

# 1 Major Transboundary Disease of Ruminants and their Economic 2 Effect in Ethiopia

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## 7 **Abstract**

8 Trans-boundary animal diseases pose a serious risk to animal production and jeopardize  
9 international trade. The objectives of this paper were to give general overview about major  
10 trans boundary disease of ruminants and their economic effect in Ethiopia. Ethiopia has been  
11 facing devastating economic losses from major outbreaks of trans-boundary animal diseases  
12 (TADs) such as foot and mouth disease, contagious bovine pleuropneumonia, lumpy skin  
13 disease in cattle and pest des petites ruminants, contagious Caprine pleuropneumonia, sheep  
14 and goat pox, and brucellosis in small ruminants. These diseases impose major economic costs  
15 and risks to the country, the neighbors, and trading partners. Even though both the direct  
16 and indirect impact of these diseases causes devastating economic losses to the country, the  
17 indirect effect is more serious. The trade implication of TADs can cause a greater economic  
18 impact than the direct production losses themselves. The trade ban due to the existence of  
19 these major trans-boundary disease and other negative domestic impacts on agriculture and  
20 other sectors, can be raised as an example. Among other factors affecting the economic benefit  
21 of the country from livestock sector, increased outbreaks of highly contagious trans- boundary  
22 animal diseases (TADs) is considered as major cause of economy loses. To obtain, expected  
23 value from animal sub-sector government policy and roles of Veterinary Services in function of  
24 TADs control, rapid detection and early response need improvement.

25

26 **Index terms**— ethiopia, economic lose, livestock, trans-boundary disease.

## 27 **1 I. Introduction**

28 Trans-boundary animal diseases (TADs) have been described as those diseases that are of significant economic,  
29 trade and food security importance for a considerable number of countries; which can easily spread to  
30 other countries and reach epidemic proportions; and where control/management, including exclusion, requires  
31 cooperation between several countries [1]. These diseases are highly contagious and have the potential for  
32 rapid spread, irrespective of national borders, causing serious socio-economic consequences [2]. With increasing  
33 globalization, the persistence of trans-boundary animal diseases(TADs) in the world poses a serious risk to the  
34 world animal agriculture and food security and jeopardizes international trade [3].

35 In recent decades, the world has been facing devastating economic losses to livestock farmers from major  
36 outbreaks of TADs, such as foot and mouth disease (FMD), in Europe, classical swine fever in the Caribbean and  
37 Europe ??1996) ??1997) ??1998) ??1999) ??2000) ??2001) ??2002), render pest (RP) in Africa in the 1980s, pest  
38 des petites ruminants in India and Bangladesh, contagious bovine pleura pneumonia in Eastern and Southern  
39 Africa (late 1990s), as well as Rift Valley fever in the Arabian Peninsula (2000) [4].

40 In Ethiopia, the aggregate annual economic losses from such animal diseases through direct mortality and  
41 reduce productive and reproductive performance were estimated at US\$ 150 million, equivalent to three billion  
42 Ethiopian birr per year [5]. The overwhelming majority of morbidity and mortality is caused by a finite set of

## 2 II. LITERATURE REVIEW A) EPIDEMIOLOGICAL FEATURE OF MAJOR TRANS-BOUNDARY DISEASES IN CATTLE

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43 common and predictably occurring disease problems that are conditioned by local geography, climate, and animal  
44 management system [6].

45 In the past two to three decades, public health authorities in industrialized countries have been faced with an  
46 increasing number of food safety problems. The situation is equally serious in developing countries. In addition  
47 to known food borne diseases, public health communities are being challenged by the emergence of new or newly  
48 recognized types of food-borne illnesses, often with serious health and economic consequences. For example,  
49 result of the BSE crises, the world suffered economic losses of more than 10 billion U.S. dollars [7].

