

Studies of zoonoses in dynamic livestock systems in Kenya

Eric Fèvre

Professor of Veterinary Infectious Diseases, Institute of Infection and Global Health, University of Liverpool, UK *and* International Livestock Research Institute, Nairobi, Kenya

Eric.Fevre@liverpool.ac.uk; www.zoonotic-diseases.org; Twitter: @ZoonoticDisease

Visit by Sir Mark Walport to ILRI, 15 July 2015



The investment

ESEI: Environmental and Social Ecology of Human Infectious Diseases (ESEI) initiative

ZELS: Zoonoses in Emerging Livestock Systems programme

Wellcome Trust and the CGIAR

The Leverhulme Centre for Integrated Research on Agriculture and Health

ILRI in partnership with several institutions
University of Liverpool Institute of Infection and Global Health



The partners



The people

- Postdocs: Pablo Alarcon, Sohel Ahmed, Annie Cook, Judy Bettridge,, John Kiiru, Melissa Ward, Joshua Onono
- PhD students: Lian Thomas, Laure Madé, James Hassell, Stella Kiambi, Maud Carron
- MSc students: James Akoko, Maurice Karani, Patrick Muinde, Mercy Cianjoka, Joseph Ogola, James Machiaria, Isaac Ngere, Maurice Omondi, Caren Ndeta
- The team: Victora Kyallo, James Akoko, Omoto Lazarus, Lorren Alumasa, Daniel Cheriyyot, Jenipher Ambaka, Fred Opinya, John Mwaniki, Hannah Kariuki, Gideon Mwali, George Omondi, Alice Kiyong' a, Lilian Abonyo, Maseno Cleophas, Fred Ambaka, Velma Kivali, Fred Amana, Allan Ogendo, Nduhiu Gitahi, Dishon Muloi, Maurice Karani, Patrick Muinde, Evaristo Malenge
- Collaborators: Cecilia Tacoli (IIED), Erastus Kang'ethe (UoN), Sam Kariuki and Njeri Wamae (Kenya Medical Research Institute, KEMRI), Mark Woolhouse (UoE), Bernard "Risky" Agwanda (NMK), Mark Bronsvort (Roslin Institute), Jonathan Rushton, Pablo Alarcon and Claire Okell (Royal Veterinary College), Catherine Kyobotungi and Djesika Amendah (APHRC), Julio Davila and Adriana Allen (DPU, UCL), Delia Grace, Phil Toye, Tim Robinson, Steve Kemp (ILRI), Heinrich Neubauer, Lisa Sprague (FLI), Dorte Dopfer (UW Madison), Greg Gray (Florida), Desiree LaBeaud (CHORI)....
- The Department of Veterinary Services Kenya, the Zoonotic Diseases Unit (Eric Osoro, Austine Bitek), Kenya



Demographic change

Probabilistic Population Projections based on the *World Population Prospects: The 2012 Revision*

- Massive increases in the population of urban and peri-urban (UPU) zones in Africa
 - From 35% of total population 2007 to 51% by 2030
- Kenya: ~35 major poles of urbanization
- Impacts on
 - human welfare
 - healthcare provision and delivery
 - sanitation
 - demography
 - economics
 - trade
 - development
 - food production
 - planning
 - **disease transmission**

