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AFRICAN BUFFALO SYMPOSIUM

13TH AND 15TH
SEPTEMBER
2016



9th International
Wildlife Ranching Symposium

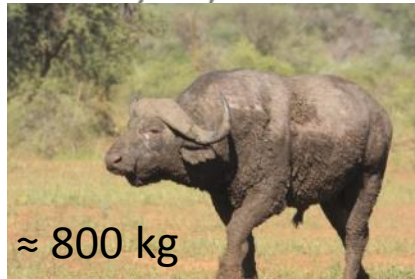
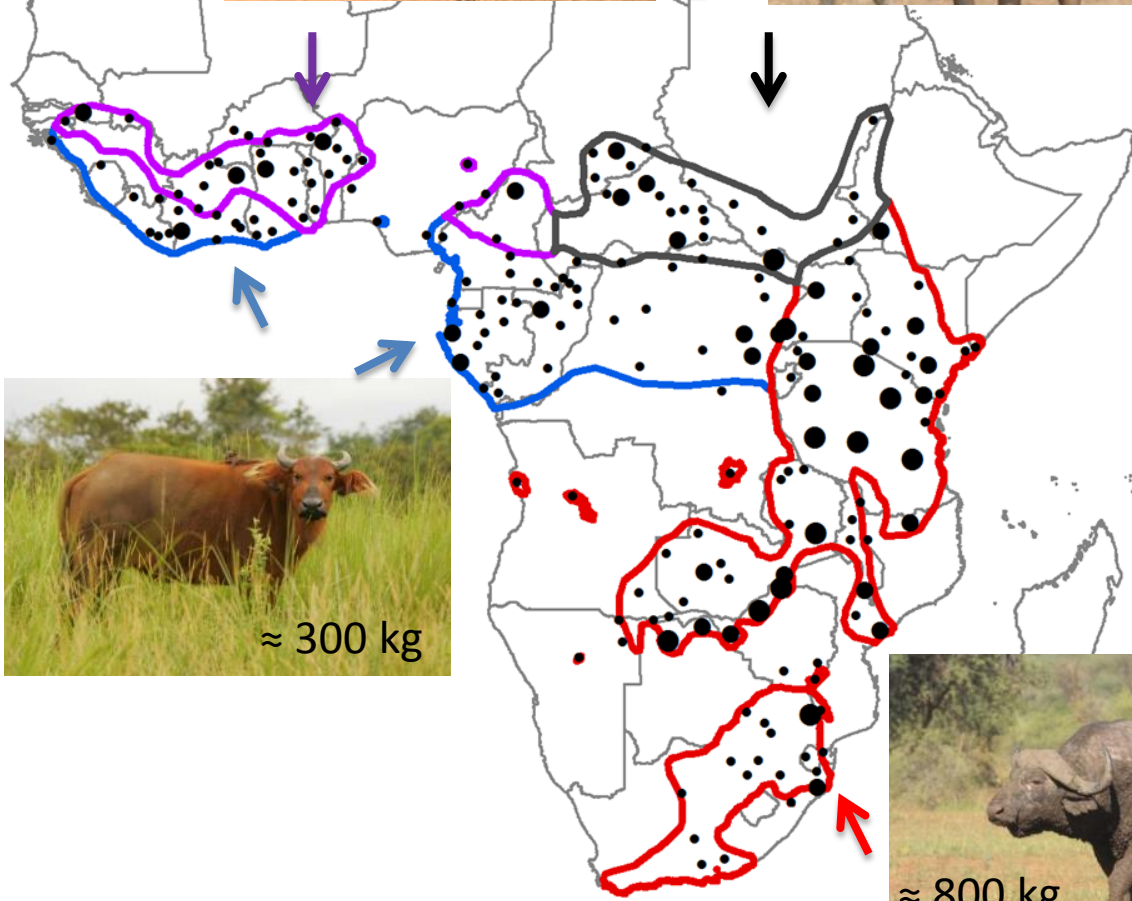
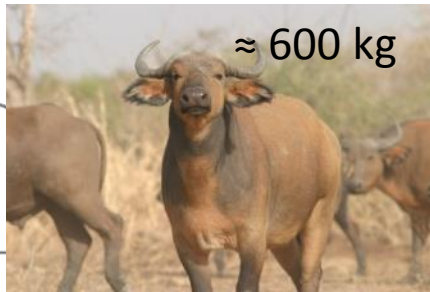




1st African Buffalo Symposium – Paris – 5th & 6th November 2014



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Legend

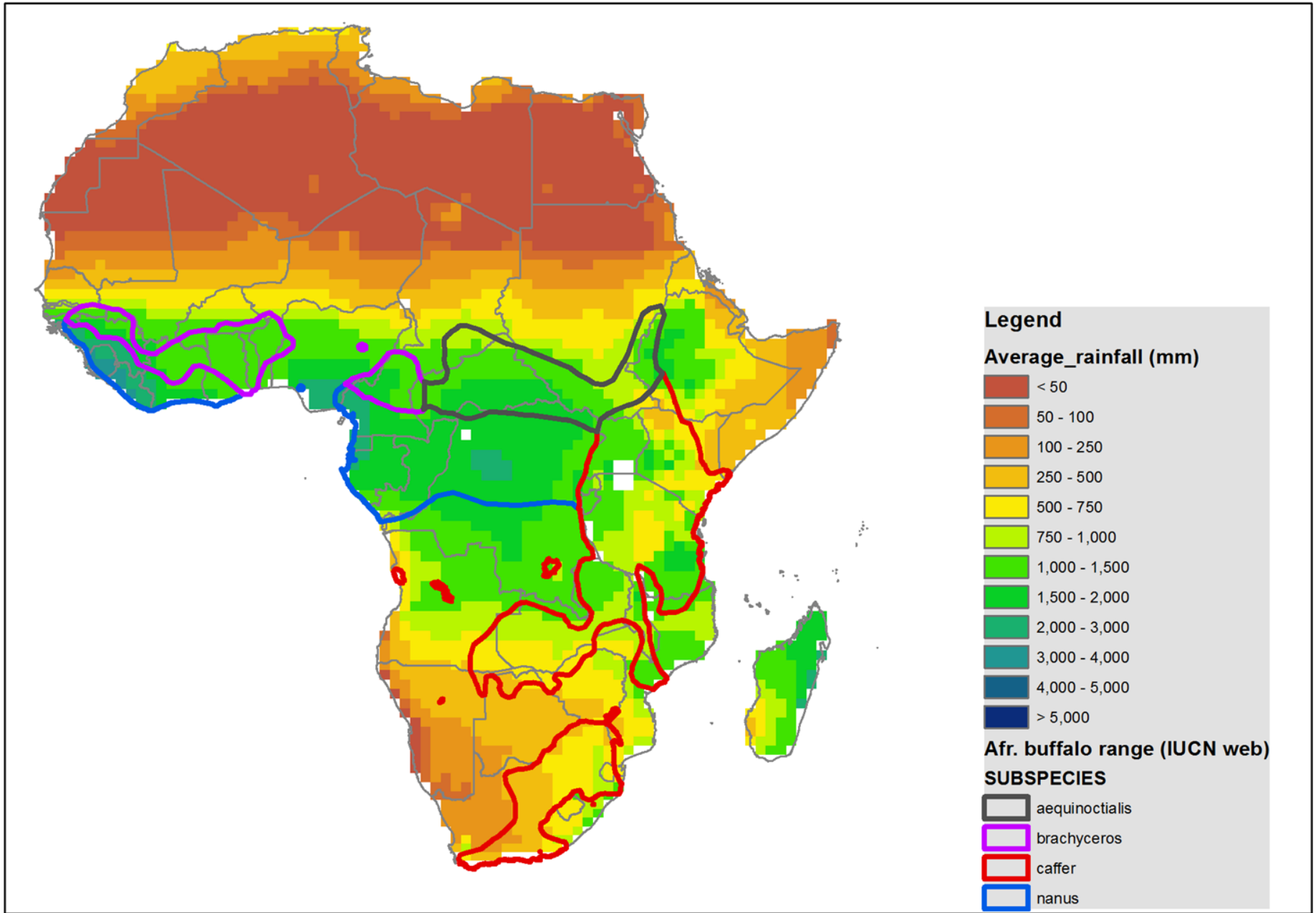
Buffalo loc (East, 1998)

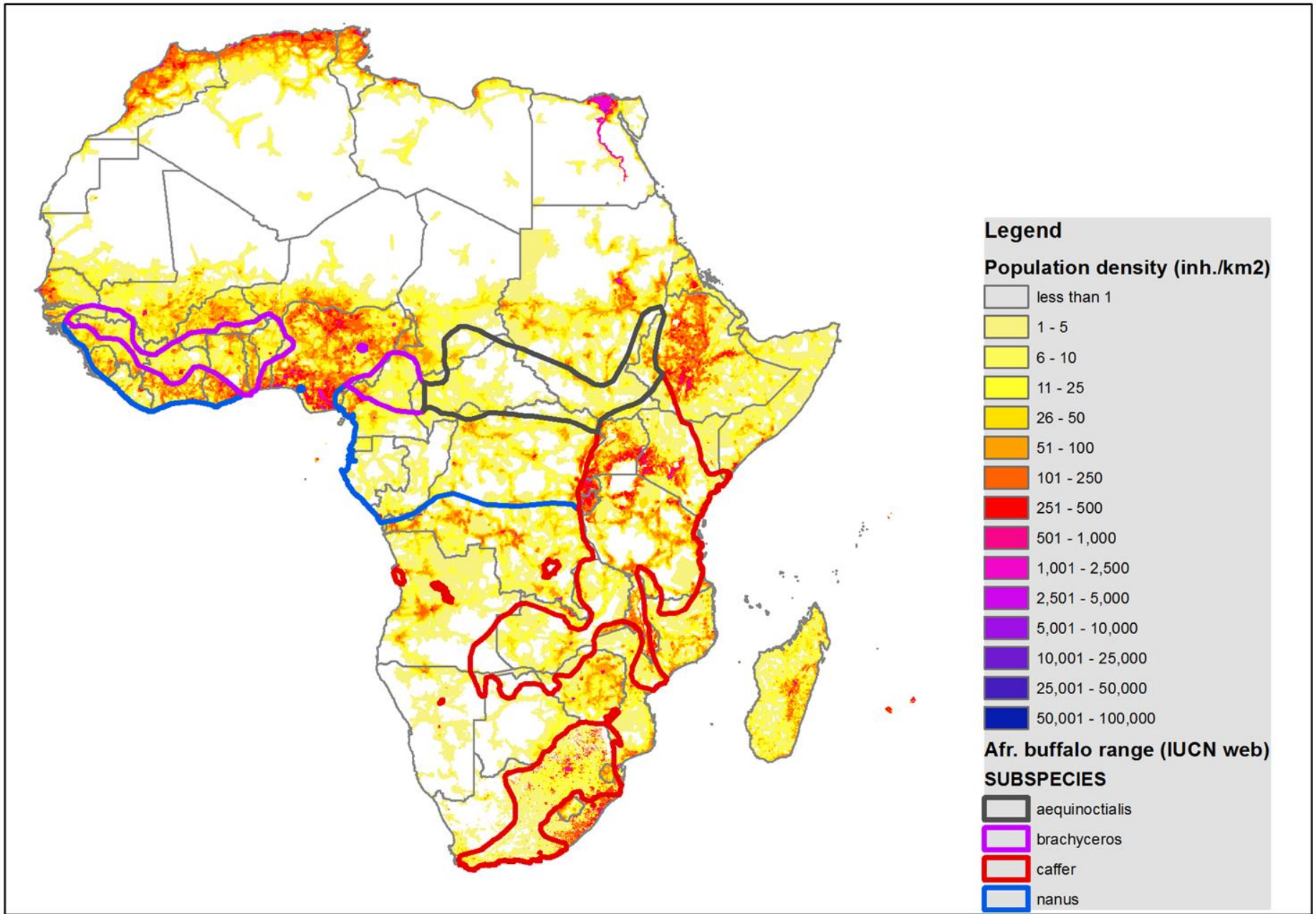
- 10 000 and more
- 1000 to 10 000
- Less than 1000

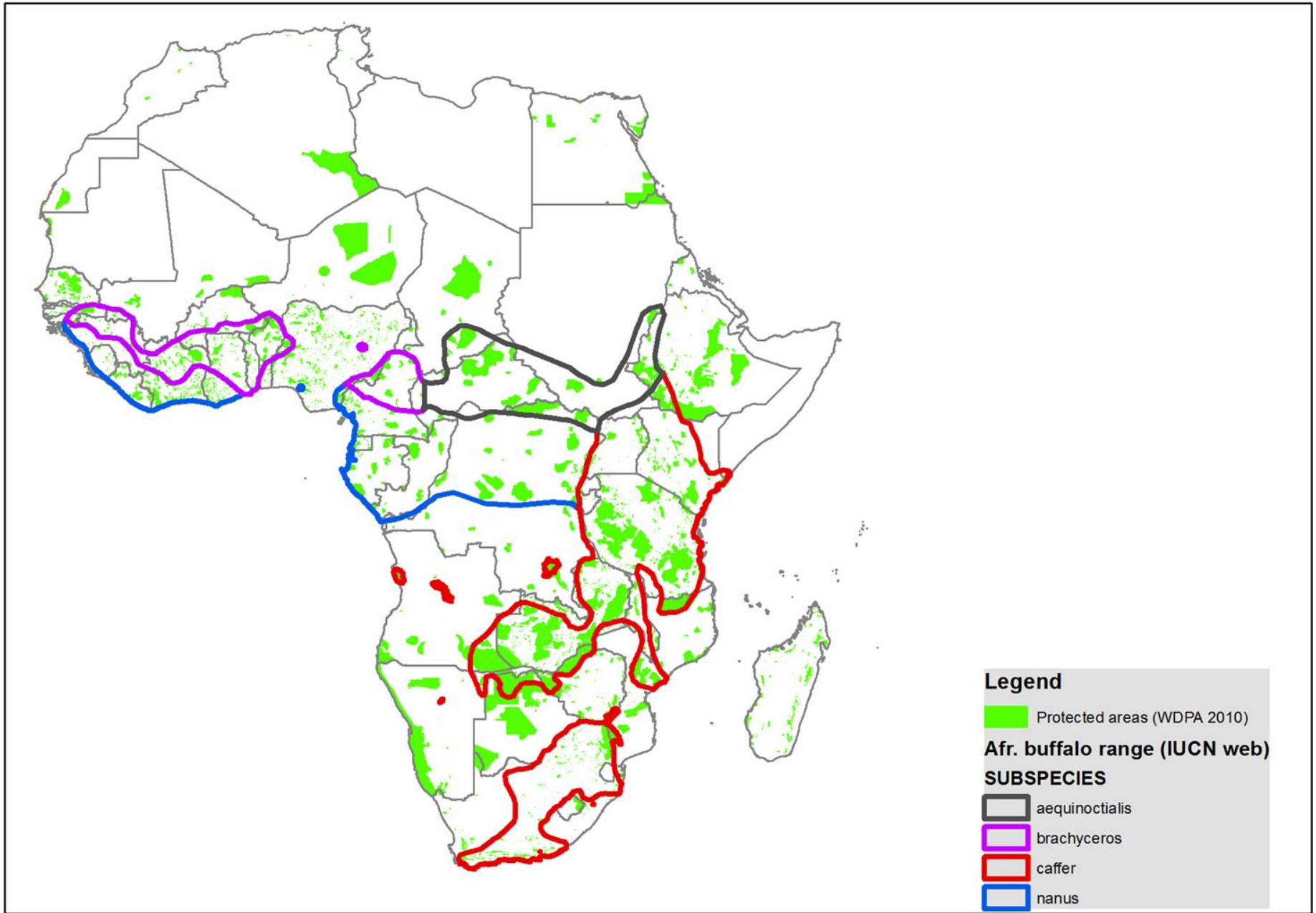
Afr. buffalo range (IUCN web)

SUBSPECIES

- aequinoctialis
- brachyceros
- caffer
- nanus







Challenges

- Habitat fragmentation
- Local decreases in population size
- Disease and health issues at the interface
- Viability of isolated populations
- Intensification issues (IGM)
- ...

