Some issues on biodiversity in Zimbabwe

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Introduction

- While the institutional structure for biodiversity monitoring potentially exists biodiversity survey projects are sporadic and undertaken by different agencies/people for different purposes.
- In the Parks estate biodiversity monitoring tends to emphasise on large mammals of economic importance in the tourism industry.
- In the past both Natural Science Museum surveys, and the National herbarium under took targeted surveys on reptiles or small mammals or areas of perceived unique botanic significance.
- The current economic situation greatly limits these activities, and the country risk losing important guilds. In our biodiversity complex.
- This presentation attempts to report on some work, largely uncoordinated but considered collectively give pointers as to what has been garnered from diverse research projects are concerned with biodiversity, as well as pointing out processes that are taking place with respect to their harmful effects on biodiversity, but are ignored by state and society
- Lastly these observation raise the question Of what importance is biodiversity?" One state official once remarked "You can't stop development for a few frogs and three trees".

What do these temperatures mean to Zimbabwe?

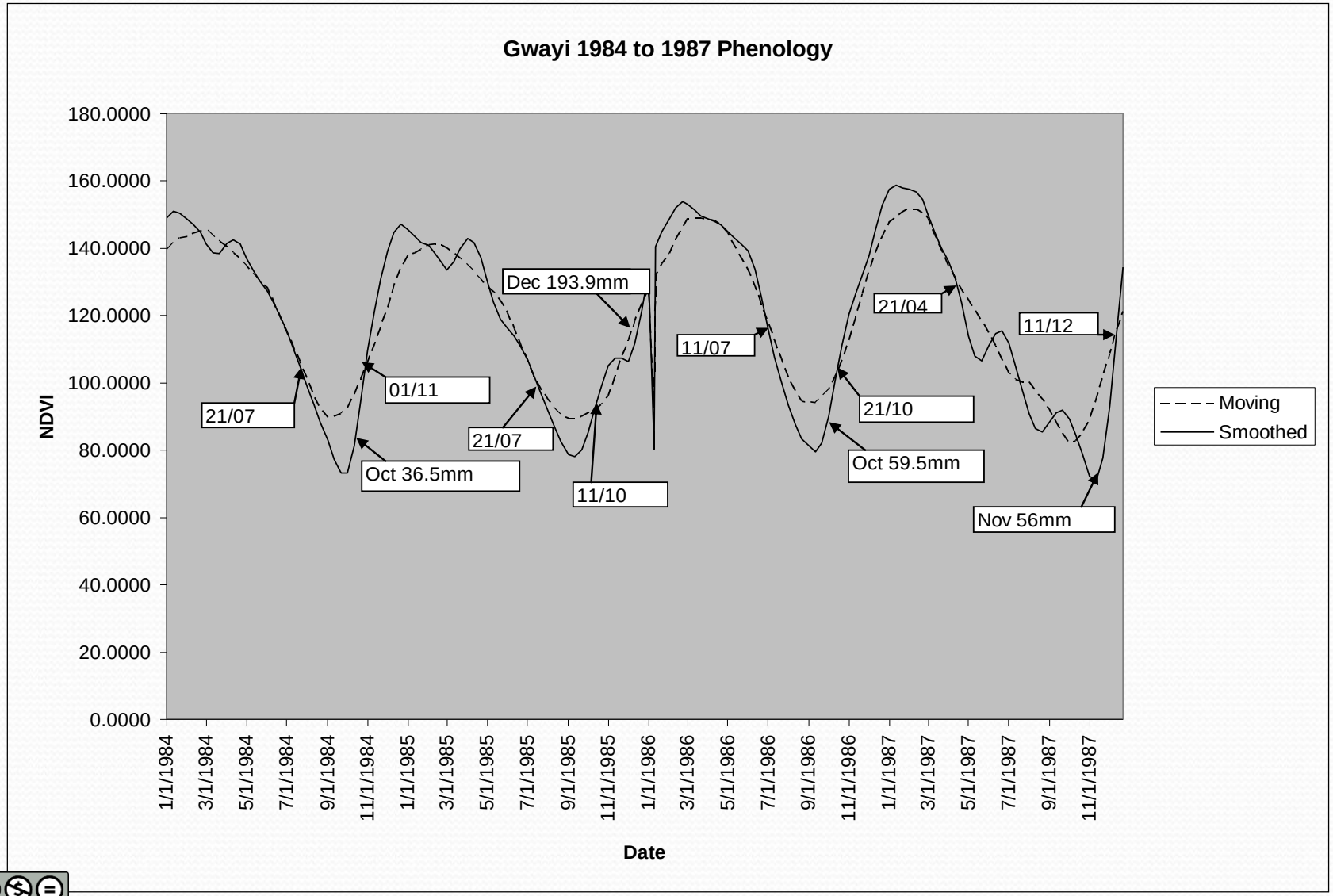
Zimbabwe Seasonal decadal warming (1960-2000); °C

	Station	Max DJF	Min DJF	MaxMAM	MinMAM	Max JJA	Min JJA	Max SON	Min SON	Mean
1	Btb	**0.56**	**0.31**	**0.9**	0.27	**0.38**	**0.3**	**0.47**	**0.34**	**0.44**
2	Buf	0.17	**0.68**	**0.58**	**-0.08**	**0.66**	**0.599**	**0.52**	**0.49**	**0.45**
3	Bul	**0.47**	0.22	**0.54**	0.29	0.27	0.21	0.28	0.22	**0.31**
4	Chm	**0.32**	-0.09	**0.62**	-0.06	**0.39**	-0.3	**0.37**	-0.27	0.12
5	Chn	**0.48**	**0.68**	**0.49**	-0.08	0.18	-0.08	**0.52**	1.5	**0.46**
6	Chp	**0.37**	-0.06	**0.7**	-0.04	**0.41**	-0.1	0.27	-0.15	0.18
7	Chv	**0.38**	0.18	**0.59**	0.2	**0.47**	**0.35**	**0.37**	**0.31**	**0.36**
8	Gwe	**0.4**	0.1	**0.51**	0.2	**0.37**	**0.47**	**0.34**	0.26	**0.33**
9	Har	0.22	0.09	**0.6**	0.09	**0.31**	**0.49**	0.26	0.26	0.29
10	Hwa	**0.64**	0.29	**0.7**	0.13	**0.34**	**0.31**	**0.35**	**0.31**	**0.38**
11	Kad	**0.25**	0.12	**0.42**	0.12	**0.31**	0.05	0.17	0.18	0.20
12	Kar	**0.74**	**0.34**	**0.65**	**0.5**	**0.46**	**0.42**	**0.53**	**0.44**	**0.51**
13	Kwe	**0.55**	0.24	**0.53**	0.2	0.27	**0.3**	**0.34**	**0.36**	**0.35**
14	Mar	**0.32**	0.1	**0.52**	0.1	**0.35**	0.29	0.27	0.2	0.27
15	Mas	**0.42**	-0.05	**0.83**	-0.21	**0.46**	0.07	**0.32**	0.13	0.25
16	Mut	**0.46**	-0.31	**0.51**	-0.13	**0.52**	**-0.06**	**0.38**	**-0.15**	0.15
17	Nya	**0.41**	0.12	**0.63**	0.18	**0.5**	0.14	**0.33**	0.08	**0.30**
18	Rus	0.23	0.1	**0.4**	0.16	0.24	**0.41**	**0.31**	0.18	0.25
	Mean	**0.41**	0.17	**0.60**	0.10	**0.38**	0.21	**0.36**	0.26	**0.31**

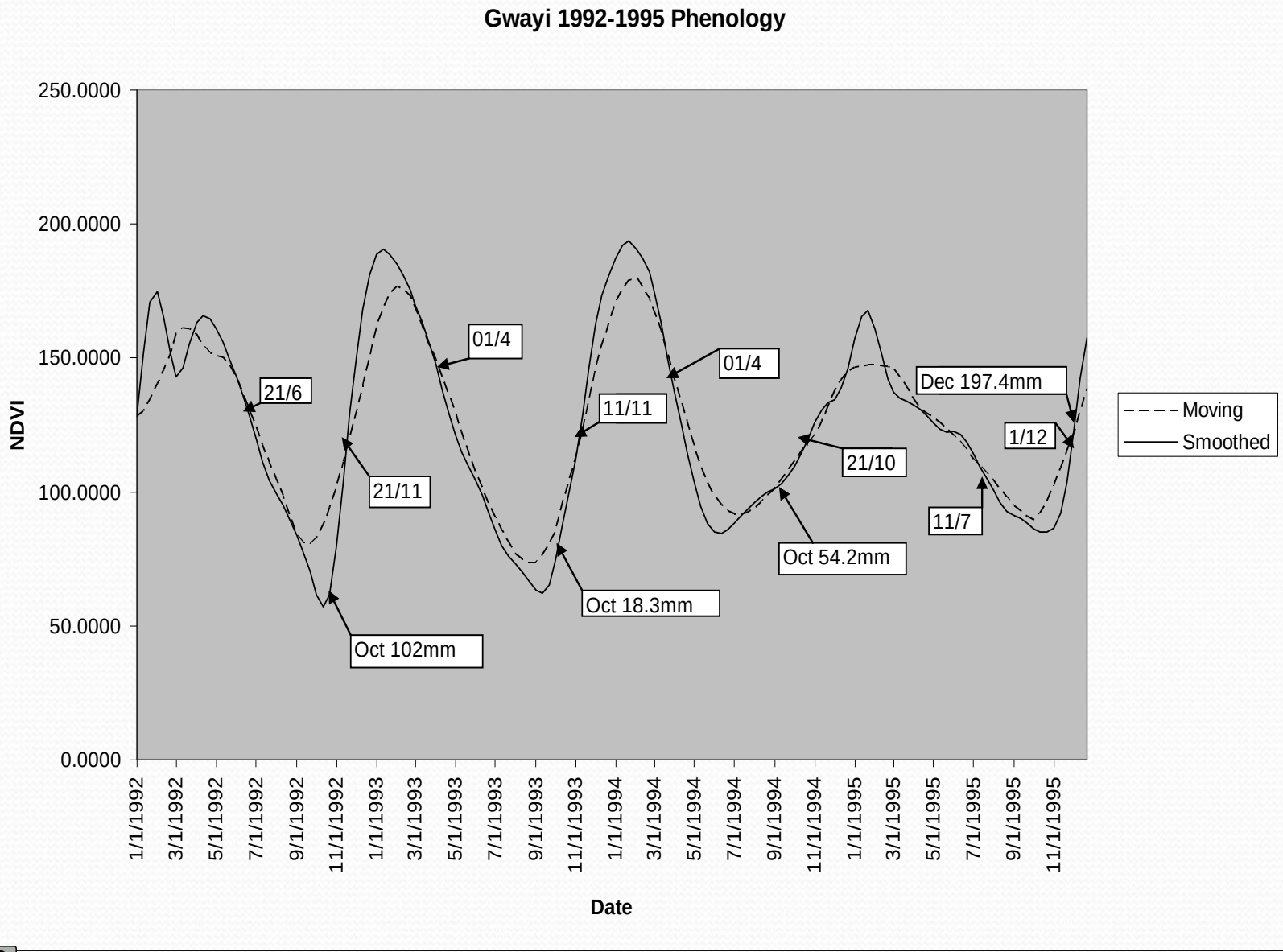
Changes in phenology in Baikiaea plurijuga: after A. Gumbi 2010

- **5.4 Conclusions and recommendations**
- The Zambezi teak woodlands are declining in extent (Pierce 1986) and productivity. Increase in temperatures during the MAM and JJA seasons are resulting in decreases in NDVI.
- Rainfall plays a major role in controlling phenological events in the woodlands.
- The predicted decline in precipitation is likely to delay the onset of greenness to occur late in December and end of greenness to occur early.
- This will further reduce the period of greenness in the forests hence reduction in forest productivity.

