Rift Valley fever virus seroprevalence among ruminants and humans in northeast Kenya

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Today's talk

1. An introduction to vector-borne diseases and Rift Valley fever
2. Our project
3. Conclusions

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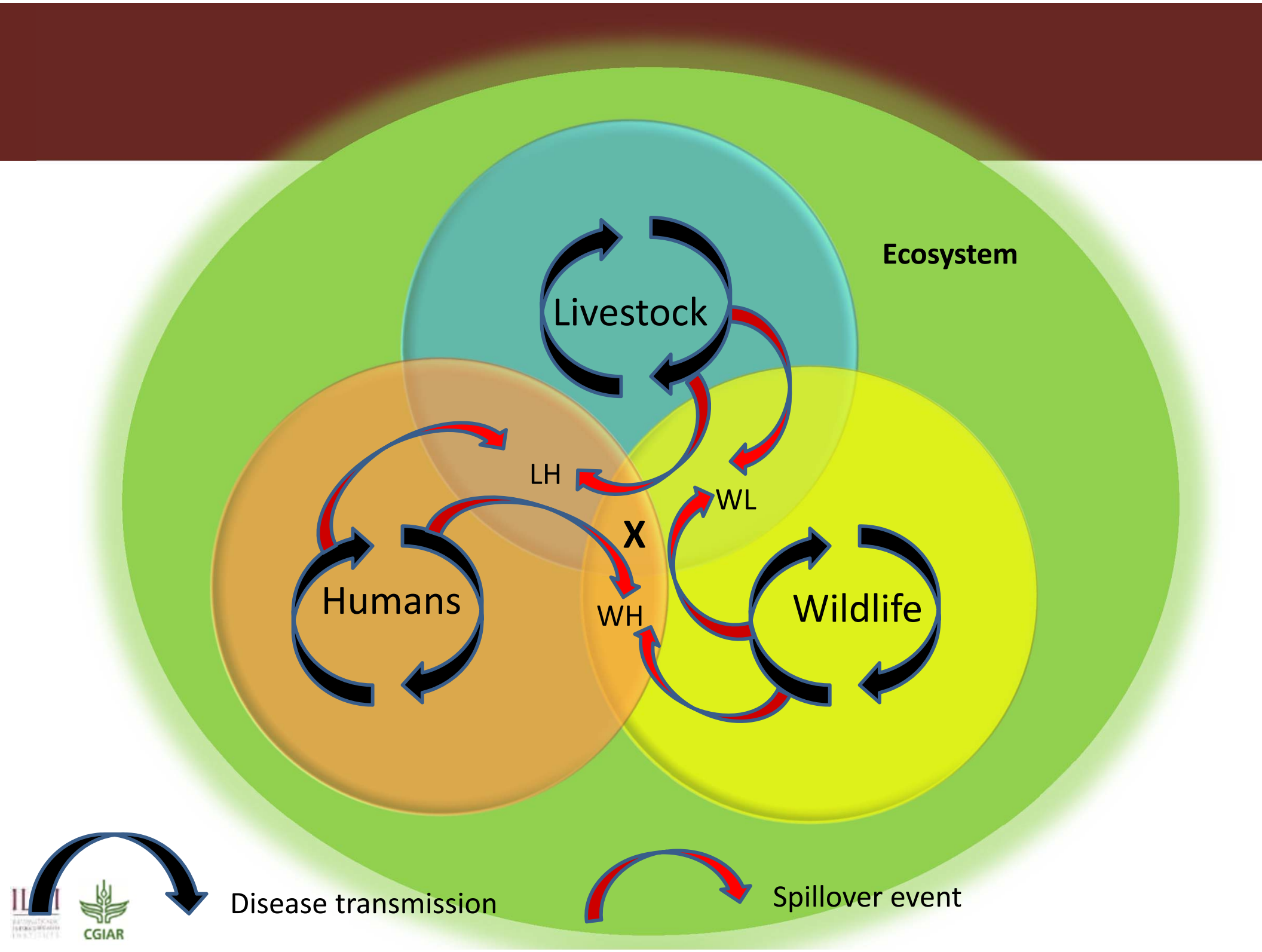
Ecosystem
Livestock
LH
WL
X
Humans
WH
Wildlife
Disease transmission
Spillover event
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Ecosystem services – and disease emergence

Ecosystem service	Importance	Effect of decrease
Provisioning	Economics, livelihoods	Increased poverty
Regulating	Health, environment	Increased disease
Cultural	Well-being, recreation	Increased stress?
Supporting	Basis for the other services	Increase in all above

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Why are vector-borne diseases emerging?

