A sero-survey of foot and mouth disease (FMD) in cattle around Mana Pools Conservation Park of northern Zimbabwe

-2016 to 2018 -

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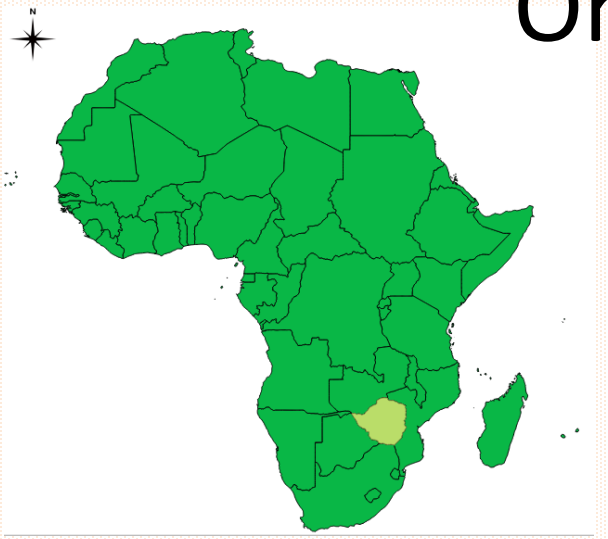
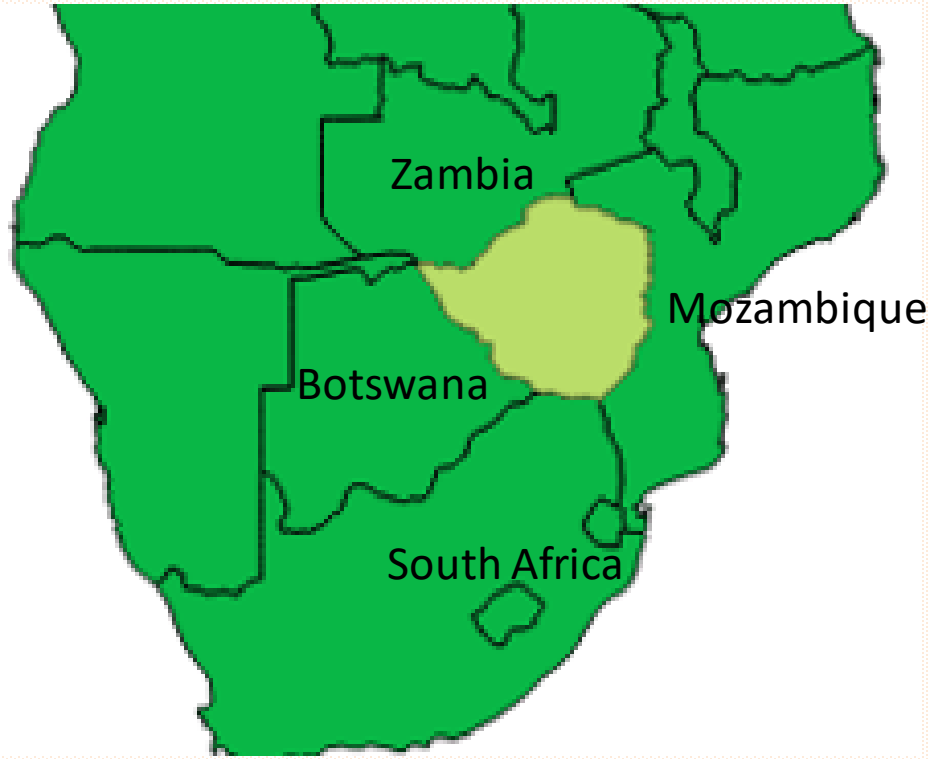
Orientation

