

**HEALTH FOR ANIMALS AND LIVELIHOOD IMPROVEMENT IN
THE RUAHA ECOSYSTEM, TANZANIA
(HALI)**

PROJECT DESCRIPTION

Recognizing the threat of diseases that are transferable from animals to humans, or zoonoses, and understanding their origins allow for the development of prevention and risk mitigation strategies to protect both the original reservoir hosts and wildlife, as well as domestic livestock and human organisms to which they are vectored. The Health for Animals and Livelihood Improvement (HALI) project was established in 2006 and is a stakeholder-driven research and capacity-building program to assess the effects of zoonotic disease and water management on animal health, biodiversity, and livelihoods in the Ruaha ecosystem, Tanzania.

PRINCIPAL INVESTIGATOR

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SUMMARY OF ACHIEVEMENTS

- HALI project research shows that bovine tuberculosis is present in both wildlife and livestock in the Ruaha ecosystem, one of the largest intact conservation areas remaining in Africa. An accurate assessment of diseases that threaten the persistence of key species, such as buffalo and lion, is essential for conserving the unique biodiversity of this region.
- Preliminary results have confirmed that livestock management is a gendered activity, whereby women are primarily responsible for milking and management of small ruminants, while men concentrate on herding. Women, however, do handle transactions for the sales of milk, goats and chickens, suggesting that increases in productivity could benefit women and children through greater food security and income generation.
- Development assistance should target those populations where the impact will be the greatest. Therefore, recognizing the economic significance of livestock in rural Tanzanian households and, subsequently, the exposure of women and children to zoonoses through their close physical association with livestock highlights the importance of HALI's screening of women in livestock-keeping households in an attempt to minimize potential outbreaks.
- HALI provides educational opportunities for African women through degree and professional training support. In 2006-2007, three women had key roles with the project: Dr. Annette Kitambi led an investigation of water-borne disease; Ms. Britz completed a veterinary student externship; and Ms. Mariam Nguvava provided key support as a socio-economic research assistant.

- The HALI project has introduced new immunomagnetic separation techniques allowing researchers to detect a high number of parasites in a river used heavily by people and livestock. The project is also employing immunofluorescent antibody staining techniques to test for the presence of these parasites in wildlife and livestock fecal samples to determine if the same parasites are found in water sources. These technologies serve to inform Tanzanian water management agencies of the presence of harmful bacteria, greatly enhancing aid efforts to improve access to clean water for rural Tanzanians.
- Water quality information generated by the HALI project will be helpful in assessing whether other non-bacterial sources of pollution are present in the Great Ruaha and its tributaries. Data monitoring of phosphorous levels can be used as an indicator of fertilizer runoff into water sources due to the relative deficiency in phosphorous in surrounding soils.
- HALI's commitment to gender diversity is evidenced by the composition of team members; seven of 25 team members are women, with four women serving in a significant advisory capacity. While this composition ensures a favorable gender balance within the project team, it also has programmatic value.
- HALI researchers have confirmed the presence of bovine tuberculosis and brucellosis in wildlife and livestock in the Ruaha landscape, establishing disease as a threat to livestock productivity and therefore household food security. To date, 28 pastoral households have benefited from tuberculosis testing of their livestock herds and disease counseling to improve the health of their livestock.
- Tanzania's livestock sector is the third largest in Africa. As it is increasingly integrated with markets, the presence and dynamics of zoonoses and other diseases will become regionally and internationally significant. Findings from HALI inform policy mechanisms and aid the application of the Tanzania Veterinary Act, along with local sale and movement restrictions to protect Tanzania's livestock market.
- The Lunda-Mkwambi Wildlife Management Area (MBOMIPA) association is charged with sustainably managing natural resources for the benefit of its 21 member villages. HALI has trained 20 game scouts from MBOMIPA on avoiding exposure to zoonotic diseases and on the use of handheld GPS units and digital cameras for the documentation of hunter and poached-killed animal locations. The training provides skills benefiting both scouts and MBOMIPA's mandate to manage wildlife.
- HALI is supporting and enhancing the research and diagnostic capacity of Sokoine University of Agriculture (SUA) by utilizing recently available technologies (including polymerase chain reaction for tuberculosis) and introducing new diagnostic methods for water-pathogen testing, solidifying SUA's reputation as a leading diagnostic center for zoonotic diseases in Tanzania.
- HALI collaborated with the Veterinary Investigation Centre (VIC) in Iringa to utilize existing lab space for HALI water microbiology work. As a result of this partnership, the project has made several improvements to the laboratory which will allow the VIC to better diagnose infectious disease outbreaks in livestock.
- The HALI project is actively building capacity within Tanzanian agencies to do advanced water health studies. For example, techniques developed by HALI are currently being adopted to study water pollution and flamingo die-offs at Lake Manyara in northern Tanzania.

