

Post-war wildlife recovery and biodiversity conservation at Gorongosa NP

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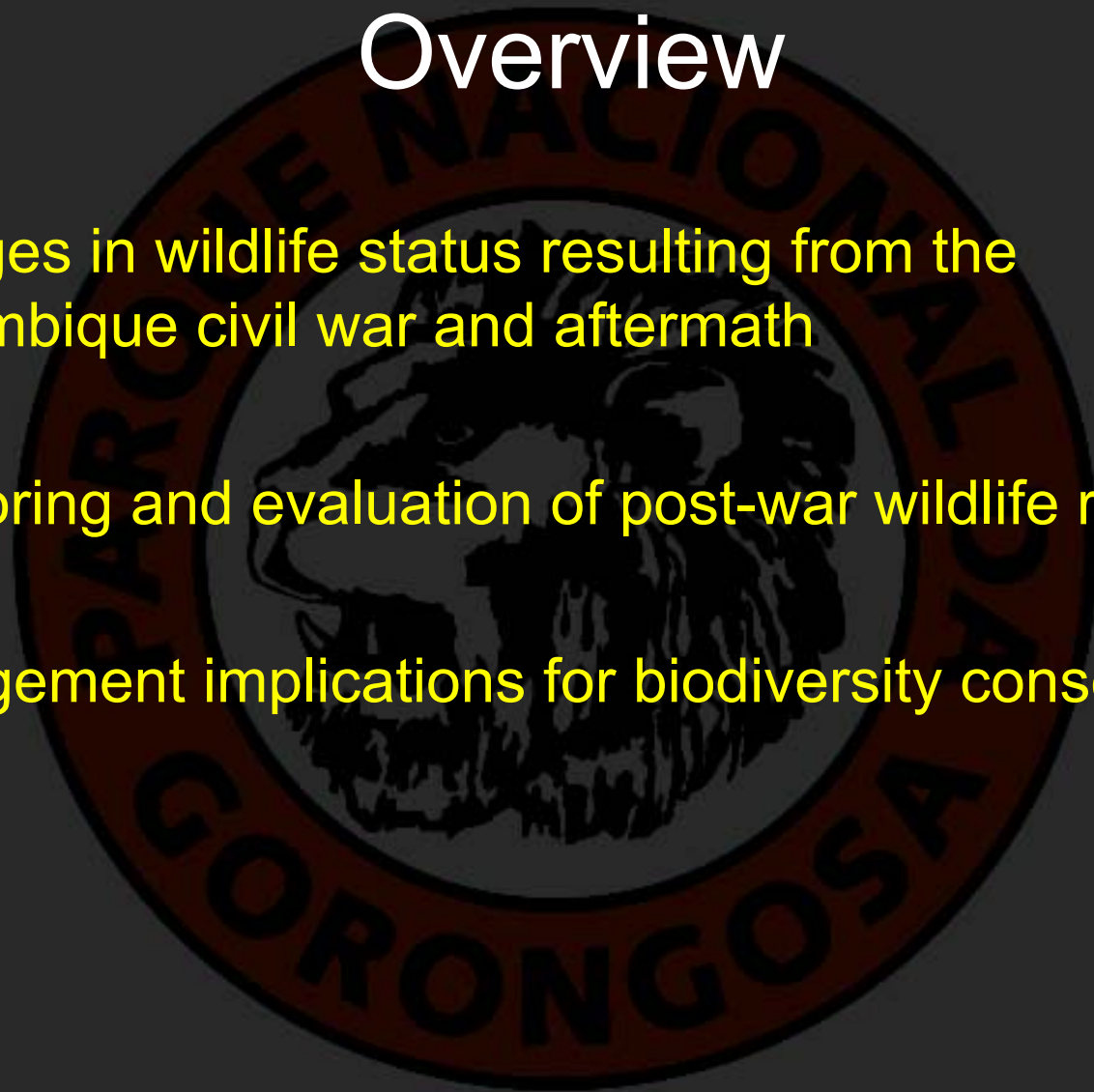
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Overview

- Changes in wildlife status resulting from the Mozambique civil war and aftermath
- Monitoring and evaluation of post-war wildlife recovery
- Management implications for biodiversity conservation



The Greater Gorongosa Ecosystem

8200 km² management area

Gorongosa Mountain (550 km²)

Gorongosa Plateau Midlands (2100 km²)

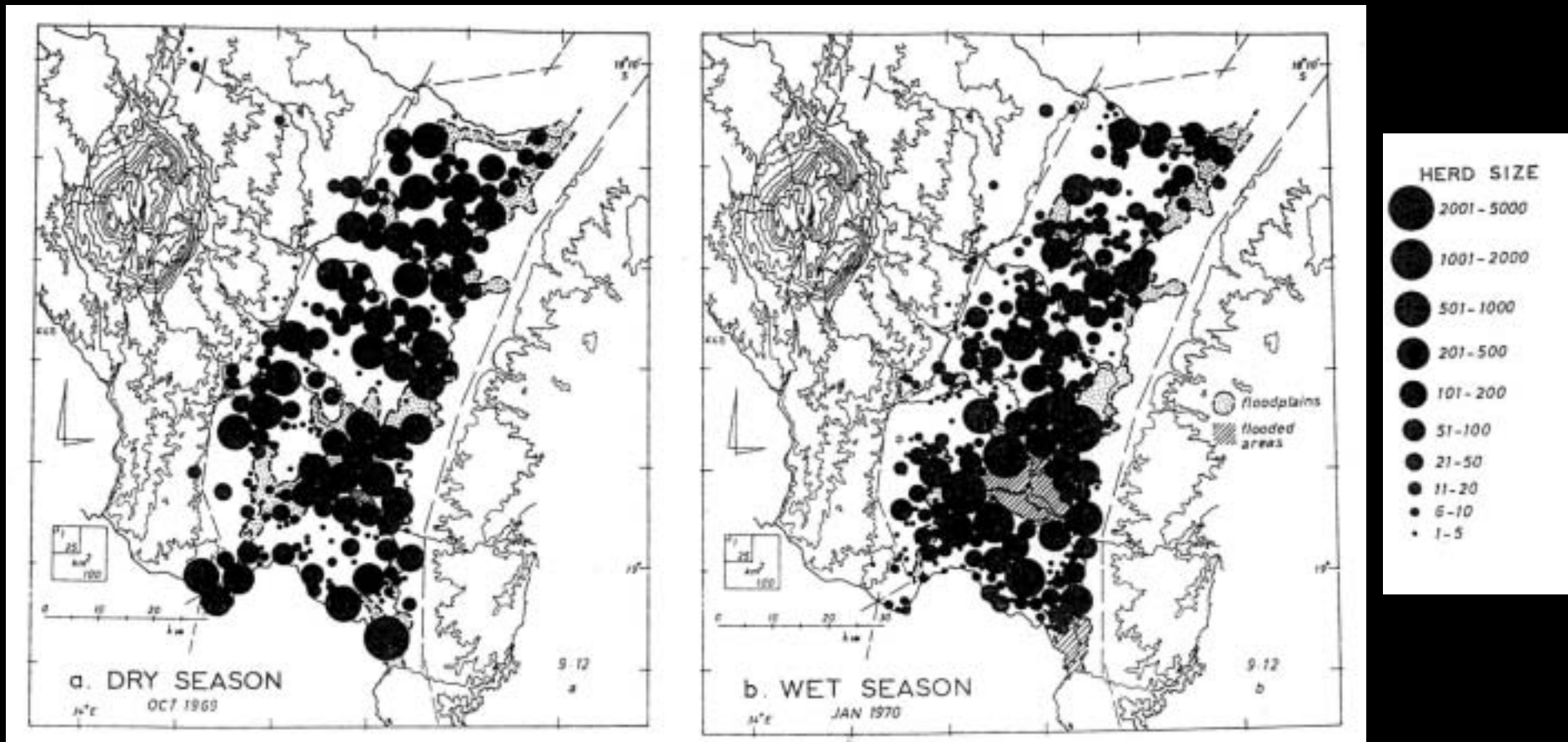
Rift Valley (3650 km²)

