



**NATIONAL STRATEGY
FOR PREVENTION AND CONTROL OF
ANTHRAX IN HUMANS & ANIMALS
2018 - 2023**

MAY 2018



TABLE OF CONTENTS

List of Tables	ii
List of Abbreviations	iii
Executive Summary	ii
Acknowledgements	iv
CHAPTER ONE	1
1. Introduction	1
1.1 Anthrax status in Tanzania (Situation Analysis)	2
1.2 Justification for the control of Anthrax in Tanzania	4
1.3 Policy and Legal Framework	5
1.4 Agencies Responsible for Anthrax control in Tanzania	6
CHAPTER TWO	8
2. Analysis of Strengths, Weaknesses, Opportunities and Challenges (SWOC) regarding anthrax prevention and control	8
CHAPTER THREE	14
3. Guiding Principles of Anthrax Prevention and Control Strategy	14
3.1 Vision	14
3.2 Mission	14
3.3 Goal	14
3.4 Overall Objective of Anthrax Control Strategic Plan	14
3.5 Key strategic objectives for anthrax	14
3.5.1 <i>Prevention and Control of Anthrax in human</i>	14
3.5.2 <i>Prevention and control of anthrax in food animals</i>	14
3.5.3 <i>Strengthen institutional capacity to control anthrax</i>	15
3.5.4 <i>Promote and coordinate research and innovation in anthrax interventions</i>	15
3.5.5 <i>Enhance awareness and knowledge on anthrax for professionals, policy makers and the public</i>	15
3.5.6 <i>Enhance partnerships and One Health approach/ multi-sectoral collaboration</i>	15
3.5.7 <i>Streamline and harmonize appropriate legal and policy framework and institutional arrangement for the implementation of strategy</i>	15
CHAPTER FOUR	16
4. Implementation Plan of the Strategy	16

CHAPTER FIVE	18
5. Institutional and Financial Arrangement	18
5.1 Institutional Arrangement	18
5.2 Financial Arrangement	19
CHAPTER SIX	20
6. Monitoring and Evaluation	20
References	21
Appendices	22

LIST OF TABLES

Table 1: Bodies responsible for the control of Anthrax in Tanzania	6
Table 2: Strengths, weaknesses, opportunities and challenges	8
Table 3: Progressive–Structured approach/Roadmap	16
Table 4: Key Stakeholder and roles	18

LIST OF ABBREVIATIONS

AU-IBAR	African Union Inter-African Bureau of Animal Resources
CBO	Community Based Organization
CDC	Centres for Disease Prevention and Control
CBEP	Cooperative Biological Engagement Programme
CMO	Chief Medical Officer
COSTECH	Commission of Science and Technology
CUHAS	Catholic University of Health and Allied Sciences
DTRA	Defence Threat Reduction Agency of US
eIDSR	Electronic Integrated Disease Surveillance and Reporting
FAO	Food and Agriculture Organization of the UN
FBO	Faith Based Organization
GHSA	Global Health Security Agenda
IDSR	Integrated Disease Surveillance and Response
IHI	Ifakara Health Institute
KCMC	Kilimanjaro Christian Medical Centre
KCRI	Kilimanjaro Clinical Research Institute
MNRT	Ministry of Natural Resources and Tourism
MOHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
MOLF	Ministry of Livestock and Fisheries
MUHAS	Muhimbili University of Health and Allied Sciences
NAPHS	National Action Plan for Health Security
NGO	Non-governmental Organization
NHLQAT	National Health Laboratory Quality Assurance and Training
NIMR	National Institute for Medical Research
NM-AIST	Nelson Mandela African Institution of Science and Technology
OHCEA	One Health Central and Eastern Africa
OHCU	One Health Coordination Unit
OIE	World Organization for Animal Health (Office Des Internationale des Epizootics)
OPD	Out Patient Department
P & R	Preparedness and Response
PMO	Prime Minister's Office
PO RALG	President's Office Regional Administration and Local Government
PVS	Performance of Veterinary Services

NATIONAL STRATEGY FOR PREVENTION AND CONTROL OF ANTHRAX IN HUMANS & ANIMALS

RVF	Rift Valley Fever
SADC	Southern Africa Development Community
SOP	Standard Operating Procedure
SPS	Sanitary and Phytosanitary Measures
SUA	Sokoine University of Agriculture
TANAPA	Tanzania National Parks
TAWIRI	Tanzania Wildlife Research Institute
TVLA	Tanzania Veterinary Laboratory Agency
URT	United Republic of Tanzania
USAID	US Agency for International Development
WHO	World Health Organization
WTO	World Trade Organization

EXECUTIVE SUMMARY

Anthrax caused by the spore-forming bacterium *Bacillus anthracis* is a potentially fatal disease. *Bacillus anthracis* spores which are the source of animal infections are geographically ubiquitous in soils. *B. anthracis* spores are stable and resistant to many environmental conditions, and can persist in the soil for decades. The stability and ubiquitous nature of the spores make them a suitable bioweapon.

This bacillus most commonly infects ungulate herbivores. It has been reported that in nature the spores are not likely to become airborne at carcass sites, despite rain, wind or some soil agitation (Turnbull et al. 1998). In nature, the vegetative form of *B. anthracis* seems to exist only in a host and is not found in the environment. Animals therefore acquire infection during grazing especially in the drier months where pastures become too short and hence increasing likelihood of ingesting soils with spores. Anthrax is primarily a disease of animals and humans become infected through handling carcasses from infected animals or contaminated animal products.

Anthrax in Tanzania has been associated with outbreaks in both livestock and wildlife and cases tend to be the highest in interface ecosystems, such as the Ngorongoro-Serengeti, Mikumi-Selous and Ruaha, where a range of susceptible species and people live in close proximity. Cases occur regularly throughout the year, but larger outbreaks have been associated with extreme weather conditions including prolonged droughts or rains. The occurrence of anthrax outbreaks in high-profile Tanzanian ecosystems may negatively affect revenue generated through tourism, which amounts to >US\$1.2 billion per year, and therefore national GDP. Individual households suffer from the human form of the disease and its associated morbidity, mortality and treatment costs. Zoonotic impacts go far beyond public health costs and include losses from animal disease with severe consequences for livelihoods, food security and nutrition.

Early detection of the disease is paramount to effective prevention and control. Improved detection systems will also help generate the evidence needed for greater prioritization of research into the epidemiology of the disease and investment into laboratory capacity for accurate confirmation of cases throughout the country.

The present National Strategy for Prevention and Control of Anthrax articulates measures for prevention and control of Anthrax in Tanzania mainland. The strategy provides guidance on early warning to enable rapid detection, reporting and response.

This document took into consideration existing legislation guiding prevention and control of animal and human diseases as well as guidelines and recommendations of International Organizations such as the Food and Agriculture Organization (FAO), the World Organisation for Animal Health (OIE), and the World Health Organization (WHO).

There are seven key areas of intervention that this document addresses. These are:

1. To enhance advocacy, communication and social mobilization for prevention and control of anthrax
2. To improve anthrax vaccine availability and accessibility to livestock keepers in Tanzania
3. To streamline and harmonise appropriate legal framework and institutional arrangement in the control of Anthrax.

NATIONAL STRATEGY FOR PREVENTION AND CONTROL OF ANTHRAX IN HUMANS & ANIMALS

4. To promote and coordinate research and innovation in Anthrax interventions
5. To strengthen capacity for surveillance using a One Health approach
6. Strengthen biosafety and biosecurity
7. Facilitate OH coordination and monitoring and control activities

