Monitoring under uncertainty for informed management decisions

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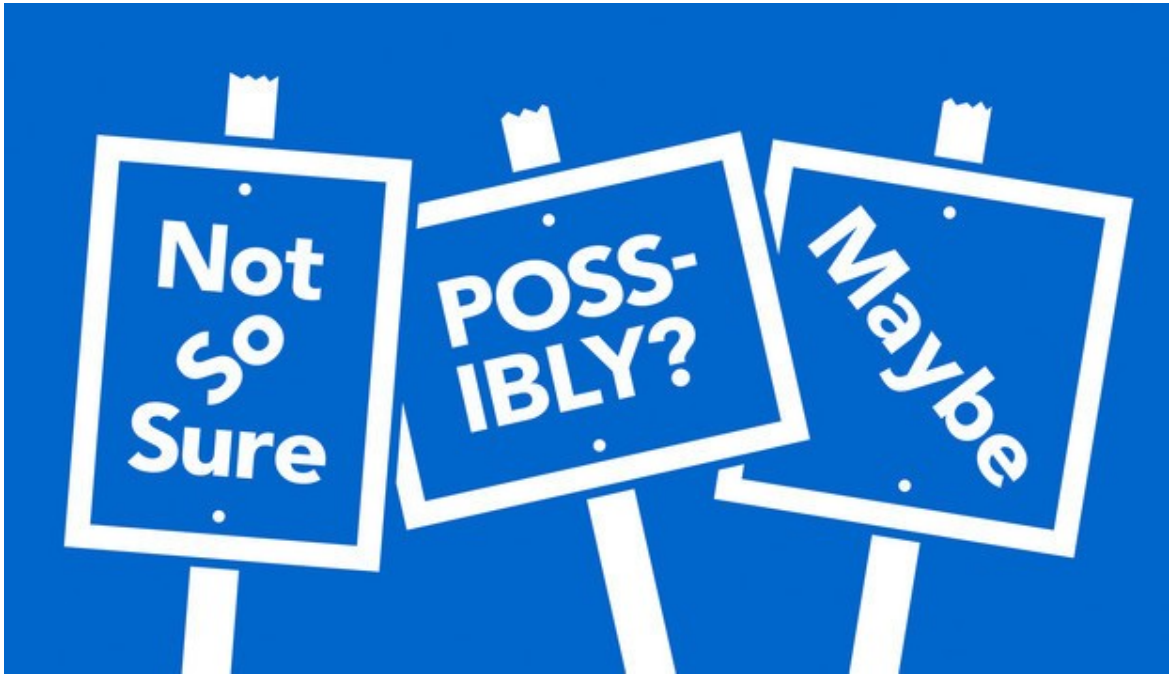
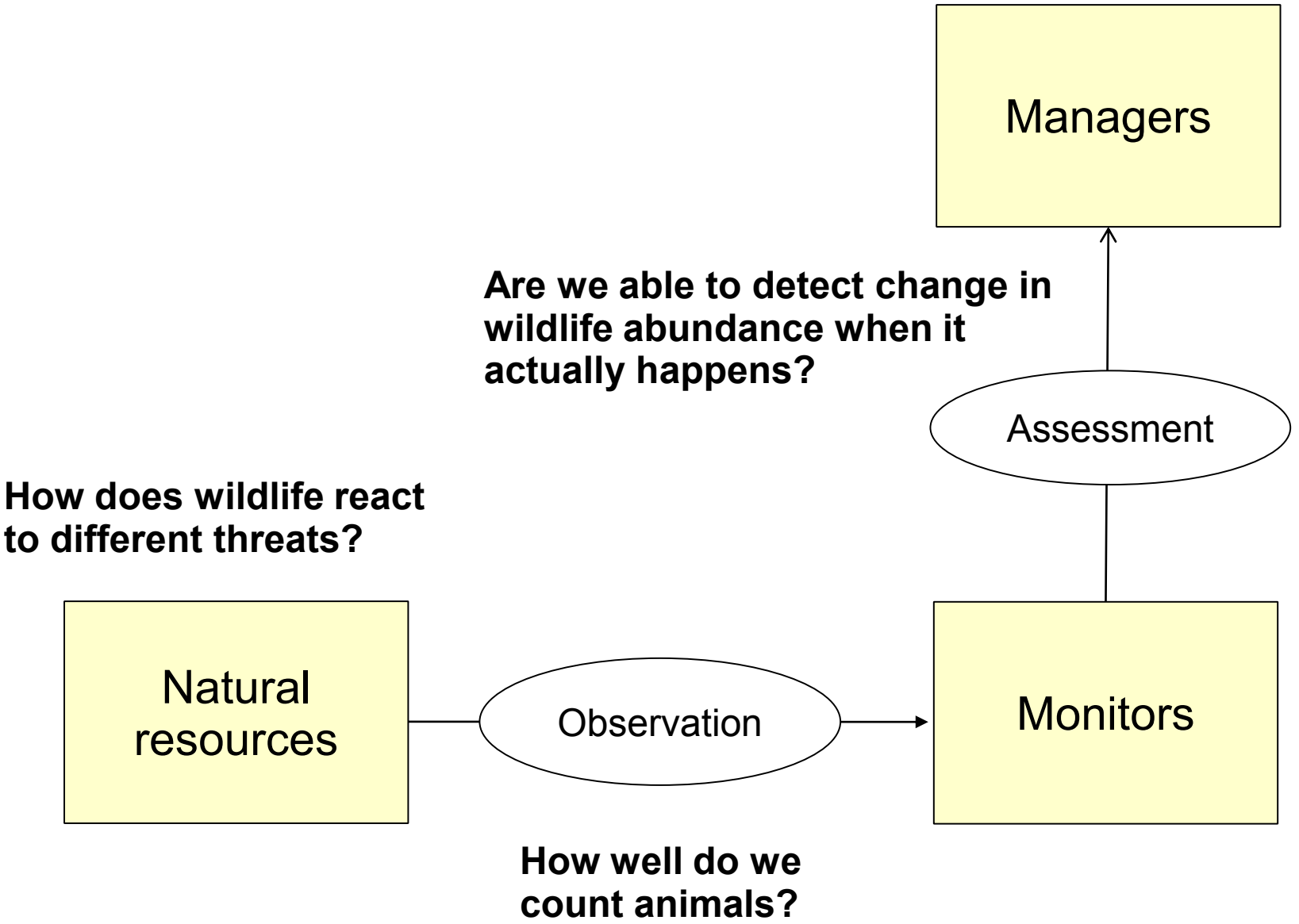
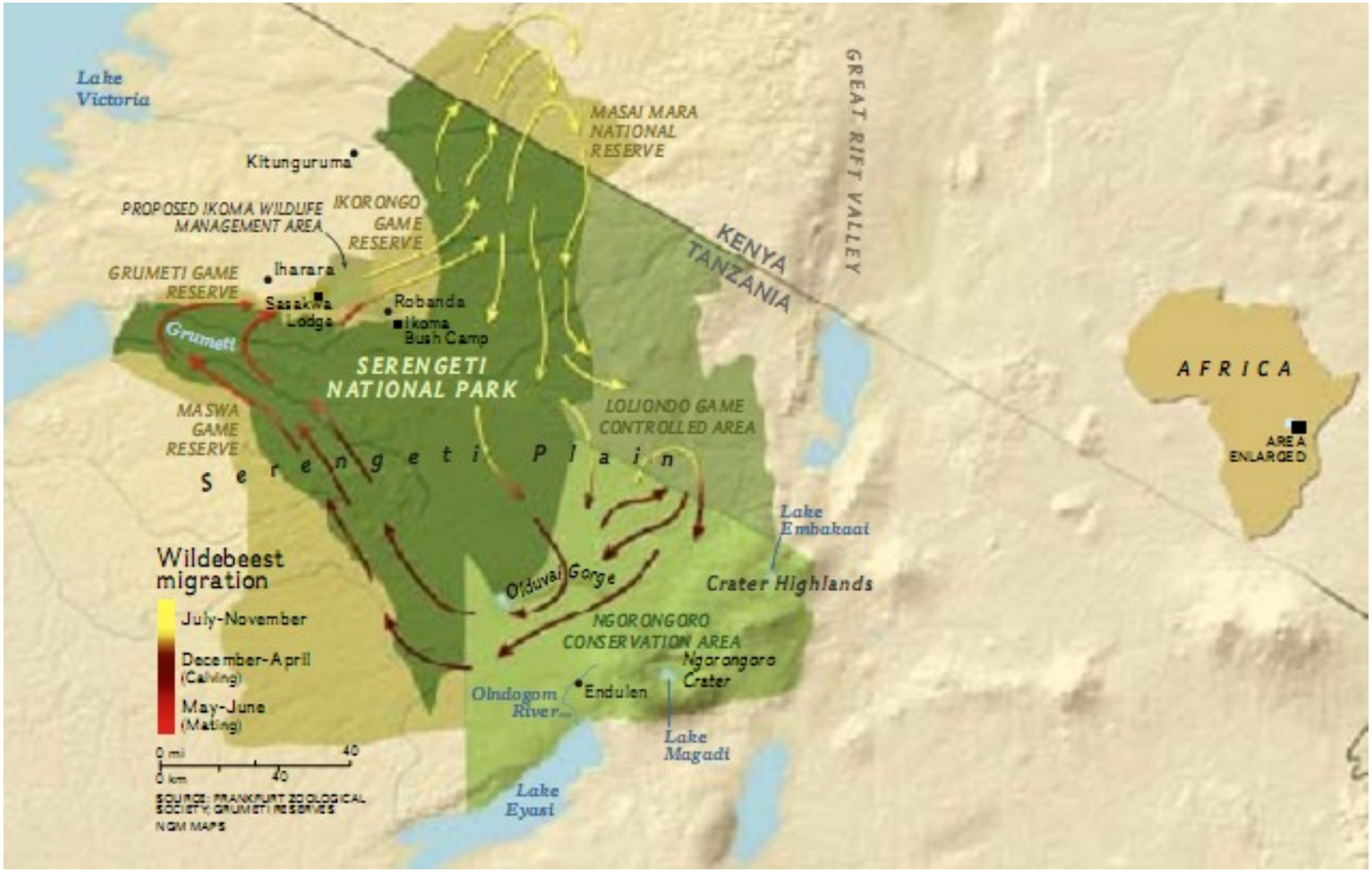
Uncertainty