Cheringoma Plateau (1900 km²)





Concentration of large herbivores on Rift Valley floor





Change in wildlife numbers and density in Gorongosa NP, 1972-1994, based on aerial survey estimates

SPECIES	1972	Density (km ²)	1994	Density	Change
African elephant	2 500	0.63	108	0.03	-89%
White rhino	6	0.00	0	0.00	-100%
Hippopotamus	3 500	0.89	0	0.00	-100%
African buffalo	14 000	3.54	0	0.00	-100%
Plains zebra	3 500	0.89	65	0.02	-98%
Blue wildebeest	7 000	1.77	0	0.00	-100%
Eland	500	0.13	0	0.00	-100%
Impala	2 000	0.51	0	0.00	-100%
Sable antelope	700	0.18	0	0.00	-100%
Lichtenstein's	800	0.20	0	0.00	-100%
Waterbuck	3 500	0.89	129	0.03	-96%
African Lion	200	0.05	0	0.00	-100%

Monitoring post-war wildlife recovery

- Determine present status and distribution of wildlife at GNP
- Assess recovery of wildlife (numbers, distribution, condition) since 1994 and in comparison to pre-war (1970s) levels
- Establish permanent, repeatable methodology for conducting aerial surveys to enable direct comparisons of survey results in future
- Establish indices to assess changes in wildlife numbers observed during repeat diurnal and nocturnal road surveys
- Train scouts to monitor wildlife status and threats using Cybertrackers
- Deploy remote tracking technology (GPS/GSM, satellite, radio)
- Integrate knowledge to set appropriate restoration targets



Aerial surveys

- Historic surveys aimed for annual total counts using Piper SuperCub
- Post-war surveys conducted 1994, 2000, 2001, 2004, and 2007
- All late dry season surveys but inconsistent methods:
- 1994 & 2004 surveys used Cessna 206 with 10% uniform coverage--directly comparable results
- 2000 & 2001 surveys used Bell 206 helicopter with mix of uniform 25% coverage and total counts--difficult to extrapolate or compare
- 2007 survey used JetRanger helicopter –doors off, struts, laptop data-logger (Sunrise Aviation); 3 stratified units (Rift Valley 50% coverage; Midlands and Cheringoma woodlands 33% coverage) established standard methodology for future surveys



2007 aerial survey results

Species	Estimated numbers	Number seen	Lower CL	Upper CL	Density (km ²)
African buffalo ¹	70	23	--	--	0.02
Bushbuck	1244	524	893	1595	0.33
Bushpig	232	99	125	340	0.06
Common duiker	203	70	80	165	0.05
Red duiker	122	48	--	--	0.03
Eland	6	2	--	--	0.00
African elephant	296	148	--	--	0.08
Hippopotamus ²	161	161	--	--	0.04
Impala	584	276	290	816	0.16
Kudu	553	198	145	554	0.15
Lichtenstein's hartebeest	350	171	321	848	0.09
African lion ³	30	3	--	--	0.01
Nyala	527	172	289	765	0.14
Oribi	1393	631	958	1829	0.37
Common reedbuck	4925	2262	3146	6704	1.32
Sable antelope	297	134	121	474	0.08
Steenbok	9	4	--	--	0.00
Warthog	3833	1756	2380	5287	1.02
Waterbuck	4926	2295	2297	7556	1.32
Blue wildebeest ¹	24	11	--	--	0.01
Plains zebra	6	3	--	--	0.00
Crocodile ²	1185	1185	--	--	0.32