Climate and climate changes
Globalization
Urbanization
Land use changes

Vector capacity and competence

k=	Probability that a vector feeding on an infected host gets infected
P_f=	Probability that a vector survives from one meal to the next
P_e=	Probability that a vector survives the extrinsic incubation period, EIP
Q=	Probability that a vector feeds from the right host – blood index for the host
H_{Br}=	Host biting rate, the number of vectors feeding from an animal per day
v=	Probability of pathogens becoming infectious in the vector
C=	Vector capacity

$$C = H_{Br}\, Qvk\, P_e/(1- P_f)$$

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Rift Valley fever

- Bunyaviridae, phlebovirus
- High mortality, abortions in ruminants
- Haemorrhagic fever, encephalitis in humans

- Arbovirus – but also directly transmitted

Inter-epidemic period

Epidemic

Buffaloes/ungulates

Increased vector populations

Above normal precipitation

Livestock

Humans

Spillover from livestock through vectors or body fluids

Infected eggs waiting in dambos

Hatching of infected mosquitoes

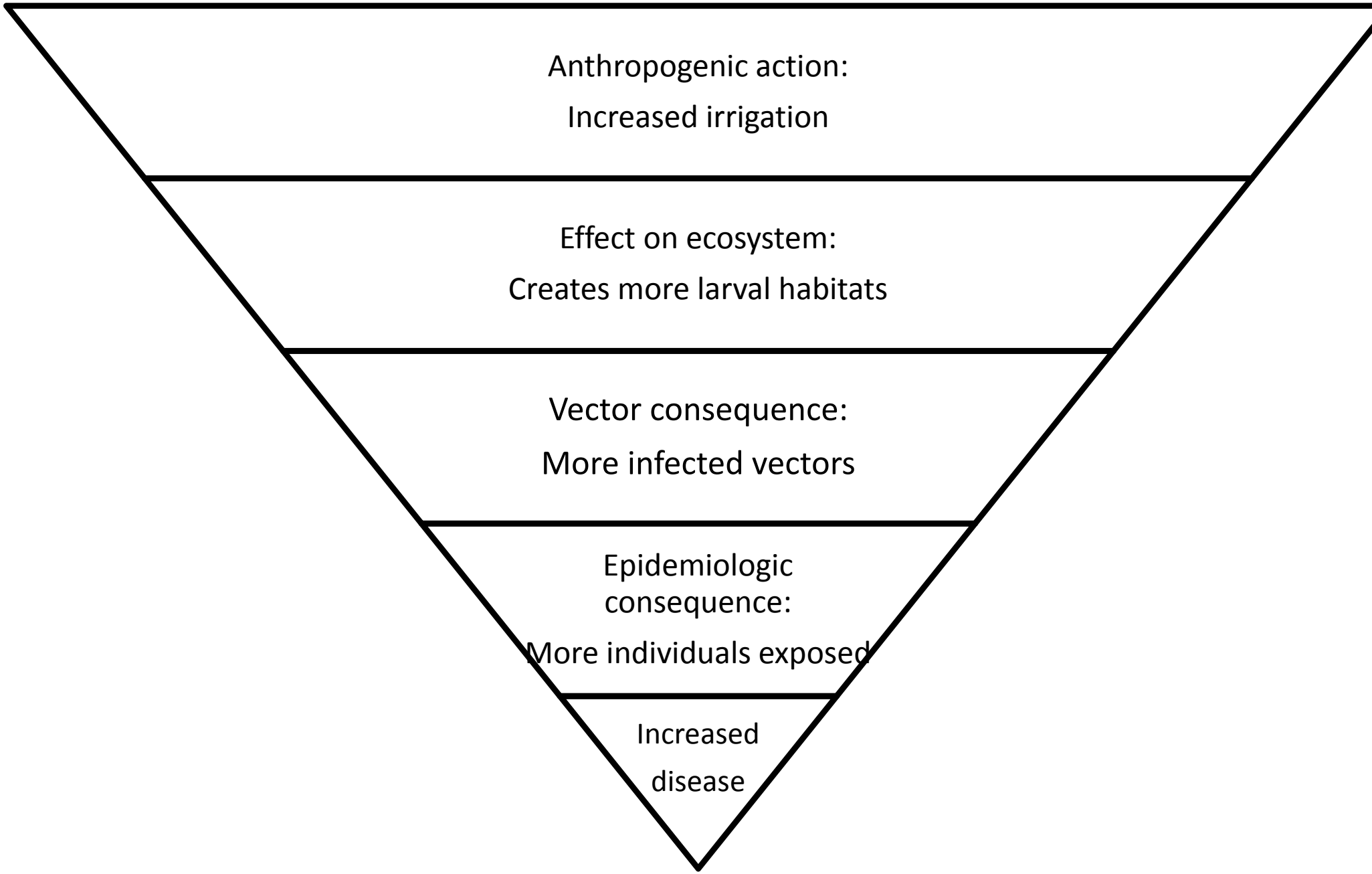
Why irrigation?