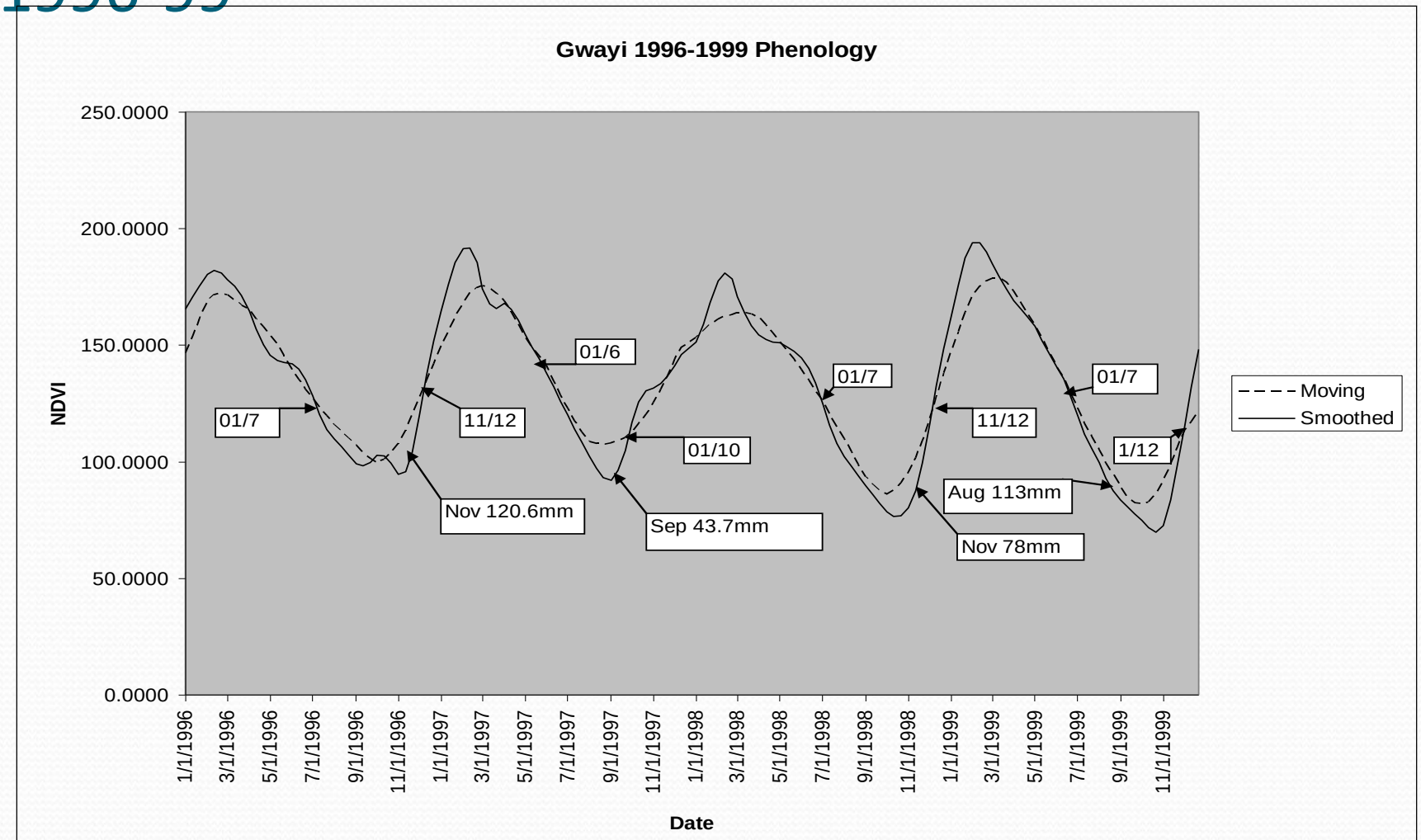
Scescence & Greenness onset date; 1984-87



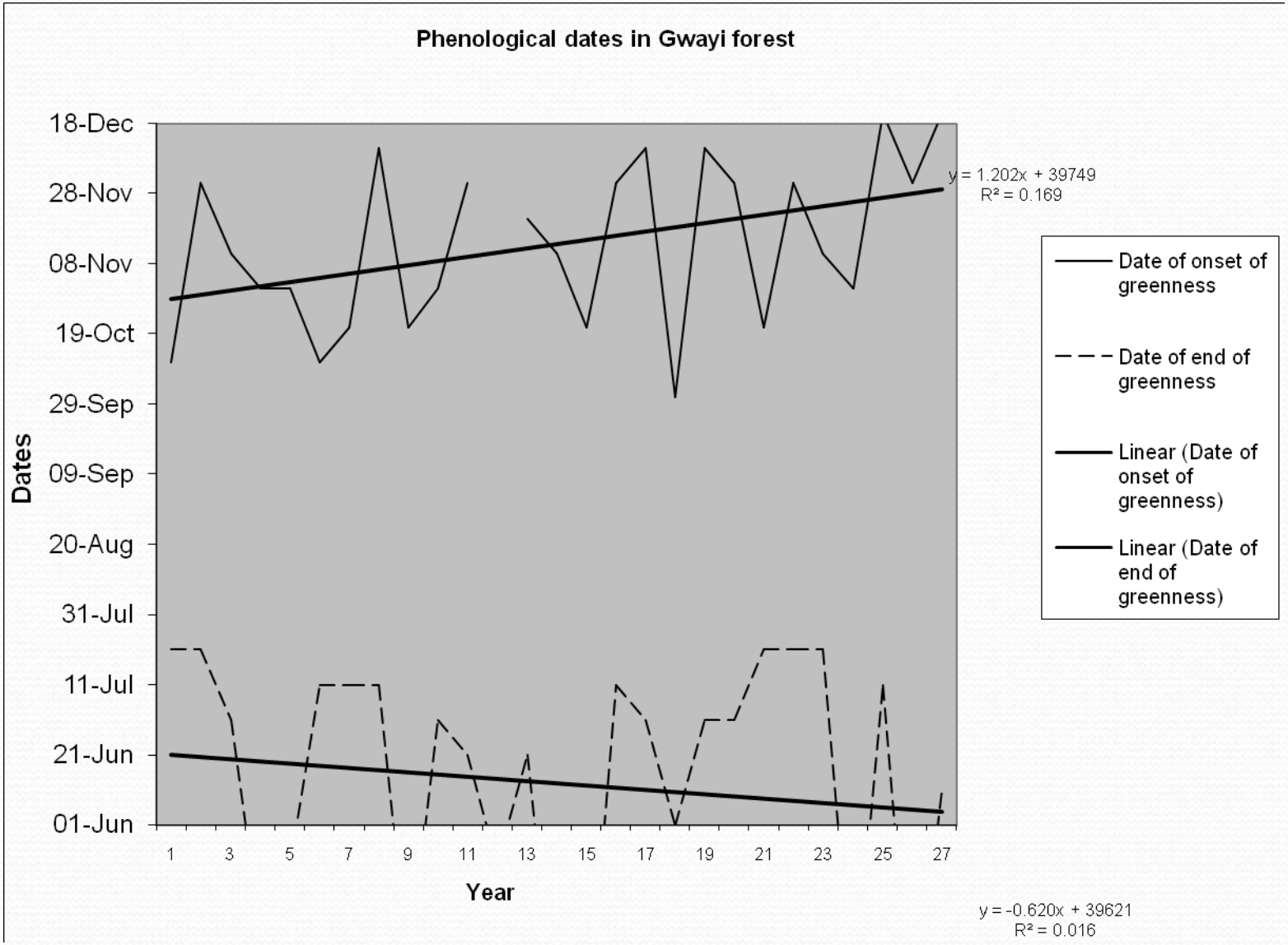
Scescence & Greenness onset date; 1991-05



Senescence & Greenness onset dates: Gwayi 1996-99



Phenology trends in Gwai forest



Forest biodiversity

- Forest diversity has been declining due to
- expansion of agriculture
- unsustainable exploitation of fuel wood,
- infrastructural developments,
- uncontrolled fires,
- invasive alien species and climate change
- Tobacco farming has contributed to 15% of deforestation due to dependence on fuel wood for curing by 90% of tobacco farmers

Aquatic biodiversity.

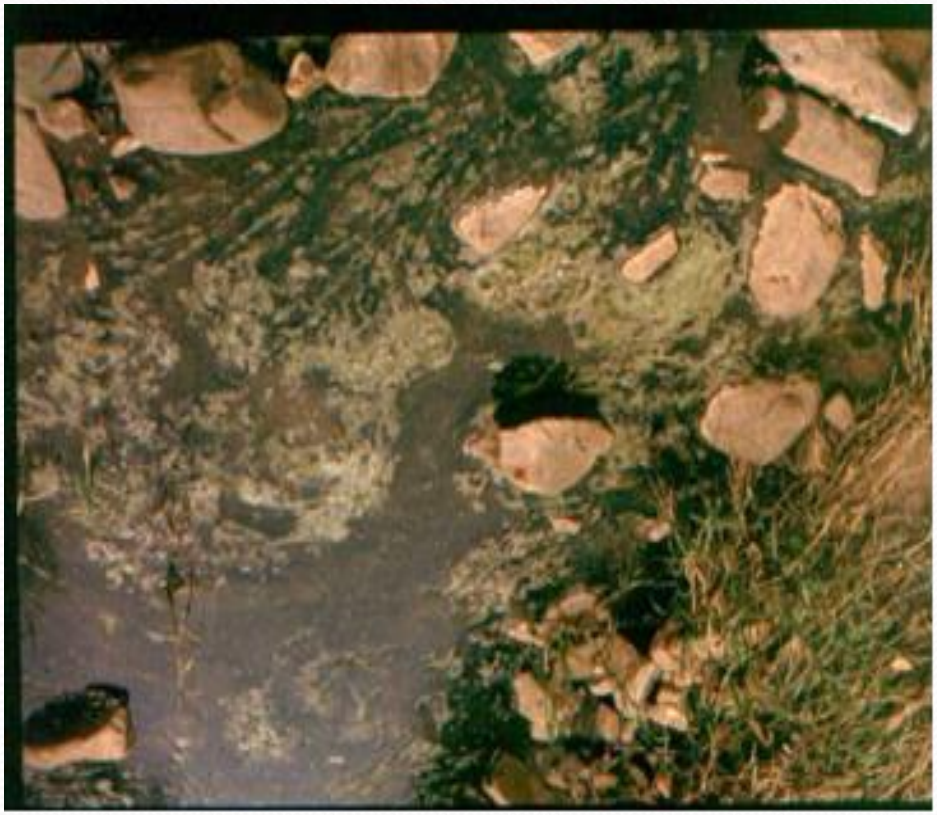
Macroinvertebrates and vertebrates.