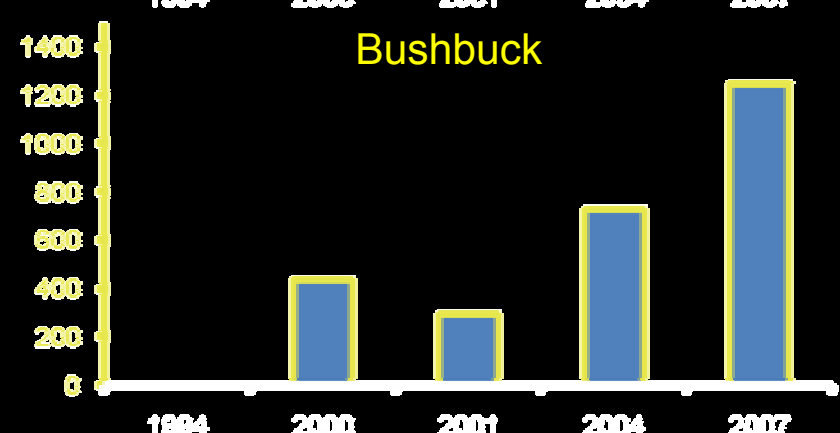
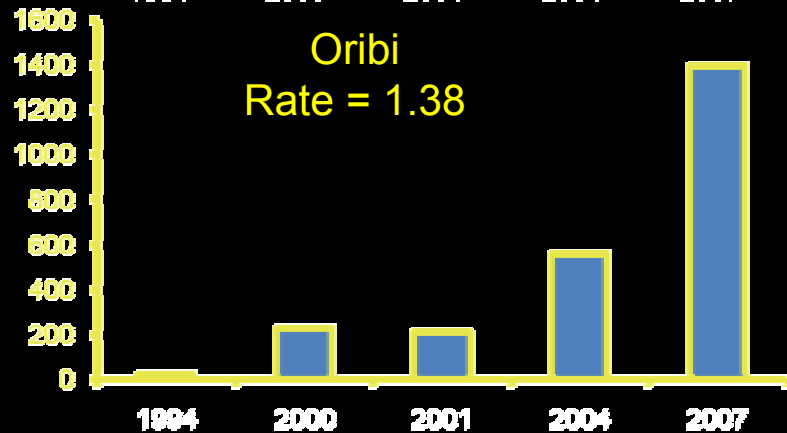
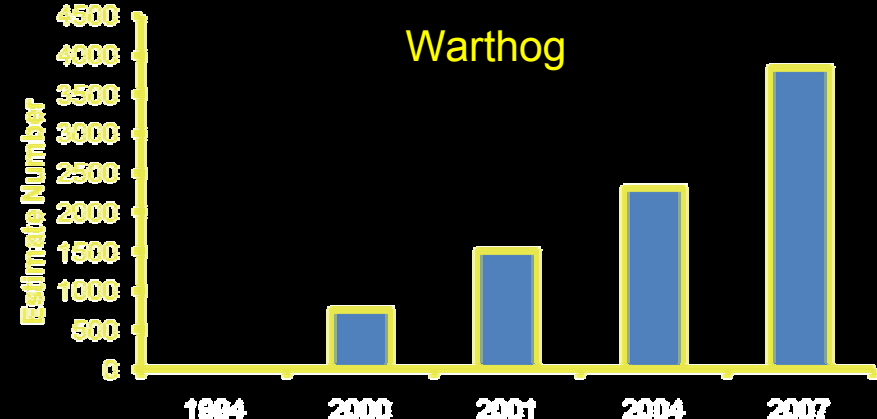
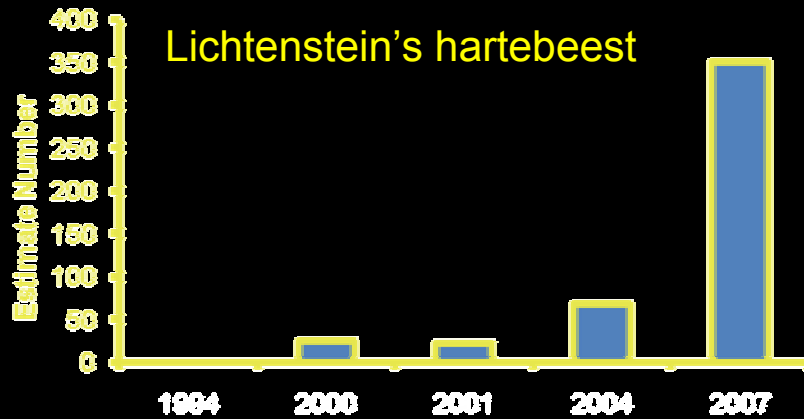
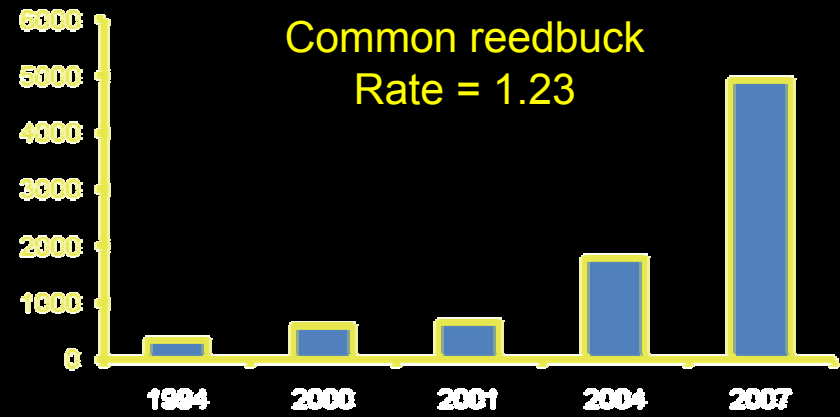
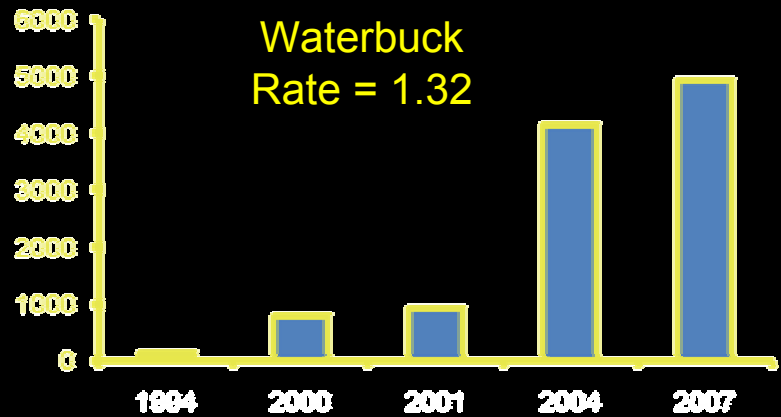
¹Does not include numbers reintroduced; ²Designated survey total count; ³Census estimate at time of aerial survey

