

# **Sustaining animal health and ecosystem services in large landscapes – 2<sup>nd</sup> Draft**

Concept for a programme to address wildlife, livestock and related human and ecosystem  
health issues in the Greater Limpopo Transfrontier Conservation Area

by

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Prepared on behalf of the

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## **Contents**

### **Summary**

1. Introduction
2. Background and assumptions
3. Project objective and justification
4. Themes, modules and approach
  - Theme #1. Overarching conceptual framework
  - Theme #2. Animal health and disease
  - Theme #3. Land use, ecosystem goods and services, and animal health
  - Theme #4. Human livelihoods, animal and ecosystem health
  - Theme #5. Policy support and capacity building, at local national and regional levels
  - Theme #6. Communications and outreach
5. Context
6. Coordination and integration
7. References

### **Acronyms used**

<i>AHEAD</i>	Animal Health for the Environment And Development
BTb	Bovine tuberculosis
FMD	Foot and Mouth Disease
GLTFCA	Greater Limpopo Transfrontier Conservation Area
GLTFNP	Great Limpopo Transfrontier National Park
FNP	Forum Natureza um Perigo
SDI	Spatial Development Initiative
SES	Social-ecological system
S-LTFCA	Shashe-Limpopo Transfrontier Conservation Area
WCS	Wildlife Conservation Society
WWF	World Wide Fund for Nature
AWF	African Wildlife Foundation

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## SUMMARY

The transboundary management of natural resources, particularly of water and wildlife, and the associated development of transfrontier conservation areas (TFCAs) has been a major focus of attention over the last few years in southern Africa. Transboundary natural resource management (TBNRM) and TFCA development has also been closely linked to emerging Spatial Development Initiatives (SDIs) and corridors within southern Africa. A key economic driver linking these conservation and infrastructure development initiatives is wildlife based tourism that seeks to maximise returns from marginal lands in a sector where southern Africa enjoys a global comparative advantage. However, the management of wildlife and livestock diseases within the envisaged larger transboundary landscapes remains unresolved and an issue of major concern to other economic sectors in the region. The interactions at the interface between animal health, ecosystem services and human wellbeing are also poorly understood with the result that policy development is compromised by a lack of appropriate information and understanding of the complex systems and issues involved.

Twenty potential and existing Transfrontier Conservation Areas (TFCAs) have been identified in the SADC region, involving 12 continental African member states. The TFCAs include many national parks, neighbouring game reserves, hunting areas and conservancies, mostly occurring within a matrix of land under traditional communal tenure. Altogether the proposed TFCAs cover about 120 million hectares. This concept outlines a framework to establish a research and development (R&D) programme to address the wildlife, livestock and related human and ecosystem health issues in the Great Limpopo Transfrontier Conservation Area. This *AHEAD-GLTFCA* concept<sup>1</sup>, has the potential to form a strong pilot project for tackling linked animal, human and ecosystem health issues associated with TFCAs in the SADC region.

The Great Limpopo Transfrontier Conservation Area is situated in south eastern Africa and straddles three countries and includes five national parks, neighbouring game reserves, hunting areas, conservancies and intervening areas of communal lands under traditional tenure. Altogether the TFCA covers about 10 million ha or 100,000 km<sup>2</sup>. The longer term plans for this vast area currently focus primarily on the development of wildlife based tourism and envisage greater freedom of movement for wildlife and tourists across international and other boundaries. These developments have the potential to greatly increase interaction between wildlife, livestock and people over a much larger landscape than has been the case for the last few decades.

Ecological imperatives and economics are presently driving wildlife and livestock based land use in arid savannas to move “up-scale” and use multispecies systems of large mammalian herbivores over large areas<sup>2</sup>. Animal diseases have, however, largely been controlled or contained by fences and intensive management of wildlife and livestock in separate, smaller and isolated patches of land. Very different approaches and techniques may be required to deal with animal health issues in larger landscapes and the more open, integrated land use systems likely to develop in TFCAs. The interface

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<sup>1</sup> This concept originated at the Southern and East African Experts Panel on Designing Successful Conservation and Development Interventions at the Wildlife/Livestock Interface: Implications for Wildlife, Livestock, and Human Health, *AHEAD* (Animal **H**ealth for the **E**nvironment **A**nd **D**evelopment) Forum, IUCN Vth World Parks Congress, Durban, South Africa, September 14<sup>th</sup> and 15<sup>th</sup>, 2003.

<sup>2</sup> Papers presented by du Toit and Fritz 2003, and Cumming and Slotow 2003, at the VII<sup>th</sup> International Rangeland Congress in Durban, July 2003.

between animal and human (community) health and ecosystem health in large landscapes thus presents exciting challenges in research and management.

The overall **Objective** of the programme is to:

*Facilitate development and conservation success in the GLTFCA through integrated understanding based on innovative inter-disciplinary applied research, monitoring and surveillance at the interface between wild and domestic animal health, ecosystem goods and services, and human livelihoods and wellbeing*

This research and development programme is **justified** by the magnitude of wildlife-livestock disease issues in the future development of sustainable land uses, approaches to transboundary natural resource management and biodiversity conservation in southern Africa in general, and in the GLTFCA in particular. Some 60% of southern Africa is semi-arid to arid where extensive livestock and wildlife production systems are the most suitable and sustainable forms of land use. The need to arrest desertification and enhance the capacity of these areas to generate wealth and sustain improved human livelihoods is of paramount importance. Innovative and integrated approaches to disease and natural resource management based on sound knowledge and understanding, are urgently needed. An integrated, interdisciplinary programme such as is proposed here offers the most promising route forward in building the understanding needed to adaptively tackle these issues.

A framework of six main **themes** is proposed for the programme, namely,

- a. An overarching conceptual framework to facilitate integrated understanding through interdisciplinary approaches
- b. Animal health and disease
- c. Land use, ecosystem goods and services, and animal health
- d. Human livelihoods, animal and ecosystem health
- e. Policy support and capacity building at local, national and regional levels
- f. Communications and outreach

Within each of these themes three to five **research modules**, that include monitoring and surveillance, are defined. They will contribute to improved knowledge and understanding of the linked social-ecological systems that comprise the TFCA and the central role of animal, ecosystem and human health in these systems.