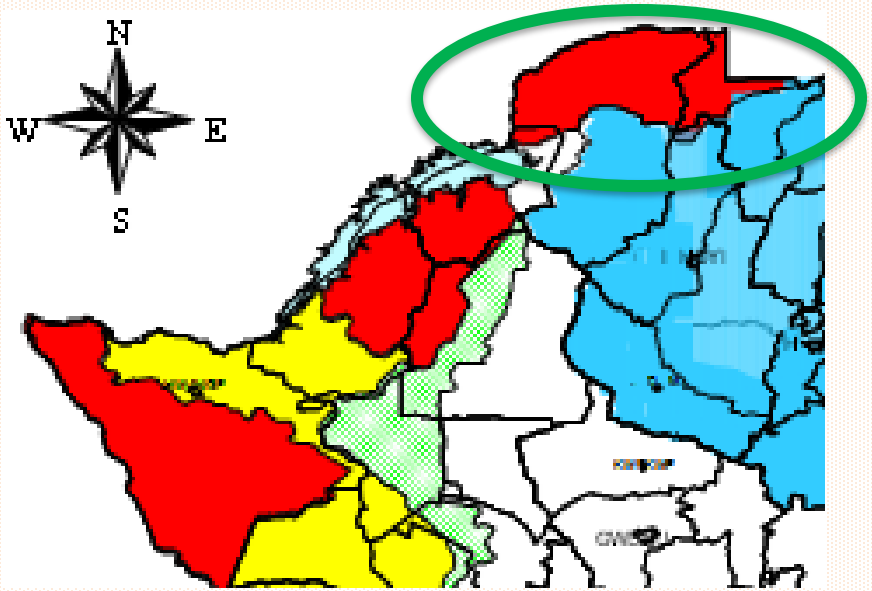




FMD outbreaks in Zimbabwe

- The 3 SAT serotypes are involved.
- FMD outbreaks are frequently reported in the southern, south eastern and western parts of the country.
- These areas are associated with huge buffalo populations:
  - Gonarezhou national park - 6600
  - Nuanetsi ranch – 1500 (Cumming 2016)
- Supports the theory of buffalo as the asymptomatic carrier of SAT serotype FMD in southern Africa.

