Healthy people, animals and ecosystems: The role of CGIAR research

Bernard Bett, Veterinary Epidemiologist, ILRI
Jimmy Smith, Director General, ILRI

Regional Conference on Zoonotic Diseases in Eastern Africa
Naivasha, Kenya
9–12 March 2015
Key messages

1 FOOD SECURITY
A key role for developing countries

2 HEALTHY ANIMALS
Food security depends on better animal health

3 HEALTHY PEOPLE
Human health is influenced by diseases endemic in and emerging from animals

4 HEALTHY ECOSYSTEMS
Agriculture impacts ecosystem health
Food Security
Levels of food insecurity in eastern Africa

- 13.3 million people (about 10%) in need of humanitarian assistance

Contributing factors:
- Low productivity of the livestock sector
- Heavy reliance on crop-fed agriculture
- Conflicts
- High levels of poverty

| USD $1/day | 18 – 59% |
| USD $2/day | 49 – 99% |

Source: FEWSNET
Gaps between food supply and demand

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

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

<table>
<thead>
<tr>
<th></th>
<th>Project change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total livestock numbers</td>
<td>1.41%</td>
</tr>
<tr>
<td>Total meat consumption</td>
<td>2.84%</td>
</tr>
<tr>
<td>Total milk production</td>
<td>2.95%</td>
</tr>
</tbody>
</table>

*Source: FAO, 2007*
Food security and sustainability

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
ILRI’s contribution: More meat, milk and fish for and by the poor
Healthy animals and people
Pig farming and zoonotic diseases

- Pig farming – expanding in eastern Africa, particularly in Uganda
  
  Total population rose from 0.19 million to 3.2 million between 1980 – 2008 in the country

- >70% of pigs produced in small holder production systems

- Close interactions between pigs and humans/wildlife
Pigs – reservoirs for many viruses, some zoonotic

30% of pigs sampled had rotavirus, family Reoviridae

Pigs as a potential reservoir for Ebola virus?

Niche map for Ebola

Pig population density

Poverty map

Sampling design

Eliza Smith, BVSc, ILRI/KYEEMA Graduate Fellow
Safe Food Fair Food project

- Risk analysis for food safety/zoonoses along the value chains
- Lots of capacity building – actors/partners
- Launched a book synthesizing the various activities conducted
  https://cgspace.cgiar.org/handle/10568/42438
- Policy briefs

Roesel Kristina, ILRI Uganda
## Multipathogen surveys in dairy value chain - Tanzania

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>% POSITIVE</th>
<th>N</th>
<th>% FARMERS REPORTING DISEASE AS COMMON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q fever</td>
<td>11.2</td>
<td>392</td>
<td>-</td>
</tr>
<tr>
<td>East Coast Fever</td>
<td>31.8</td>
<td>402</td>
<td>37</td>
</tr>
<tr>
<td>Theileriosis</td>
<td>10.2</td>
<td>402</td>
<td>--</td>
</tr>
<tr>
<td>Anaplasmosis</td>
<td>31.6</td>
<td>402</td>
<td>18</td>
</tr>
<tr>
<td>Babesiosis</td>
<td>21.4</td>
<td>402</td>
<td>--</td>
</tr>
<tr>
<td>Brucellosis</td>
<td>11.4</td>
<td>403</td>
<td>0.7</td>
</tr>
<tr>
<td>CBPP</td>
<td>18.1</td>
<td>381</td>
<td>22</td>
</tr>
<tr>
<td>Bovine Respiratory Syncytial Virus</td>
<td>Ŧ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious Bovine Rhinotracheitis</td>
<td>Ŧ</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Bovine Parainfluenza Virus Type 3</td>
<td>Ŧ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bovine Viral Diarrhoea Virus</td>
<td>Ŧ</td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>Neospora</td>
<td>Ŧ</td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

†- Lab work in progress

Silvia Alonso – Scientist, ILRI
Land use change and zoonotic diseases - Kenya

Legend
- Closed trees
- Open trees (65-40% crown cover)
- Very open trees (40-15% crown cover)
- Trees and shrubs savannah
- Open trees on temporarily flooded land

- Open shrubs (65-40% crown cover)
- Very open shrubs (40-15% crown cover)

- Closed herbaceous vegetation on permanently flooded land
- Open to closed herbaceous vegetation on temporarily flooded
- Open to closed herbaceous vegetation

- Irrigated land / Cropland
- Tana River-Waterbodies
- Clouds
- Urban and Rural Setlements

a) 1975  b) 2010

ILRI CGIAR

DDDAC Research team
Mosquito niche values: pastoral, irrigated and riverine ecosystems