50 Ethiopia has estimated livestock population of 57.4 million cattle, 58.6 million sheep and goat [8].However,  
51 Livestock production system, particularly in pastoral areas, is mainly constrained by rampant animal disease  
52 and seasonal feed and water shortages, which can be up to a level of losing the entire livelihood of the pastoral  
53 households. Besides the direct losses incurred by the disease, the trans-boundary nature of most diseases, with  
54 potential risk of introduction of notifiable diseases, which are not yet reported from Ethiopia, and its high rate  
55 of transmissibility among different herds and/or between domestic animals and wildlife increases the risk. In  
56 particular concern to South Omo Zone area apart from other areas of the region, is that it shares boundaries  
57 with other countries, Kenya and South Sudan, and there is no real avoidance of movement of animals among  
58 the different pastoral agro-pastoral communities in these different countries, which makes the situation most  
59 favorable for the introduction and/or transmission of trans-boundary diseases; some are known to be found in  
60 neighboring countries ,but, not in Ethiopia, like East Coast fever, Rift Valley fever, and Nairobi sheep disease  
61 [9].

62 In Ethiopia limited works has been done on this disease so far and few works have been reported on risk  
63 factors assessments, epidemiological aspects, seroprevalence and financial impacts in selected areas of the country.  
64 Therefore, the objective of this paper is to review major trans-boundary disease of ruminants and their economic  
65 effect in Ethiopia.

## 66 2 II. Literature Review a) Epidemiological Feature of Major 67 Trans-boundary Diseases in Cattle

68 Ethiopia is a resourceful country bestowed with the largest livestock resource in the Africa continent [10] with the  
69 potential to export substantial numbers of live animals and their products. Livestock is central to the Ethiopian  
70 economy, contributing for 20% of the GDP, supporting the livelihoods of 70% of the population and generating  
71 about 11% of annual export earnings [11]. However, the livestock sub-sector's contribution to the economy and  
72 foreign currency earnings in particular, is very low as per the country expectation and potential of the sectors.  
73 Some of the major factors contributing to the poor performance of the livestock sub-sector include the prevalence  
74 of highly contagious trans-boundary animal diseases (TADs) such as foot-and-mouth disease (FMD), lumpy skin  
75 disease (LSD) and contagious bovine pleura pneumonia (CBPP). These diseases continue to hinder international  
76 trade in live cattle and their products seriously in an era of globalization. Public concern is growing regarding  
77 the rapid trans-boundary spread of animal diseases through animals and animal products have forced importing  
78 countries to apply strict measures so that animals and their products exported should meet international sanitary  
79 phytosanitary (SPS) requirements [12]. i. Foot and mouth disease Foot and Mouth Disease (FMD) also known as  
80 Aphthous fever, is a major global animal health problem [13]. It ranks first among the notifiable, list of infection  
81 animals disease. It is the most contagious transboundary animal disease (TAD) affecting cloven hoofed animals  
82 of domesticated and wildlife. Among species of the domesticated animals; cattle, sheep, goats, pigs and buffalo  
83 are susceptible. It is caused by RNA virus of genus Aphthous virus known as foot and mouth disease virus. There  
84 are seven recognized serotypes of FMD (O, A, C, Asia 1, SAT 1, SAT 2 and SAT 3), which differ in distribution  
85 across the world [14].

86 In Ethiopia, although its level of prevalence may have significant variations across the different farming systems  
87 and agro ecological zones of the country, FMD is endemic and known for its wider distribution. The records of  
88 the Ministry of Agriculture and Rural Development (MOARD) from 1997 to 2006 showed that FMD outbreak  
89 occurred everywhere throughout the country with highest incidence in the central part [15]. The sero-prevalence  
90 of FMD among Borana pastoral cattle in 2008 was reported to be 24.6% (14). Another study that covered broader  
91 areas of the country showed sero-positivity of 44.2% with 1.6% and 8.9% mortality and case fatality rates [16].

92 Endemic distributions of five of seven serotypes of FMDV are maintained in Ethiopia: serotype O, serotype A,  
93 serotype C, serotype SAT 2, and serotype SAT 1. Infection or vaccination against one serotype does not provide  
94 protection against the other serotypes ??17; 18; 15].

