Despite potential risks African elephants do not always avoid mountaineering

Justine M. Teixeira, Rickert van der Westhuizen & Adrian M Shrader

Department of Zoology and Entomology, University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

EZEMVELO KZN WILDLIFE
Conservation, Partnerships & Ecotourism

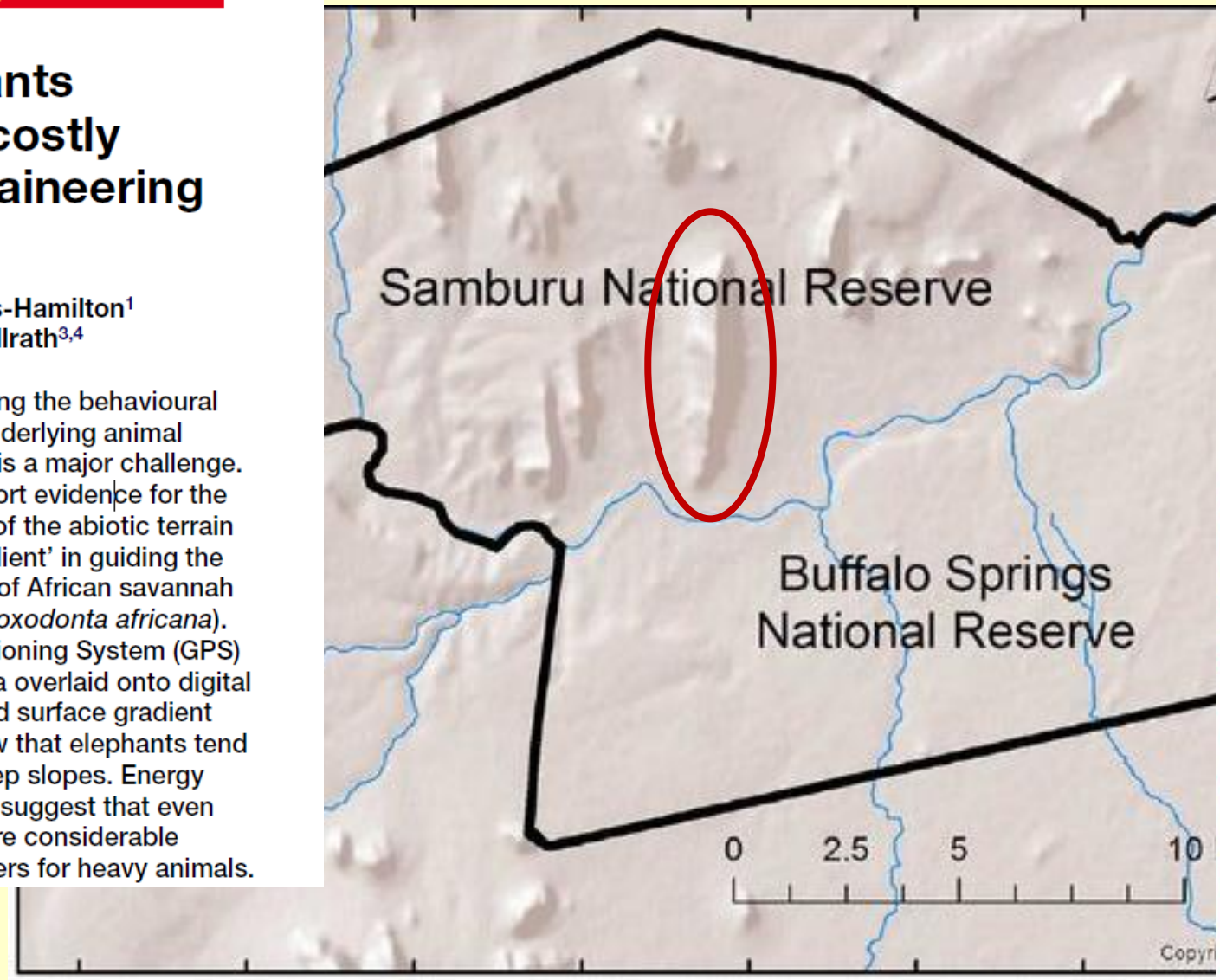
Correspondences

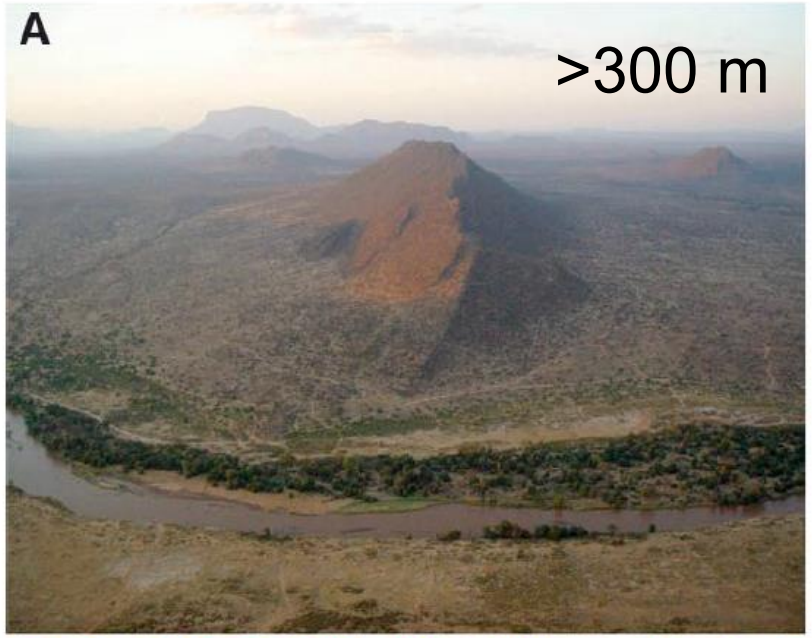
Elephants avoid costly mountaineering

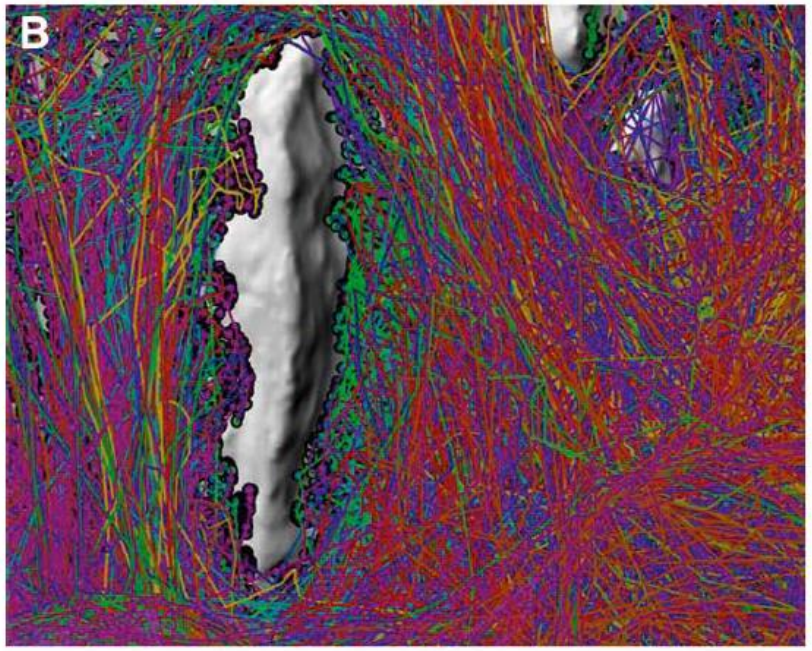
Jake Wall[1,2],
Iain Douglas-Hamilton[1]
and Fritz Vollrath[3,4]

Understanding the behavioural decisions underlying animal movements is a major challenge. Here we report evidence for the importance of the abiotic terrain feature 'gradient' in guiding the movements of African savannah elephants (*Loxodonta africana*). Global Positioning System (GPS) tracking data overlaid onto digital elevation and surface gradient models show that elephants tend to avoid steep slopes. Energy calculations suggest that even minor hills are considerable energy barriers for heavy animals.