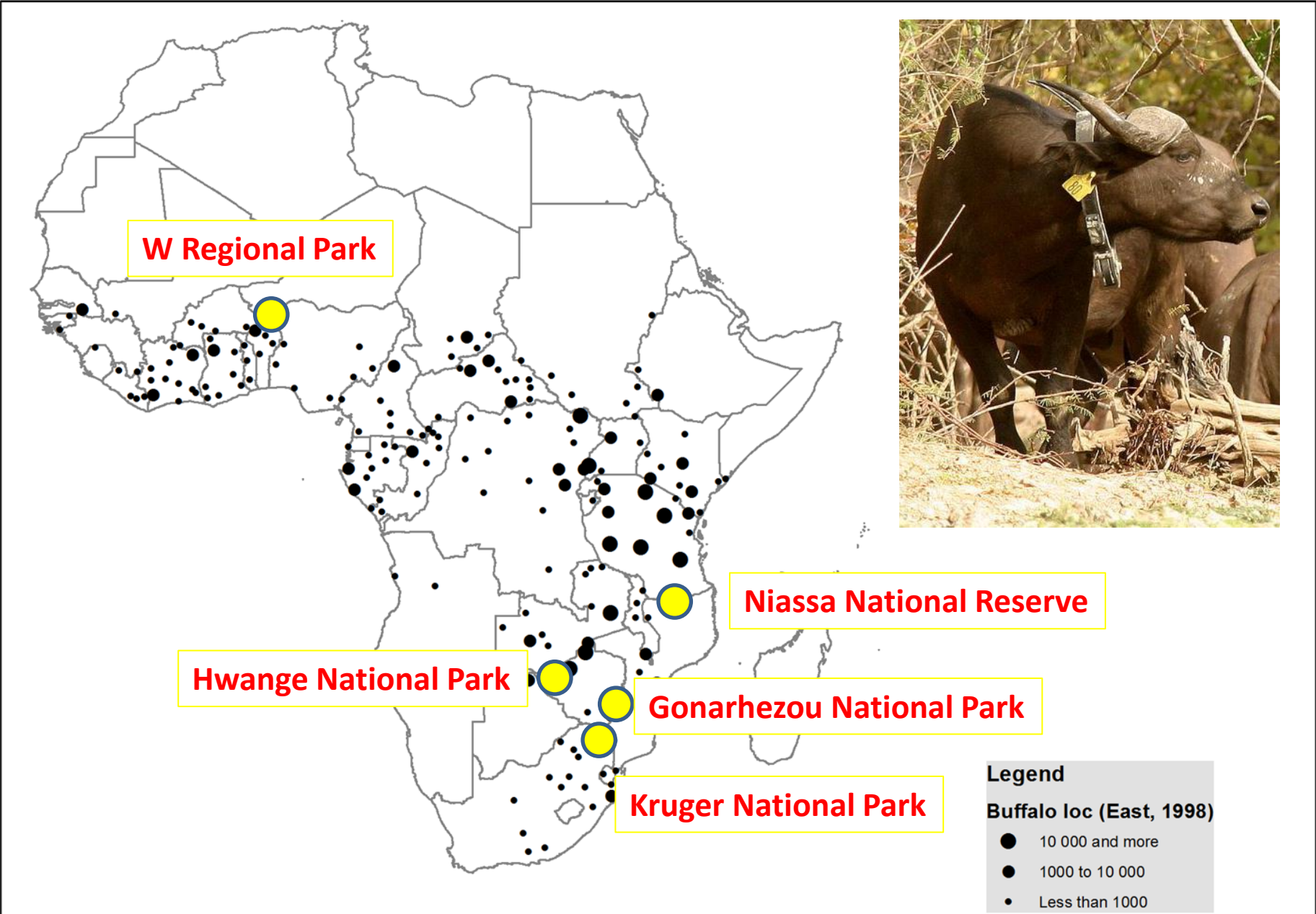
		SPEAKER	TITLE
SESSION 1 Tuesday PM ECOLOGY & CONSERVATION	13:30	Cornelis	Social dynamics in the African buffalo (<i>Syncerus caffer</i>)
	14:00	Keoikantse	Analyzing herbivore movements in relation to resource availability in the Savuti-Mababe-Linyanti Ecosystem (SMLE) in Northern Botswana
	14:30		TEA BREAK
	15:00	Bennitt	Effects of divergent migratory strategies on access to resources for Cape buffalo (<i>Syncerus caffer caffer</i>)
	15:30	Caron	Does surface water availability shape the human-wildlife interface at the edge of a protected area?
	16:00	DISCUSSION ECOLOGY & CONSERVATION	
SESSION 2 Thursday AM GENETICS, CONSERVATION & MANAGEMENT	08:00	Melletti	Comparative Analysis of Forest Buffalo Grouping Patterns In Central Africa
	08:30	Michaux	Evolutionary history of the African bufflao (<i>Syncerus caffer</i>) at continental scale based on mitochondrila and nuclear molecular markers
	09:00		TEA BREAK
	09:30	van der Westhuizen	Genetic variability of Cape buffalo populations in South Africa
	10:00	Smitz	Population genomics of the Cape buffalo subspecies (<i>Syncerus caffer caffer</i>) of the southern African region based on SNP markers
	10:30	Shepstone	Feeding buffalo: Improving production, reproduction and health in intensive, semi intensive and extensive game farming systems in southern Africa
	11:00	Robertson	Sustainably Managing Buffalo Trophy Quality
	11:30	DISCUSSION GENETICS, CONSERVATION & MANAGEMENT	
SESSION 3 Thursday PM HEALTH & DISEASE	13:30	Roug	Health and demographics of African buffalo (<i>Syncerus caffer</i>) in Ruaha National Park, Tanzania
	14:00	Combrink	Primary production drives eco-physiological cascades in African buffalo
	14:30		TEA BREAK
	15:00	Caron	Escherichia coli populations sharing and antibioresistance gradient at a buffalo/cattle interface in southern Africa
	15:30	DISCUSSION HEALTH & DISEASE	
	16:00	Symposium closing session	

Social dynamics in the African buffalo (*Syncerus caffer*)



*Daniel Cornélis, Alexandre Caron, Eve Miguel,
Vladimir Grosbois, Michel de Garine*

STUDY AREAS



W Regional Park

Niassa National Reserve

Hwange National Park

Gonarhezou National Park

Kruger National Park

Legend
Buffalo loc (East, 1998)

- 10 000 and more
- 1000 to 10 000
- Less than 1000

I - SOUTH GONARHEZOU NATIONAL PARK - (2008-2010)



**Gonarhezou National Park
(2008-2010)**

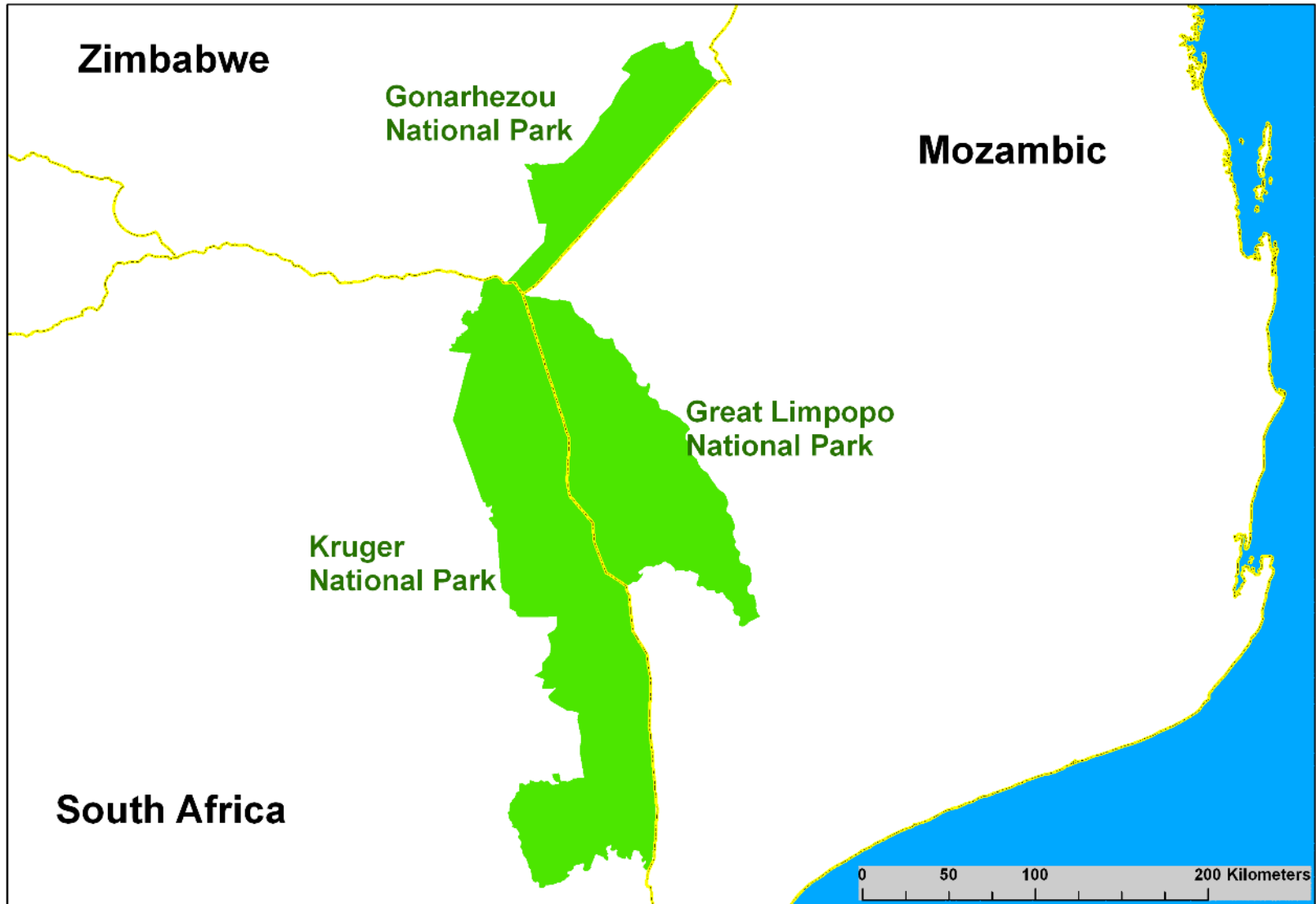


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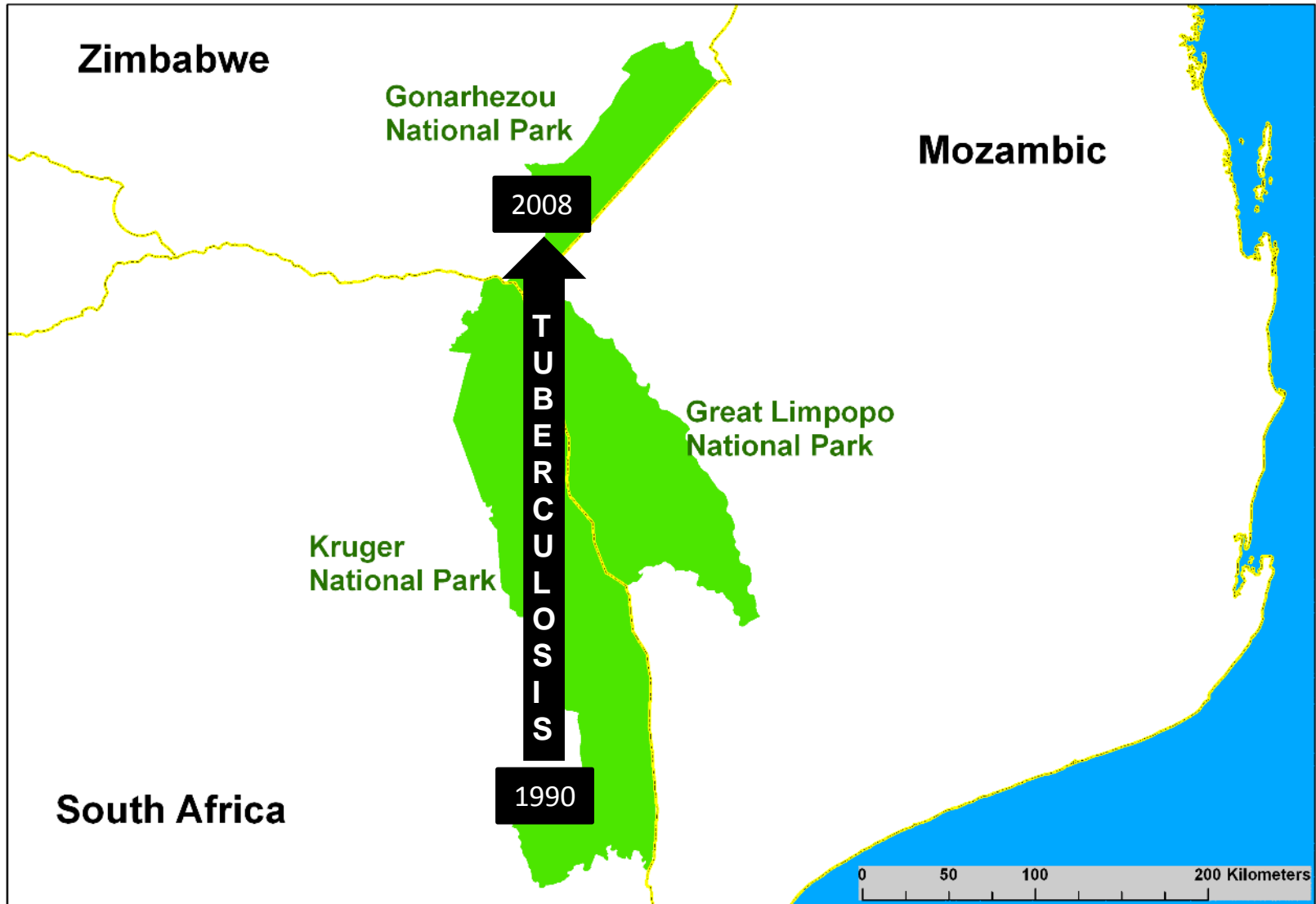
Buffalo loc (East, 1998)

- 10 000 and more
- 1000 to 10 000
- Less than 1000

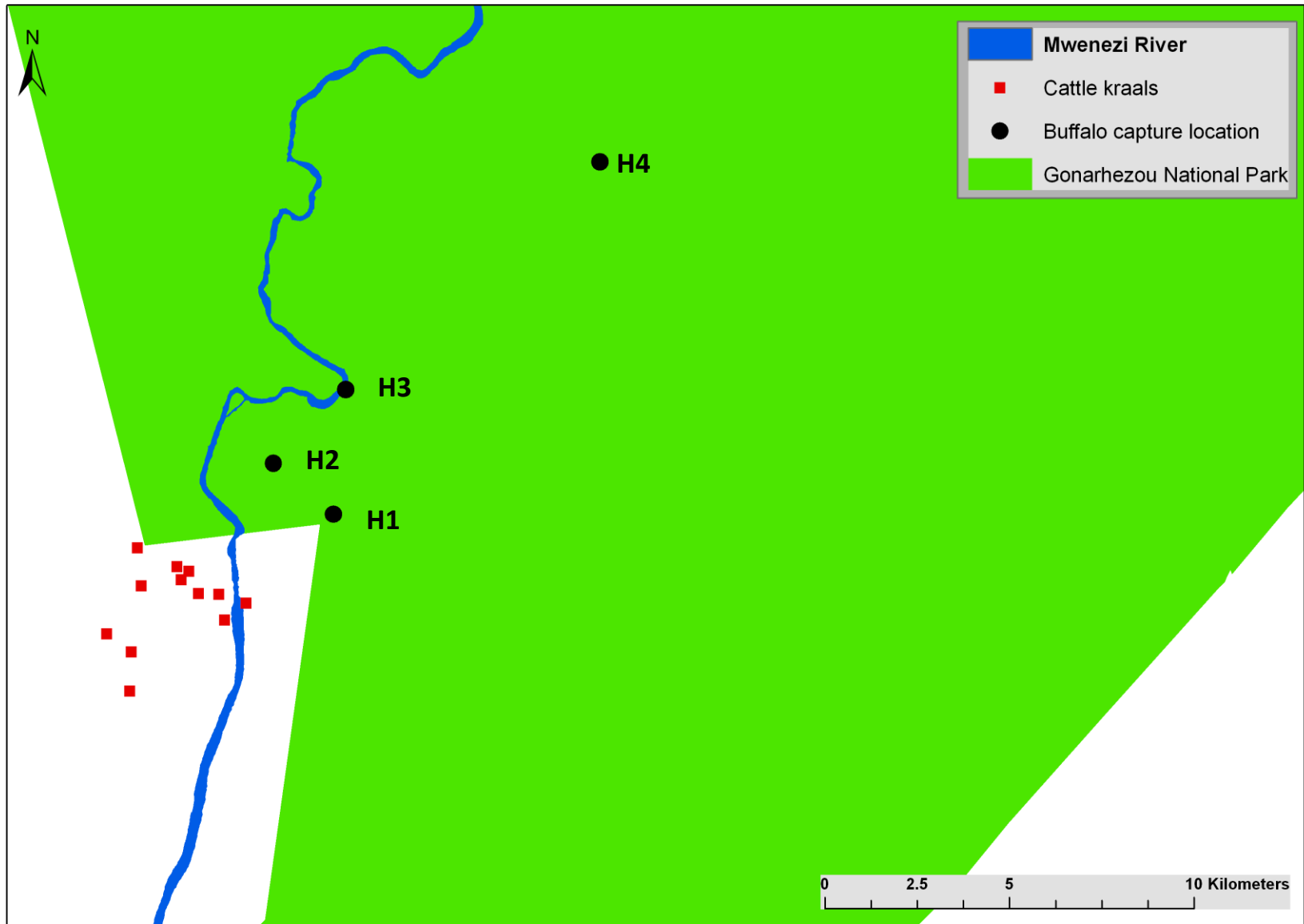
1. Introduction – Study area



1. Introduction – Study area



2. Methodology - Study design



2. Methodology - Study design

Group ID	Animal ID	Capture date	Group size
H1	80	09/10/2008	40
	81		
	82		
H2	83	11/10/2008	50-60
	84		
	85		
H3	86	12/10/2008	50
	87		
	88		
H4	89	13/10/2008	50-60
	90		
	91		



Note : GPS fixes interval : 1 hour

2. Methodology - Study design and GPS success rates

Group ID	Animal ID	Capture date	Group size	Recapture date	Duration (days)	Success rate (%)
H1	80	09/10/2008	40	24/11/2009	411	99%
	81			-	-	-
	82			10/02/2009	124	29%
H2	83	11/10/2008	50-60	24/11/2009	409	99%
	84			24/11/2009	409	99%
	85			24/11/2009	409	99%
H3	86	12/10/2008	50	25/11/2009	409	99%
	87			25/11/2009	409	99%
	88			25/11/2009	409	99%
H4	89	13/10/2008	50-60	25/11/2009	408	99%
	90			25/11/2009	408	99%
	91			-	288	69%



Analysis at :

- annual scale on 9/12 individuals.
- seasonal (first wet season) scale on 11/12 individuals.