ACKNOWLEDGEMENTS

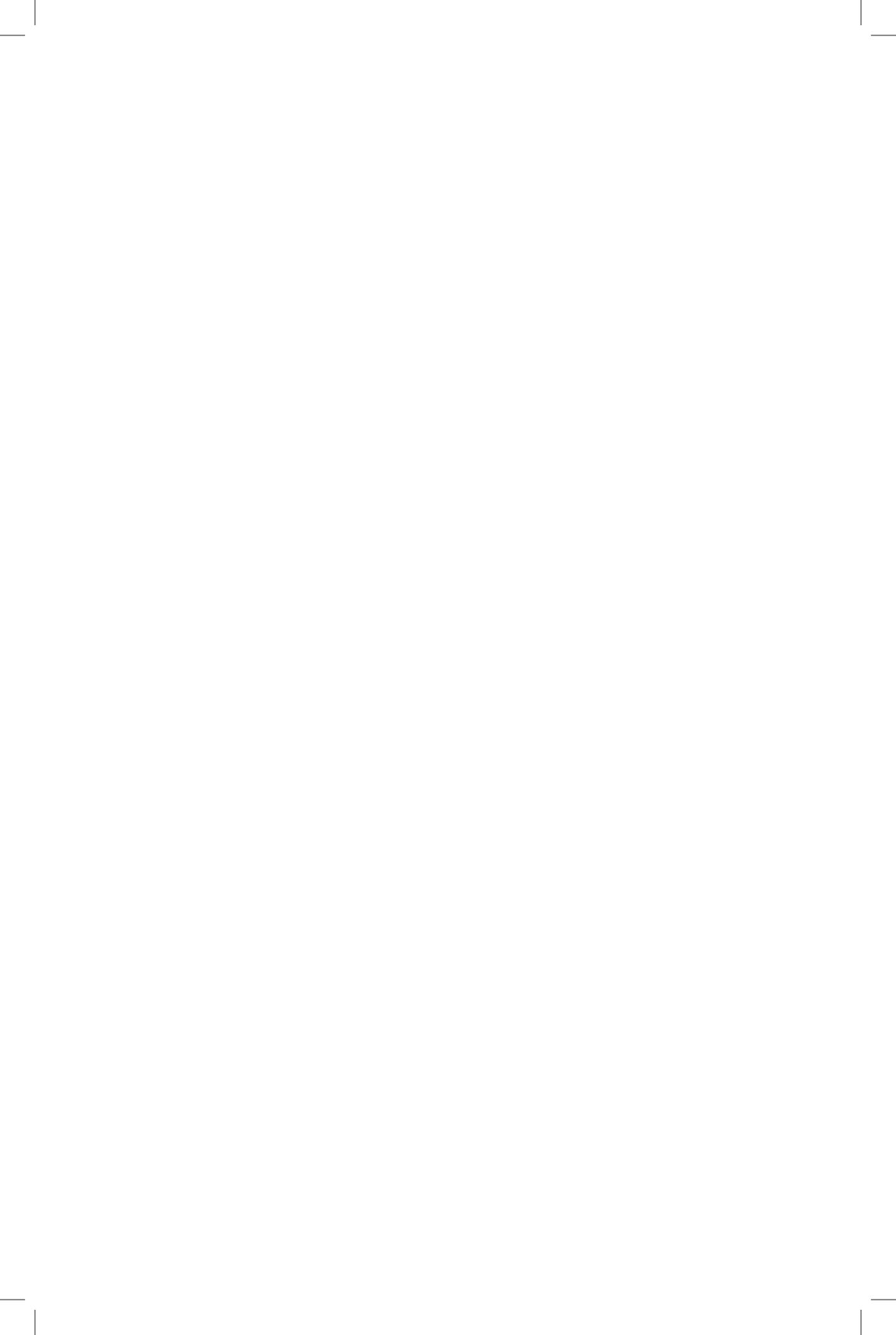
The development of the National Strategy for Prevention and Control of Anthrax is a great achievement in ensuring a systematic mechanism for addressing priority zoonoses as identified through a prioritization exercise carried out in March 2017. This is a multi-sectoral strategic document to guide the prevention and control of anthrax in animals and humans in Tanzania and has been prepared in line with the national integrated surveillance guidelines, National One Health Strategy (URT OH), National Action Plan for Health Security (NAPHS) and the recommendations drawn from the Global Health Security Agenda (GHSA).

The development process was coordinated by the Prime Minister's – One health Coordination Unit (PMO-OHCU) under the Disaster Management Department (DMD) in collaboration with the Ministry of Livestock and Fisheries (MoLF), Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) and Ministry of Natural Resources and Tourism (MNRT), through a number of stakeholder consultative meetings. These are highly appreciated as they shaped the document significantly. The plan received technical backstopping from PREDICT, Preparedness and Response (P&R), FAO and WHO.

Preparation of this Plan was made possible with the support of the FAO's component of the Emerging Pandemic Threats Phase II (EPT-2) project, which is financed by the United States Agency for International Development (USAID). We highly appreciate such contributions.

Dr. Mpoki M. Ulisubisya
PERMANENT SECRETARY
MoHCDGEC

Prof. Elisante Ole Gabriel
PERMANENT SECRETARY
MoLF



Anthrax is an acute to peracute, highly contagious, disease of domestic and wild animals, although also humans can acquire infection. Anthrax is primarily a disease of herbivores, but all mammals are susceptible. In the more susceptible animal species, the disease is usually characterized by sudden death. Other signs may include oedema, haemorrhages and splenic necrosis. Blood and/or bloody fluid oozing from natural orifices and lack of rigor mortis have also been described. The causal agent, *Bacillus anthracis*, can be detected in the blood and body fluids towards the terminal phase of the disease.

Animals acquire infection through ingestion of *B. anthracis* endospores from soil when grazing or in contaminated water, through abrasions of the skin or inhalation. Inhalation occurs to a lesser extent in animals than in humans. Transmission by biting insects may be important especially during an outbreak. Animal anthrax is therefore difficult to treat because of the rapid onset of the condition. A mortality rate of approximately 100% is reported for animal systemic infections. Susceptibility to the disease is variable among different animal species. Cattle, sheep and goats are most susceptible to infection, horses and humans occupy an intermediate position, while pigs, birds and carnivores are comparatively resistant, but can succumb if the infective dose is high. The disease also occurs in wildlife herbivores and this complicates its management.

Anthrax in humans can be deadly. The disease is classified into three forms according to the clinical features and transmission route: the cutaneous form of anthrax, accounting for about 95% of all reported human cases worldwide, the gastrointestinal form kills about 60 percent of infected people, even with treatment, and the inhalational form, which has the highest mortality rate, around 75 percent. Anthrax mortality drops to 20 percent for individuals infected with cutaneous anthrax. There is no evidence of person-to-person transmission of *B. anthracis*, and humans normally acquire the disease from direct contact with anthrax-infected animals or anthrax-contaminated animal products or biological materials during laboratory manipulation. Humans can incidentally acquire the disease by contact with endospores from infected animals or their contaminated products or from a bioterrorism source. Transmission may also occur through inhaling anthrax spores from contaminated animal products and consumption of undercooked meat from infected animals. A lack of awareness regarding the risks posed by potentially infected or contaminated animal products as well as limited alternative meat sources may contribute to cases in humans.

In Tanzania, anthrax is mostly transmitted through skin lesions, either through abrasion, cuts or insect bites. Cutaneous anthrax is rarely fatal as the infection area is limited to skin, preventing the lethal factor, edema factor, and protective antigen from entering and destroying vital organs. Pulmonary anthrax is obtained through inhalation of anthrax spores. Early symptoms of pulmonary anthrax include mild fever, muscle aches and malaise, mild cough, sore throat, and chest pain. This may progress to a more complicated form of disease presenting with severe breathing problems, shock, disorientation with coma, and death. Gastrointestinal (GI) anthrax is often caused by consuming anthrax-infected meat. The disease is characterized by serious GI difficulty, vomiting of blood, severe diarrhea, acute inflammation of the intestinal tract, and loss of appetite. Lesions have been found in the intestines and in the mouth and throat. When death occurs, this results from the bacterium toxins, which damage body cells. Antibiotic treatment is necessary and effective in killing the infecting bacteria if administered promptly after exposure

Economically, the disease is of significant importance across several key economic sectors. The disease in wildlife has negative repercussions on tourism. Outbreaks occurring in protected areas hamper tourism activities resulting in reduced national GDP. The disease also affects livestock-dependent communities by causing mortality in domestic animals and therefore loss of food and income. It is estimated that there may be about six anthrax outbreaks annually occurring in Tanzania. In humans, due to poor surveillance and diagnostic capacities not so much has been recorded although one study reported some cases in persons who consumed livestock carcasses, 4 deaths and 8 cases in 7,538 (with 50% case-fatality rate) persons during 1999-2006 (Lembo *et al* 2011). *Bacillus anthracis* poses a potential bio-threat through deliberate release as biological warfare and bioterrorism agent.

Response to anthrax requires joint collaborative efforts of the Ministries responsible for human health, livestock, and wildlife services. However, one of the biggest challenges in control of zoonotic diseases including Anthrax is the lack of joint approach for responding to those diseases. Therefore, there is a need for joint response actions with combined technologies and infrastructures from both public health and veterinary professionals, social scientists, and ecologists to initiate approaches to contain Anthrax and other zoonotic diseases. This is a multi-sectoral strategic document to guide prevention and control of anthrax in animals and humans in Tanzania through a coordinated One Health approach.

Potential users of this document will be all public health and veterinary stakeholders in the Ministry of Livestock and Fisheries (MOLF), Ministry of Health, Community Development, Gender Elderly and Children (MOHCDGEC), Ministry of Natural Resources and Tourism (MNRT), President's Office Regional Administration and Local Government Authorities (PO-RALG), Training & Research institutions, Development Partners, relevant NGOs and the private sector.

This document has been prepared in line with the Anthrax National Integrated Surveillance guideline, National Action Plan for Health Security (NAPHS), and the recommendations drawn from various missions, assessments, surveys and evaluation reports, and the Global Health Security Agenda (GHSA).