Smothering of aquatic habitats by siltation”

Cattle grazing on Nyamabishi dam, Chihota, built 1958: by 1976 it had almost silted up & is now completely silted.

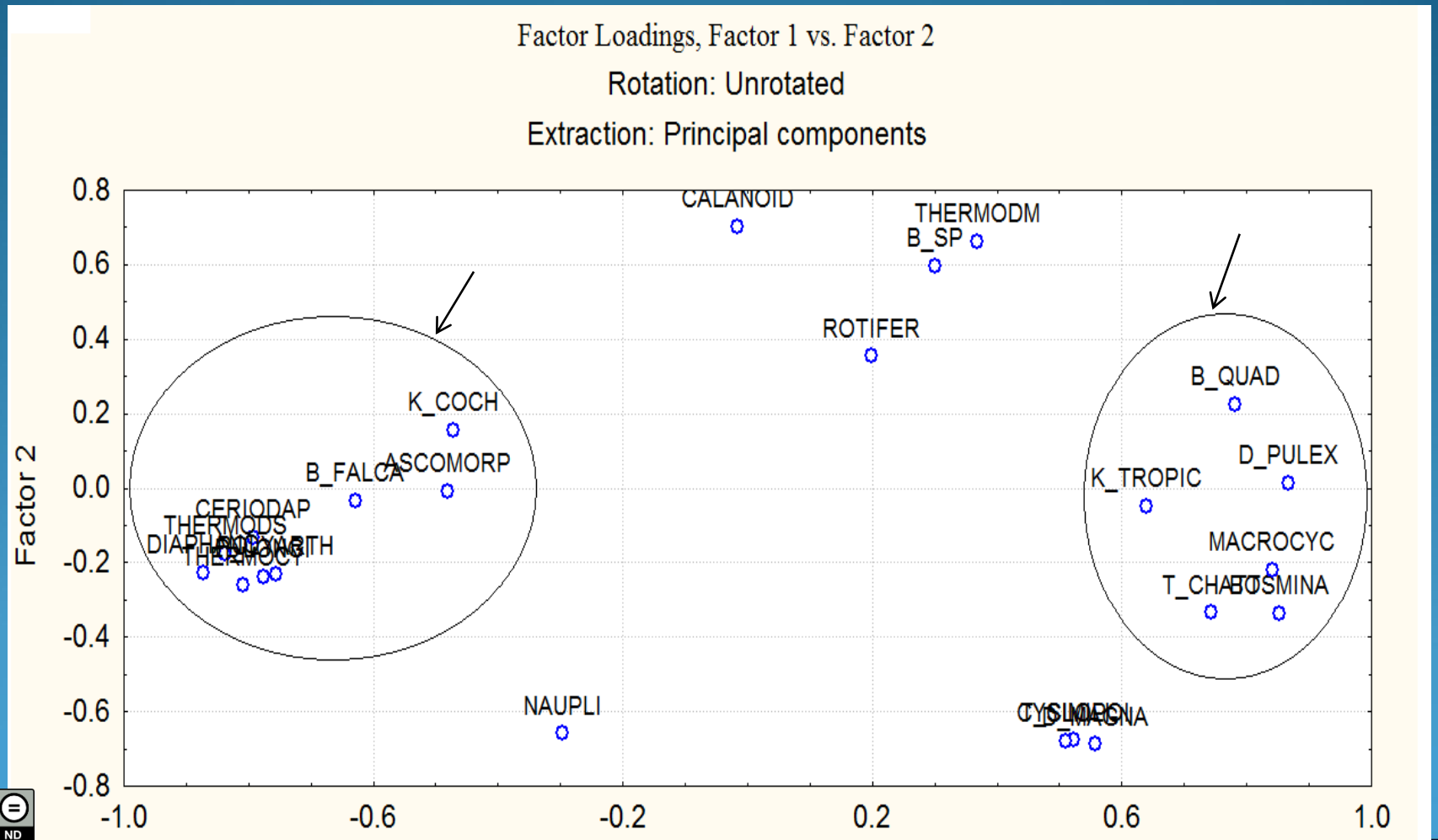
Destruction of aquatic habitats

Substrate structure: Nyaodza: 17 genera: 1987



View of same site 15 yrs later: 0 genera 2012

Figure 4-11: Principal component analysis of the species in Mazvikadei and Lake Chivero. Abbreviation of different taxa are Rotifer: unidentified rotifer; B_sp.: *Brachionus sp.*; B_quad: *Brachionus quadridentatus,* K_tropic*: Keratella tropica,* Macrocyc: *Macrocyclops albidus,* T_chatt*: Trichocerca chattoni,* Bosmina*: Bosmina longirostris*, D_pulex: *Daphnia pulex,* Calanoid:Calanoid copepodites, Naupli: Naupli, Themrmodm*:Thermodipatomus mixtus*, Thermods: *Thermodiaptomus syngenes,* Ascormorp: *Ascormorpha sp.*,Ceriodap: *Ceriodaphnia cornuta,* K_coch*:Keratella cochlearis, B_falca: Brachionus falcatus, Diaphano: Diaphanosoma excisum),D_magna:Daphnia magna, Cyclopoid: Cyclopoid copepodites.* Note that the



Wetlands (GOZ 5th CBD report)

•Most of Zimbabwe's wetlands (60%) fall within communal and resettlement areas and

•are prone to high levels of degradation

•The major causes of degradation are unsustainable human activities such as

• overgrazing,

•cultivation and the impact of climate change.

•Wetlands in urban areas are threatened by illegal housing construction, infrastructure development and informal agriculture

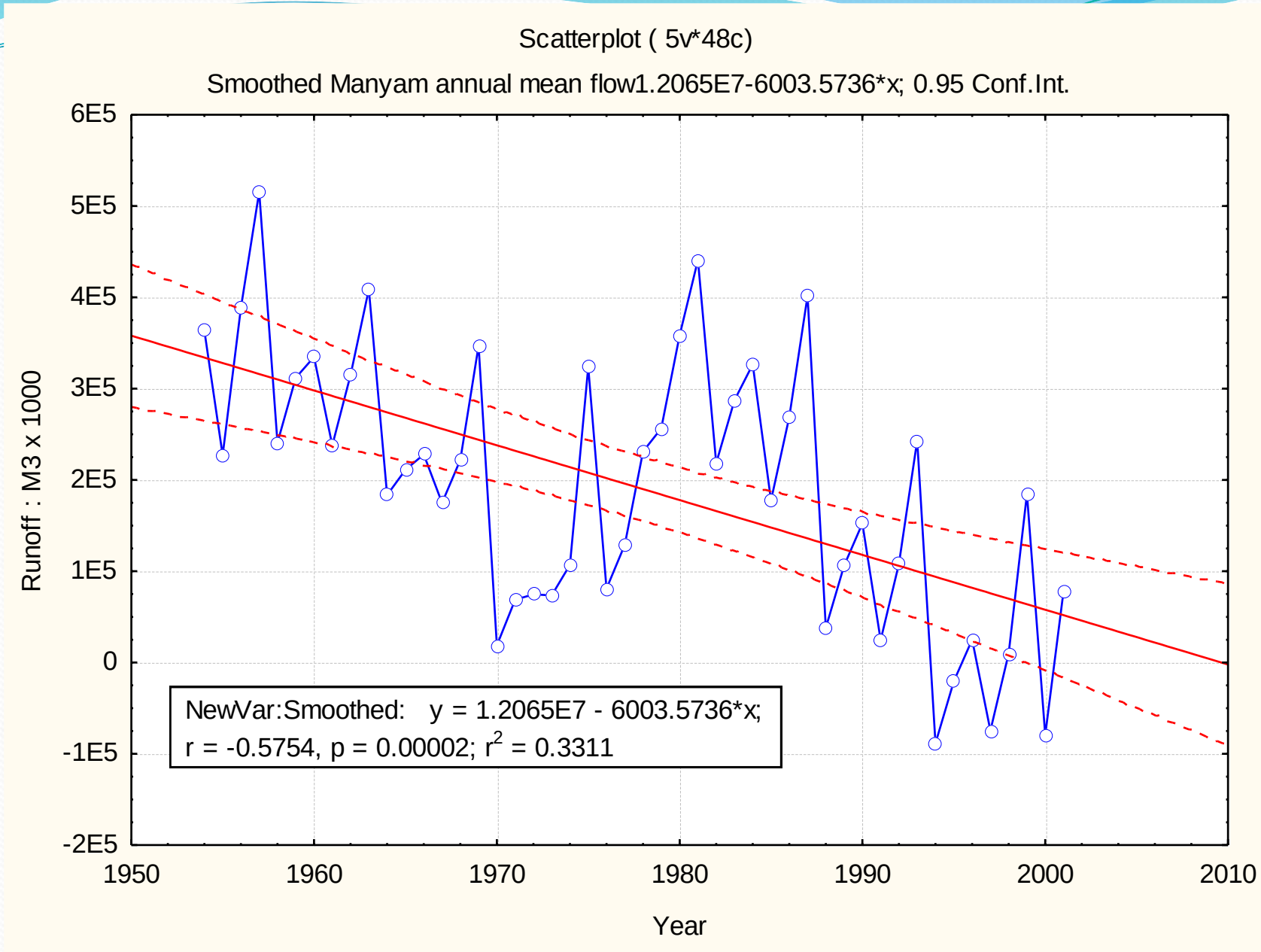
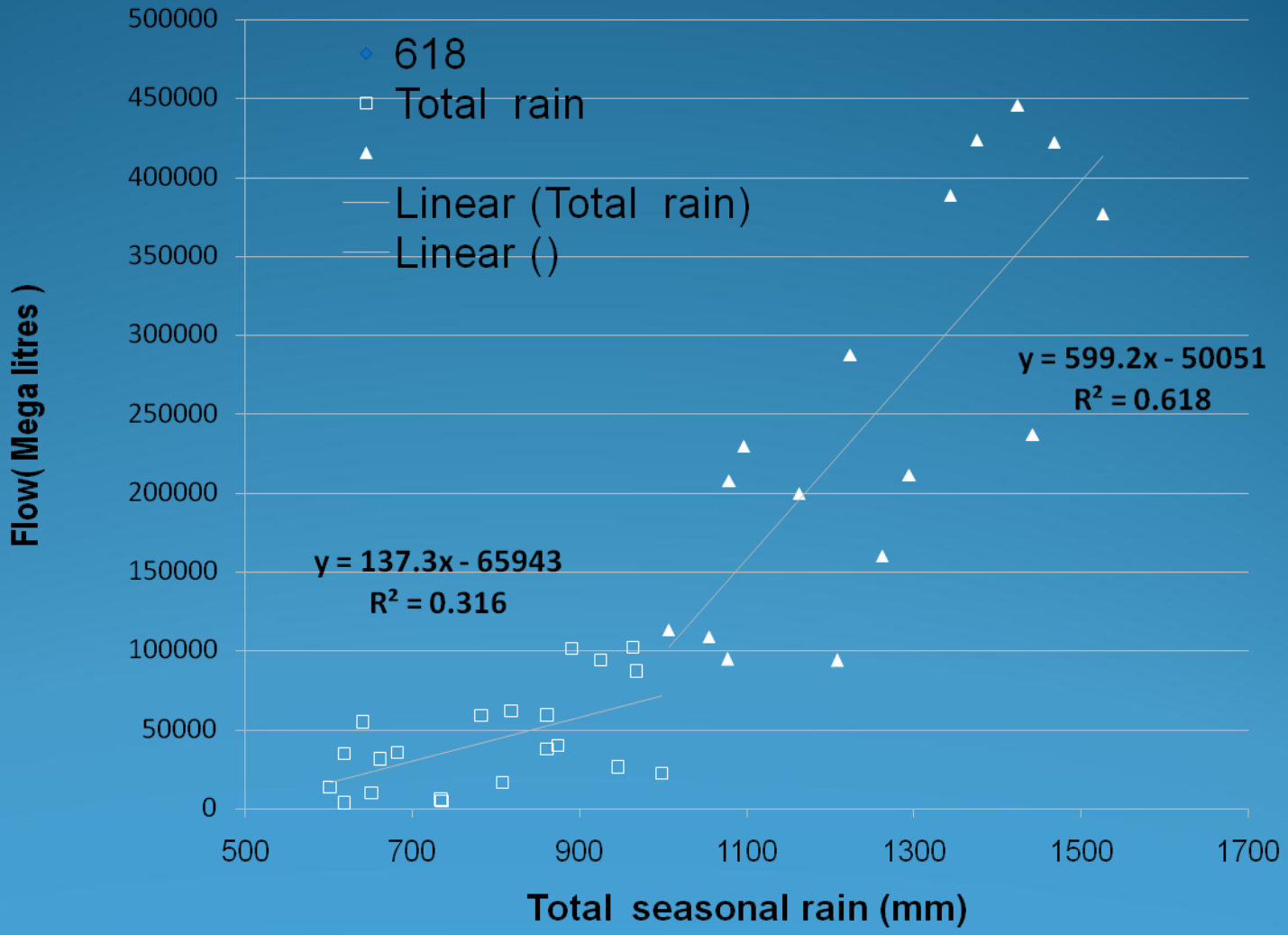