Kenya: Total Population

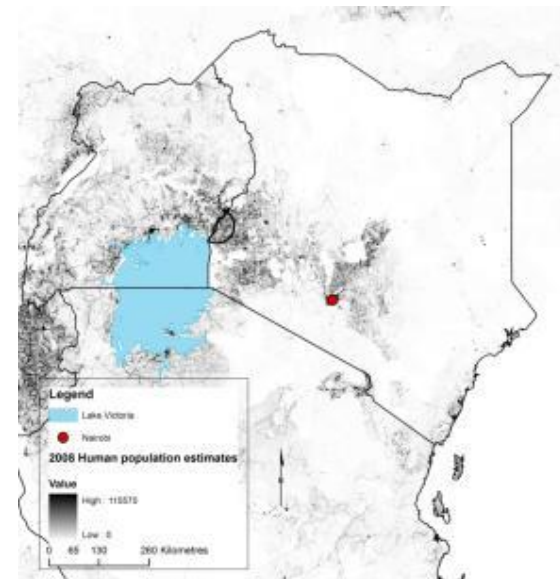
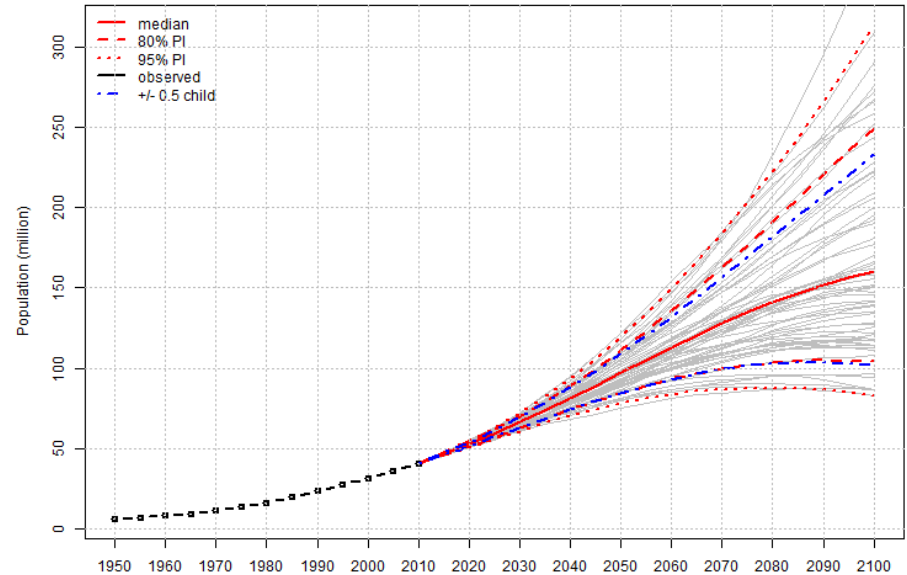
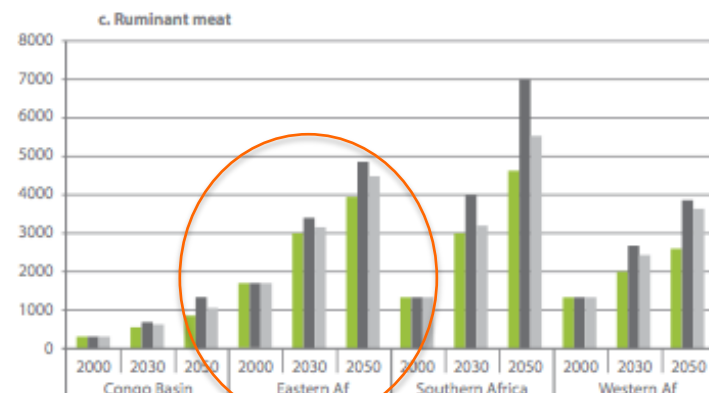
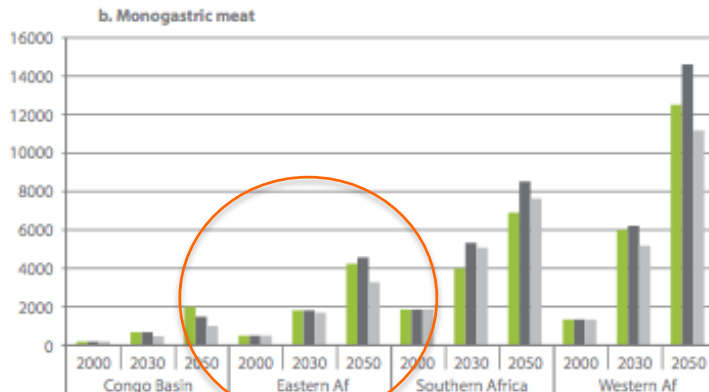
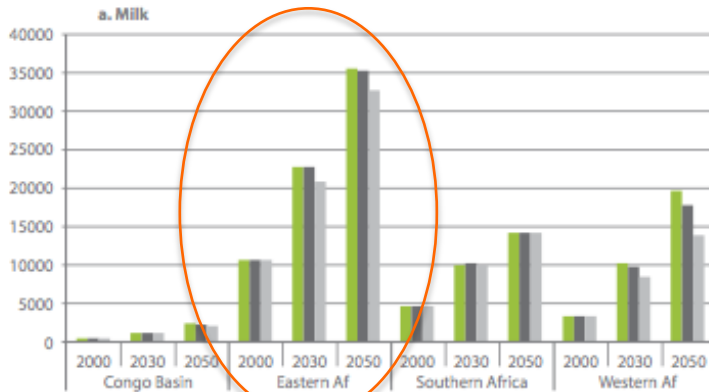




Figure 38 - The total consumption of livestock products (tons 000s) in different regions of sub-Saharan Africa to 2050 by SSP scenario.



■ SSP1
■ SSP2
■ SSP3

Trajectories in African animal source food - consumption

Herrero, M., Havlik, P., McIntire, J., Palazzo, A. and Valin, H. 2014. African Livestock Futures: Realizing the Potential of Livestock for Food Security, Poverty Reduction and the Environment in Sub-Saharan Africa. Office of the Special Representative of the UN Secretary General for Food Security and Nutrition and the United Nations System Influenza Coordination (UNSIC), Geneva, Switzerland, 118 p.

<http://un-influenza.org/?q=content/press-release-african-livestock-futures-realizing-potential-livestock-food-security-poverty>

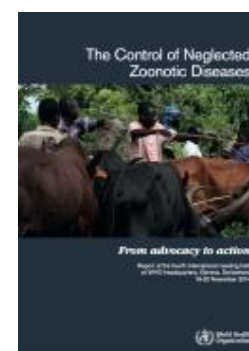
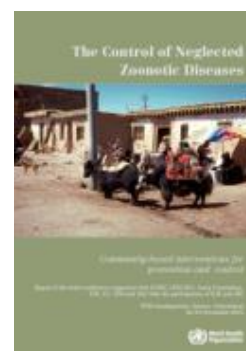
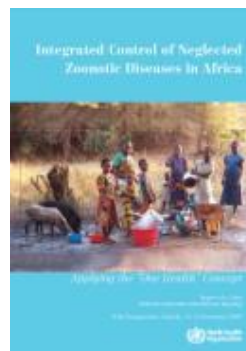




Integrated zoonotic disease surveillance and reporting

Brucellosis
Leptospirosis
Trypanosomiasis
Echinococcosis
Rift Valley Fever
T. solium/*T. saginata* cysticercosis
Fascioliasis

Anthrax
Q fever
TB
Salmonella spp. including AST
E. coli including AST
Campylobacter spp. including AST
Staphylococcus spp. including AST



Field site

- Lake Victoria Crescent ecosystem:
 - Small-holder crop-livestock production system
 - Approximately 70% of households in the region keep livestock
- Close collaboration with: National and County gov't



Southern extremity of the study area: Lake Victoria



Mixed crop-livestock farming area in the central study site



The foothills of Mt Elgon, northern study area



Zoonoses in context: Key sources of epidemiological data

Hospitals, markets, slaughterhouses, butcheries, household tracebacks

Figure 3: Spatially smoothed relative risks of Q fever seropositivity in humans (left panel) and cattle (right panel).