Koitogor Mountain





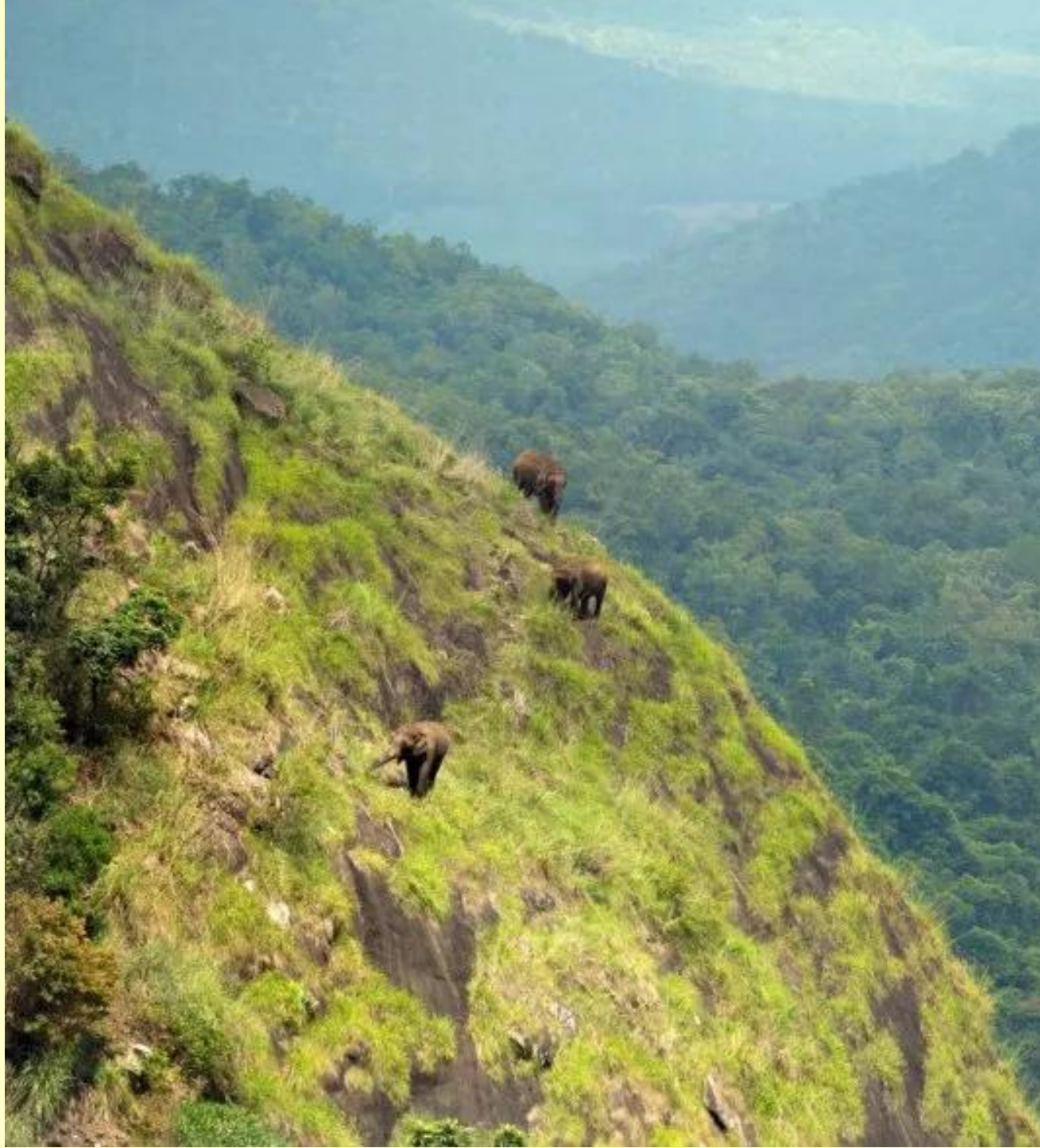


Wall et al. 2006 Current Biology 16: 527-529

Why avoid?

- Energetic costs
  - 2500% > flat ground
  - More time feeding or body reserves
- Accident landscape
  - Falls and tumbles
  - 4000-6000 kg

