



RESEARCH UPDATE

SITUATION ANALYSIS ZAMBIA

The Dynamic Drivers of Disease in Africa Consortium is an ESPA¹-funded research programme designed to deliver much-needed, cutting-edge science on the relationships between ecosystems, zoonoses, health and wellbeing with the objective of moving people out of poverty and promoting social justice. This document offers a research update on the Consortium case study exploring the drivers of trypanosomiasis in Zambia.



Photo: Catherine Holley

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INTRODUCTION

Trypanosomiasis is a disease caused by blood parasites of the genus *Trypanosoma* which affects both animals and humans. It is transmitted by tsetse flies (genus *Glossina*) and is widespread in the Eastern and Northern provinces of Zambia. In animals, the disease is referred to as African animal



TSETSE FLY

Photo: USDA/Peggy Greb

trypanosomiasis (AAT), or *nagana*. In people, it is known as human African trypanosomiasis (HAT), or sleeping sickness.

In Zambia, HAT is found in its more acute Rhodesian form and is a zoonosis (i.e. transmitted to people by animals). HAT is fatal if left untreated and involves a prolonged recovery period when it is. AAT causes severe production losses and sometimes death in livestock. Thus, the impacts of both the human and animal forms of the disease can be devastating for affected households.

The Dynamic Drivers of Disease in Africa Consortium (www.driversofdisease.org) is working in Eastern Province, an area undergoing major social and environmental changes linked to population growth and economic development. Researchers are using interdisciplinary and participatory methods to investigate the linkages between changes in land use, biodiversity and livelihoods on the processes of trypanosomiasis transmission and to explore the consequent impacts this has for people living there.

KEY QUESTIONS

The research is exploring the ecological, environmental and socioeconomic drivers behind trypanosomiasis, and considering the impacts of the disease and the responses appropriate to mitigate these impacts.

Questions for the research include:

- What is the extent of land-cover change in the Luangwa Valley, Eastern Province?
- What is the effect of changing livestock populations on transmission of HAT?
- What is the effect of the growth of cash crops, particularly cotton farming, on tsetse population dynamics – and thus on animal and human trypanosomiasis transmission?
- What are the poverty implications of changes in trypanosomiasis transmission?

BACKGROUND

African trypanosomiasis is transmitted by 23 different species of tsetse, each occupying a slightly different habitat, though most prefer thickets and riverine woodlands. They feed primarily on the blood of wild animals but, depending on their relative availability, tsetse will feed on a wide range of hosts, including livestock and people.

A significant proportion of HAT patients are active adults, often because their work brings them into contact with tsetse flies. Their prolonged illness, need for care and possible death have a major impact on their families. Illness or death of livestock too, often vital working animals, reduces household income and undermines household coping strategies. Added to these impacts are the costs associated with medicines and control methods (for people and livestock) and hospital treatment (for people). The presence of AAT and HAT therefore can greatly increase household vulnerability. Fear of the disease has historically acted as a brake on human settlement, with families keeping away



WORKING CATTLE

Photo: Sue Welburn

from fertile but highly tsetse-infested areas. However, land pressure is now gradually leading to the colonisation of tsetse-infested areas, so both people and their livestock face new risks.

Farming is the main livelihood strategy within Zambia's Eastern Province. Maize and groundnuts are commonly grown for home use, but cash crops are on the increase. Since the decline of the mining industry, cotton growing in particular has been promoted, resulting in increased land clearance. The cotton is grown via outgrower schemes which also provide farmers with insecticides. These control cotton pests but also kill tsetse. The cotton fields are usually located between people's homesteads and the natural vegetation (which forms the tsetse habitat), thus, potentially creating a protective barrier thanks to the use of these insecticides.

Eastern Province has recently experienced considerable immigration, with people moving into the area in search of fertile land for farming. Livestock population density on the plateau has also been increasing. Other notable changes in land use include increasing food production on mountain slopes, the result of a shortage of arable land, particularly around large towns. This has caused deforestation, soil erosion and flooding.

KNOWN AND UNKNOWN

Exactly how many people in Zambia are affected by HAT is unknown. In part, the problem lies in the disease's easy confusion with other infections. In its early stages patients are often thought to have malaria, and in its later stages AIDS. Thus an important proportion of patients are repeatedly treated

for the wrong disease and some die, undiagnosed, of HAT. Research results suggest that up to 90 per cent of HAT deaths in Africa go unreported.

In this region, HAT cases are found where there is significant contact between people, tsetse and animal reservoirs, for example at watering points. The incidence of trypanosomiasis in people and livestock reflects their movements and contacts with infected tsetse, and is thus affected by variations in tsetse numbers and distribution. Tsetse population dynamics are determined by environmental and ecosystem changes. Known factors which affect tsetse distribution include climate, altitude, vegetation, land-use patterns, land-cover types and rainfall. However, little research exists assessing the actual impact of environmental and ecosystem changes on trypanosomiasis incidence and distribution in humans and livestock.

Growing land pressure and human activities in Eastern Province are reducing biodiversity and increasingly bringing people, their domestic animals and wildlife into contact. Changes in land use, wildlife abundance and livestock populations, as well as the application of insecticides, are also impacting on tsetse populations here. These human-wrought (anthropogenic) changes have the potential to destabilise trypanosomiasis transmission cycles, resulting in an increase in the prevalence of AAT and HAT, and the spread of HAT into previously unaffected areas. The extent of this is unknown.

In addition, although it is widely accepted that the focal distribution of HAT reflects environmental and ecological factors, few studies have looked at local spatial risk factors. In studies undertaken at the village and/or household level, familial clustering has been noted, and proximity to swamps and wetlands identified as a risk factor.