The context to the project and project area is briefly covered, with particular reference to animal health and land use in terms of historical changes, key environmental features, development and food security, socio-economic factors and wildlife policy and management.

The challenge of coordinating and integrating a large interdisciplinary research and development initiative is examined, and potential participating groups and organizations are indicated. Some existing initiatives in the TFCA area are mentioned.

A detailed budget for the programme has yet to be developed. However, a start-up phase building a common framework, establishing local and regional linkages, and tackling some of the more immediate disease surveillance and monitoring work in GLTFCA could be accomplished with a budget of between US\$ 0.75 and 1 million. A programme with all modules operating at a realistic level would probably require in the region of US \$12 million a year. Many of the sub-modules could be funded separately and the project could still achieve the aims of a targeted and integrated applied

research and development programme - provided that essential core themes, such as a unifying conceptual framework and a communications and outreach programme were in place.

A multifaceted research and development programme of this nature with wide applicability, and of high potential interest to policy makers at national and international levels, will clearly require the formation of a consortium of appropriate implementing partners and supporting agencies. The formation of such a consortium, which would include development and implementing partners in both public and private sectors, is under active consideration.

## 1. Introduction

The transboundary management of natural resources, particularly of water and wildlife, and the associated development of transfrontier conservation areas (TFCAs) has been a major focus of attention over the last few years in southern Africa. Transboundary natural resource management (TBNRM) and TFCA development has also been closely linked to emerging Spatial Development Initiatives (SDIs) and corridors within southern Africa. A key economic driver linking these conservation and infrastructure development initiatives is wildlife based tourism that seeks to greatly increase returns from marginal lands in a sector where southern Africa enjoys a global comparative advantage. However, the management of wildlife and livestock diseases within the larger transboundary landscapes that are envisaged remains unresolved and an issue of major concern to other economic sectors in the region. The interactions at the interface between animal health, human livelihoods and health and ecosystem services are also poorly understood; with the result that policy development is compromised by a lack of appropriate information and understanding of the complex systems and issues involved.

Twenty potential and existing Transfrontier Conservation Areas (TFCAs) have been identified in the SADC region involving 12 continental African member states. The TFCAs include many national parks, neighbouring game reserves, hunting areas and conservancies, mostly occurring within an intervening matrix of land under traditional communal tenure. Altogether the proposed TFCAs cover about 120 million hectares. This concept outlines a framework to establish a research and development (R&D) programme to address the wildlife, livestock and related human and ecosystem health issues in the Great Limpopo Transfrontier Conservation Area. This *AHEAD*-GLTFCA concept<sup>3</sup> has the potential to form a strong pilot project for tackling linked animal, human and ecosystem health issues associated with TFCAs more broadly in southern Africa

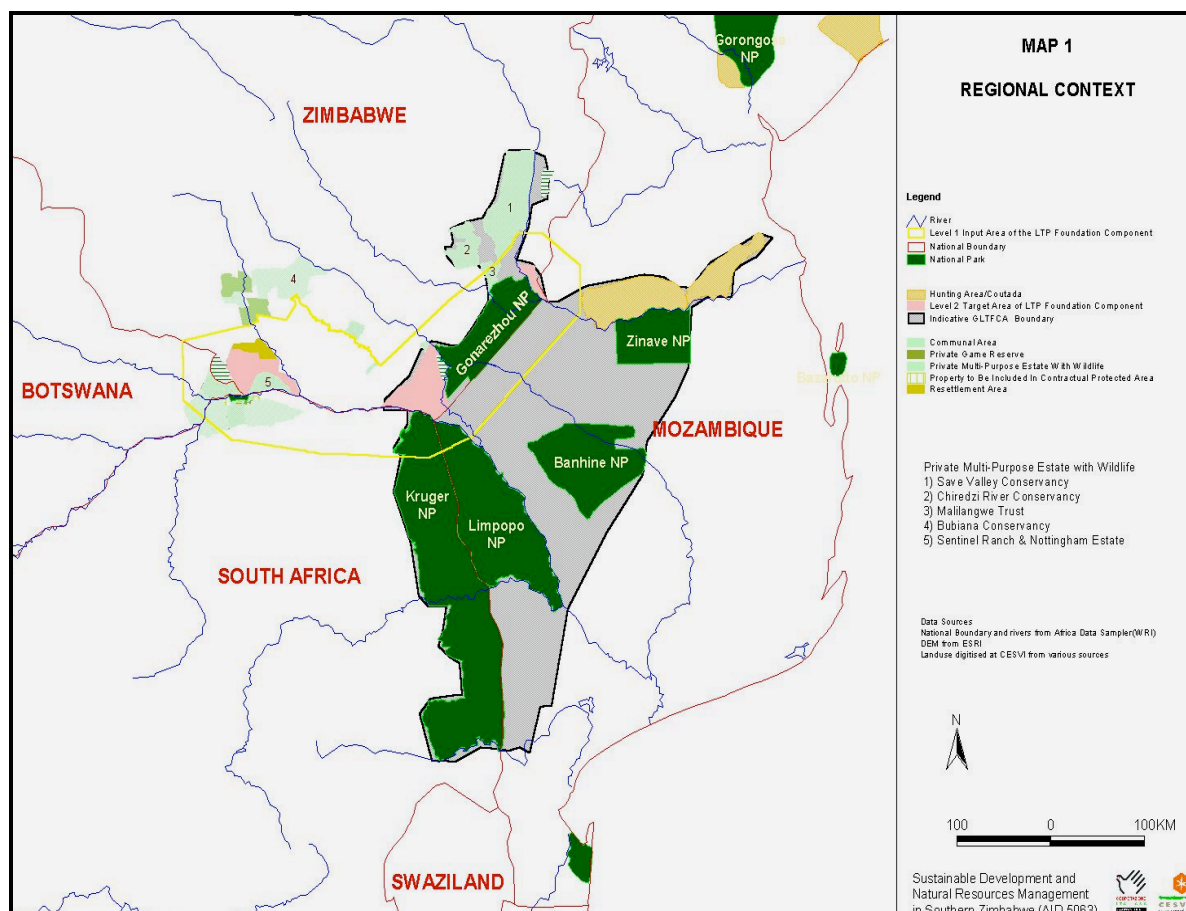
The Great Limpopo Transfrontier Conservation Area (GLTFCA), covers *c.* 100,000 km<sup>2</sup> of Mozambique, South Africa and Zimbabwe (**Fig. 1**). The area includes several land use/land tenure regimes including national parks, state and private safari and hunting areas, conservancies and game ranches on freehold land, small-scale agro-pastoral farming areas under communal tenure, large scale commercial irrigation schemes, and smaller irrigation schemes within the communal areas. About 35% of the area comprises state protected areas and a further approximately 10% is freehold land under wildlife. Most of the remaining land, the matrix between the designated national parks, is under communal tenure with varying forms of small scale agro-pastoralism. The international treaty to establish the Great Limpopo Transfrontier National Park (GLTFNP) was signed by the presidents of Mozambique, South Africa and Zimbabwe in December 2002. Agreement has been reached on creating a transfrontier conservation area (TFCA) that encompasses the GLTFNP and the intervening matrix of conservancies and wildlife ranches on freehold land, together with the communal farming areas. The precise boundaries of this vast TFCA remain undefined but the primary land use in the matrix is expected to be wildlife based tourism with reasonably unimpeded movement of wildlife and tourists.

