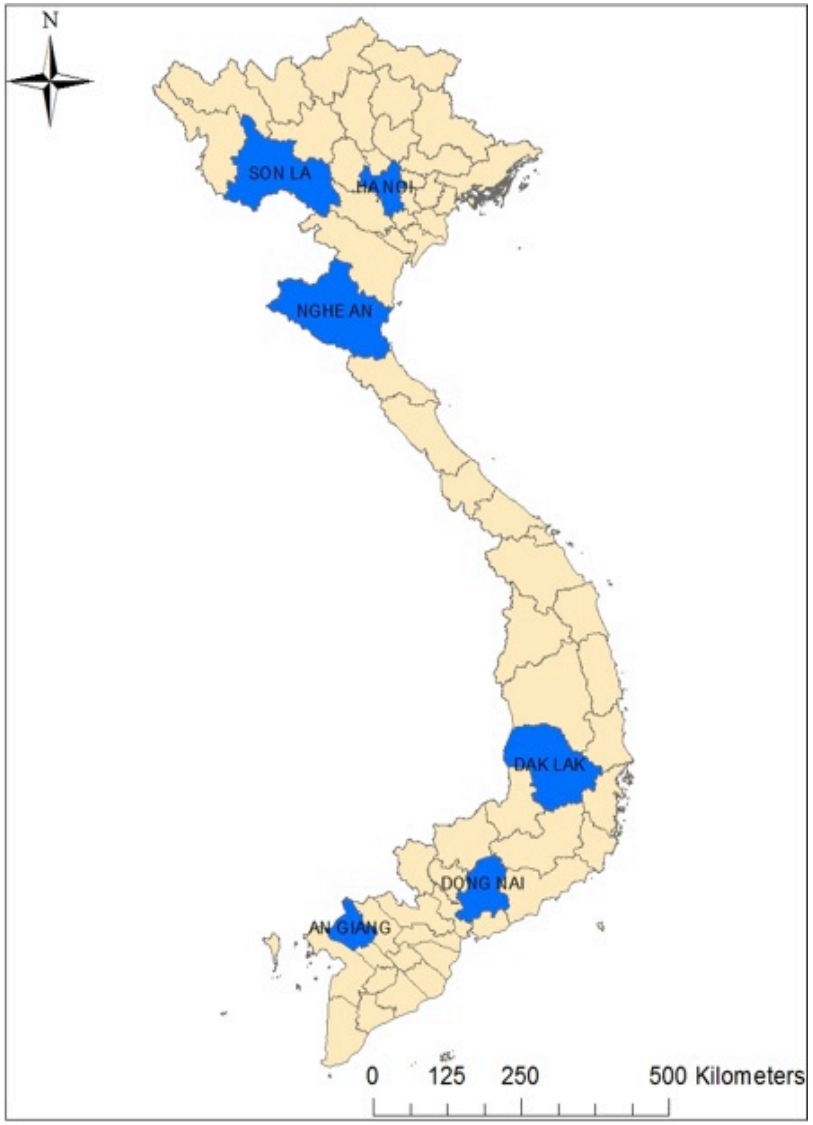
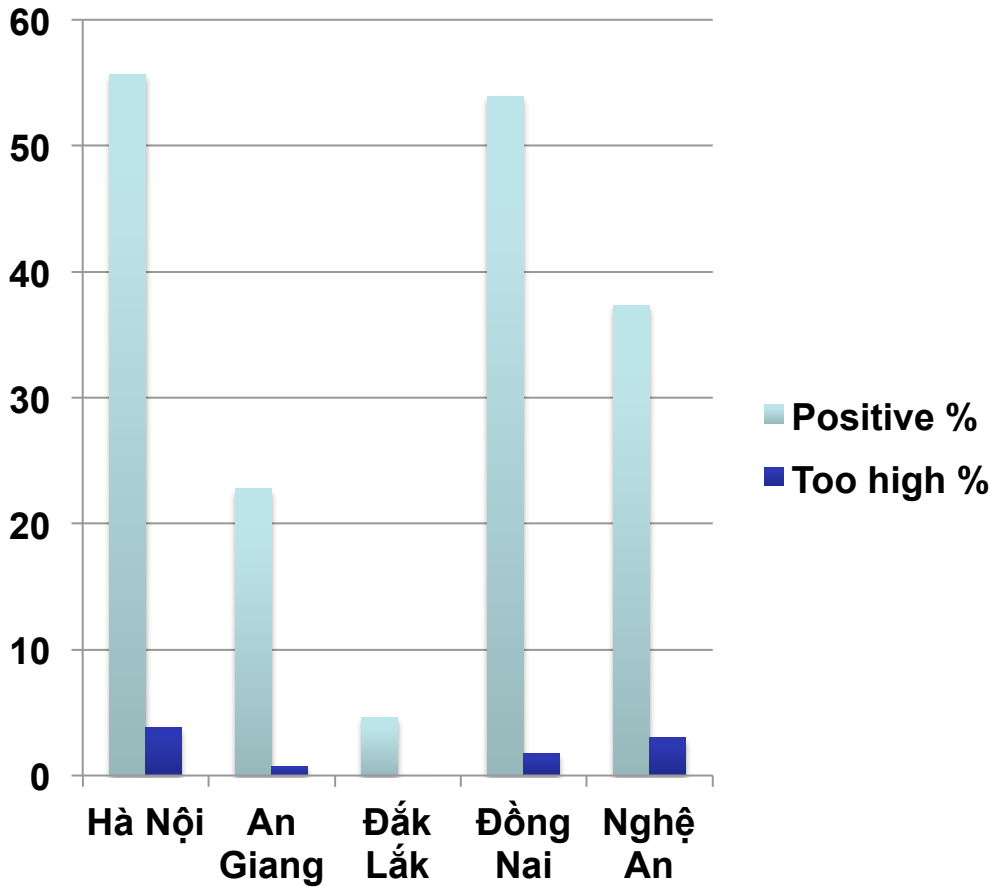
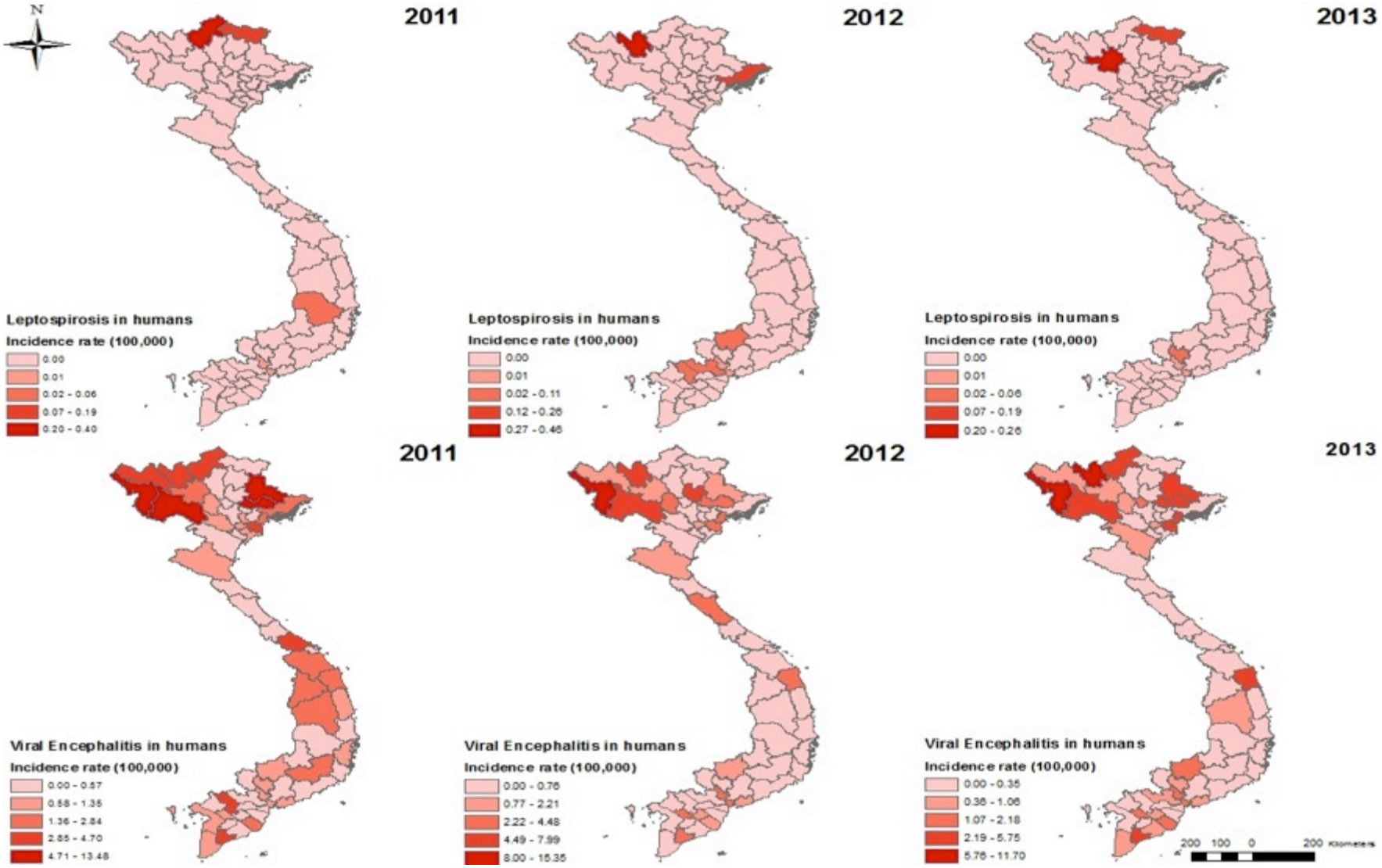
Source: Tackling Aflatoxins: An Overview of Challenges and Solutions. Laurian Unnevehr and Delia Grace.