1.1 Anthrax status in Tanzania (Situation Analysis)

Anthrax is still endemic in Africa, with several outbreaks causing significant losses in domestic animals, wildlife and human. In Tanzania, frequent anthrax outbreaks have been reported at the livestock-wildlife interface. However, while some data are available from specific areas, there is no comprehensive dataset allowing to determine the magnitude and distribution of the disease in susceptible species. Regular cases as well as major epidemics have been reported in several protected areas including the Serengeti National Park (Serengeti District), the Ngorongoro Conservation Area (Ngorongoro District), the Selous Game Reserve (spanning five different regions), Mto wa Mbu Game Controlled Area (Monduli District), West Kilimanjaro (Hai District), Mpwapwa in Dodoma posing risks of transboundary spread to neighbouring areas both in Uganda and Kenya, for example the Queen Elizabeth National Park, and Maasai Mara. Infected areas therefore represent a persistent risk to surrounding communities.

INTRODUCTION

Retrospective data available for the period 2013 - 2016 through the national human surveillance system revealed cumulative human incidence of 8.1/100,000 people in Arusha and 6.6/100,000 in Kilimanjaro regions, respectively (Regional Hospital Reports, 2016). The afore-mentioned regions are considered areas at increased anthrax risk, although this may be the result of surveillance biases. A health facility-based review, carried out in high-risk districts of Ngorongoro, Meru, and Monduli of Arusha and Siha, Moshi, Rombo and Hai districts of Kilimanjaro regions from 2006 to 2016, identified 330 human cases while 243 cases only were recorded through the National Surveillance System from all the health facilities in the two regions during the same period (Mwakapeje et al 2018).

Reports of Anthrax covering the period 2001 to July 2017 and compiled at 8 zonal veterinary Investigation Centres (ZVC) indicated a total of 152 outbreaks involving 15 Regions and 33 Local Government Authorities (LGA's). The affected LGA's have been reporting Anthrax for many years underscoring the significance of the disease in those LGA's. The highest number of Anthrax outbreaks was reported from Arusha region with 50 outbreaks, followed by Kilimanjaro 47 outbreaks, Manyara 16 outbreaks, Dodoma 9 outbreaks, Iringa 7 outbreaks and Mbeya 6 outbreaks. Overall, during the period under report, Anthrax caused 601 cases and 471 deaths with an estimated case fatality rate of 78%. The data described here are based from passive animal disease surveillance system, which is characterized by under reporting and misclassification of cases partly due to the lack of laboratory confirmatory diagnosis at the source of disease outbreak (LGA's) (Markey *et. al.*, 2013, MEBA 2017).

A recent anthrax outbreak in Mto wa Mbu was associated with the death of a reported 131 wildlife, 10 cattle, 26 goats, and 3 sheep as well as a total of 21 humans cases (Mwakapeje et al 2017). There's anecdotal evidence that the outbreak may have been associated with grazing and watering patterns, introduction of new animals, recently moved animals and the season during which the disease occur (Ibid.).

Management of the disease is mainly through vaccination of animals at risk and stringent adherence to biosafety and biosecurity measures (especially during disposal of dead animals) at various levels, including sustained and structured surveillance operations to identify active disease cases. Anthrax vaccine is produced at Tanzania Vaccine Institute, but there is no national vaccination programme in place to date.

Humans can acquire anthrax infection through the handling of contaminated animals or products from animals that have died of anthrax. Inhaling anthrax spores from contaminated animal products, for example when handling contaminated wool, leather or hair products from infected animals or the environment can also cause infection. A good example is that of pulmonary anthrax. The bacterium forms spores that can survive extremely harsh conditions for decades. Germination and multiplication take place when the spores are taken up by a host, through inhalation, ingestion or contamination of skin abrasions (Lembo et al 2011). In Tanzania, the most commonly reported form of the disease is cutaneous anthrax, acquired through skin lesions, usually when handling infected carcasses or animal products (e.g. hides) (Mwakapeje et al. 2017).

Early clinical signs and symptoms of pulmonary anthrax include mild fever, muscle aches and malaise, mild cough, sore throat, and chest pain. This may progress to a more complicated

form of the disease presenting with severe breathing problems, shock, disorientation with coma, and death. Pulmonary anthrax is not generally reported in Tanzania, although this may reflect underreporting or difficulties in diagnosing the disease rather than absence. Gastrointestinal (GI) anthrax is often caused by consuming meat from animals that have died of disease. The disease is characterized by serious GI signs and symptoms such as vomiting of blood, severe diarrhea, acute inflammation of the intestinal tract, and loss of appetite. Lesions have been found in the intestines and in the mouth and throat. Data on GI anthrax are limited as signs are non-specific and can be confused with other gastro-enteric conditions if not accompanied by a clear history of consumption of potentially contaminated meat.

Community practices and behaviours while taming their livestock and handling of livestock related products, which are often informed by cultural norms and values, do put people at risk of acquiring the disease. A recent study on perceptions and practices related to anthrax report that some communities of livestock keepers in northern Tanzania do not necessarily consider anthrax on humans as a threat to their lives. Additionally, some of their customs and traditions that involve handling livestock, livestock products and by products put them at higher risk of acquiring the anthrax (Mangesho *et. al.*, 2017). More information is needed on how different communities in Tanzania interact with livestock, and how they handle animal products to better plan relevant and responsible interventions.

1.2 Justification for the control of Anthrax in Tanzania

Anthrax is internationally categorised among the mandatory reportable diseases and a notifiable disease in Tanzania and therefore included in the current human electronic integrated diseases surveillance and response system (eIDSR) and Animal Health Information system (AHIS). However, many cases may go unreported both in animals and in humans due to several factors including weak passive reporting systems and the absence of clear control guidelines. Therefore, a comprehensive multi-sectoral strategic plan for preparedness and response is necessary for the successful prevention and control of anthrax in the country. Based on WHO classification, 1 cutaneous lesion represent 10 animal cases underscoring the fact that the source of human infection is the occurrence of Anthrax in animal population.

In developing this strategy framework, various reports, assessments and internal and external mission/survey reports were consulted. In September 2016, the country underwent a prioritization exercise for the zoonoses risks in Tanzania. Based on the finding of the integrated risk profiling of public health threats, Anthrax was ranked to be high in terms of likelihood of occurrence and impact (Anthrax => High morbidity/ mortality in both humans and animals in affected area, high transmission/spread, high consumption of drugs, funds, supplies, animal quarantine). Several other assessments have also been done to address gaps in various core capacities such as detection, surveillance, control and management of diseases. These assessments include Performance of Veterinary Services (PVS) Reports, PVS Gap analysis report, PVS- Veterinary Legislation report, PVS-Laboratory report, PVS-Follow up reports of 2008-2016 and Baseline Analysis report – Improving human and animal disease surveillance and response (DTRA/CBEP) of 2013-2014. All reports emphasize and recommend on the need for tackling zoonotic diseases through multi-sectoral collaboration and One Health approach. Therefore, a comprehensive multi sectoral strategic plan is necessary for the successful prevention and control of anthrax in the country.

INTRODUCTION

1.3 Policy and Legal Framework

There are a number of policies, laws and regulations guiding prevention and control of anthrax at national, regional and international level. The strategy is going to be linked with many existing policy instruments, programme/initiatives and these include:

- **National Livestock Policy of 2006** - The policy gives the provision of veterinary services including control of zoonoses that comply with the World Organization for Animal Health (OIE) standards, recommendations on animal health and guidelines for international animal disease control and trade (WTO & SPS).
- **Animal disease Act No. 17, 2003** under chapter Part IV chapter 48 - For the purpose of controlling diseases including zoonoses, the Act provides legislation relevant to outbreak notifications and investigations.
- **Public Health Act, 2009** - Places emphasis on notification of infectious diseases of public health concern.
- **Tanzania National Health Policy 2007** - The policy emphasizes the provision of equitable, quality and affordable basic health services to reduce disease burden, maternal and infant mortality, and increase life expectancy; availability of drugs and equipment; availability of health services to all people (urban and rural); as well as human resource capacity development.
- **Tanzania National eHealth Strategy 2013** - The strategy recognizes the potential of information and communication technology (ICT) in transforming healthcare delivery by enabling access to information and supporting healthcare operations, management, and decision making.
- **URT National One Health Strategy 2015:** - elaborates on the need to address zoonotic diseases using holistic and multi-sectoral one health approach
- **Tanzania Action Plan for Health Security 2017-2021:** – emphasized on the need to reduce morbidity, mortality, disability and socio-economic disruptions due to public health threats
- **Presidential Circular No 1 2002** - It restricts movements of animals from notifiable disease-infected area.
- **The Food, Drugs and Cosmetic Act No 1 of 2003** - Food Hygiene Regulations 2006 - TFDA and veterinary biological quality control and market authorization.
- The Animal Welfare Act No 19 of 2008:
- Livestock Registration, Identification, and Traceability Act No 12 of 2010:
- The Local Government (District) Authorities Act No 7 of (1982):
- Local Government (Urban Authorities) Act (1982):
- Disaster Act No 7 of 2015 - It provides official guidelines for risk management of disasters including outbreaks of infectious diseases.