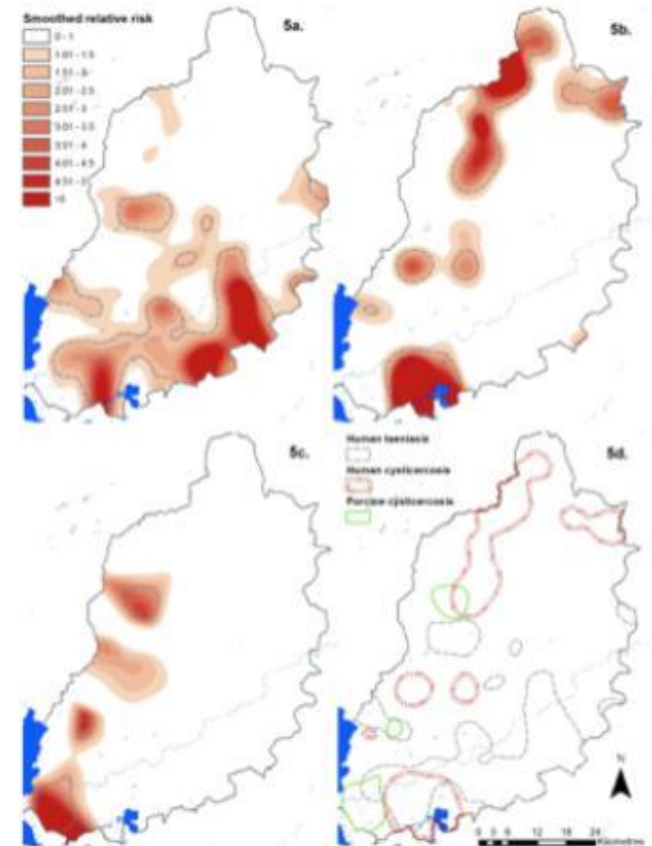
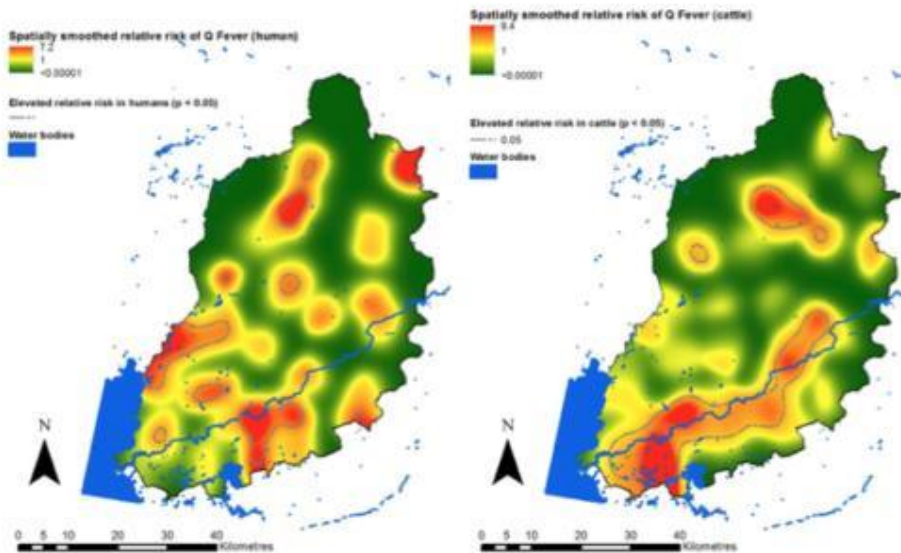