Scatterplot (5v*48c)
Smoothed Manyam annual mean flow1.2065E7-6003.5736*x; 0.95 Conf.Int.
Runoff : M3 x 1000
6E5
5E5
4E5
3E5
2E5
1E5
0
-1E5
-2E5
1950
1960
1970
1980
1990
2000
2010
Year
NewVar:Smoothed: y = 1.2065E7 - 6003.5736*x;
r = -0.5754, p = 0.00002; r2 = 0.3311

Fig. Rain vv Manyame River flow.

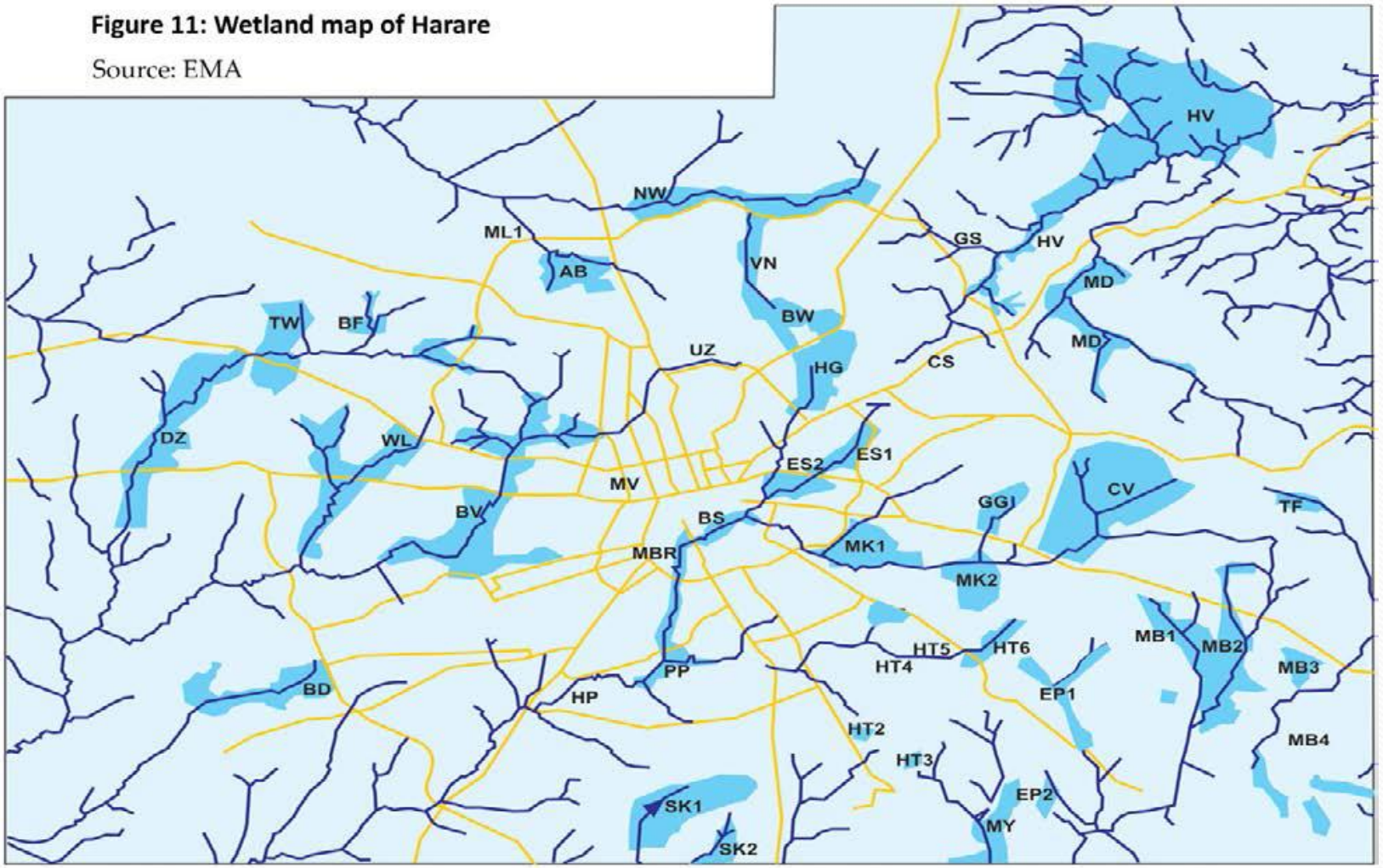


Seke Dam (Prince Edward) on 23 rd Feb 2013

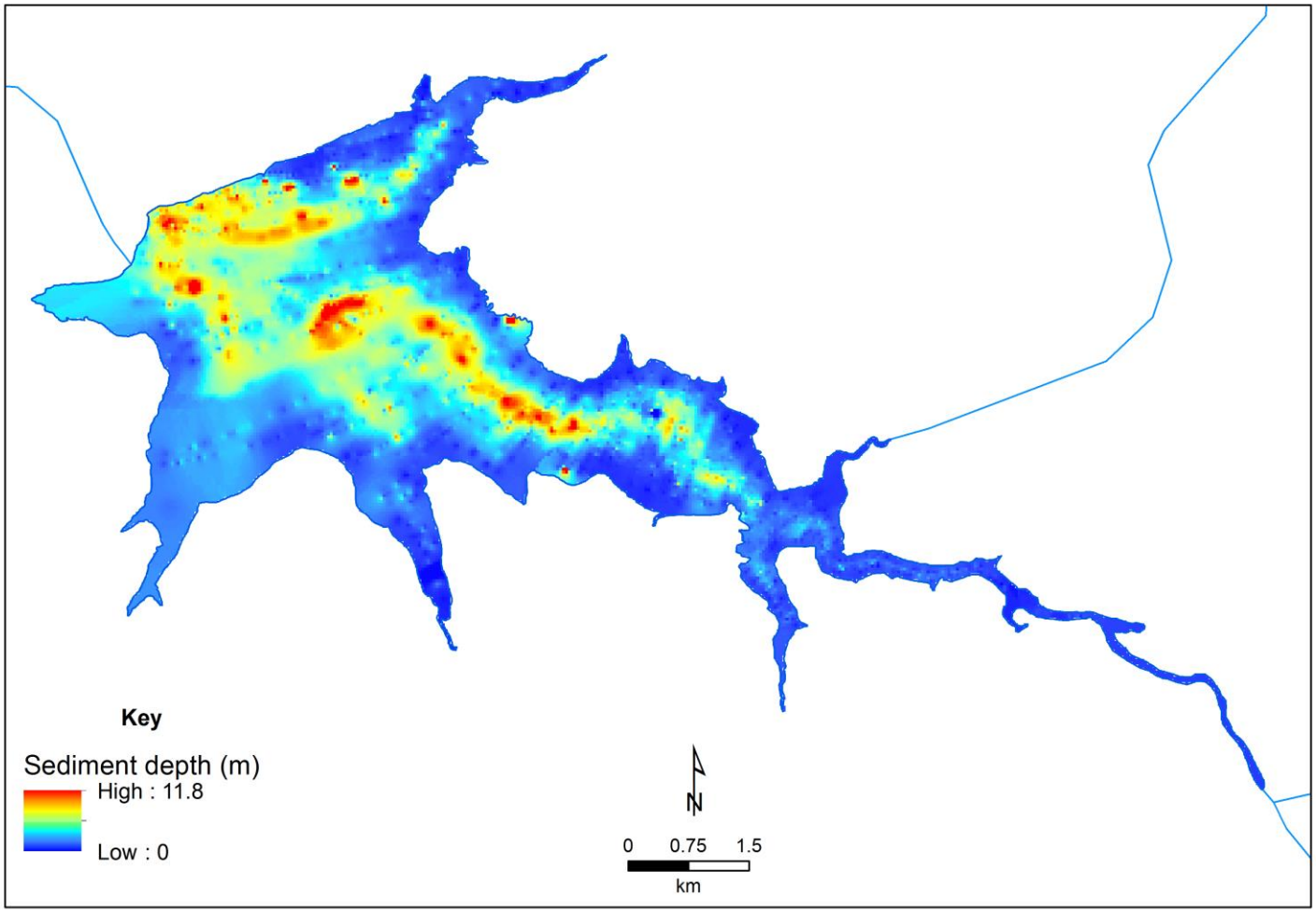
Wetlands of Harare

Figure 11: Wetland map of Harare

Source: EMA



Loss of storage in reservoirs. The map shows the distribution of sediments in Lake Chivero according to depth of sediments. Note that in many places the sediments are as much as 11m deep! (After Tendaupenyu P)



Cattle grazing on communal lands wetlands

An erosion terracec wetland caused by drying of: Chihota

A recent survey by EMA indicates that more than 75% of Zimbabwe's wetl ands are degraded.