- EAC: East African Public Health Laboratory- World Bank Funded Project
- SADC:
- FAO,WHO and OIE:

International policies/guidelines/regulations

- OIE /FAO/WHO – provide broad guidance and protocols on disease surveillance, contingency planning, preparedness and response to zoonotic diseases
- World Organization for Animal Health (OIE) terrestrial animal health code that set standards for the improvement of animal health and welfare and veterinary public health worldwide; OIE manual for diagnostic tests and vaccines for terrestrial animals.
- WHO: World Health Organization (WHO) is the body of the United Nations (UN) responsible for directing and coordinating human health, main function includes; providing leadership on matters critical to health and engaging in partnerships where joint action is needed; shaping the research agenda and stimulating the generation, translation and dissemination of valuable knowledge; setting norms and standards and promoting and monitoring their implementation; articulating ethical and evidence-based policy options; providing technical support, catalysing change, and building sustainable institutional capacity and monitoring the health situation and addressing health trends
- FAO/OIE: Progressive Control Pathway (PCP) for Brucellosis -
- AU IBAR: Integrated regional coordination mechanism sets mechanism for prevention and control of zoonoses

1.4 Agencies Responsible for Anthrax control in Tanzania

Table 1: Bodies responsible for the control of Anthrax in Tanzania

Area of Intervention	Stakeholders involved
Policies, standards and regulations development and implementation resource mobilization	MoLF, MNRT, MOHCDGEC VPO-Environment PM-DMP
Technical backstopping, capacity building and resource mobilization for disease for prevention and control	FAO WHO OIE UNICEF NGO's CDC
Reinforcement of policies and laws and control intervention implementations	PO-RALG, Home Affairs and other relevant NGO's and private sector and livestock keeping community

INTRODUCTION

Area of Intervention	Stakeholders involved
Biosafety and Biosecurity	MoLF, MNRT, MoHCDGEC, PO-RALG, and other relevant NGO's and private sector, Institute (e.g. Universities and colleges – SUA, UDSM, LITA. MATI, etc)
Research, training, consultancy and vaccine production	National: Tanzania Veterinary Laboratory Agency (TVLA), DVS, COSTECH, NIMR, TAWIRI, TALIRI, IHI SUA, NM-AIST, UDSM, LITA, MUHAS, CUHAS, TVI, TFDA International: Glasgow, University of Minnesota, Penny state University, Washington University, University of Edinburgh among others
Advocacy and Ethical standards	Professional bodies: TVA, MAT, MCT, VCT, Pharmacies, Nurses, allied Association, Tanzania Public Health Association (TPHA), TAVEPA
Public awareness and prevention and control	MoLF, MNRT, MoHCDGEC, PO-RALG, and other relevant NGO's PMO-DMD (OHCU), Community and private sector, FAO, WHO
Implementers	MoLF: Director of Veterinary services (DVS), Tanzania Veterinary Laboratory Agency (TVLA), Veterinary Council of Tanzania (VCT) MoHCDGEC: DPS, PO-RALG: RAS, Local Government Authorities (LGAs) MNRT: TAWIRI, TANAPA, TAWA NGOs: BRAC Tanzania, and other private NGO or CBO such as World Vision, CARE, Catholic Relief Services, Global Services Corps.

2

ANALYSIS OF STRENGTHS, WEAKNESSES, OPPORTUNITIES AND CHALLENGES (SWOC) REGARDING ANTHRAX PREVENTION AND CONTROL

Anthrax has serious public health implications and is a constraint to the development of the livestock industry. The latter is associated with sanitary measures put in place for trade in livestock, livestock products and by products as stipulated by national laws as well as World Organization for Animal Health (OIE) and World Trade Organization (WTO) regulations and requirements.

In this section we consider strengths and opportunities that could be harnessed to facilitate prevention and control so as to eliminate anthrax risks in the country. In addition, we highlight weaknesses and challenges which must be addressed for effective prevention and control of the disease.

Critical issues to be considered includes:

- i. Frameworks supporting anthrax prevention and control (political will)
- ii. Skilled human resources towards anthrax control
- iii. Institutional organization
- iv. Financial resources
- v. Tools for anthrax surveillance and control (e.g. vaccines, reporting system, feedback and response system)
- vi. Research, training and development
- vii. Advocacy, communication and social mobilization
- viii. Partnerships and multi-sectoral collaboration
- ix. Monitoring and evaluation
- x. Biosecurity and biosafety at various levels

Table 2: Strengths, weaknesses, opportunities and challenges

Issue	Strengths	Weaknesses	Opportunities	Challenges
Frameworks supporting anthrax prevention and control (political will)	<ul style="list-style-type: none"> • The existence of national level One Health initiatives • The political will to improve the current situation is in place • Existence of national sectoral policies, strategies and legal frameworks • eg • National Livestock Policy of 2006, and Animal Diseases Act, 2003 • Public Health policy 2016 • National Health Security Plan,2017 	<ul style="list-style-type: none"> • Low awareness among stakeholders about anthrax and the need to prevent and control it • Lack of policy guidelines • Bureaucratic barrier among different sectors • Uncoordinated/ fragmented habit of doing work 	<ul style="list-style-type: none"> • Availability of global guidelines and standards from international bodies such as FAO, OIE, WHO • Presence of Global Health Security Agenda • Presence of International Public Health Regulations 	<ul style="list-style-type: none"> • Inadequate enforcement of disease control and livestock movement laws. • Uncoordinated/ fragmented coordination arrangements 1. Inadequate of own resources

ANALYSIS OF SWOC REGARDING ANTHRAX PREVENTION AND CONTROL

Issue	Strengths	Weaknesses	Opportunities	Challenges
	<ul style="list-style-type: none"> • Second five-year Development Plan (2016-2020) • Tanzania National e-Health Strategy, 2013 • Presidential secular No 1 of 2002, • The Food, Drug and Cosmetics Act, 2003 • Livestock Registration, Identification and Traceability Act No 12 of 2010 • Local Government Authority Act No 7 of (1982) • One Health Strategic Plan of 2016 • List of national priority zoonotic diseases • Involvement of other law enforcers, example Police, Judiciary etc 			
Skilled human resource	<ul style="list-style-type: none"> • Available skilled human resource at various levels. (human, animal and environmental health experts and laboratory technologists) 	<ul style="list-style-type: none"> • Insufficient number of trained personnel (human, veterinary, environmental health experts and lab technologists), particularly on the ground • Inadequate continuous professional development programmes <p>Absence of mechanisms for government-level recognition and training of community animal health workers</p> <ol style="list-style-type: none"> 2. Competing Priorities 3. Conflicting interests in different ministries and change of personnel 	<ul style="list-style-type: none"> • Availability of training institutions / facilities • Technical backstopping from partners (e.g. FAO, WHO and OIE, and national and international research/ training institutions) 	Inadequate funding to support human resource development

NATIONAL STRATEGY FOR PREVENTION AND CONTROL OF ANTHRAX IN HUMANS & ANIMALS

Issue	Strengths	Weaknesses	Opportunities	Challenges
Institutional organization	<p>Presence of human and animal health infrastructure and institutions including OH coordination unit (under prime minister's office)</p> <p>Presence of relevant ministries and departments</p> <p>Existence of other control plans providing guidelines and insight in the control of other zoonoses (e.g. for Rabies, Avian influenza and Rift Valley Fever)</p>	<ul style="list-style-type: none"> Inadequate communication/ sharing of data and information to ensure early warning, detection and response Overlap of implementation of activities Overlapping priorities 	<ul style="list-style-type: none"> One Health (OH) coordination frameworks/ networks Presence of International organization (FAO, WHO, OIE) 	<ul style="list-style-type: none"> Broken chain of command for animal health
Financial resources to support anthrax prevention and control	Annual budgetary allocation for disease surveillance and control	<p>Inadequate funding</p> <p>Lack of mechanisms for sharing resources across Ministries (e.g. Health and Agriculture).</p>	<ul style="list-style-type: none"> Partnerships with development and bilateral partners Development initiatives/ programmes at national, regional and international levels Partnerships with national and international research institutions 	<ul style="list-style-type: none"> There is no single basket fund for zoonoses control including Anthrax of absence of mechanisms for sharing resources between public health and animal health budgets • weak collaboration and coordination among sectors
Tools for anthrax surveillance and control (diagnostics, Vaccines, reporting system, feedback response system)	<ul style="list-style-type: none"> Availability of infrastructure and expertise for local production of animal vaccines Availability of laboratory diagnostic capacity Presence of guidelines for surveillance of prioritized zoonotic diseases 	<ul style="list-style-type: none"> Low vaccination coverage associated with availability and accessibility – (distribution - cold chain) of vaccine Lack of diagnostic capacity and expertise for confirming the disease at subnational level 	Presence of reference laboratories for provision of expertise and training in anthrax diagnostics, as well as quality assurance and proficiency testing mechanisms Demand for vaccination	<p>Financial resources</p> <p>Inadequate animal disease surveillance systems</p> <ul style="list-style-type: none"> Conflicting and / competing interests on priority setting and resource allocation