cartoonsbyjosh.com




Managers
Are we able to detect change in wildlife abundance when it actually happens?
Assessment
How does wildlife react to different threats?
Natural resources
Observation
Monitors
How well do we count animals?

Study-area: Serengeti, Tanzania



Illegal bushmeat hunting

Questions

1. How do different monitoring budgets translate into data quality (accuracy and precision)?

2. How are different types of error affected by budgetary, observational and ecological conditions?

Types of error

-**Type I errors (α):** rejecting the null hypothesis when it is true

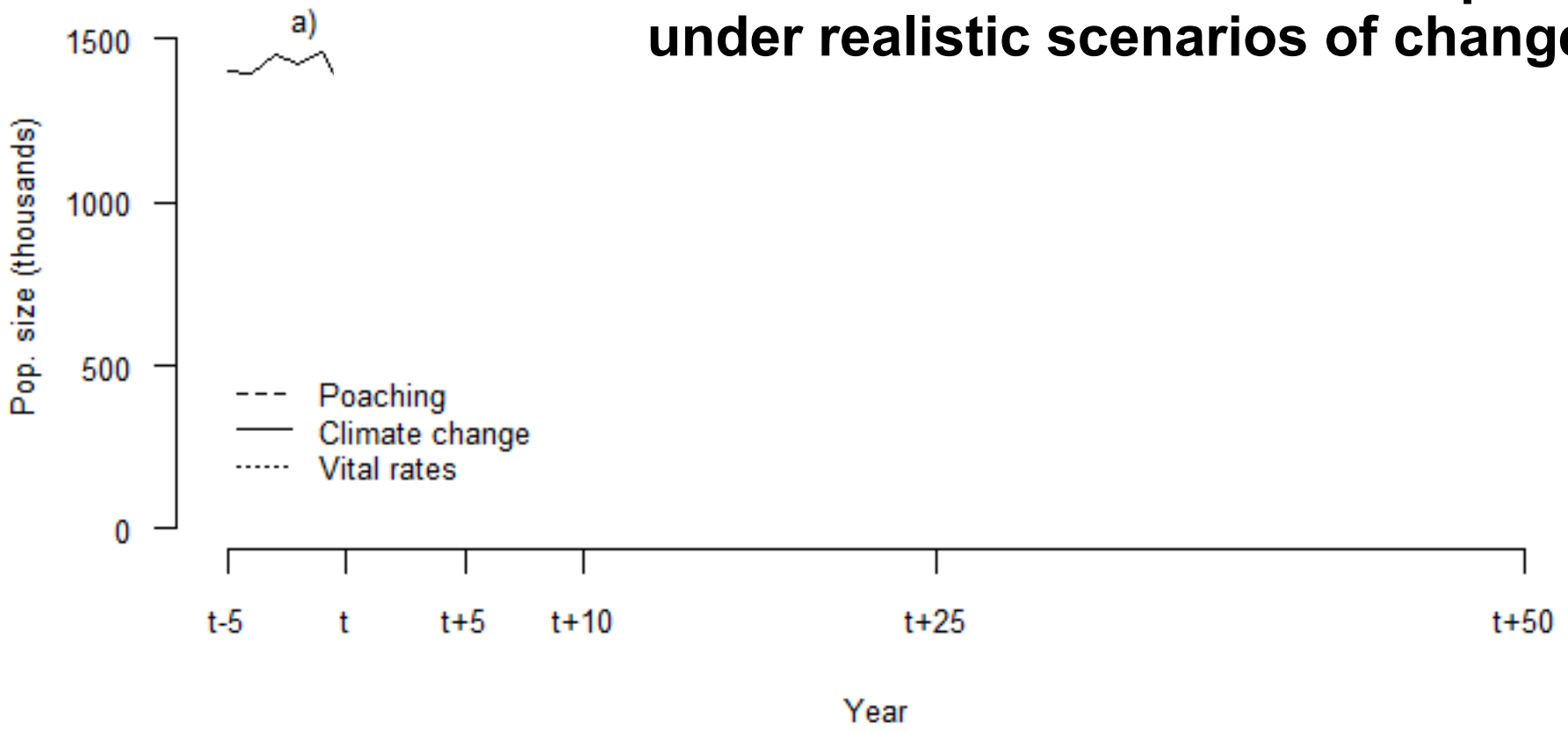
-**Type II errors (β):** failing to detect a difference that is present

