

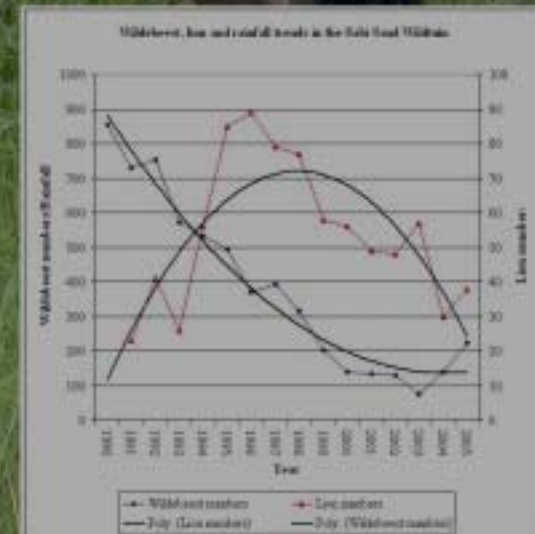


An important threshold exceeded

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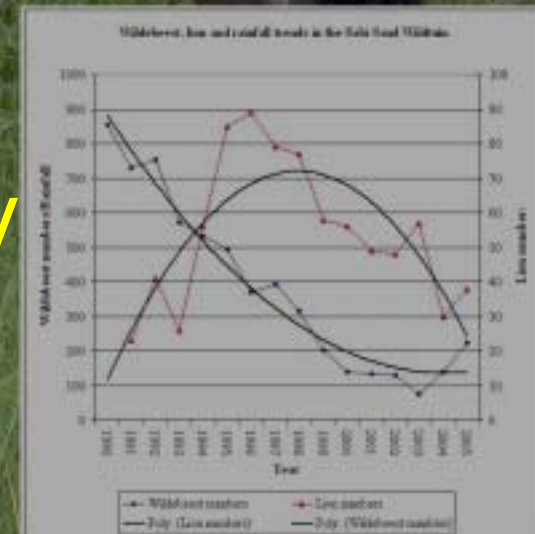
Thresholds, Order-of-magnitude and Sustainability in African savannas

Mike Peel, Harry Biggs, Pete Zacharias & Rina Grant



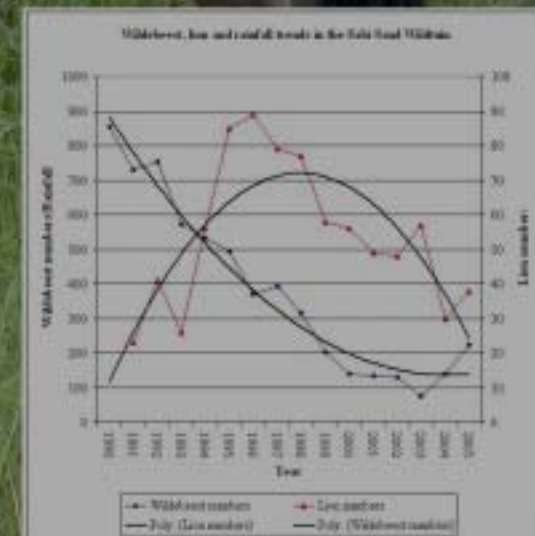
Introduction

- Proactive management
- Strategic Adaptive Management (SAM)
- Thresholds of Potential Concern (TPC)
- Savanna ecosystems
- Small/intermediate size properties
- Management challenges
- Sustainability above biodiversity



Introduction

- Wildebeest
- Monitoring/research – management
- Potential – integrate TPC's – order-of-magnitude and sustainability

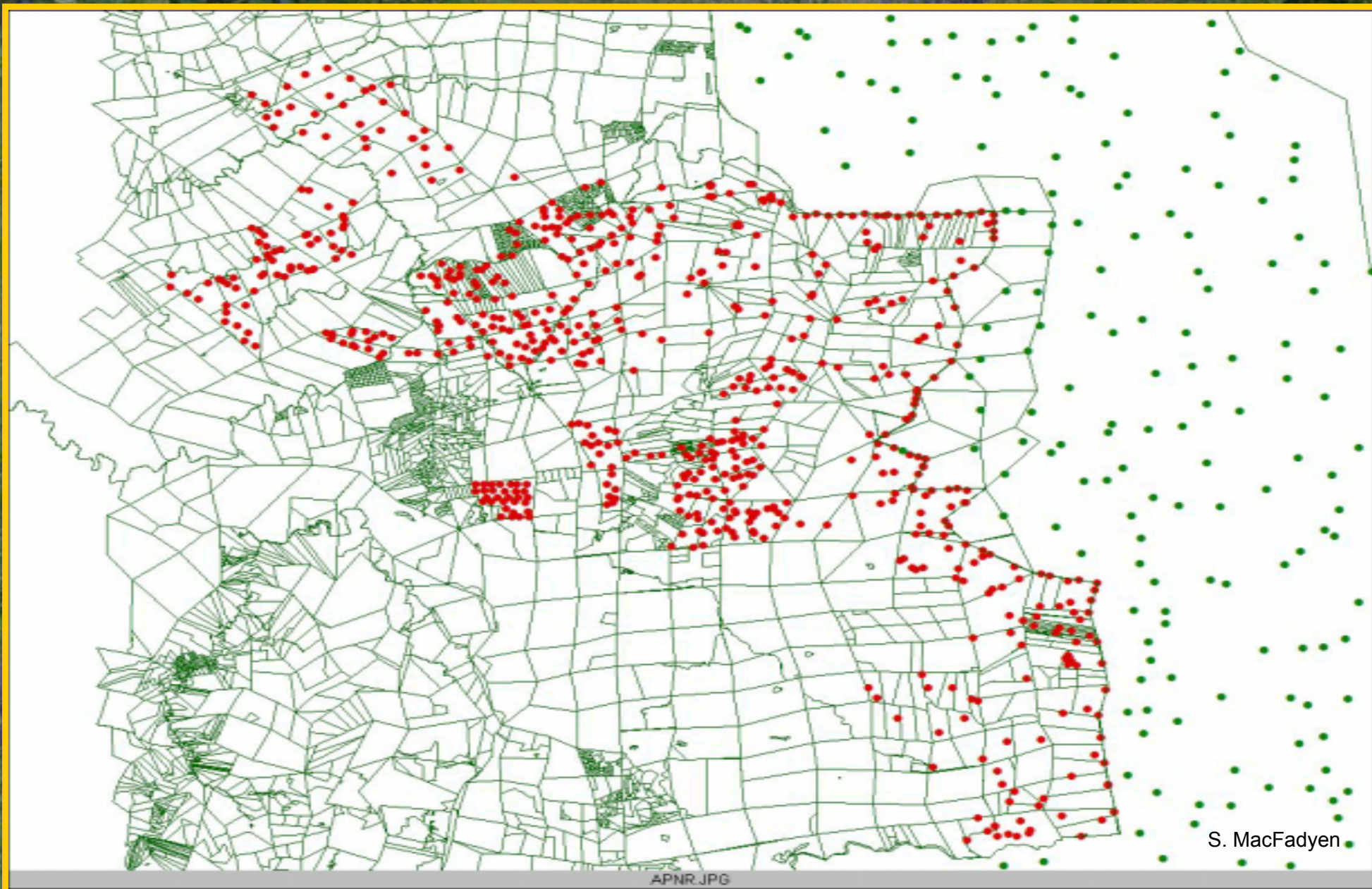


Approach

- Value and costs of wildlife
- Vegetation types - ecological potential
- Review models – stocking densities
- Management regimes – spatial scales
- Predictive understanding - vegetation – dynamics - **Proactive management**