Major trends in aquatic habitats

- Habitat destruction by siltation in all major rivers of the high veldt leading to restricted distribution of aquatic vertebrates (fishes, reptiles (crocodiles monitor lizards, Hippopotamus, otters etc)
- Disappearance of benthic macroinvertebrates in Lake Chivero (P Tendaupenyu)
- Local extinction of *Hydrocynus vittatus, Labeo altivelis, Orochromis andersoni* in Lake Chivero due to anoxia
- Replacement of green algae by cyanobacteria
- Local extinction of *Anhinga. rufa. rufa* from L Chivero due to gillnet fishing
- Climate induced changes in phytoplankton species, leading to near extinction of entomostraca zooplankton in L. Kariba.

Policy contradictions

- Wetland cultivation and management

- Dambos, the most common type of wetland in Zimbabwe occupy between 3 and 4 percent of the land area

- Wetland cultivation has been discouraged or even prohibited since colonial times

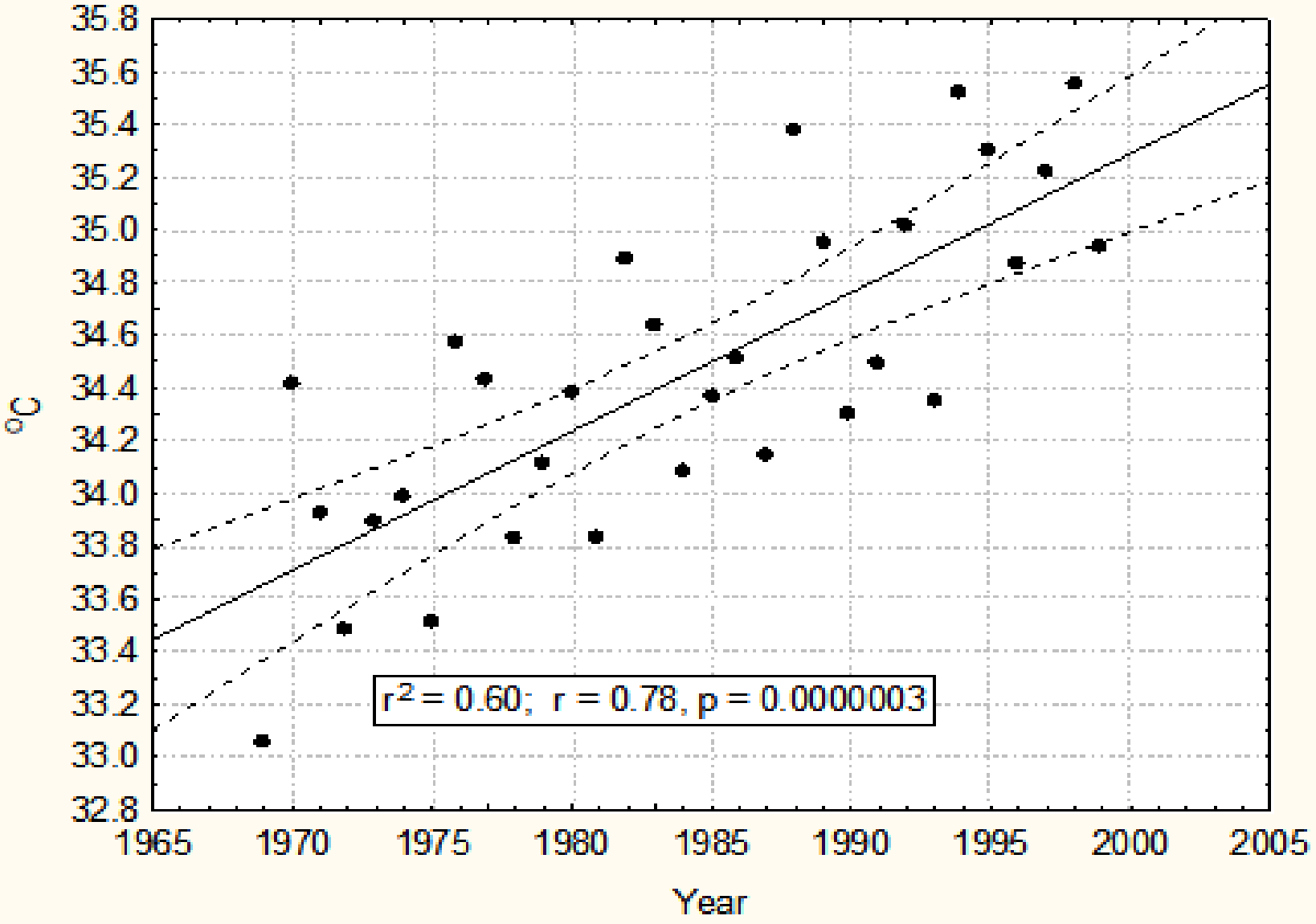
- Presently, a permit is needed to cultivate wetlands and stream banks.

- However, there are several advantages of wetland agriculture, including dry-season cropping, the possibility of early planting and double cropping

- The presence of shallow groundwater provides an opportunity of supplementary irrigation of high value crop
- Ref
- CLIMATE-SMART AGRICULTURAL SMALLHOLDER PRODUCTION IN ZIMBABWE

Climate related changes in L. Kariba

Fig. 1A. Mean maximum temperature (SON); Kariba



Limnothrissa catch vv lake temperature

$\ln y = a + bx + cx^2$

r^2=0.95314141 DF Adj r^2=0.94702942 FitStdErr=2098.946 Fstat=244.08963

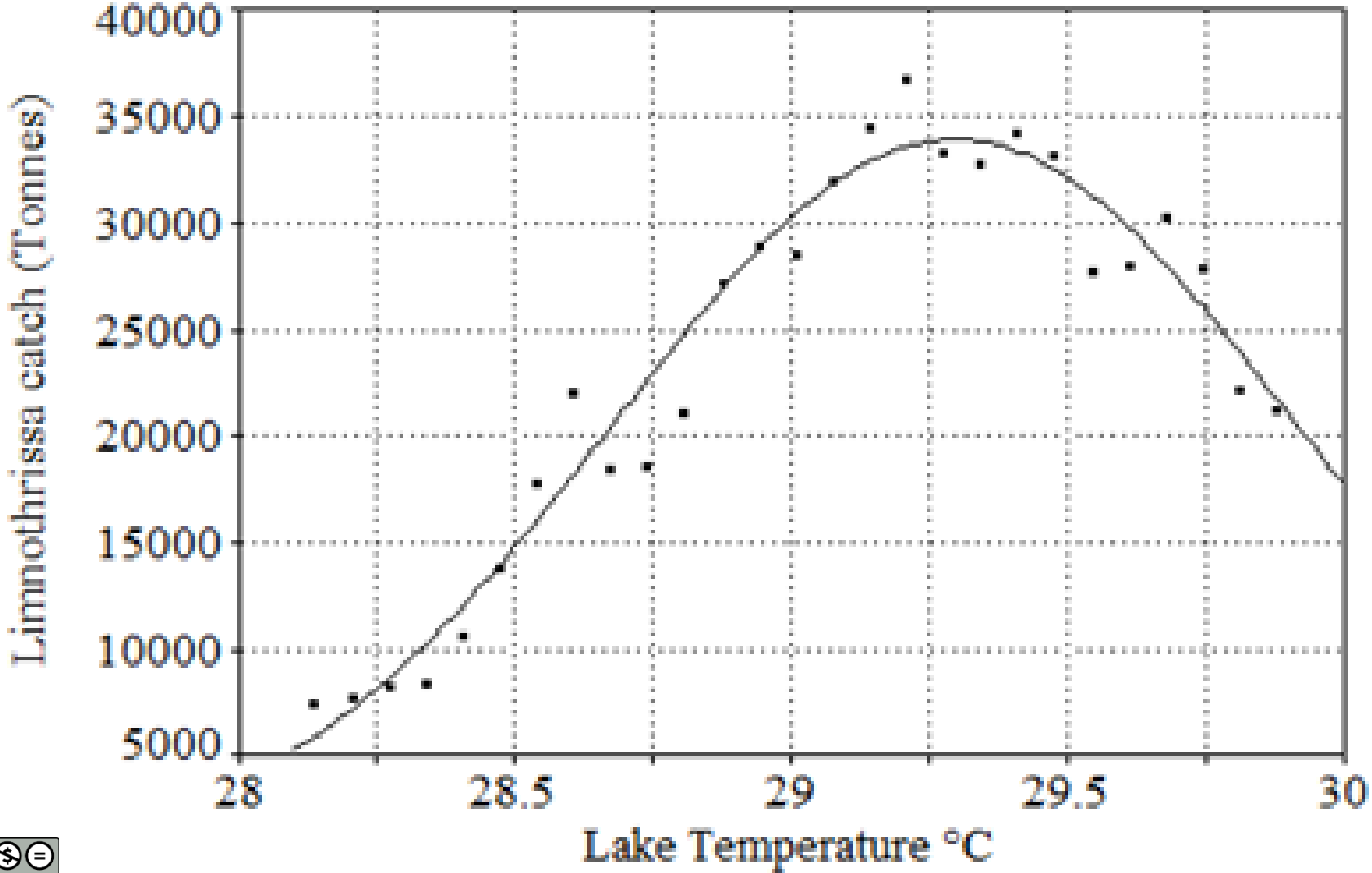


Table 3. Piecewise linear regression analysis of exponentially smoothed precipitation against time in Zambezi valley stations

	Before breakpoint		After breakpoint			%Variance
Station	Const.B1	Smoothed 1	Const.B2	Smoothed 2	Breakpt.	
Binga	1943	0.037	2019	-0.035	1982.5	80
Kariba	1947	0.035	2019	-0.033	1984.5	88
Gwembe	1927	0.039	2025	-0.047	1974	83
Rukomechi	1936	0.049	2024	-0.042	1983	78