Objective

Investigate the spatiotemporal patterns of association within and between buffalo herds (“fission-fusion patterns”)

Questions

1. How do individuals share space? (space use patterns)

2. How do individuals share time? (association patterns)

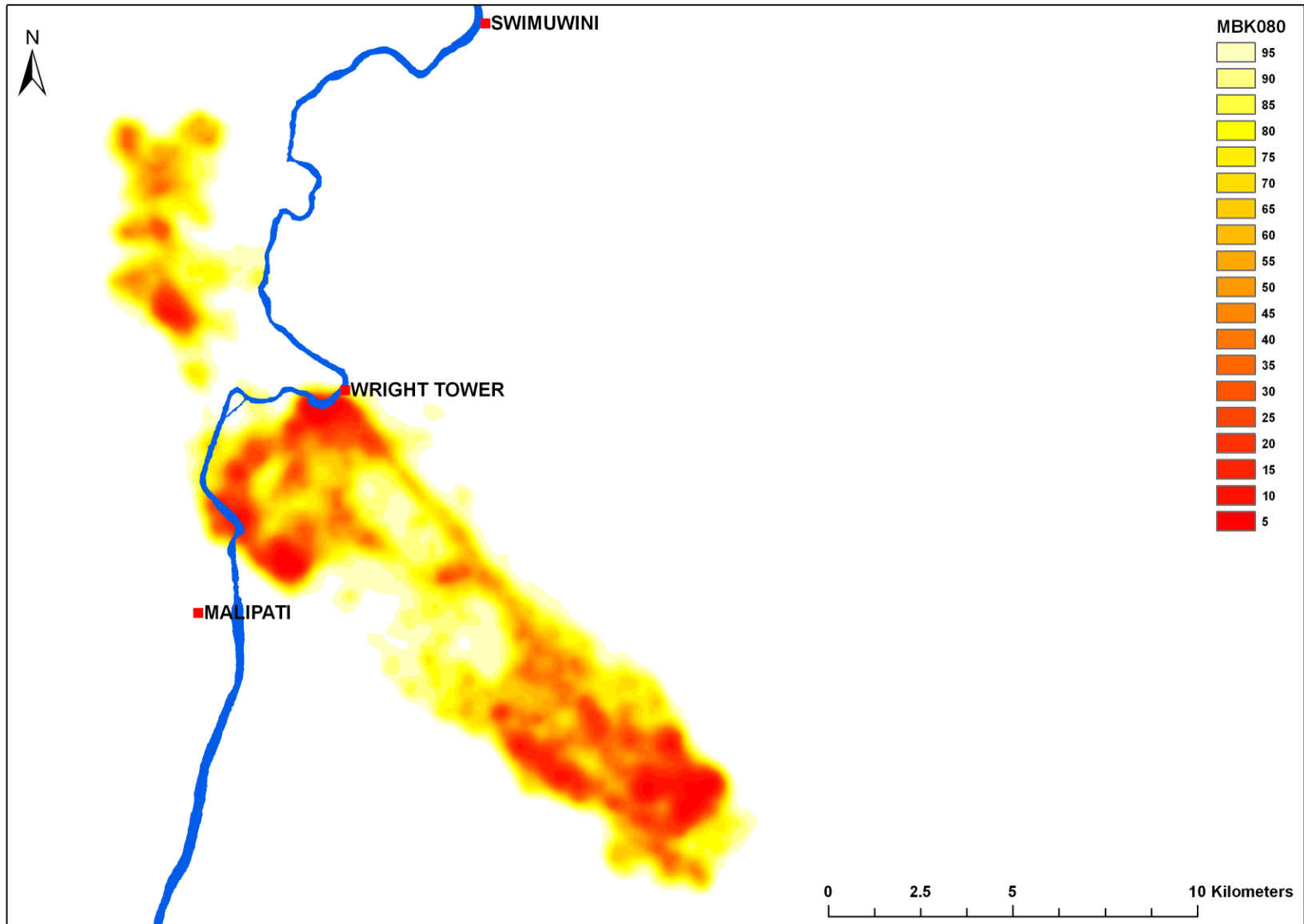
3. Between herds :

- Do adjacent herds interact, and if yes, when?
- Are spatial interactions between herds related to resources (i.e. water) ?

4. Within herds :

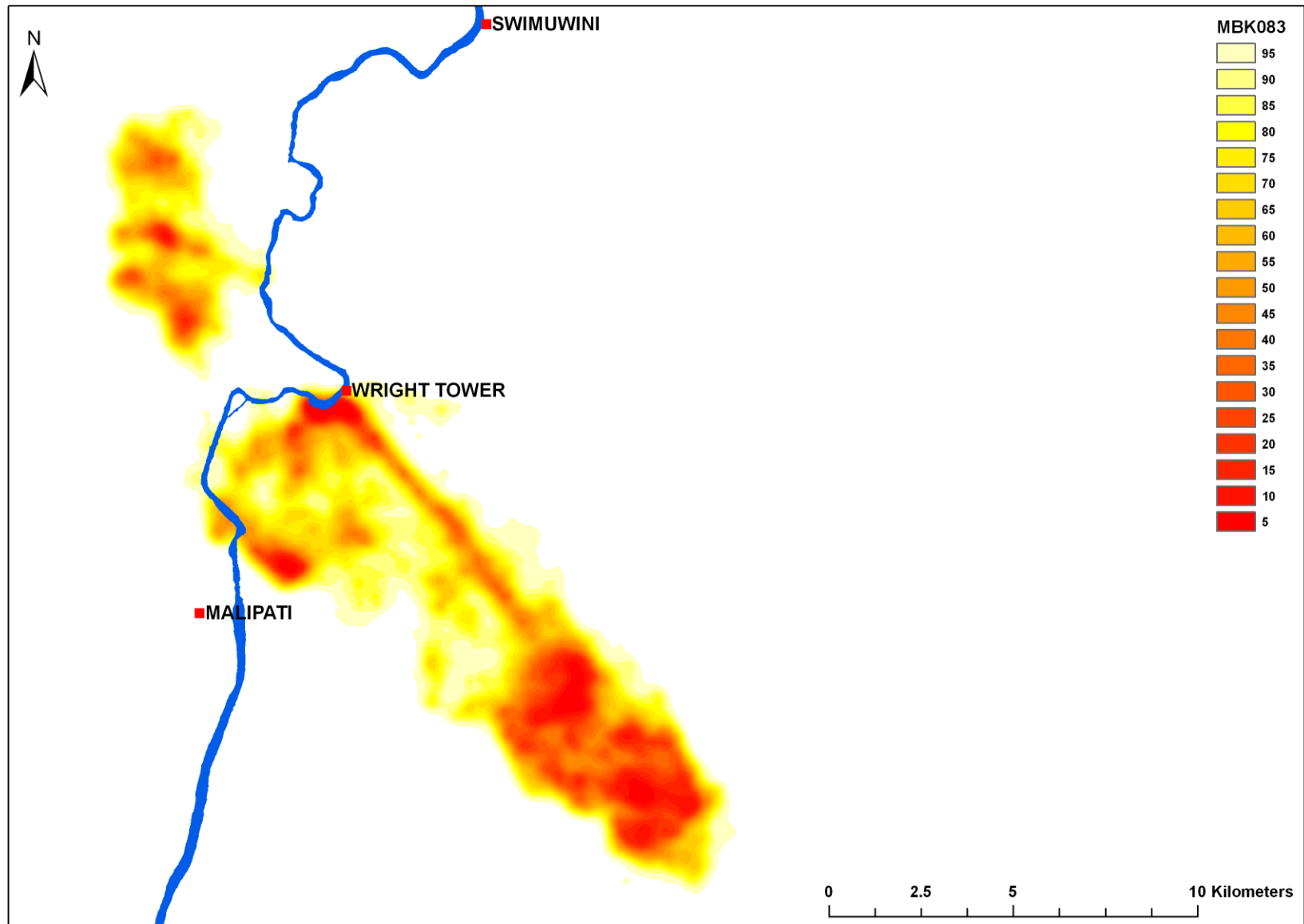
- When do fusion and fission events occur? (at both seasonal and daily scale)
- Is the spatial distribution of fusion and fission occurrences related to resources (i.e. water) ?

3.1. Space-use patterns (annual home range - female 080)



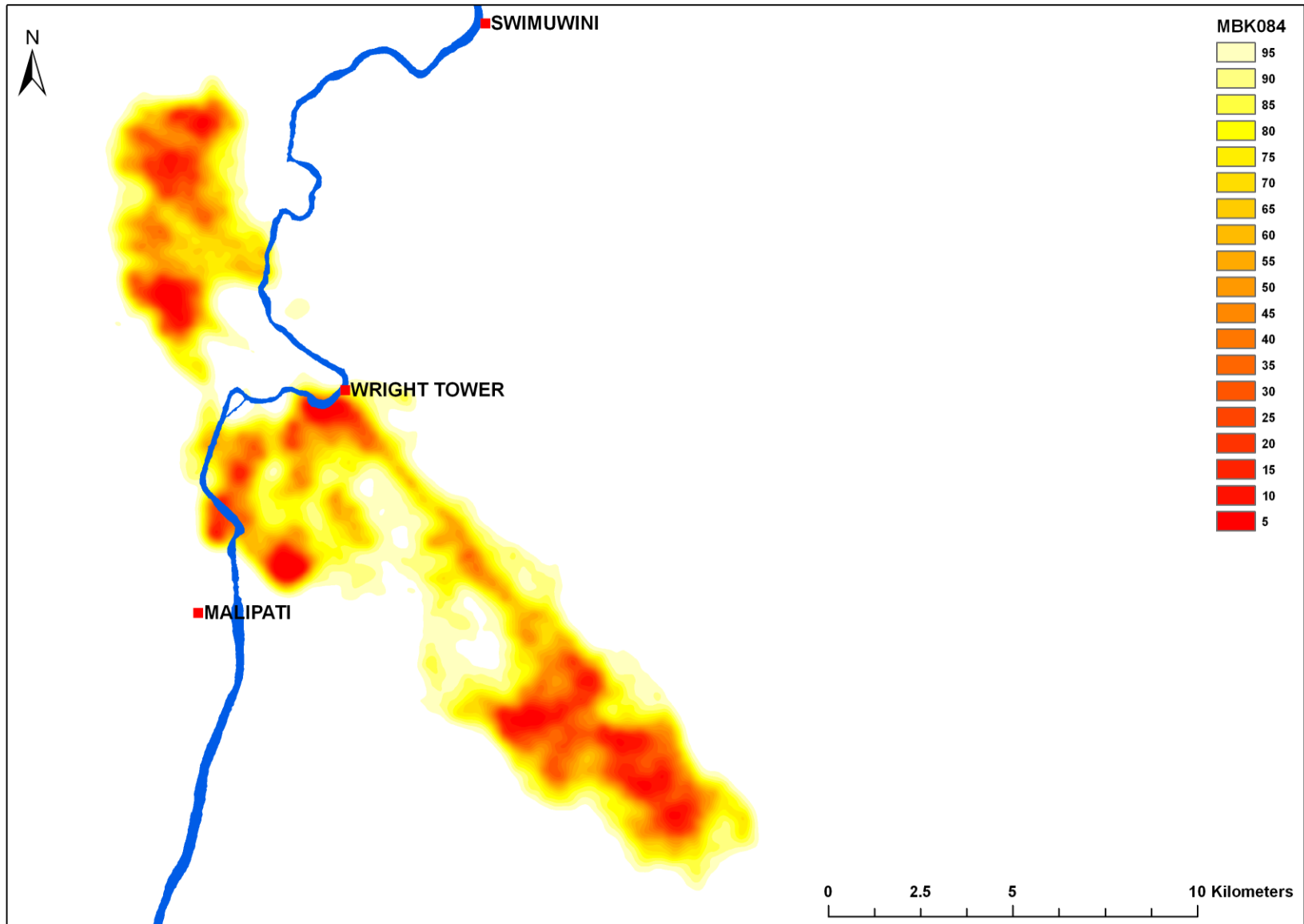
Movement-based kernel - Benhamou S. & Cornélis, D. (2010)

3.1. Space-use patterns (annual home range - female 083)



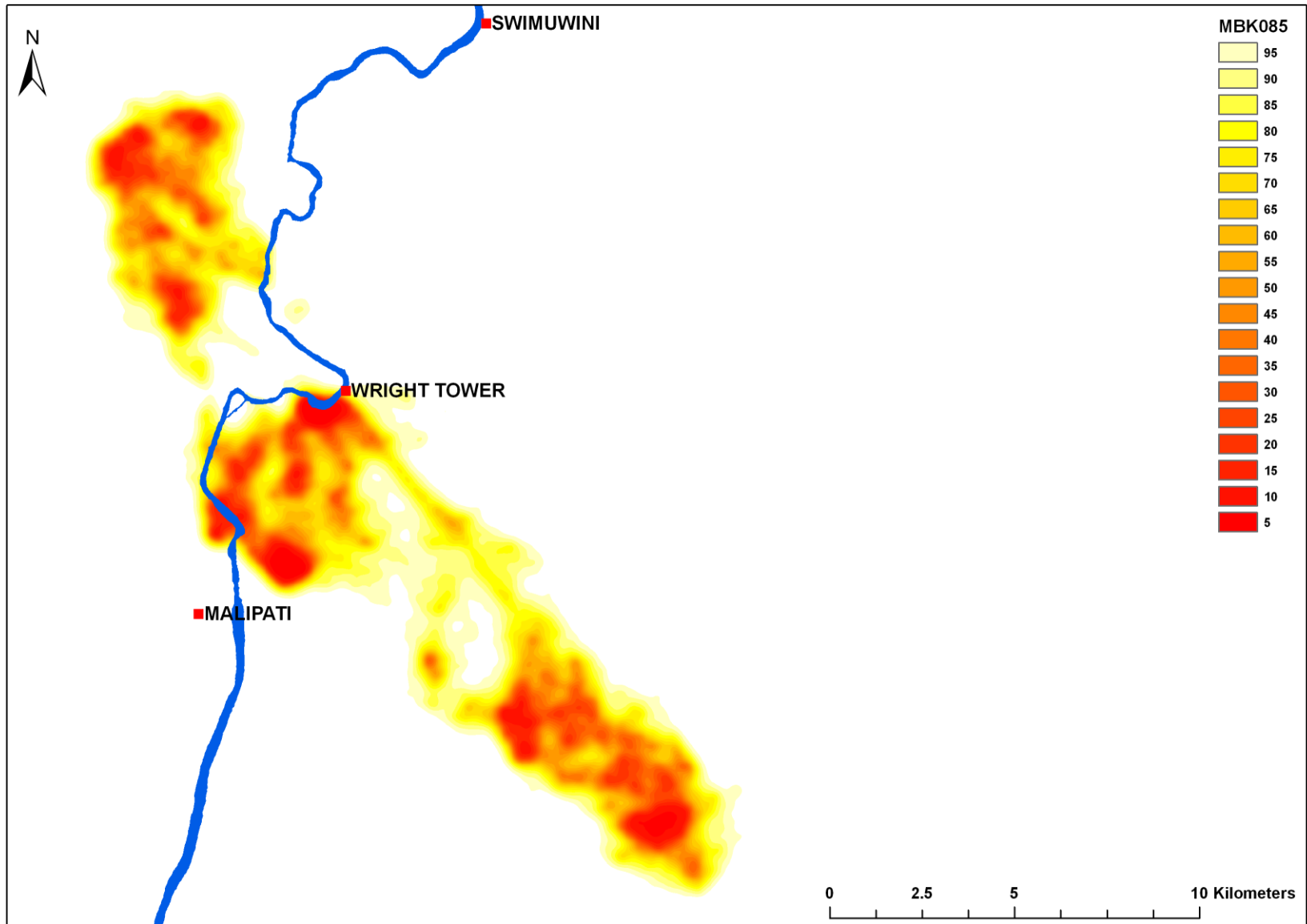
Movement-based kernel - Benhamou S. & Corn elis, D. (2010)