More and more range lands in Africa are being converted to crop lands through irrigation to alleviate food insecurity

Results: major trade-offs in ecosystem services

- More food produced (provisioning services) at the expense of biodiversity and regulatory services (disease, flooding, erosion)

Case study- irrigation and disease



Our project

- Rift Valley fever prevalence
  - Humans
  - Ruminants
- Land use changes
  - Protected area vs. irrigated area
  - Pastoralist areas

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Hypothesis

- Irrigation in an arid and semi-arid area increases the risk for Rift Valley fever
- But other diseases can also be affected by this…
- … and the doctors don't know if it is Rift Valley fever

Study site with stagnant water in irrigation canals – source of water for the locals but also breeding grounds for mosquitoes

Study area

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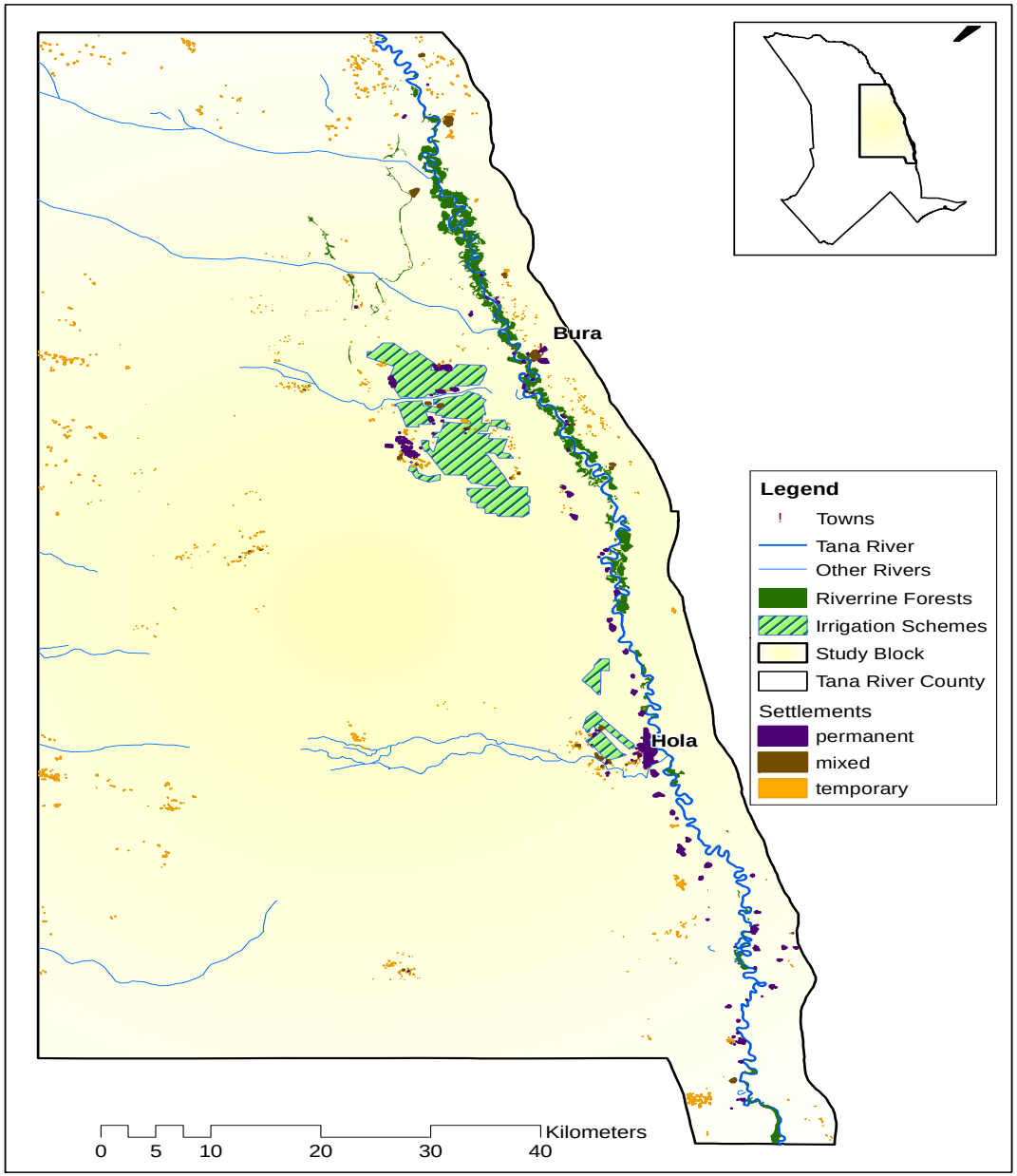
Study site