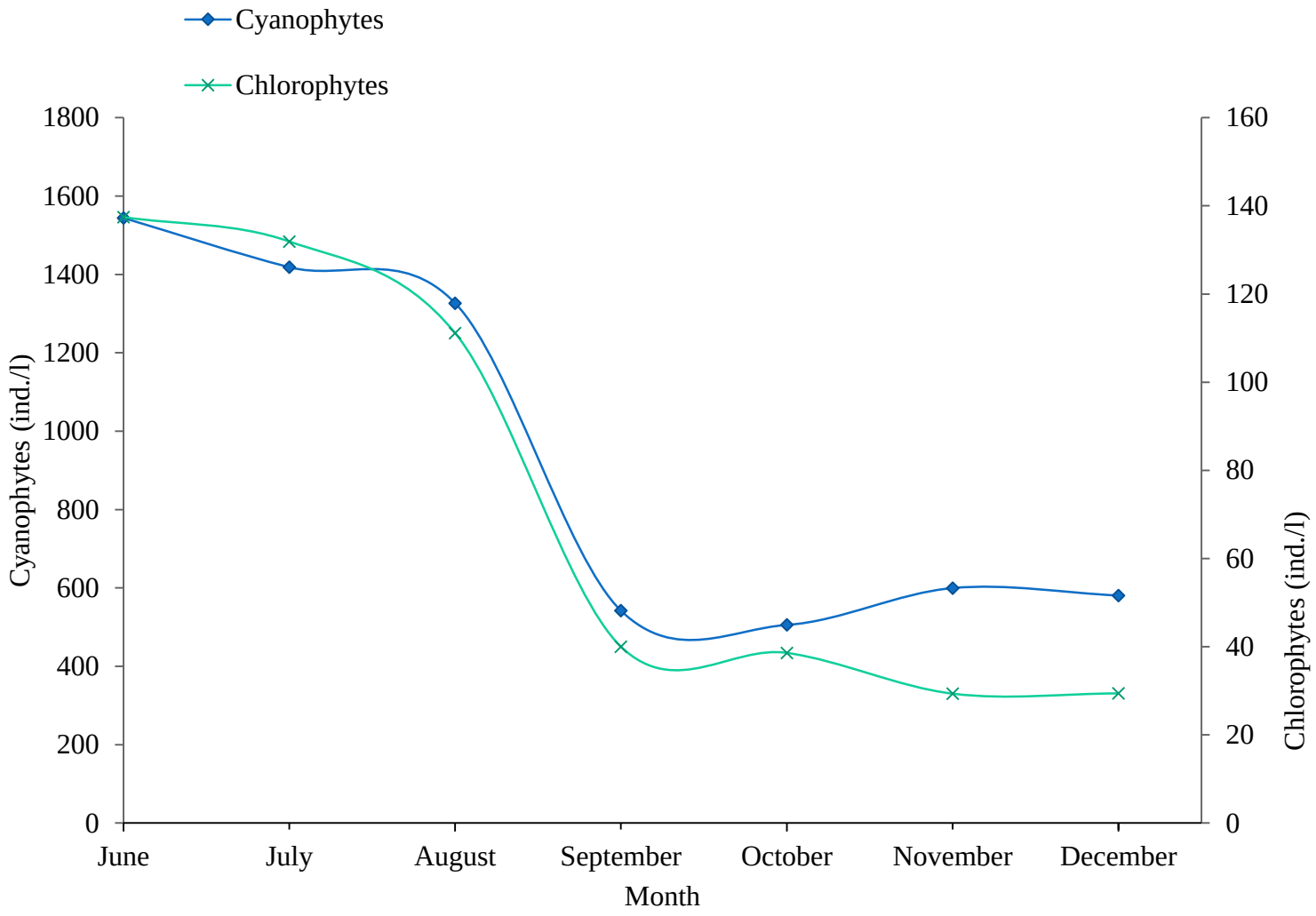
Table 2. Mean seasonal decadal warming rates and absolute warming since 1965; Kariba met station data.

Warming rate, L. Kariba: data Met Department Magadza (2011)

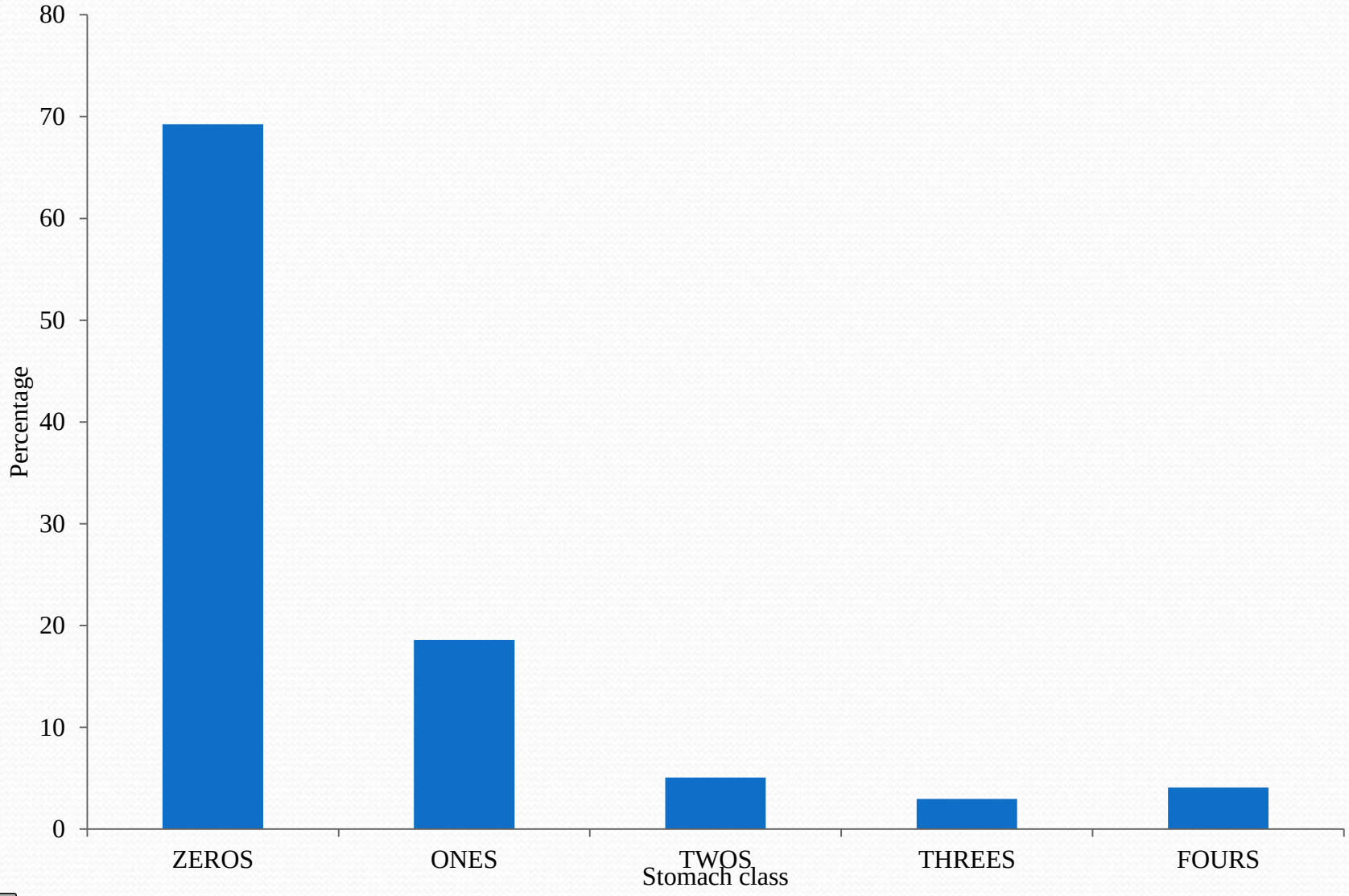
	DJF		MAM		JJA		SON		Annual mean
	Max.	Min	Max	Min	Max	Min	Max	Min	
Rate/decade	0.75	0.34	0.65	0.50	0.46	0.42	0.52	0.44	0.51
S.E.	0.047	0.02	0.013	0.04	0.04	0.04	0.04	0.03	0.046
Mean observed warming (1965 - 2000) ºC	2.1	1.2	2.3	1.52	1.57	1.5	1.85	1.55	1.7

Table 5. Piecewise regression of *Limnothrissa* catches vv air temperature, and catches with time

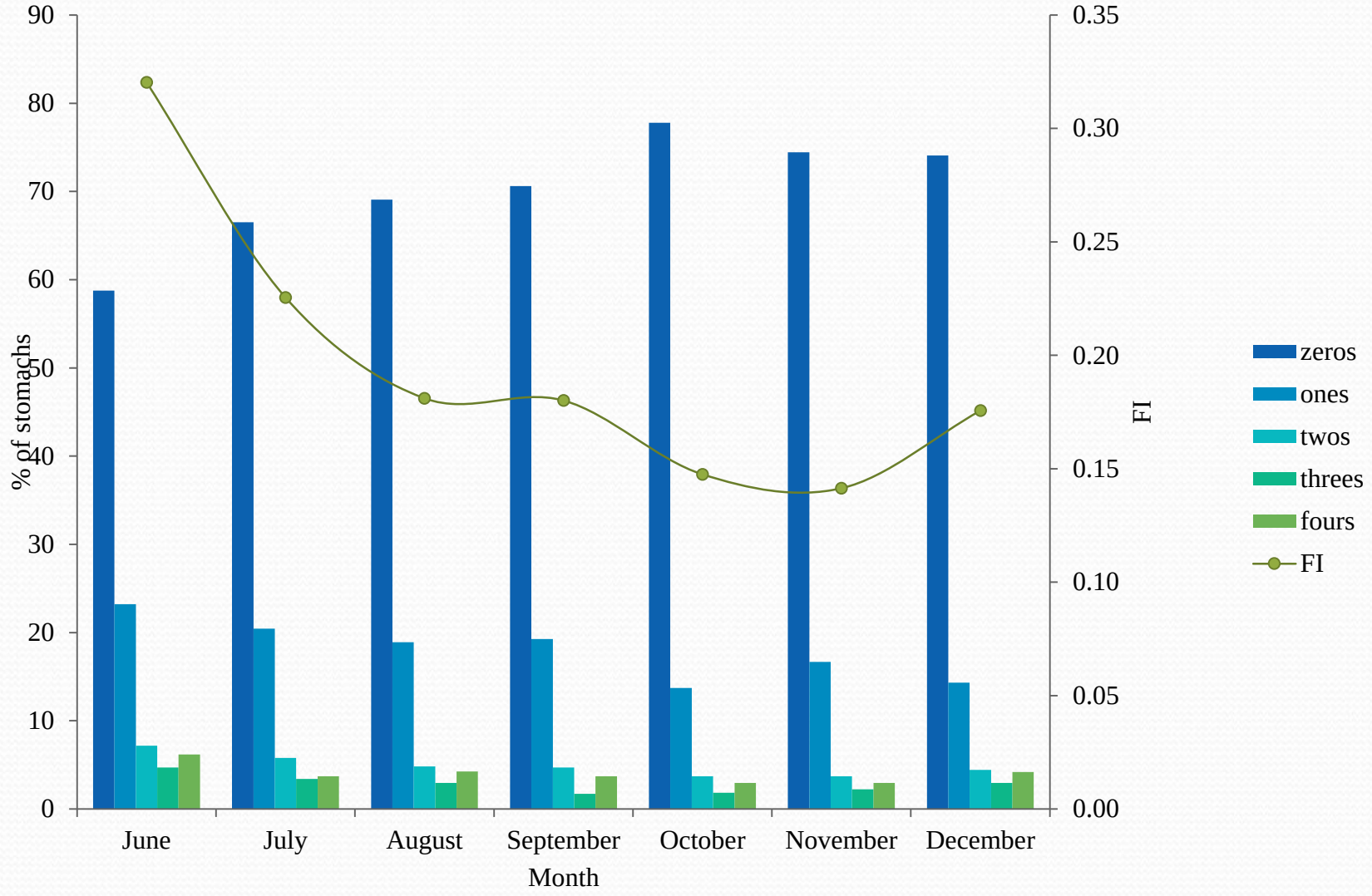
	Before breakpoint		Post breakpoint			
Regression	**Bo1**	**Catch**	**Bo2**	**Catch**	**Breakpoint**	**Variance explained**
Air temperature	**34.07**	**0.000035**	**33.9**	**0.00066**	**34.84**	**98%**
Time	**1971.18**	**0.0059**	**2014.5**	**-0.000077**	**1988.2**	**97.45%**