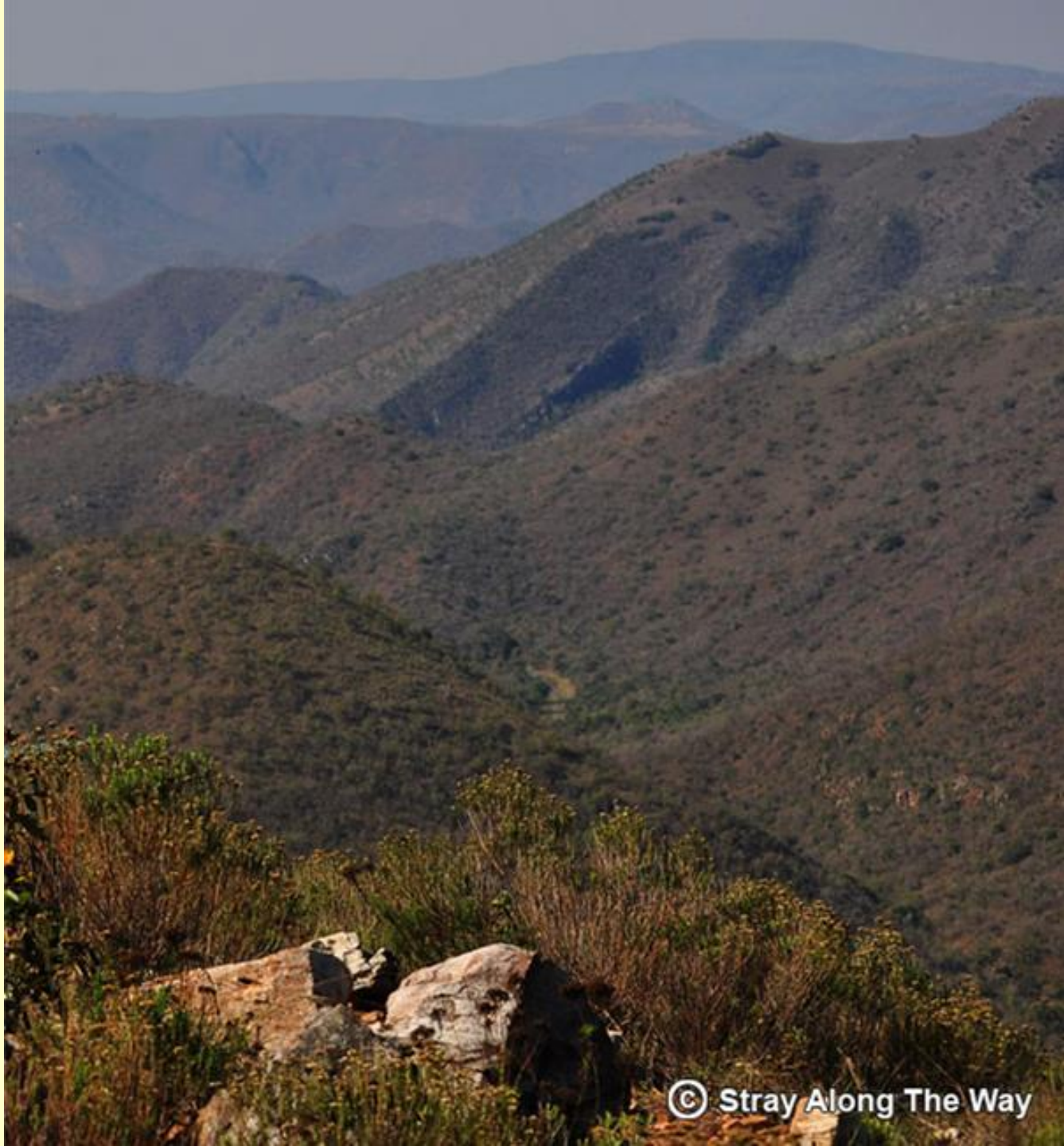
Wall et al. 2006, Wheatley et al. 2021



Protected areas

- High elevations & steep slopes
- Ithala Game Reserve
  - 291 km^2
  - 400 to 1400 masl
- 265 elephants