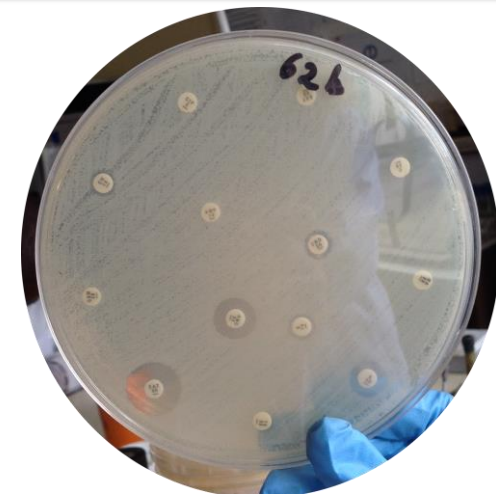
Fig 5

Improved diagnostic platforms for zoonoses detection

High-throughput, multiplexed laboratory assays

Pen/bed-side assays

AMR in changing livestock system



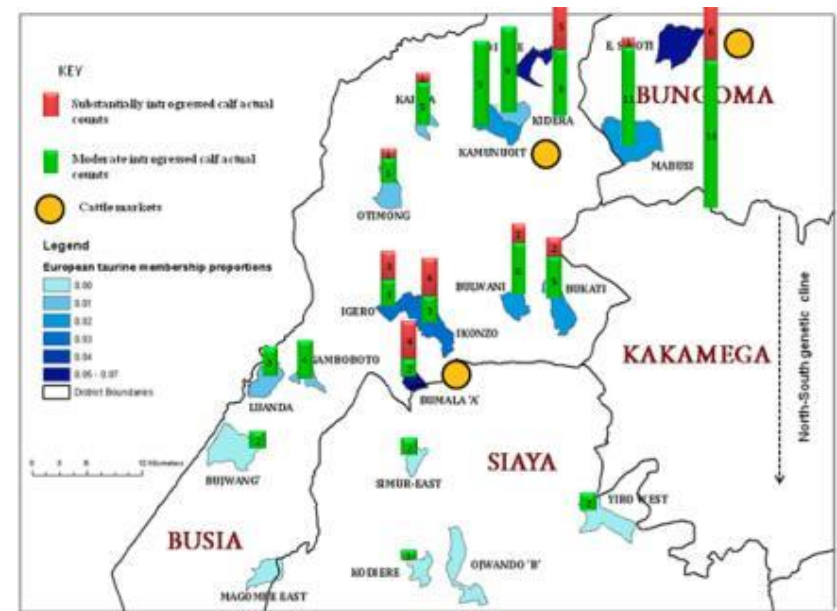
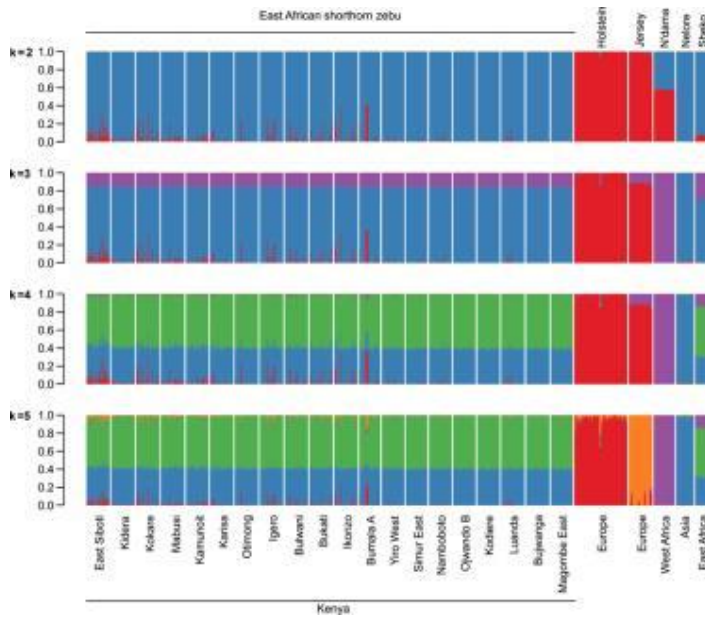
	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
BAT	81.8 (43.3 - 99.5)	80.6 (77.8 - 83.2)	3.7 (1.2 - 7.3)	99.8 (99.3 - 100)
RBT*	96.6 (89.1 - 99.8)	99.4 (98.7 - 99.8)	58.6 (29.8 - 86.2)	100 (99.9 - 100)
SAT	66.4 (39.4 - 89.0)	99.8 (99.4 - 100)	74.5 (40.1 - 96.6)	99.7 (99.2 - 99.9)
Coombs test	88.6 (64.7 - 99.7)	99.8 (99.4 - 100)	79.2 (48.4 - 97.4)	99.9 (99.6 - 100)

*Using results from confirmatory tests performed at the University of Navarra

Livestock husbandry, marketing, population dynamics and population genetics

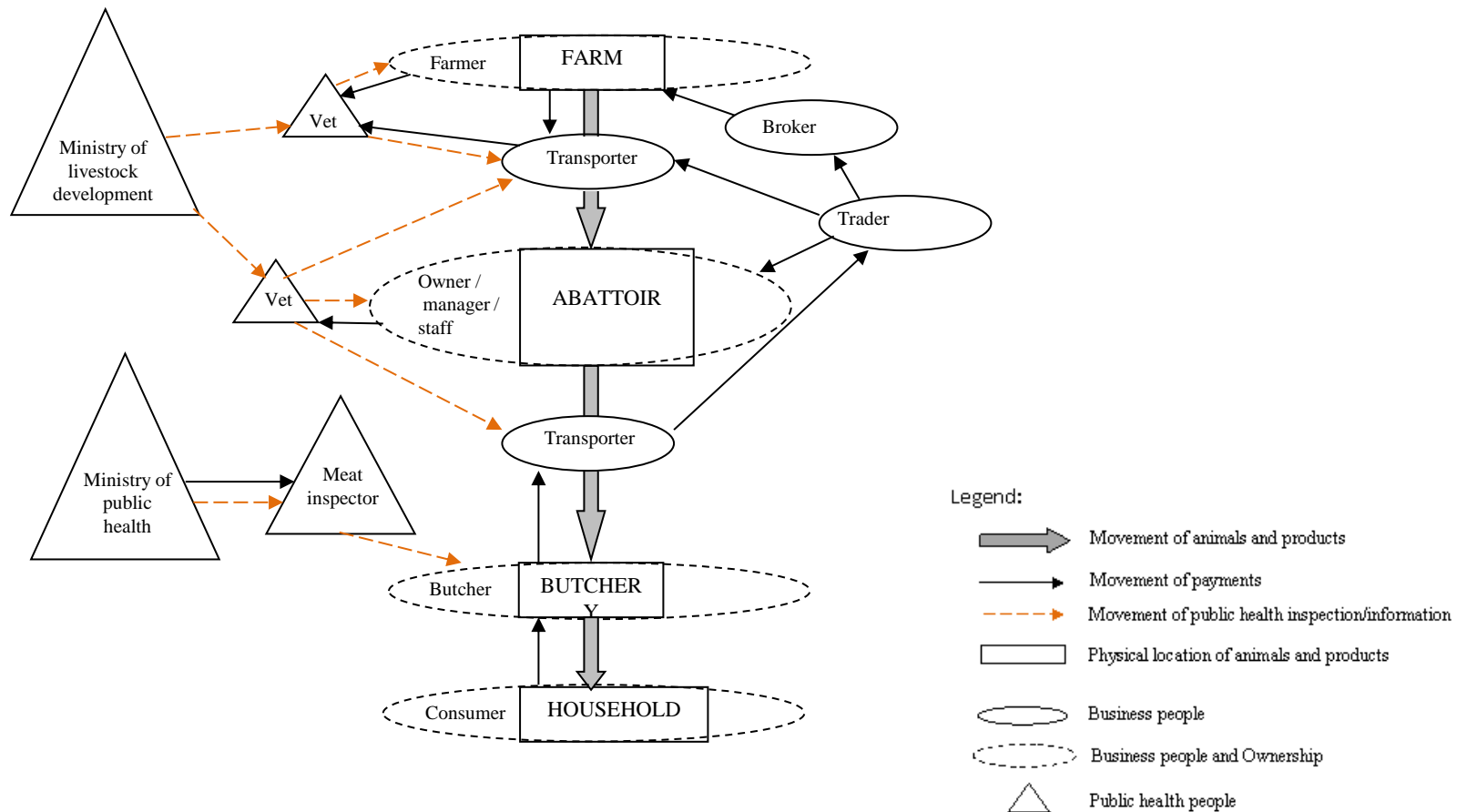
Study of livestock marketing and livestock population dynamics