Suitability index

Site
Multipathogen surveys – Tana River, Kenya

Sero-prevalences of selected zoonoses by area

- Brucellosis
- Leptospirosis
- Q fever
- West Nile
- Dengue

Multiple infections per subject

- Irrigated area
- Pastoral area
- Riverine ecosystem

ILRI

CGIAR

DDDAC Research team
Irrigation in the ASALs and vector-borne diseases

- Irrigation covers only 6% of the sub-Saharan Africa, compared to 37% of Asia and 17% of Latin America
- Kenya, Tanzania and Zambia – greatest potential to expand irrigation; each offering 100 – 200 thousand ha [WB Report, 2008]
- Implications on VBDs:
  - Standing water - breeding sites
  - Target sites have very high temperatures
  - Pests – rats, birds,
  - Wildlife
Solutions – One Health approach

- Control zoonoses in animal hosts “One Health”
  - Median benefit to cost ratio is 4:1
- Timely response to outbreaks can reduce 90% costs
- Capacities to detect zoonoses

Adapted from IOM (2009)
Solutions: Food safety in developing countries

- Branding & certification of milk vendors in Kenya: led to improved milk safety & saved economy $33 million
- Training Nigerian butchers led to 20% more meat samples meeting standards. It cost $9 per butcher but resulted in savings $780/per butcher per year from reduced cost of illness among consumers
Solutions: Innovations, incentives, capacities and institutions for managing zoonotic diseases

- Develop and test technologies

Novel lateral flow assays for cysticercosis
Solutions:
ILVAC – a global vaccine initiative

Vaccines save lives of animals that both increase food security and reduce poverty

ILVAC – a vaccine platform

- Infectious disease research: basic & applied
- Improved vaccines and diagnostic tools

- Antibody technologies
- Cellular technologies
- Vaccine technologies
- Genomic technologies
- Diagnostic technologies

- African swine fever
- Contagious bovine pleuropneumonia
- East Coast fever
- Peste des petits ruminants
- Rift Valley fever

Private sector
GALVmed
CRPs
NARS
Inter-gov agencies

Consortia for research & product development and capacity development
Healthy ecosystems
Livestock and ecosystem health

- Livestock are a source of greenhouse gases but improving production efficiencies is key to reducing their C footprints.
- Livestock feed can compete with staple crops and biofuels for water and other natural resources but:
  - Pastures can help store carbon.
  - Animals in smallholder systems consume crop wastes and natural pasture, not grain.
- Manure can pollute land and water but is an important source of organic matter for soil fertility.
Addressing GHG inefficiencies in the developing world is an opportunity

GHG per kg of animal protein produced

Herrero et al 2013
Developing countries can mitigate GHG emissions without moving to industrial grain-fed systems:

e.g., through improved efficiencies
(e.g., better feeds and feeding systems)
A global water crisis

- 2 billion people lack access
- Demand is growing; freshwater is getting scarcer
- 70% of total freshwater use is for agriculture, of which 31% is for livestock
Water for feed

30% reduction in water needed for 1 litre of milk by improving sorghum stalk digestibility by 5%
Key messages

1 FOOD SECURITY
A key role for developing countries

2 HEALTHY ANIMALS
Food security depends on better animal health

3 HEALTHY PEOPLE
Human health is influenced by diseases endemic in and emerging from animals

4 HEALTHY ECOSYSTEMS
Agriculture impacts ecosystem health
Key messages

1 FOOD SECURITY
A key role for developing countries

2 HEALTHY ANIMALS
Food security depends on better animal health

3 HEALTHY PEOPLE
Human health is influenced by diseases endemic in and emerging from animals

4 HEALTHY ECOSYSTEMS
Agriculture impacts ecosystem health
Acknowledgements

- Partners
- Funding agencies

Thank you!
Better lives through livestock

ilri.org

ilri.org

Box 30709, Nairobi 00100, Kenya
Phone: + 254 20 422 3000
Fax: +254 20 422 3001
Email: ILRI-Kenya@cgiar.org

Box 5689, Addis Ababa, Ethiopia
Phone: +251 11 617 2000
Fax: +251 11 617 2001
Email: ILRI-Ethiopia@cgiar.org

other offices
China • India • Mali
Mozambique • Nigeria • Tanzania
Thailand • Uganda • Vietnam

The presentation has a Creative Commons licence. You are free to re-use or distribute this work, provided credit is given to ILRI.