3.1. Space-use patterns (annual home range - female 084)



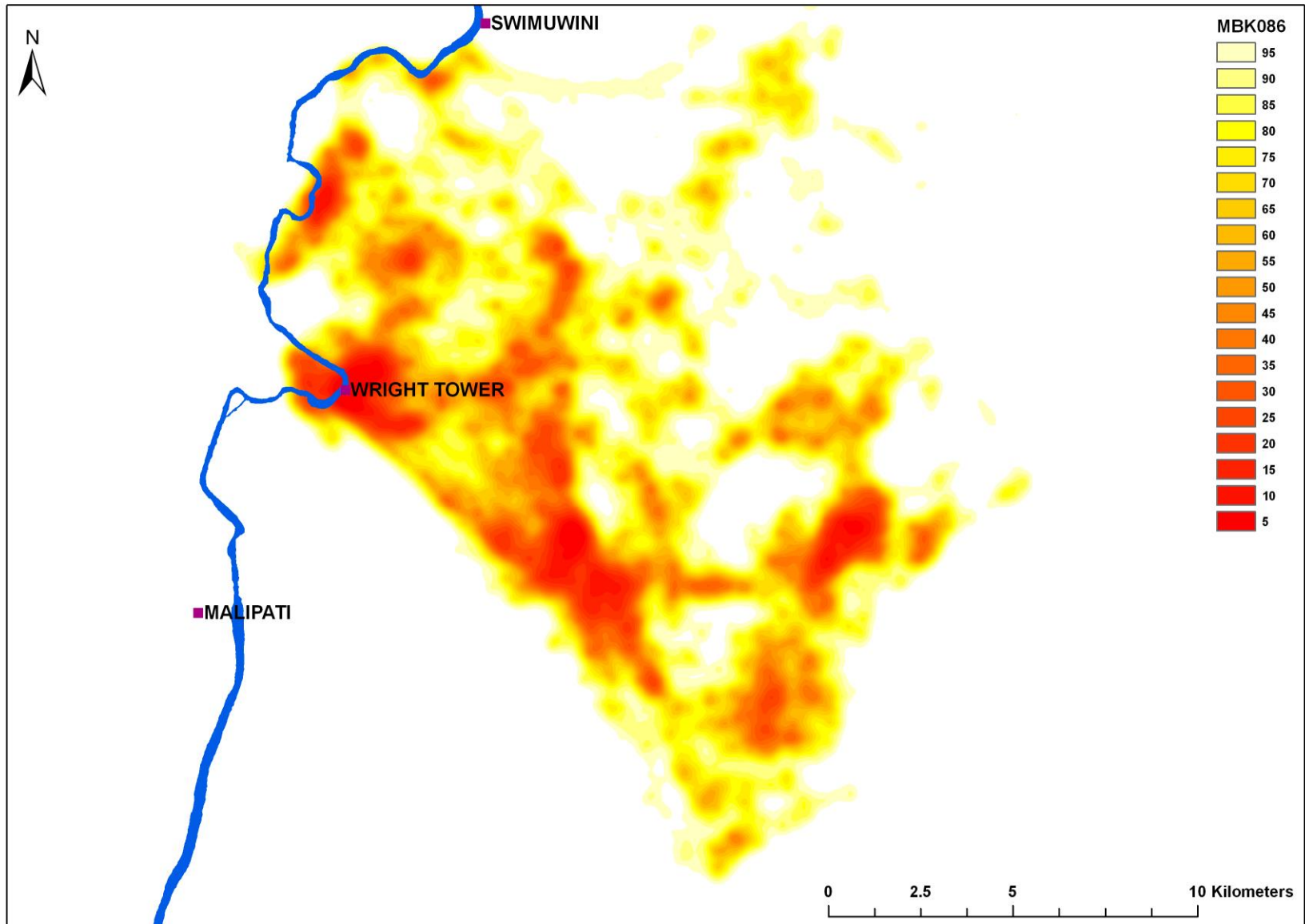
Movement-based kernel - Benhamou S. & Cornélis, D. (2010)

3.1. Space-use patterns (annual home range - female 085)



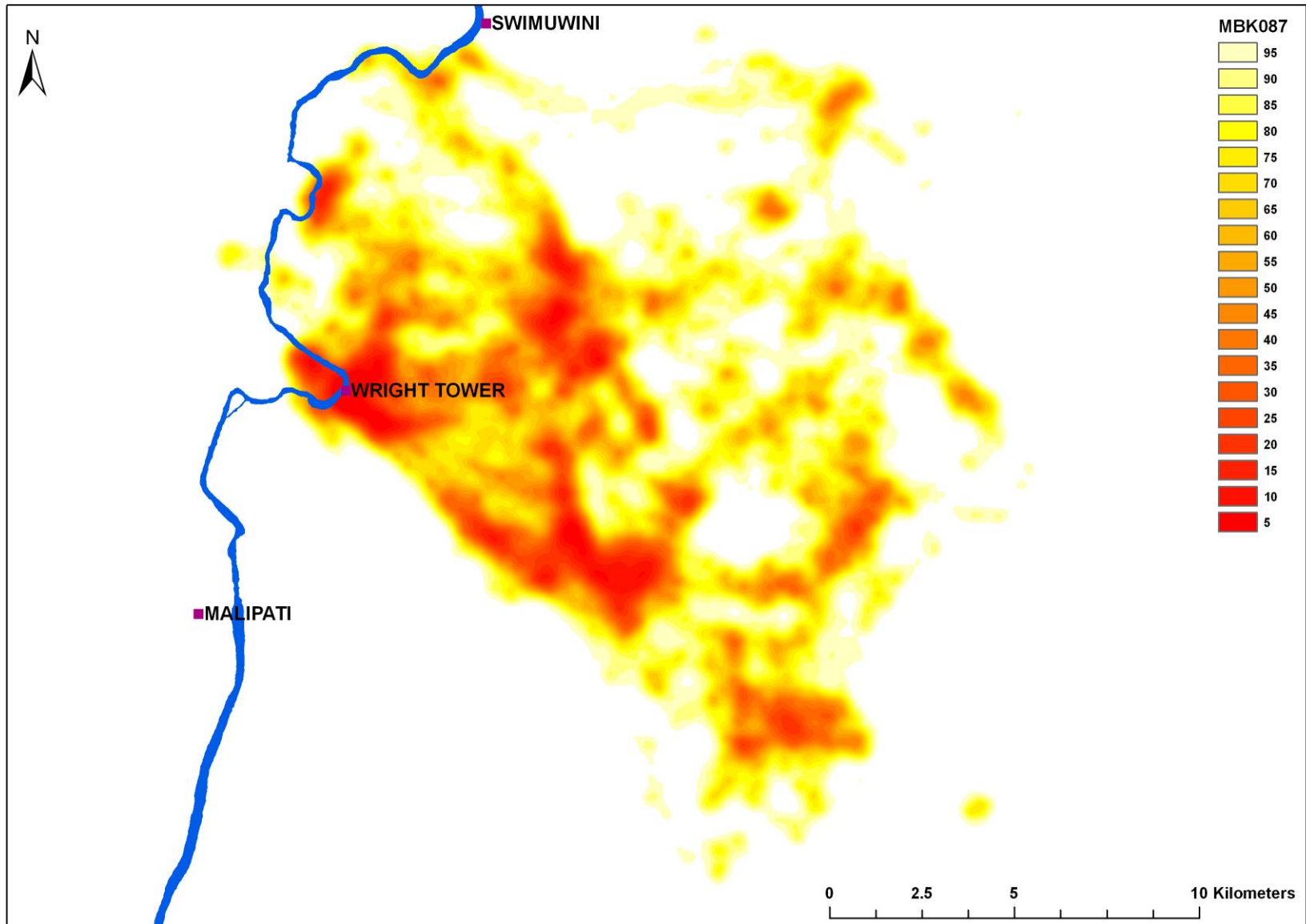
Movement-based kernel - Benhamou S. & Cornélis, D. (2010)

3.1. Space-use patterns (annual home range - female 086)



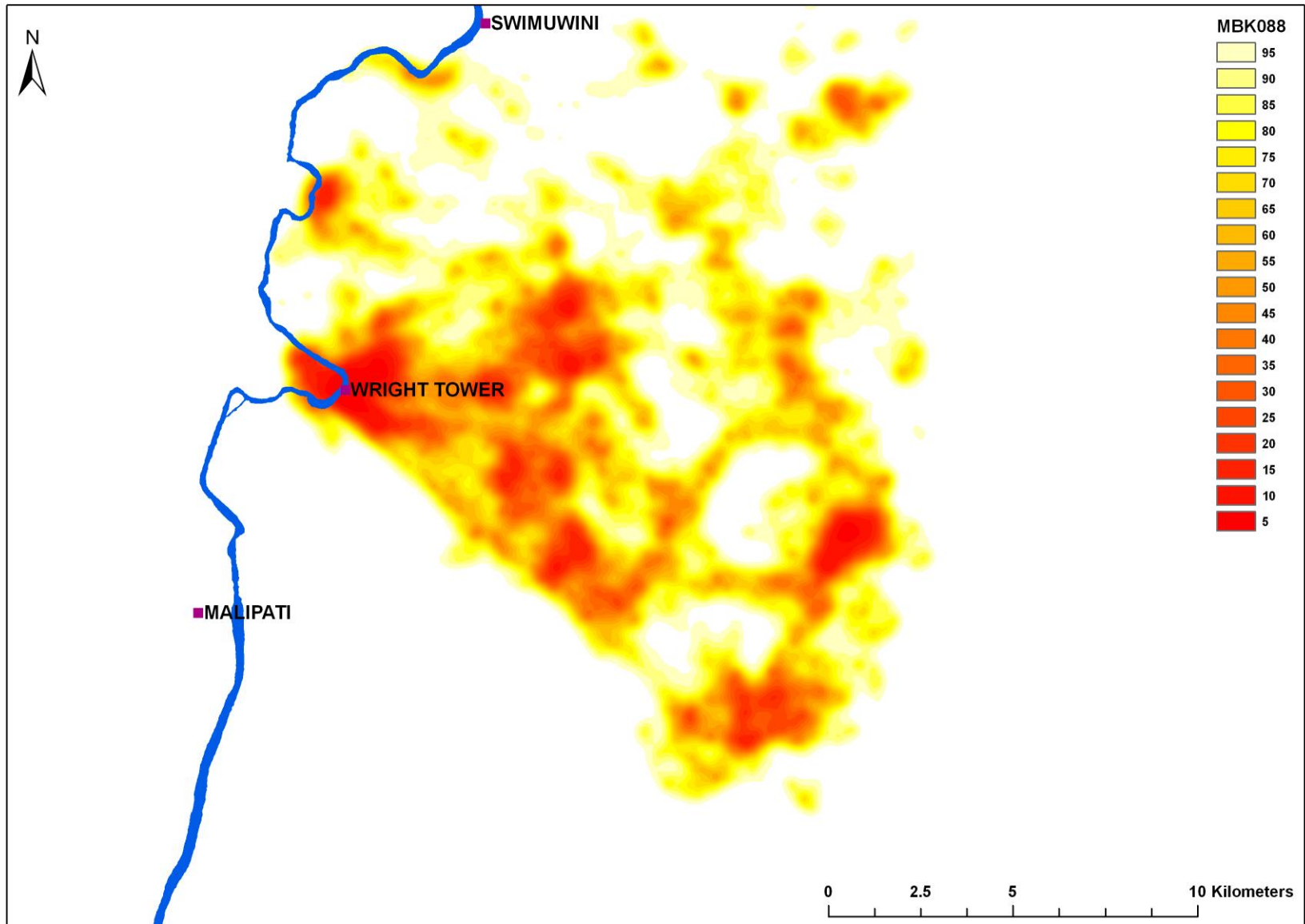
Movement-based kernel - Benhamou S. & Cornélis, D. (2010)

3.1. Space-use patterns (annual home range - female 087)



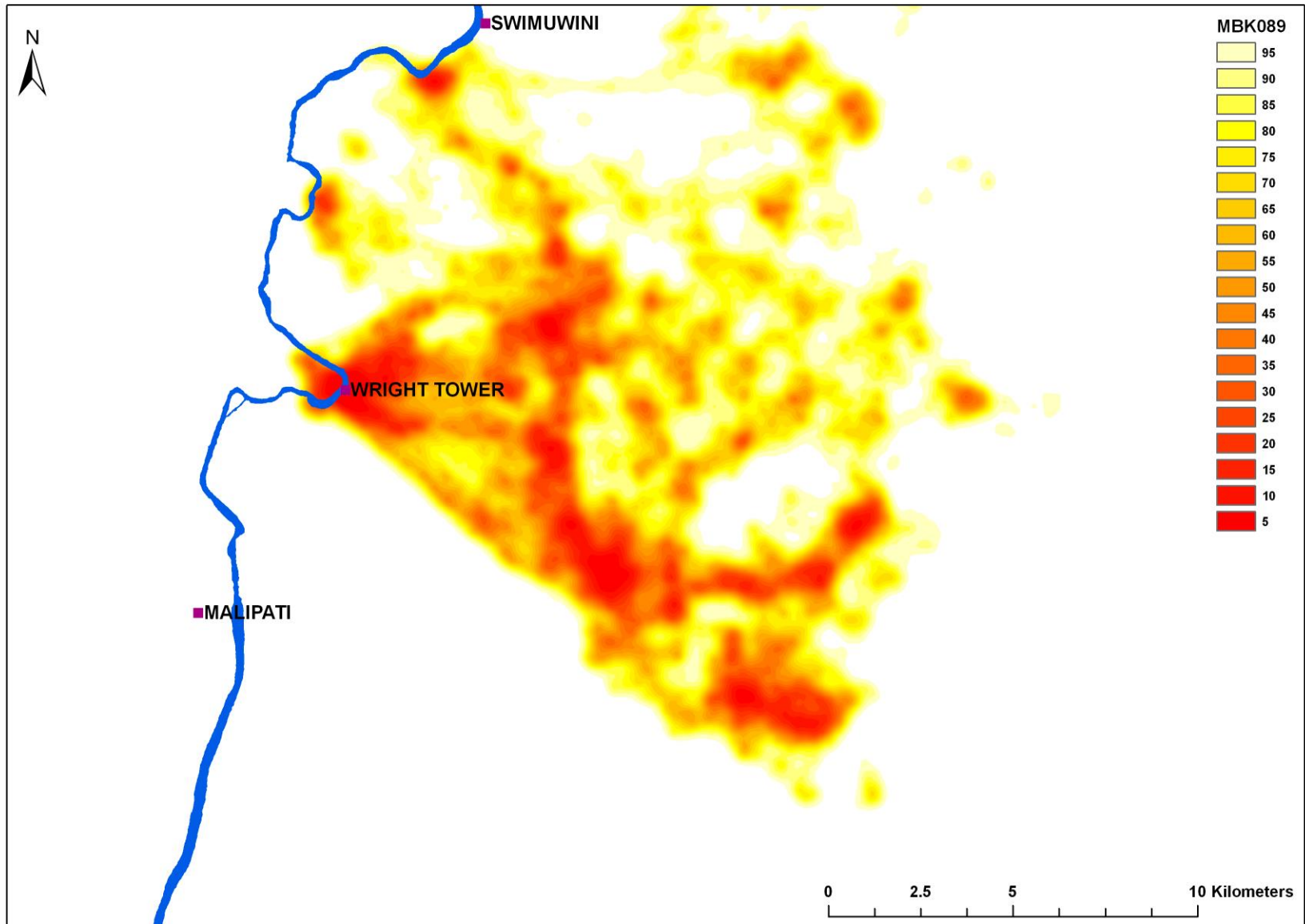
Movement-based kernel - Benhamou S. & Cornélis, D. (2010)

