



**SOUTHERN AFRICAN CENTRE  
FOR  
INFECTIOUS DISEASE SURVEILLANCE**

## **Risk Factors for Foot and Mouth Disease outbreaks in Zambia**

### **Review Article**

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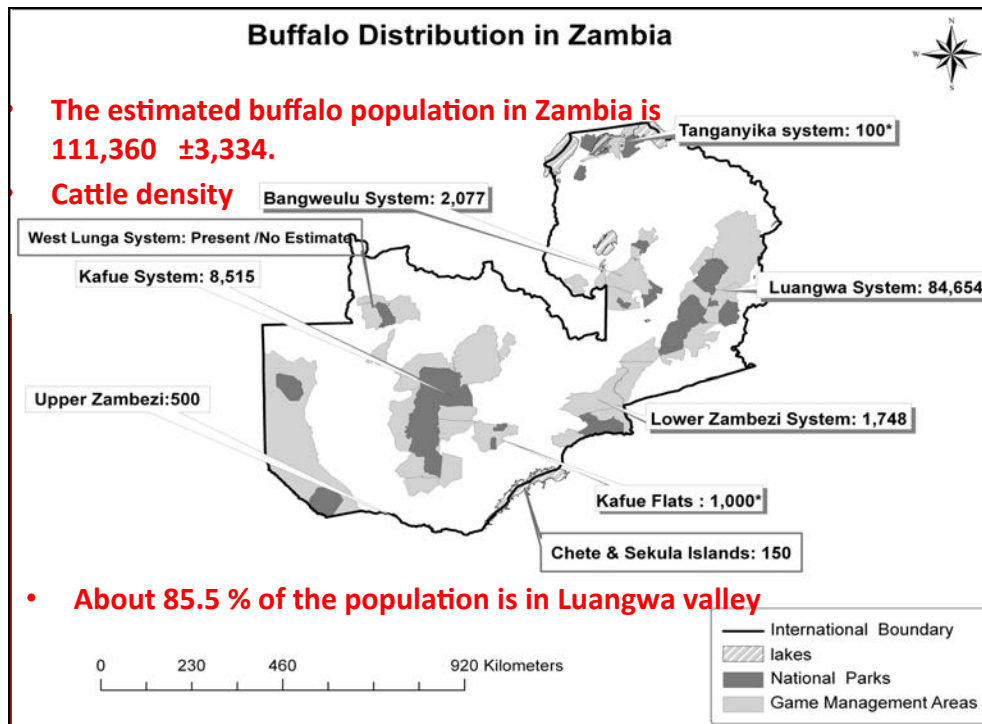
## **Outline**

- Introduction
- Wildlife sanctuaries and distribution of buffaloes and cattle
- Distribution of outbreaks – 30 years
- Risk Factors
- Conclusion