- **Shape errors:** misclassifying a trend as linear when it is actually non-linear or vice-versa

1. Operating biological model

Wildebeest

“True” abundance of different species under realistic scenarios of change



2. Observation model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Types of factors

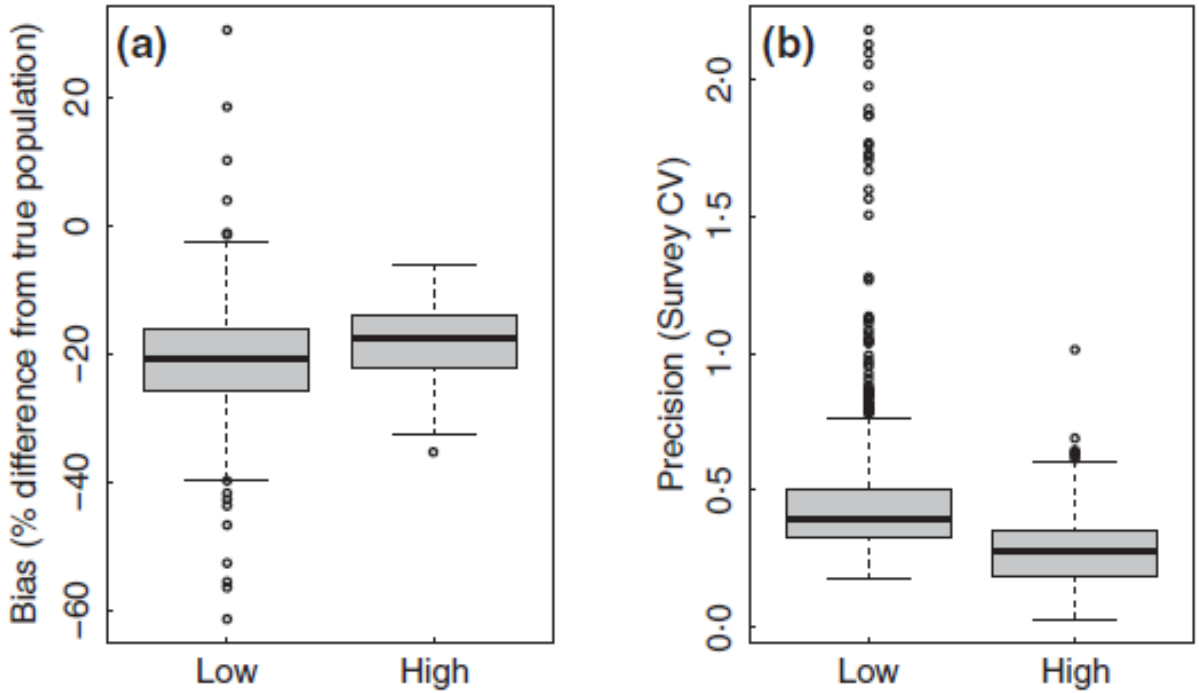
Wildebeest monitoring:

Population characteristics	Population size Proportion of juveniles (%) Aggregation Spatial autocorrelation
Sampling characteristics	Distance between transects (km) Time between photos (seconds)
Flight characteristics	Mean flight altitude (m) CV (coefficient of variation) error altitude Mean flight speed (km/sec) CV (coefficient of variation) error speed
Observer effects	Minimum error counting juveniles (%) Number of animals in a photo for which 50% juveniles are missed Mean error counting adults (%) CV (coefficient of variation) error counting adults

Results: monitoring wildebeest

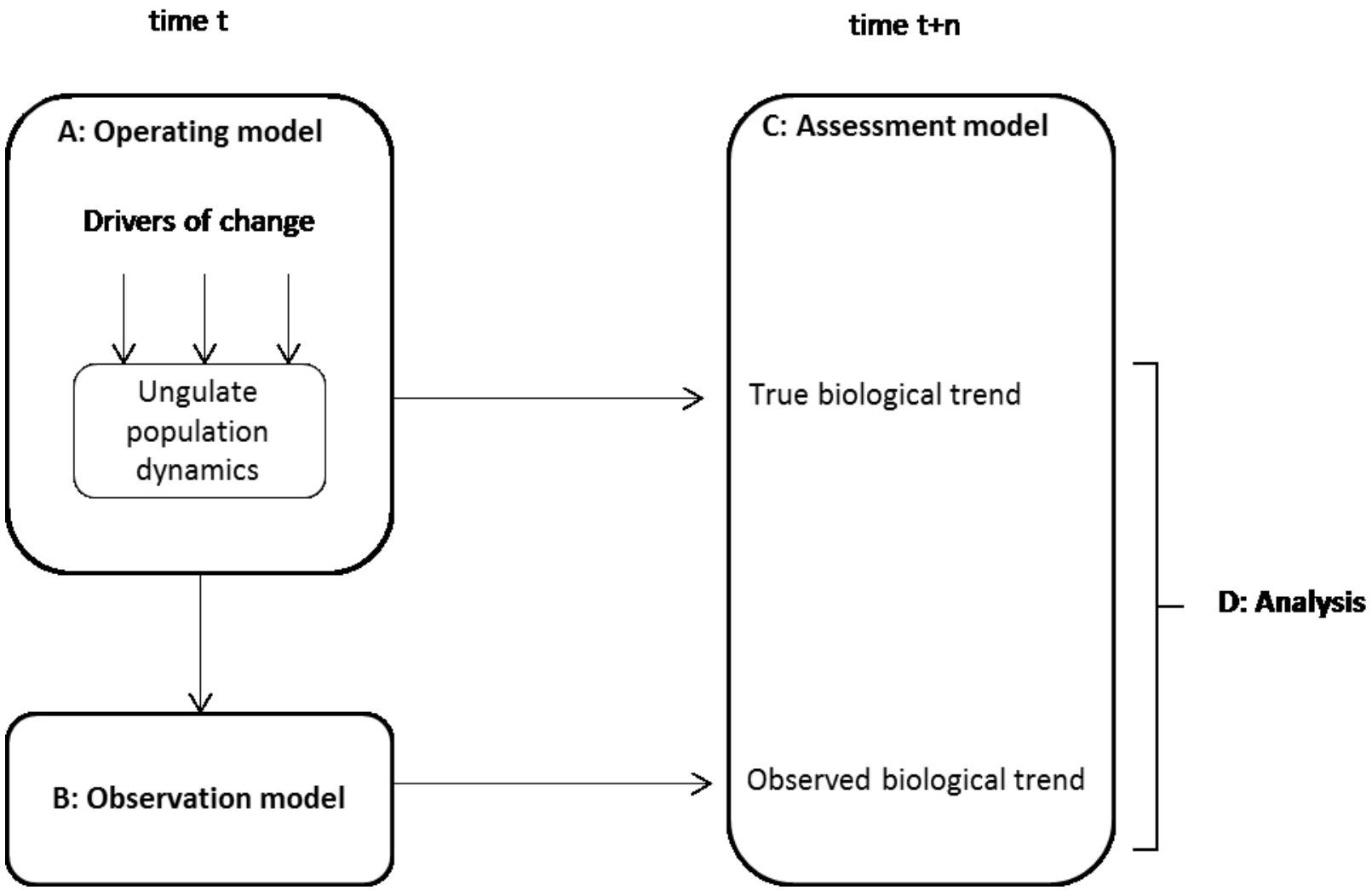
The likely effect of budget on data quality