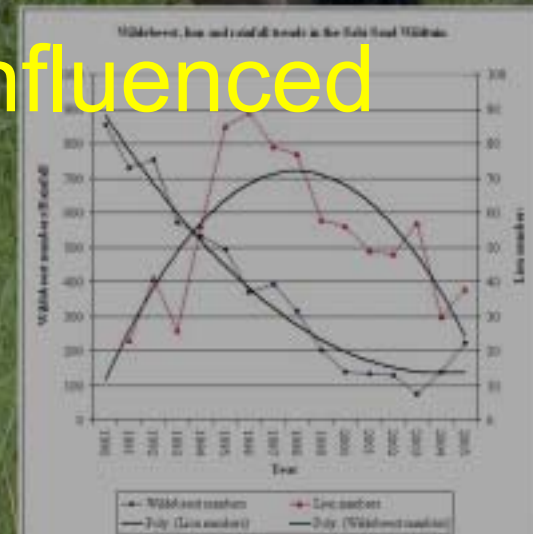
The study area



Legend:
- Wildland markers
- July (Low marker)
- July (Wildland marker)
- Low marker
- July (Wildland marker)

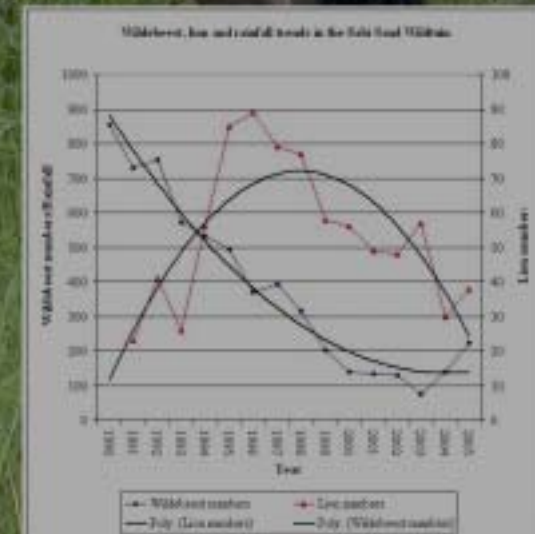
Order-of-magnitude - Sustainability

- Order-of-magnitude – OOM
- System levels – balance – rate of production – service – rate of loss
- Sustainability – environment – based - predictability – affirmed or denied – organisation of environment – influenced by man



Sustainability

- Technology – benefits – cost - diminishing return – negative > positive
- Old solutions often prevail – break even - environmental degradation – limit land-use options – reduction – ecosystem services



Research-monitoring-management

Research

$869 \div 24\% + \Omega - \Sigma$ [wildebeest legs/4]

$+ \Pi \Rightarrow 626 \sqrt{8} \div 11 \geq 1911 \times 36 \times 11 \div 26 \times \Sigma$

[birthdate/2] \leftrightarrow zebra numbers

1962 α β [buffalo calves]

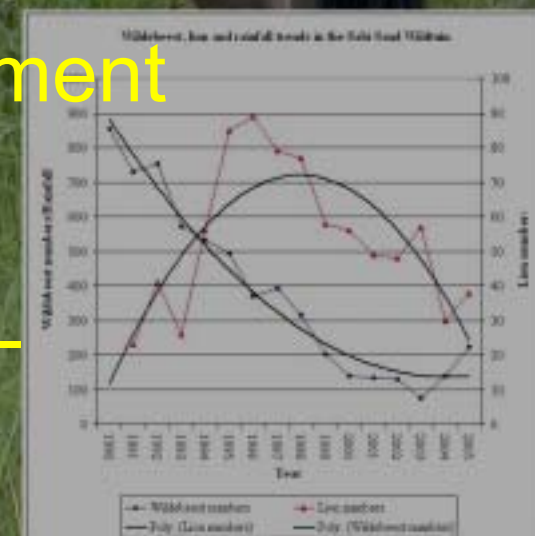
$\chi^2 \Psi$: [giraffe survival]

$\cong 8 = 10^2 < 46 \text{ km}^2 > 1846 = \text{Cull}$



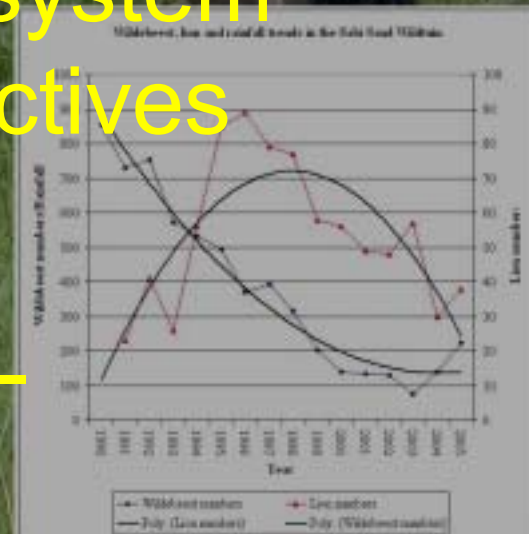
Thresholds of Potential Concern

- SAM – strong goal setting – developed objectives – endpoints – TPC's
- TPC's define - Spatio-temporal heterogeneity – area managed – essential connecting
 - Research – Monitoring - Management
- Upper/lower limits – indicators – continuum change



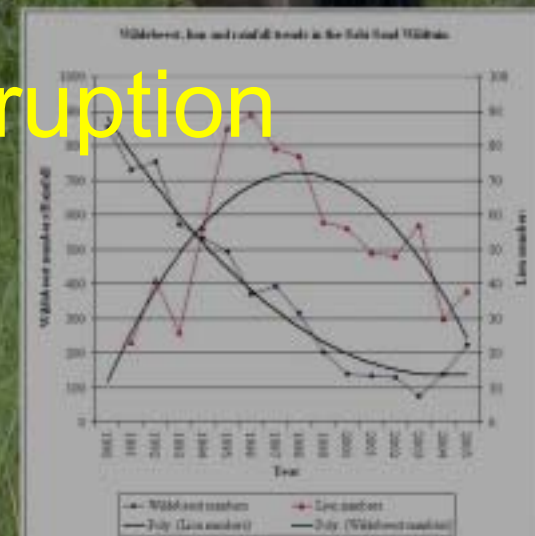
Thresholds of Potential Concern

- TPC – envelope – flux acceptable - manager's/scientists – vision/objectives
- TPC width – risk
- Management – administered – system state – acceptable range – objectives
- Operationalising TPC's – OOM – Sustainability



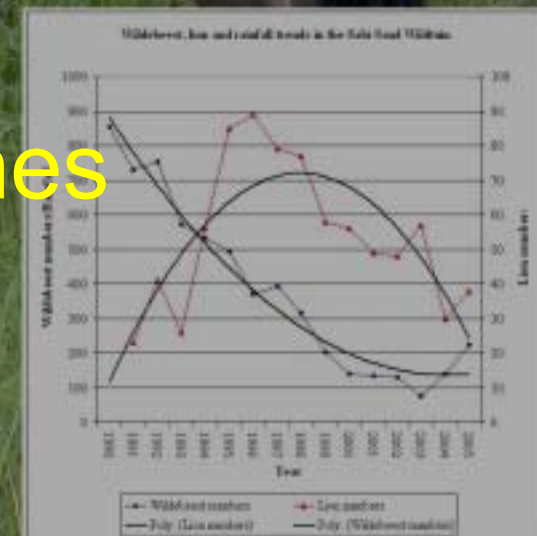
Order-of-magnitude

- Throughput (T) and Perturbation (P) – estimated – one order-of magnitude – wildebeest numbers
- $P \geq T$ – disrupt – supply
- $P < T$ but $> 10\%T$ – possible disruption
- $P < 0.1T$ – unlikely - disruption



