The challenge of climate-related infectious livestock diseases in undermining social entrepreneurship development for rural communities

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Presented at a National Museums of Kenya–DAAD high-level forum on climate change and biodiversity

Nairobi, Kenya, 17– 19 July 2013

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Outline

1. Livestock production systems
2. Production constraints
3. Climate change and variability
4. Climate sensitive diseases
5. Disease impacts
6. Prevention/control/coping strategies

Livestock production systems

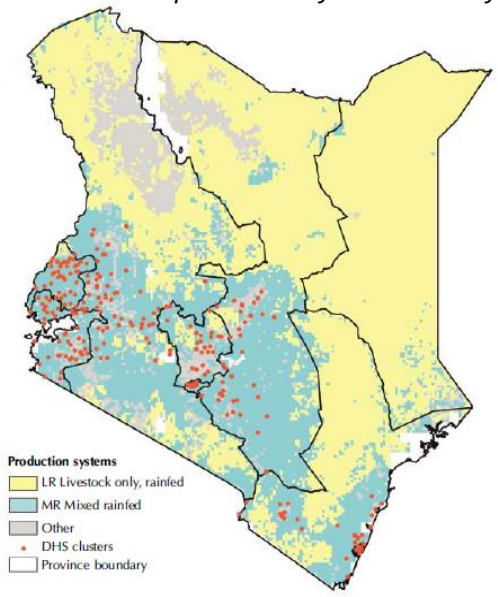
- Livestock contribution to GDP:
  - Revised estimates:
  - 43% (IGAD), 12% (FAO)
- Livestock population

  Cattle (17 m); sheep (17m); goats (27m)

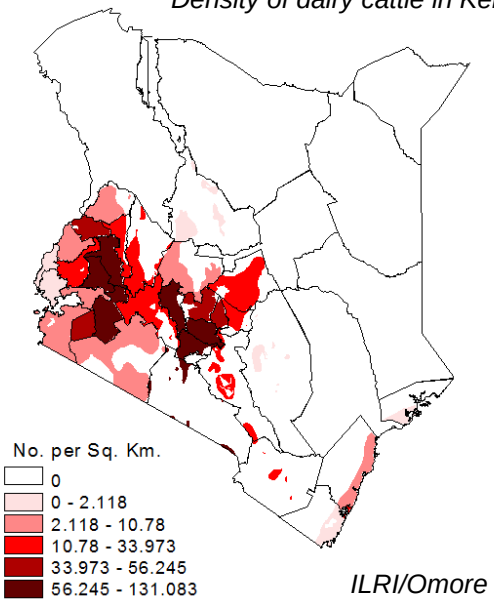
  Camel (3m); donkeys (2m); pigs (300,000)

  Poultry (31m)
- Broad classification of production systems:
  - rangeland livestock
  - mixed crop-livestock
  - landless systems

Livestock production systems in Kenya



Density of dairy cattle in Kenya



ILRI/Omore et al

- Livelihoods

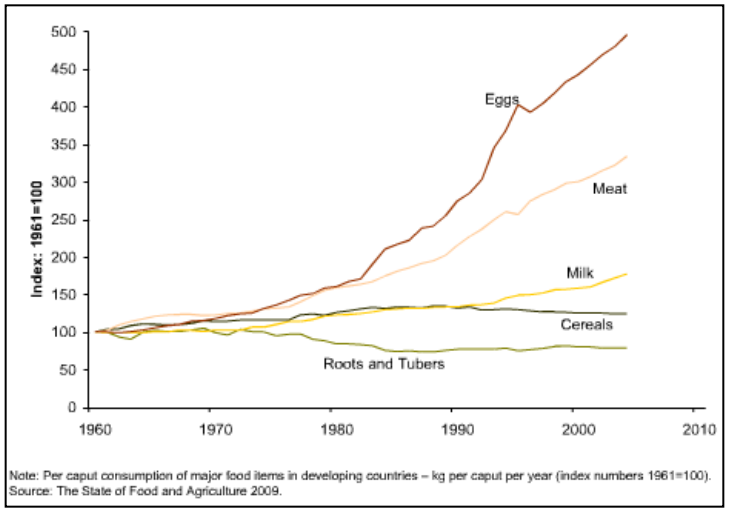
  Livelihoods (milk, meat, manure, draft power, insurance, credit, etc.)