"Observed" abundance of different species under realistic scenarios of change



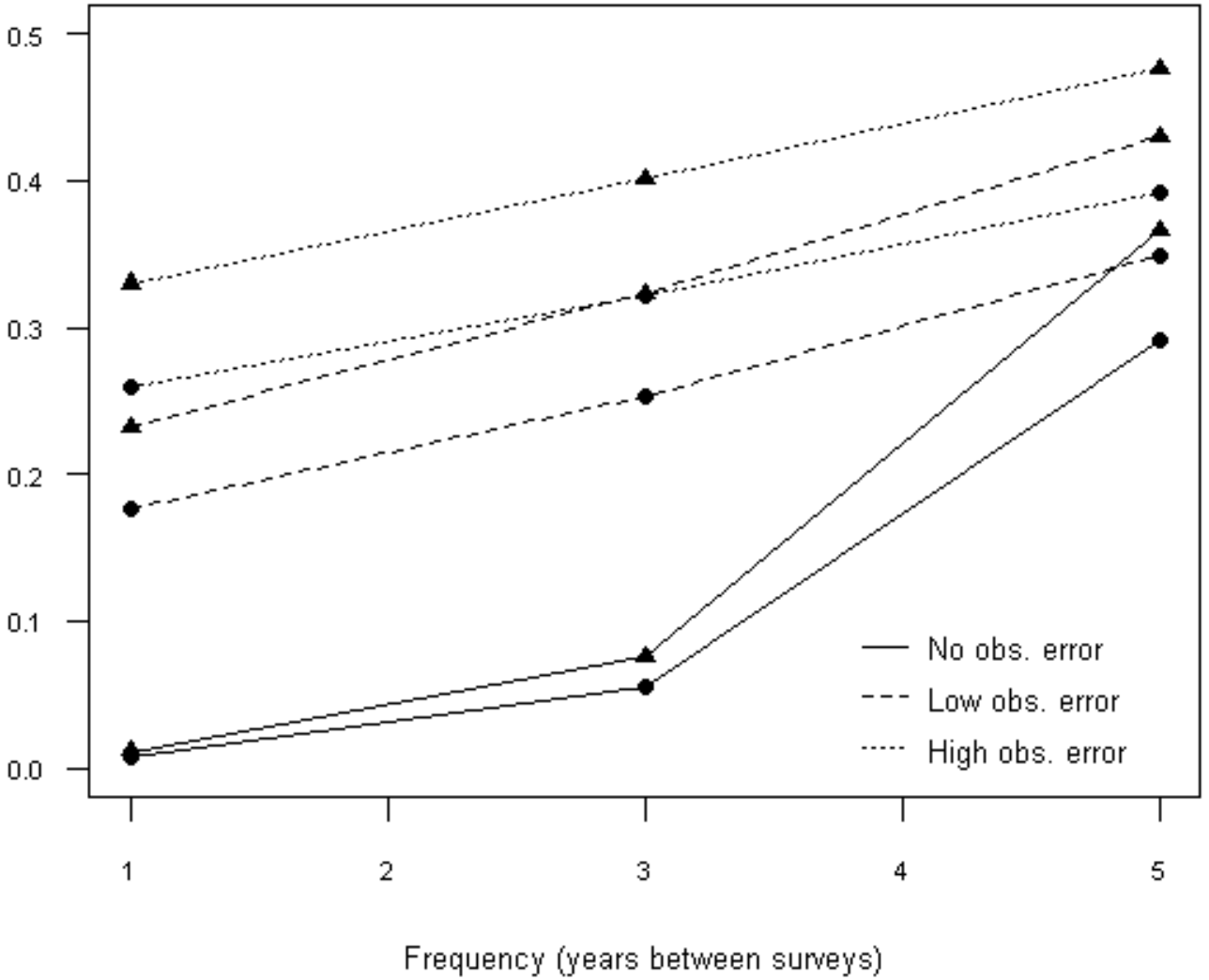
Nuno, Bunnefeld & Milner-Gulland (2013) ***Journal of Applied Ecology***