Aflatoxins in maize (n= 2,370)

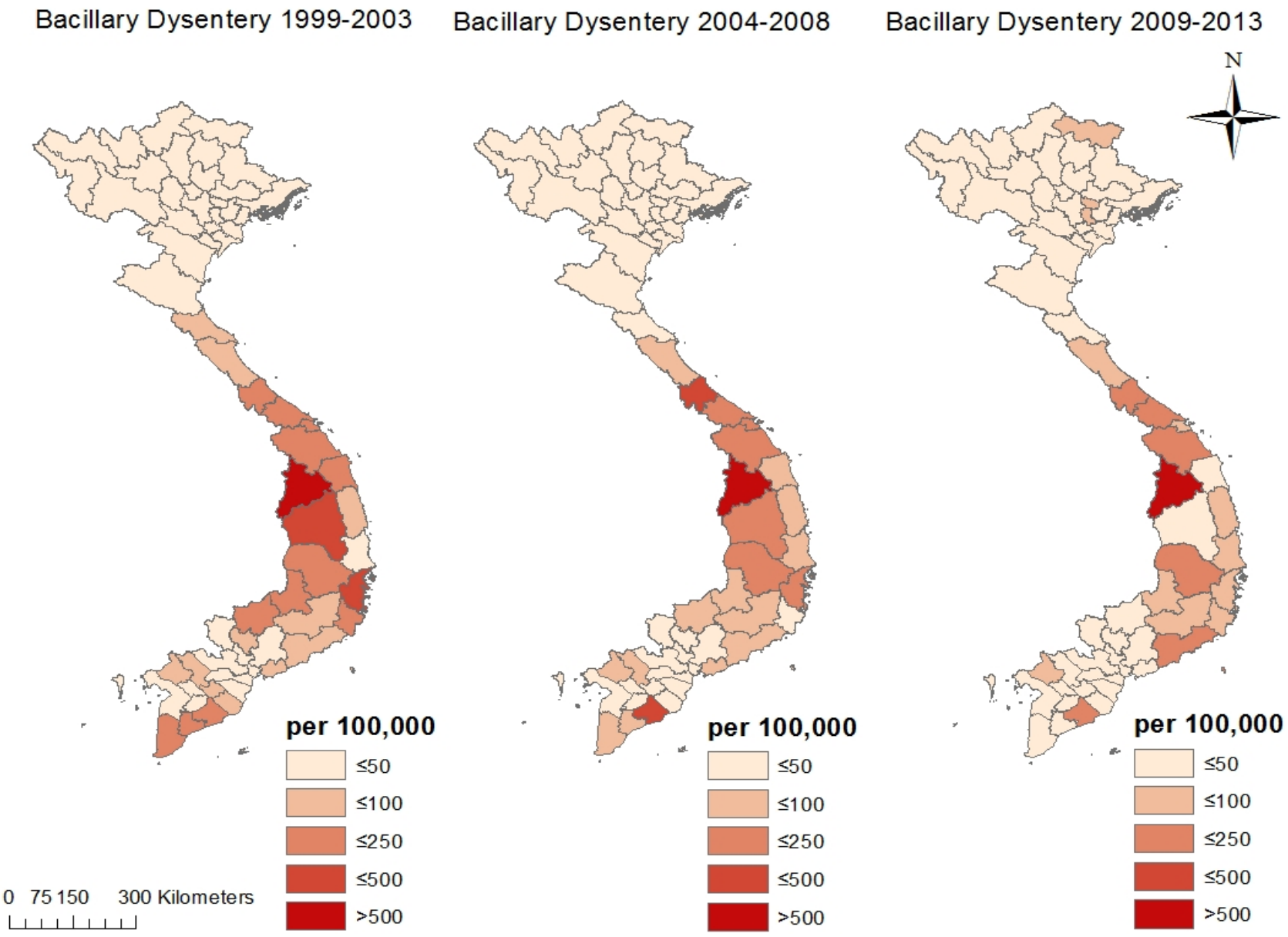




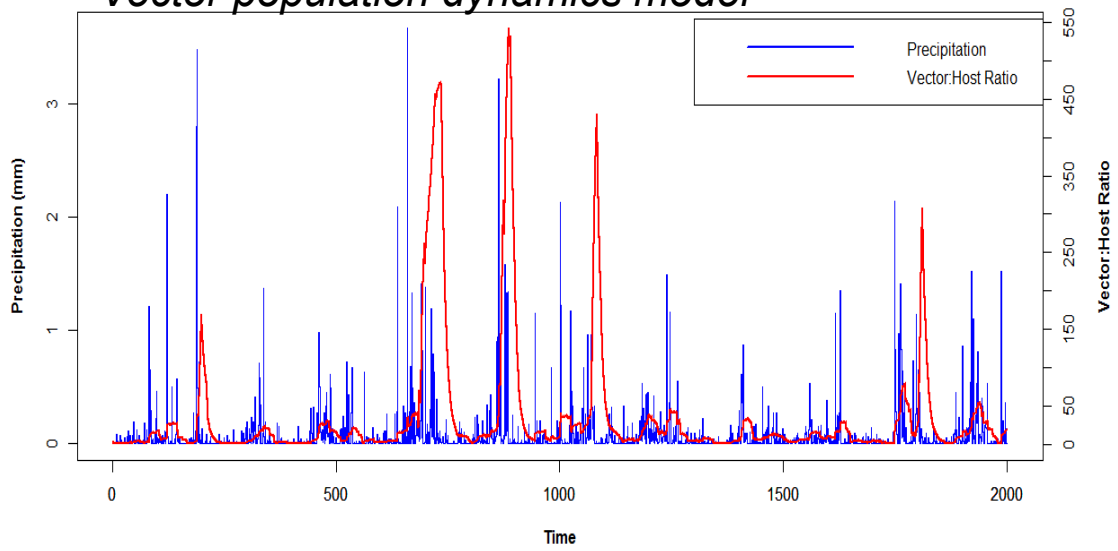
Annual incidence rates for lepto and VE in humans



*Previous study showed that 60~71% of VE were caused by JE in Vietnam

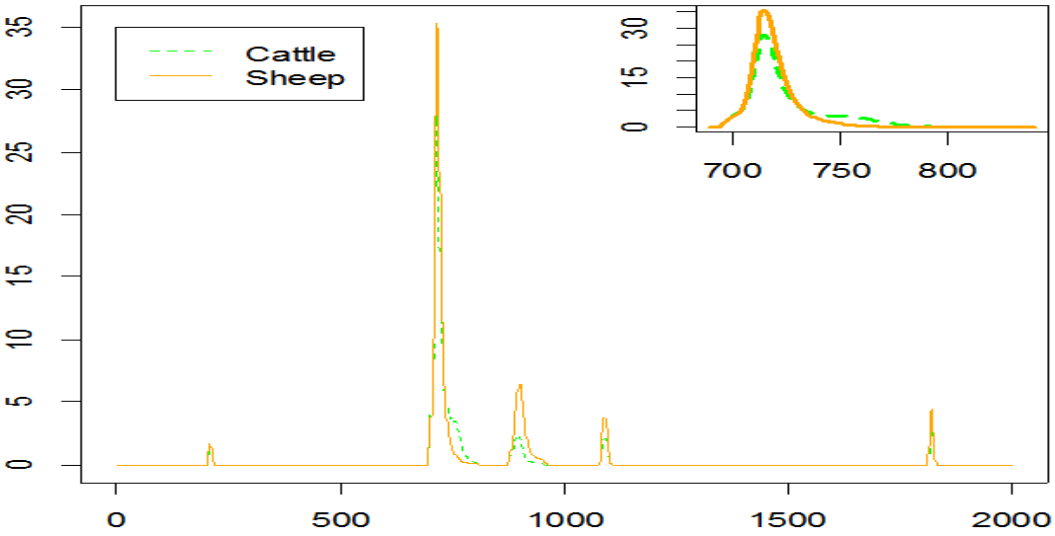

Bacillary Dysentery 1999-2003
Bacillary Dysentery 2004-2008
Bacillary Dysentery 2009-2013
N
per 100,000
≤50
≤100
≤250
≤500
>500
0 75 150 300 Kilometers

Vector population dynamics model



RVF outbreaks follow periods of excessive rains (TRMM precipitation data from NASA)

Disease transmission dynamics



Interaction between environmental factors, immunity in the disease occurrence and impacts

Jan 2005

July 2010

Anticipated outcome story/stories

Concept of climate and weather-sensitive disease explored and promoted

Researchers and policy makers will have evidence on spatial hotspots for climatic sensitive zoonoses and temporal risk patterns in order to better target surveillance and response

Better understanding of the relative importance of risk factors for diseases and pests in different contexts

One health weather based pest forecasting piloted for rubber, aflatoxins and weather sensitive disease

M.Hasan, c/o Photoshare