Trends in post-war recovery from aerial survey results

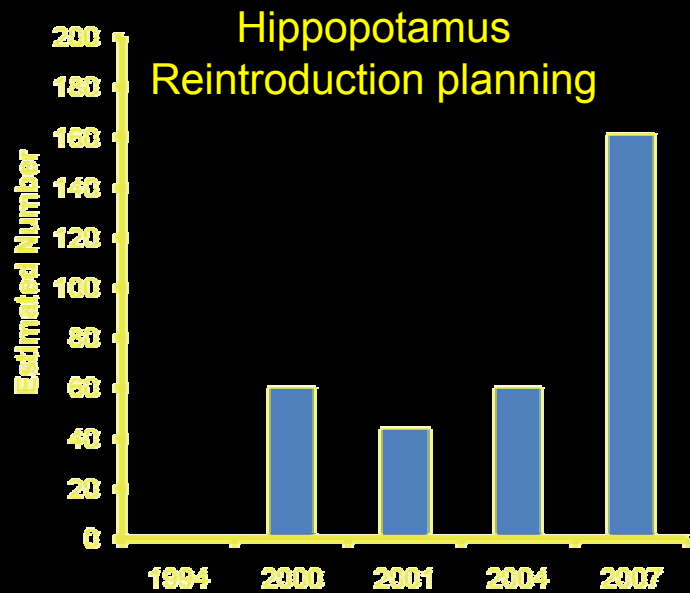
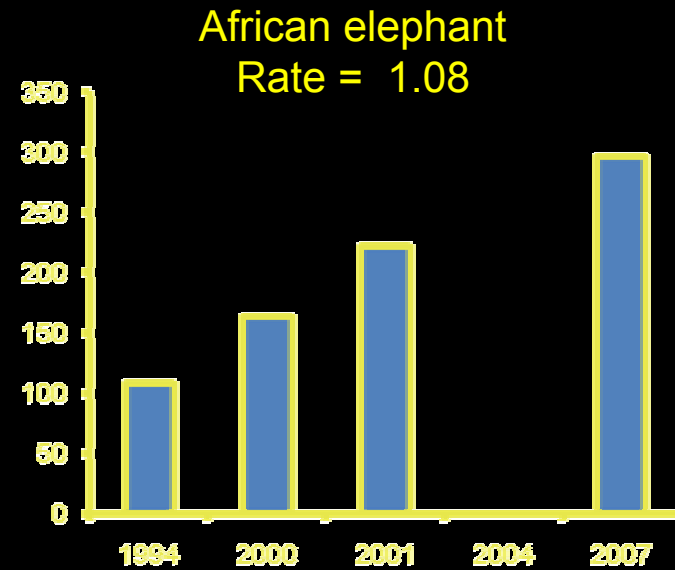
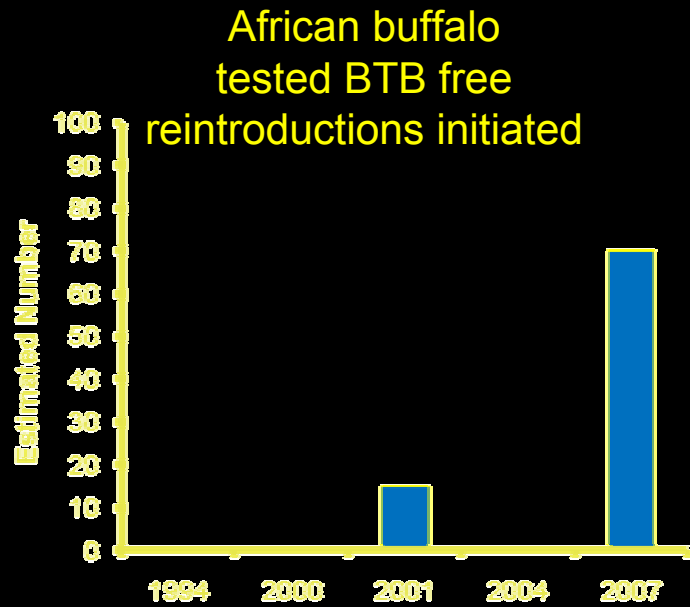
Species	1994	2000	2001	2004	2007
African buffalo ¹	0	0	15	0	70
Bushbuck	0	436	290	725	1244
Common duiker	0	39	69	125	203
Eland	0	0	40	0	6
African elephant	108	163	222	0	296
Hippopotamus	0	60	44	60	161
Impala	0	106	76	520	584
Kudu	0	102	80	549	553
Lichtenstein's hartebeest	0	26	22	69	350
Nyala	22	268	314	173	527
Oribi	22	226	212	559	1393
Common reedbuck	334	592	664	1793	4925
Sable antelope	0	80	204	668	297
Warthog	0	756	1500	2297	3833
Waterbuck	129	786	930	4136	4926
Blue wildebeest ¹	0	0	2	0	24
Plains zebra	65	22	10	0	6

¹Numbers do not include individuals translocated to fenced sanctuary inside park during 2006-2007

Rapid recovery (initial immigration and high growth rates)

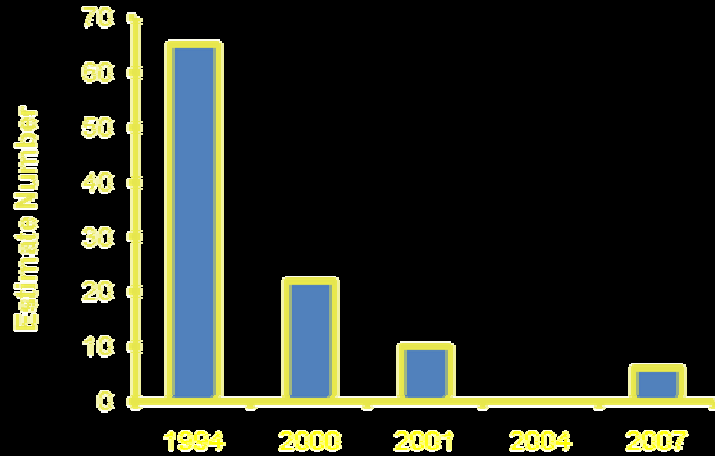


Moderate recovery (tending towards viable population)