Joppa and Pfaff 2009



Topography

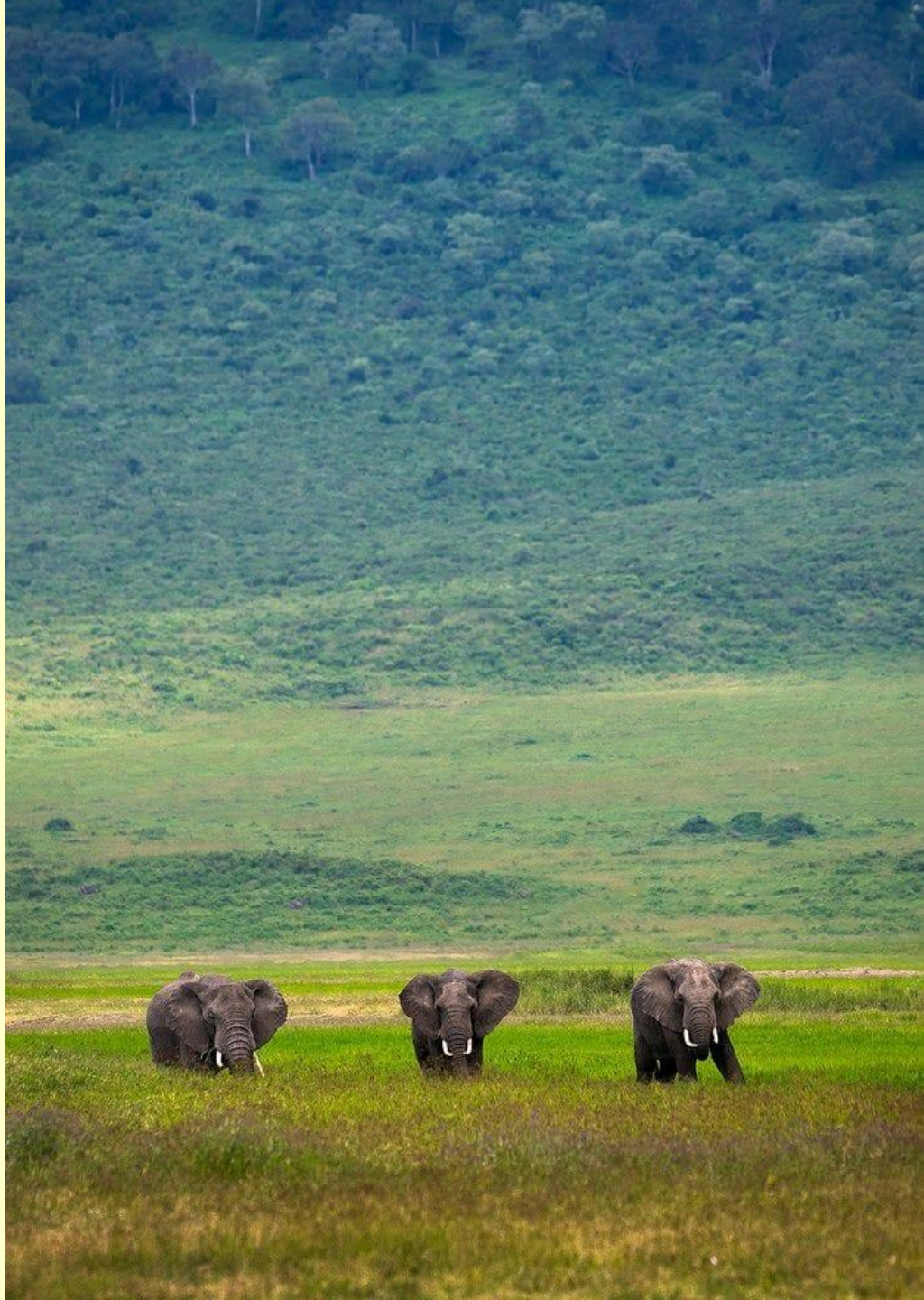
- Savanna elephants 3˚ to 4˚
- Forest elephants 5˚ to 15˚
- Asian elephants ~10˚

- Why important?
  - Available space?
  - Range expansion
  - Spatial impacts
  - Vulnerable plants