Tana River and Garissa counties, northeastern Kenya



Land use change

- Making changes in a highly diverse landscape
- Increased number of scavengers
- Increased numbers of mosquitoes



Dynamic drivers of disease in Africa
Case study: Kenya

- Cross-sectional
  - Humans
  - Ruminants
  - Mosquitoes
  - Wildlife
  - Ticks
- Longitudinal
  - Human febrile cases
  - Livestock: shoats
  - Mosquitoes

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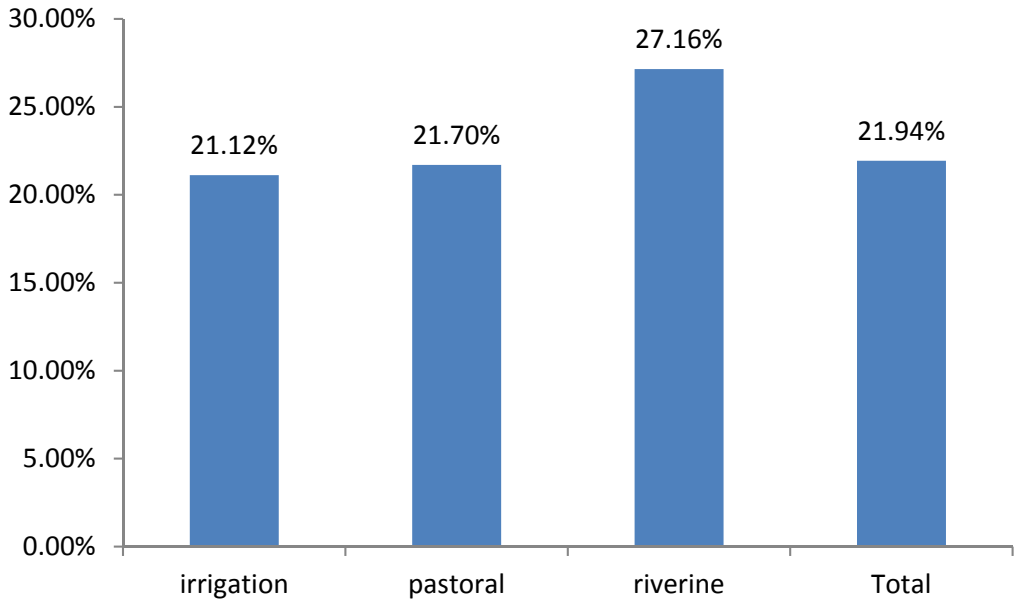
Prevalence in humans

Significantly higher prevalence in men



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Prevalence in ruminants

	Ruminants
Overall seropositivity	25.59%
Young	12.31%
Adults	30.22%
Male	14.81%
Female	28.80%

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RVF-only part of the problem

- Too many differentials: Malaria, RVF, Dengue, YF, *Brucella*, *Leptospira*, Chikungunya, CCHF
- Socioeconomic consequences and factors

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Unwillingness to pay for prevention

How much did you spend last year on the following health protection (Kenyan shilling)?