HOWEVER,

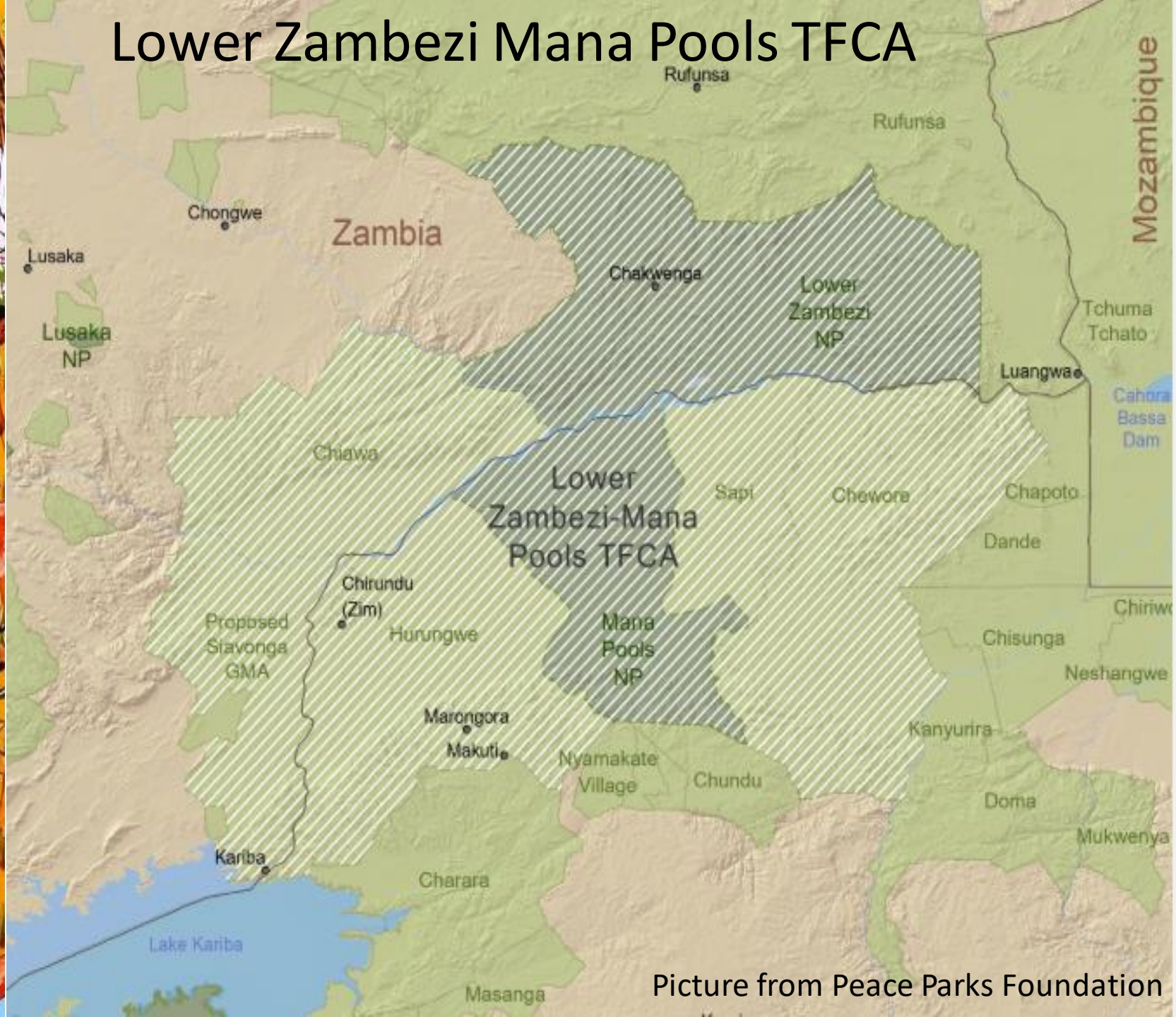


- Northern Zimbabwe(lower Zambezi) is home to 6300 buffalo (Cumming, 2016)
- There is observed buffalo – cattle contact
- No clinical FMD outbreak ever reported in the north of the country
- Could we be dealing with subclinical FMD outbreaks in this area?

Objective

To establish the foot and mouth disease serological status of cattle in the periphery of the Lower Zambezi Mana Pools TFCA on the Zimbabwe side

