

White-Bearded Wildebeest Response to Fragmentation near Three Protected Areas in Kenya

Jared Stabach, Randall Boone

Natural Resource Ecology Laboratory
Colorado State University

Front Range Student Ecology Symposium
Fort Collins, CO
February 22-23, 2011



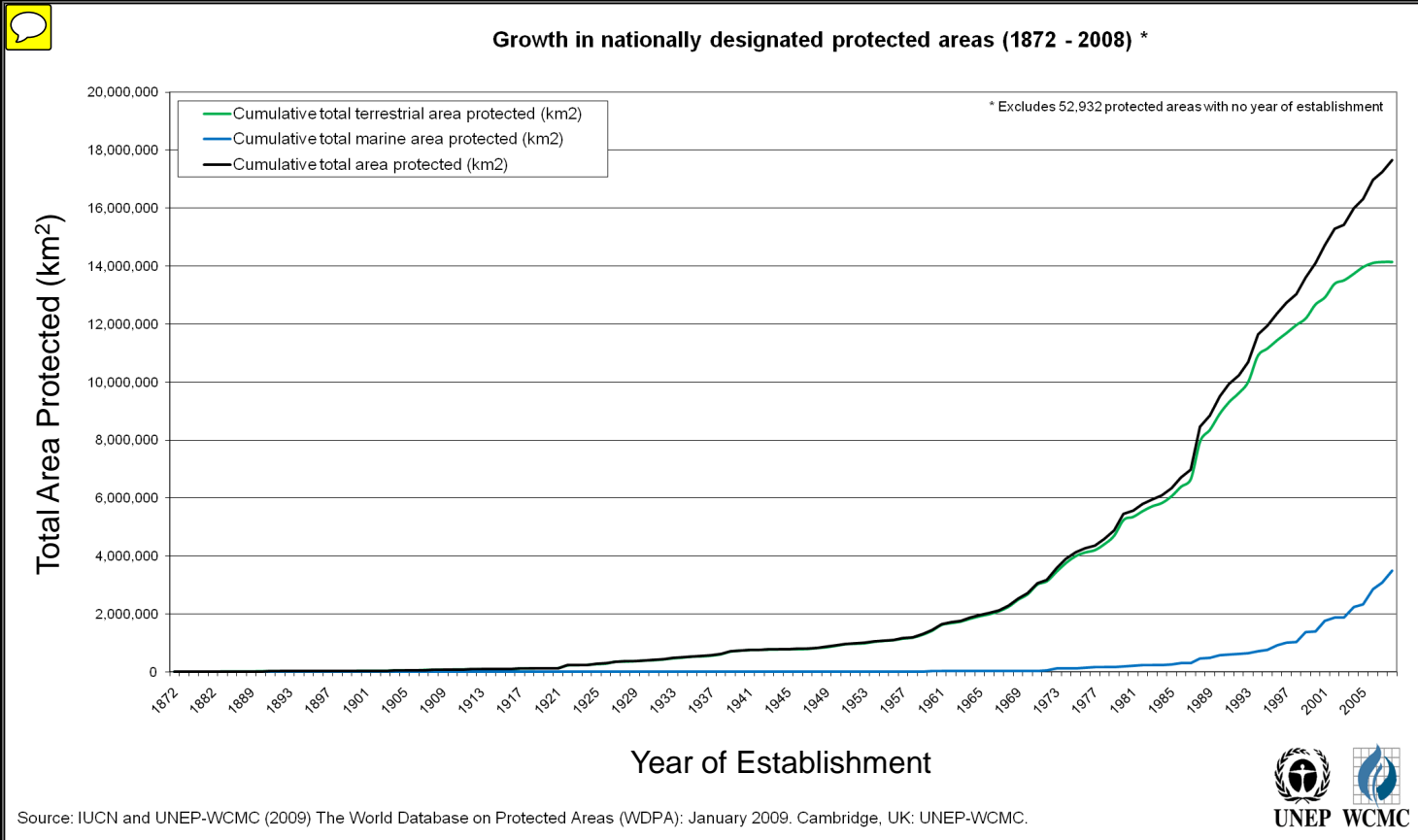
Outline

- I. Introduction and Justification
- II. Current Research Progress
- III. Next steps