Source: Tsetse Repellent Project , ILRI

- The sub-sector is expanding due to increased demand from:
  - Rising human population
  - Urbanization
  - Income growth

Source: ILRI/Dave Elsworth

- Livestock in the balance:
  - Zoonotic diseases
  - Environmental impacts



Source: FAO, 2009

Production constraints

Technical

- Feed and nutrition
- Breeding
- Health
- Management

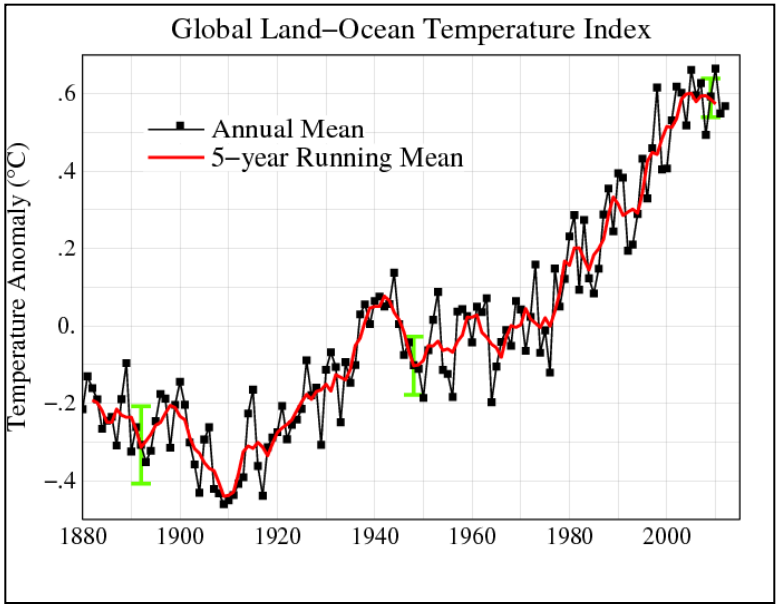
Non-technical

- Socio-economics and institutional factors
- Poor funding
- Land rites
- Producer incentives

Climate change and variability

- Controversies on whether climate is really changing

- IPCC (2007):
  - last century, temp rose by 1.7°F
  - Expected to rise by 1.8 – 5.8°C next 100 years

