TDR-IDRC RESEARCH INITIATIVE ON VECTOR BORNE DISEASES IN THE CONTEXT OF CLIMATE CHANGE

FINDINGS FOR POLICY MAKERS

TRYPANOSOMIASIS IN TANZANIA

Predicting vulnerability and improving resilience of Maasai communities to vector-borne infections

THE DISEASE: Trypanosomiasis

The Problem

The pastoralists of the Maasai Steppe are vulnerable to zoonotic diseases, such as trypanosomiasis, because they live with their cattle close to large wildlife populations. These can act as reservoirs of infection, and compete for access to water and food. This vulnerability is exacerbated by social and environmental factors such as land use and climate change.

Climate change effects (seasonality) on tsetse fly abundance and trypanosome infection rates information is limited. Lack of this information renders trypanosomiasis control strategies ineffective. Assessing the relative influence of climate, land use change and host availability on the distribution and abundance of trypanosomiasis vectors will improve resilience in the Maasai steppe to the risks and impact of infection and develop capacity in transdisciplinary research associated with vector-borne diseases and climate prediction.

This 3-year innovative research conducted in Tanzania has shed light on how to help communities adapt to the devastating effects of climate change and unexpected weather patterns.

About the project

This policy brief forms part of the research project on *Predicting vulnerability and improving resilience of Maasai communities to vector-borne infections: an Ecohealth approach in the Maasai Steppe ecosystem*.

This programme is implemented by TDR-WHO, with funding support from the International Development Research Centre (IDRC) and in technical collaboration with WHO's Department of Public Health and Environment (WHO-PHE), WHO's Regional Office for Africa (WHO-AFRO), and the International Research Institute for Climate and Society (IRI), Columbia University, New York, USA.

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Summary of available evidence to address the policy problem

Trypanosomiasis continues to cause wide socioeconomic impacts, increasing health inequities, and acting as a brake on socioeconomic development, particularly in pastoral systems in northern Tanzania. The disease has long been a significant issue to the pastoralists in the Maasai steppe and the burden of the disease is expected to increase as a result of climate and land use changes. The disease effects are an increasing problem in the Maasai Steppe ecosystem due to the ecologies that include large wildlife populations that act as a reservoir of trypanosome infections. Agricultural encroachment and changes in water availability are forcing the Maasai to change movement patterns for their livestock as they search for water and pasture. These changes in their lifestyle make the Maasai and their livestock more vulnerable to infection from trypanosomiasis.

Our study took a multi-pronged approach to examine the dynamics of tsetse fly abundance, trypanosome prevalence and factors affecting vulnerability to trypanosomiasis in semi-arid pastoral socio-ecological systems of Simanjiro and Monduli districts under the strain of changing climate and land use regimes. Our research approach combined extensive ecological and social field research with molecular identification of trypanosome species, and statistical and distribution modeling to understand drivers of disease dynamics and likely future scenarios.

We showed that trypanosomiasis, as a neglected tropical disease, is not only a disease of public health concern, but it exacerbates economic hardships due to loss of livestock or through additional costs needed to control and treat the disease. Maasai in particular rely on cattle to meet economic and nutritional needs, and morbidity and mortality of livestock as the result of disease can have major impacts on human health and livelihoods.

Our research used a multi-disciplinary ecohealth approach to understand changing adaptation strategies and vulnerability, as well as drivers to tsetse and trypanosome distribution, to help communities and supporting agencies better adapt to disease risk and burden. In doing so, we filled notable gaps in knowledge related to seasonality of infections, habitat and host species impacts on abundance and prevalence, and how vector infections may translate to livestock infections. Additionally, we identified factors leading to vulnerability throughout our study areas and predicted where future hotspots of infection are likely to occur. Notably, the communities were partners in the research, an approach which had not previously been practiced in Maasai communities. Availability of a policy for vectors and vector borne diseases (VBD) in pastoral communities will enhance research impacts and community engagement in control programmes.

