

# Illegal bushmeat hunting in the Serengeti: management under uncertainty

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## Introduction

Bushmeat is widespread in communities surrounding the **protected areas** of the Serengeti, Tanzania, where hunting is conducted illegally for both food and cash [1].

Because of the illegal and sensitive nature of hunting, there is enormous **uncertainty** surrounding hunting rates and catch composition [2].

How can **non-compliant harvest behaviour and observation uncertainty** be incorporated in our management recommendations?

Using **simulation modelling**, harvester and wildlife observation uncertainty are explicitly incorporated and their impacts on management decisions and **migratory and resident wildlife** are currently being investigated.



Photo by Frankfurt Zoological Society

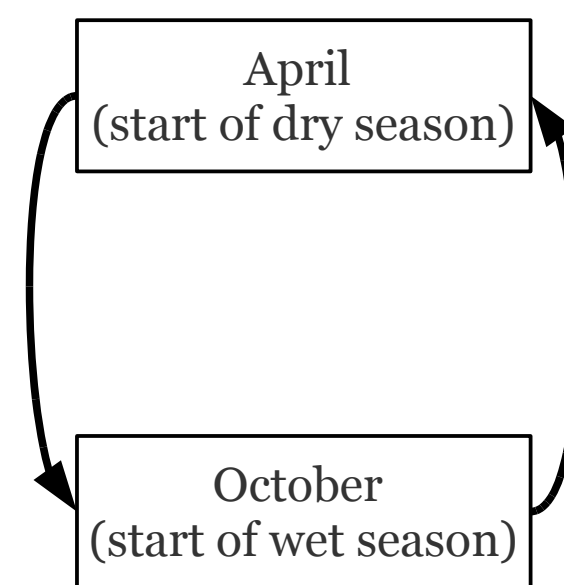
## Step 1: Multi-species harvest model

### Main drivers and processes incorporated in seasonal age-and sex-structured model



Resident topi (*Damaliscus korrigum*, left) and impala (*Aepyceros melampus*, right) are harvested all year-round

- Wildebeest migration
- Rainfall
- Births (impala)
- Natural mortality
- Intraspecific competition
- Interspecific competition/facilitation
- Illegal harvest (all species)



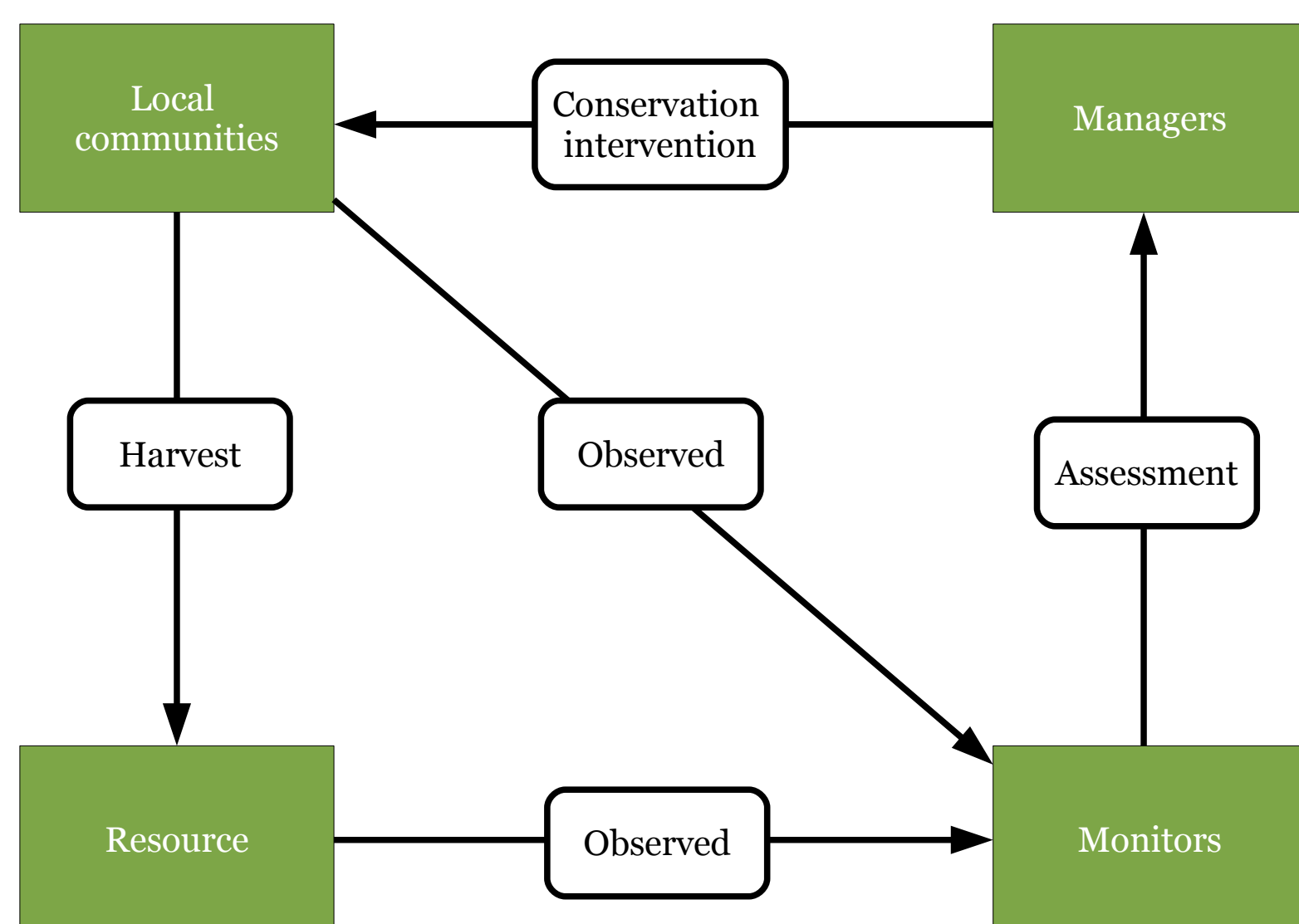
- Births (all species)
- Illegal harvest (impala and topi)