ANALYSIS OF SWOC REGARDING ANTHRAX PREVENTION AND CONTROL

Issue	Strengths	Weaknesses	Opportunities	Challenges
	<ul style="list-style-type: none"> Existence of Integrated Disease Surveillance and Response (IDSR) for humans which capture anthrax incidence weekly 	<ul style="list-style-type: none"> Under-reporting leading to a lack of appreciation of the disease problem particularly in remote areas, which are typically the most affected. Limited mechanisms for communication across sectors and between communities and local- and central-level government officers and officials. Poor systems to reach remote locations for case investigation and sampling. Poor infrastructure for transporting samples to diagnostic laboratories. Lack of intersectoral laboratory sharing policy Habit to work in silos Low disease awareness at lower levels (Farmers/ livestock keepers) Lack of intersectoral laboratory sharing policy 	<p>at local level suggests that community engagement in vaccination programmes would be high</p> <p>Availability of technical backstopping (e.g. FAO,WHO, OIE as well as national and international partner research institution)</p> <p>Opportunities to build on the experience of IDSR to create integrated systems relevant to animal health problems of zoonotic nature</p>	<ul style="list-style-type: none"> Diversity of disease reservoir Unpredictable weather / climate change <p>Fragmented chain of command</p>
Research, training and development	<ul style="list-style-type: none"> Presence of Research and Training Institutions (SUA, MUHAS, TAWIRI, NIMR, TVLA, NM-AIST, CUHAS, KCRI, NHLQA) Research regulatory bodies - COSTECH Political will for allocating 1% of total budget for research (Government commitment) 	Inadequate coordination of training and research initiatives	<ul style="list-style-type: none"> Presence of reference laboratories providing opportunities for diagnostic training as well as quality assurance and proficiency testing mechanisms 	<ul style="list-style-type: none"> Inadequate funding Inadequate research data/information on anthrax Inadequate sharing of research findings

NATIONAL STRATEGY FOR PREVENTION AND CONTROL OF ANTHRAX IN HUMANS & ANIMALS

Issue	Strengths	Weaknesses	Opportunities	Challenges
			<ul style="list-style-type: none"> • Collaborations with international reference laboratories, and national and international research institutions 	
<p>Advocacy, communication and socio mobilization</p>	<ul style="list-style-type: none"> • Existence of elaborate administrative infrastructure down to grass- root level (from the Ministry to the village) that can support communication and socio mobilization • Presence of multi-media outlets at national and sub-national levels • Good coverage of mobile networks and social media channels 	<ul style="list-style-type: none"> • Inadequate knowledge among farmers (only 20% of farmers access extension services) • Lack of information, communication and awareness materials tailored to specific stakeholder groups • Disjoint communication plans before/during/ after outbreak 	<p>Globally, disease fact sheets and protocols are available</p>	<ul style="list-style-type: none"> • Socio-cultural practices • Inadequate funding
<p>Partnerships and multi-sectoral collaboration</p>	<ul style="list-style-type: none"> • Presence of OH Coordination Unit, OH Technical working groups • One Health Strategic Plan (2016) • The National Strategy for Income Growth and Poverty Reduction 2010 (NSGRP-MKUKUTA)-It emphasizes inter-sectoral collaboration in disease control 	<ul style="list-style-type: none"> • Lack of multi- sectoral communication strategy • Lack of joint financing mechanisms to facilitate resource/ cost sharing 	<ul style="list-style-type: none"> • Available OH networks/ forums/ organizations both regionally and globally • Partnerships with national and international multi-disciplinary research/ academic groups and institutions 	<ul style="list-style-type: none"> • Poor communication and lack of common understanding among collaborators • Different sets of health priorities and agendas
<p>Monitoring and evaluation</p>	<ul style="list-style-type: none"> • Presence of guidelines for priority zoonotic diseases 	<ul style="list-style-type: none"> • Under-reporting and inadequate feedback in the animal health sector 	<ul style="list-style-type: none"> • Use of mobile tools to promote reporting with technical backstopping from national and international partners (FAO, WHO) 	

ANALYSIS OF SWOC REGARDING ANTHRAX PREVENTION AND CONTROL

Issue	Strengths	Weaknesses	Opportunities	Challenges
			<ul style="list-style-type: none"> • Presence of reference laboratories for diagnosis, research and training 	Funding to support active and passive surveillance
Biosecurity and biosafety at various levels	<ul style="list-style-type: none"> • Presence of containment facilities and tools 	<ul style="list-style-type: none"> • Inadequate biosafety and biosecurity facilities at all levels (field and laboratory) • Inadequate knowledge on biosecurity and biosafety issues of technical staff and farmers 	<ul style="list-style-type: none"> • Presence of reference laboratories and experts on biosafety issues • Presence of training institutions that can help establish the necessary capacity 	<ul style="list-style-type: none"> • Lack of biosecurity and biosafety training curriculum • Lack of SOPs in disease prevention and control

3

GUIDING PRINCIPLES OF Anthrax PREVENTION AND CONTROL STRATEGY

3.1 Vision

To be a nation free from Anthrax

3.2 Mission

Improve human and animal health by implementing Anthrax prevention and control measures using One Health Approach

3.3 Goal

To control and reduce anthrax risks in humans and animals through integrated interventions

3.4 Overall Objective of Anthrax Control Strategic Plan

To reduce the burden of Anthrax in Human and Animal population in Tanzania

3.5 Key strategic objectives for anthrax

1. To enhance advocacy, communication and social mobilization for prevention and control of anthrax
2. To facilitate availability and accessibility of quality and affordable drugs and vaccines to livestock keepers and general public in Tanzania
3. To streamline and harmonize appropriate legal /policy frameworks and institutional arrangements in the implementation of the plan
4. To support implementation of effective and properly integrated surveillance and control activities using One Health frameworks and according to international standards
5. To promote and coordinate research and innovation in Anthrax interventions
6. To facilitate and support application of bio-security and bio-safety measures at all levels
7. To advocate and mobilize resources for supporting implementation of the plan

3.5.1 Prevention and Control of Anthrax in human

The prevention and control of anthrax in human hinges on elimination of contacts between people and infected animals or their products as well as avoiding risk behavioural practice. Measures for anthrax should include public education on the risks, transmission avoidance and control of anthrax specifically targeting high-risk populations. Among the commonly used approaches to prevent anthrax in humans include adhering to all safety regulations in handling suspected and confirmed cases such as wearing protective clothing while emphasising education to improve food and occupational hygiene; avoid all blood-spilling operations (such as slaughtering) on infected or suspect animals/carcasses; take appropriate disinfection measures before coming into contact with other persons or animals.

3.5.2 Prevention and control of anthrax in food animals

Anthrax control in animals centres on ensuring immediate notification of any suspected animal to a veterinary authority or registered practicing veterinary officer. The disease should be urgently reported to public health authorities and appropriate measures taken commensurate to existing laws and guidelines. Normally, suspected animals in a farm are isolated and the dead animal disposed appropriately to reduce contamination of the soil. It is advised to vaccinate the rest of the heard to prevent spread of the disease to other animals.

Where necessary, a quarantine with a specified buffer area as per guidelines, would be instituted. The veterinary authority should develop appropriate SOP for case management in livestock, companion animals and wildlife settings.

3.5.3 Strengthen institutional capacity to control anthrax

Surveillance and diagnostics capacities for prioritized zoonoses including Anthrax will be strengthened at national and subnational levels through training of field and lab personnel to support anthrax surveillance. Effort to equip laboratories for anthrax diagnosis will be implemented. Efforts will be made to introduce testing schemes in targeted farms and incorporate anthrax in existing surveillance systems, such as Integrated Disease Surveillance and Response (IDSR). Capacity strengthening to carry out epidemiological investigation to detect the source of infection (history of site, feed, disturbance of the environment etc) to identify the source of the incident will be conducted. Quality vaccine production capacity at Tanzania Vaccine Institute – Kibaha will be strengthened to support vaccination programmes (including vaccines for small ruminants).