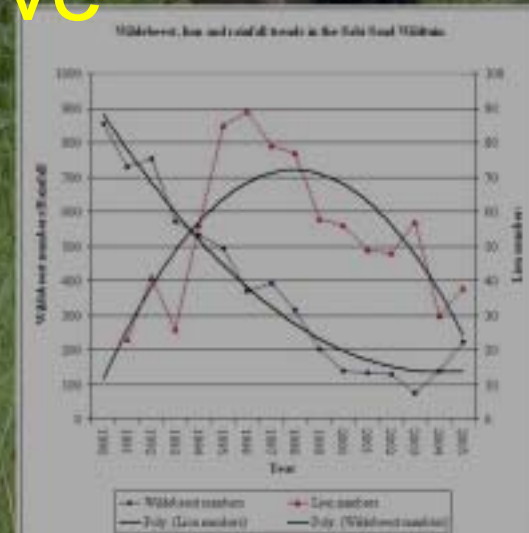
Results – Order-of-magnitude

- Approach useful – extreme cases
- Sensitive – over a number of years – less so – annual basis – minimum period – management decisions are made
- Miss the start of dramatic declines
- Delay in management



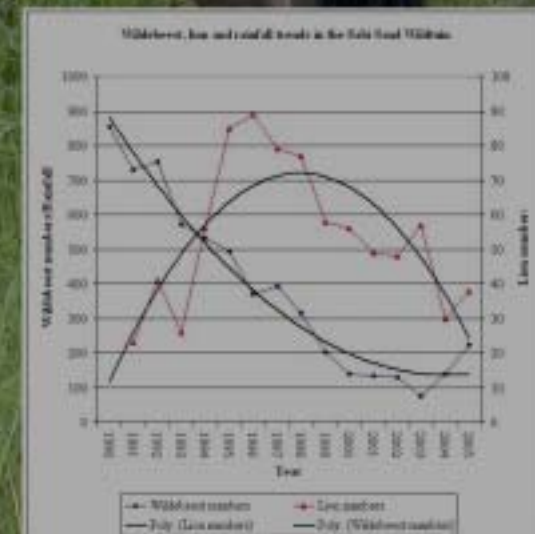
Sustainability

- Important - Independent of objectives
- Negative – use less – pay more
- Alternative – maintain contexts - produce goods/services – achieve objectives – acceptable cost
- For as long as needed



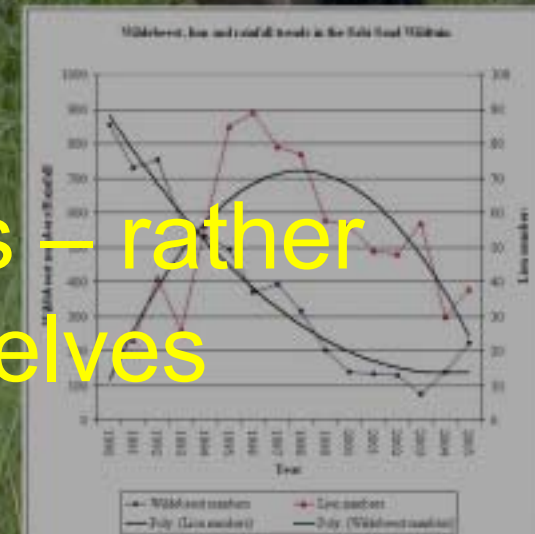
Sustainability

- Multi-faceted – social/economic/environment – objectives – manage:
 - Productive systems – rather than outputs
 - Systems – managing contexts
 - Identify – dysfunctional systems lack – supply
 - Ecological processes – subsidise management
 - Understand – diminishing returns



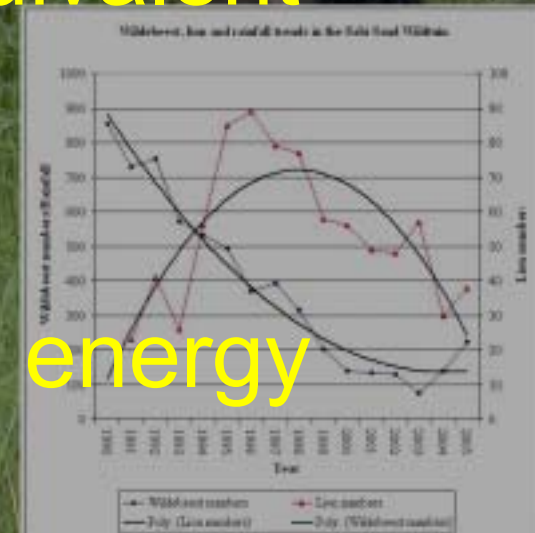
Sustainability

- System knowledge – high quality – current – quick response – management - financial – human values – ecological
- Prediction – difficult – exploratory – reduction – holism
- Management – produce outputs – rather than manage for outputs themselves



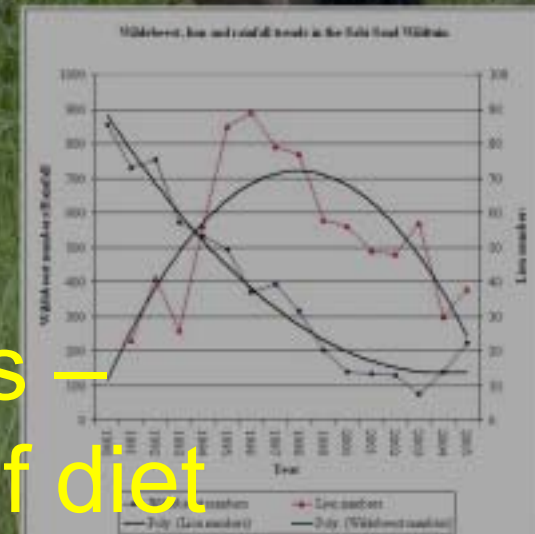
Sustainability

- Stabilisation – blue wildebeest metabolism – loop of useful energy (stable/growing population) – stabilises the input (number entering system)
- Process – represented spatial/temporal scales - loop analysis – non-equivalent domains
- Wildebeest – stabilisation – two energy forms - chemical - survival