Migratory wildebeest (*Connochaetes taurinus*) travel through the western Serengeti, close to villages, during the **dry season**

## Study system model: MSE approach

### Conceptual model using an integrated MSE\* approach [3]



\* **Management strategy evaluation** (MSE; widely used in commercial fisheries) uses simulation modelling to assess the likely performance of alternative management options.

## Step 2: Indirect questioning techniques

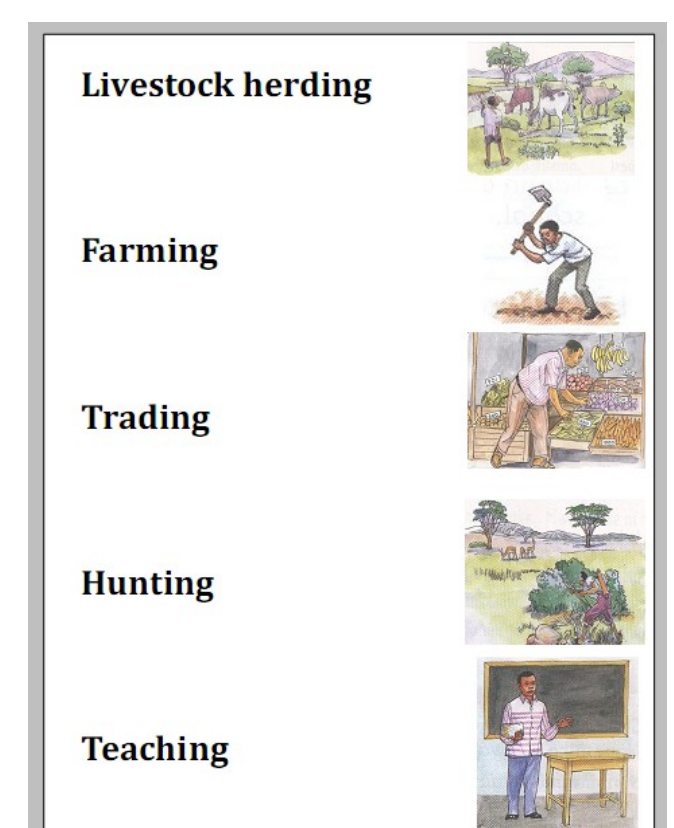
We use indirect questioning to reduce the bias of answering **sensitive questions**. Methodological trials suggest respondents are most comfortable with the unmatched card technique.

### Unmatched count technique:

Based on a list of several items, respondents indicate the number of items that are applicable to them.

Sensitive item is only included in the card shown to one sub-sample. Differences in means between two sub-samples estimate prevalence of sensitive behaviour.

Ongoing data collection in 15 villages, western Serengeti.



## Observation uncertainty and bias

**Observation uncertainty:** current state of the system is not completely known due to difficulties in making accurate measurements.

### Examples:

1. respondents' reluctance to admit engagement in illegal bushmeat hunting affects estimates of number of hunters;
2. variations in observer performance and animal observability affect population estimates obtained from aerial surveys.

## Next steps

- Develop **household utility model** and investigate harvester decision-making and behaviour as a function of management intervention.
- Delineate general **management rules and potential future scenarios** based on scenario-building analyses with multiple stakeholders.
- Develop an unified bushmeat hunting **model based on MSE approach** to produce robust management advice under uncertainty for effective conservation interventions.

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## Literature

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- [2] Milner-Gulland et al. (2010) New directions in Management Strategy Evaluation through cross-fertilisation between fisheries science and terrestrial conservation. *Biology Letters* 6: 719–722
- [3] Milner-Gulland, E.J. (2011). Integrating fisheries approaches and household utility models for improved resource management. *PNAS* 108: 1741–1746