The control and containment of livestock diseases has, in the past, relied heavily on game fences and the control of wild and domestic animal movements and translocations. The prospect of

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<sup>3</sup> This concept originated at the Southern and East African Experts Panel on Designing Successful Conservation and Development Interventions at the Wildlife/Livestock Interface: Implications for Wildlife, Livestock, and Human Health, *AHEAD* (Animal Health for the Environment And Development) Forum, IUCN Vth World Parks Congress, Durban, South Africa, September 14<sup>th</sup> and 15<sup>th</sup>, 2003.

removing barriers to wildlife and livestock movement therefore has major implications for animal health and disease control strategies within the TFCA. It could also have wider implications for disease control in the three countries concerned. The GLTFCA covers land of diverse tenure and use in all three countries and, because of the large “edge effect” within each country, the animal health and land management strategies within the TFCA will have major implications for livestock disease control, production and export markets in each country. The animal health issues, coupled with very high expectations on the part of nearly all stakeholders for development benefits from wildlife based tourism, provide a unique opportunity for targeted interdisciplinary research to contribute to meeting these expectations. The development of a TFCA over such a large landscape also provides an exceptional opportunity to conduct research at the interface between wildlife, livestock, human communities and varied social-ecological systems in terms of health and the provision of ecosystem goods and services; and in so doing to work towards sustainable improvements in human health and livelihoods from local to regional scales. Furthermore, there is the opportunity, if not the necessity, to establish a R&D framework that establishes a synergistic partnership between farmers, natural resource managers and researchers on one hand, and government and non-governmental agencies involved in animal and human disease control, conservation, agriculture and rural development on the other.



**Fig. 1. Map of part of southern Africa showing the juxtaposition of Botswana, Zimbabwe, Mozambique and South Africa, and the locations of the Greater Limpopo TFCA and the Shashe-Limpopo TFCA to the west. (Source: CESVI Southern Lowveld Project)**

While this initiative could have been developed as a series of conventional veterinary research projects or as a standard animal health program, the *AHEAD*-GLTFCA Working Group believes that the innovative, adaptive and long term solutions required are more likely to be reached through an inter-disciplinary R&D programme. Such a programme would need to be strongly participatory and actively involve farmers, resource managers and development partners in a comprehensive social-ecological systems approach to the interface between animal health, ecosystem goods and services, and human livelihoods and health. The theme of the initial *AHEAD* (*Animal Health for the Environment And Development*) Forum at the World Parks Congress in Durban was one of addressing real world needs from a regional basis, with an emphasis on research priorities being very much targeted at solving management problems

## 2. Background and assumptions

The need to develop a concept paper and subsequent proposals for an integrated research, conservation, and development program originated during a working group session at the *AHEAD* Forum, held in Durban during September 2003 under the auspices of the Wildlife Conservation Society, the IUCN, and a consortium of partners. The working group identified the Greater Limpopo and Shashe-Limpopo Transfrontier Conservation Areas (TFCAs) as priority areas in southern Africa for research and development at the interface between wildlife, livestock, ecosystem and human health. The working group also emphasized that the animal health problems identified during the working sessions required a broad, integrated approach to research and management of animal diseases (including zoonoses) that should be closely linked to rural development, land use and livelihood issues. A meeting of an expanded version of the *AHEAD*-GLTFCA Working Group held in Pretoria on the 7<sup>th</sup> November, 2003 reinforced the need for such an approach - one which was perhaps mirrored earlier in the *Pilanesberg Resolution* adopted by a joint meeting of the Wildlife Disease Association and the Society for Tropical Veterinary Medicine at their joint meeting in July 2001 (Karesh *et al* 2002). These organizations resolved to:

*“ ... urge those organizations contemplating the funding and implementation of programs involving wildlife and livestock to:*