95 The disease was first recorded in Ethiopia in 1957 when serotypes O and C were found ??19; 20]. FMD  
96 is transmitted by a variety of methods between herds, countries and continents. In endemic areas, the most  
97 important method of spread is probably by direct contact between animals moving across state and national  
98 boundaries as trade or nomadic cattle. The routes of spread include inhalation of aerosolized virus, ingestion of  
99 contaminated feed, and entry of the virus through skin abrasions or mucous membranes [21].

100 In Ethiopia, it is believed that infected animal's movement is common method of spreads of FMD. The  
101 movement of animal health workers and artificial inseminators from one farm to the other without taking into  
102 consideration the disease situation suggest that these could have been suspected in a spread of virus. On top of  
103 these, poor hygienic conditions on the farms notably the absence of foot bath, management practices like failure

104 to isolate infected animals from the healthy ones and the absence of quarantine for newly introduced animals are  
105 also open doors for introduction of the virus to a farm ??22;23]. In the most favorable circumstances, it is now  
106 estimated that sufficient virus to initiate an infection can be wind borne as far as 250 km (156 miles) [24].

107 The morbidity rate in outbreaks of FMD in susceptible animal's involvement and complications such as  
108 secondary infection, exposure or malnutrition can rapid approach 100% but some strains are limited in their  
109 infectivity to particular species [25]. However, the case fatality is generally very low, about 2% in adults and  
110 20% in young stock [26].

### 111 **3 ii. Lumpy skin disease**

112 Lumpy skin disease is one of the most economically significant trans-boundary, emerging viral diseases. It is a  
113 disease with a high morbidity and low mortality rate and affects cattle of all ages and breeds [27]. The disease is  
114 caused by Neethling virus prototype strain classified in the genus Capri poxvirus of family Poxviridae. It is acute  
115 to sub-acute infectious disease and cattle strain of Capri poxvirus does not infect and transmit between sheep and  
116 goats ??28; 29]. Lumpy skin disease occurs in different ecological and climatic zones and extends its boundaries  
117 to different areas [30]. It is currently endemic in most African countries and expanded to Middle East region  
118 [31]. It has been endemic in Africa for more than 70 years occurring in a wide range of ecotypes. In Ethiopia the  
119 disease was first observed in the western part of the country (southwest of Lake Tana) in 1983. Recently, Lumpy  
120 skin disease is found almost in all the regions and agro ecological zones of the country ??32 and33].

121 Lumpy skin disease is mechanically transmitted by different types of biting and blood feeding arthropods  
122 [34]. Direct contact could be a minor source of infection. LSDV occurs in cutaneous lesions, saliva, respiratory  
123 secretions, milk and semen. The virus is very resistant to inactivation, surviving in desiccated crusts for up to  
124 35 days, and can remain viable for long periods in the environment and this favors its transmission for prolong  
125 period [35].

126 Outbreaks of LSD are highly associated with seasonal peak of mechanical vectors in wet and warm weather  
127 conditions in Ethiopia. Therefore, morbidity and mortality rates for LSD vary greatly in different endemic  
128 areas depending on the severity of strain, prevalence of insect vectors and susceptibility of the host. During its  
129 occurrence it causes significant economic problems as a result of reduced milk production, beef and draft animals'  
130 loss, abortion, infertility, loss of condition and damage to the hide ??36 and 28].

131 iii. Contagious bovine pleuropneumonia Contagious Bovine Pleuropneumonia (CBPP) is a highly infectious  
132 cattle disease, which is caused by *Mycoplasma mycoides* subsp. *mycoides* SC (small colony, bovine biotype),  
133 is one of the major constraints to cattle-raising and trade in Africa. Contagious bovine pleuropneumonia is  
134 widespread in pastoral areas of African countries [37]. According to Tambi et al, [38],

135 Ethiopia is one of countries in which CBPP is endemically maintained all over the country with 25% morbidity  
136 and more than 10% mortality rate. The economic effects of CBPP in a cattle population are enormous often  
137 resulting into heavy losses. In Zambia CBPP devastated livestock production and reduced the cattle from 650,000  
138 herds in 1997 to about 400,000 herds in 2006 [39].