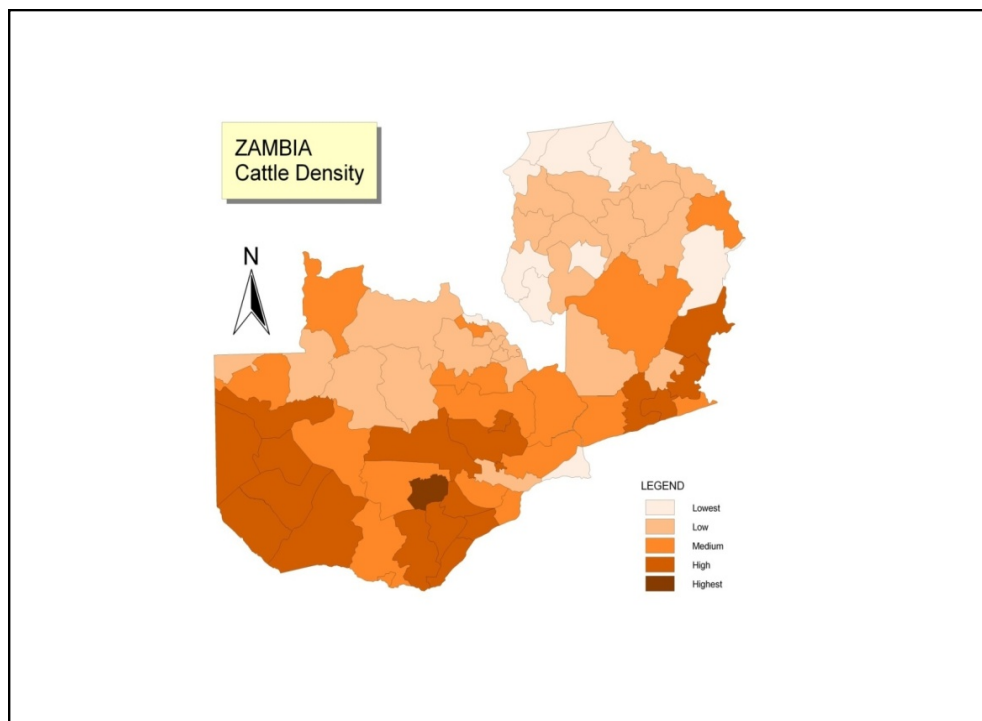
# Introduction

- FMD is endemic in Zambia
- 1933 – First identification
- 1948 - First characterisation
- 1953 – SAT 2 Kafue flats
- The disease has since been endemic
- Sporadic outbreaks in cattle
- What factors or combinations have triggered these outbreaks?