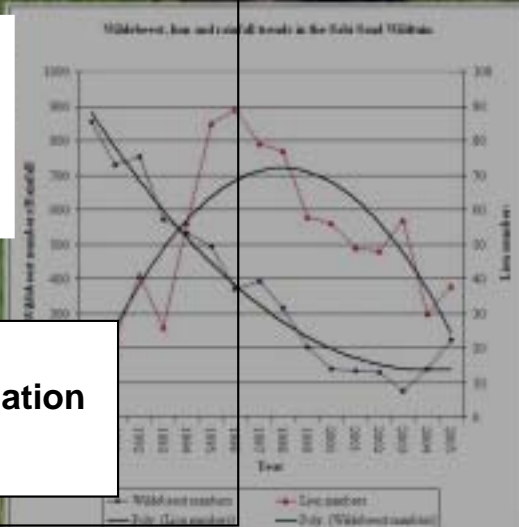
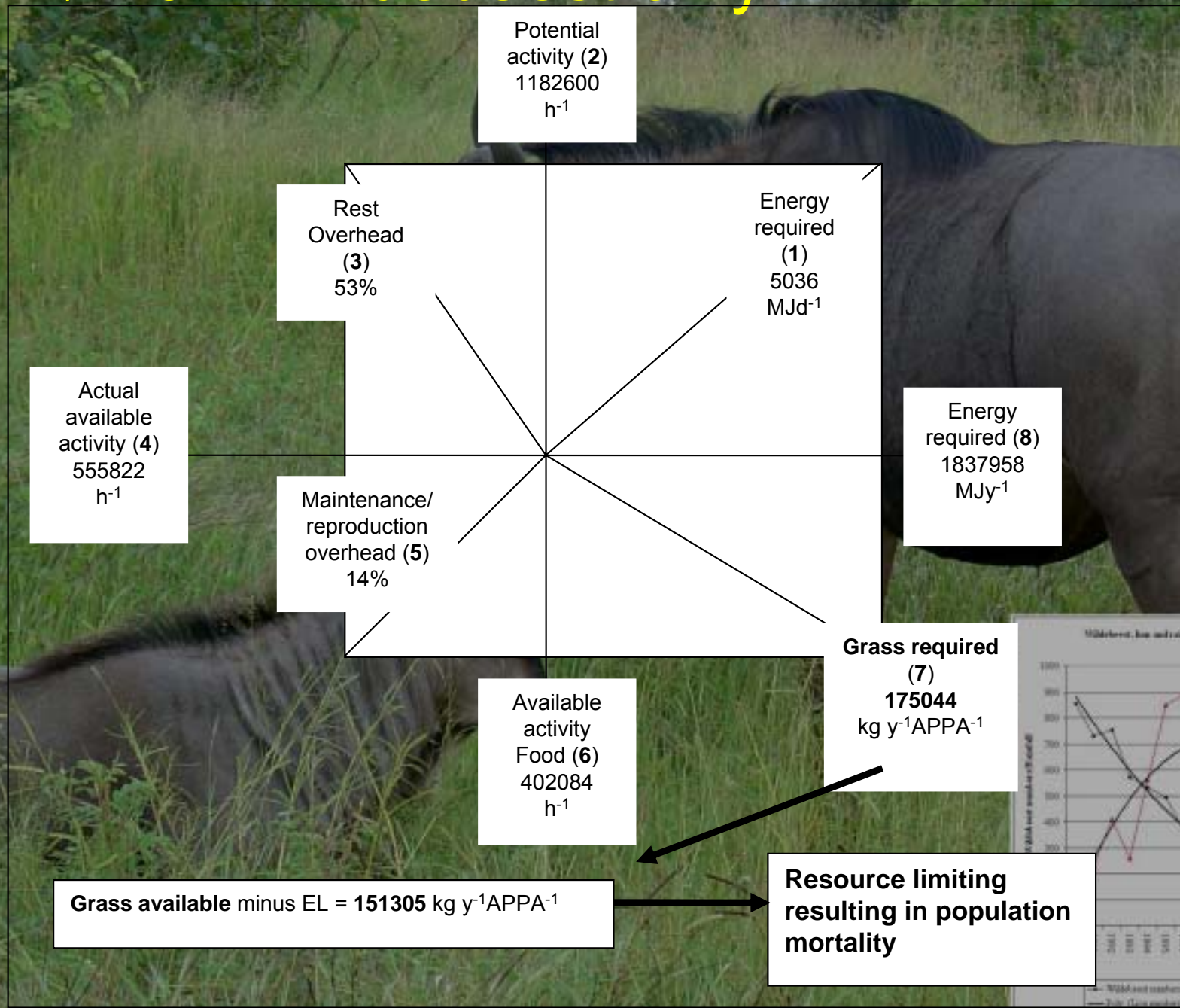
Data

- Two declining wildebeest populations
- Ability - stabilise – population metabolism
- Resource requirements – spectrum of species
- Useful energy flows – internal overheads – external overheads – Environmental Loading – cost of diet



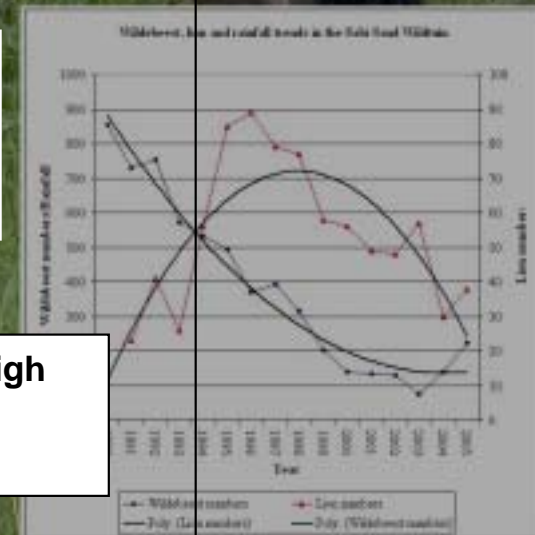
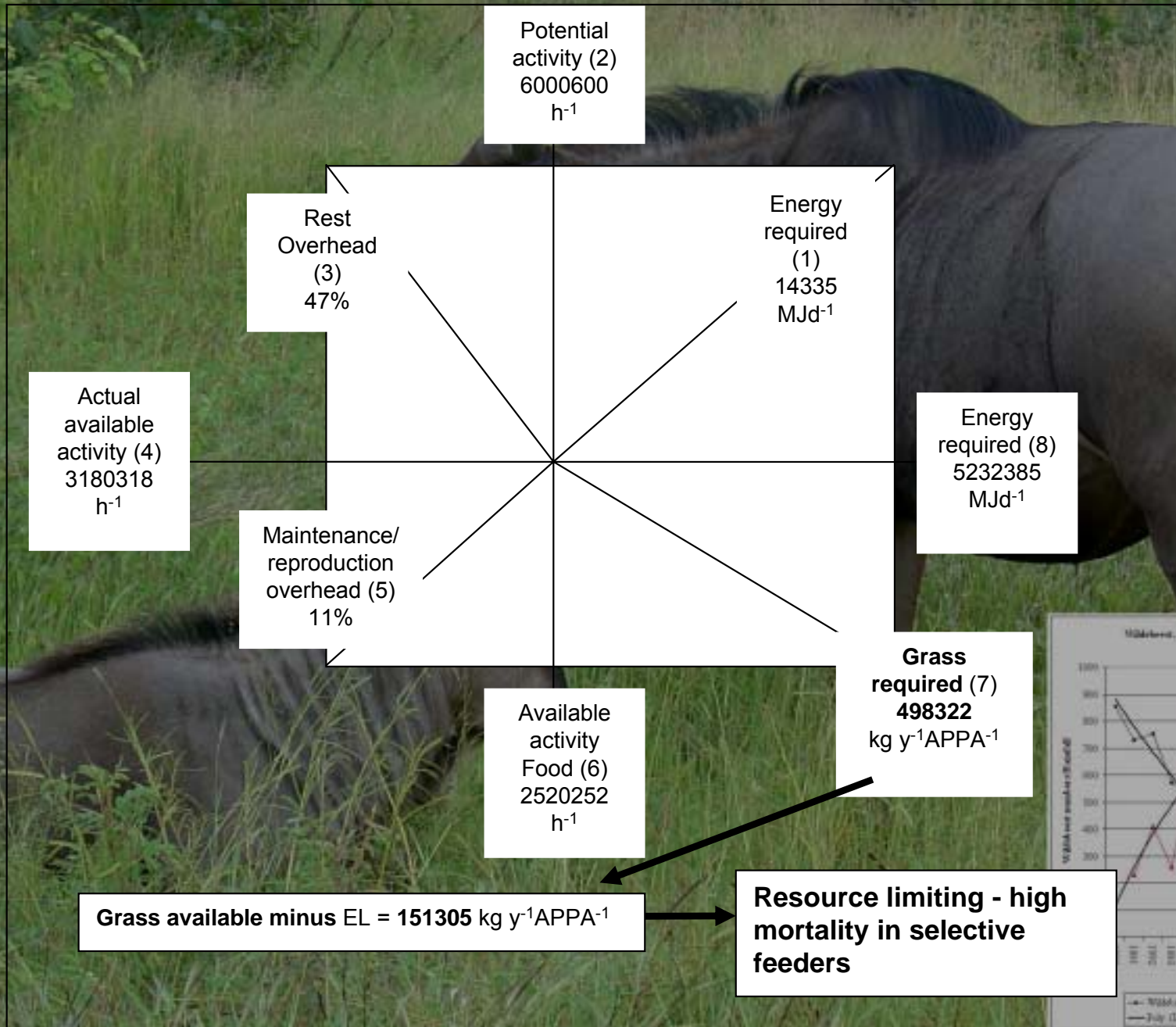
Results – Sustainability – Wildebeest