Roever et al. 2012, Ngama et al. 2019, Wilson et al. 2021, Huang et al. 2022

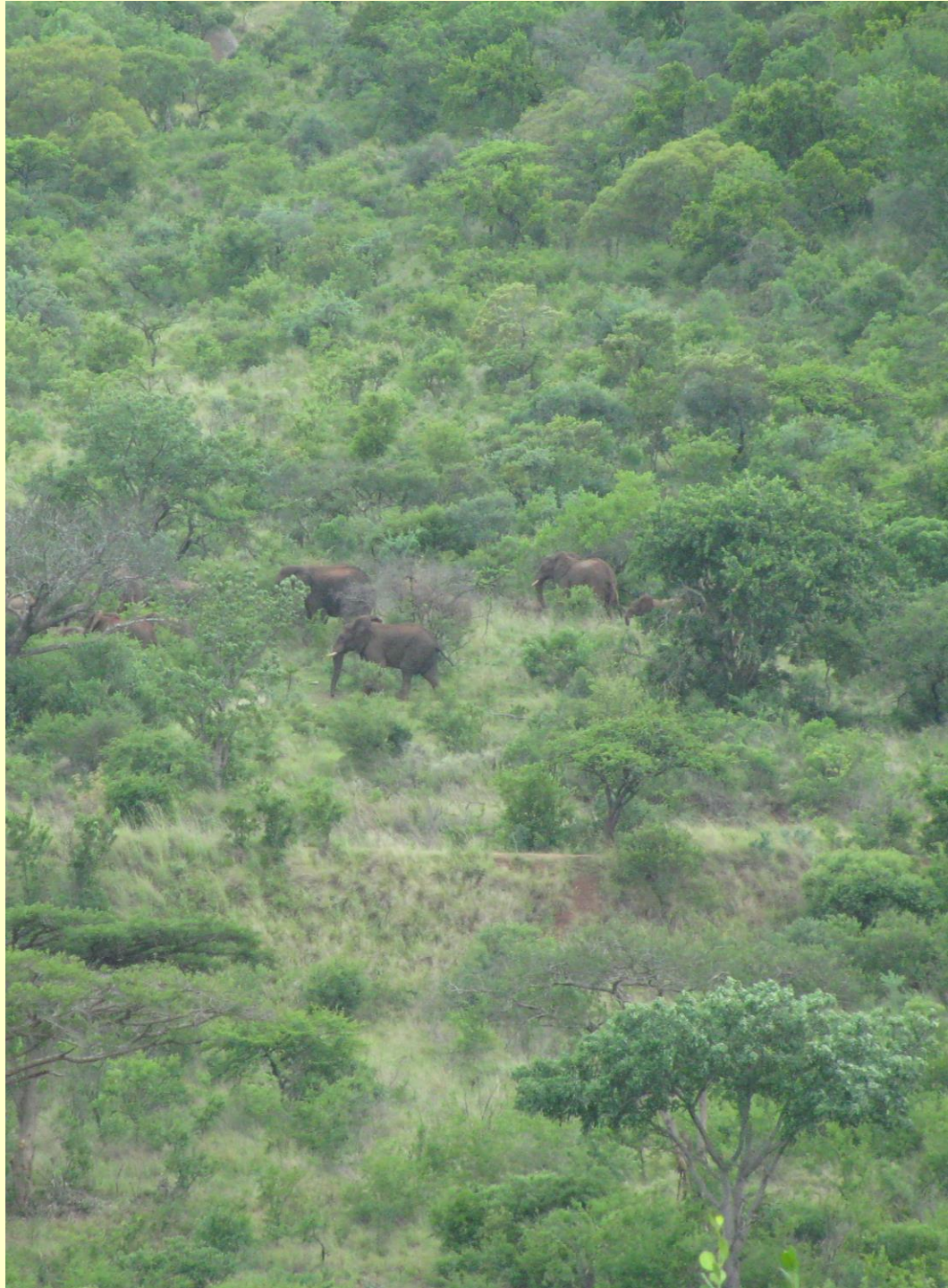
Key questions

- What is the maximum slope that elephants will use?
- Does this vary between herd types?
- Do environmental factors affect slope use?