Livestock genetics and genetic change



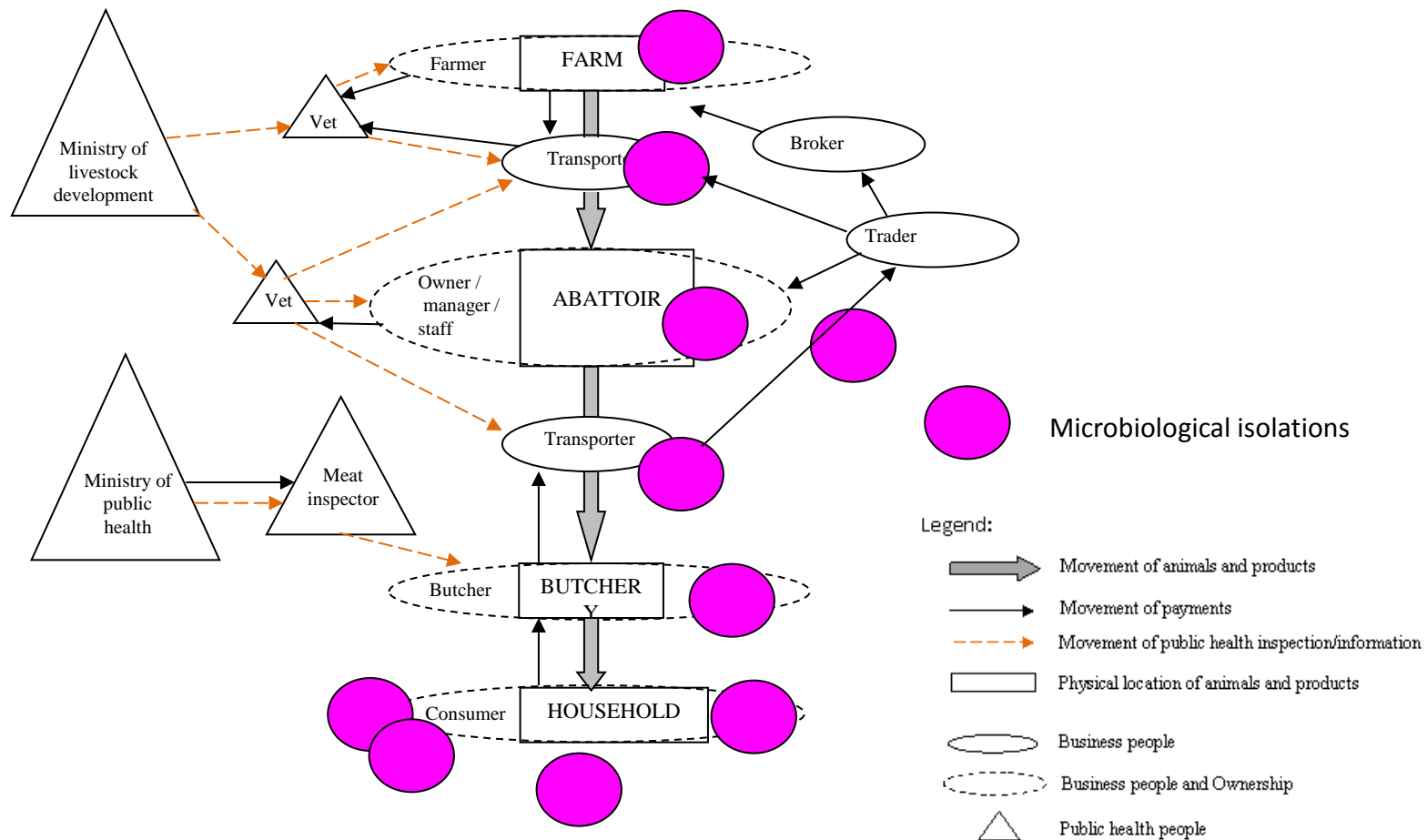
Predicting the future....