135 → 10 – Wildebeest only



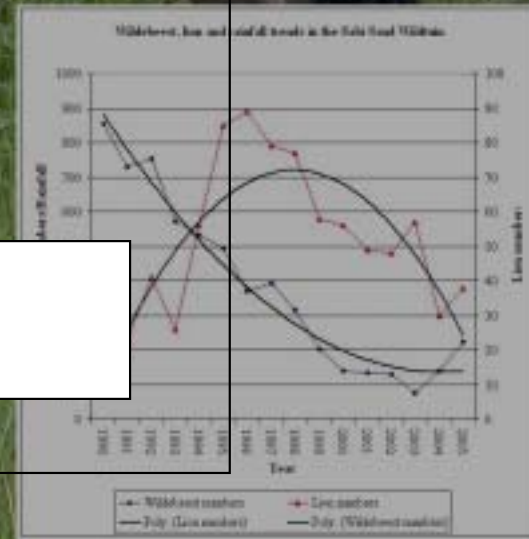
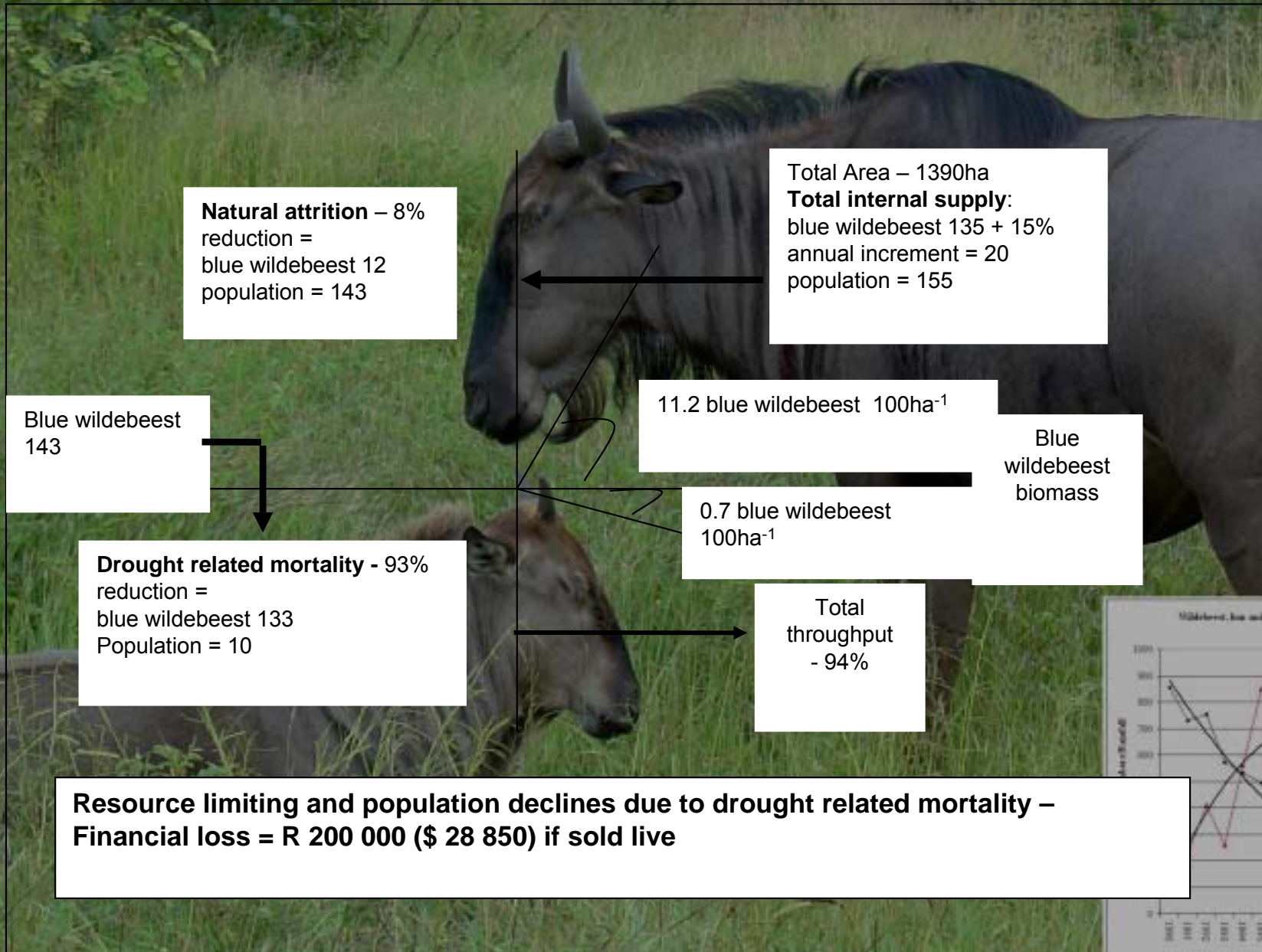
Results – Sustainability – Wildebeest