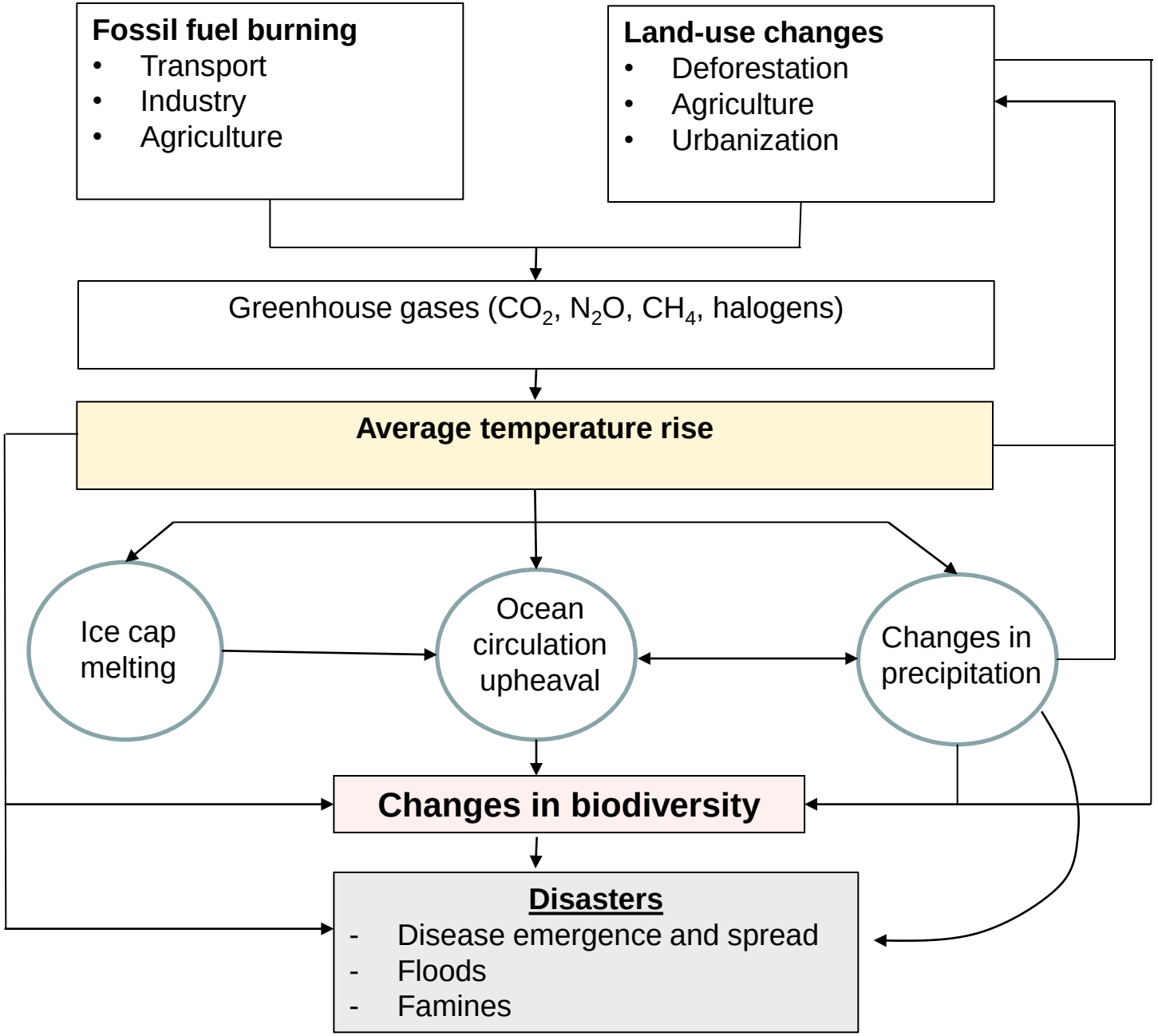


Source: NASA

- Consequences:

Floods, famines, heat waves, changes in distribution of infectious diseases

Dynamics driving climate change



Impact of climate change on livestock production

Water - *reduced quantity*	• Change in quantity and timing of precipitation affects - Dry areas will get drier and wet ones wetter
Feed - *reduced quality and quantity*	• Land use and systems changes • Decline in productivity of rangelands, crops, forages • Quality of plant material deteriorates • Reduced feed intake
Changes in the incidence of infectious diseases	• Changes in the patterns and range of infectious diseases • Loss of disease resistant breeds • Increased heat stress, deterioration of immunity

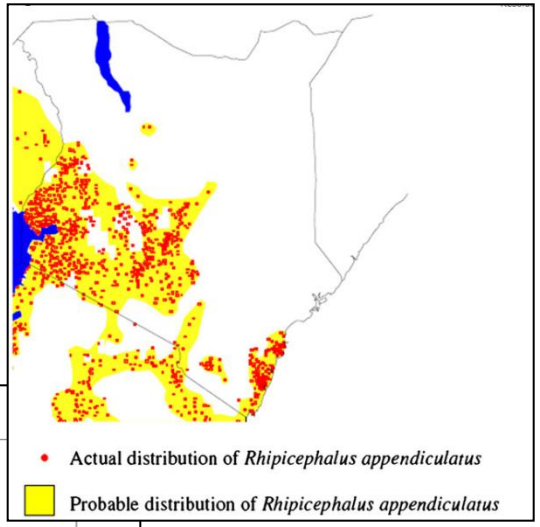
Climate sensitive-diseases

- Vector borne diseases well studied (RVF, tick-borne diseases, tsetse) but other diseases e.g. helminthoses equally important

