# Survey of Important Parasitic and Infectious Diseases Shared by Elephants and Livestock in Dimbangombe, Zimbabwe

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**Background**

Dimbangombe Wildlife Ranch, encompassing 20,000 acres, is located in the heart of the Four Corners ecosystem which ranges from the Hwange National Park to the Victoria Falls National Park in Zimbabwe, and further into the neighboring countries of Zambia, Botswana, and Namibia. Dimbangombe Wildlife Ranch is managed by the African Centre for Holistic Management (ACHM), a Zimbabwe-based NGO, and its Board of Trustees, almost all of whom are local Abehwange people living in the surrounding communal lands. TUSVM has an ongoing partnership with ACHM designed to assist in monitoring ecosystem health on the ranch and in the surrounding communities. As part of this relationship, ACHM has implemented a novel approach to grazing cattle on the ranch called holistic grazing planning, with the intentions of providing long term environmental, economic and social sustainability. Currently, the grazing herd consists of 600 cattle: 500 owned by the ranch and 100 belonging to the local village. The health of the entire ecosystem is expected to improve with restoration of the grassland habitat. The advantages of this long term management plan should be beneficial to the ecosystem and the economic situation of the local communities, as well as create a healthier environment for wildlife and livestock.

**Problem and Significance**

Designed to combine the lives of native peoples, wildlife and domestic animals, Dimbangombe Wildlife Ranch involves increased human-animal and domestic livestock-wildlife contact. This creates a potential obstacle to the successful management of infectious diseases. Diseases transmitted from domestic livestock populations into wild animal populations can have several deleterious effects. Wild animal populations can be damaged, leading to an unbalanced and unhealthy ecosystem and potential species loss. Once a disease is established in a wild population, control measures in domestic populations of free ranging livestock become much more problematic. In several countries, it has been shown that an infected wildlife reservoir that interacts with livestock causes frequent herd breakdowns and substantial economic losses to the agricultural sector.

Elephants are considered a “flagship” species as their protective survival will maintain biological diversity and ecological integrity in the environments in which they live. During the mid-1970’s to 1980’s, there has been a large decline in the population of African elephants due to significant poaching. Conservation organizations, such as CITES and the IUCN, have since placed African elephants (*Loxodonta africana*) in Appendix I and endangered species categories, respectively, which has led to a ban on poaching and increased numbers of elephants. However, ongoing habitat loss and encroachment continue to threaten their livelihood, with less than 500,000 elephants existing in 37 states of Africa, including Zimbabwe. Dimbangombe Ranch is unfenced, leading to frequent interactions between the African elephants and the livestock, especially at a common watering hole at Dimbangombe. Approximately 500 African elephants are seen during the dry season at the watering hole.

This research project has two specific aims. First it will attempt to assess the prevalence of two contagious zoonotic pathogens *Mycobacterium bovis* and *Brucella abortus* in the livestock population on the ranch. Both *M. bovis* and *B. abortus* are prevalent in the livestock populations in Zimbabwe and the surrounding countries. *M. bovis* is the most common cause of tuberculosis in cattle, but can also infect humans, non-human primates, pigs, sheep, goats, African buffalo, African elephant, and Greater Kudu. Transmission of *M. bovis* is via respiratory route or ingestion. *M. bovis* is of particular concern in sub-Saharan Africa due to the fact that HIV rates have been found in over 40% of tuberculosis patients in a number of African countries. *M. bovis* is clinically indistinguishable from *M. tuberculosis* and has been isolated in humans in Africa. Most diagnoses are made via microscope where *M. tuberculosis* and *M. bovis* look identical. *B. abortus* causes brucellosis (contagious abortion), reduced milk production, and economic losses in cattle. Brucellosis is a zoonotic disease which causes undulant fever and poses a serious public health threat. Multiple outbreaks of this disease are reported annually in Zimbabwe. Brucellosis has also been found in wild herbivores, usually when the wild species are raised together with domestic herbivores on ranches, similar to the situation at Dimbangombe. The most common form of transmission is from the infected female and her abortion products, either by direct contact, via ingestion or through the skin, or from the contaminated environment.