- Encourage projects that foster integrative approaches to livestock production, food security, human health, economic growth, democracy and governance, biodiversity conservation and natural resource management in order to build upon synergies among these sectors while precluding conflicting policies and/or negative impacts on either livestock or wildlife health;*
- Formalize steps in their project design, environmental impact assessment, and implementation processes which address wildlife, livestock and rangeland health issues and their implications for sustainability and thus success, recognizing that these projects may alter fundamental relationships between animal hosts and potential pathogens and parasites;*
- When contemplating projects involving domestic and/or wild animals, establish relationships with appropriate wildlife and domestic animal health oriented organizations and recognized local, national, regional and international experts, thereby identifying an appropriate pool of professionals who can assist in ensuring the inclusion of timely, science-based advice in planning, implementation, and monitoring processes; and*
- Put a premium on local human capacity building to address the long-term technical needs of development activities that require expertise in domestic animal health and wildlife health by building adequate support into project design and implementation so as to engage local expertise and to foster capacity building at professional as well as community levels as a first-tier priority within and beyond the life-spans of such programs. ”*

The proposal emerging from these working sessions and meetings is influenced in part by the following propositions/assumptions:



1. The development of major transfrontier parks and surrounding and/or intervening transfrontier conservation areas in southern and eastern Africa is a reality. These often very large areas of mostly agriculturally marginal land are expected to facilitate freer movement of wildlife (and possibly livestock) across differing land use and tenure regimes. Infrastructural constraints, such as fences and other barriers to the movement of animals, are likely to be minimized in establishing viable corridors linking areas of high wildlife-based tourism potential. Areas of intensive agriculture (e.g. irrigation schemes) may have to become physically isolated islands in a matrix of land uses increasingly based on the sustainable exploitation of biodiversity (Walker 1999, Cumming 1999a, 1999b).
2. The GLTFCA is seen as a *complex system* and a predominantly *systems approach* will be taken in developing the R&D programme. Such an approach recognizes that social-ecological systems (SES) are closely interlinked and that treating them as separate ecological and social systems, or as separate sectors, for the purposes of research and management is largely artificial and likely to perpetuate past resource management and development failures (Gunderson and Holling 2002; Ostrom and Janssen 2002).
3. The evolution of these large TFCAs and the coupled social-ecological systems (SES) they incorporate will result in benefits and losses (tradeoffs) between their various components. Wild and domestic animal health, the sustainable delivery of ecosystem goods and services, and associated human health issues, will form an important component of this dynamic development.
4. Command and control resource management and development approaches (often driven by narrowly focused, single discipline research) that result in natural resource management pathologies (Holling and Meffe 1996; Ostrom and Janssen 2002; Biggs 2003) are inappropriate for the SES within the GLTFCA. Such systems behave as complex adaptive systems with non-linear, essentially non-predictable dynamics (Gunderson and Holling 2002). Participatory and inclusive R&D approaches that are also inter-disciplinary and recognise the complexity of the SES comprising the TFCA will be essential.
5. Both government and non-governmental agencies are involved in implementing development and conservation in the TFCA area. A key requirement will therefore be to work with farmers, resource managers and development and regulatory agencies. It will also be necessary to conduct research that is continually informed by, and is responsive to, their problems. In this way research, provided it is at the right scale (Dalgaard, Hutchings and Porter 2003), is most likely to inform and influence resource management policy and practice (Getz *et al* 1999; du Toit, Walker and Campbell 2004).
6. The program will involve a mix of normal science (*sensu* Kuhn 1970), standard hypothetico-deductive science (a science of parts – Popper 1959), integrative inductive science (a science of wholes – Wilson 1998; Gunderson and Holling 2003) and post normal science (science that deals with uncertainty - Funtowicz and Ravetz 1993, 1994; Ravetz 1999). The term “research” is used here in the broad sense of increasing knowledge and understanding and includes monitoring and surveillance, integral components of the type of programme needed

### 3. Project objective and justification

The overall *objective* for a program comprising an integrated set of projects can be phrased in development terminology along the following lines:

Facilitate development and conservation success in the GLTFCA through integrated understanding based on innovative inter-disciplinary applied research, monitoring and surveillance at the interface between wild and domestic animal health, ecosystem goods and services, and human livelihoods and wellbeing

### **Justification.**

The overall objective and the focus on R&D in this programme is justified by the magnitude of wildlife-livestock disease issues in the future development of sustainable land uses, transboundary natural resource management, biodiversity conservation and human livelihoods in the marginal lands of southern Africa in general and in the GLTFCA in particular. Some 65% of southern Africa<sup>4</sup> is semi-arid to arid where extensive livestock and wildlife production systems are the most suitable and potentially sustainable forms of land use. The need to arrest desertification and enhance the capacity of these marginal areas to generate wealth and sustain improved human livelihoods is of paramount importance to the region.

During the period 1961 to 1994 cereal production *per person* declined by nearly 30% while protein (meat and milk) production declined by more than 50% in southern Africa (Cumming 1999b) resulting in much of the region becoming net importers of food. Livestock populations reached a ceiling in about 1987, by which time the number of humans surpassed the number of livestock units. Meat and milk production per animal and per person for the region is about 1/25<sup>th</sup> of the production levels in Europe (Cumming 1999b). Given these alarming trends and comparisons, the need to produce greater wealth from marginal lands through alternative enterprises such as high valued wildlife based tourism is clear. Furthermore such service-orientated generation of wealth, which is also partly decoupled from primary production and the vagaries of drought, is likely to generate greater employment opportunities in marginal lands. However, because the tourism sector is also subject to the vagaries of world markets the need to maintain a diversity of production systems (i.e. irrigated agriculture, wildlife and livestock) in arid lands is likely to remain paramount.

Whatever the potential of wildlife based tourism to generate wealth in areas such as the GLTFCA, the current reality is that small scale agro-pastoralists living in the adjacent communal lands depend greatly on livestock for their livelihoods (Cumming 2004). The need to balance their livelihoods and environmental security with the development of alternative land uses and opportunities gives rise to a very complex set of development issues. A central focus of these issues, and one that provides a unifying theme across sectors and disciplines, is that of animal, human and environmental health –“One Health”– which is the focus of this proposal. Innovative and integrated approaches to disease and natural resource management based on sound knowledge and understanding are urgently needed. An integrated, interdisciplinary programme such as is proposed here offers the most promising route forward in tackling these issues. It is a programme that the region can ill afford to do without.