HALI Funding for 2006-2007	
Total Core Funding	\$340,496
Total Cost Share	\$46,837
Leveraged Funding	\$212,065
USAID Buy-In	\$17,250

RESEARCH BRIEFS

GL-CRSP Research Brief 08-01-HALI: Evaluating and Managing Zoonotic Disease Risk in Rural Tanzania

Authors: Deana Clifford, University of California, Davis; Rudovick Kazwala, Sokoine University of Agriculture; Peter Coppolillo, Tanzania Wildlife Conservation Society

Summary. Daily workloads and livelihoods in rural communities depend heavily on the availability of natural resources. When water is scarce, workloads increase, as more distance must be traveled to acquire adequate supply for consumption, hygiene, and livestock. In addition, water limitation brings people, livestock and wildlife together, increasing contamination of the limited water sources, as well as the potential for disease transmission. Nowhere is the risk of waterborne illness and zoonotic disease more important than in the high HIV/AIDS prevalence regions of East Africa. Assessing the impacts of zoonotic diseases, like bovine tuberculosis on health, economic livelihoods, and conservation requires a multi-disciplinary approach, uniting specialists from a wide variety of fields including medicine (veterinary

and human), ecology and conservation, sociology, and economics. Support from the Global Livestock CRSP is allowing an objective assessment of emerging zoonotic disease impact on health and livelihoods of pastoral communities in the sensitive Ruaha region of Tanzania. Results will inform management and policy to improve human, livestock, and wildlife health; facilitate economic development through improved livestock productivity and wildlife-based tourism; and strengthen local capacity to diagnose zoonotic disease problems and to design disease prevention programs.

GL-CRSP Research Brief 08-02-HALI: The Unintended Consequences of Development Assistance: The Case of Usangu Irrigation Schemes

Authors: Peter Coppolillo, Tanzania Wildlife Conservation Society; Deana Clifford and Jonna Mazet, University of California, Davis

Summary. Development projects aimed at improving agriculture in rural communities have been a cornerstone of international aid to developing countries. The intended results of improved local livelihoods and access to increased trade have been variably realized, and, in some cases, there have been dramatic unforeseen negative consequences on the environment with regional and national impacts. In the Usangu region of Tanzania, smallholder rice schemes established with development assistance in the 1980s and early 90s precipitated a cascade of unintended outcomes, many of which are still being realized. The primary and direct effect was that legal channelization of water facilitated a proliferation of illegal diversions and satellite farms surrounding the rice schemes. The resultant loss of water was (and remains) the central driver of the environmental and socioeconomic cascade of unintended effects. The most notable of those effects include: a 77% reduction in the area of the Ihefu swamp, over 60% loss of dry season habitat in Ruaha National Park, the collapse of fisheries in Mtera Reservoir,



Maasai woman sharing water sources with livestock. Shared water sources increase the risk associated with disease transmission between wildlife, livestock, and humans. Photo by Joe Brownlie.