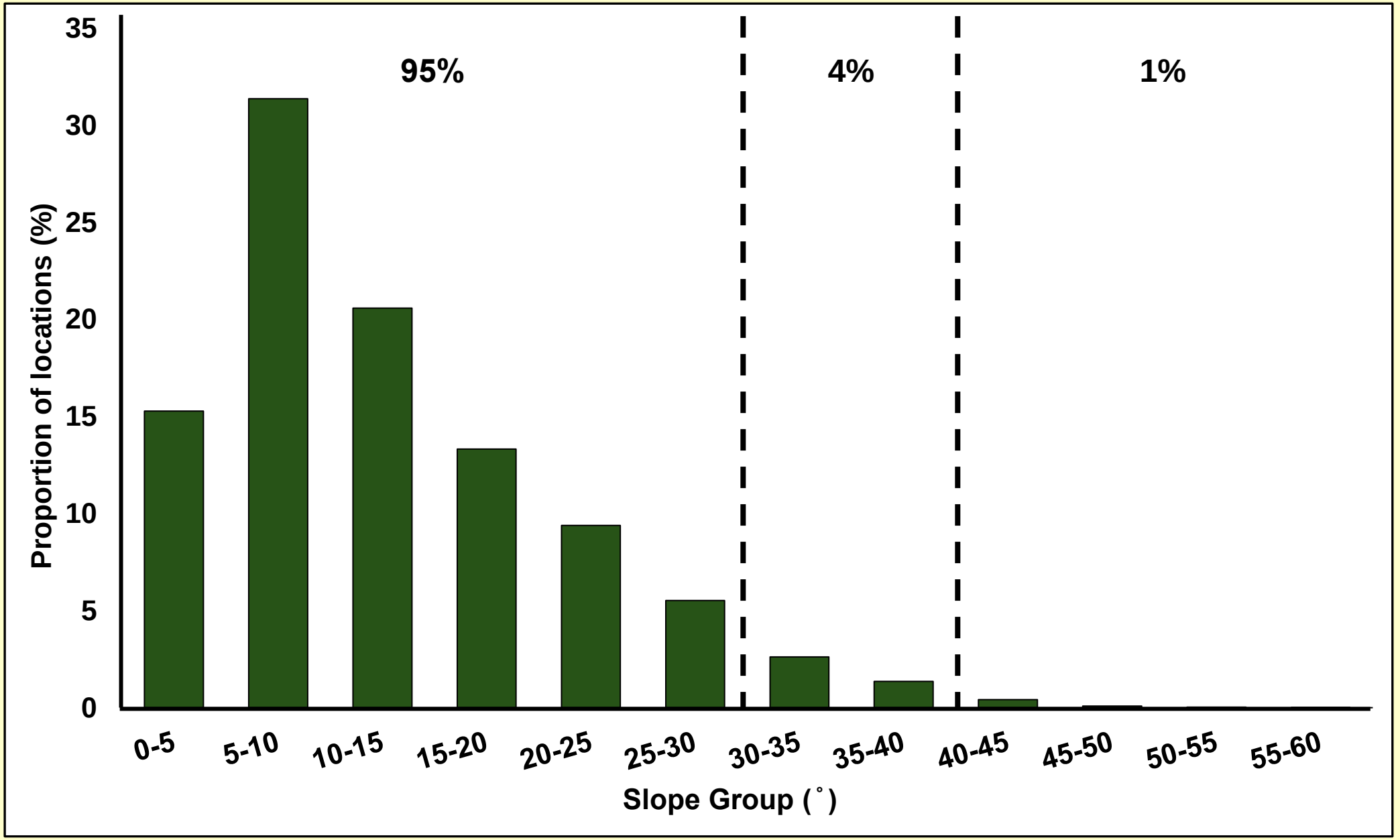
Predictions

- Prefer slopes between 0˚-15˚
- Breeding herds should avoid steep slopes
- Bulls should avoid steep slopes
- Use steeper slopes in dry season & dry years

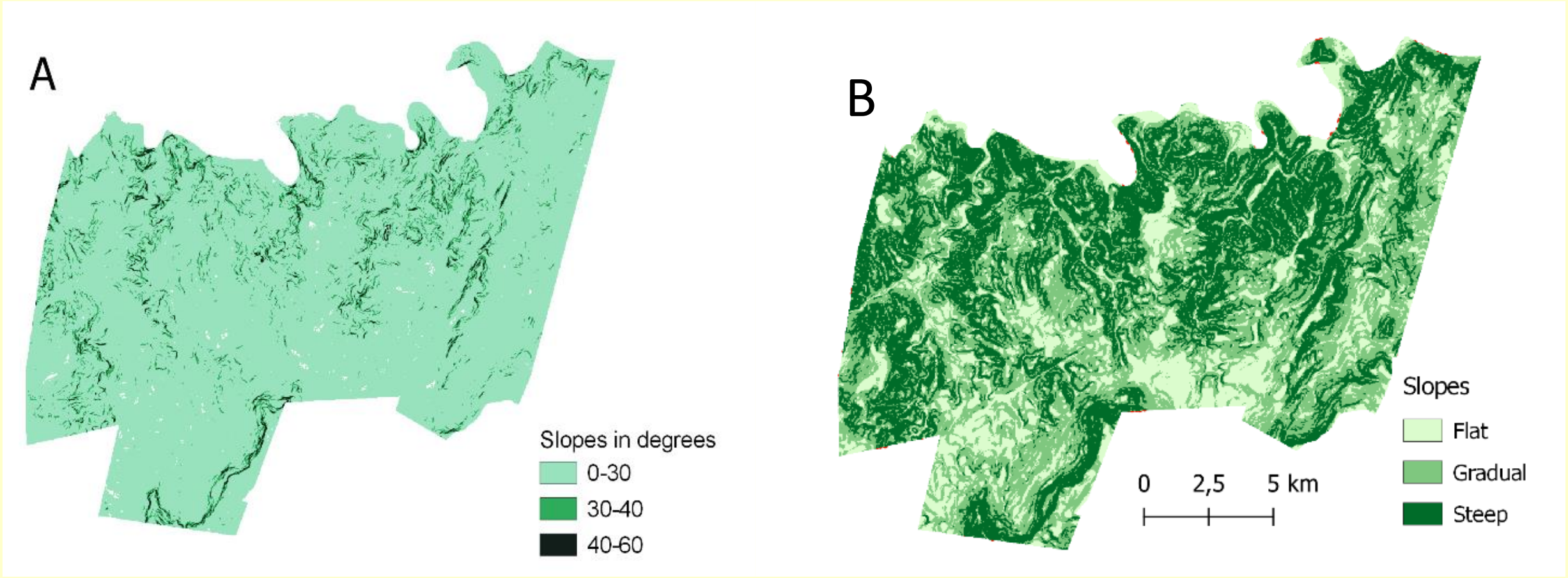


Ithala Game Reserve

- 27 herds
  - 14 breeding, 13 males
- 8.5 years (2014-2023)
  - 23,837 locations
- Wet & dry seasons
- Average & dry years
- Habitats


95%
4%
1%
Proportion of locations (%)
35
30
25
20
15
10
5
0
0-5
5-10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-55
55-60
Slope Group (˚)