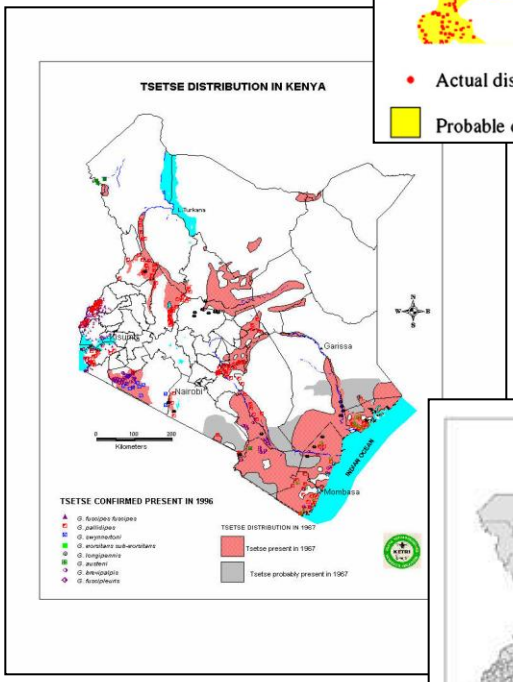
- Mechanisms: Direct or indirect

- Direct
  - Distribution and development rate of vectors
  - Infection probability and development rates of pathogens in vectors
  - Feeding frequency of the vector
  - Heat stress and hosts' resistance

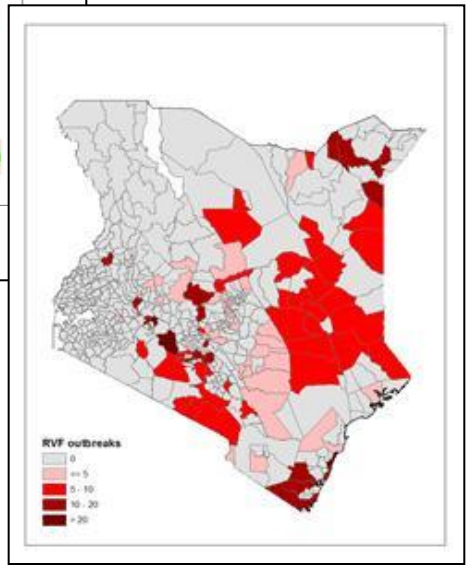
- Indirect:
  - Decline in biodiversity – monocultures of highly productive breeds of animals
  - Land use changes -- irrigation/deforestation
  - Decline in disease regulation at expense of food production



*Rhipicephalus appendiculatus distribution map (***Gachohi et al., 2012**



Tsetse distribution map (KETRI)