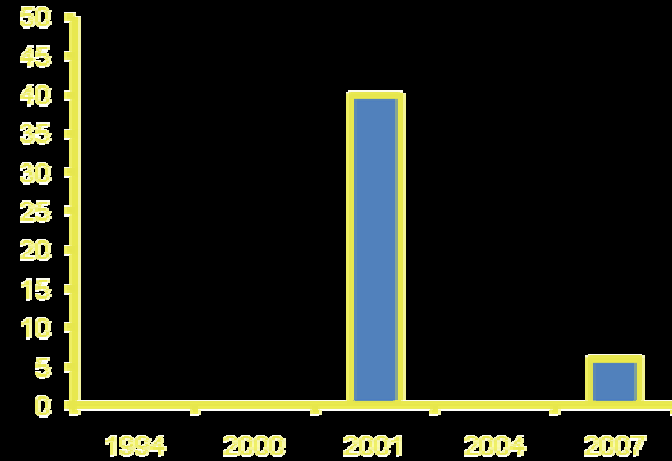


Poor recovery (decline, stagnation) or uncertainty

“Selous” zebra
Non-viable GNP; increasing
in Zambezi Delta but not mobile



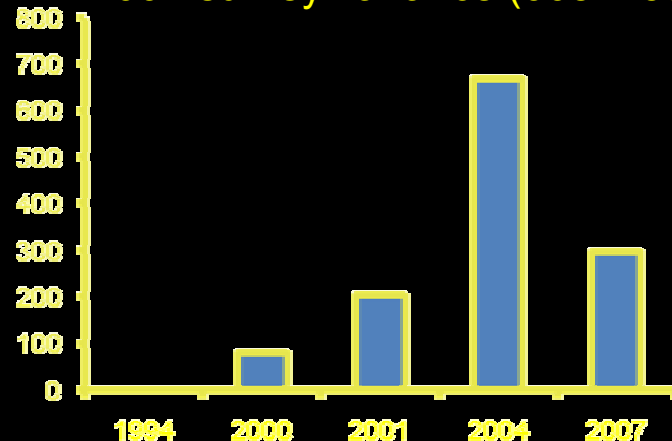
Eland
Non-viable GNP; increasing
in Zambezi Delta and highly mobile



Blue wildebeest
Non-viable GNP;
reintroductions initiated



Sable antelope
Recent “decline “ explained by
2004 survey variance (668 ± 589)?



Ground surveys

- complement and validate aerial survey results
- clarify status and trends for species under dense cover, less conspicuous, nocturnal
- establish repeatable monthly or quarterly index (not extrapolation)
- four diurnal road circuits covering 216 km (repeated as separate and/or combined indices)
- two nocturnal road circuits covering 103 km (repeated as separate and/or combined indices)



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Results of diurnal and nocturnal road index surveys

Species	Diurnal survey	Nocturnal survey
Chacma baboon	850	0
Lesser bushbaby	0	1
Bushbuck	222	66
Bushpig	11	3
Greater canerat	1	0
African civet	0	17
Common duiker	1	0
Red duker	1	0
African elephant	16	8
Elephant shrew	0	4
Large-spotted genet	0	15
Lichtenstein's hartebeest	5	0
Hippopotamus	0	1
Impala	142	125
Kudu	1	0
Africa lion	3	0
Large grey mongoose	1	0
Slender mongoose	1	0
Water mongoose	0	1
Nyala	7	0
Oribi	191	39
Porcupine	0	20
Common reedbuck	589	24
Sable antelope	12	2
Red squirrel	2	0
Vervet monkey	23	0
Warthog	711	1
Waterbuck	507	77
Crocodile	87	1
Total numbers	3411	422

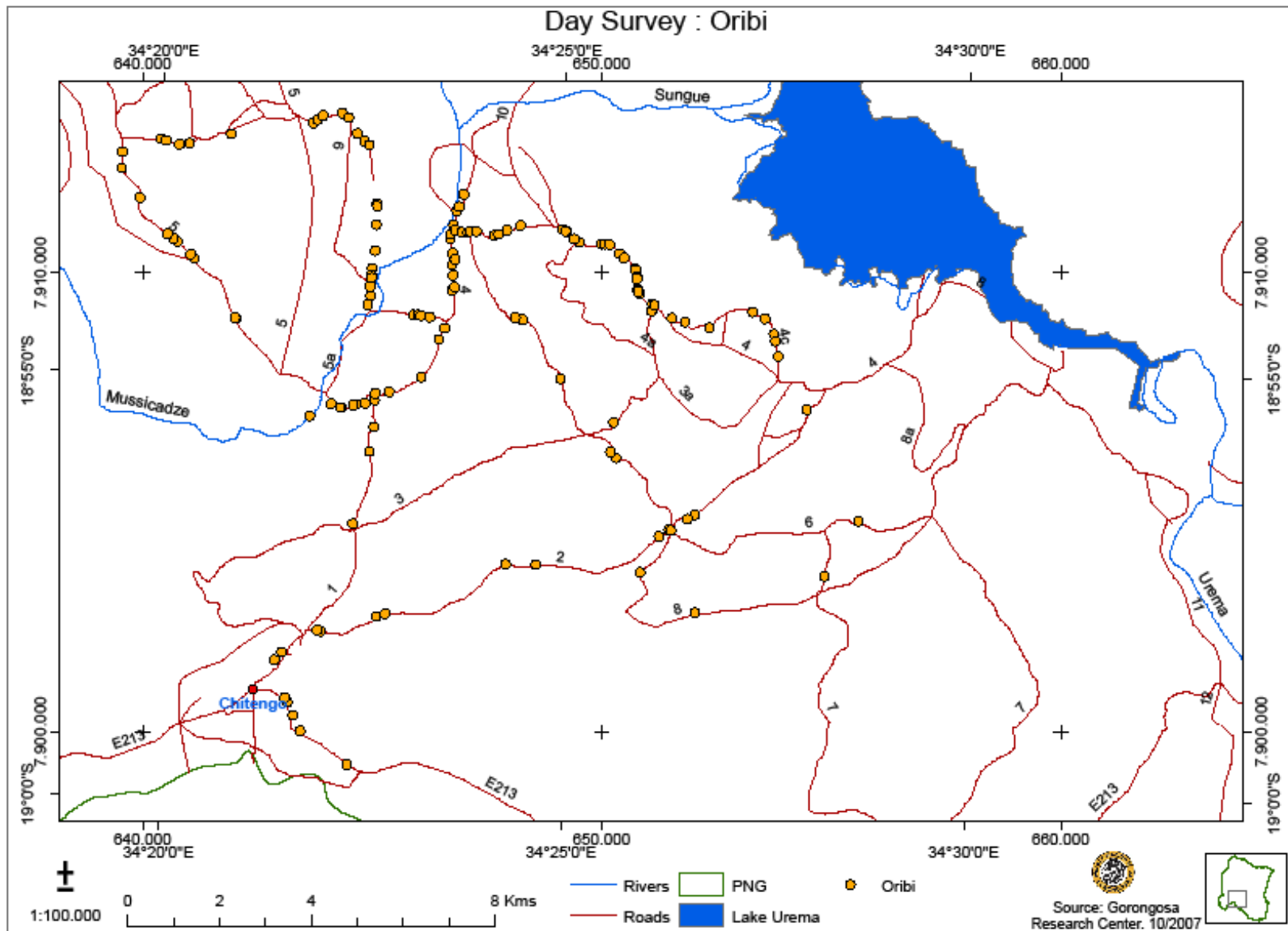
* Diurnal 15.8 obs/km & nocturnal 4.1 obs/km - further perspective on wildlife recovery (<1.0 obs/km in 1994)