The research outputs and deliverables required to achieve the programme’s overall objective are most easily cast as a set of themes and modules within an overall program as follows:

## **4. Themes and modules**

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<sup>4</sup> Here southern Africa includes Angola, Zambia and Tanzania, and the countries lying to the south of them.

A framework of six main **themes** is proposed for the programme, namely,

- g. An overarching conceptual framework to facilitate integrated interdisciplinary work
- h. Animal health and disease
- i. Land use, ecosystem goods and services, and animal health
- j. Human livelihoods, animal and ecosystem health
- k. Policy support and capacity building at local, national and regional levels
- l. Communications and outreach

Within each of these themes three to five **research modules**, that include monitoring and surveillance, are defined. They will contribute to improved knowledge and understanding of the linked social-ecological systems that comprise the TFCA and the central role of animal, ecosystem and human health in these systems.

### **Theme #1. Overarching conceptual model/framework.**

Develop an overarching conceptual or framework of the TFCA social-ecological system (SES) that provides a basis for a common, interdisciplinary, and generally agreed understanding of how selected system components (i.e. animal and ecosystem health and human livelihoods) are linked and interact. This framework, comprising a range of linked conceptual models, provides an essential basis for building a common vision amongst proponents engaged in the project/program and a platform for participatory interaction between researchers, farmers, resource managers, implementing agencies and policy makers. The conceptual framework should also assist in defining core, as opposed to peripheral, research questions and projects within the program. A core model should describe historical, existing and potential future alternative system states, and shed explicit light on driving variable thresholds that may be crossed in reaching such states. In particular, the ease with which these thresholds are reached and the desirability or otherwise of doing so, should contribute to a resilience (or vulnerability) analysis of the social-ecological systems in the GLTFCA. Some key issues such as water resources and land tenure and resource access rights that may not be tackled directly in other modules may need to be addressed in this theme.

### **Theme #2. Animal health and diseases**

Develop a set of animal health modules covering the following:

- a. **Epidemiological studies** of key livestock and wildlife diseases in the TFCA with the following three main components: i) surveillance – including that of alternative and potential cryptic hosts, ii) monitoring, and, iii) developing spatially explicit epidemiological models that can be used to explore disease ecology through alternative health management and disease control/containment strategies.
- b. **Alternative animal health management and disease control strategies** using surveillance and monitoring data, and models developed in epidemiological studies; examine the biological, social and economic implications of alternative strategies.
- c. **Theoretical studies** that might open up novel approaches to managing wildlife and livestock diseases, and the interface between domestic and wild animals, with particular emphasis on such issues as, i) impacts of anthropogenic interventions (e.g. fences, water points, introducing new livestock breeds, disease control interventions)

on host–parasite population dynamics in wildlife and livestock, and, ii) impacts of interventions and system shocks (droughts, floods, epidemics) on host-parasite-pathogen dynamics (e.g. incidence, virulence, enzootic stability, competitive displacement of pathogen strains) in wildlife, livestock and multispecies populations or systems.

There will need to be strong linkages and feedback loops between these modules and sub-modules as well as between researchers engaged in this work and the regulatory and implementing agencies that are responsible for controlling and managing diseases in each country and the region. A key player in this arena will be the Veterinary sub-committee of the Joint Management Board of the GLTFCA.

### **Theme #3. Land use, ecosystem goods and services, and animal health**

Social-ecological system dynamics in the GLTFCA area are strongly influenced by cycles of dry and wet years. These have influenced predator prey dynamics (Starfield and Bleloch 1991), declines in rare and endangered antelope species (Ogutu and Owen-Smith 2003), shifts in landuse from ranching to wildlife (Du Toit 1994), and cycles of food aid and human social dynamics. They are also likely to strongly influence spatial and temporal dynamics of diseases in the GLTFCA area and beyond (e.g. Randolph 1997; Hay *et al* 2002). There is therefore a clear need to develop a set of modules that include the following:

- a. **Exploring spatial and temporal relationships between ecosystem processes and disease prevalence** and virulence in the TFCA with particular emphasis on spatial and temporal distribution, patch dynamics (heterogeneity) and source-sink dynamics<sup>5</sup> of large mammals, vectors and pathogens.
- b. **Examining landscape level resource use and impacts by wild and domestic ungulates on ecosystem goods and services** (which may have implications for (a) above and in turn be influenced by spatial and temporal dynamics).
- c. **Determining the effect of land use scale and pattern on animal health.** Explore questions relating to the scales at which enterprise/landuse units operate (e.g. size of farms, communal areas, village areas) within the TFCA and the extent to which their patterns and scale may influence animal health and disease control or mitigation strategies, and impact on ecosystem goods and services and human livelihoods.
- d. **Examining linkages between animal and human health.** Examine links between animal and human health and potential zoonoses (e.g. bovine tuberculosis, brucellosis) with particular reference to the interaction between zoonoses and HIV-AIDS.

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<sup>5</sup> Source sink dynamics – ecological communities are generally open and heterogeneous in space and time (i.e. they are patchy) with the result that organisms move between patches of habitat of varying quality. Patches of high quality habitat may be characterised by population growth and emigration (i.e. sources) while poor quality habitats may experience negative population growth despite immigration with the result that they act as sinks. The population fluxes involved between sources and sinks is referred to as source-sink dynamics. (Kristan 2003, Loreau and Holt 2003 )

- e. **Understanding animal husbandry practices.** Examine current practices particularly in relation to disease prevention and problem animal control in order to explore the development and introduction of mitigating strategies early on. Many animal husbandry practices are deeply rooted in cultural tradition and their origins and usefulness under past and current conditions need to be understood if there is a need for them to adapt to evolving management systems within the TFCA.