139 Cattle movements are responsible for the transmission of the CBPP from one herd, region or country to others.  
140 Close, repeated contact is generally thought to be necessary for transmission. In addition to contact *M. mycoides*  
141 SC can also spread through aerosol route if the climatic conditions are favorable [37,40].

## 142 **4 b) Epidemiological Feature of Major Trans-boundary Diseases 143 in Small Ruminant**

144 Small ruminants form an integral and important component of pattern of animal production. Because of factors  
145 such as their low cost, little feed requirement, manageable quantities of products and high reproductive rate,  
146 keeping sheep and goats is preferable than large ruminants [41].

147 Development of small ruminant production in Ethiopia is constrained by widely distributed disease, lack of  
148 feed and improper management. Among diseases contributing to the poor production of small ruminants, highly  
149 contagious trans-boundary animal diseases (TADs) such as Pest des petites ruminants (PPR), Sheep and Goat  
150 pox, Brucellosis and Contagious Caprine Pleuropneumonia (CCPP) are found to be common in the country [42].  
151 These diseases continue to hinder international trade of live goat and sheep and their products seriously in an  
152 era of globalization [43].

### 153 **5 i. Peste des petites ruminants**

154 Peste des Petits Ruminants (PPR) is an acute, highly contagious, infectious and notifiable transboundary viral  
155 disease of domestic and wild small ruminants [44]. Pest des petitis Ruminants virus (PPRV), the causative agent,  
156 belongs to the genus Morbillivirus of the family Paramyxoviridae [45]. Currently, PPR occurs in most African  
157 countries situated in the wide belt between the Sahara and the Equator (including the Sudan, Ethiopia, Kenya  
158 and Uganda), the Middle East, and the Indian subcontinent [46]. It is a disease that threatens the national food  
159 security of affected countries and also results in economic losses due to sanitary related trade embargoes. The  
160 disease has high morbidity and mortality rates and significant economic impacts in developing countries [47].

## 7 C) FACTORS SPREAD TRANS-BOUNDARY DISEASES

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161 There are often a number of risk factors that contribute to the overall risk of disease transmission in a particular  
162 community, production system or value chain [48]. These risk factors are often quite simple attributes of the  
163 sub-population such as the amount of movement, exchange of animals between households and flocks as a result  
164 of social practices and changes in economic conditions that exhibit seasonal patterns, distance from services,  
165 lack of large scale vaccination campaigns, altitude, season, and inter-species contact or interaction with wildlife  
166 [26]. In Ethiopia the morbidity and mortality rates from PPR can be up to 100% in severe outbreaks. In milder  
167 outbreaks, morbidity is still high but the mortality rate may be closer to 50% [49].

168 ii. Contagious caprine pleuropneumonia Contagious Caprine pleuropneumonia (CCPP) is a highly fatal  
169 Caprine disease firstly reported in Algeria in 1873 [50]. It is a devastating disease of goats [51] included in  
170 the list of notifiable diseases of the Office International des Epizooties (OIE) and caused by [52]. It is a major  
171 threat to the goat farming industry in developing countries [53] and is pandemic in Africa, the Middle East and  
172 Asia [54].

173 This disease is the major trans-boundary disease in Ethiopia and characterized by fibrinous pleuro-pneumonia  
174 with increased straw colored pleural fluid in the infected lung [55]. The disease has been reported to affect only  
175 goat species and does not infect sheep [56]. In Ethiopia CCPP has been suspected to occur for a long period,  
176 especially in areas found at the vicinity of endemic areas of Kenya and Sudan. It has been confirmed to be  
177 present in Ethiopia since 1980s. The disease has been reported from almost all regional states of Ethiopia [57].  
178 It is more prevalent in the arid and semi-arid low land of rift valley, Borena rangelands, South Omo, Afar and  
179 other pastoral areas of Ethiopia where about 70% the national goat population are existed. Sero prevalence rate  
180 from different authors varies from 6% to 77% in different parts of the countries [58].