Lower Zambezi Mana Pools TFCA

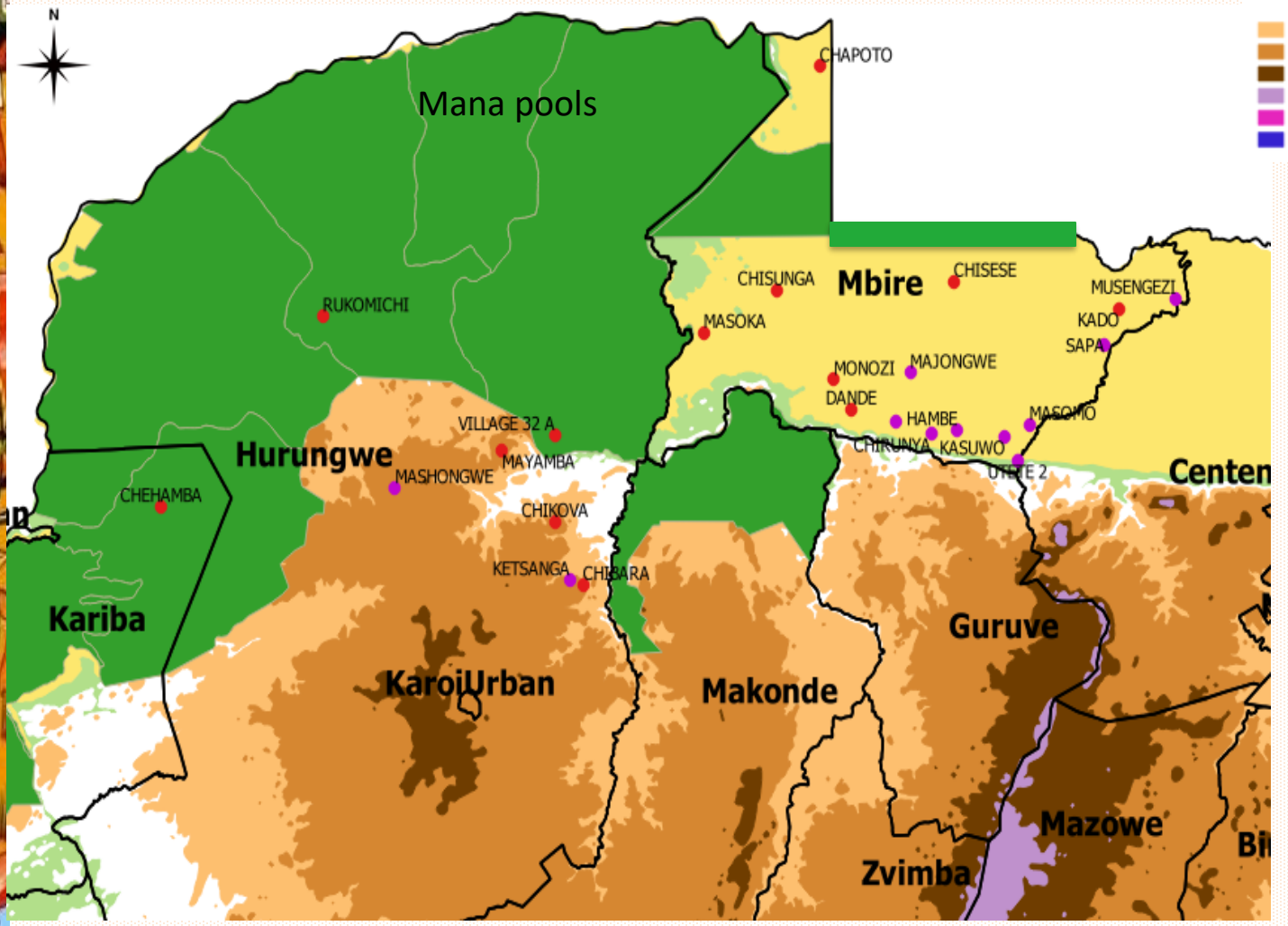


Picture from Peace Parks Foundation

About the study Area

- Communal settlement
- Porous, unfenced interface with wildlife
- Up to 40km from the interface
- Climate ranges from hot dry in the Zambezi valley to hot wet on the plateau
- Cattle densities increasing trend
- Cattle are the main source of draught power
- Buffalo-cattle contact observed

Study area



LEGEND

Distance from game park

- 0-20km radius
- Over 20km radius
- District boundary
- Protected conservation areas

Contour interval in metres

- 300
- 500
- 700
- 900
- 1100
- 1300
- 1500
- 1700
- 2000
- 2600

Materials and Methods
Sero-survey

1. A cross-sectional study involving:
   - 24/48 diptanks (epi-units)
   - 548/28400 cattle
2. A longitudinal study of 10 of the epidemiological units covering:
   - 690/9901 cattle
   - Wet Season (Jan, Feb, Mar)
   - Cold dry season (Jun, Jul, Aug)
   - Hot Dry Season (Sept, Oct, Nov)
3. A questionnaire, 492 respondents, interrogating some risk factors

Test Kit

- PrioCHECK FMDV NS (ELISA commercial test kit)
- Precise protocol instructions and controls guarantee validity
- Specificity estimated at 98.1%, sensitivity at 97.2% (Brocchi et al 2006).

Results: NSP-ELISA

Table 1: Distribution of foot and mouth disease seroprevalence according to the district of origin, distance from the park, age group and season of sampling of cattle from Mbire and Hurungwe districts of Zimbabwe (2016-2018)

