FARM D Forum for Agricultural Risk Management in Development

Session 4 – Climate Change: More Bugs, More Diseases?

Presentation by Peter Ithondeka, Veterinary Services, Republic of Kenya

FARM D Forum for Agricultural Risk Management in Development

Animal Pests and Diseases in Sub Saharan Africa

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Dr Peter Maina Ithondeka PhD, MBS

Introduction

Climate and environment are major factors in determining:

1. Geographic and temporal distribution of bugs ;
2. Characteristics of (bugs) arthropod life cycles;
3. Dispersal patterns of associated pathogens (arboviruses, parasites, protozoa, bacteria and rikettsiea);
4. Evolution of pathogens eg in virulence;
5. Efficiency of transmission from arthropods to vertebrate hosts.

Transmission

- Survival in the environment is the result of an adaptation of bugs that largely determines how it is transmitted.
- Transmission through direct contact, or through other ways such as, (air, water, feces, body fluids, food, or formites).
- Vector borne transmission needs the participation of other living organisms, so-called vectors, in which the pathogen is equally propagated.
- Vectors are often blood-sucking insects
- Spread by inoculating the infectious pathogen(bugs) through their bites
- Bugs preferably use a single transmission route, but bugs may use more than one route.

Colonization of new areas by pests

- Diseases with trends that depict that they are becoming more rampant due to climate change among others include
- Q-Fever, blue-tongue, West Nile Virus Fever, Dugbe Virus (DUGV), Nairobi sheep disease virus (NSDV), African horse sickness, African swine fever, bovine schistosomiasis
- Colonization of new areas by pests in terms of extended upper altitude limits

Trans-boundary diseases (TADS)

- Persistence of Trans-boundary diseases (TADS) in Sub-Sahara Africa;
- Most important TADS in Sub-saharan Africa include for sheep and goats
  i. Pestis de petit ruminaire
  ii. Sheep and goat pox
  iii. Contagious caprine pleuro-pneumonia
  iv. Blue tongue

Trans-boundary diseases (TADS) (2)

Diseases of Cattle

i. Foot and Mouth
ii. Contagious bovine pleuro-pnumonia
iii. Brucellosis

Diseases of camels

Brucellosis

Vector borne diseases

Ticks in spread of protozoa and rikettsiae

Cattle

- East coast fever
- Anaplasmosis
- Heartwater
- Q fever
- Trypanosomiasis

Sheep and goats

Nairobi sheep disease

Mosquitos and culicoides viral diseases

- Rift valley fever for cattle, sheep, goats, camels and man

Vector borne diseases (2)

Diseases of Pigs

i. African swine fever

Diseases of Camels

i. Trypanosomiasis

Vertebrate vectors

- Rabies which is caused by a virus - requiring a vertebrate vector in transmission

Which commodities/animals are more or less prone to pest and diseases?

- Genetics demands importation yet there are risks,
- life vaccines with potential to revert to virulence and revert to disease,
- animals themselves, meat and milk and hides and bee diseases
- Effect on crops as a result of bee diseases

To the human population result in food security concerns

Causal links

- Hypothesized cause-effect relationships between climactic/environmental factors and disease events?
- Do observed statistical associations between exposure and disease represent a cause-effect relationship? **Yes**
- Rift Valley Fever outbreaks positively correlated with El Niño events.
- Can this causal relationship be of practical effect in mitigating against outbreaks, human mortality and livestock losses?
- **Yes but requires improvement in predictive value.**

Causal links

"The ability to forecast regional RVF virus activity… based on Pacific & Indian Ocean SST anomalies & NDVI, 2 to 5 months before outbreaks could permit vaccination of domestic animals and pretreatment of mosquito habitats adjacent to domestic animal herds and human habitations with highly effective sustained release insecticides that would be released upon flooding", (Linchman, 1999).

Climactic Drought Events

- A proper audit and risk based assessment of the effects of climate change on livestock diseases is pending.
- Current observations indicate an increasingly shorter perennial drought cycle with droughts becoming more frequent and intense.
- In traditional extensive pastoral production systems, shortage of pasture and water forces livestock to move into non-traditional rangeland where they are poorly adopted to circulating parasites causing increased infections,
- new unfamiliar poisonous plants and deaths.
- E.g. movement of camels into higher altitude non traditional ranging areas exposes them to heavy tsetse, trypanosomosis and mange challenge.

Climactic Drought Events

- Increase in livestock numbers especially in the arid and semi arid areas places pressure on dwindling pasture and water resources.
- Traditional husbandry, range & pasture management practices have led to increased and uncontrolled movement of animals during perennial drought cycles.
- This results in increased in communicable disease outbreaks and losses from deaths arising from starvation.

Threat to Biodiversity

- Climate change threatens the rich biodiversity of the continent's natural resources, in particular the rich flora and fauna that are among the most valuable natural assets.
- Species loss has been observed, while in some places, the number of indigenous and important species has tremendously dwindled.
- Overexploitation of Natural Resources & overgrazing and invasive species.