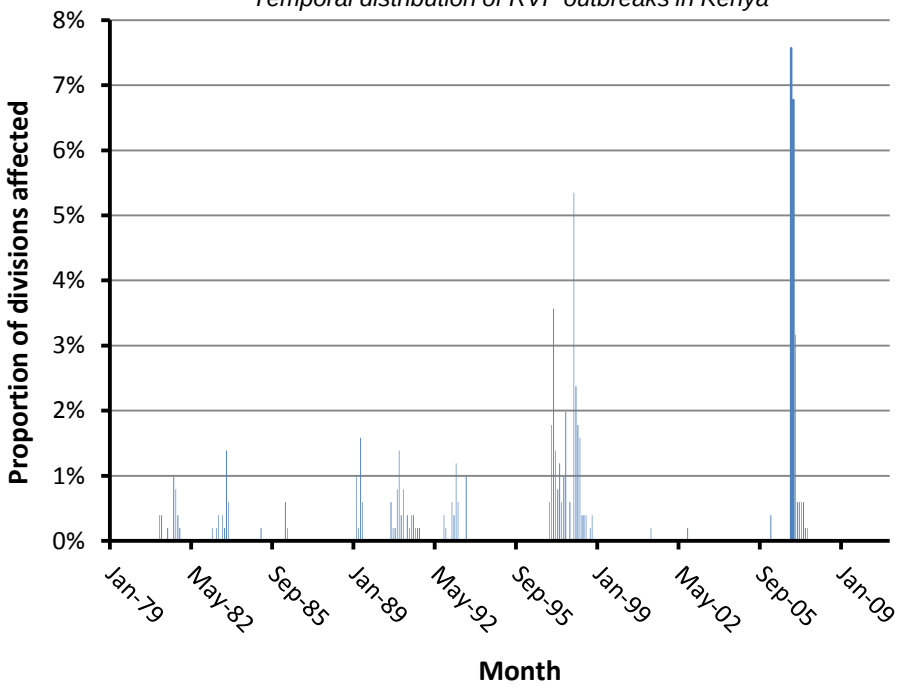
RVF risk map (ILRI)

RVF outbreaks

- Rift Valley fever – mosquito-borne viral disease of sheep, goats, cattle, camels with zoonotic potential
- Outbreaks associated with exceptionally high, persistent rainfall and flooding
- The number of areas reporting outbreaks in Kenya seem to be increasing over time
- The last outbreak 2006-2007 caused losses estimated at KES 2.1 billion

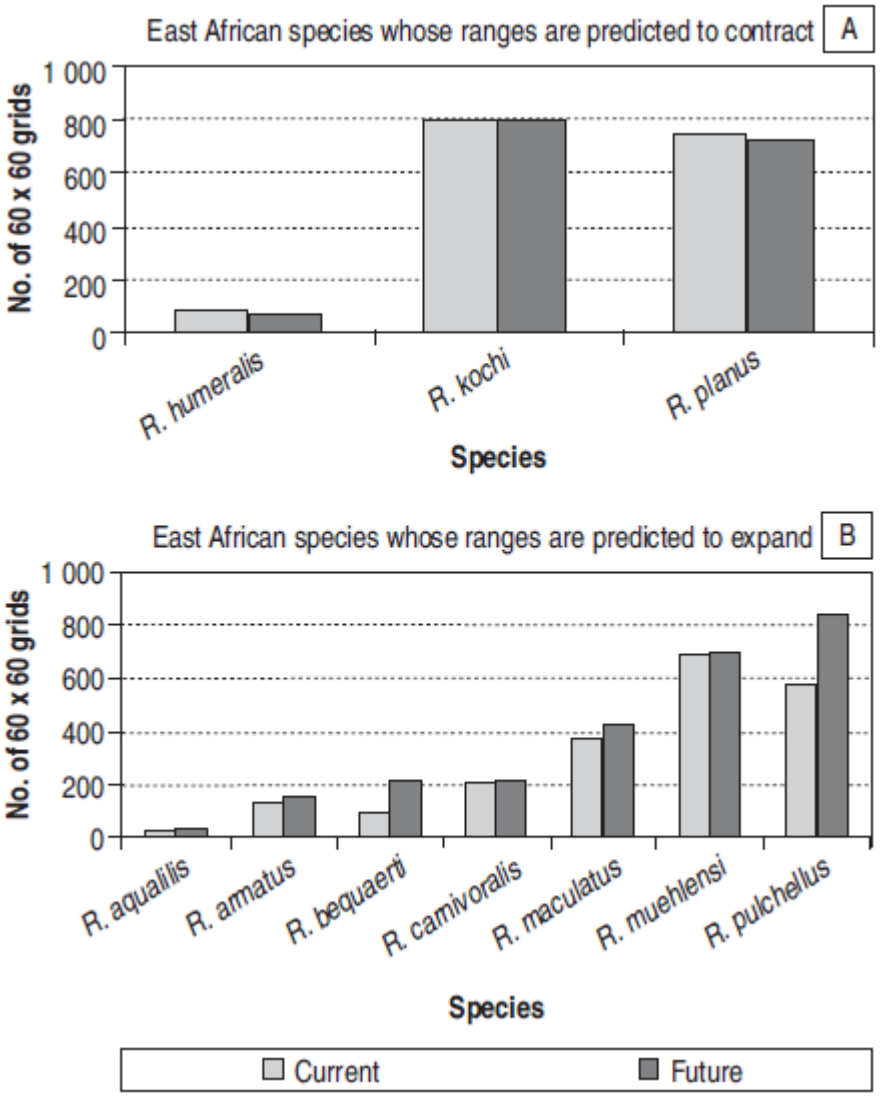
Floods in Ijara during the recent 2006-2007 outbreak (RVF project, ILRI)