181 CCPP is transmitted directly by an aero genic route through contaminated droplets. The outbreak of the  
182 disease follows the introduction of an infected animal into a group of susceptible goats [59]. Disease outbreak  
183 may occur after heavy rain, animal transportation over a long distance, poor climatic conditions and primary  
184 infections. This is because recovered carrier begins shedding the infectious agent during stress [56]. CCPP is a  
185 major cause of economic losses in the goat industry globally as these intracellular bacteria can infect domestic as  
186 well as wild breeds of goat [58,60,61], with 100% morbidity and 60-80% mortality rates [55].

187 iii. Sheep and goat pox Sheep and goat pox (SGP) is viral diseases of sheep and goats characterized by fever,  
188 generalized papules or nodules, vesicles (rarely), internal lesions (particularly in the lungs) and death [62]. The  
189 virus that causes SGP is a Capri poxvirus, one of the largest viruses (170-260 nm by 300-450 nm) [63]. There  
190 is only one serotype of SGP virus (SGPV). Various strains of SGPV cause disease only in sheep, others only in  
191 goats, and some in both sheep and goats [64].

192 Sheep and Goat Pox (SGP) is one of the most important diseases of sheep and goats in Ethiopia following  
193 Pest des Petites Ruminants (PPR) and Contagious Caprine Pleuropneumonia (CCPP). This disease is among  
194 the commonest of the diseases that affect small ruminants entailing a huge economic loss and Office International  
195 des Epizooties (OIE) listed as trans-boundary disease of animal affecting the economy of the country through  
196 limiting international trade of animals and their products [65]. Morbidity rates in indigenous breeds can be  
197 70-90% with mortality ranging from 5-10%. Mortality and morbidity rates in newly imported animals can reach  
198 100% [66].

199 The most likely manner for SGP to enter a new area is by introduction of infected animals. Restrictions on  
200 the movement of animals and animal products (meat, hair, wool, and hides) are important to prevent SGP [67].

## 201 6 iv. Brucellosis

202 Brucellosis is an infectious bacterial disease that's caused by different species of Brucella. Each Brucella spp. has  
203 a preferred natural host that serves as a reservoir. Brucellosis in small ruminants is caused mainly by B.melitensis  
204 [68]. Brucella infection follows a very strict, host-related hierarchy of pathogenicity [69].

205 Thus, goats are the natural hosts of B.melitensis and sheep are preferred hosts of the pathogen [70]. Prevalence  
206 rates vary throughout and even within the same geographical zones operating different husbandry techniques [71].

207 This disease is common trans-boundary disease in Ethiopia that cause huge economic loses and trade restriction  
208 [72]. The herd level important risk factors for small ruminants brucellosis identified are large flock size, addition  
209 of new animals from unscreened sources, intensive system of management, history of abortion, grazing communal  
210 pasture, keeping sheep and goat together [73].

211 In Ethiopia, studies conducted on brucellosis in small ruminants indicated that; prevalence proportions of 1.5%  
212 in sheep and 1.3% in goats in the central highlands [74], prevalence proportions of 15% in sheep and 16.5% in  
213 goats in the Afar region [75] and 1.6% in sheep and 1.7% in goats in the Somali region [76]. The presence of this  
214 disease has also been reported in the Southern Nations, Nationalities and Peoples' Regional State and pastoral  
215 areas of Borana [77]. The disease is known by its high mortality rate in lambs and kids [78].

## 216 7 c) Factors Spread Trans-boundary Diseases

217 Traditionally, trade and travel have been instruments for disease spread. Now, changing climate across the globe  
218 is adding to the misery. Climate change is creating new ecological platform for the entry and establishment of  
219 diseases from one geographical region to another. Several new trans-boundary diseases emerge, and old diseases  
220 reemerge, exhibiting increased chances for unexpected spread to new regions, often over great distances [79].