3.1. Space-use patterns (annual home range - female 088)



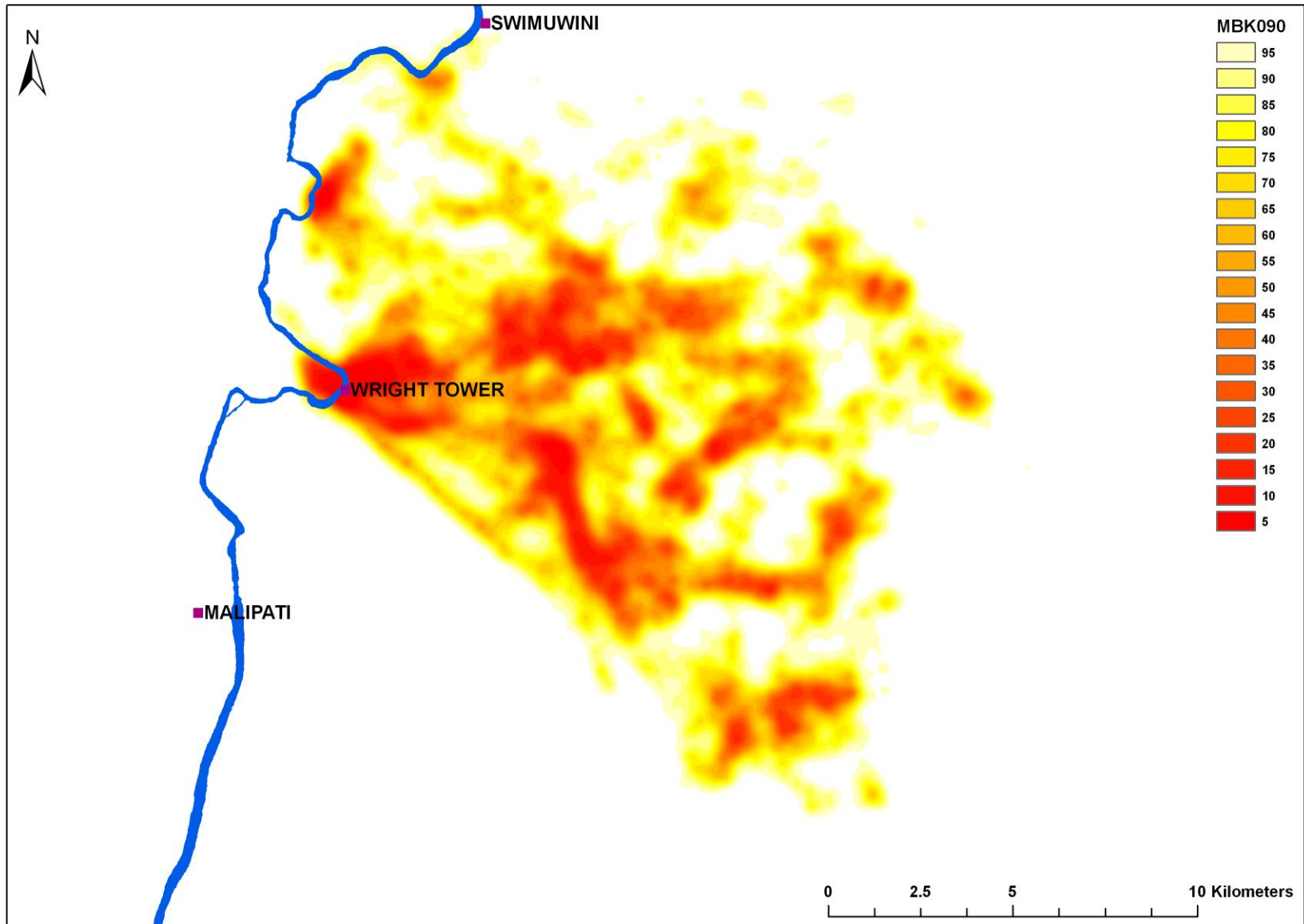
Movement-based kernel - Benhamou S. & Corn elis, D. (2010)

3.1. Space-use patterns (annual home range - female 089)



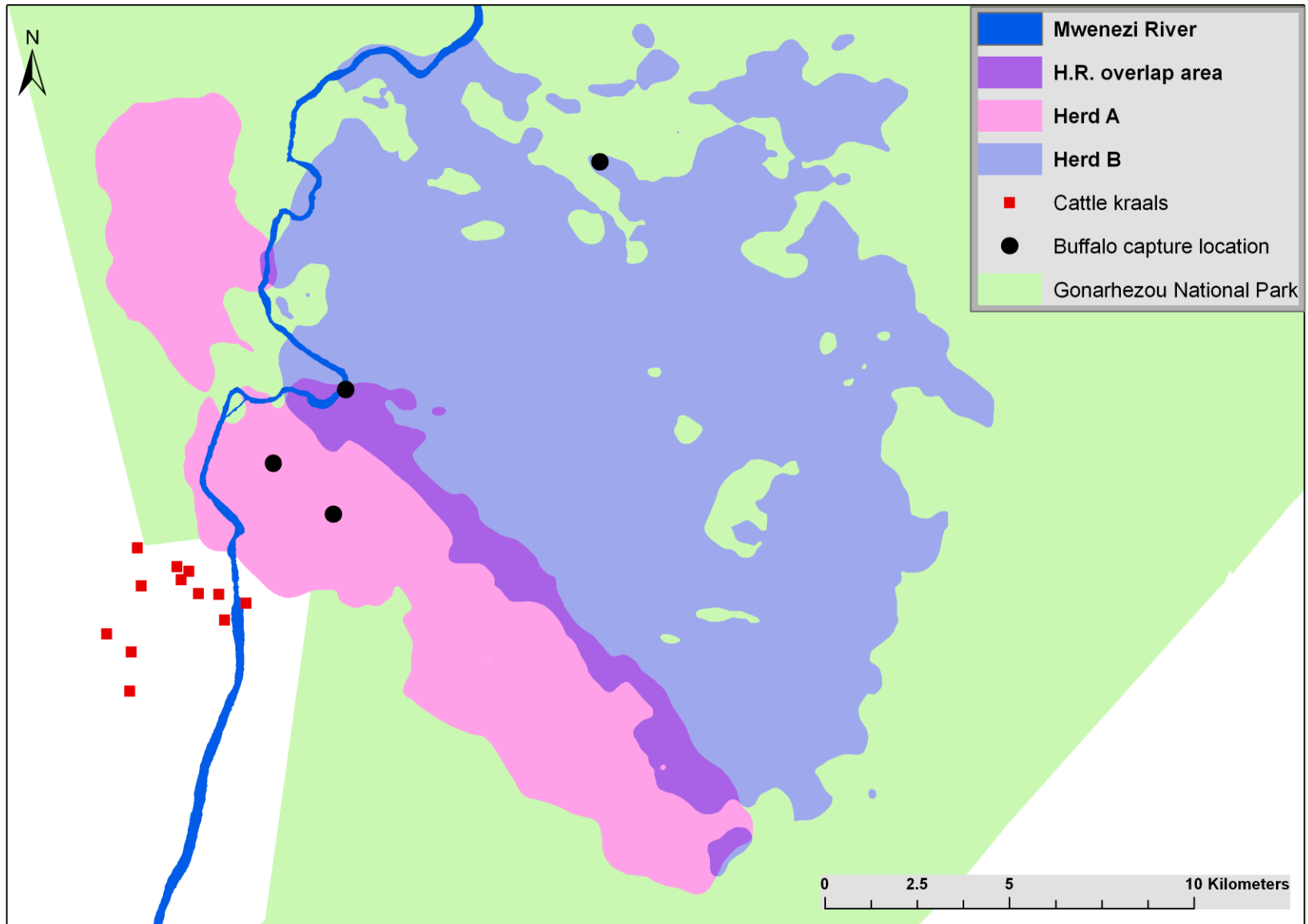
Movement-based kernel - Benhamou S. & Cornélis, D. (2010)

3.1. Space-use patterns (annual home range - female 090)



Movement-based kernel - Benhamou S. & Cornélis, D. (2010)

3.1. Space-use patterns



3.2. Space sharing between individuals (UD volume overlaps)

%	AU080	AU083	AU084	AU085	AU086	AU087	AU088	AU089
AU083	78.4							
AU084	74.4	76.7						
AU085	75.4	74.6	80					
AU086	8.1	7.8	7.6	6.4				
AU087	5.8	6	5.7	5.2	67.7			
AU088	5.4	5.2	4.8	4.5	68	67.7		
AU089	4	3.9	3.5	3	64	67.6	66.6	
AU090	3.2	3	2.7	2.5	59.3	66.8	64.3	68.6

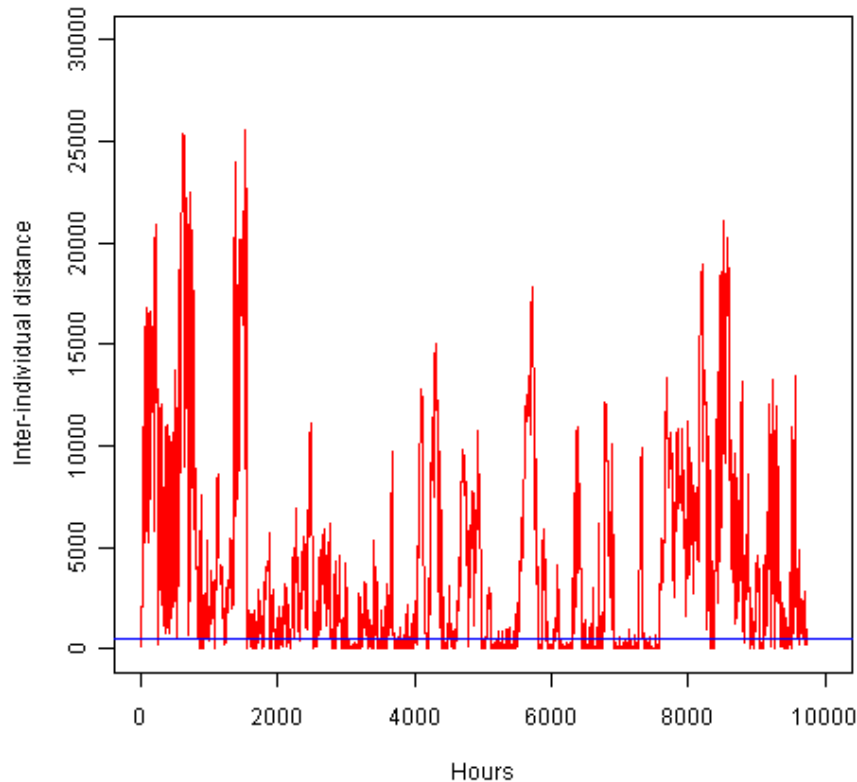
3.3. Time sharing between individuals

Example : time series of inter-individual distances between two buffalos ...



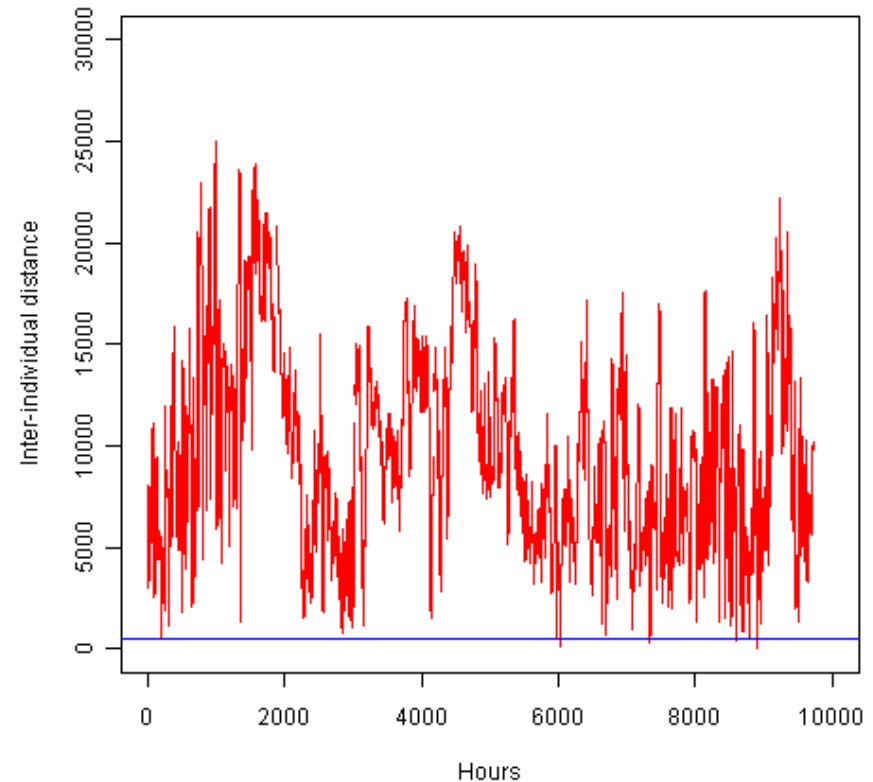
...belonging to the same herd

e.g. : distance ID 80 – ID 85 (herd A)



...belonging to adjacent herds

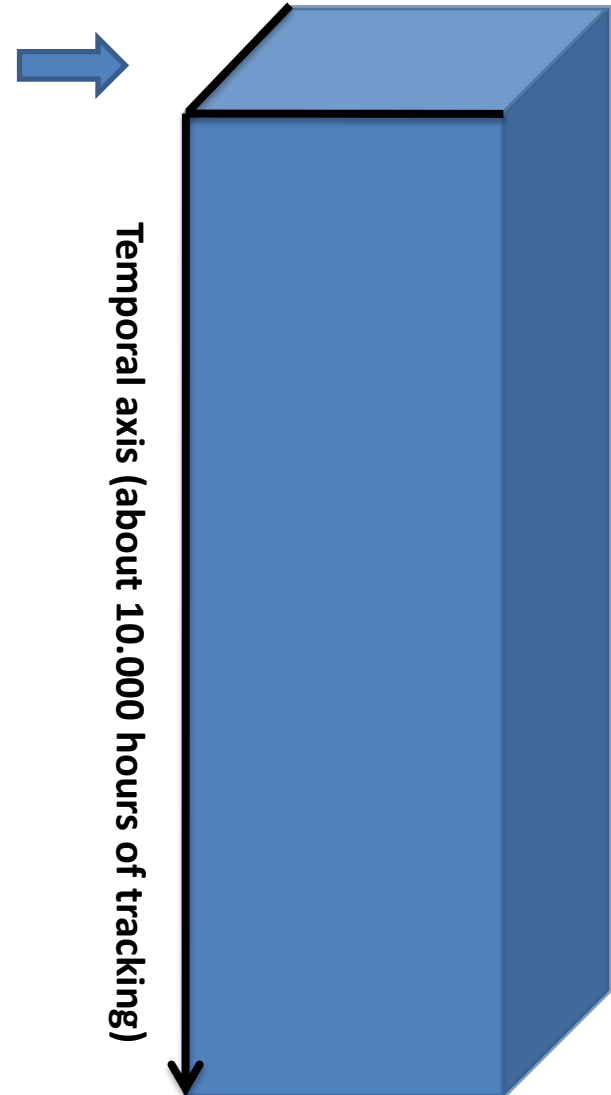
e.g. : distance ID 80 (herd A) – ID 88 (herd B)



3.3. Time sharing between individuals

Matrices of association (methodology)

(m)	80	83	84	85	86	87	88	89	90
80									
83	50								
84	446	4565							
85	345	123	3						
86	1232	1	56	234					
87	4	1234	2342	1234	24				
88	1	123	789	789	6	1237			
89	78	83	34	14	953	1513	1516		
90	24	2	223	2	243	24	24	2342	654



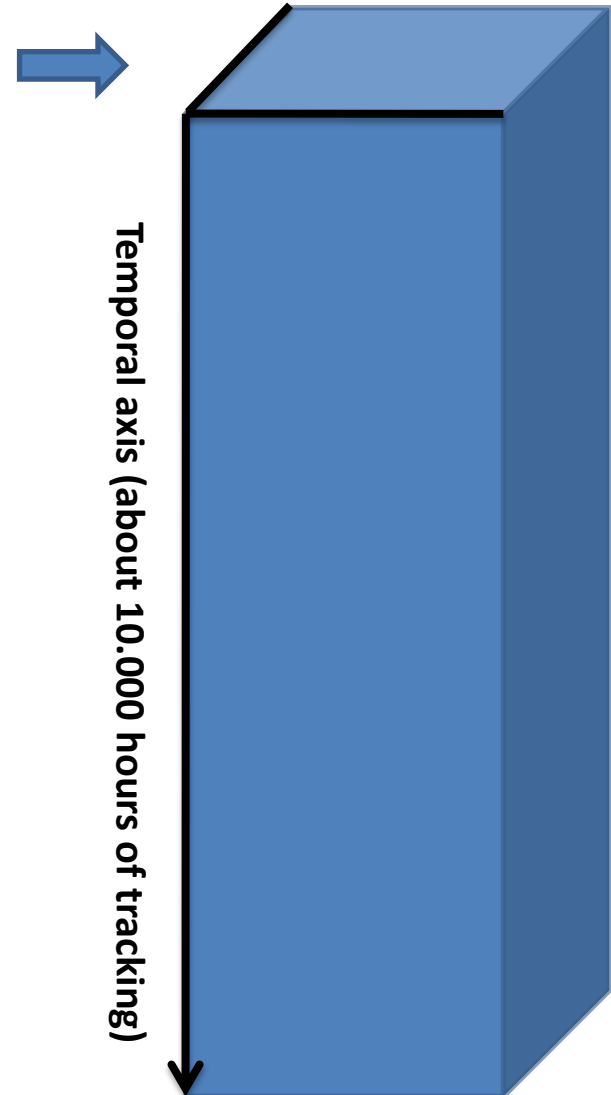
3.3. Time sharing between individuals

Matrices of association (methodology)