- Value chain approach, demographic and consumption models, scenario analysis
- Forward projections of population growth, urbanisation, land use, consumption patterns and changing demand for animal source foods



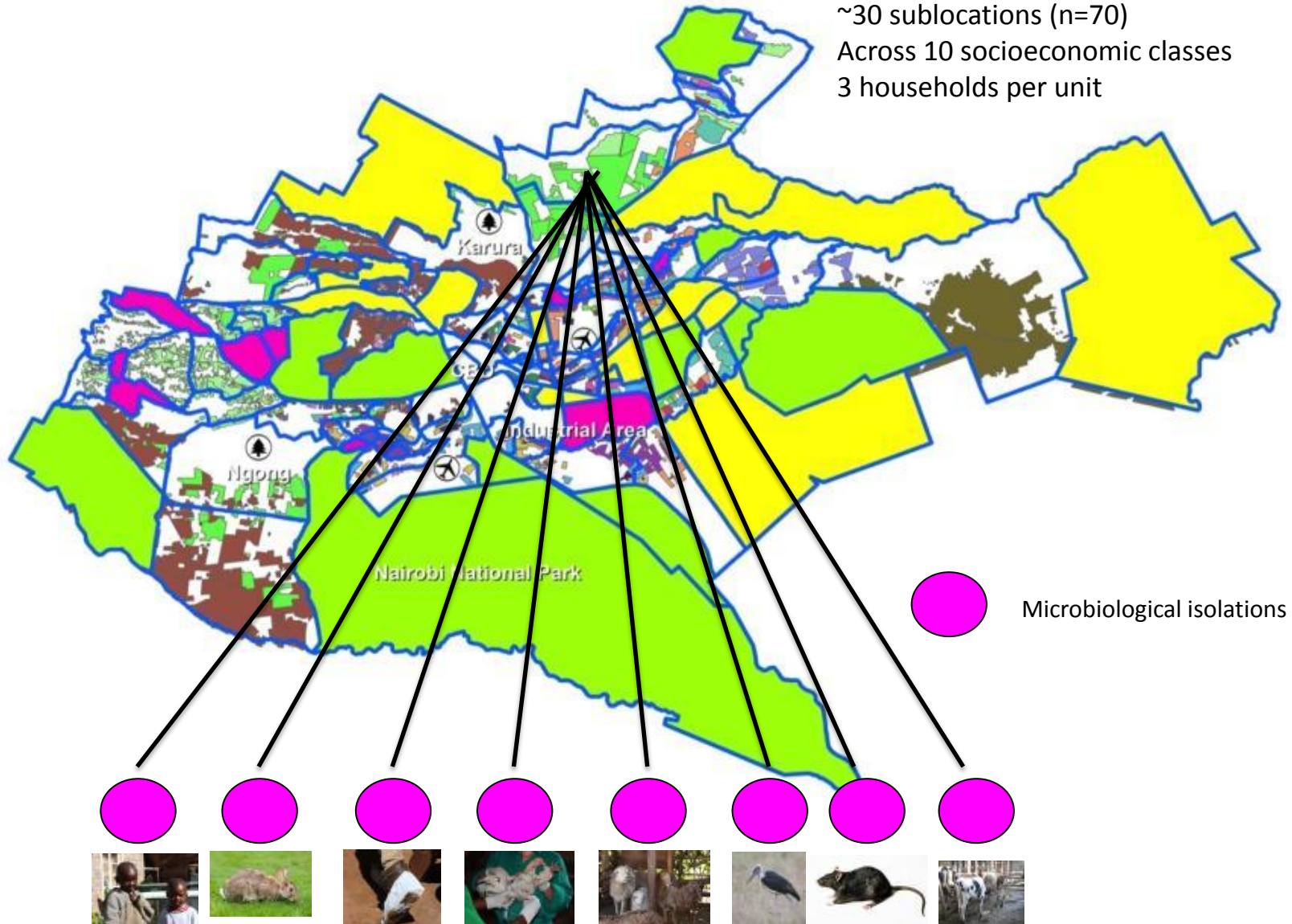
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Sampling across socio-economic groups

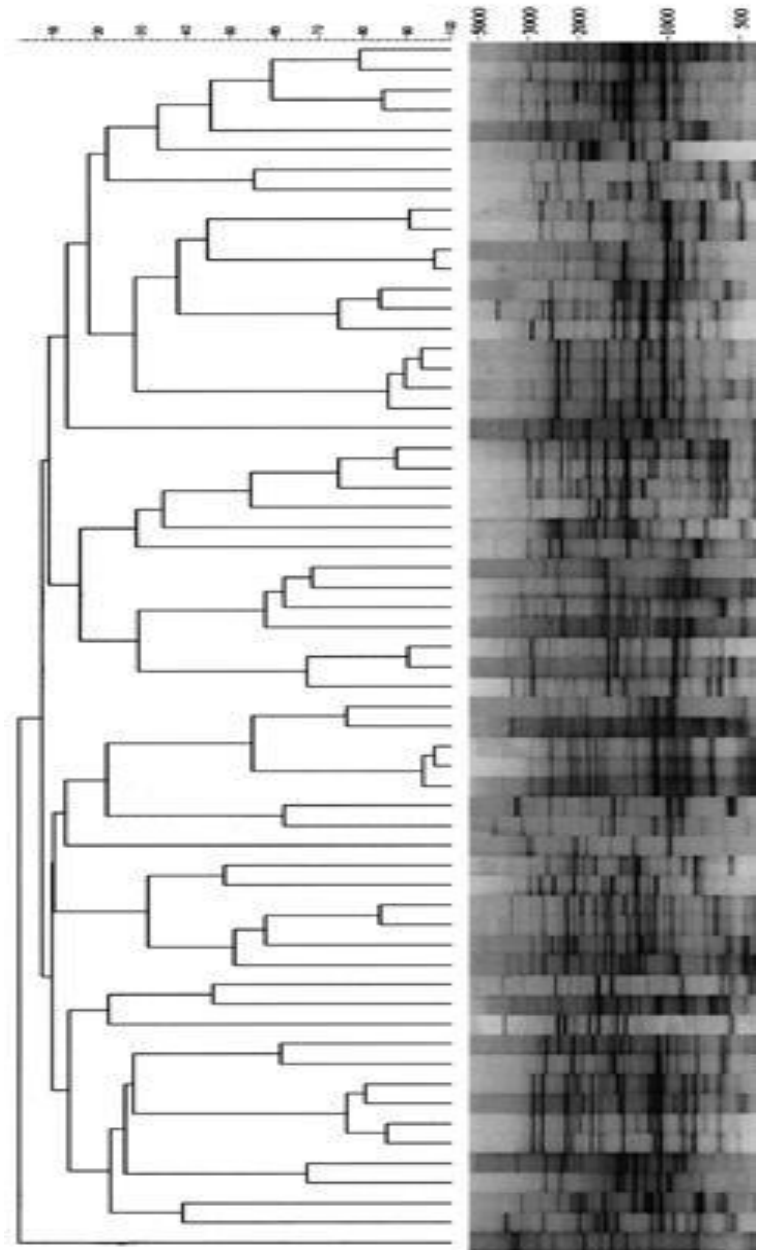
99 households:
~30 sublocations (n=70)
Across 10 socioeconomic classes
3 households per unit