221 Other common ways of spreading of transboundary diseases to a new geographical location are through entry  
222 of live diseased animals and contaminated animal products, importation of contaminated biological products  
223 such as vaccines or germplasm or via entry of infected people (in case of zoonotic diseases). Even migration  
224 of animals and birds, or natural spreading by insect vectors or wind currents, could also spread diseases across  
225 geographical border [80,2]. TADs impose major economic costs and risks to infected countries, their neighbors,  
226 and trading partners. The varying impact of TADs among stakeholders and the threat to existing and potential  
227 trade in wealthier countries complicates the question of appropriate control. For all livestock producers, the  
228 threat of TADs increases the risk of lost production and impacts on livelihood, increasing vulnerability to poverty  
229 particularly for small-scale producers. The impact of TADs and of their control varies depending on the virulence  
230 of the disease, number of animals at risk, dependency on livestock for livelihood, and method of control [81].

231 Direct effects of TADs on livestock productivity include reduced feed intake, changes in digestion and  
232 metabolism, increased morbidity and mortality and decreased rates of reproduction, weight gain, reduced draught  
233 power and manure and milk production. These have aggregate effects that limit economically important herd-  
234 management decisions regarding animal selection and optimal longevity. Many TADs have mortality rate 50-90%  
235 in susceptible animals [2]. For instance, in the wake of the render pest pandemic of 1887 was estimated to have  
236 killed about 90% of Ethiopian cattle and more than 10 million cattle on the continent as whole [82]. On other  
237 hand, the socio-economic significance of PPR is a result of heavy losses at production level and market effects along  
238 the value chain. It is estimated that 10% of the total impact of the disease is on trade and public expenditure and  
239 90% on herd productivity [83]. In Ethiopia, FAO estimated that losses associated with PPR reached an average  
240 of US\$ 375 per flock, with an average of 143 small ruminants per flock (an average loss of more than US\$ 2 per  
241 animal) [84].

242 Indirect losses are often less visible than the obvious effects of clinical disease but may be equally or more  
243 important in their overall economic impact. Disease control has costs including vaccine purchase, vaccine  
244 delivery, disease surveillance, laboratory diagnosis and testing, quarantine and movement management, expensive  
245 antibiotic treatment [85]. Movement restrictions and local quarantines mean the closure of livestock markets and  
246 reduced or no opportunities for sale of live animals and possibly meat and other products. In addition to the  
247 measurable economic impact on a national economy the inability to sell one steer or some sheep or goats can  
248 bring severe hardship to a pastoral family with no other income of sources of support [86].

249 The trade implication of TADs can cause a greater economic impact than the direct production losses  
250 themselves [87]. The trade ban From February 1998 to April 1999, by Saudi Arabia and Other Gulf states  
251 of live animals from the Horn due to Rift Valley fever outbreak in Kenya is estimated to have cost US \$32  
252 million in lost exports and other negative domestic impacts on agriculture and other sectors such as transport  
253 and services [72]. In addition to this FMD is one of the major diseases in Ethiopia that hampering export of  
254 livestock and livestock products to the Middle East and other African countries, in which the country lost more  
255 than US\$14 million [88]. These bans have disrupted trade patterns and dealt severe economic blows to the region.  
256 Following the 1998 ban, for instance, exports from the port of Berbera in Somaliland ,a major export point for  
257 Ethiopian livestock from Somali Region, dropped from nearly three million head in 1997 to just over one million  
258 in 1998, representing an export loss of approximately \$100 million. As a result livestock prices in Ethiopia and  
259 Somalia fell by approximately 30 percent [89]. Traders have found ways of circumventing trade bans, for instance  
260 by exporting livestock to Yemen for re-export to Saudi Arabia, but, such measures do not address the root  
261 problem of SPS concerns from Gulf States. Indeed, the length of the bans suggests that Saudi Arabia and other  
262 Gulf States lack confidence in the Horn's disease surveillance and regulatory systems. The most recent ban was  
263 finally lifted in October 2009 [90].

264 Trans-boundary animal diseases have significant and measurable effects on human welfare in developing  
265 countries. Particularly in pastoral societies, livestock contribute directly or indirectly to food security and  
266 nutrition a source of protein, micronutrients, animal power and tradable asset [91].