Cyanophytes
Chlorophytes
1800
1600
1400
1200
1000
800
600
400
200
0
Cyanophytes (ind./l)
160
140
120
100
80
60
40
20
0
Chlorophytes (ind./l)
June
July
August
September
October
November
December
Month

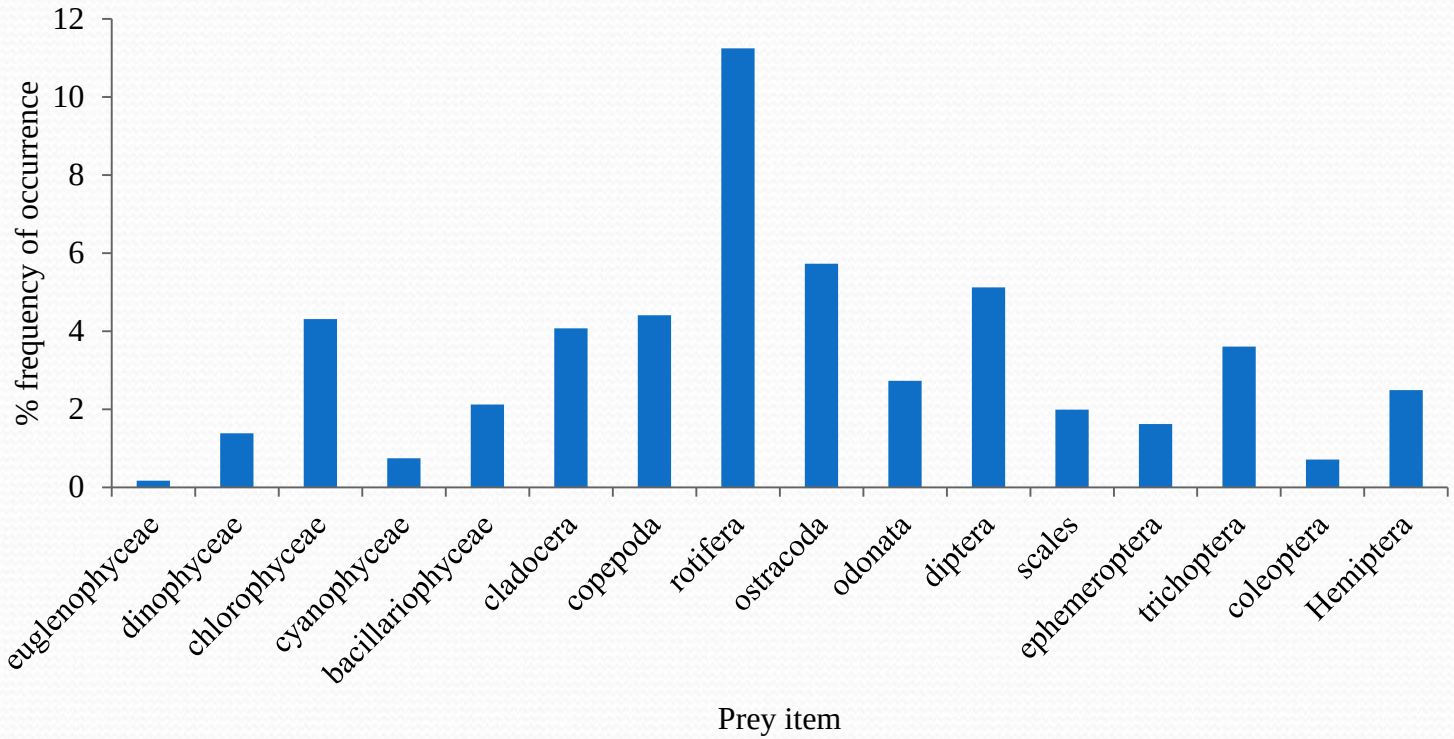
Repleteness of Limnothrissa miodon in Kariba, 2015 (Madzinzura 2016)



Stomach fullness in Limnothrissa in L Kariba (Madziwanzira 2016)



Diet composition of *L. miodon* in L Kariba.



Comparison of zooplankton composition: Lake Kariba 1991 and 2016

	Masundire 1991	Madziwanzira 2016
Rotifers	52	16
Cladocera	9	3
Copepoda: Cyclopoida	6	3
Copepoda: Calanoida	3	1
Hydrozoa	1	0
Insecta: Cahoborus	1	0
Total	72	23

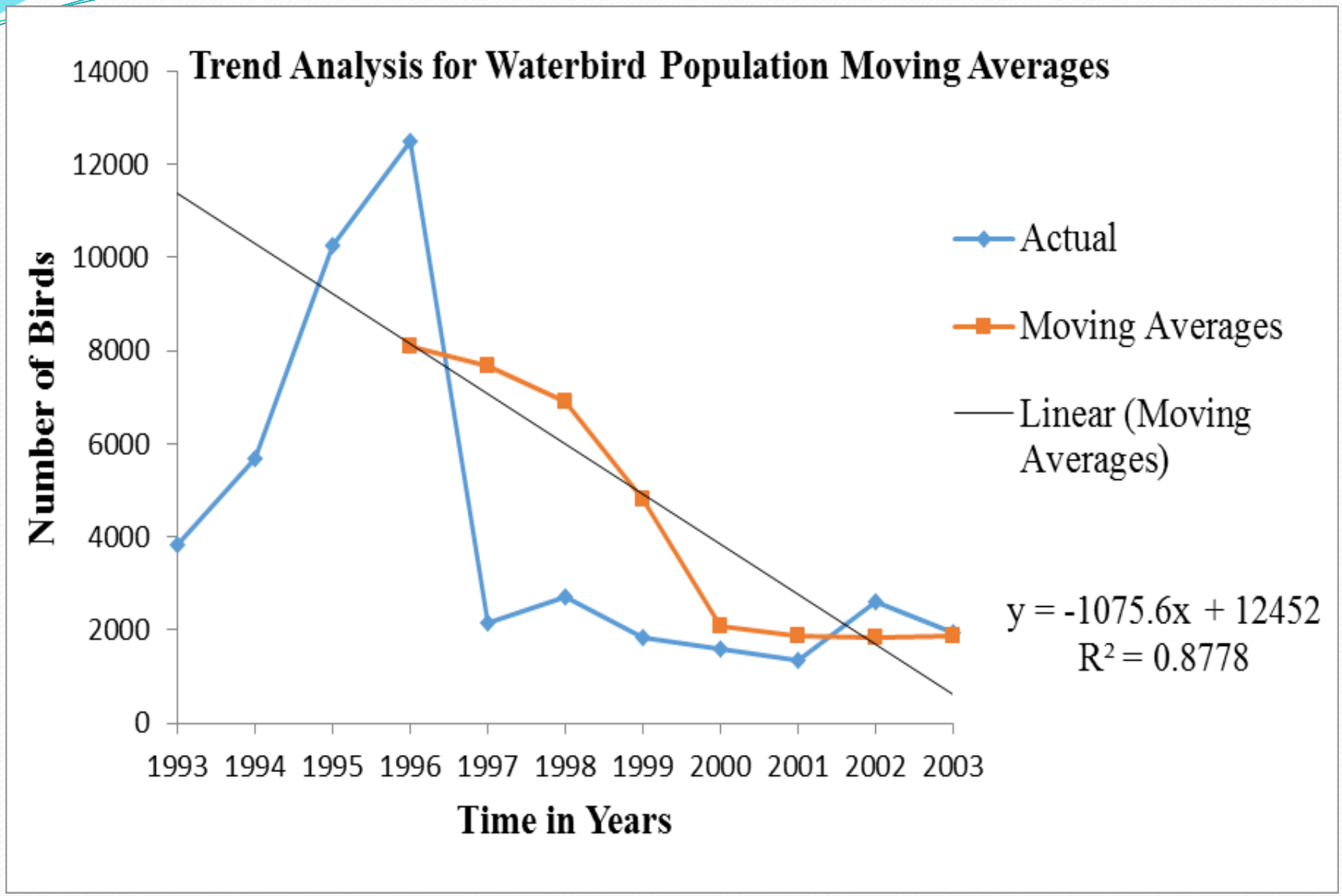
Avifauna

Avifaunal biodiversity: **Zimbabwe's Fifth National Report to the Convention on Biodiversity** *GOZ, Ministry of Environment, water and climate:*

- Zimbabwe has 20 Important Bird Areas (IBAs) covering 30,050 square kilometres, which is 7.7% of the total surface area. Eleven of these IBAs are in protected areas.

- The number of endangered species has increased from two in 2010 to four in 2014, while the white-winged flufftail (*Sarothrura ayresi)* is critically endangered and may be on the brink of extinction

Impact of gill netting on waterfowl population (Dhliwayo 2016)



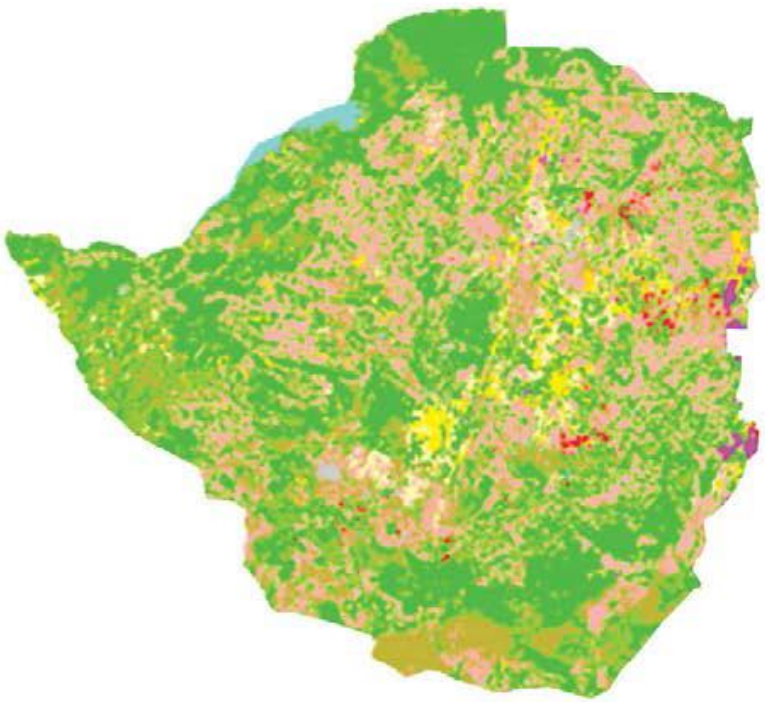
Command Fisheries

- In the 2016 2017 agriculture season the state introduce "command agriculture"
- Framers followed a prescribed programme of farming activities and were advised what crops to plant. The programme improved the yields
- Buoyed by this the state has now introduced "command fisheries". Every reservoir in Zimbabwe will be stoked with *Oriochromis nilotica*, the Nile tilapia.
- The consequences of this on aquatic avifauna is likely to be an extension of the impacts on Lake Chivero throughout the whole country.