Second, it will attempt to describe the type and geographical distribution of parasites found in the wild African elephants and domestic livestock in Dimbangombe. Elephants and the livestock are likely to share the same parasite species since they graze, drink, and defecate in the same geographical area and they share many physiological and anatomical features. The type of parasite will determine the route of transmission, species of animal affected, level of moribidity and mortality, and organ systems affected in the animal. High parasitic loads can cause general malaise, diarrhea, weight loss, anemia, etc. Understanding the movement of common parasites between elephants and livestock will assist in improved health management techniques for both groups.

**Methodology**

***B. abortus and M. bovis Prevalence***

Tuberculosis testing and brucellosis test evaluation will be performed over a course of eight weeks (June/July 2004) under the guidance of Dr. Christine Jost (TUSVM) and Mr. Roger Parry (ACHM). The herd of 500 cattle will be subjected to random systemic sampling proportional to sex and age distribution. To test for brucellosis, serum will be obtained from blood samples taken from the tail vein and analyzed using the Brewer Diagnostic Brucellosis Card Test Kit. To test for tuberculosis, a dose of tuberculin will be injected into the superficial dermal layers of the caudal fold just distal to the base of the tail. The injection site will be visually inspected and palpated for swelling between 66 and 72 hours after the injection. A sample size of 148 cattle will be utilized to achieve an estimated prevalence of *B. abortus* and tuberculosis exposure with a 95% confidence level at a precision value of 0.05. The results will be entered into Microsoft Excel and statistically analyzed in groups based upon age and sex.

***Type and Geographical Distribution of GI Parasites***

Over a course of eight weeks (June/July 2004), opportunistic fecal samples that are less than one week old will be collected from the wild elephants in and around the Dimbangombe Ranch. Fecal samples will be obtained from the same 148 randomly selected cattle for the brucellosis and tuberculosis testing, giving a precision value of 0.05 at a 95% confidence level. Fecal samples will be taken from the 3 sheep, 21 horses, 10 donkeys, 24 pigs, and 50 goats living on the ranch. GPS points will be recorded for each fecal sample and analyzed spatially using ArcGIS 8. Fecal sedimentation will be performed in order to visualize heavier eggs such as trematodes, acanthocephalans, amebas, ciliates, and *Giardia* cysts. Fecal flotation will be performed in order to visualize lighter eggs such as cestodes, nematodes, and protozoal cysts. Direct smears will be performed in order to visualize delicate forms such as nematode larvae and protozoan trophozoites that can be destroyed in the other procedures. Baerman's technique will be performed in order to visualize nematode larvae. Fecal cultures will be performed in order to determine species of nematode eggs. DNA will also be extracted from the elephant fecal samples using Whatman FTA Classic Cards and transported to the United States for genetic analysis.

**Anticipated Results**

Prevalence of *B. abortus* and *M. bovis* are anticipated to be approximately 11.5% and 1.3%, respectively, as these are the reported prevalence values in neighboring Zambia and South Africa. The same types of parasites are anticipated to be found in the elephants and the livestock. A higher load of parasites is anticipated to be found closer to the watering hole as more animals frequent this location. The information gathered from this study will be used to help guide livestock management and wildlife conservation policy with respect to shared diseases in the region. Types and loads of parasites will be used to direct further research studies to determine other important wildlife reservoirs. Once more is known about present livestock and wildlife diseases, the livestock, wildlife and local community will be more secure.

**Statement of Long Term Goals**

Upon graduation, Karin plans to pursue veterinary medicine in the field of research, focusing on the area of international conservation medicine. She spent last summer doing research on elephant parasitology and hemotology in Nepal. She is most interested in exotics, wildlife and zoo animals.

Following graduation James will pursue a career in veterinary field research, focused on conservation medicine. His main interest includes the transmission of infectious disease between humans, domestic and wild animals.

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