* 11 species recorded that were not covered by aerial survey; 5 species missed from aerial survey coverage

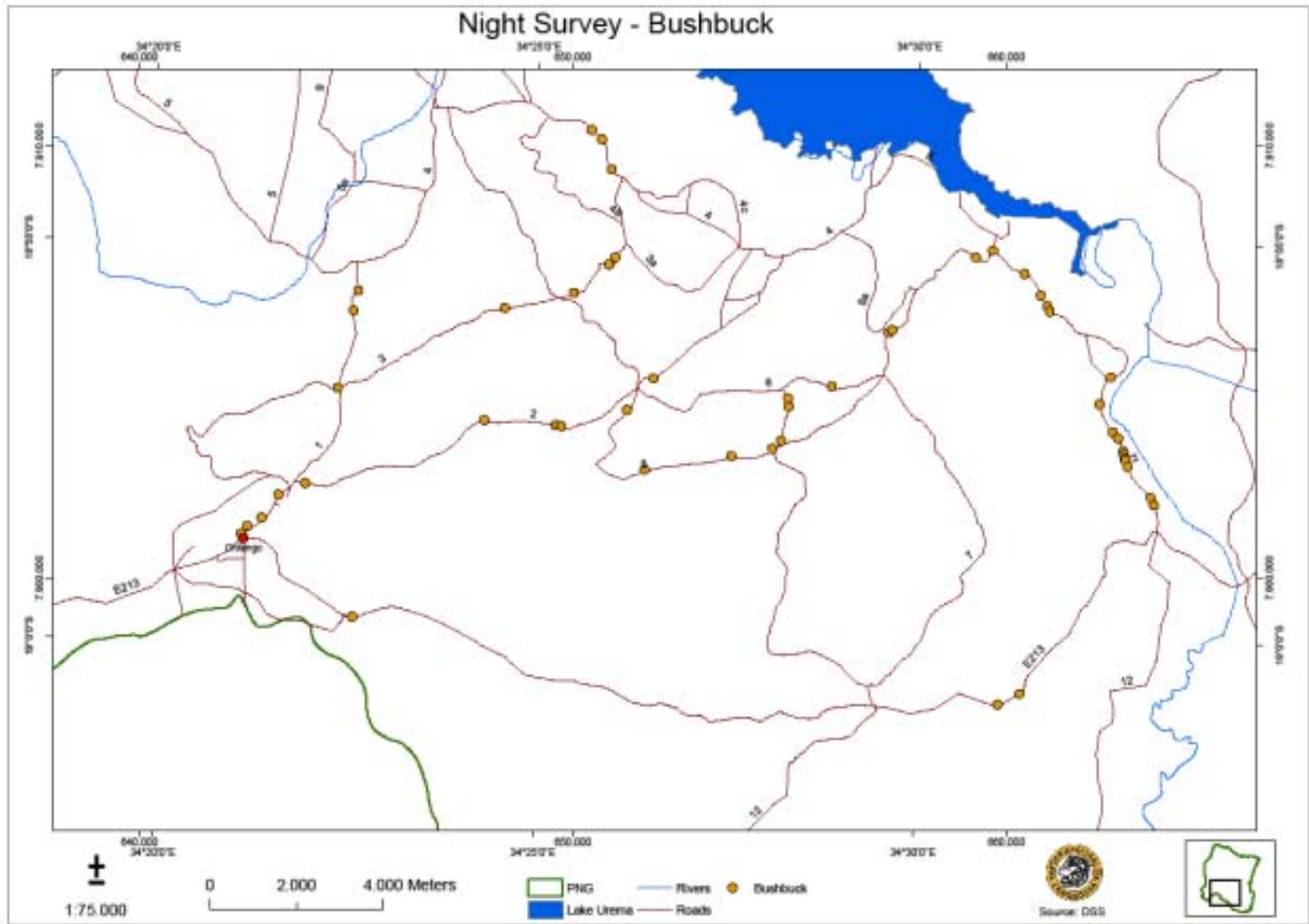
* Extrapolation confounded by variable observation distance (\perp) due to burn status, veg density, behavioral patterns, etc.

* Moderate variability on three repeat road sections suggest further replications needed to test index

