

# Modelling the mobility of pastoralist herds to quantify rangeland use in East Africa



ILRI  
INTERNATIONAL  
LIVESTOCK RESEARCH  
INSTITUTE



**Shibia M. Guyo**  
University of Trier, Germany  
ILRI, Nairobi, Kenya



**Manuel K. Schneider**  
Agroscope, Zurich, Switzerland

## BACKGROUND

Extensive pastoralism is a key livelihood strategy in arid regions to exploit highly fluctuating forage resources.

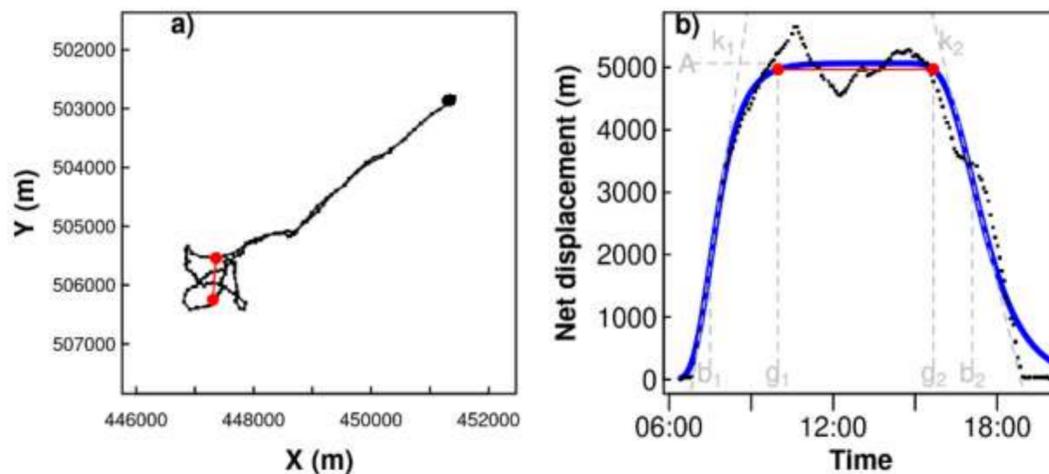
In East Africa, pastoralists daily walk their herds from night pens to rangelands. The layout of these daily grazing orbits allows pastoralists to balance forage uptake against energy expenditure.

Our aim was to develop a suitable mathematical model for the orbits and to analyse the underlying environmental and socio-economic drivers.

## MATERIALS AND METHODS

During 3.5 years, we recorded 15'000 daily orbits of 22 cattle herds of Borana pastoralists in the Kenyan-Ethiopian border area.

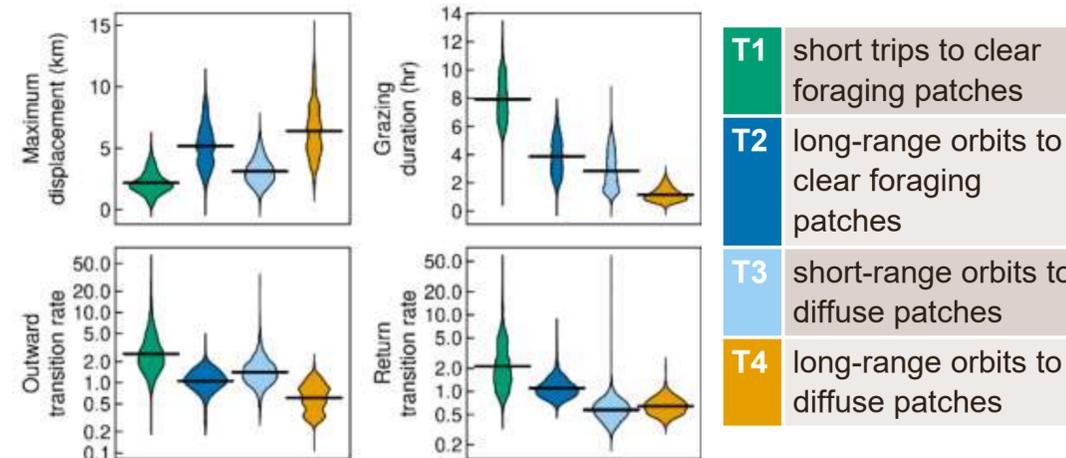
We used the double Gompertz function to describe the net displacement from the starting point and to derive spatially and temporally explicit movement parameters. Partitioning Around Medoids clustering was used to classify the daily grazing orbits.



**Figure 1.** a) Daily grazing orbit and b) net displacement from the start, observed in black and predicted by a double Gompertz model in blue. In red the grazing phase.

## RESULT 1

Clustering identified four types of grazing orbits T1-T4 with increasing investment in movement energy. The types T1-T4 comprised 25%, 31%, 21% and 22% of the orbits, respectively.



**Figure 2.** Characteristics of orbit types derived for double Gompertz models fitted to GPS tracking data.



## RESULT 2

All four daily grazing orbit types were used in substantial proportions within each month. Their abundance depended of climatic and socio-economic factors

**Table 1.** Effects of environmental and socio-economic drivers on the abundance of orbit types T1-T4. The Long Dry Season is the baseline in the linear model.

	T1	T2	T3	T4
Herd size	-0.29 ***	0.099	-0.047	0.23 ***
Long Rain Season	0.35	-0.13	0.3	-0.51 **
Short Dry Season	0.31	0.41 **	-0.88 ***	0.15
Short Rain Season	-0.52 **	-0.013	0.75 ***	-0.22

## CONCLUSIONS

- The identified grazing orbit types were indicative of different forage acquisition strategies.
- Borana pastoralist normally walk their herds in a complex scheme mixing short and long trips as well as clear and diffuse forage patches on a daily basis.
- Nevertheless, herd size categories and seasons are important determinants of the realised orbit proportions. Larger herds execute more extensive searching trips than small herds and in dry seasons, more remote resources are used than in the wet season.
- Clever balancing of the energy demand and forage gain of animals in different orbit types allows mobile pastoralists to exploit scarce and highly fluctuating resources..