Category	Level	No. tested	Positive	*Seroprevalence (%)	#95% CI	Odds Ratio (95% CI)
	All animals	1238	45	3.6	2.6- 4.7	-
District	Mbire	803	19	2.4[a]	1.3- 3.4	-
	Hurungwe	435	26	6.0[b]	3.7- 8.2	2.6 (1.4-4.8)
Distance from a game park	> 20km	502	10	2.0[b]	1.0-3.2	-
	≤20km	736	35	4.8[a]	3.2-6.3	2.4 (1.2-5.0)
Season of sampling	Cold-dry (June-August)	683	14	2.0[a]	1.0-3.1	-
	Hot-dry (Sept. Nov.)	274	21	7.7[b]	4.5-10.8	4.0 (2.0-7.9)
	Hot-wet (Dec.-Mar)	281	10	3.6[a]	1.4-5.7	1.8 (0.8-4.0)
Age group	≤ 36 months	403	13	3.2[a]	1.5-5.0	-
	37-57 months	216	8	3.7[a]	1.2 -6.2	-
	58-84 months	381	13	3.4[a]	1.6-5.2	-
	> 84 months	238	11	4.6[a]	1.9-7.3	-

*Figures with a different superscript in the same category are significantly different at $p < 0.05$

#CI = Confidence Interval

Results: NSP-ELISA

Table 2: The final multivariable logistic regression of the predictor variables associated with foot and mouth disease seropositivity of cattle from Mbire and Hurungwe districts (Lower Zambezi areas) of Zimbabwe (2016-2018)[a]

Variable	Level	Multivariable logistic regression [b]				
		b	SE (*b*)	*P*	OR	95% CI
	Constant	-4.3	0.37	0.000	-	-
Season	Cold-dry	-	-	-	1.0	-
	Hot-dry	1.3	0.36	0.000	3.6	1.8-7.2
	Hot-wet	0.5	0.42	0.26	1.6	0.7 – 3.7
Distance from the game park	> 20km	-	-	-	1.0	-
	≤20km	0.8	0.37	0.04	2.1	1.0 – 4.4

[a]Results given with *(b)*, logistic regression coefficient; SE(*b*), standard error for the logistic regression coefficient; *P*, probability value; OR, odds ratio; CI, confidence interval.

[b]Overall data of the model: Log likelihood = -183.2, LR chi2(3 d.f.) = 20.3, *P*= 0.0001, number of observations = 1238.

Liquid Phase Blocking ELISA Results

The 45 NSP positives were subjected to LPBE with the following result:

- 17/45 tested ++
  - 10/17 (59%) SAT1
  - 5/17 (29%) SAT2
  - 2/17 (12%) SAT3
- 17/1238 (1%)