RESEARCH APPROACHES INCLUDE:

Modeling temperature and precipitation patterns in East Africa

Modeling land-use and land cover

Vector distribution and infection prevalence measurement

Vector density and location predictions

Collecting confidential data on the views and responses of Maasai people to VBDs

Working with Maasai communities to raise awareness of risks, and develop adaptive strategies

Policy options

Trypanosomiasis is an endemic and yet neglected disease of humans (sleeping sickness) and animals. The term "neglected" highlights that the disease affects mainly poor and marginalized populations in low-resource settings. It is transmitted by tsetse flies from reservoir animals (wildlife) to livestock and humans. There are multiple trypanosome parasite species transmitted by tsetse flies (*T. congolense, T. vivax, T. brucei*, etc) but only *T. brucei rhodensiense* is infective to humans in eastern and central Africa. Management of the disease requires integrated approaches to control both the vector and the infections. Proper addressing of this disease requires collaborative, cross-sectoral efforts of human and animal health systems and a multidisciplinary approach that considers the complexities of the interface ecosystems where humans and animals coexist. Some of the challenges for controlling trypanosomiasis in humans and livestock in remote pastoral areas of the Maasai steppe of Tanzania include the following:

1. Lack of epidemiological data showing distribution of tsetse flies and disease cases in human–animal–ecosystems interface areas with high concentration of wildlife (infection reservoirs);
2. Low level of community engagement for awareness creation among Maasai people, who usually have poor perception of HAT despite their high awareness of the disease (AAT) in their cattle;
3. Low diagnostic capability and poor facilities for accurate identification of etiologies of febrile illnesses in primary health centers in vulnerable areas, where all fevers are treated by default, as malaria cases;
4. Low levels of funding for research addressing neglected tropical diseases, such as trypanosomiasis;
5. People affected often live in remote rural areas with poor communication infrastructure such as roads, and limited access to diagnosis and treatment;
6. Government willingness to enhance trypanosomiasis control by combining expertise in vector and disease research with cross-cutting issues such as surveillance, capacity building and advocacy.

Implementation considerations

The following policy implementation considerations were presented during a policy dialogue involving key stakeholders in Tanzania in March 2017.

The majority of pastoralists have knowledge on Animal African Trypanosomiasis (AAT) but not Human African Trypanosomiasis (HAT).

COMMUNITY AWARENESS ON AFRICAN TRYPANOSOMIASIS

Majority of pastoralists have knowledge on Animal African Trypanosomiasis (AAT) but not Human African Trypanosomiasis (HAT). There is need to provide guidance on how communities living in interface ecosystem areas can increase resilience to trypanosomiasis under changing climate and land cover. This will allow easy engagement of communities in vector and disease control programmes.

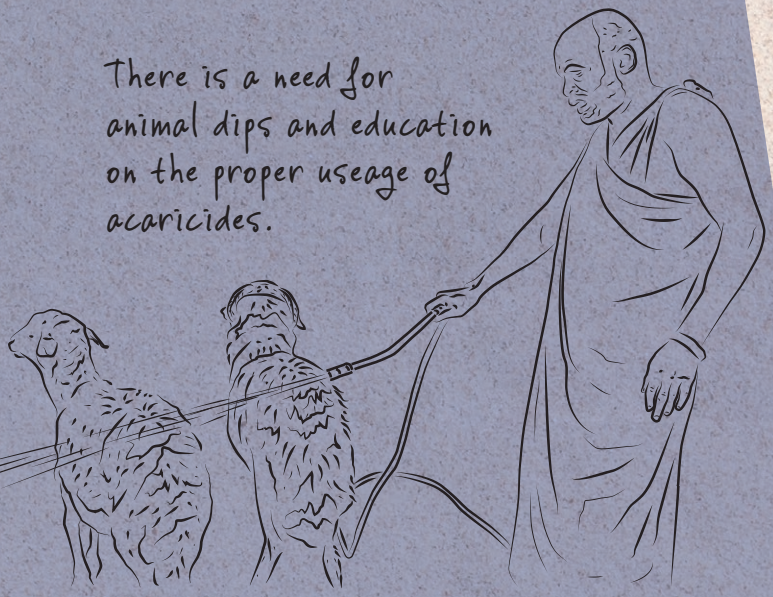
Land should be demarcated for agriculture, pasture and protected areas.

OPTIMAL LAND USE PLAN FOR PASTORAL AREAS

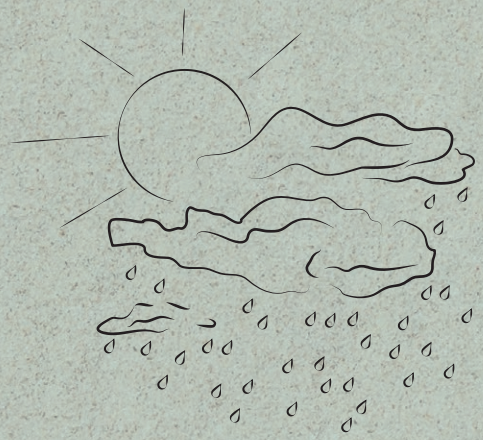
High interaction of wildlife, livestock and humans in the Maasai steppe increases abundance of disease vectors (tsetse flies and others) and hence vulnerability to vector borne diseases. This calls for proper mitigation efforts to demarcate land for agriculture, pasture and protected areas. This will lessen uncontrolled livestock movement and allow appropriate improvement programmes.