Diurnal ground survey distribution maps



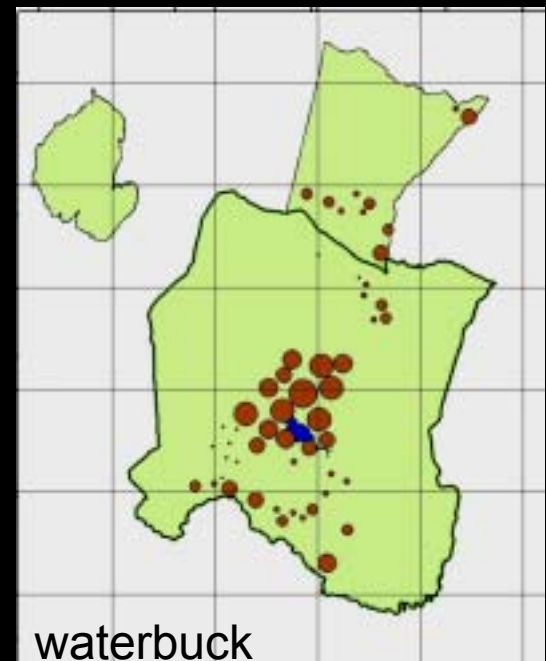
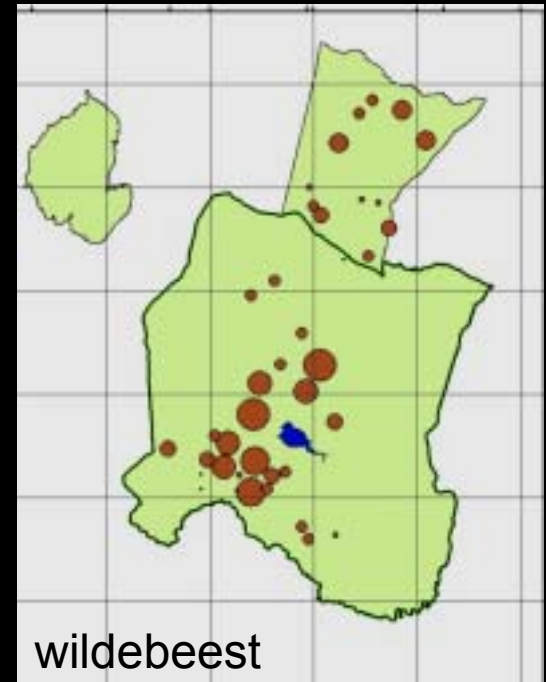
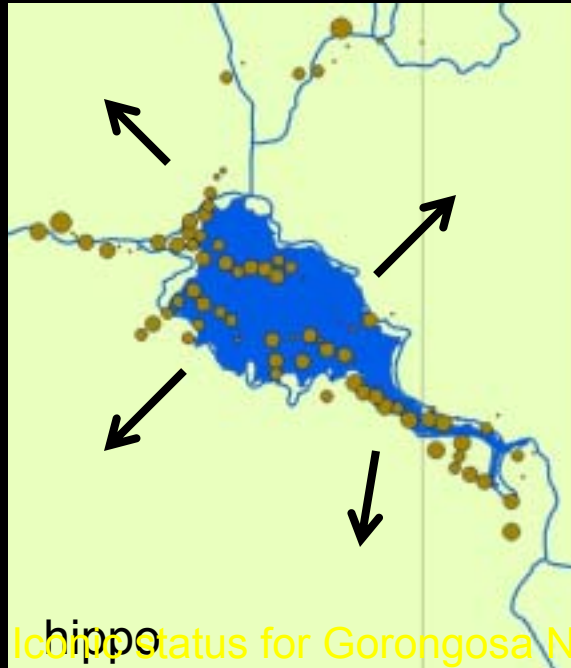
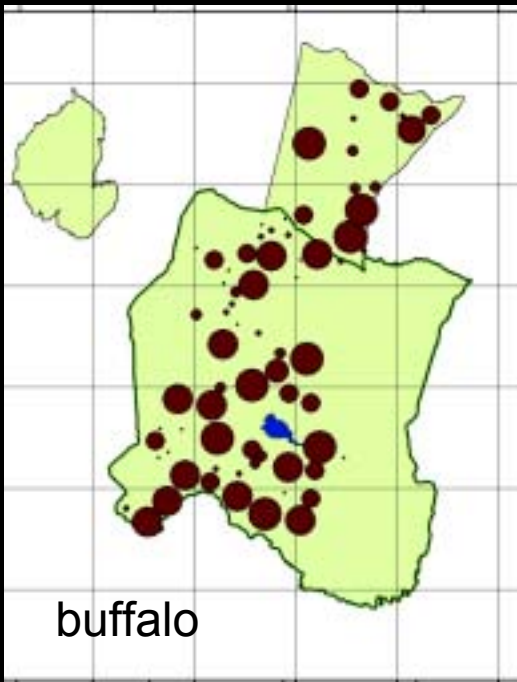
Nocturnal ground survey distribution maps



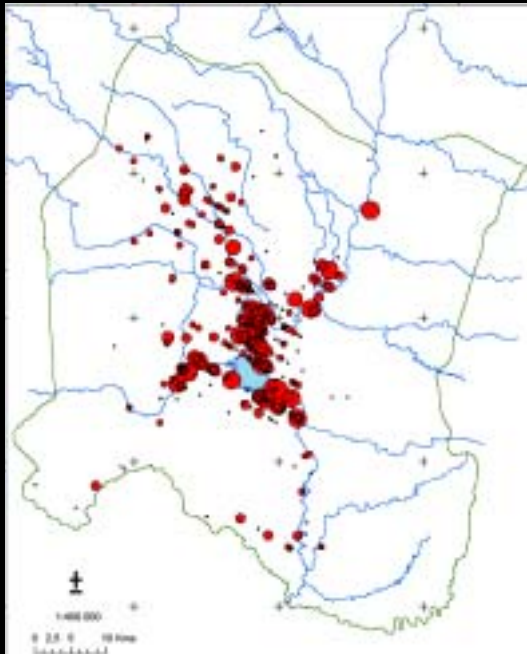
Management implications for biodiversity conservation



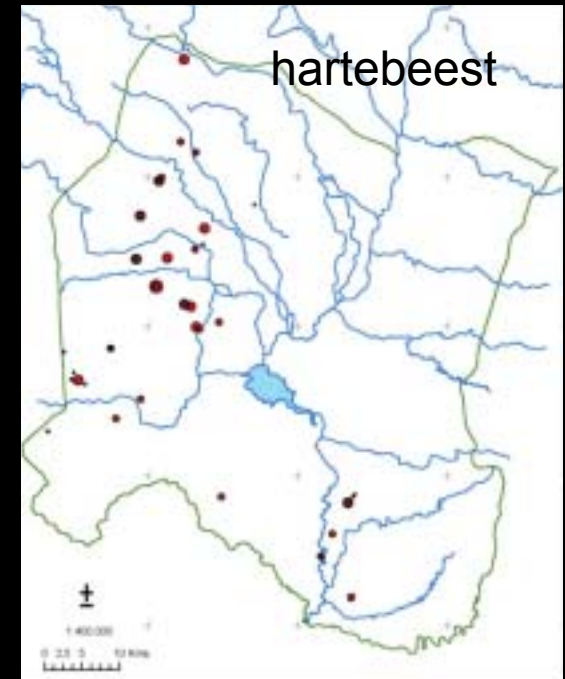
Pre-war grazing regime



- ICBP status for Gorongosa NP
- Gross over-stocking relative to dry season carrying capacity
- Poor physical condition most species
- Loss of tsessebe and roan by 1960s
- High BTB prevalence in buffalo