The Great Ruaha riverbed in October (left) and the flowing river in December (right). The drying of this normally perennial river may increase disease transmission among people, livestock and wildlife, as all are forced to share diminishing dry season water sources. Dry Ruaha photo by Peter Coppolillo. Flowing Ruaha photo by Deana Clifford.

increased potential for transmission of disease among livestock, wildlife and people (both waterborne and other), and the loss of hydroelectric power produced by the Mtera hydroelectric plant. The social and economic costs of these unintended consequences remain untallied, but the power crisis alone likely costs the Tanzanian economy around one billion U.S. dollars. Two conclusions arise from this case: 1) development assistance projects must control the propagation of unintended consequences or risk having a negative net benefit, and 2) the perception that developing countries, like Tanzania, are not financially able to manage water sustainably should be replaced by the idea that those countries cannot afford the consequences of unsustainable water resource management.

GL-CRSP Research Brief 08-03-HALI: Disease Perceptions in Pastoralist Households at the Human-Livestock-Wildlife Interface in Tanzania

Authors: Deana Clifford, University of California, Davis; Michel Masozera, University of Vermont; Mariam Nguvava and Peter Coppolillo, Tanzania Wildlife Conservation Society; Jonna Mazet, University of California, Davis

Summary. Diseases that can be transmitted between animals and humans are the most significant cause of emerging infectious diseases in people.

Pastoralists living in close proximity to both livestock and free-ranging wildlife may be at high risk of infection. Pastoralists often depend on limited water sources that are shared with animals, have little access to healthcare, and rely on traditional food consumption practices that may increase their risk of contracting infection from animals. As part of the GL-CRSP-sponsored Health for Animals and Livelihood Improvement project (HALI) assessing the impact of emerging zoonotic disease on health and livelihoods of pastoral communities in the sensitive Ruaha region of Tanzania, 160 pastoralist households comprising three ethnic groups (Maasai, Sukuma, and Barabaig) were surveyed to: 1) assess local knowledge and perceptions regarding zoonotic and water-borne disease risk; 2) assess local beliefs about where disease in livestock originates; and 3) determine the prevalence of traditional household water and food consumption practices that may increase risk of disease. Results indicate that many pastoralist households do not believe that diseases can be transmitted to people from their livestock or wildlife. Many also believe that sharing water with animals (livestock or wildlife) does not pose a health risk to people. Of the three groups participating, Maasai were the most likely to report that disease in people could come from livestock and also expressed concerns that neighboring livestock herds were a source of disease. The influence of household factors, including ethnicity, disease history, wealth, education, access to health care, and proximity to

wildlife, on disease perceptions and prevention practices will be further assessed by the HALI team. Given the widespread lack of knowledge regarding disease transmission in the most highly mobile segments of rural Tanzanian society, policy-makers and development professionals must address deficiencies in local knowledge to improve public health and avoid risks associated with animal movements.

GL-CRSP Research Brief 08-04-HALI: From the Ground Up: HALI Builds Capacity to Address Complex Disease Issues to Improve Livestock Trade in Tanzania

Authors: Deana Clifford, University of California, Davis; Rudovick Kazwala, Sokoine University of Agriculture; Hamza Mwambebe, Veterinary Investigation Centre, Iringa; Jonna Mazet, University of California, Davis

Summary. In order to open up legal trade opportunities for livestock products, regional authorities must be able to ensure that animals and animal products are free of transmissible diseases that could have economic consequences on neighboring and distant regions targeted for trade. Obtaining this “disease-free” status requires local diagnostic and surveillance capacity not often present in rural areas of developing countries. In the southern highlands of Tanzania, there is no lack of willpower, only a lack of opportunity for people to gain necessary skills to tackle complex livestock disease problems. The HALI project recognizes that highly motivated individuals can make the difference in these rural communities and, therefore, invests in training and regional capacity building. In their first year of laboratory and field-based research training, HALI students are already improving the regional