Table 1 : Species Richness (S) of aquatic avifauna in the three sections of the Zambezi Valley in July, August and October 2014 and 2015 (Gamundani)

Section	Month	Species Richness (S)	
		2014	2015
1. Kariba	July	19	18
	August	20	19
	October	23	23
1. Upper Zambezi	July	13	15
	August	14	21
	October	18	17
1. Lower mid-Zambezi	July	27	25
	August	25	27
	October	30	32

Changes in woodland cover and associated land use



	1992	2008
Forest plantations	0.4%	0.43%
Woodland	53.2%	42.34%
Bush land	12.72%	10.82%
Wooded grassland	3.08%	2.27%

	1992	2008
Grassland	1.76%	1.23%
Cultivation	27.48%	41.24%
Rock outcrop & mine dump	0.2%	0.93%
Settlement	0.36%	1.46%

Table 3: Areas under various land uses in Zimbabwe

Forest cover type	Hectares	Total
Moist montane forests	11,508	0.03
Plantations	168,581	0.43
Woodlands	16,542,210	42.34
Bush land	4,228,547	10.82
Wooded grassland	888,463	2.27
Grasslands	479,883	1.23
Cultivated land	16,113,866	41.24
Settlements (including cities)	180,904	0.46
Other (rock outcrops & water bodies)	462,051	1.18
TOTAL	**39,076,013**	**100**

Source: Forestry Commission Mapping and Inventory Unit 2008

Large mammals

Table 2 : Levels of animal poaching reported in ZPWMA annual reports

Species	2009	2010	2011	2012	Total loss	Unit value	Cumulative loss over four years
Elephant	145	77	223	*212*	657	$50,000	$32,850,000
Buffalo	91	88	68	*46*	293	$9,000	$2,637,000
Impala	73	-		106	179	$1,000	$179,000
Kudu	56	63	58	74	251	$2,500	$627,500
Zebra	42	20	48	36	146	$3,000	$438,000
Rhino	27	22	33	8	90	$120,000	$10,800,000
LOSS	**$11,648,000**	**$7,499,500**	**$16,011,000**	**$12,373,000**	-	-	**$47,531,500**

Source: ZPWMA ($ values based on Statutory Instrument 56 Schedule of Species)

Special cases under existential threats

Lycaon pictus

Lycaon pictus: info source Dr G. Rasmussen, and other sources.

- Previously wide spread in sub-Sahara Africa
- Practically extinct in West Africa
- Needs a large home range
- Was widely traditionally persecuted due to belief that they were vermin
- Now exists in populations of a few hundreds in “stronghold” localities in few protected areas.
- Medium sized p-predator; unable, individually. To defend themselves from larger predators
- Needs woodland shelter to hunt unnoticed by hyenas or lions
- Den disturbance by tourists Causing defective pups due to inadequate feeding by mothers shying away fro tourist den watchers.
- This results in reduced ability to hunt, due to shortened hind lags.
- Woodland degradation seen in previous slide renders these animals vulnerable
- Now included in endangered specie in Zimbabwe.
- Zambia and Mozambique appear to be sinks for the Zambezi valley painted dog population

Wild fires distribution

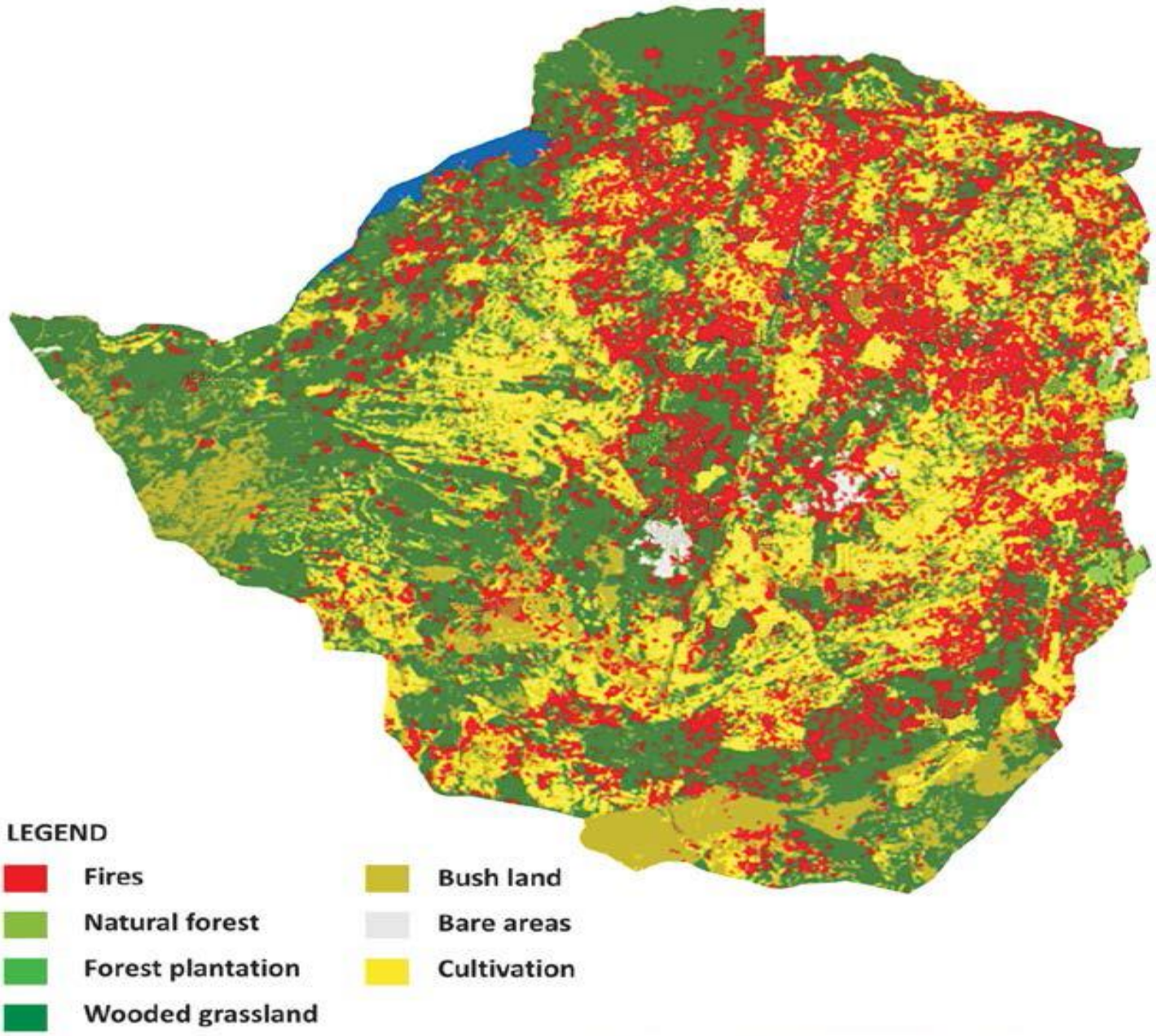
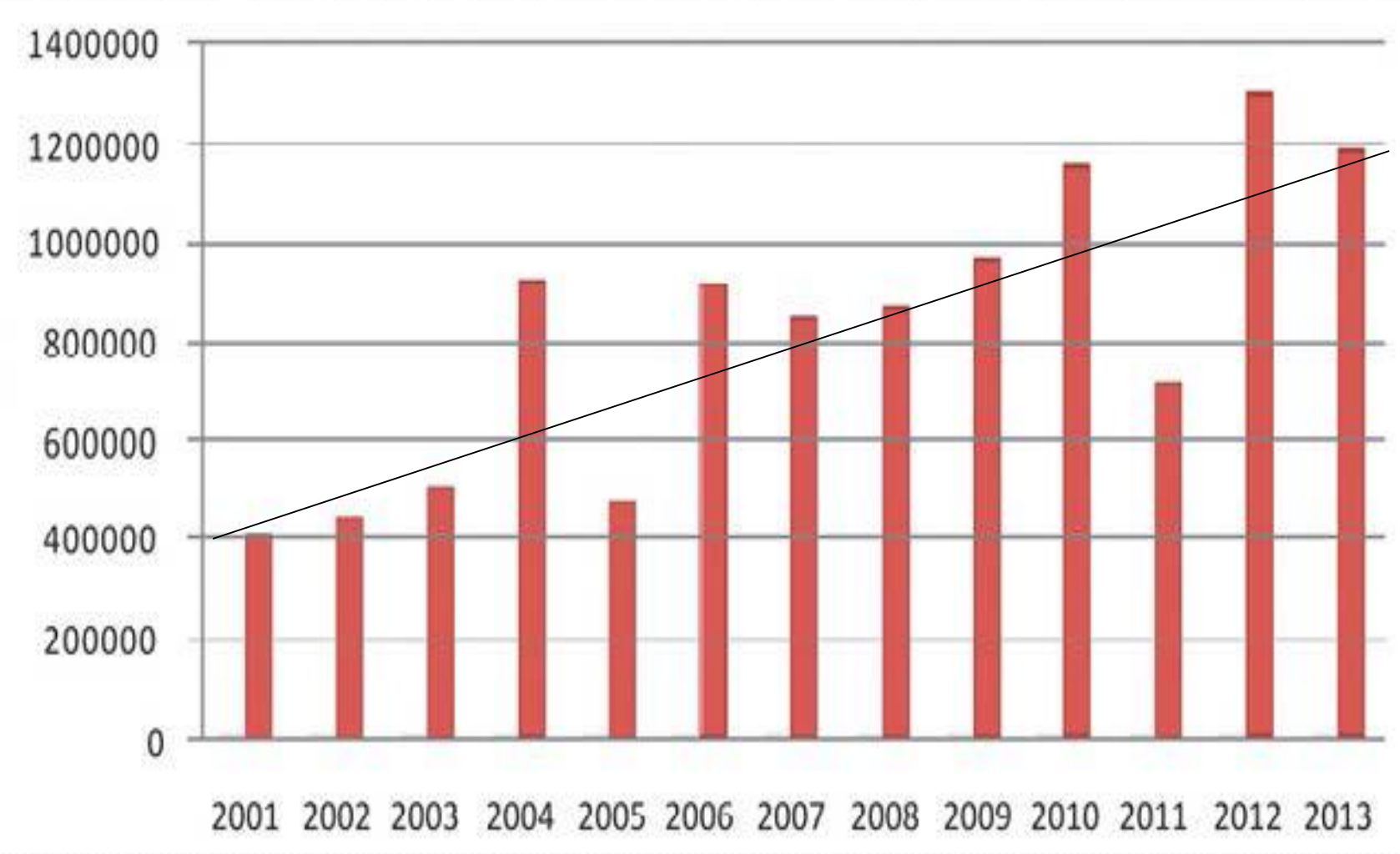


Figure 19: Veldt fire incidence 2000-2013 (hectares)



Conclusion

- The few examples of research relevant to biodiversity strongly suggest that there are sectors are undergoing negative changes due both to climate and human influence.....

- But
- The most serious threat to biodiversity are the insidious processes of landscape degradation that while obvious, yet are ignored by both Society and State
- The impacts of these will be felt in a much shorter time horizon than those of climate change.