#### **Theme #4. Human livelihoods, animal and ecosystem health**

Develop a module that explores linkages between animal and ecosystem health and human livelihoods – particularly in communal farming areas within the TFCA. Sub-modules would include the following:

- a. A **scenario planning**<sup>6</sup> module that uses appropriate participatory procedures to explore current states and alternative futures for land use and development within the TFCA with particular emphasis on opportunities for building synergistic linkages between major land use options such as wildlife tourism, agro-pastoralism and irrigation. This module will have strong links to Theme #5 on policy support.
- b. Examine economic, social and ecological (including health) consequences and trade offs of alternative models for linking (integrating) land use enterprises across the landscape.
- c. Examine the effects of existing and alternative policy and institutional structures (and strictures) on the development of desirable scenarios/futures that may emerge from (a) and (b) above, with particular emphasis on scale effects and resilience and adaptive capacity.
- d. Develop a minimal (baseline) set of indicators, and appropriate thresholds for each, for monitoring animal, ecosystem and human wellbeing within the TFCA that can be used and sustained beyond the life of the project.

#### **Theme #5. Policy support and capacity building at local, national and regional levels.**

The results of monitoring, surveillance and research will have important implications for the development of policy and protocols related to a wide range of animal, human and ecosystem health issues. It will therefore be important to establish the capability to provide support to policy makers at various levels. Two related activities are envisaged under this theme:

- a. Facilitate and provide support to local, national and regional (including SADC) needs in the development of policy related to animal health and the linkages between animal and human health and ecosystems.
- b. Explore likely consequences of alternative policies using **scenario planning** and related planning approaches. See also module (a) under Theme #4.
- c. Facilitate the growth of adequate capacity to achieve and maintain (a) and (b).

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<sup>6</sup> Scenario planning – a participatory planning technique that formally and explicitly examines plausible alternative future states of a social-ecological system – futures that could be. They represent alternative dynamic stories that include qualitative and quantitative descriptions of the system and capture key ingredients of our uncertainty about the future (e.g. Peterson, Cumming and Carpenter, 2003)

## Theme #6. Communications and outreach

If the research program is to have any effect on the ground it will require an effective and appropriately supported communications and outreach program that caters for the following:

- a. Communication between research workers and the array of organizations involved in the program.
- b. Communications and information flow between scientists and governmental implementing and policy making agencies linked to and/or supporting the program.
- c. Participation of landowners, communal farmers, local government agencies and individuals in the research program.
- d. Support for the development of mechanisms that foster the spread of information and learning on new developments in resource and disease management (e.g. exchange visits between resource managers within the TFCA) and so contribute to enhanced adaptability and resilience in the social-ecological systems of the TFCA.
- e. Production and distribution of research results, syntheses, policy briefs, etc.
- f. Community and village outreach including theatre linked to meetings and participatory rural appraisal approaches to communicate information to and receive input from communities and villages where a high proportion of stakeholders are not literate.

It is particularly important for this module to be seen and developed as a core module that, together with Module #1, provides the “glue that holds the programme (i.e. themes and modules) together” and helps to build participation and capacity of all stakeholders involved. *It must be started early in the programme, to facilitate adequate constituency building.*

## 4. Context

Animal health and livelihood problems in the TFCA are a function of current environmental and socio-economic conditions and an outcome of developments in the region over the last 150 years. A brief overview of past and recent developments in relation to animal health and disease control provides a necessary background and context in which to examine the current animal health, land use and development issues in the GLTFCA.

### *Historical*

Livestock arrived in southern Africa between 2000 and 1500 years ago (Denbow and Wilmsen 1986) from East Africa and were certainly present in the Limpopo valley from about AD 600 (Plug 2000). The earliest identified archaeological site (known as *Pa 8.1* near the Luvuvu/Limpopo confluence) occupied in c. AD 850 contained the remains of sheep and goats, eleven wild ungulates, but no cattle. Later sites in the same area, such as Thulamela, (c. AD 1350-1750) included cattle, sheep, goats, dogs and chickens and the remains of 32 non-domestic mammals (Plug 2000). The collapse of the Mapungubwe culture in about 1100 AD and the subsequent shift to

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Great Zimbabwe was associated with changing climate and the development of smaller settlements, possibly intermediary chiefdoms, at several sites in the Limpopo, Lundi, Mwenezi, Save and Bulyabulo valleys in Zimbabwe (Manyanga, Pikiyayi and Ndoro 2000), with sites such as Malumbu in the Mateke Hills near the Bulyabulo River, and others near Chiredzi. The Malumbu site (*c.* AD 600- 1000) in the Mateke Hills, for example, exploited mainly cattle and sheep and/or goats with little use of wildlife while the Mwenezi Farm site (AD 800-1300) exploited a greater proportion of wild ungulates and particularly zebra, wildebeest and impala (Manyanga, *et al* 2000). The important point about the archaeological findings for the Limpopo Valley in sites within or bordering the GLTFCA and the S-LTFCA is that domestic livestock were present alongside wildlife, which was exploited, within the area for at least 1000 years before the advent of introduced (i.e. alien/exotic) livestock diseases *c.* 150 years ago and European settlers in the Lowveld 90 to 100 years ago.

The major external shocks to both livestock and wildlife in the mid to late 1800s were in fact from introduced diseases – often carried by animals imported from other countries or elsewhere in Africa. The most serious of these introduced diseases were rinderpest and contagious bovine pleuropneumonia. Bovine pleuro-pneumonia had a major impact on cattle populations in the 1850s and later (Roberts 1980), while rinderpest decimated both domestic livestock and wild ungulates during the 1890s. Subsequent introductions followed, such as strains of East Coast Fever from East Africa, the rabies street virus from Europe, bovine tuberculosis, schistosomiasis, brucellosis, and more recently a novel FMD topotype, or strain, from northwestern Zimbabwe was introduced when buffalo were translocated from Hwange and Chizarira National Parks to Gonarezhou National Park in the late 1990s. The ecological impacts of the devastating epidemics of rinderpest, and possibly also pleuropneumonia in cattle, are still evident a century later (Caron, Cross and du Toit 2003).