However, it is likely that risk factors for HAT or AAT found in one area may not apply in other areas because of the differing habitats and behaviours of local tsetse species and the movements and habits of their animal and human hosts. Thus, livelihood strategies and socio-cultural activities that bring people into contact with tsetse are key HAT risk factors. These include seasonal movements of people with their livestock, the collecting of herbs for medicines in forests, firewood and fruit gathering, and wildlife hunting. For livestock they include grazing areas and watering points, and daily and seasonal routines.

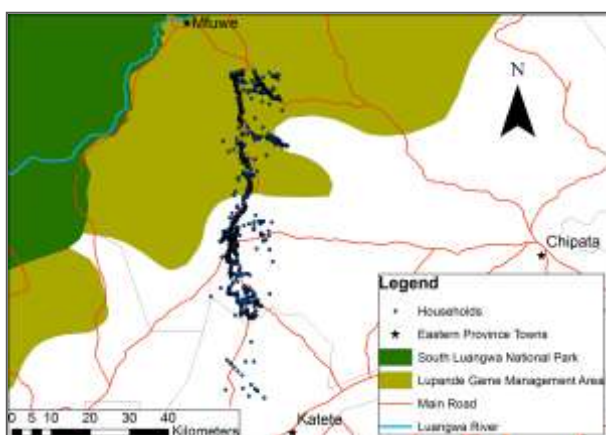
Information on people's attitudes towards tsetse and trypanosomiasis is relatively limited. Initial investigations indicate that local people associate tsetse with disease in cattle, but awareness of sleeping sickness in people is low. Little is also currently known about any social differences in vulnerability to HAT by gender, ethnicity, livelihood activities or use of ecosystem services.

CASE STUDY METHODOLOGY

Drivers of Disease researchers are working in the Luangwa Valley, an internationally acclaimed area of wild fauna which is also well suited to tsetse. It comprises a flat-bottomed valley bounded by steep, dissected escarpments which rise to a plateau at approximately 900-1,000 metres. The valley floor and escarpment areas contain four national parks and several areas designated as game management areas.

The three main study areas are as follows:

- Valley bottom. This has low human and livestock populations due to tsetse prevalence, as well as a prohibition on settling within national parks. However, there is increasing interaction between people and wildlife here due to tourism activities.
- Plateau area. This is settled, highly cultivated and supports growing numbers of cattle.
- Escarpment areas. These support growing human populations with consequent increasing cultivation and livestock numbers.



MAP SHOWING TRANSECT *Map: Neil Anderson*

The research is taking in a transect (see map) from the valley floor to the plateau, an area that has undergone considerable change in the past decade. It has been reported that significant population movements from the plateau area to the escarpment area have taken place over the past 10 to 20 years, with increasing areas of land on the escarpment being used for cotton growing. This change would have important implications for tsetse populations and trypanosomiasis transmission. Our researchers are quantifying the changes which have occurred in the study area before assessing the impacts this has had on transmission of trypanosomiasis, the implications for poverty and potential future impacts.

The research is being undertaken over multiple sites along the transect and is using and integrating information from tsetse abundance studies, trypanosomiasis surveys in livestock, environmental data and social science studies. The latter includes participatory mapping, focus group discussions, key informant interviews, structured questionnaires and transect walks. There is a clear multidisciplinary element to the research, including using participatory mapping and the survey to feed an agent-based model, allowing an estimation to be made of the movements of livestock and people. This is important as a linear or meandering route could affect disease transmission rates in model simulations. The overall objective is to capture



LIVESTOCK SAMPLING *Photo: Neil Anderson*

the ecosystem diversity and on-going changes within the area and assess the impact of environmental and socio-economic changes over time on tsetse abundance and trypanosomiasis

incidence. Fieldwork includes livestock, human and tsetse sampling. HAT records are also being collected from health centres. A series of land cover classifications is being prepared using Landsat imagery to provide information on land cover changes, and geostatistical models will be constructed to assess the relationships between environmental factors and trypanosomiasis prevalence.

PATHWAYS TO IMPACT

During the 1980s and 1990s, in Africa as a whole, human and animal trypanosomiasis attracted less and less attention from donors and policy makers. This situation has improved somewhat in the past decade. As a result of interventions to control HAT, the number of HAT cases reported annually in sub-Saharan Africa has declined in recent years. In 2009, the World Health Organization (WHO) stated that these had dipped below 10,000 per year for the first time in 50 years. However, because of under-reporting and misdiagnosis the actual incidence of HAT is higher, estimated at some 30,000 cases a year by WHO, but still a tenth of the number occurring in the mid-1990s. Nevertheless, the situation in areas such as Zambia, where Rhodesian HAT is found and is often maintained by a cattle reservoir as well as by wildlife, requires careful monitoring.

As well as exploring the 'whys' and 'how manys' behind trypanosomiasis transmission, a major objective of Drivers of Disease researchers is to assess the local AAT and HAT situation and propose appropriate mitigating measures. To this end, researchers are making contact and entering into dialogue with a range of stakeholders in health, environment and development in Zambia, at the local, national and international levels, to inform policy and practice. The discussions taking place, it is hoped, will lead to greater joined-up action across government departments and other relevant agencies, so that effective One Health (www.onehealthinitiative.com) policies can be pursued which will achieve optimal health for animals, people and the environment. The Zambian research findings will also prove relevant to understanding similar contexts elsewhere in Africa, especially so in Zimbabwe where the Drivers of Disease programme is also working on trypanosomiasis.

FURTHER INFORMATION

For more information on the work of the Dynamic Drivers of Disease in Africa Consortium:

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