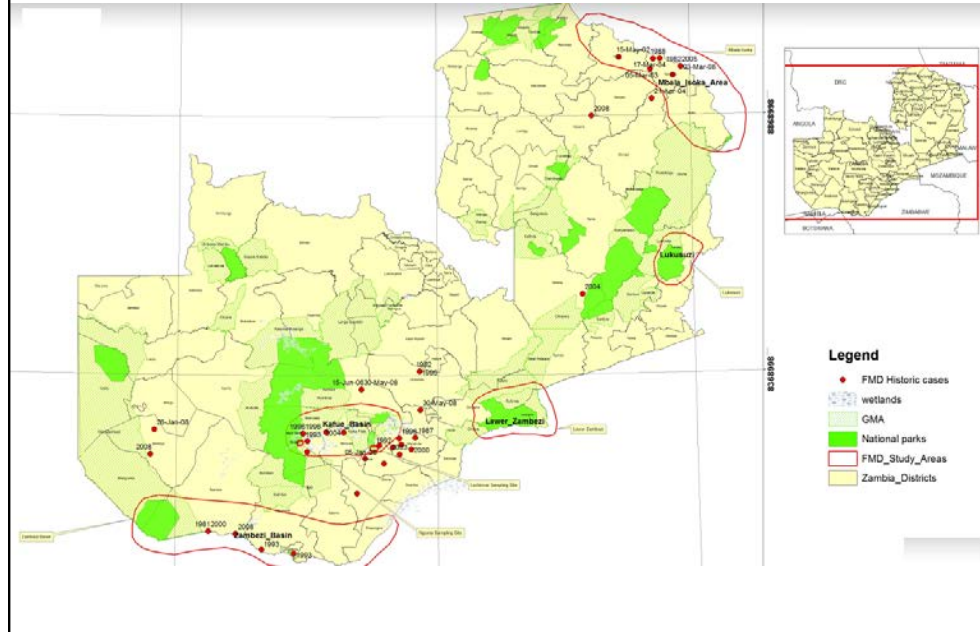




- About 85.5 % of the population is in Luangwa valley



## Spatial distribution of FMD cases last 30 years



Date	District	Location	SAT1	SAT2	SAT3	Serotype_A	Serotype_O	Source
2008	Senanga	Senanga	0	SAT 2	0	0	0	Cattle
26/01/2008	Senanga	Senanga	0	SAT 2	0	0	0	Cattle
2008	Sesheke	Mwandi	0	SAT 2	0	0	0	Cattle
1993	Itezhi tezhi	Nanzhila_KNP	SAT 1	0	0	0	0	Buffalo
1993	Itezhi tezhi	Nanzhila_KNP	0	SAT 2	SAT 3	0	0	Buffalo
1993	Itezhi tezhi	Nanzhila_KNP	0	SAT 2	SAT 3	0	0	Buffalo
1993	Itezhi tezhi	Nanzhila_KNP	0	SAT 2	SAT 3	0	0	Buffalo
1996	Itezhi tezhi	Nanzhila_KNP	SAT 1	0	0	0	0	Buffalo
1996	Itezhi tezhi	Nanzhila_KNP	0	SAT 2	SAT 3	0	0	Buffalo
1996	Itezhi tezhi	Nanzhila_KNP	0	SAT 2	SAT 3	0	0	Buffalo
1981	Itezhi tezhi	Basanga village	0	SAT 2	0	0	0	Cattle
2005	Mazabuka	Mazabuka	SAT 1	0	0	0	0	Cattle
21/12/2004	Mazabuka	Chisoba farm	Unknown	0	0	0	0	Cattle
21/01/2005	Mazabuka	Nega-nega	Unknown	0	0	0	0	Cattle
06/09/2004	Chibombo	Chibombo	SAT 1	0	0	0	0	Cattle
17/07/2005	Chibombo	Chibombo	Unknown	0	0	0	0	Cattle
20/09/2010	Mbala	Kaka	0	0	0	0	0	Cattle
11/05/2009	Mbala	Chozl	0	SAT 2	0	0	0	Cattle
02/12/2010	Chinsali	Kalela	0	0	0	0	0	Cattle
25/11/2010	Nakonde	Ntatumbila	0	0	0	0	0	Cattle
1982	Choma	Choma	0	SAT 2	0	0	0	Cattle
15/06/2006	Namwala	HH	Unknown	0	0	0	0	Cattle
18/07/2005	Itezhi tezhi	Itezhi tezhi	Unknown	0	0	0	0	Cattle
05/01/2006	Itezhi tezhi	Itezhi tezhi	Unknown	0	0	0	0	buffalo
1981	Monze	Kambwa village	0	SAT 2	0	0	0	Buffalo
19/11/2004	Kasama	Kasama	Unknown	0	0	0	0	Cattle
23/07/2004	Namwala	Katengwa	0	SAT 2	0	0	0	Cattle
2007	Kazungula	Kazungula	0	SAT 2	0	0	0	Cattle
1992	Livingstone	Livingstone	SAT 1	0	0	0	0	Cattle
1996	Monze	Lochinvar NP	SAT 1	0	0	0	0	Buffalo
2000	Serenje	Luswesi	SAT 1	0	0	0	0	Cattle
1987	Mazabuka	Magoye	SAT 1	0	0	0	0	Cattle
1995	Itezhi tezhi	Mambova	0	0	SAT 3	0	0	Cattle
1982	Mazabuka	Mazabuka	0	SAT 2	0	0	0	Cattle
2004	Mazabuka	Mazabuka	SAT 1	0	0	0	0	Cattle
2008	Mazabuka	Mazabuka	SAT 1	0	0	0	0	Cattle
15/05/2002	Mbala	Mbala	Unknown	0	0	0	0	Cattle
05/03/2003	Mbala	Mbala	Unknown	0	0	0	0	Cattle
21/04/2004	Mbala	Mbala	SAT 1	0	SAT 3	0	0	Cattle
30/03/2008	Mbala	Mbala	Unknown	0	0	0	0	Cattle
1988	Monze	Mininga	SAT 1	0	0	0	0	Cattle
25/01/2008	Mongu	Mongu	0	SAT 2	0	0	0	Cattle
1982	Monze	Monze	0	SAT 2	0	0	0	Cattle
2004	Monze	Monze	SAT 1	0	0	0	0	Cattle
07/04/2008	Monze	Monze	SAT 1	0	0	0	0	Cattle
30/03/2009	Monze	Monze	Unknown	0	0	0	0	Cattle
1996	Itezhi tezhi	Mulanga_KNP	0	SAT 2	SAT 3	0	0	Buffalo
1996	Itezhi tezhi	Mulanga_KNP	0	SAT 2	SAT 3	0	0	Buffalo
30/03/2008	Mumbwa	Mumbwa	Unknown	0	0	0	0	Cattle
2005	Mungwi	Mungwi	Unknown	0	0	0	0	Cattle
17/03/2004	Nakonde	Mwenzo	Unknown	0	0	0	0	Cattle
03/03/2008	Nakonde	Nakonde	SAT 1	0	0	0	0	Cattle
20/10/2000	Namwala	Namwala	SAT 1	SAT 2	SAT 3	0	0	Buffalo
03/07/2008	Namwala	Namwala	SAT 1	0	0	0	0	Cattle
2004	Namwala	Namwala	SAT 1	0	0	0	0	Cattle
30/03/2008	Lusaka	Ndilita	Unknown	0	0	0	0	Cattle

## **Risk Factors for Occurrence**

### **Stress related**

- Drought – increase contact livestock/wildlife
- Floods - increase contact livestock/wildlife
- Outbreaks of other diseases – may lower immunity
- Changes within buffalo immune system that cause increased shedding of viruses
- Movement of infected cattle

## **Factors for Spread**

- Cattle density
- Unrestricted cattle movement - Pastoral, Lobola, Stock theft
- Trade & livestock markets
- Transhumance, communal grazing
- Movement ban
- Poaching

## Ecological Factors

- Depletion of habitat and disturbance
  - Mining activities in the national park
  - Predation including poaching
  - Human settlements into protected areas
  - Tourism - hunting safaris
  - Grazing
  - Land cover changes overtime

## Factors for Maintenance

- Buffalo distribution - reservoir/carrier
- SAT types distribution & mutation – inadequate genomic analysis – relatedness to outbreak viruses
- Inadequate control in cattle – vaccination, movement control
- Poor immune response in vaccinated animals as a result of cytokines mRNA responses in previously exposed animals