135 → 10 – Multiple species



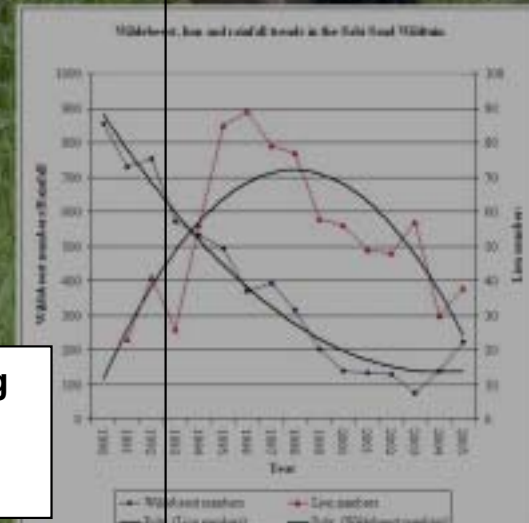
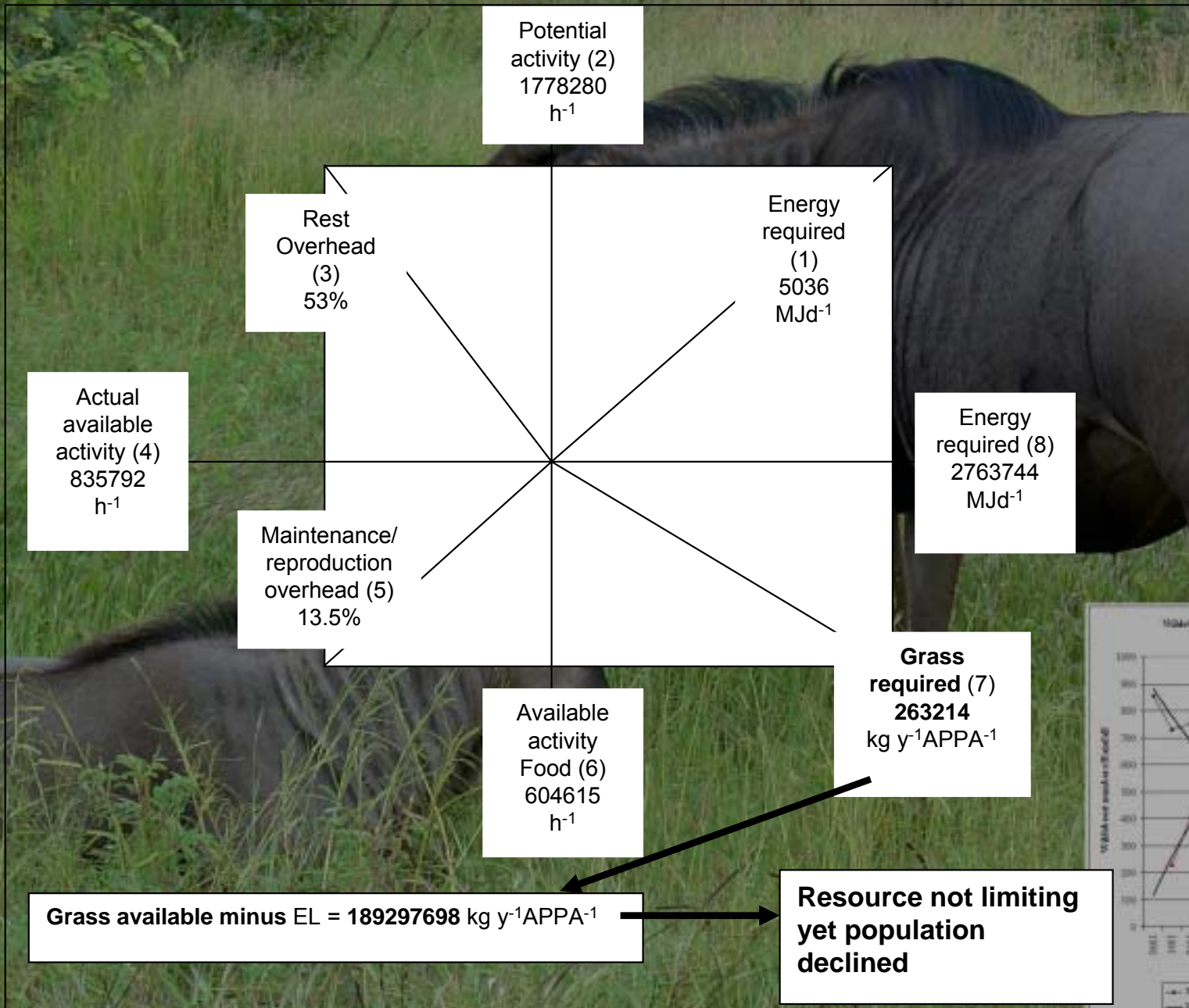
Results – Sustainability – Wildebeest

135 → 10 – Economic implications



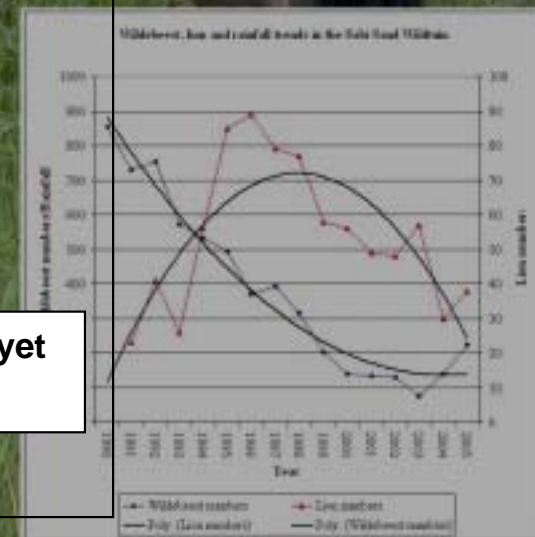
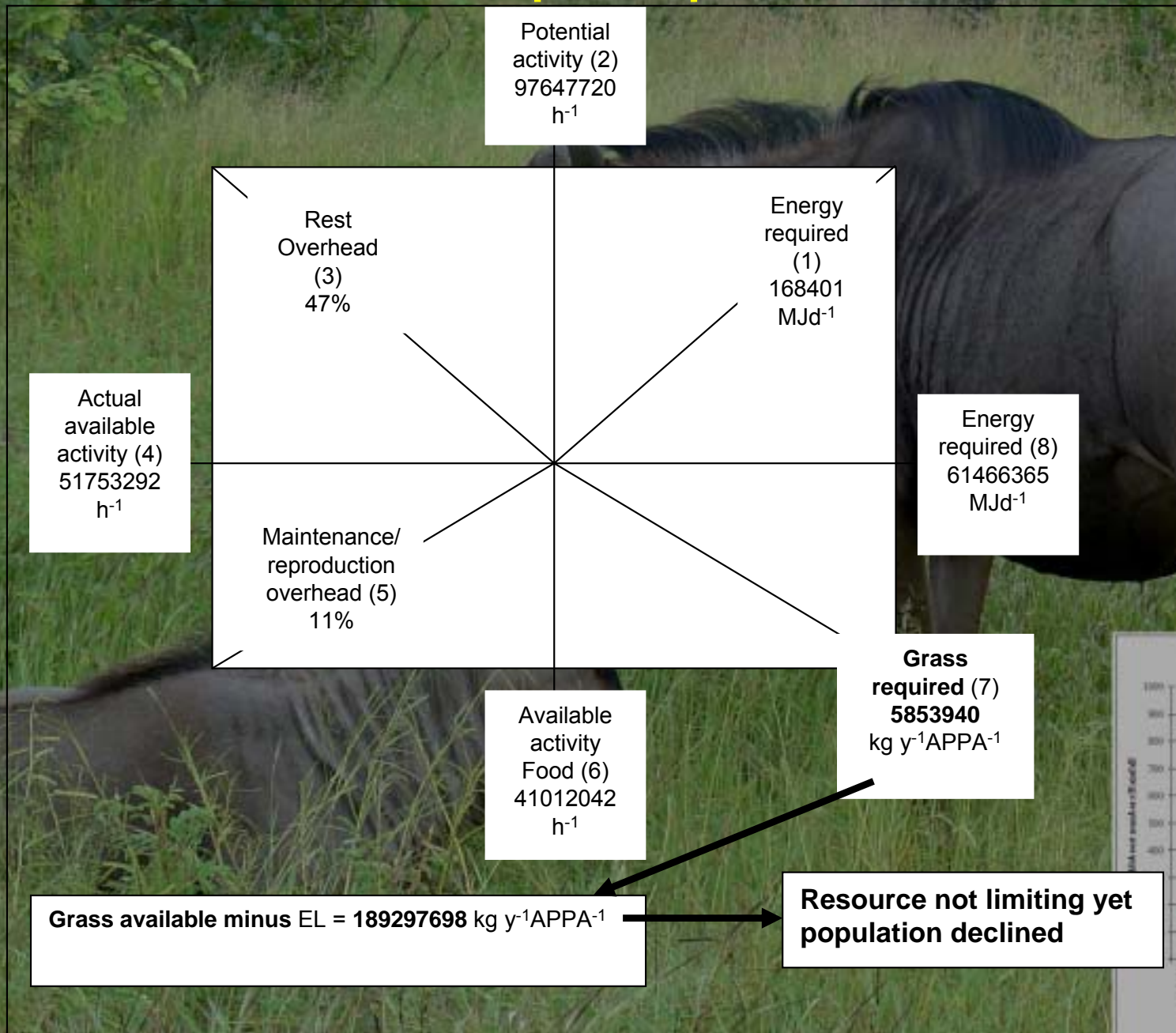
Results – Sustainability – Wildebeest