	Mosquito nets	Vaccines and routine clinic visits for kids	Boiling or other water treatment	Insurance (annual fee)	Other health prevention
Mean	762	254	6.8	0.9	586
Range	0-3150	0-5000	4 households paid between 150-600	220 households paid nothing, one household paid 200	0-6000

How much did you spend last year on the following health prevention for animals?

	Deworming	Vaccinations (to prevent not to treat)	Tick and fly treatments	Insurance (annual fee)
Mean	928	437	599	0
Range	0-11000	0-5000	0-5000	Not existing

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The vicious cycle

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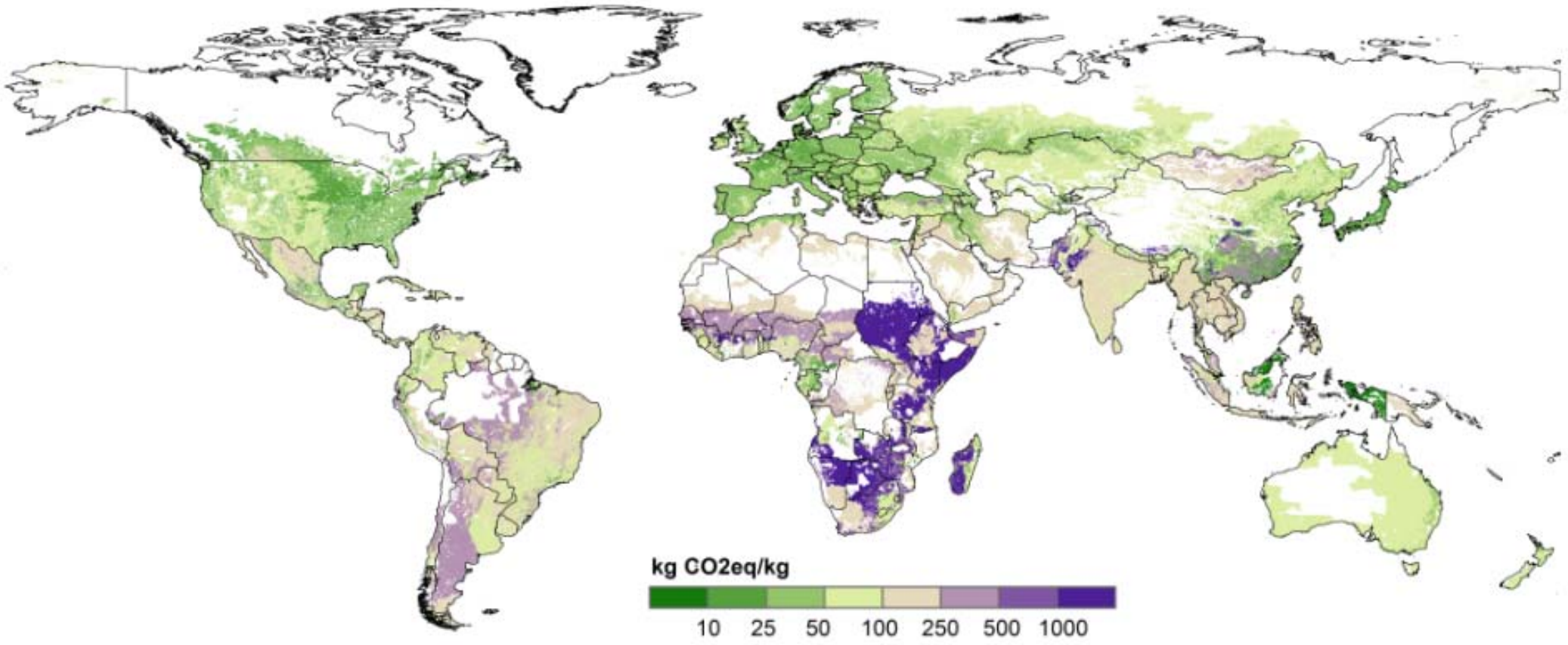
Impact of poor animal health



GHG per kg of animal protein produced

Herrero et al. (2013)

Conclusions

- Land use changes can affect disease occurrence
- Irrigation can sustain inter-epidemic transmission
- More people, more food insecurity and more disease

Acknowledgements

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