Invasive Species

- Alarming invasive proliferation and spread of *Prosopis* species (mesquite) introduced in Northern Kenya in the ‘80s.
- Has spread over large swathes of territory and is now visibly conspicuous as a green canopy in previously bare areas.
- Prosopis competes with desired pasture grass species for water, light, and nutrients thus reducing the worth of previously rich rangeland.

Invasive Species

- *Prosopis* has eliminated grass species that have previously provided forage for livestock.
- The thorny barbs of the tree's foliage render heavily infested areas impassable and therefore inaccessible for grazing thus imposing restrictions on pastoral activities.
- *Prosopis* thickets have cut off access roads forcing people and vehicles to make long detours to reach intended destinations.
- Livestock now more concentrated in limited ranging acreage available with concomitant increase in disease burden (helminths, FMD).

Invasive Species

- *Prosopis* encroachment impacts negatively on seasonal river systems & waterways.
- Causes drying off of water wells that are the only source of water for humans and livestock.
- Disrupts seasonal migratory movement patterns.
- Inflicts a heavy toll in terms of livestock epidemic disease outbreaks and environmental degradation.

What can be done to overcome the challenge?

- The advent of globalization and free movement of people, animals and products substantially
- Movement is faster than average incubation period
- raises the risk of introduction and spread of novel animal diseases into naïve livestock populations.
- The pressure to import new animals to improve genetics and reproductive performance creates a necessary risk of introduction of novel pathogens (haemorrhagic virus disease of rabbits,

What can be done to overcome the challenge? (2)

- low global investment into research and development of new drugs and products
- some of the disease of livestock prevailing in the less developed world as pharmaceutical concerns do not discern this markets as profitable.
- Imperils future control of diseases like trypanosomosis as the drugs that are currently available are rendered ineffective by continuous adaptation by parasites and development of resistance.
- Drug misuse due to weak prescribing mechanisms can lead to the presence of undesirable residues in food products of animal origin and also contributes to the development of microbial resistance.

What can be done to overcome the challenge? (3)

- import sanitary controls at official ports of entry
- compliance with international movement requirements to minimize the risk of introduction and spread of disease.
- Passive surveillance and active, husbandry practises, biosecurity measures,
- lobby for research and development for like ECF vaccination by GALVMED (bill and Melinda gates foundation)

Projected Disease Trends

- Future endemicity of diseases that are currently only sporadic:
- Ebola haemorrhagic virus?
- Heightened incidence and geographic spread of other arboviruses of veterinary and public health importance including Q-Fever, blue-tongue, West Nile Virus Fever, Dugbe Virus (DUGV), Nairobi sheep disease virus (NSDV), African horse sickness, African swine fever, bovine schistosomiasis, bovine petechial fever, heartwater.
- Unexpected but successful establishment of Chikungunya fever in northern Italy,
- Sudden appearance of West Nile virus in North America
- Increasing frequency of Rift Valley fever epidemics in the Arabian Peninsula,
- Recent emergence of Bluetongue virus in northern Europe.

Projected Disease Trends

- Shortened cyclicity of RVF outbreaks- In Kenya, the outbreaks show a trend of reduced inter-epidemicity from ten (10) years to lesser than five (years).
- Human to human transmission with explosive urban epidemics?
- The inadvertent introduction and spread of diseases through reversion to virulence in animals vaccinated with live inactivate vaccines?

Projected Disease Trends

- Development of ticks resistance to acarides and spread of ticks, culicoides and midges into previously uninfested areas .

- No new molecules for control for vectors and parasites
- (conventional vet practise in Africa has used the same molecules for over 3 decades)

Disease Control Options

- Improve animals' immunity to infectious agents through vaccination with newer more expensive sub unit vaccines;
- Lower exposure of susceptible animals to infectious animals through movement controls and quarantine;
- Enhanced public education and awareness campaigns;
- Development of disease contingency plans for outbreaks response and control (ongoing R & D for African Swine Fever vaccine and development of Africa-wide strategic plan through AU-IBAR).
- Application of strict sanitary import controls on animals and animal products in line with WTO/OIE SPS guidelines and recommendations.

Critical Gaps

- Inadequate spatially dynamic models capable of simulating the response of diseases e.g. RVF, Tryps. & West Nile Fever on changes in environment.
- Role of vectors usually left out while making decisions on management and control of animal diseases.
- Limited capacity in terms of vector and animal disease laboratories for rapid and effective diagnosis.
- Capacity building mitigation and interventions and managing risks in face of climate change.
- Inadequate data base on the trend of livestock diseases and vectors for the past and current scenario.

Thank you!

References

1. **Linthicum, *et al*** "Climate and Satellite Indicators to Forecast Rift Valley Fever Epidemics in Kenya" *Science 285, 397 (1999)*

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