203 → 109 – Wildebeest only



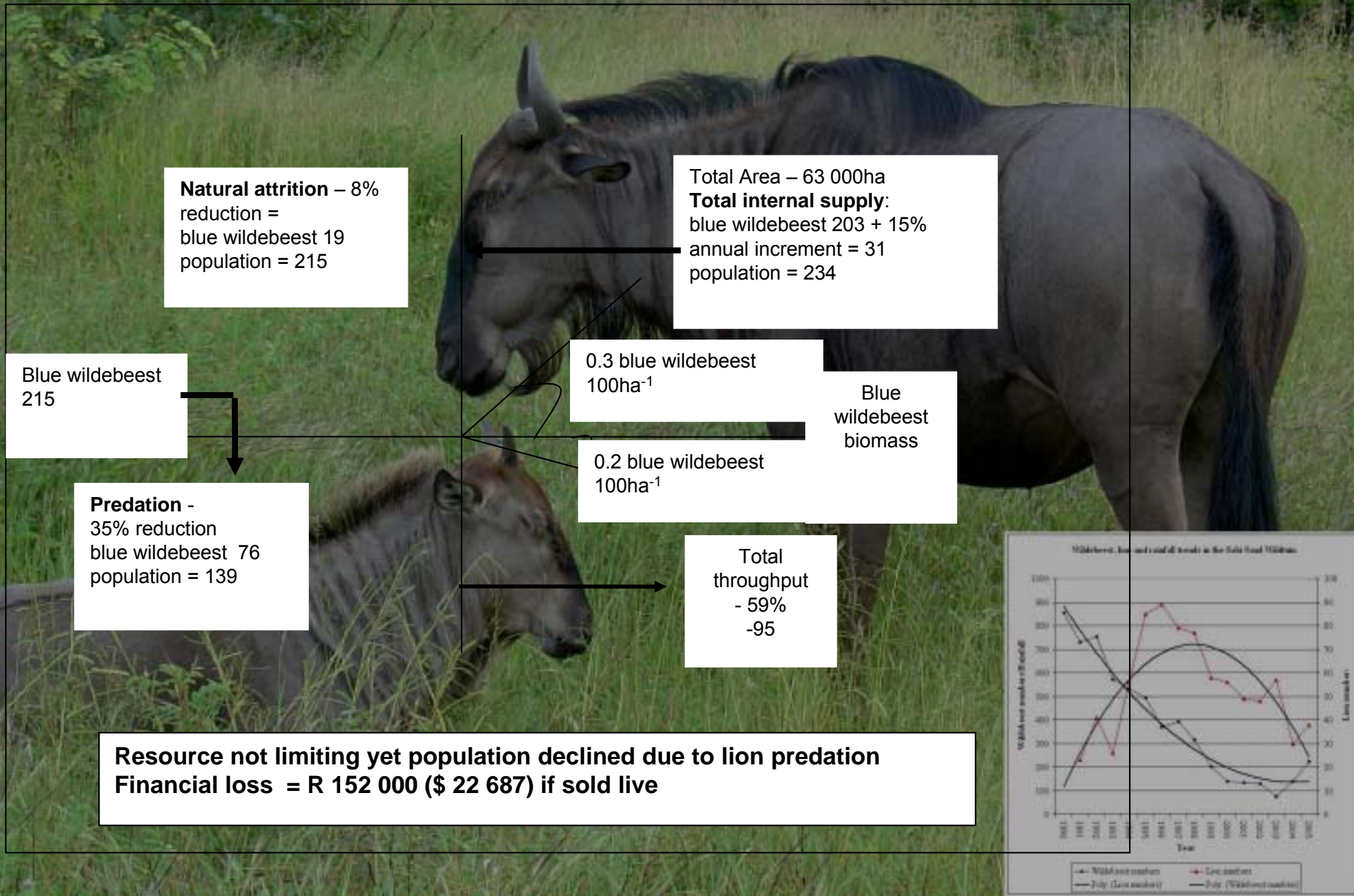
Results – Sustainability – Wildebeest

203 → 109 – Multiple species

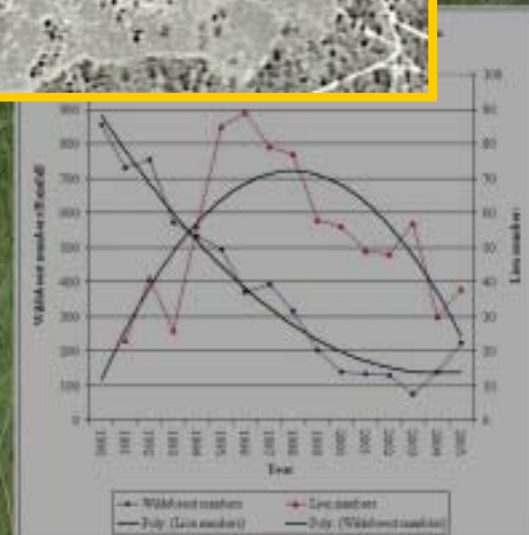
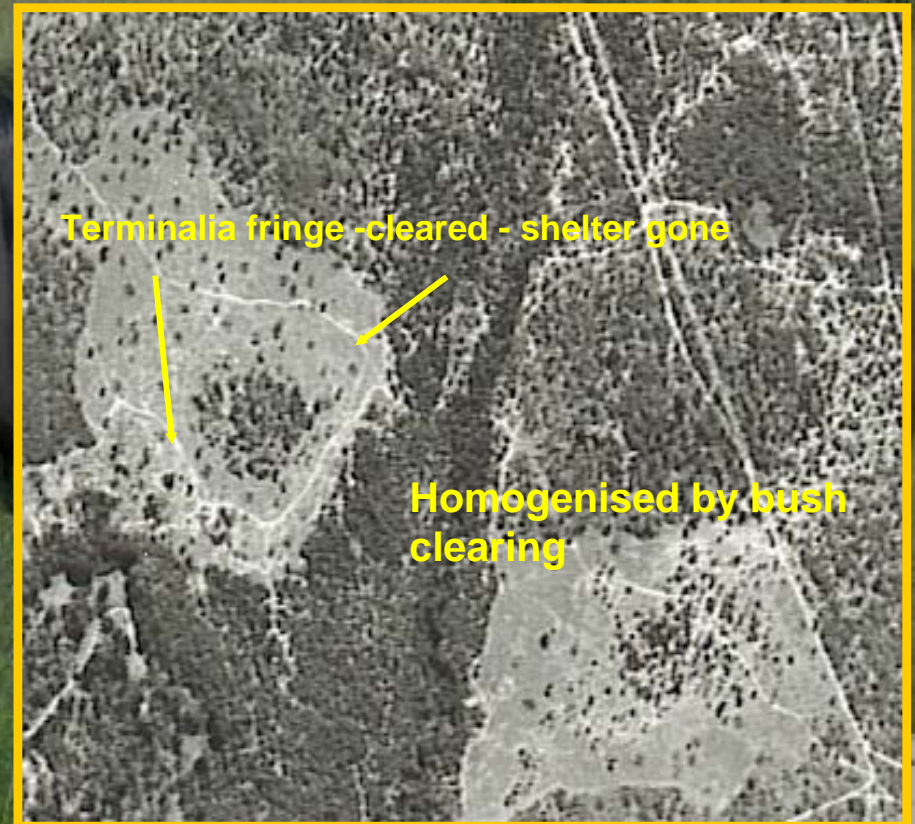
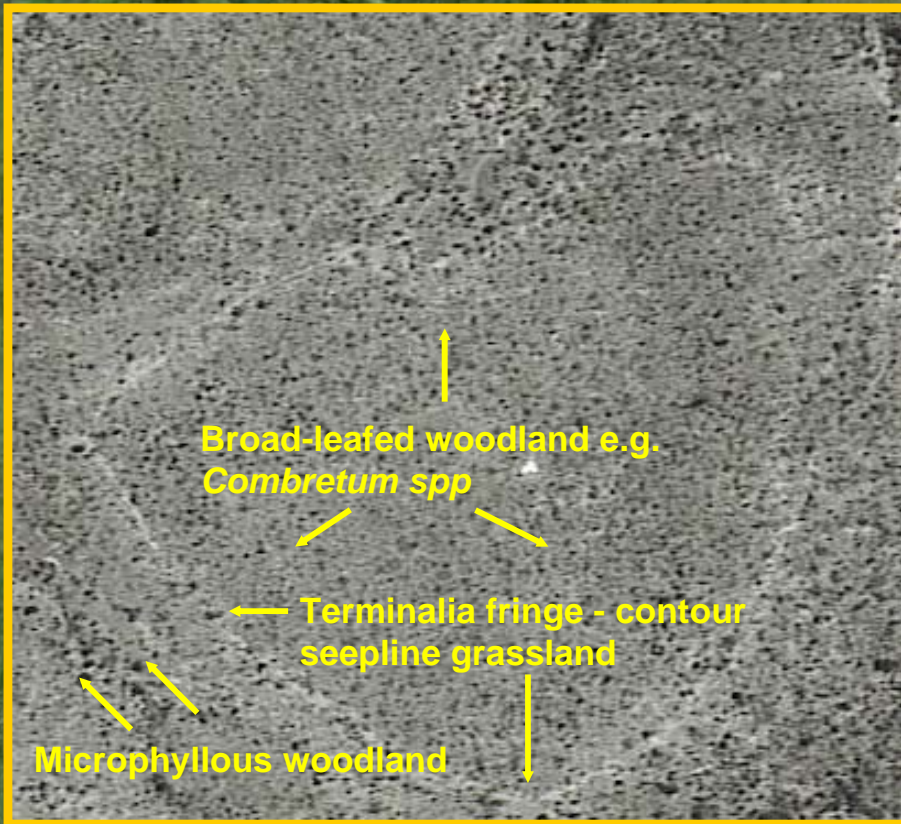