The collapse of both domestic animal and wildlife populations in the 1890s and early 1900s had major implications for livelihoods and food security in the GLTFCA area. It also probably prompted, and perhaps indirectly facilitated, the movement to establish game reserves in the more remote areas with low human densities and depleted livestock populations such as the Gonarezhou (Zimbabwe) and Kruger (South Africa) National Parks.

The three countries represented in the TFCA differ considerably in their colonial and post independence history and current economic status. There are, however, some common experiences that influenced land use and livestock/wildlife management in the GLTFCA area. After colonial occupation and coinciding with the final partition of Africa in 1912 (Pakenham 1992), the rural areas encompassed by the TFCA were subjected to land apportionment acts in South Africa and Zimbabwe (then Southern Rhodesia) that resulted in the transfer of land to commercial (mainly white) farmers or to game reserves and eventually to national parks. Adjustments to land category boundaries and the consequent displacement of rural, largely subsistence, farmers occurred intermittently through to the 1970s (e.g. extension of Gonarezhou following the clearance of tsetse fly in 1975 and extension of Kruger NP to include the Pafuri Game Reserve in 1969, [Pollard, Shackleton and Carruthers 2003]). In Mozambique, however, the establishment of Zinave and Banhine National Parks and Coutada 16 in 1972, and transformation of the latter into the Limpopo National Park in 2001, did not involve the displacement of people living in these areas.

Despite the relative neglect of the marginal areas now comprising the TFCA from a development perspective, animal disease control through coordinated national policies was effective until about the mid-1970s. A joint tri-national tsetse control program, for example, was concluded in the early 1970s with the removal of tsetse fly from the south-east Lowveld of Zimbabwe and from the

area of Mozambique south of the Save River (Robertson and Kluge 1968, Robertson *et al* 1972). The program prevented the re-invasion of Kruger NP by tsetse fly. The resurgence of tick-borne diseases in south-east Zimbabwe followed the onset of the guerilla war and collapse of dipping services in the mid 1970s (Norval – undated, Tice *et al* 1998).

#### *Current situation and animal health concerns*

Within Zimbabwe disease control measures were re-established after independence with European Union support, particularly for FMD, but these measures have largely collapsed again over the last three years and there is also evidence of a return of tsetse fly to the Save-Rundi junction area of the Gonarezhou National Park.

Apart from information on the control of tsetse fly during the 1970s, and some recent information on the spread of the fly, no published information appears to be available on animal health and diseases in the Mozambique sector of the TFCA.

The animal health and disease situation in the South African component of the TFCA, the Kruger National Park, has been well studied and documented (e.g. Bengis *et al* 2003). Major current concerns include, for example, the northward spread of bovine tuberculosis (BTb) within the park (Bengis *et al* 2003, Caron *et al* 2003).

**Table 1. Animal diseases of concern in the GLTFCA (\*\* Priorities for surveillance and strategic control/containment: *Origin* indicates whether the disease is indigenous (Ind) or introduced/alien (Al)**

Mode of Transmission	Disease	Origin	Wildlife	Domestic animal	Human	Comments
Contagious	Rinderpest	Al	+	+	-	Last Outbreak in 1896
	<b>Foot and Mouth Disease**</b>	Al	+	+	-	New strain from Zambezi Valley introduced 2000
	Malignant catarrhal fever	Ind	+	+	-	
	Brucellosis	Al	+	+	+	
	<b>Bovine tuberculosis**</b>	Al	+	+	+	
	Anthrax	Ind	+	+	+	
	Rabies	Ind	+	+	+	
	Canine distemper	Al	+	+	-	
	Toxoplasmosis		+	+	+	
	Sarcoptic mange		+			
Vector borne	<b>Trypanosomiasis**</b>	Ind	+	+	-	No human cases south of Zambezi Valley
	African Swine fever	Ind	+	+	-	
	African horse sickness	Ind	+	+	-	
	Rift Valley fever (Theileriosis)	Al	+	+	+	
	Heartwater	Al	+	+		
	Echinococcosis	Ind	+	+	+	

The animal health issues presently of greatest concern (Table 1) are the breakdown of FMD controls in Zimbabwe and its spread (including novel strains of FMD) within the south eastern sector of the country, the possible re-invasion of tsetse fly, the spread of BTb in Kruger and its possible entry into Zimbabwe as well as its status in Mozambique. Rabies has been documented on the Mozambican side of the TFCA, for example, but never in wildlife in Kruger National Park. Other current important disease concerns are also indicated in Table 1.



### *Key environmental features*

Both the GLTFCA and the S-LTFCA are characterized by low altitude (< 600m a.s.l.) and high mean annual temperatures. Mean annual rainfall varies between 250-600mm and is highly variable both temporally and spatially. The region is repeatedly subject to severe droughts. Geologically the area is dominated by Karroo sediments and basalts with dolerite and diabase sills and dykes. The basalt derived soils are generally nutrient rich while sandy soils are mostly nutrient poor. Large areas are characterised by very poor shallow and rocky soils with no agricultural potential (Anderson *et al* 1993). Plant production is constrained in both soil types by moisture and particularly by the short growing season (< 120 d but with much of the area at <90 d) coupled with a long dry season. Low and intermittent winter rainfall does occur and is particularly important for grass growth and nutrition of some ungulate species (Ogutu and Owen-Smith 2003; Dunham, Robertson and Grant 2004). The area is agriculturally marginal and unsuited to dry land cropping. Areas of irrigable soil are present and several large existing or potential commercial irrigation schemes fall within the area. The most suitable form of land use is generally recognized to be extensive livestock and/or wildlife production (Jansen, Child and Bond 1992).