Ngama et al. 2019



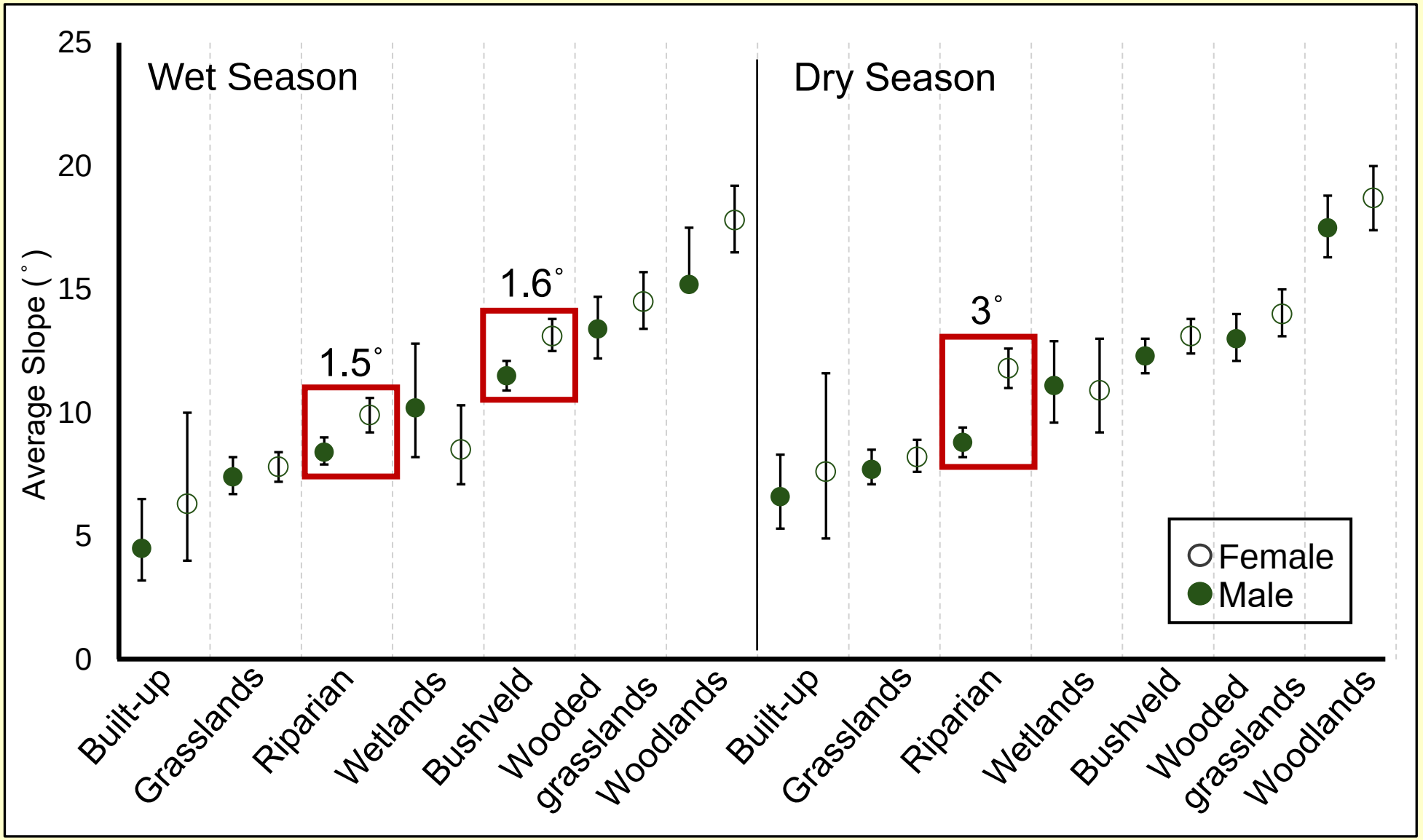
- 90% of slopes <30˚
- 8% of slopes 30˚- 40˚
- 5% of slopes >40˚

- 17% flat <5˚
- 42% gradual 5˚- 15˚
- 41% steep >15˚

Slope use

- Habitat
  - Built-up to Woodlands (9.7˚)
- Herd x Year
  - ♀ on steeper slopes in dry years (1˚)
- Season x Year
  - Steeper slopes in dry season (1.3˚)

Herd x Season x Habitat



Take home

- Used steeper slopes
  - 33% locations >15˚
  - >15˚ not a barrier
- Factors influenced
  - Biologically relevant?
- Availability?
  - <30˚= 96%; <15˚= 40%
- Underestimate
  - Landscape availability
  - Range expansion