Landscape genetics

- Bacterial isolates
- Characterize and quantify genetic diversity on 000's of isolates
- Whole Genome Sequencing
- Build **genetic/geographical** maps of microbial diversity





Briefing

Issue date: March 2014

Keywords: Food security, informal settlements, Urban, Nairobi, mapping tools

Logos: iied, icddr, dpu

Policy pointers

- Policy makers aiming to increase urban food security and safety should recognize street vendors' important role and support them and their organizations to improve the safety and quality of urban food.**
- Participatory mapping by local organizations in informal settlements reflect on how to expand community-based activities that improve food security.**
- Mapping also reveals opportunities for innovative use of public space and its informal governance, demonstrating a strong role for evidence-led development solutions.**
- However, progress on food security and safety in informal settlements will depend on a foundation of secure housing, land tenure and infrastructure policies.**

Dining with less danger: mapping food and environmental hazards in Mathare, Nairobi

Street vendors play an important role in securing access to food for the residents of low-income settlements in many cities. Yet they are often seen as providing unsafe food and contributing to environmental degradation. In Nairobi, the local federation of the urban poor, Muungano wa Wanavijiji, set out to explore how to improve food safety and work with street vendors and livestock keepers, who are in most cases also local residents. This briefing describes how community-led participatory mapping, including innovative techniques such as balloon mapping, helps create maps that reflect local communities' needs and priorities as well as environmental hazards.

Poor urban households rely largely on the informal sector to buy their food. Processors and vendors are at large informal economies by urban centers, including Nairobi. An important role in securing food for low-income consumers goes largely unrecog- nized by policy makers. In informal settlements, vendors face their food collection activities affect their income and health.

Download the pdf at [http://www.iied.org](#)

Cooking up a storm

Community-led mapping and advocacy with food vendors in Nairobi's informal settlements

Sohel Ahmed, Edwin Simiyu, Grace Githiri, Alice Sverdluk and Shadrack Mbaka

CGIAR RESEARCH PROGRAM ON Agriculture for Nutrition and Health

IMPROVING THE NUTRITION AND HEALTH OF POOR PEOPLE

LED BY IFPRI

Agriculture has made remarkable advances in the past decades, but progress in improving the nutrition and health of poor farmers and consumers in developing countries is lagging behind. The CGIAR research program on Agriculture for Nutrition and Health (AANH) is designed to fill the existing gaps between agricultural development and its unfulfilled health and nutritional benefits. The starting point is that agricultural practices, interventions, and policies can be better adapted and redesigned to maximize health and nutrition benefits and reduce health risks.

RESEARCH COMPONENTS

AANH will accelerate progress in improving the nutrition and health of poor people by exploring and enhancing the synergies between agriculture, nutrition, and health through four key research components:

1. **Improving an environment to improve nutrition along value chains to increase the poor's access to nutritious foods**
2. **Aiming to improve the availability, access, and intake of nutrient-rich, biofortified staple foods for the poor**
3. **Addressing food safety issues along the value chain, including the control of zoonotic diseases to reduce the risk of human diseases**
4. **Addressing the need for integration among the agriculture, nutrition, and health sectors, at both the program and policy levels**