Temporal distribution of RVF outbreaks in Kenya



Other diseases

- Models on ticks (Olwoch et al. 2007) show that the most important ticks are likely to expand in geographical range
- These changes unlikely to be affected by reduction in host diversity since ticks are generalists
- Tsetse – likely to see shifts in distribution though the coverage is expected to shrink due to increase in human population
- Helminthoses – effects of temperature less discernible but improved population dynamics of vectors e.g. snails likely to increase rates of transmission



Outputs from ecological niche models (Olwuoch et al., 2007)

Impacts of the diseases on livelihoods

- Morbidity and mortality losses
  - high mortality in young animals and abortions in pregnant animals

    -- *Outbreaks of RVF particularly disrupts livestock demographics*

    -- *East Coast fever – mortality can reach 100% in susceptible, highly productive breeds*

  - Morbidity – poor growth rates, poor milk production

- Treatment costs

  – producers – inefficiency of production

  -- the environment – use of chemicals

- Zoonotic diseases

Prevention/control/coping strategies

- Prediction systems
  - For RVF but with a 2-6 week lead time
  - Risk maps – for targeted surveillance
- Range of interventions
  - Good for tick-borne diseases, helminthoses and trypanosomosis
  - Vaccination seems to be the most practical and widely used method for managing RVF
- Recovery :
  - Producer level – depending on the capacity to cope:
    - (a) diversity of livelihood options
    - (b) Education level
    - (c) other safety nets e.g. credit schemes

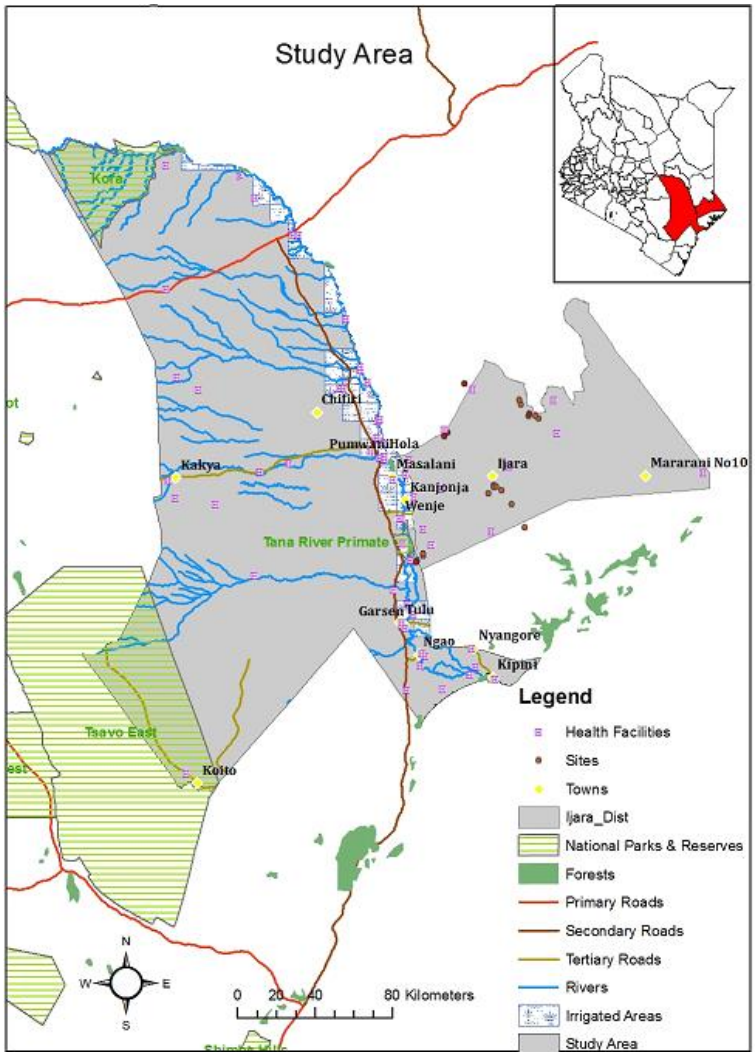
Challenges with the management of climate sensitive diseases