### *Development and food security*

From a development perspective, the GLTFCA area has in the past been regarded as disease ridden, marginal and largely unproductive land on distant national boundaries, with the result that infrastructural development has, until recently, been minimal. Human population densities in Zimbabwe and Mozambique are generally below 20 people per km<sup>2</sup> but when examined in relation to rainfall and primary productivity without external energy inputs (as in commercial irrigation) they are too high – particularly in the subsistence agro-pastoral farming areas in the Communal Lands in Zimbabwe (Cumming 2003). In South Africa, however, human population densities in the communal lands on the western boundary of Kruger NP vary between 150-300 people per km<sup>2</sup> (Pollard *et al* 2003). These high densities are not supported by the local natural resource base but by remittances from wage labour in the cities. In south eastern Zimbabwe food security for subsistence farmers is very low with surplus cereals being reaped in less than one year in ten (Frost 1999), and dependence on livestock is high.

### *Socio-economic features*

Mozambique, although still emerging from a protracted and damaging civil war that ended a decade ago, has the highest economic growth rate in the region. The Masengena and Chikwarakwara Districts in Gaza Province, however, have little infrastructure and are poorly developed. The national parks within the TFCA (Limpopo, Banhine and Zinave) are essentially undeveloped.

The South African transition from apartheid to democratic representative government occurred in 1994. Tourism has been a major growth industry, and Kruger National Park with its well developed infrastructure attracts about 1 million tourists a year. Tourist developments in game ranches and conservancies on the western boundary of the park also attract high numbers of tourists. The communal lands are however densely settled and underdeveloped and face major social and resource management problems (Pollard *et al* 2003).

Zimbabwe gained independence in 1980. After nearly 20 years of relative stability and economic growth the country has, since 2001, experienced rapid economic decline - reputedly the fastest in the world. This period has coincided with a fast track land reform program that has had

major impacts on the viability of the commercial farming and wildlife-based tourism sectors in the south east Lowveld of Zimbabwe. The Gonarezhou National Park is largely undeveloped as a tourist destination but adjacent conservancies still support some “low volume- high value” tourism.

#### *Wildlife policy and management*

Broad policy guidelines, in keeping with the SADC Wildlife Protocols, are in place for the GLTFP but not for the TFCA<sup>7</sup>. The Joint Management Committee for the TFNP has drafted a management plan but this has yet to be finalized and ratified. The Joint Management Board for the Great Limpopo Transfrontier National Park is advised on animal health and disease matters by a Veterinary Subcommittee of its Conservation Committee.

The major differences between the participating countries in technical capacity and resources in the fields of conservation and veterinary services presents a major challenge in the development of the TFNP and the TFCA, and this factor will need to be considered in the development and implementation of this project.

#### *Animal health policies*

There does not appear to be an existing formal policy on animal health and disease control for the GLTFCA or for any of the other TFCAs being developed. This perhaps makes the *AHEAD-GLTFCA* initiative that much more important and exciting as a potential model.

## **6. Programme coordination, participants and budgets**

At the outset it will be important to establish clear lines of communication between the project and its various research components and the veterinary, community health and rural development authorities in each country. It will also be important to alert them at an early stage of plans to develop this proposal and to secure their support. This might best be accomplished by members of the working group meeting with senior officials in the relevant agencies within each country to outline and seek comment on the concept. At an early stage the Veterinary Sub-Committee of the GLTFNP Joint Management Board needs to be informed – perhaps through members of the *AHEAD-GLTFCA* Working Group who are members of the Veterinary Sub-Committee.

For an inter-disciplinary and multi-agency initiative such as this, mechanisms for effective coordination and communication amongst all stakeholders will need to be carefully designed and planned – and adequately resourced. The programme will need an “institutional home” and the formal establishment of a consortium comprising a core group of agencies who will be responsible for raising and managing funds and generally managing the programme.

The following is a preliminary list of organizations and groups that could potentially be involved and participate, even if only peripherally, in the program.

1. Veterinary departments of Mozambique, South Africa and Zimbabwe

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<sup>7</sup> Note that GLTFNP refers to the Transfrontier National Park that comprises Kruger, Limpopo and Gonarezhou National Parks and the Sengwe Corridor (that has still to be established) to link Kruger and Gonarezhou. The TFCA refers to the much larger complex of National Parks (including Banhine and Zinave), game reserves and conservancies on freehold land and the intervening communal farming lands on state land, etc.

2. The government wildlife conservation and research agencies, TFCA Committees, and national parks in the three countries involved.
3. The government agricultural/livestock extension agencies
4. The Universities of Pretoria (Centre for Wildlife Studies – an inter-faculty body), Natal (Institute of Natural Resources), Zimbabwe (Centre for Applied Social Sciences, Institute of Environmental Studies, Tropical Resource Ecology Programme), University of Eduardo Mondlane veterinary faculty, and several university research groups from Europe and North America (e.g. University of California (Berkeley) Dept. of Environmental Science, Policy & Management, which is already working in Kruger).
5. NGOs, including the Wildlife Conservation Society (WCS), Peace Parks Foundation (PPF), CESVI- Cooperazione e Sviluppo, World Wide Fund for Nature – Southern Africa Regional Office (WWF-SARPO), African Wildlife Foundation (AWF), and Fauna Natureza um Perigo (FNP) in Mozambique.
6. Conservancies in South Africa and Zimbabwe
7. Public health authorities and health-related NGOs
8. Local government authorities in the districts that are part of the TFCA
9. Resource managers and farmers on the ground (i.e. on freehold and communal lands) within the TFCA.

## **Budgets**

A detailed budget for the programme has yet to be developed. However, a start up phase building a common framework, establishing local and regional linkages, and tackling some of the more immediate disease surveillance and monitoring work in GLTFCA could be accomplished with a budget of between US\$ 0.75 and 1 million. A programme with all modules operating at a realistic level would probably require in the region of US \$12 million a year. However, many of the sub-modules could be funded separately and provided that essential core themes such as a unifying conceptual framework and a communications and outreach programme were in place, the project could still achieve the aims of a targeted and integrated applied research and development programme.

A multifaceted research and development programme of this nature with wide applicability and of high potential interest to policy makers at national and international levels will clearly require the formation of a consortium of appropriate implementing partners and supporting agencies. The formation of such a consortium, which would include development and implementing partners in both public and private sectors, is under active consideration

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