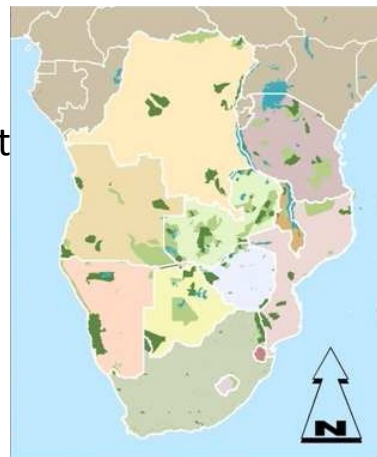


## Factors for Maintenance

- **Subclinical infection of vaccinated animals following challenge**
- **Infected animals mount different defenses following infection - differences in virus clearance**
- **Transhumance & pastoral systems**
- **Cattle density**
- **Traditional practices – Mafisa**

## Viral Factors

- presence of different serotypes and nature of the FMDV - variability in the capsid structural proteins especially VP1-  
virus attachment, protective immunity and serotype specificity
- TFCA - Uncontrolled movement of buffalo
- Virus mutation and comingling of topotypes



## Viral Factors

- presence of different serotypes and nature of the FMDV - variability in the capsid structural proteins especially VP1- virus attachment, protective immunity and serotype specificity
- TFCA - Uncontrolled movement of buffalo
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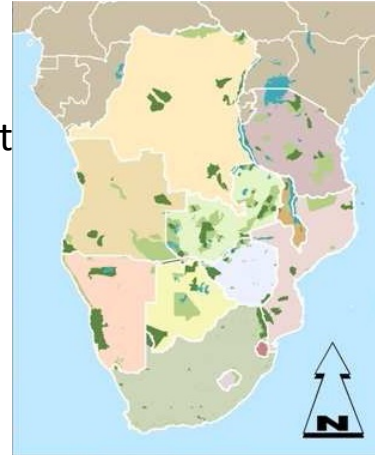


Table 2: Risk factor for FMDV outbreaks distribution in relation to ecological systems					Remark
Risk factor	Kafue basin	Zambezi basin	Mbala/Isoka	Luangwa	
Drought	Occasionally last 2000-2002	Occasionally last 2000-2002	Not often – high rainfall area	Not often – high rainfall area	Reports
Floods	Annually	Annually in some areas	N/A	ANY REPORT	Reports
Disease Burden	ECF, Brucellosis, TB, Tryps, worms	CBPP, Anthrax worms,	CBPP, ECF,	ECF, Tryps, Anthrax	Annual Reports
Cattle density	Highest	Moderate	Low	Low	Annual reports Perry <i>et al</i> 1984
Other ruminants	Moderate	Moderate	low	Highest for goats and pigs	Annual Reports
Buffalo density	Moderate	Low	Extremely low	Highest	ZAWA
Other antelopes	High	Low	Extremely low	High	ZAWA
Serotypes isolated from buffalo	SAT 1,2,3	N/A	N/A	SAT 1,2,3	Literature
Serotypes isolated from cattle	SAT 1, 2	SAT 1,2,3	O, A, SAT 1,2, 1976 type O but Disease reported 42 years before	SAT 1	Annual reports
Antigenic relationship buffalo And cattle strains	No relationship except for suspected SAT 1 in 1973 Perry <i>et al</i> 1984	No relationship so far	N/A	Not established	Literature
Seasonality	No seasonal Association. 70% dry season Perry <i>et al</i> 1984	No seasonal association but mostly dry season	No seasonal association	N/A	Annual reports Thomson 1995
Buffalo migration	High	High	N/A	High	ZAWA
Buffalo habitat Disturbance	Mining in the Park, tourism	Tourism	Non existent	Tourism	ZAWA
Poaching/ Hunting Field dressing of carcasses	High	Moderate	Non existent	High	ZAWA
Human activity Settlements around the park	High	High	Non existent	Moderate	ZAWA
Proximity to cross –	Nil	Chobe, Hwange,	Rukwa plains,	Nyika, Kasungu	ZAWA



## Conclusion

- Several factors are attributed to FMDV endemicity in Zambia
- Risk factors vary for different eco-systems
- Proximity of cattle production areas to wildlife sanctuaries; cattle husbandry practices and presence of stress factors seem to be the major contributors.
- More detailed risk factor analysis centered on the biology of the disease and statistical significance is recommended. Further due to gaps in FMDV transmission knowledge modelling is recommended with testable assumptions.



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