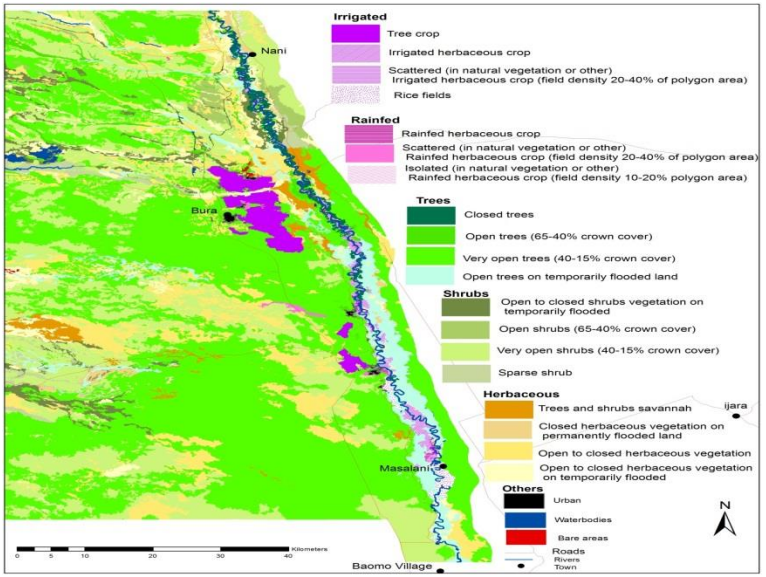
- Multi-host systems
  - Livestock, wildlife, vectors, sometimes people
  - Diversity in the types of hosts involved - good for disease regulation, but there is inadequate understanding on factors that cause disease spill-overs
  - Develop and strengthen multidisciplinary approaches – surveillance, & disease management (one health)

- Convergence of diseases in given landscapes
  - Overlaying the risk maps – areas with multiple disease risks
  - Good for targeting but a challenge for disease management
  - Technologies for controlling multiple diseases e.g. multivalent vaccines, pyrethroids, conservation of disease resistant breeds

- Disease prediction:
  - Satellite data being used widely for disease prediction
  - Challenge: these products overestimate rainfall in dry areas and underestimate in the highlands
  - Lack of understanding on transmission dynamics
  - Build capacity on climate issues and other facets of disease transmission

ILRI's research to link land use and climate change, biodiversity, and disease incidence in Tana River County, Kenya





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A research programme co-funded by DFID, NERC & ESRC and accredited by LWEC
UKaid from the British people
NATURAL ENVIRONMENT RESEARCH COUNCIL
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Acknowledgements

This review falls under the project *Dynamic Drivers of Disease in Africa: Ecosystems, livestock/wildlife, health and wellbeing: REF:NE/J001422/1* partly funded with support from the Ecosystem Services for Poverty Alleviation Programme (ESPA). The ESPA program is funded by the Department for International Development (DFID), the Economic and Social Research Council (ESRC) and the Natural Environment Research Council (NERC). Other funding was provided by CGIAR Research Program Agriculture for Nutrition and Health