3.5.4 Promote and coordinate research and innovation in anthrax interventions

One Health stakeholders comprising of animal health, wildlife health, medical, public and environmental health, anthropologists and other experts, to identify and undertake implementation research. For example, efficacy of current vaccines, vaccine delivery model, pathogen/infection dynamics, Knowledge, Attitude and Practices (KAP), system's research, and others. In addition, research focusing on the development and validation of rapid field and laboratory confirmatory tests will be crucial to pursue.

3.5.5 Enhance awareness and knowledge on anthrax for professionals, policy makers and the public

Awareness raising and sensitizing various stakeholders (Livestock keepers, consumers, policy makers, FBO/CBO leaders) using different avenue including but not limited to schools, Churches, Mosques, mass media (Radio, TV, Brochures, social media) and meetings at different levels will be enhanced. Livestock keepers will be made aware on risks related to improper disposal of anthrax confirmed cases and good husbandry practices including bio-security measure will be promoted.

3.5.6 Enhance partnerships and One Health approach/ multi-sectoral collaboration

Establish a way to allow sharing of disease reports, other information and discussions among the animal health and human health departments at various administrative levels. This may include joint implementation where applicable.

3.5.7 Streamline and harmonize appropriate legal and policy framework and institutional arrangement for the implementation of strategy

Legal/ policy framework will be streamlined and harmonised to support zoonosis control. In addition, law enforcers will be engaged to raise awareness to all stakeholders regarding legal aspects providing for animal disease control including anthrax. This will facilitate compliance to application of control measures.

4

IMPLEMENTATION PLAN OF THE STRATEGY

A gradual (step-wise) approach for the control of anthrax is adopted in this strategy, through the adaptation of other approaches for the control of Transboundary Animal Diseases (TADs) that have been developed for a number of diseases including, foot-and-mouth (FMD) (<http://www.fao.org/ag/againfo/commissions/docs/pcp/pcp-26012011.pdf>), Peste des petits ruminants (PPR) (<http://www.fao.org/3/a-i4460e.pdf>) and rabies (<http://www.fao.org/3/a-i3467e.pdf>). While resources for national-level disease programs to control these diseases are limited, these global initiatives provide valuable frameworks to guide individual countries through gradual progression along disease control and elimination pathways. The approach in this strategy entails to progressively move from one stage to the next immediately after, and is based on four different stages each with a situation analysis, expected outcome and summarized key activities as indicated in table 3. Stage 1 is where the epidemiological situation is being assessed and stage 4 is when the country has maintained freedom from anthrax status in livestock and humans, following a reduction of infection rate within susceptible livestock and human population.

Table 3: Progressive–Structured approach/Roadmap

Stage 1	Stage 2	Stage 3	Stage 4
Situation			
<ul style="list-style-type: none"> • Anthrax is known to be present but with limited epidemiological information • No structured control plan 	Known situation of the disease and implementation of the control strategy	<ul style="list-style-type: none"> • Anthrax risks reduced through full scale implementation of anthrax control strategy • Infection rate reduced within susceptible livestock and human population 	Maintain freedom from anthrax status in livestock and humans
Outcome			
Better understanding of the disease situation. Development of national anthrax control plan and preparation for its implementation	Anthrax incidence rates in livestock and human reduced	Reduced impact of anthrax in livestock and humans	Self-declaration of freedom from anthrax with or without vaccination
Activities			
Objective (Communication) <ul style="list-style-type: none"> • Review anthrax situation and undertake risk mapping • Development of communication campaigns aimed at addressing potential gaps • Develop, produce and disseminate Information Communication and education (ICE) materials through multi-media channels 	Objective (Communication) <ul style="list-style-type: none"> • Orientation of community-based health workers, animal health field personnel, community mobilizers and media • Conduct awareness campaigns/vaccine promotion using multi-media channels and targeted education 	Objective (Communication) <ul style="list-style-type: none"> • Sustain achievements gained 	Objective (Communication) <ul style="list-style-type: none"> • Document best practices lessons learnt and share with stakeholders • Sustain achievements gained • Continue advocacy and communication

IMPLEMENTATION PLAN OF THE STRATEGY

Stage 1	Stage 2	Stage 3	Stage 4
<p>Objective (Surveillance) in line with integrated surveillance guidelines for Prioritized Zoonotic Diseases)</p> <ul style="list-style-type: none"> • Train personnel and equip epidemiology units (for animal and public health) for anthrax surveillance • Train personnel and equip laboratories at central and sub national level for anthrax detection • Train clinicians and equip health facilities for proper case management • Train and equip field staff/health officers for data collection and reporting • Develop outbreak investigation protocol • Collect, collate and analyze data and generate information about each suspected anthrax outbreak 	<p>Objectives (vaccination/ surveillance)</p> <ul style="list-style-type: none"> • Implement vaccination focusing on susceptible animals (as per vaccination plan – ring and strategic/ prophylactic) • Monitor the vaccination programme for quality and progress • Undertake active surveillance 	<p>Objective (vaccination)</p> <ul style="list-style-type: none"> • Vaccination • Undertake surveillance and monitoring of the vaccination programme • Undertake risk analysis to revise the control strategy as appropriate • Implement revised control plan 	<p>Objective (vaccination)</p> <ul style="list-style-type: none"> • Vaccinate in high risk areas • Monitor and maintain disease free status
<p>Objective (Vaccination)</p> <ul style="list-style-type: none"> • Develop national vaccination plan • Produce quality Anthrax vaccine • Vaccinate susceptible animals in hotspot areas 	<p>Objective (biosafety and biosecurity)</p> <ul style="list-style-type: none"> • Review, update and disseminate biosafety and biosecurity curriculum • Train personnel including meat inspectors and market officers and equip for anthrax biosafety and biosecurity • Undertake inventory of laboratories carrying out anthrax research/ detection 	<p>Objective (Research)</p> <p>Conduct innovative anthrax research to inform planning</p>	
<p>Objective (legislation)</p> <ul style="list-style-type: none"> • Review and advocate for harmonization of legal frameworks • Support enforcement of legislation • Train and equip legal enforcers 	<p>Objective (Research)</p> <ul style="list-style-type: none"> • Conduct innovative anthrax research to inform legislation and planning 		
<p>Objective (multi sectoral collaboration)</p> <ul style="list-style-type: none"> • Develop database of stakeholders relevant to anthrax surveillance and control • Implement guideline for surveillance of priority zoonotic diseases 	<p>Objective (legislation)</p> <ul style="list-style-type: none"> • Support enforcement of legislation 		

5.1 Institutional Arrangement

An integrated control strategy for Anthrax will be implemented through the existing infrastructure that include the One Health Coordination Unit and the line Ministries, Local Government Authorities and stakeholders including development partners. At the regional, district and village levels the respective Primary Health Care Committee (PHC)/sub-national OH committees will be responsible in their respective areas. However at the levels of MOLF and MoHCDGEC in the Directorates of Veterinary Services and Preventive Services respectively, there shall be a coordinator for overseeing the day-to-day activities of the anthrax prevention and control strategy. The One Health Coordination Unit – at the Prime Minister's office shall be the coordinator of multi-sectorial activities pertinent with anthrax control. It is expected that the control program will involve all the high- risk districts/LGAs of United Republic of Tanzania.

Key stakeholders and responsibilities for the implementation of this plan are indicated in the table below (Table 4).

Table 4: Key Stakeholder and roles

Stakeholder/Institution	Roles/Responsibility
Ministry responsible for Finance	Provision of funds and other resources Oversees budget preparation and execution
Ministries responsible for livestock, public health and natural resources	Formulation and harmonisation of protocols, policies and strategies Information and data collection Provision of technical support and implementation of activities Resource mobilization
Ministry responsible for Regional Administration and Local Government	Implementation of vaccination activities Creation of anthrax awareness Participate in anthrax surveillance
Ministry of Home Affairs	Enforcement of government laws
Ministry of Justice and Constitution Affairs	Interpretation and custody of government laws
PMO - One Health Coordination Unit	Coordination of multi-partners and multi-sectorial activities related to One-Health and resource mobilization
TFDA	To ensure quality, safety and effectiveness of medicines by evaluating and registering quality vaccines, controlling the importation of vaccines and conducting post-marketing surveillances for vaccines
TVLA, TVI, NHQALTC,	Diagnosis, biosafety and biosecurity, research and vaccine production, vaccine quality control
TANAPA and Ngorongoro Conservation Area Authority (NCAA)	Coordination of wildlife-related activities and control of anthrax in wildlife buffer zones
ZVCs, Regional Health facilities	Surveillance in humans and animals

INSTITUTIONAL AND FINANCIAL ARRANGEMENT

Stakeholder/Institution	Roles/Responsibility
Academic and Research Institutions (Eg: NM-AIST, KCMC, SUA, MUHAS, NIMR, IHI, TAWIRI, CUHAS, KCRI, etc)	Research, training, diagnosis, consultancy and vaccine manufacture, biosafety and biosecurity training
Private Animal Health Service Providers	Surveillance, provision of veterinary services and reporting
NGOs both local and International	Provides technical support, public awareness, funding and linkages with communities and outreach activities
Development Partners (eg. B&MGF, WHO, OIE, FAO, UNICEF, USAID, CDC etc)	Support of Anthrax vaccination activities, funding of outreach activities and technical backstopping
TVA, MAT, pharmacies, nurses, allied Association	Advocacy and awareness
Livestock keepers and their associations	Community engagement
Veterinary Council of Tanzania, Pharmacy Board, Medical Council of Tanganyika	Professional ethics and conduct

5.2 Financial Arrangement

Funding will be sourced from the Tanzania central government ministries (Ministry of Livestock and Fisheries (MoLF), Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC), Ministry of Natural Resources and Tourism (MNRT), President's Office, Regional Administration and Local Government (PORALG), Prime Minister's Office (PMO) and Development Partners as well as NGOs, CBOs and FBOs. The private sector will be engaged to further support activities. Communities own resources will be requested to support community level initiatives.