Results – Sustainability – Wildebeest

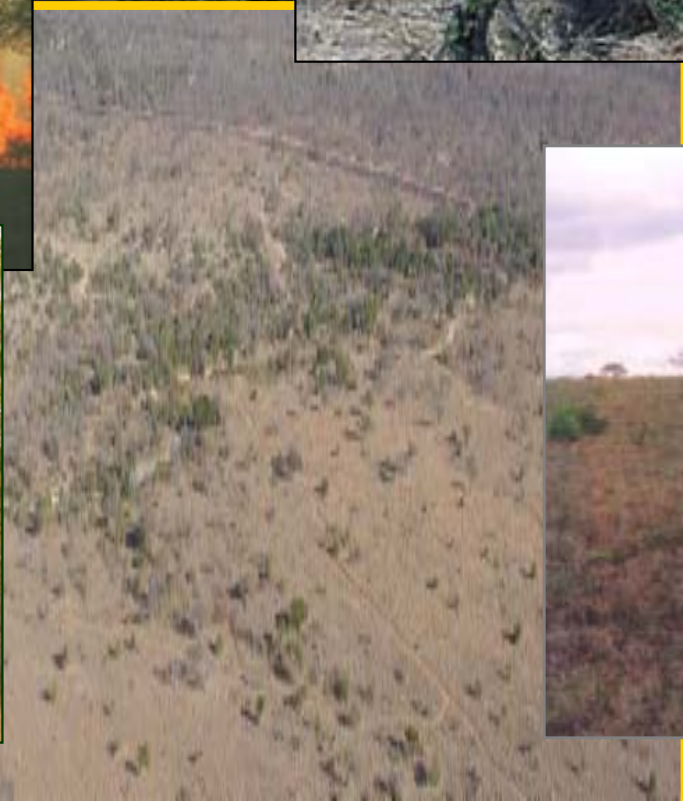
203 → 109 – Economic implications



Why has this happened? Some thoughts



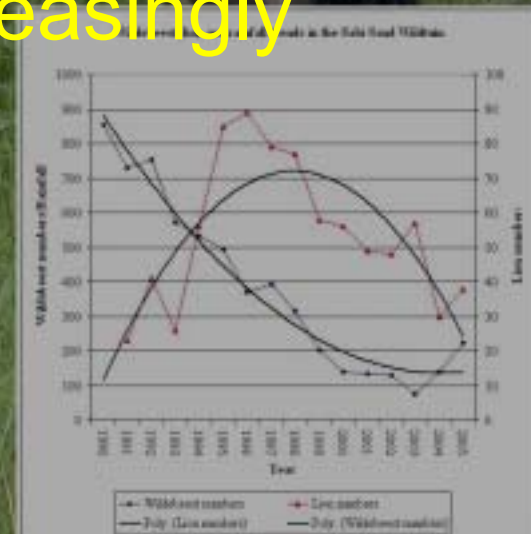
Why has this happened? Some thoughts



Wildland savanna Lowland savanna
July (Low savanna) July (Wildland savanna)

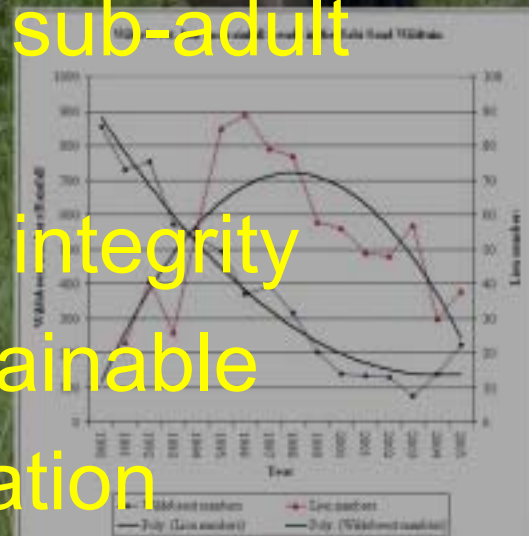
So

- Fences and water – sedentary wildebeest population – re-scaled
- Two cases
 - Resources limiting – absence – predators – numbers game
 - Resource not limiting – Lions increasingly successful



The two approaches

- **OOM** - useful – extreme cases - sensitive – number of years – less so – annual basis – management decisions
- **Loop analysis** – management action
 - 1. Animal numbers
 - 2. Removal – portion - nomadic – sub-adult males – maintain pride integrity
 - 2. Contraception – maintain pride integrity
 - 2. Re-introduce wildebeest – sustainable
 - 2. Halt excessive habitat manipulation



Spatial scale and land-use objectives AND why APPA's don't necessarily manage like KNP and visa versa

Objective

- Maintain essential Ecological processes and life support systems
- Preserve diversity (genetic)
- Sustainable utilisation of species and ecosystems

Relevance- Large Protected areas e.g. Kruger High

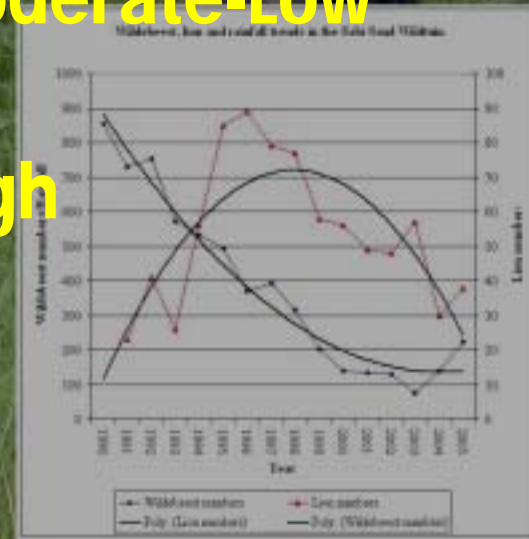
Relevance- Small/ re-scaled areas Moderate-Low

High

Moderate-Low

Moderate-Low

High



NO GNUS
IS BAD GNUS!