	80	83	84	85	86	87	88	89	90
80									
83	1								
84	0	0							
85	0	1	1						
86	0	1	1	1					
87	1	0	0	0	1				
88	1	1	0	0	1	0			
89	1	1	1	1	0	0	0		
90	1	1	1	1	1	1	1	0	0

Cutt-off point :300m

$\leq 300\text{m}$: "1" $>300\text{m}$: "0"

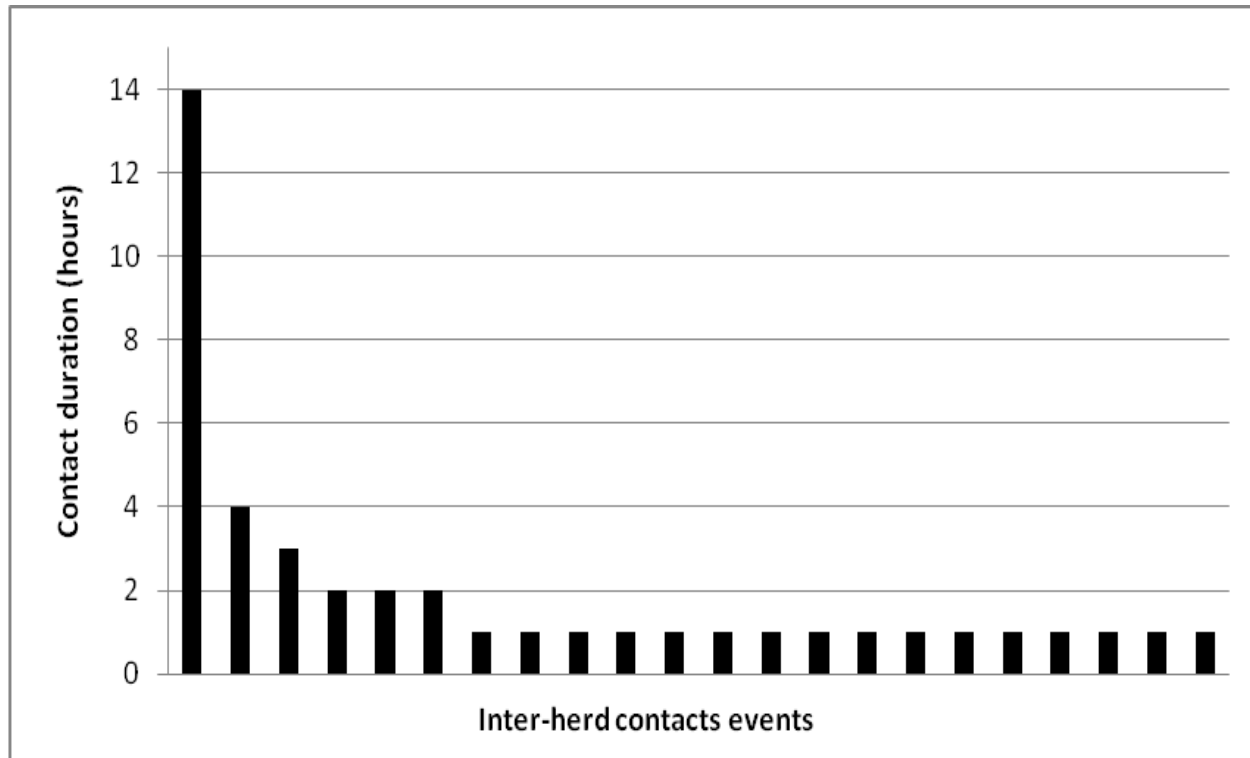


3.3. Time sharing between individuals (%)

%	AU080	AU083	AU084	AU085	AU086	AU087	AU088	AU089
AU083	29							
AU084	21	32						
AU085	26	30	44					
AU086	0.09	0.05	0.03	0.06				
AU087	0.07	0.01	0.00	0.02	19			
AU088	0.04	0.03	0.05	0.07	24	22		
AU089	0.01	0.05	0.04	0.02	13	13	17	
AU090	0.02	0.02	0.00	0.14	10	16	16	22

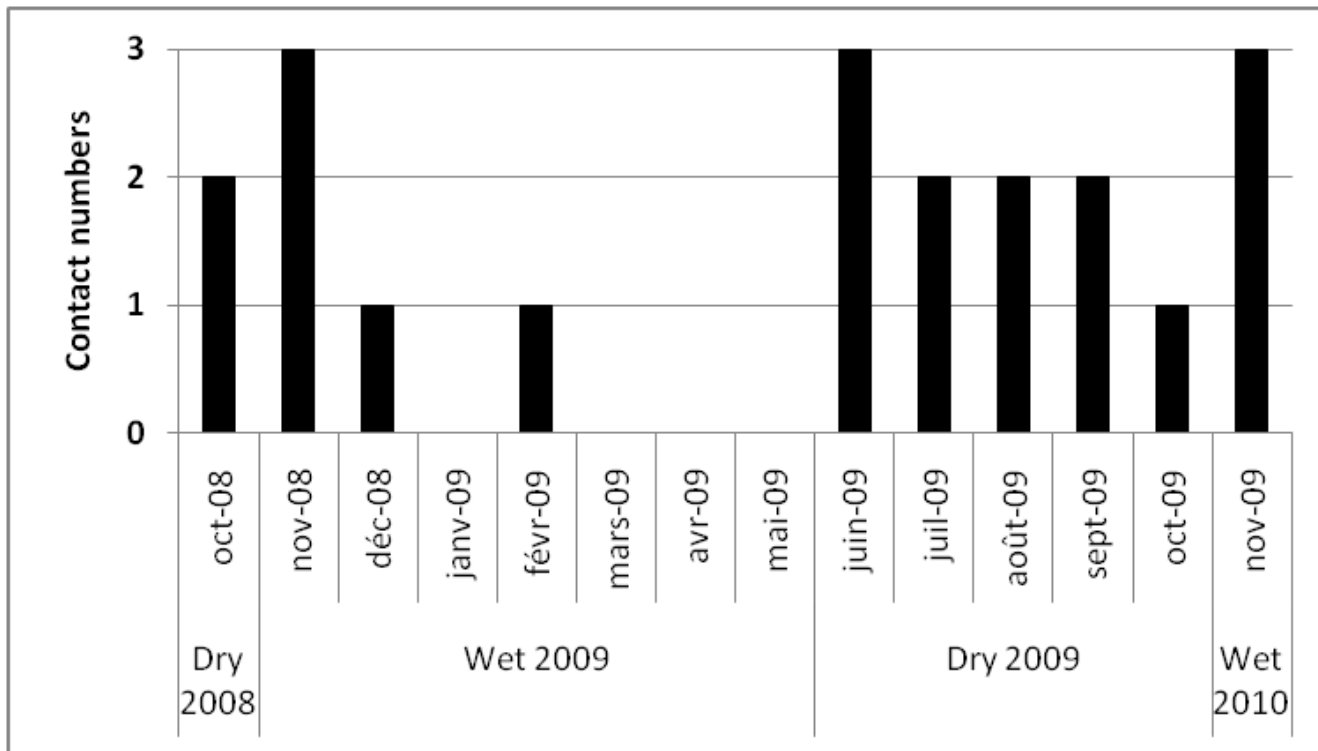
3.3. Time sharing between individuals

Inter-herd level : distribution frequencies of contacts duration

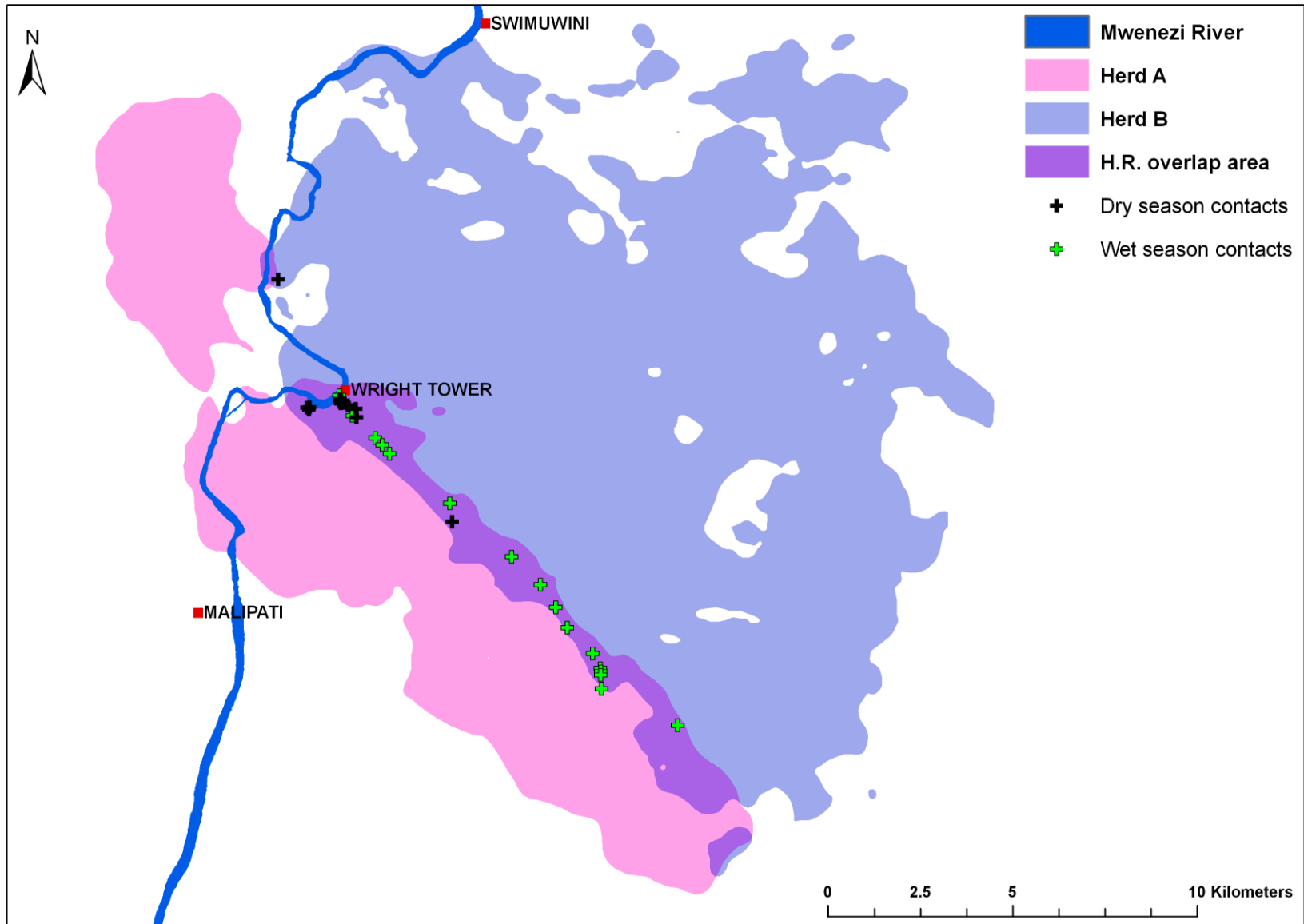


3.3. Time sharing between individuals

**Inter-herd level : temporal distribution frequency of contacts
(herd A versus herd B within an inter-herd distance of 300 meters)**



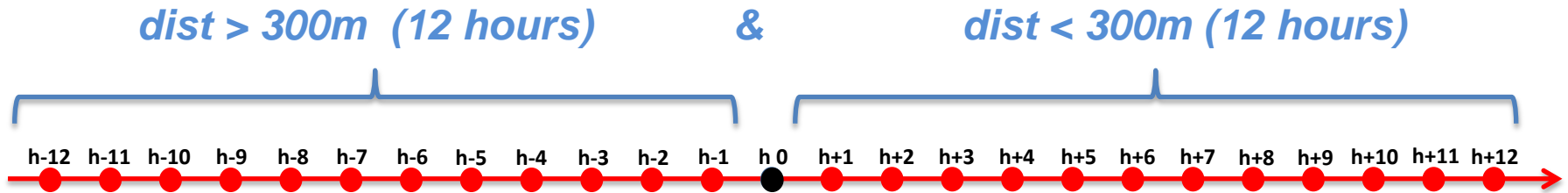
Inter-herd level : spatial distribution of contacts (herd A versus herd B)



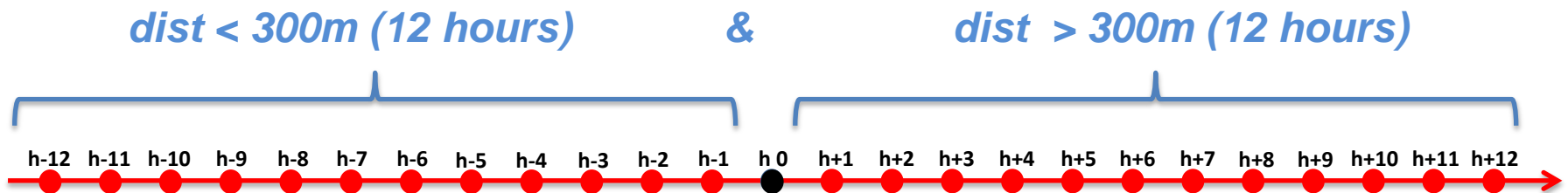
3.4. Spatiotemporal distribution fusion-fission events (intra-herd level s.s.)

Fusion and fission events were extracted from the distance 3D array using the following rules:

1. A location was considered as a fusion event if

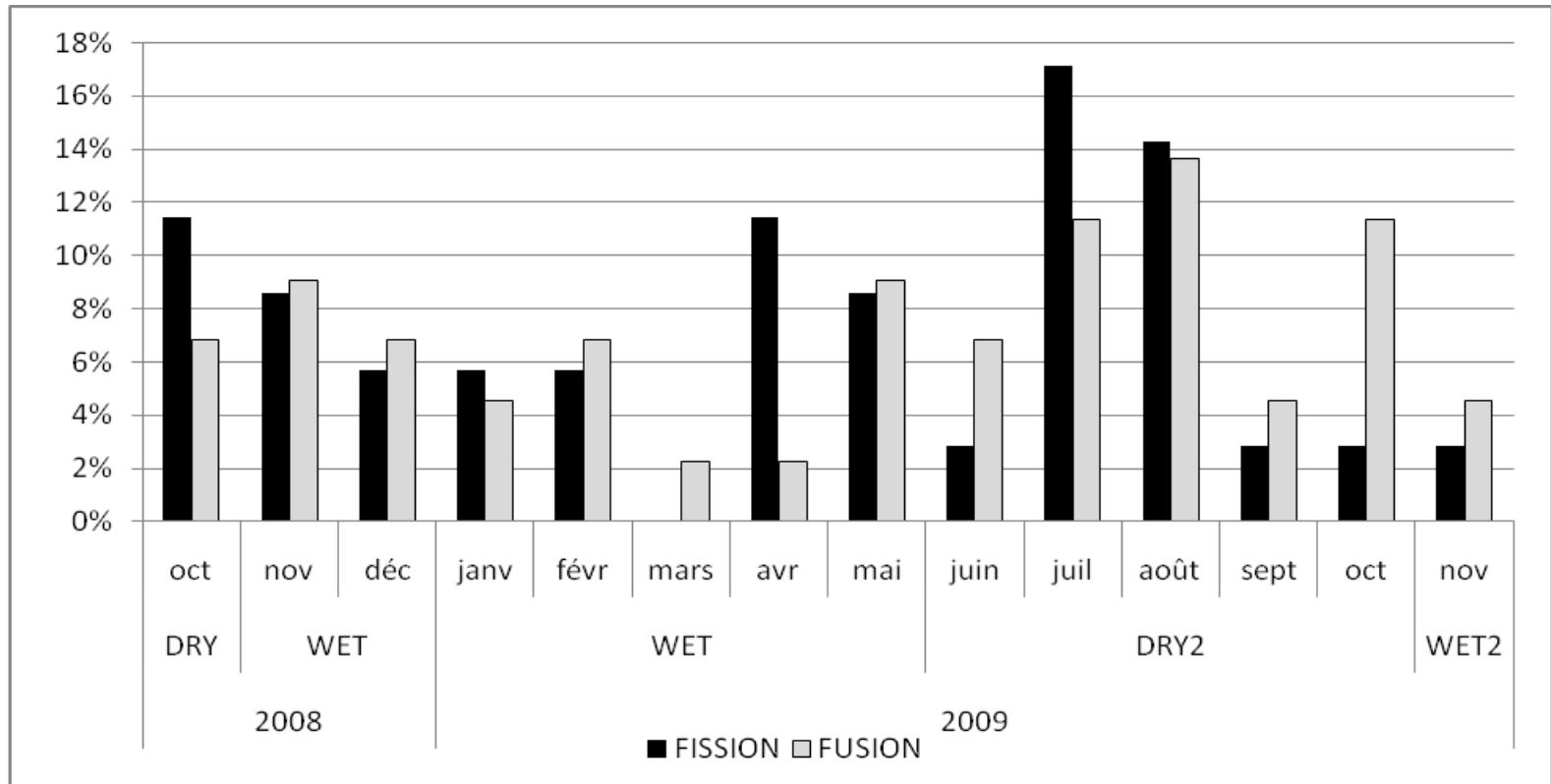


2. A location was considered as a fission event if



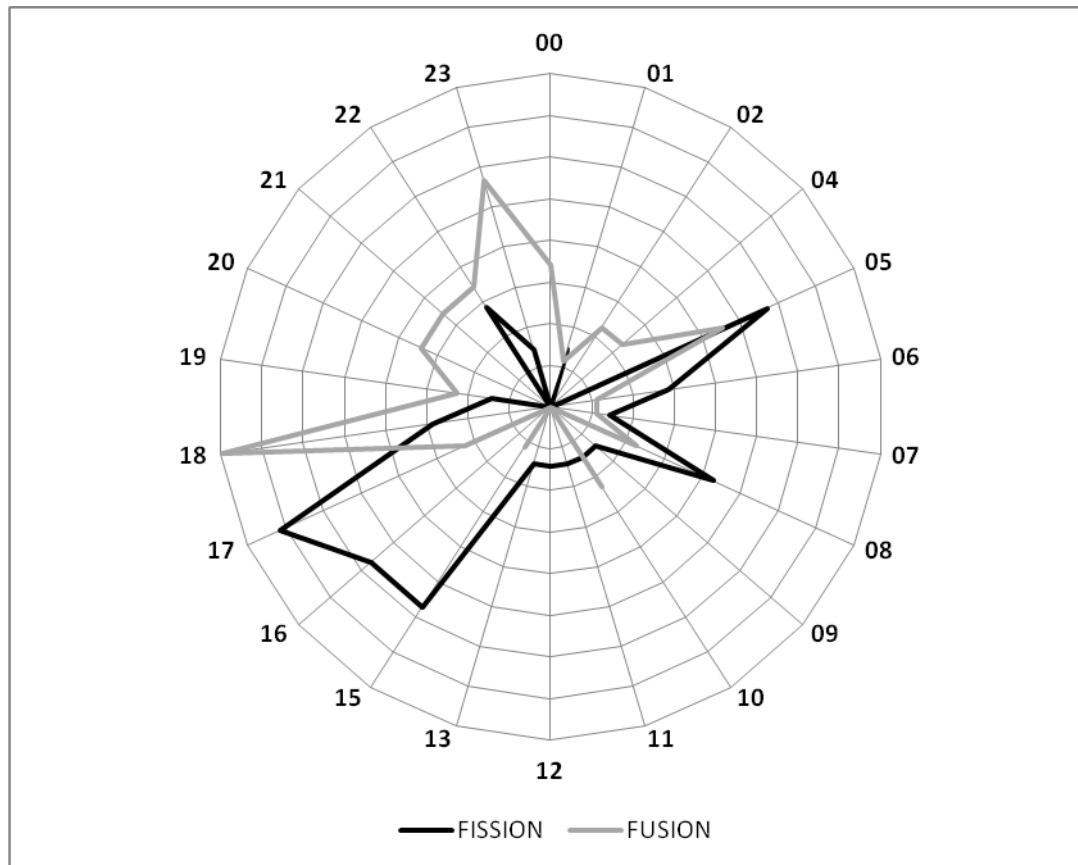
3.4. Spatiotemporal distribution fusion-fission events (intra-herd level s.s.)

Intra-herd level : annual pattern of fusion and fission occurrences

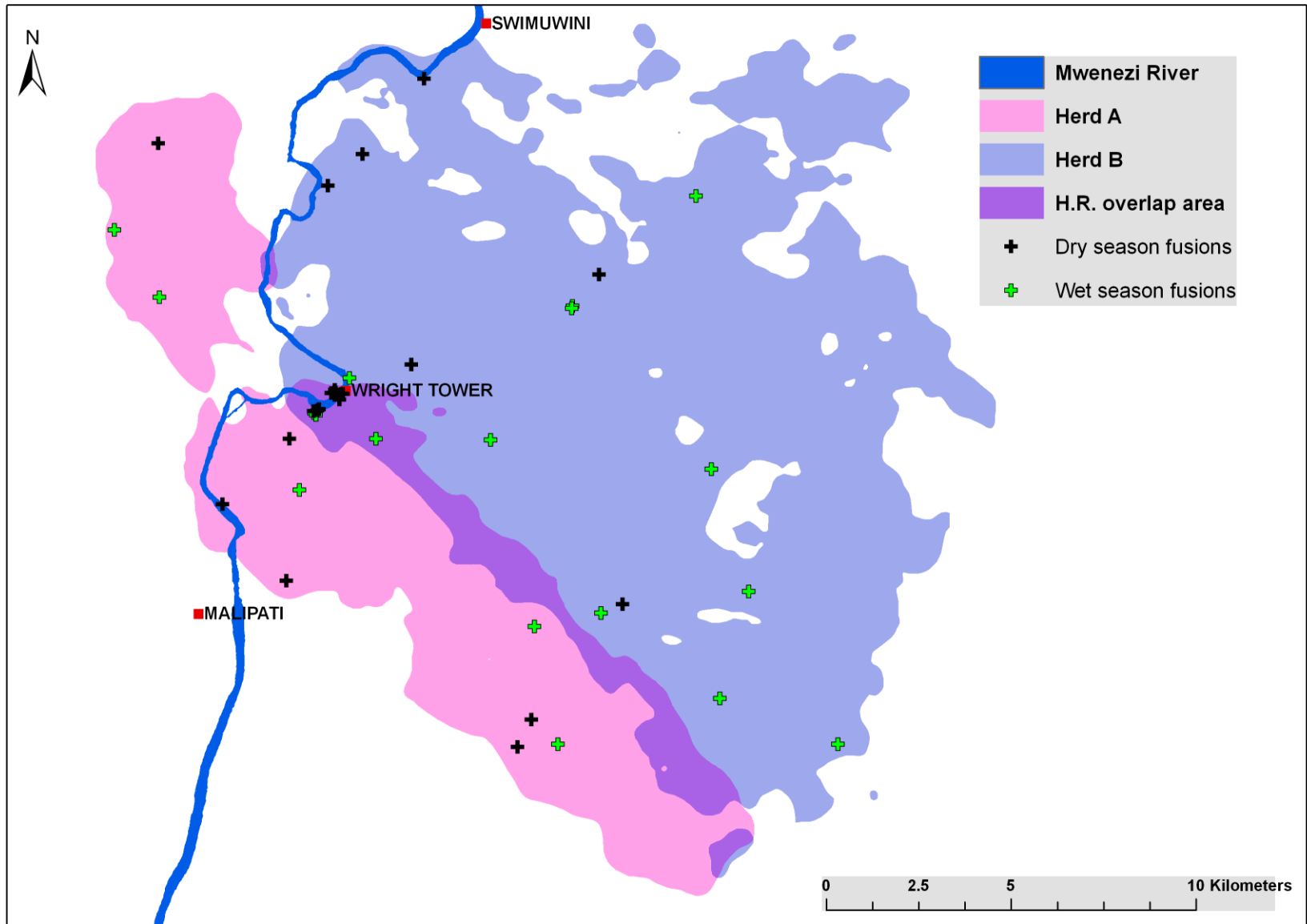


3.4. Spatiotemporal distribution fusion-fission events (intra-herd level s.s.)

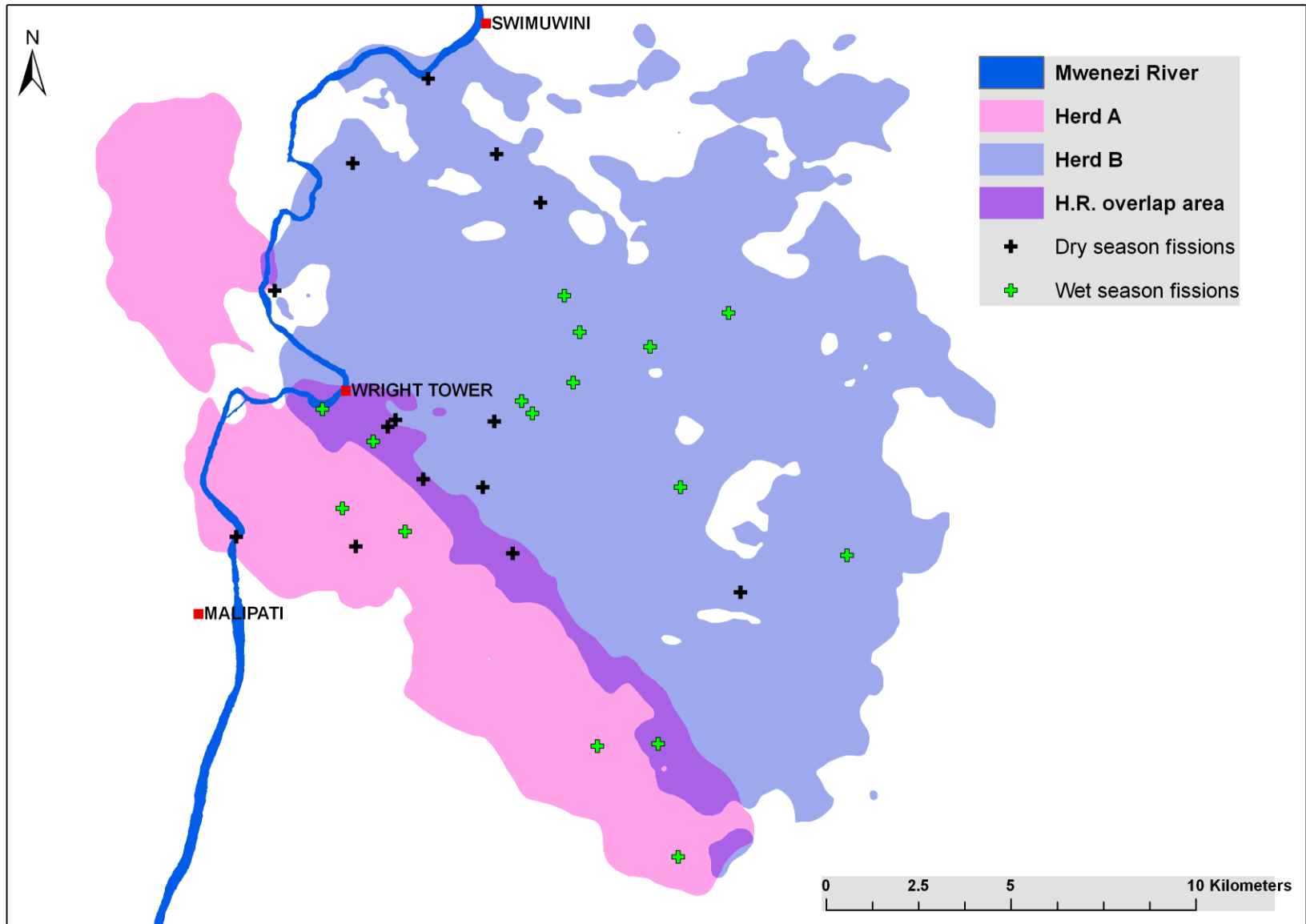
Hourly distribution frequencies of fusion and fission events



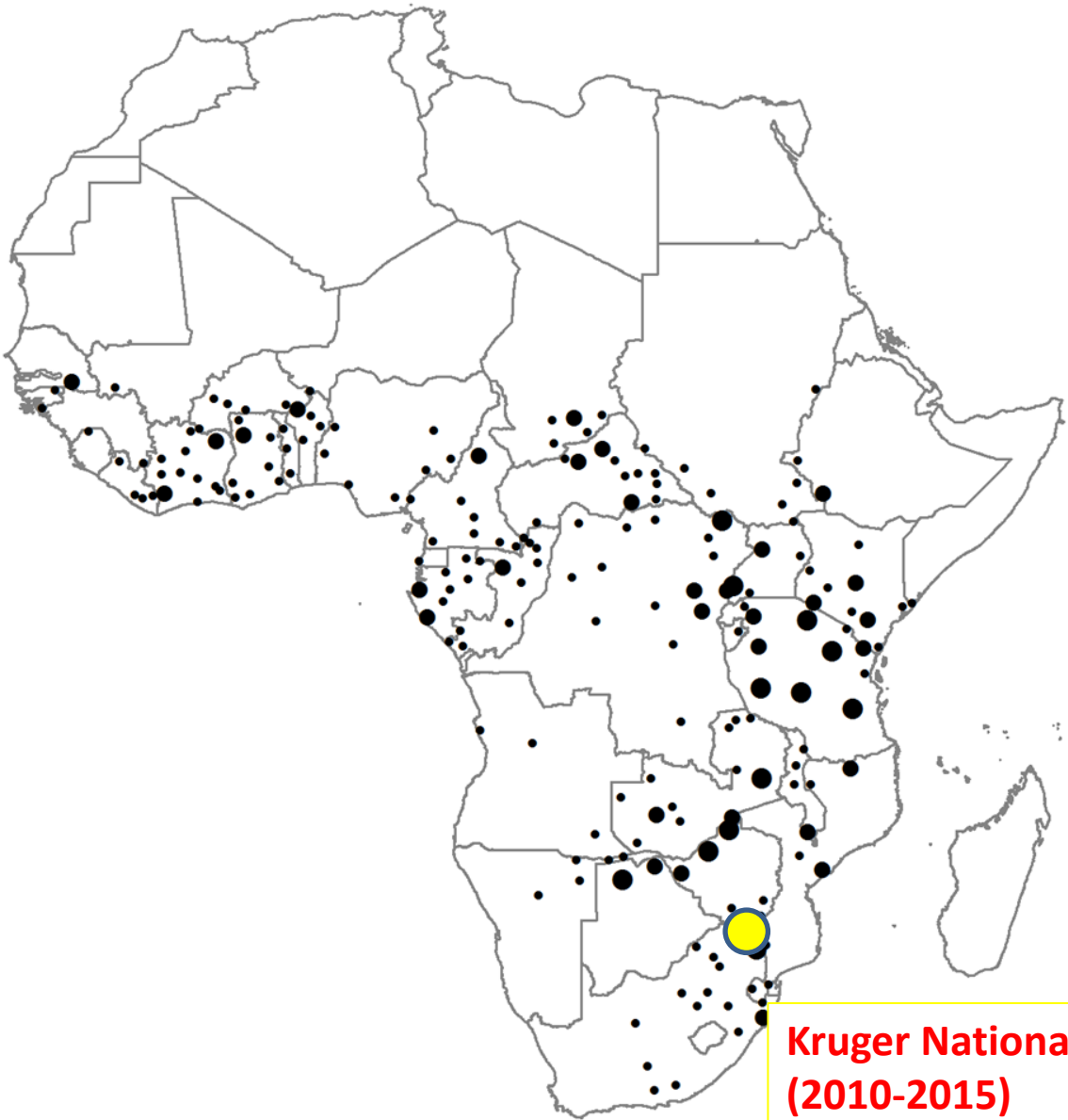
3.4. Spatial distribution fusion events according to seasons