6

MONITORING AND EVALUATION

The National Strategy for Prevention and Control Anthrax will be implemented through Ministries responsible for Livestock, Health and Wildlife. Other Ministries are those responsible for Local Government Authorities and other stakeholders. A national anthrax control task force will be established to report to the ministries responsible for animal and human health. At regional, district and ward-levels, representatives of One Health Committees will be responsible for their respective areas. Designated officer (at DVS and DPS) shall be coordinators responsible for overseeing day-to-day activities of the programme. The One Health Coordination Unit – at the Prime Minister’s office shall be coordinator of multi-sectorial activities within a One Health framework.

Monitoring and Evaluation (M&E) of the anthrax prevention and control strategic plan will be critical to measure the effectiveness of interventions. Indicators will be used to determine whether the interventions are making progress towards achieving objectives and goals of the anthrax prevention and control strategic plan. Each activity bears a monitoring indicator to be measured in the process of its implementation. Monitoring and evaluation frameworks will incorporate both process and outcome indicators. Individual Ministries/institutions/bodies will have responsibility for monitoring and evaluating relevant identified activities and feeding information, findings and recommendations into the overall M&E process. A mid-term review will be done after three years to monitor the implementation of the plan. End-of-term evaluation will be conducted in 2022.



REFERENCES

- Lembo, T., Hampson, K., Auty, H., Beesley, C. A., Bessell, P., Packer, C., Halliday, J., Fyumagwa, R., Hoare, R., Ernest, E., Mentzel, C., Mlengeya, T., Stamey, K., Wilkins, P.P. and Cleaveland, S. (2011). Serologic surveillance of anthrax in the Serengeti ecosystem, Tanzania, 1996–2009. *Emerging Infectious Diseases*, 17(3), 387-394
- Mangesho PE, Neselle MO, Karimuribo ED, Mlangwa JE, Queenan K, Mboera LEG, et al. Exploring local knowledge and perceptions on zoonoses among pastoralists in northern and eastern Tanzania. *PLoS Negl Trop Dis*. Public Library of Science; 2017;11(2):e0005345.
- Markey BK, Leonard FC, Archambault M, Cullinane A, Maguire D (2013). *Clinical Veterinary Microbiology*, Second edition. Mosby Elsevier Ltd. Pages 195-203
- Molecular epidemiology of *Bacillus anthracis* (MEBA): Capacity, data and techniques for local surveillance in Ngorongoro Conservation Area, Tanzania. Year 2 Update – December, 2017
- Mwakapeje ER, Assenga JA, Kunda JS, Mjingo EE, Makondo ZE, Nonga HE, Mdegela RH, Skjerve E. (2017). Prevention, detection, and response to anthrax outbreak in Northern Tanzania using one health approach: A case study of Selela ward in Monduli district. *Int J One Health*;3: 66-76.
- Mwakapeje, E. R., Høgset, S., Fyumagwa, R., Nonga, H. E., Mdegela, R. H., & Skjerve, E. (2018). Anthrax outbreaks in the humans-livestock and wildlife interface areas of Northern Tanzania: a retrospective record review 2006–2016. *BMC public health*, 18(1), 106.

Appendix 1: Logical framework

Objectives	Activity	Indicator (output)	Data source/Means of Verification	Baseline	
1. To enhance advocacy, communication and social mobilization for prevention and control of anthrax	<ul style="list-style-type: none"> Undertake knowledge, Attitude, Practice (KAP) studies in different social and professional groups 	<ul style="list-style-type: none"> KAP survey conducted 	KAP Survey report	No pre-existing data	
	<ul style="list-style-type: none"> Review anthrax situation and undertake risk mapping 	<ul style="list-style-type: none"> Anthrax risk maps in place 	Anthrax risk maps and review reports		
	<ul style="list-style-type: none"> Develop, produce and disseminate Anthrax related IEC materials for different levels through meetings and multi-media channels 	<ul style="list-style-type: none"> Number of IEC materials developed, produced and disseminated 	Number of IEC materials developed, produced and disseminated		
	<ul style="list-style-type: none"> Conduct advocacy meetings for policy and decision makers at all levels (National, regional, districts, wards and villages) 	<ul style="list-style-type: none"> Number of advocacy meetings conducted 	Meeting reports		
	<ul style="list-style-type: none"> Orient community-based animal, human health workers and media personnel on anthrax prevention and control strategies) 	<ul style="list-style-type: none"> Number of orientation meetings conducted 	Meeting reports		
	<ul style="list-style-type: none"> Conduct awareness campaigns for prevention and control of anthrax among communities 	<ul style="list-style-type: none"> Number of awareness campaigns conducted 	Campaign reports		
	2. To improve anthrax vaccine availability and accessibility to livestock keepers in Tanzania	<ul style="list-style-type: none"> Develop national vaccination plan 	<ul style="list-style-type: none"> National vaccination plan documentation 	Reports and document	Existing data
		<ul style="list-style-type: none"> Produce vaccine 	<ul style="list-style-type: none"> Number of vaccine produced and administered 		
		<ul style="list-style-type: none"> Conduct vaccination programmes in hotspots 	<ul style="list-style-type: none"> Number of vaccination campaign /monitoring/coverage visits 		

APPENDICES

Objectives	Activity	Indicator (output)	Data source/Means of Verification	Baseline
	<ul style="list-style-type: none"> Develop national vaccination plan 	<ul style="list-style-type: none"> National vaccination plan document in place 	<ul style="list-style-type: none"> Reports and document 	Existing data
	<ul style="list-style-type: none"> Nationalize and harmonize registration regulations of veterinary biologicals and vaccines 	<ul style="list-style-type: none"> Harmonized guideline in place 		
	<ul style="list-style-type: none"> Identify suppliers and vaccine candidates. 	<ul style="list-style-type: none"> Number of suppliers identified and types of vaccines identified 		
	<ul style="list-style-type: none"> Register and accredit the chosen vaccine (see guiding criteria) 	<ul style="list-style-type: none"> Type of vaccine chosen 		
	<ul style="list-style-type: none"> Produce vaccine 	<ul style="list-style-type: none"> Number of vaccine doses produced 		
	<ul style="list-style-type: none"> Designate the vaccine distribution centers (to be nested in the TVLA zonal centers) 	<ul style="list-style-type: none"> Number of centres designated 		
	<ul style="list-style-type: none"> Develop vaccination calendar. 	<ul style="list-style-type: none"> Vaccination calendar in place 		
	<ul style="list-style-type: none"> RVO, DVO and extension officers to coordinate the distribution and vaccination procedures to ensure that the cold chain is maintained. 	<ul style="list-style-type: none"> Vaccination coverage in each district 		
	<ul style="list-style-type: none"> Identification and registration of vaccine service providers. 	<ul style="list-style-type: none"> Number of vaccine service providers registered. 		
	<ul style="list-style-type: none"> Conduct vaccination programmes countrywide 	<ul style="list-style-type: none"> Vaccination coverage throughout the country 		
	<ul style="list-style-type: none"> The existing Tanzania Veterinary Vaccine Institute should be strengthened to produce more vaccines and have vaccine stock piles 	<ul style="list-style-type: none"> Increased number of vaccine doses produced 		