INTEGRATED VECTOR CONTROL

Infrastructures for vector control will be a critical component for sustainable integrated control programmes. This should include animal dips and qualified personnel. Educational programmes to train communities on proper usage of acaricides/drugs and knowledge of acaricide/drug resistance will be a vital component of this component. This consideration will also contribute to reduction of risks associated with chemical pollution of the environment and unwanted development of acaricide resistance in ticks and other disease-transmitting vectors.



There is a need for animal dips and education on the proper useage of acaricides.



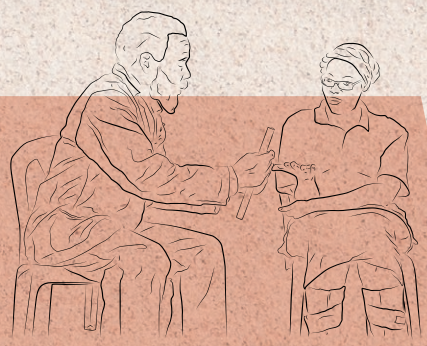
Improved climate data will allow implementation of early warning systems.

AVAILABILITY AND ACCESS OF CLIMATE-RELATED DATA

It is important to enhance the quantity and quality of meteorological data as well as their access by researchers. Improved climate data will allow implementation of early warning systems and community adaptation to multiple stressors, including climate-sensitive vector-borne diseases. Sustainable vector and disease control will also require reliable climate data for proper planning of current and future programmes.

IMPROVING RESILIENCE OF THE MAASAI PEOPLE TO VECTOR BORNE DISEASES

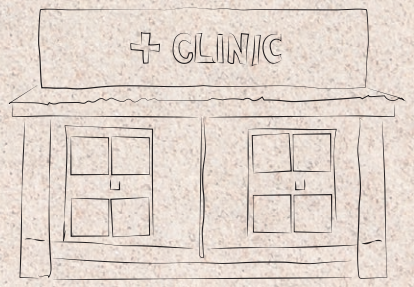
Often, pastoralists (6.75%) use herbs to treat their cattle infected with trypanosomes. However, treatment success is limited by dependence on individual knowledge and own instincts. The indigenous methods could be improved by partnering with researchers to look into medicinal components of the plants and help them identify useful herbs with trypanocidal activity.



Joint efforts between community, government and researchers and an eco-health partnership will enhance strategies to reduce burden and risks of trypanosomiasis.

ACCESS TO DIAGNOSTIC SERVICES AND TREATMENT FOR HAT

The Maasai pastoralists in northern Tanzania are particularly vulnerable to the combined effects of climate change and zoonotic diseases because they live in remote rural areas close to large wildlife populations that act as reser-voirs of infection. They are therefore exposed to tsetse flies and the disease, HAT. Although our study did not reveal presence of human infective trypanosomes (*T. b. rhodensiense*) in sampled tsetse flies or cattle, blood meal analysis revealed presence of human DNA, which confirms exposure of humans to tsetse bites. With environmental changes, parasite trends can be unpredictable and hence HAT can potentially re-emerge. It is therefore important to institute surveillance especially in human-animal interface areas.



Former health centres should be revived, and new ones established in vulnerable areas for diagnosis and treatment of HAT.

Key messages

1. African trypanosomiasis remains to be a disease of public health importance affecting animals and humans in the Maasai steppe of Tanzania.
2. Majority of pastoralists in northern Tanzania are aware of Animal African Trypanosomiasis (AAT) but have poor knowledge of Human African Trypanosomiasis (HAT).
3. Climate (season) is a major driver for abundance of tsetse flies and their infection rates.
4. Habitats, vegetation greenness (NDVI), host availability and distance from the national park are strong predictors of tsetse abundance and infection rates.
5. Tsetse infection rates trend to be associated with host seasonal grazing patterns.
6. No human-infective trypanosomes were found in the study area. However, due to presence of reservoirs and anthropo-zoonotic feeding behaviour of tsetse flies we cannot negate vulnerability of Maasai communities to Trypanosomiasis. With changing environment, Human African Trypanosomiasis can potentially re-emerge, and hence it is important to institute surveillance, especially in human-animal interface areas.

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