## 267 **8 e) Prevention and Control of Trans-boundary Diseases**

268 Techniques and tools for the control of major TADs are already existed. They have been used successfully in  
269 many countries that most have been eradicated from or prevented from infecting North America, much of Europe,  
270 much of Southern Africa, Australia and New Zealand. In these countries there is now nothing other than sporadic  
271 and localized outbreaks which are usually quickly dealt with [92,93].

272 The following techniques are used for prevention and control of Trans-boundary disease these are: Preventing  
273 incidence of trans-boundary diseases and disease transmitting vectors and minimizing the movement of animals  
274 across the borders is essential. Also, prompt practice of quarantine protocol would reduce many trans-boundary  
275 diseases [94], Reducing man-made disasters that have adverse implications on climate [79], Interrupting the  
276 human-livestock wildlife transmission of infections, Breaking the cycle of disease transmission [95], Establishing  
277 regional biosecurity arrangement with capacity for early disease warning system for surveillance, monitoring and  
278 diagnosis of emerging disease threats [96], Undertaking animal breeding strategies to create disease resistant  
279 gene pools [97], Strengthening government policies to enhance agricultural/animal research and training, and  
280 technology development [98], Ensuring appropriate preparedness and response capacity to any emerging disease  
281 and Intensification of international cooperation in preventing spread of TADs [96,99].

282 In addition to this the International Organization for Animal Health recognizes the improvement of national

### 9 III. CONCLUSION AND RECOMMENDATION

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283 standards in animal health, should be parallel to the improvement of veterinary services in terms of increasing  
284 the capacity of early epidemiological detection, diagnosis and control of TAD [59]. Roles of Veterinary Services in  
285 function of TADs control, rapid detection and early response are crucial for the control of TADs. This function is  
286 highly linked with the transparent and timely notification of disease for effective control of such diseases at source.  
287 To achieve those, national Veterinary Services (VSs), as a public good, play quite important roles and need to be  
288 strengthened in various areas of their important mission, including human and financial resources, legislation for  
289 animal health and diagnostic and surveillance capability, and disease control measures. The World Organization  
290 for Animal Health, has supported Member Countries/ Territories to evaluate Performance of Veterinary Services,  
291 by applying the OIE Public Veterinary Service tool, which is designed to assist VSs to identify gaps and weaknesses  
292 regarding their ability to comply with OIE International Standards on animal health, to form a shared vision  
293 with stakeholders and to establish priorities and carry out strategic in control of TADs [100].

### 294 9 III. Conclusion and Recommendation

295 Trans-boundary diseases is becoming ever more important since it can spread throughout an entire region, impact  
296 trading partners and commerce, tourism, consumer confidence, and occur in distant countries, with devastating  
297 economic and livelihood consequences. With the globalization of trade and the increasing movements of people,  
298 these major crises will continue to menace the global animal and human populations. In Ethiopia the Livestock  
299 sub-sector's contribution to the economy and foreign currency earnings in particular, is very low as per the country  
300 expectation and potential of the sectors. Some of the major factors contributing to the poor performance of the  
301 livestock sub-sector include the prevalence of highly contagious trans-boundary animal diseases (TADs) such as  
302 foot-and-mouth disease (FMD), lumpy skin disease (LSD) and contagious bovine pleura pneumonia (CBPP) in  
303 cattle and pest des petites ruminants, contagious Caprine pleuropneumonia, sheep and goat pox, and brucellosis  
304 in small ruminants. These diseases continue to hinder international trade in live animal and their products  
305 seriously in an era of globalization.

306 Based on above conclusive remarks the following recommendations are forwarded: ? Strategies to improve  
307 veterinary service delivery by field staff and laboratories should be designed. ? In the medium to long term,  
308 health facilities and laboratories need to be better equipped and the number of veterinary staff in the public and  
309 private sectors should be increased. ? Rapid detection and early response are crucial for the control of TADs  
310 at source and national level. ? Government policies to enhance agricultural/animal research and training, and  
311 technology development should be strengthened. ? Animal movement from region to region should be controlled  
312 and quarantine should also be established. <sup>1 2 3</sup>

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