capacity to detect economically important livestock diseases. For example, HALI student Dr. Julius John joined a small governmental investigatory team to evaluate an outbreak of pneumonia in small ruminants in 2007. Because of his participation, diagnostic sample size was increased, and Rift Valley Fever was quickly identified resulting in the rapid implementation of control measures. After only one year of HALI training, students like Dr. Annette Kitambi are lecturing to university students about disease transmission and water quality. In addition, project researchers are noticing the diffusion of this knowledge to others. Students, for example, are educating households about preventing the transmission of bovine tuberculosis to other cattle and family members. They are also training game scouts to protect themselves from diseases carried by the animals that they handle. By training individuals who will then share their skills and knowledge with others, HALI is building long term capacity to both investigate and respond to zoonotic disease challenges in Tanzania. Obtaining regional disease-free status will also require bolstering laboratory capacity and access to scientists and research institutions. To this end, the HALI project has partnered with the Veterinary Investigation Centre in Iringa, Tanzania to increase zoonotic disease surveillance in the region and has augmented the technical capacity at Sokoine University of Agriculture’s Faculty of Veterinary Medicine.

PRESENTATIONS AND PROCEEDINGS

Clifford, D.L. “Health for Animals and Livelihood Improvement Project in the Rungwa-Ruaha Ecosystem, Tanzania.” Interim Progress Report for Tanzania National Parks, Tanzania Wildlife Research Institute, and Tanzania Commission on Science and Technology, March 1, 2007.

HALI Degree Training for 2006-2007					
Name (Last, First)	Nationality	Gender M/F	University	Discipline	Degree
John, Julius	Tanzanian	M	Sokoine University of Agriculture	Preventive Veterinary Medicine	MPVM
Kitambi, Anette	Tanzanian	F	Sokoine University of Agriculture	Preventive Veterinary Medicine	MPVM
Masozera, Michel	Rwandan	M	University of Vermont	Ecological Economics	PhD

Clifford, D.L., R. Kazwala, P. Coppolillo, D. Kambarage, T. Mlengeya, J. Erickson, and J.A.K. Mazet. "Health for Animals and Livelihood Improvement (HALI) in the Ruaha Ecosystem, Tanzania." Proceedings of the *21st annual meeting of the Society for Conservation Biology*. Port Elizabeth, South Africa, July 1-5, 2007.

Mazet, J.A.K. and D.L. Clifford. "Community-based conservation – is it effective?" Presentation and discussion session for graduate veterinary course at the University of California, Davis, VME 294B – Conservation Biology and Veterinary Medicine. Davis, California, March 6, 2007.

Clifford, D.L., R. Kazwala, P. Coppolillo, D. Kambarage, T. Mlengeya, J. Erickson, and J.A.K. Mazet. "HALI in the Ruaha Ecosystem, Tanzania." Poster presentation created for GL-CRSP donor meeting, Switzerland, June 2007.

Clifford, D.L. "HALI in the Ruaha Ecosystem, Tanzania." Presentation given in a special symposium on Linking Biodiversity and Health at the *21st annual meeting of the Society for Conservation Biology*. Port Elizabeth, South Africa, July 1-5, 2007.

Mazet, J.A.K. and R. Kazwala. "Linking Habitat, Wildlife, Livestock and Human Health: The HALI Project." Presentation given at the *Envirovet Summer Institute*. White Oak Conservation Center, Yulee, Florida, June 26, 2007.

Britz, E., D.L. Clifford, and J.A.K. Mazet. "Water-related risk factors associated with diarrhea in pastoralist households or rural Tanzania." Poster presentation given at the UC Davis School of Veterinary Medicine Open House and Orientation Day and at the STARS in Science meeting. Davis, California, October 12, 2007.

Mazet, J.A.K. "Using epidemiology to evaluate the linkages among wildlife, human, and livestock health." Presentation given to the UC Davis Graduate Group in Epidemiology (EPI 290). Davis, California, October 11, 2007.

TEAM MEMBERS

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COLLABORATING INSTITUTIONS

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Tanzanian National Parks
Tanzanian Wildlife Research Institute
University of Vermont
Veterinary Investigation Centre, Tanzania
Wildlife Conservation Society, Field Veterinary Program and AHEAD (Animal Health for the Environment and Development)
Wildlife Conservation Society, Tanzania