Conceptual framework

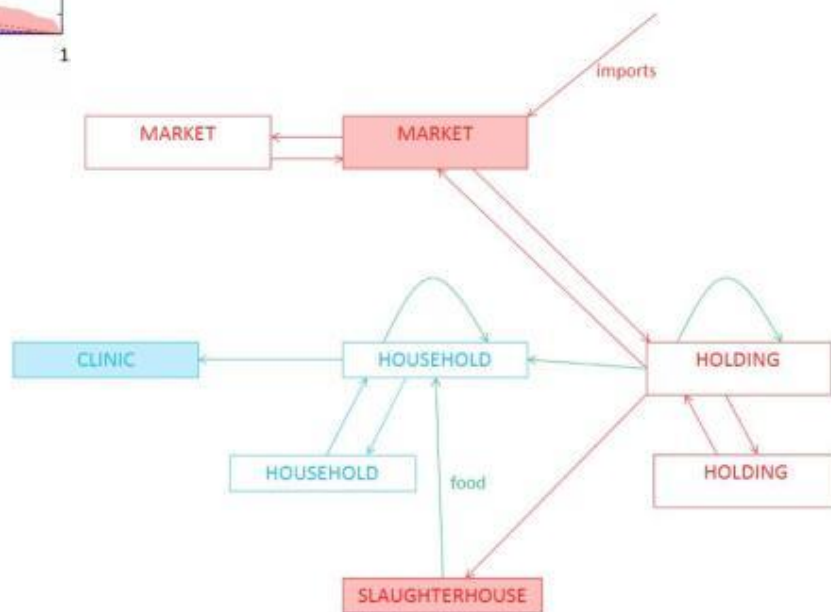
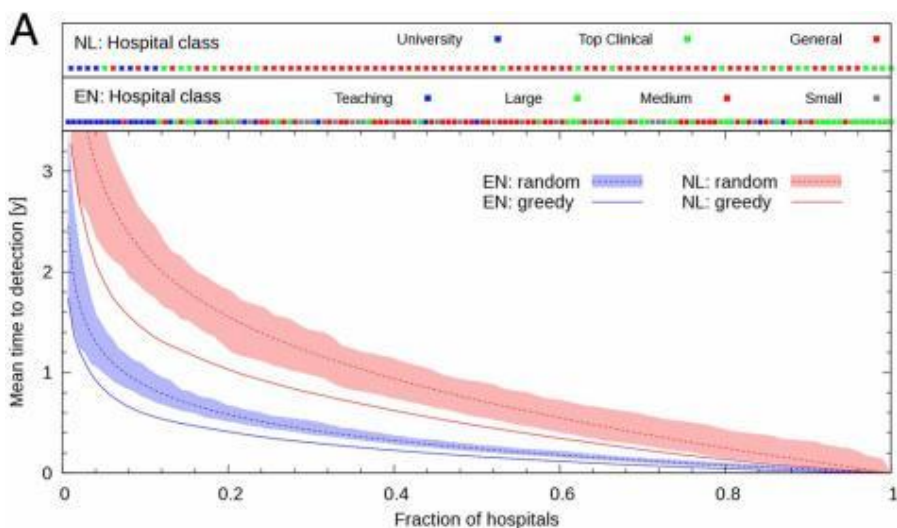
Make poor people suffer from malnutrition and ill health, stunted children and wasted women

Download the pdf at [http://www.aanh.org](#)



Modelling frameworks for optimised surveillance

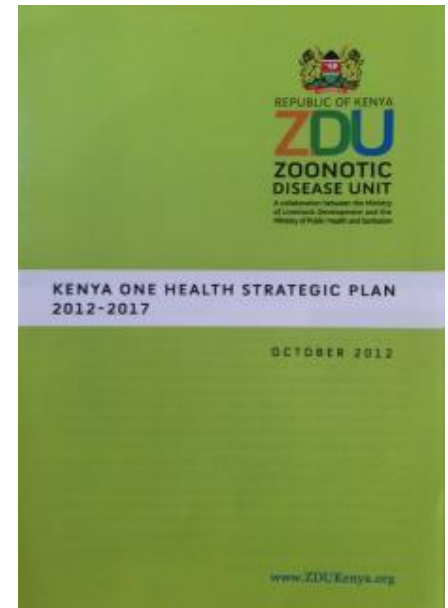
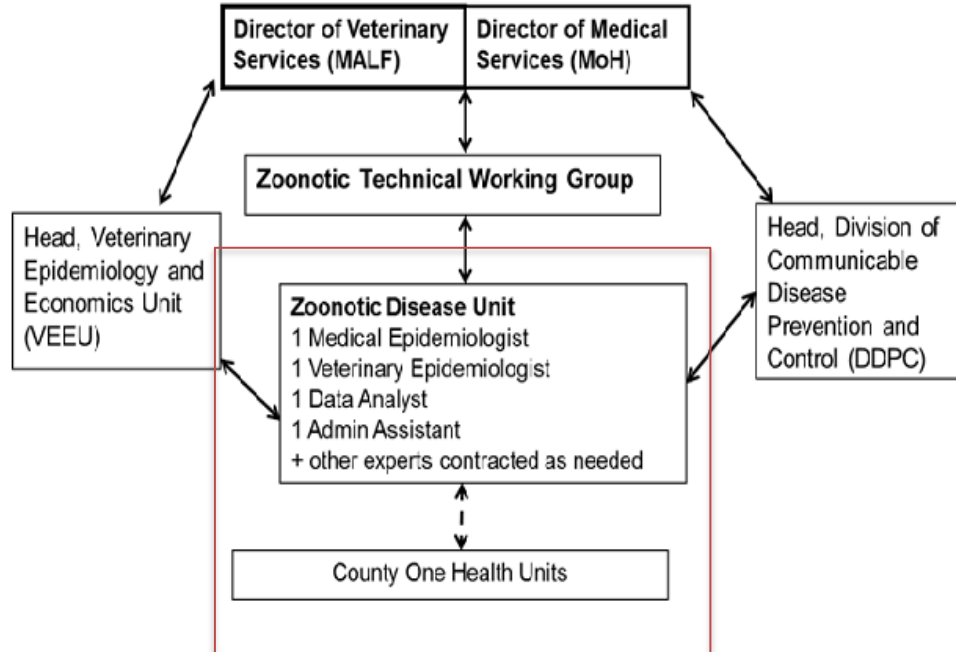
- What are the minimum requirements for routine data?
- Intelligence-driven approach to Identify and quantify risk factors for presence of a zoonotic infection in individuals and the population



Costs of surveillance

Cost and cost benefit of surveillance system

Decision support for local and national government



Fin

Thanks for your attention!

Eric Fèvre

Email: Eric.Fevre@liverpool.ac.uk

Web: www.zoonotic-diseases.org

Twitter: @ZoonoticDisease

Tel (VOIP): +44 151 324 1241

Tel: +254 722 545 345

Institute of Infection and Global Health
University of Liverpool
Leahurst Campus
Neston
CH64 7TE
United Kingdom
UK



International Livestock Research Institute
Old Naivasha Road
Po Box 30709-00100
Nairobi
Kenya