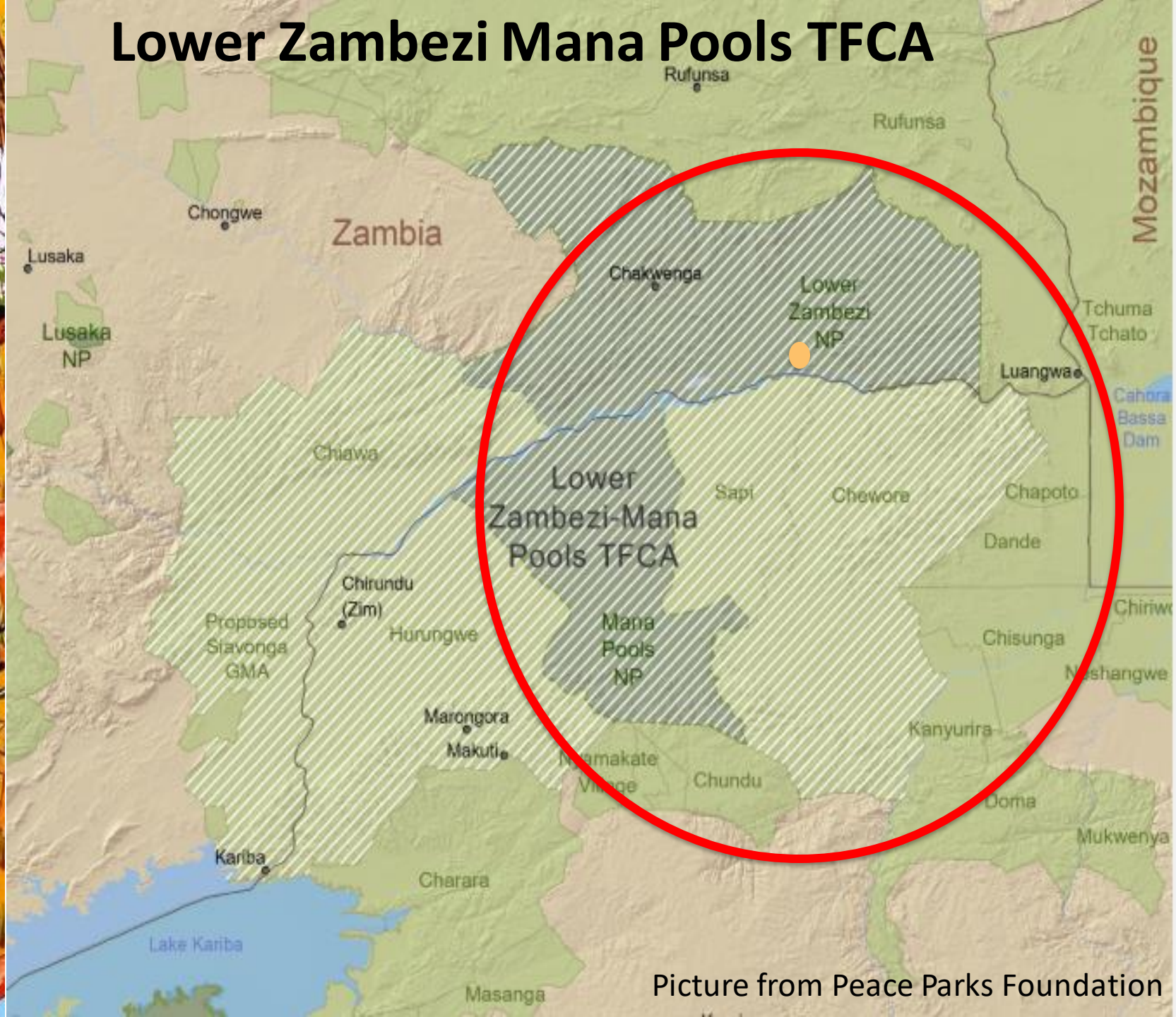
Results: Questionnaire

- Number of respondents = 492
- 16% (79/492) - see buffalo in the area
- 15% (74/492) - cattle sometimes mix with wild buffalo at grazing and watering
- 69% (340/492) - market their cattle outside the district

Discussion

- NSP seroprevalence of 4.8% and LPBE seroprevalence of 1% in an environment of buffalo-cattle mixing was considered very low:
  - Miguel et al, 2013, reported by 36.7% NSP in an unfenced interface in Malipati and 30.6% NSP in an unfenced interface in Pesvi in the south eastern lowveld of Zimbabwe.
- Do buffalo in the lower Zambezi carry the FMD virus?
- No work has been successfully carried out on the Zimbabwean side but there is some data on the Zambian side just acros the Zambezi river.

Lower Zambezi Mana Pools TFCA



Picture from Peace Parks Foundation

Discussion

- 25 buffalos were captured and sampled on the Zambian side between 2011 and 2012 (Sinkala et al, 2015)
- The following sero-prevalencies were reported using LPBE:
  - 88% sero-prevalence to SAT 1
  - 84% sero-prevalence to SAT 2
  - 8% sero-prevalence to SAT 3
- In the same study, SAT 1 was isolated from probang samples

Discussion

- Sinkala et al report the following sero-prevalencies by LPBE:
  - 88% sero-prevalence to SAT 1
  - 84% sero-prevalence to SAT 2
  - 8% sero-prevalence to SAT 3
- In the same study, SAT 1 was isolated from probang samples

Future work

- buffalo work to isolate the serotypes and strains involved.
- further investigation of the factors responsible for the low sero-prevalence

ACKNOWLEDGEMENT

- 1. This work was conducted within the framework of the Research Platform **“Production and Conservation in Partnership” (www.rp-pcp.org)”** with the financial assistance of the European Union.

- 2. NSP ELISA test kits were funded by the European Commission on foot and mouth disease (EuFMD)

Thank you for your attention

Grazie per l'attenzione