Post-war grazing regime



- Species generally in excellent physical condition and recovering rapidly
- Triad of formerly-dominant bulk grazers (buffalo, zebra, wildebeest) and hippo greatly diminished in numbers and ecological influence (although buffalo survivors are BTB-free)
- Lake fringe grazing lawn created by waterbuck and reedbuck
- Riverine and savanna under-utilized and characterized by rank, mostly inaccessible grass—fire critical in providing available habitat for many species and more than 80% of Gorongosa NP burns annually

Elephant recovery and management

- Elephant numbers have recovered to ~12% of historic levels
- Pre-war Rift density $>1.0/\text{km}^2$ and poor physical condition
- Strong pressure from neighboring countries to translocate
- Widespread encroachment and densification of fever tree/palm scrub on floodplain
- Increasing levels of human-elephant conflict with border communities (crop raiding; one fatality)



Carnivore recovery and management

- Poor recovery or substantial time lag for lions despite rapidly increasing prey base
- Lion are vulnerable to trophy hunting pressure if disperse to surrounding hunting concessions and to snaring in Park
- Hyena, jackal, wild dog nearly extirpated and no indication of recovery
- Abundant small carnivores

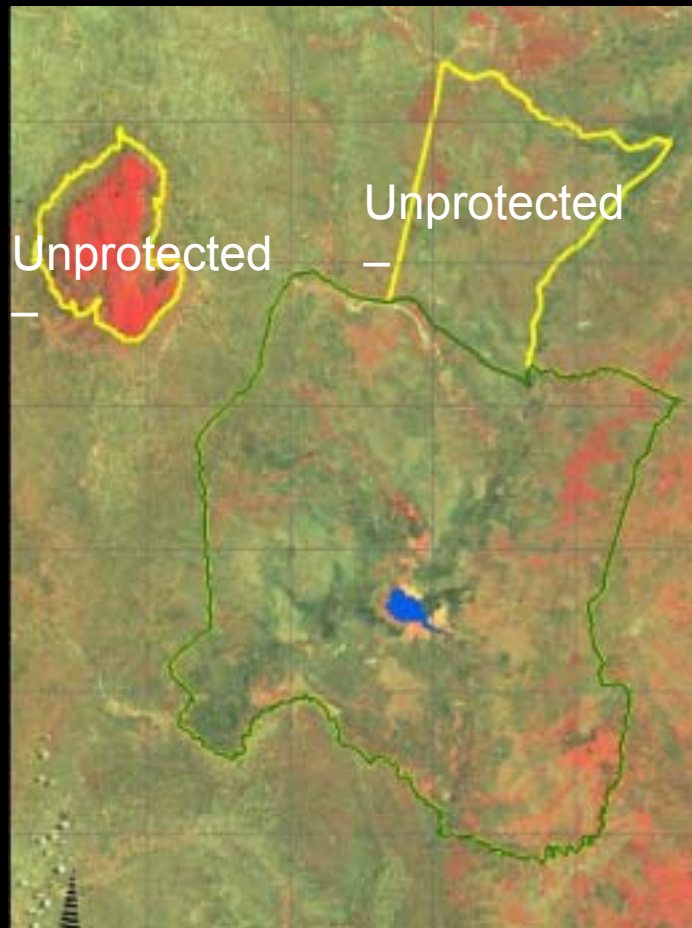


Law enforcement and community outreach

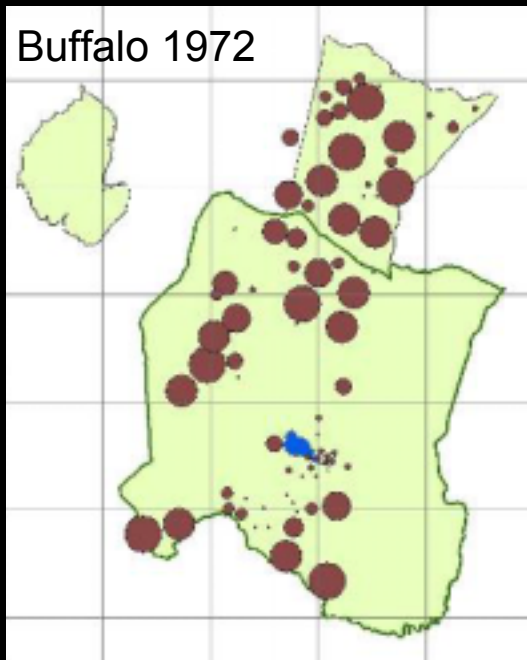
- Central core area of Gorongosa NP mostly secure and sustaining high growth rates for most species
- Extensive regional bush meat trade and subsistence hunting (snaring) on periphery
- Law enforcement focus on improved training, increased incentives, and more efficient deployment of scout patrols
- Community focus on conservation education, conservation contracts, and socio-economic



Future Protected Area Network must consider critical landscape linkages to ensure continued wildlife recovery



Buffalo 1972



Seasonal movements 1972



Concluding thoughts...

Redefining targets for biodiversity management

- Does “new” grazing regime trajectory better support overall biodiversity? Program aims to restore for viable populations of buffalo, zebra, wildebeest -- but could reestablishing the ecological dominance of these bulk grazers reduce current or potential biodiversity? Need hydrological role of hippo; grazing dominance less desirable
- Window of opportunity to reestablish viable populations of missing herbivore species
- Need to understand carnivore recovery dynamics before further action
- Heterogeneous mix of fire (varied in timing, extent, intensity) probably necessary to fulfill bulk grazing role away from Lake fringe, but full biodiversity implications unclear
- Do barriers to wildlife movement in Greater Gorongosa Ecosystem

Acknowledgements

- Aerial and ground survey team members
- GIS and database management team
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