3.4. Spatial distribution of fission events according to seasons



II. NORTH KRUGER NP (2010-2015)



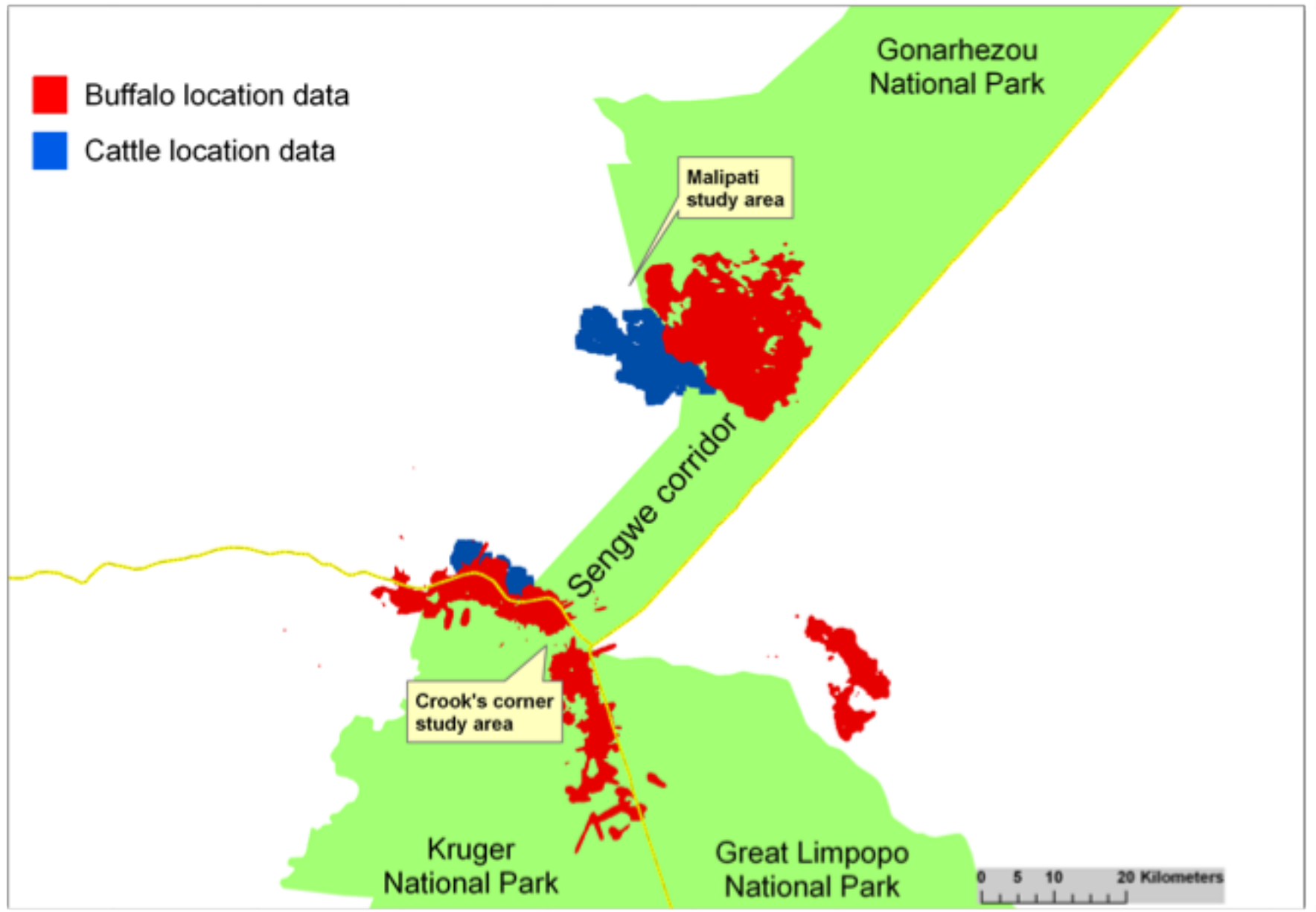
**Kruger National Park
(2010-2015)**



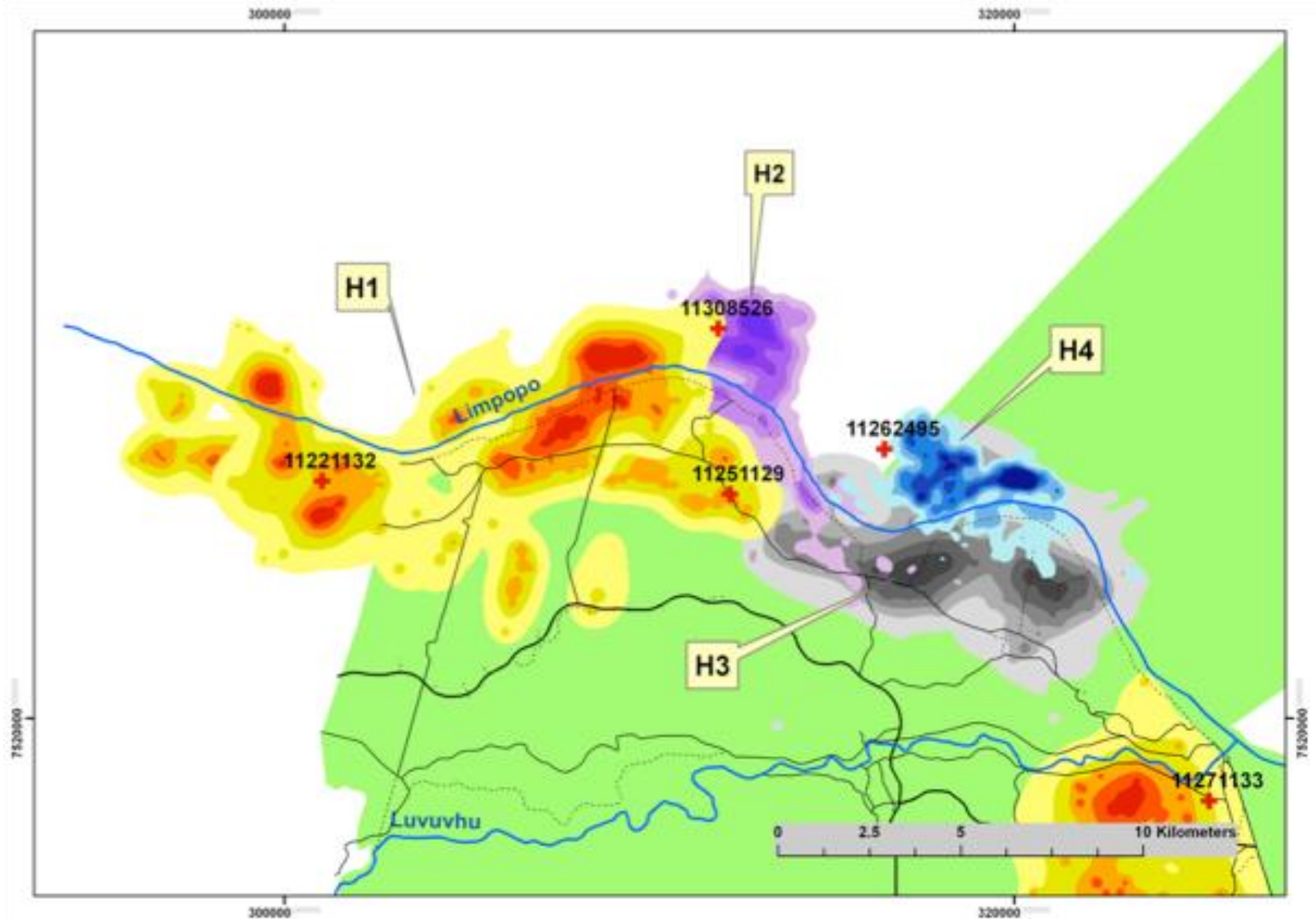
Legend

Buffalo loc (East, 1998)

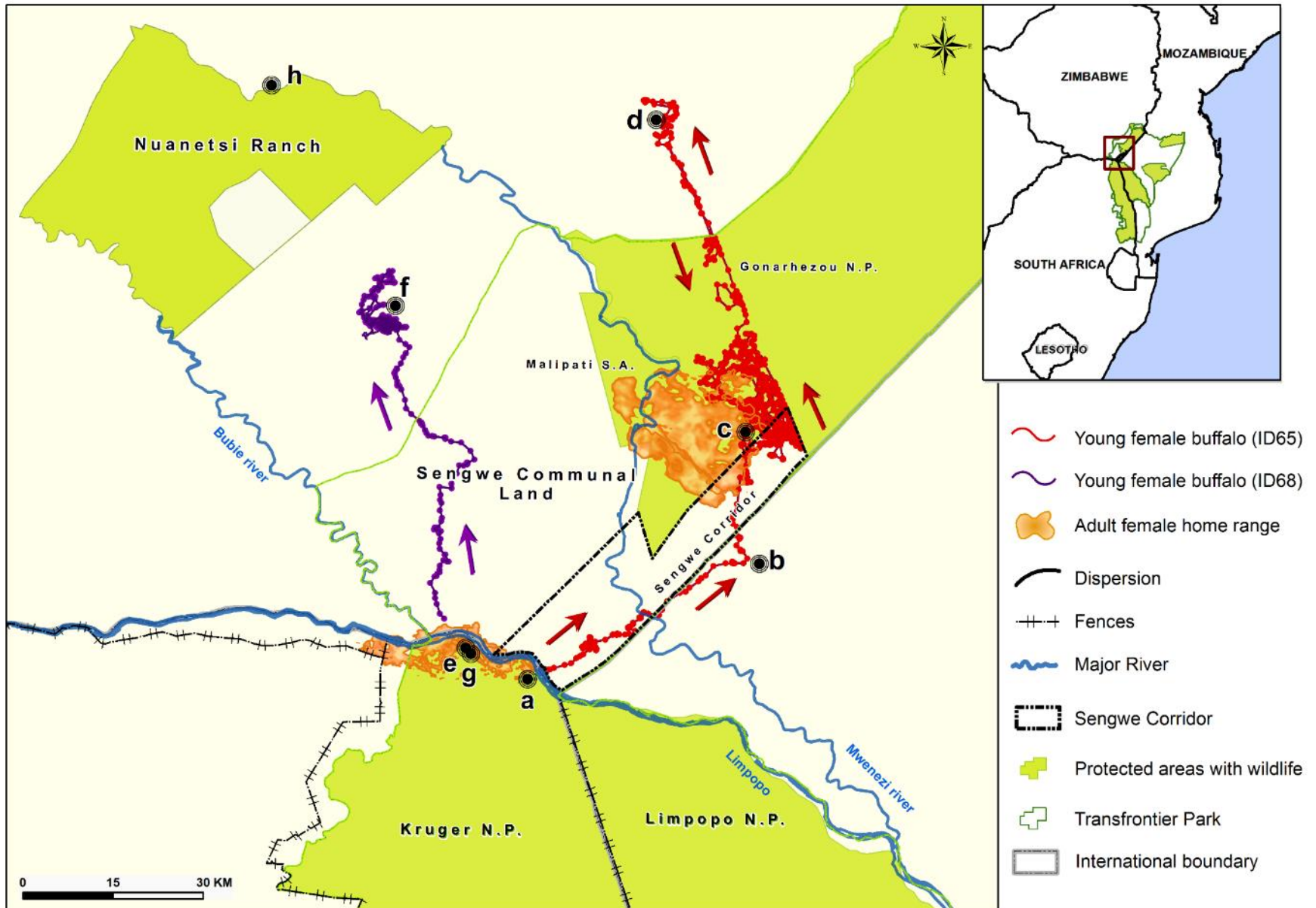
- 10 000 and more
- 1000 to 10 000
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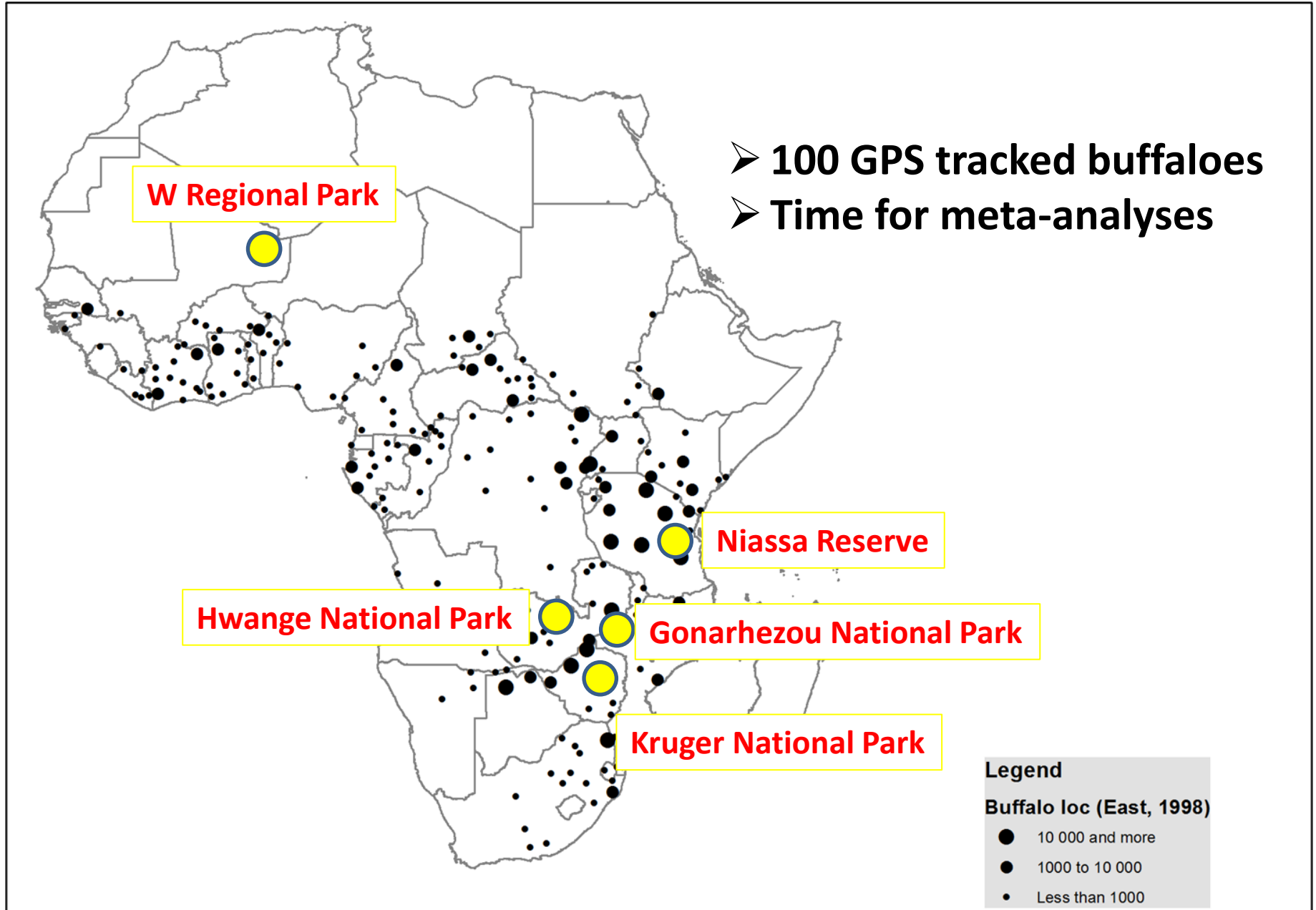
Limpopo River adult females



New protocol in October 2013 – young females hypothesis



WAY FORWARD



- **New PhD study (2017-2020)**
- ***“Social dynamics in the African buffalo (*Syncerus caffer*): from socio-ecological drivers to eco-epidemiological implications”***
- **Co-funded by CIRAD (F) , Manchester University (UK) and IGF (F)**
- **Open to ideas and collaborations**

Thanks for your attention



		East (1998)	Cornélis & al (2013)
S.c. aequinoctialis		> 59 000	> 23 000
	Central African Republic	19 000	4 050
	Chad	1 020	8 090
	DRC Congo	39 180	5 980
	Erythrea	Ex	Ex
	Ethiopia	x	4 380
	Sudan	> 100	(8900)
S.c. brachyceros		>20 000	> 17 000
	Benin	> 2 000	4 560
	Burkina Faso	1 620	5 070
	Cameroon	3 210	4 000
	Gambia	Ex	Ex
	Ghana	C	700
	Guinea Conakry	V	V
	Guinea Bissau	x	?
	Ivory Cost	8 330	900
	Mali	120	Ex
	Niger	500	1 170
	Nigeria	> 200	> 170
	Senegal	> 4 000	460
	Togo	U/R	x

		East (1998)	Cornélis & al (2013)
S.c. caffer		> 548 000	> 473 000
	Angola	<500	x
	Botswana	26 890	39 580
	Burundi	500	Uk
	DRC	No data	2 150
	Ethiopia	2 330	3 600
	Kenya	> 19 560	> 16 560
	Malawi	> 3 150	Uk
	Mozambique	9 570	23 310
	Namibia	1 000	6 000
	Rwanda	1 200	R
	Somalia	U	Uk
	South Africa	30 970	>77 800
	Swaziland	U	Uk
	Tanzania	> 342 450	> 189 230
	Uganda	> 20 220	23 120
	Zambia	> 40 090	> 28 330
	Zimbabwe	50 330	63 000

Total		> 627 000	> 513 000
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-: absent

?: current presence not confirmed

Ab: abundant

C : Common

Ex : Extinct

Ex?: probably extinct

R: rare

U: uncommon

Uk : unknown

V : occurs only as a vagrant

x: definitely present but abundance unknown