Objectives	Activity	Indicator (output)	Data source/Means of Verification	Baseline
<p>3. To streamline and harmonize appropriate legal framework and institutional arrangement in the control of Anthrax.</p>	<ul style="list-style-type: none"> Conduct monitoring of vaccination programme Carry out legal and policy analysis, spot some weakness and amend accordingly Review carry out advocacy and operationalize legal frameworks To revitalize the veterinary structure to recognize RVO in the veterinary act Institutional arrangement Work out a mechanism which assist to revive veterinary structure to put in place professional and technical a answerability of DVOs and DVS to the sector ministry Train and equip legal enforcers To carry out stakeholders engagement (through training seminars etc them) especially for the low enforcers and DEDs to involve them in disease control i.e quarantine Promote adoption of OH approach in the detection, prevention and control of Anthrax Facilitate Inter-ministerial arrangement through development of MoUs Identify research needs and prioritize 	<p>Monitoring and evaluation tools developed</p> <ul style="list-style-type: none"> -Report of Revised document -Number of people sensitized Animal health professional command structure Number of training Number of stakeholder sensitization workshops/seminars conducted Guidelines for OH actions in detection, prevention and control developed Number of interministerial MoUs signed Priority OH research guidelines available 	<p>Reports and document</p>	<p>Existing data</p>

Objectives	Activity	Indicator (output)	Data source/Means of Verification	Baseline
4. To promote and coordinate research and innovation in Anthrax interventions	<ul style="list-style-type: none"> To strengthen research links between line ministries and research institutions to support the control of Anthrax 	<ul style="list-style-type: none"> Guidelines for OH research coordination developed 		
	<ul style="list-style-type: none"> To develop community base policy institutional and legal frameworks to support community engagement in the control of anthrax 	<ul style="list-style-type: none"> Policy guidelines and harmonized legal framework developed 		
	<ul style="list-style-type: none"> To develop appropriate regulations for the control of Anthrax and other disease of importance 	<ul style="list-style-type: none"> Harmonised regulatory framework for OH actions developed 		
	<ul style="list-style-type: none"> Conduct innovative anthrax research to inform legislation and intervention planning 	<ul style="list-style-type: none"> Reports/publications collaborative, inter-, trans- multi-disciplinary researches 	Reports and documents	Existing data
	<ul style="list-style-type: none"> Research on Policy and coordination structure which support implementation and interventions 	<ul style="list-style-type: none"> Number of publications 		
	<ul style="list-style-type: none"> Research on disease epidemiology in wildlife, livestock and humans 	<ul style="list-style-type: none"> Number of publications 		
	<ul style="list-style-type: none"> Research on interactions which lead into outbreaks between the compartments 	<ul style="list-style-type: none"> Number of publications 		
	<ul style="list-style-type: none"> Research in new technology on rapid detection identification and vaccines plus biosecurity measures 	<ul style="list-style-type: none"> Number of publications 		
	<ul style="list-style-type: none"> Research on dynamics of disease in livestock wildlife and humans 	<ul style="list-style-type: none"> Number of publications 		

Objectives	Activity	Indicator (output)	Data source/Means of Verification	Baseline
5. To strengthen capacity for surveillance using a One Health approach	<ul style="list-style-type: none"> Research on sociocultural context of anthrax occurrence which affect detection identification and control 	<ul style="list-style-type: none"> Number of publications 		
	<ul style="list-style-type: none"> Risk mapping - identification of risk levels in different areas 	<ul style="list-style-type: none"> Risk maps available 		
	<ul style="list-style-type: none"> Research on treatment and drug efficacy 	<ul style="list-style-type: none"> Number of publications on treatment and efficacy trials 		
	<ul style="list-style-type: none"> Train personnel and equip Epi Units to enable anthrax surveillance 	<ul style="list-style-type: none"> Reports of number of supplies and equipment for training 	Reports and documents	
	<ul style="list-style-type: none"> To strengthen capacities of epidemiology units / regional and district teams to support disease surveillance 	<ul style="list-style-type: none"> Number of Units established Number of operational guidelines for region/districts teams developed Number of cases reported 		No pre-existing data
	<ul style="list-style-type: none"> To develop a national epidemiological/surveillance system on the animal health side and to harmonize it with IDSR to support one health and sharing of resources 	<ul style="list-style-type: none"> A comprehensive National Animal health Information and surveillance systems established A system of harmonized data sharing with IDRS established Number of samples collected Number of samples delivered to the laboratory for diagnosis 		
	<ul style="list-style-type: none"> Train personnel and equip Lab Unit to enable anthrax detection 	<ul style="list-style-type: none"> Number of training conducted Number of samples correctly diagnosed by laboratory technicians 		

Objectives	Activity	Indicator (output)	Data source/Means of Verification
	<ul style="list-style-type: none"> Mapping of lab facilities and (physical and human resources). 	<ul style="list-style-type: none"> An inventory of laboratory facilities and human resource available 	
	<ul style="list-style-type: none"> To build capacity and strengthen the existing lab units e.g TVLA, KCRI 	<ul style="list-style-type: none"> Number of laboratories accredited 	
	<ul style="list-style-type: none"> To link research and academic institutions and line ministries through MoU to enable sharing of lab facilities 	<ul style="list-style-type: none"> Number of MoUs signed 	
	<ul style="list-style-type: none"> Train clinicians in proper case management 	<ul style="list-style-type: none"> Number of training conducted 	
	<ul style="list-style-type: none"> Retooling of animal health service providers (CPD) 	<ul style="list-style-type: none"> Number and types of tool kits purchased and distributed 	
	<ul style="list-style-type: none"> To train human health care providers in case management 	<ul style="list-style-type: none"> Number of training conducted 	
	<ul style="list-style-type: none"> Train and equip field staff/health officers in data collection and reporting 	<ul style="list-style-type: none"> Number of joint training conducted 	
	<ul style="list-style-type: none"> Develop joint outbreak investigation protocols 	<ul style="list-style-type: none"> Joint outbreak investigation protocols developed 	
	<ul style="list-style-type: none"> To carry out resource mobilization to undertake active surveillance 	<ul style="list-style-type: none"> Amount of resources available for joint surveillance activities 	
	<ul style="list-style-type: none"> To develop and strengthen disease surveillance guidelines on the animal health side and harmonize with existing one on the human health side (integrated) 	<ul style="list-style-type: none"> Integrated disease surveillance protocol developed 	

Objectives	Activity	Indicator (output)	Data source/Means of Verification	Baseline
6. Strengthen biosafety and biosecurity	<ul style="list-style-type: none"> To develop and strengthen a joint after-action review Review, update and disseminate the biosafety and biosecurity policy and curricula Creation of awareness to the first responders - farmers, extension officers Train and equip biosafety officers including meat inspectors and market staff Inventory of lab research and detection Designate laboratories for handling and identification of Anthrax Disposal of identified samples and vaccines according to international standards Management of contaminated environment 	<ul style="list-style-type: none"> Number of joint review meetings held Biosafety and Biosecurity policy Biosafety and Biosecurity Curricula Number of training conducted Number of Training Biosafety kits purchased Designated laboratories Number of laboratories designated SOP's for Anthrax identification SOPs for disposal of samples SOPs for environmental decontamination Database Number of priority zoonotic diseases identified Number of surveillance reports 	<ul style="list-style-type: none"> Reports Training report Procurement reports 	<ul style="list-style-type: none"> No pre-existing
7. Facilitate OH coordination and monitoring and control activities	<ul style="list-style-type: none"> Develop database and mechanism for information sharing Implement guideline for surveillance of priority zoonotic diseases 	<ul style="list-style-type: none"> Database Number of priority zoonotic diseases identified Number of surveillance reports 	<ul style="list-style-type: none"> Reports 	<ul style="list-style-type: none"> No pre-existing

Appendix 2: Guiding principles of prevention and control of Anthrax

Prevention and control Anthrax in humans

The main sources of human Anthrax infection are direct or indirect contact with infected animals, or contaminated animal products. Therefore, effective prevention and control of anthrax in humans can be achieved through control of the disease in animals and prevention of risks arising from handling and consuming contaminated products (inspectorate services). Raising awareness regarding anthrax and promotion of good practices in hotspot areas at all levels (from communities to local- and central-level health professionals) will reduce disease transmission and spread. Provision and promotion of use of PPE for occupational groups such as laboratory personnel, animal health workers, meat inspectors, meat processor etc) will be enhanced. Early case detection through surveillance (Refer Guideline of Priority Zoonoses), proper diagnosis and case management will be promoted.

Prevention and control Anthrax in animals

Anthrax transmission in animals occurs through ingestion of spores from contaminated soil, pastures/feed or water. Prevention is based on annual vaccination in hot spot areas or ring vaccination in outbreak areas (radius 5-10km?) and prophylaxis treatment of the exposed animals. Control is based on enhanced case surveillance, proper carcass disposal, disinfection of affected premises and materials as per Animal Disease Act and Regulation of 2003 (SOPxxx). Good husbandry practices including bio-security measures will be emphasized. Mechanisms for sharing of disease reports, other information and discussions among the animal and human health experts at various levels will be promoted. Control of disease in wildlife areas as a matter of existing policy is not done unless the affected animal are categorized as endangered spp.