3. Assessment model & Analysis



Results

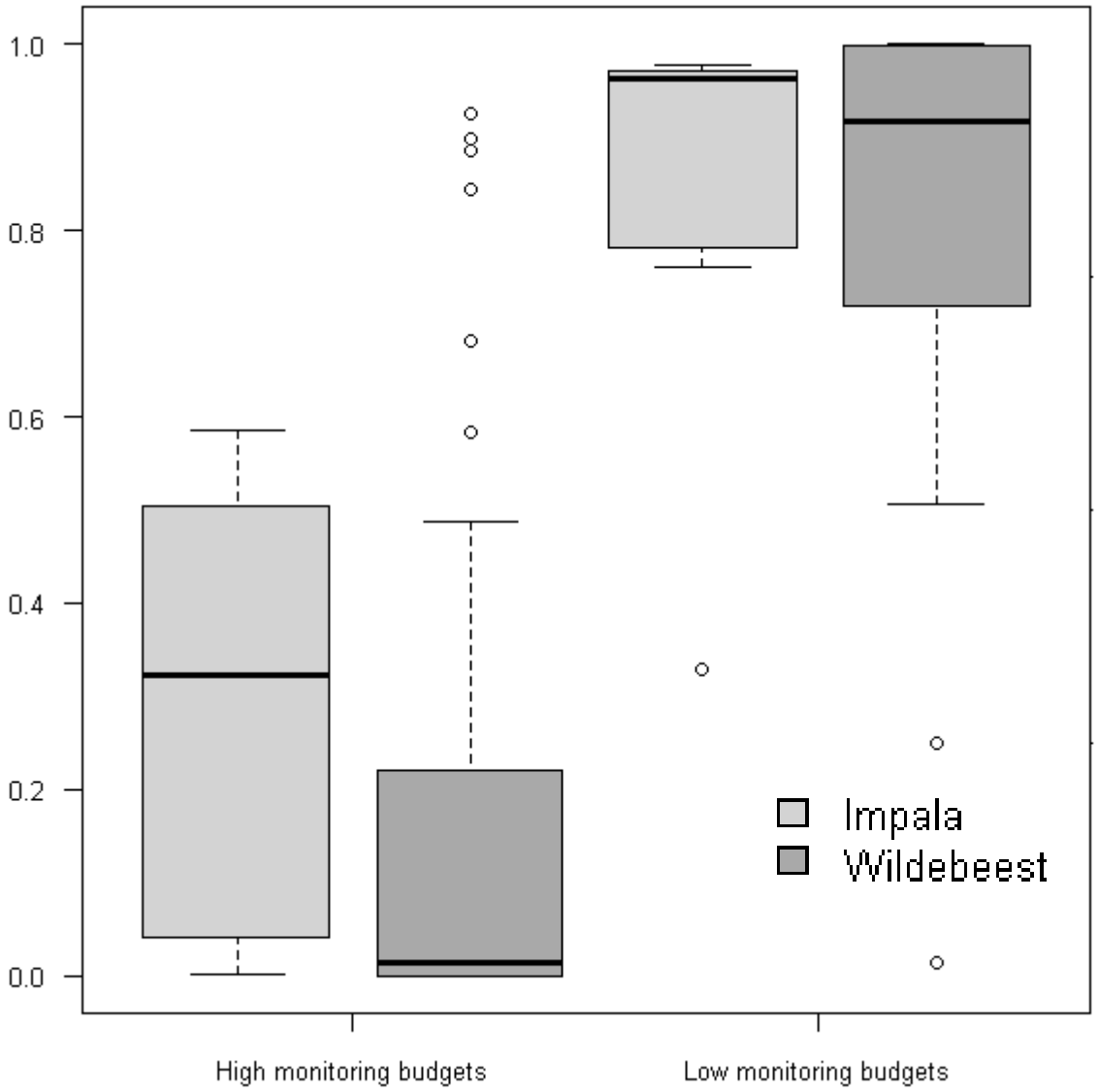
Type II error



▲ Impala
● Wildebeest

Results

Type II error

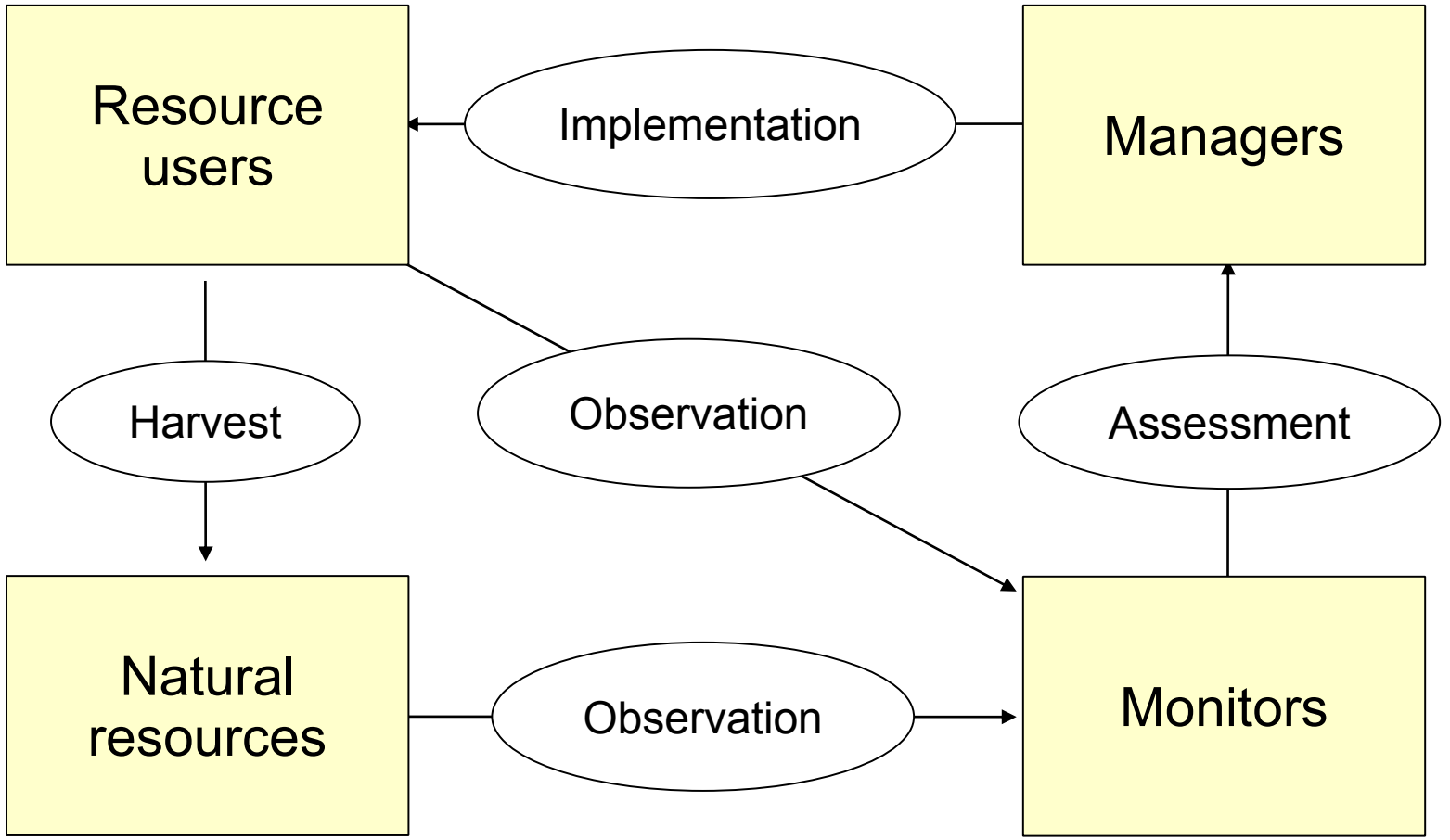


Key messages

- To make robust management decisions, we should account for multiple types and sources of uncertainty

- Need to integrate ecological modelling, threat scenarios and costs into decision-theoretic approaches to NRM and conservation

- Our uncertainty mitigation efforts must be focused on the kinds of information which are most valuable


Resource users
Implementation
Managers
Harvest
Observation
Assessment
Natural resources
Observation
Monitors

Acknowledgements & Questions

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