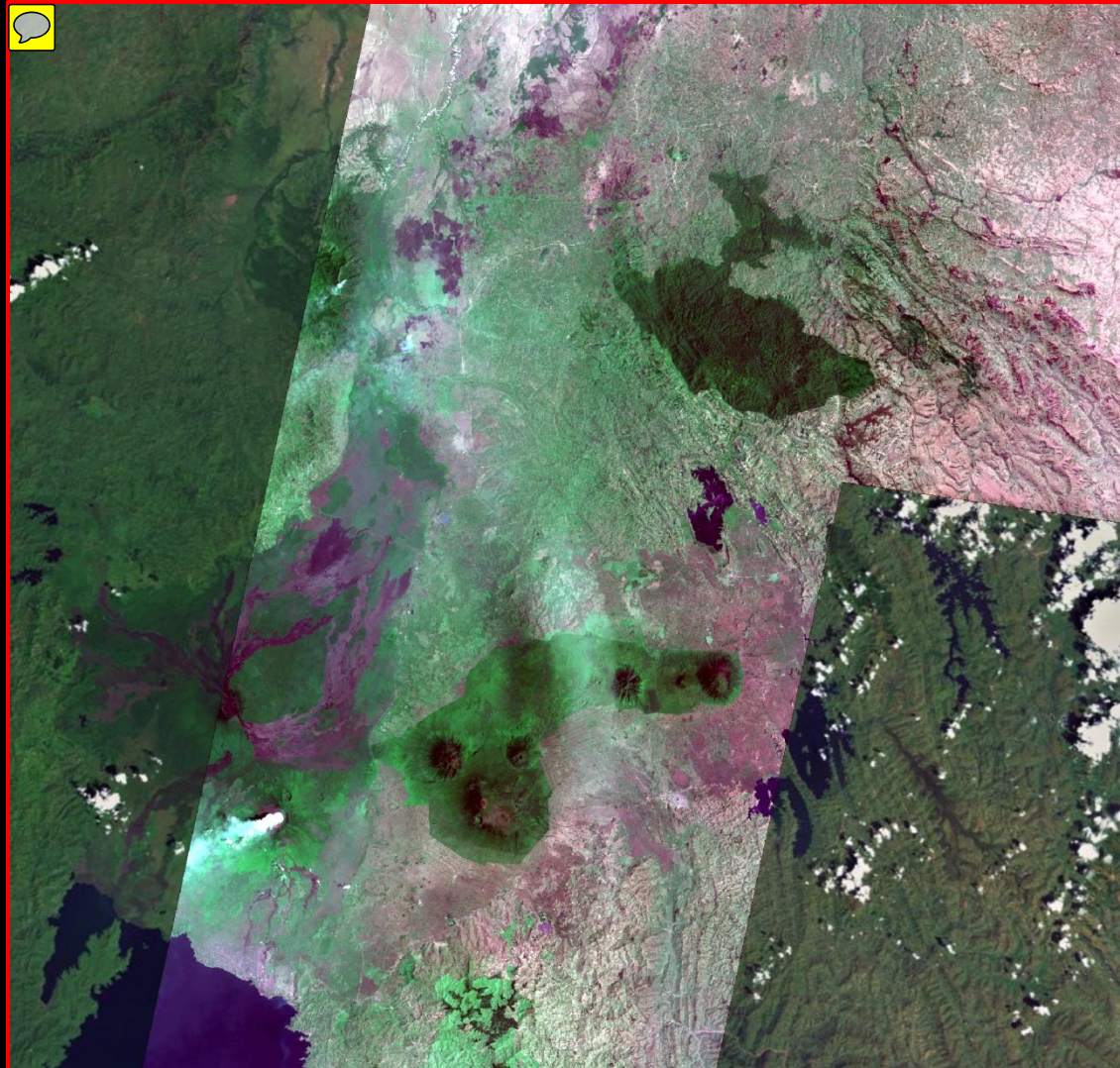


Adult wildebeest (30072)
regaining her strength
after being collared.
Animal is a 9-year old
female with calf.

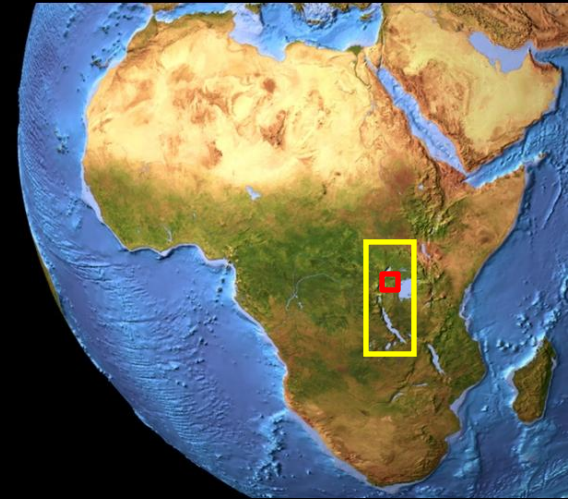
Protected Areas Worldwide



Protected Areas

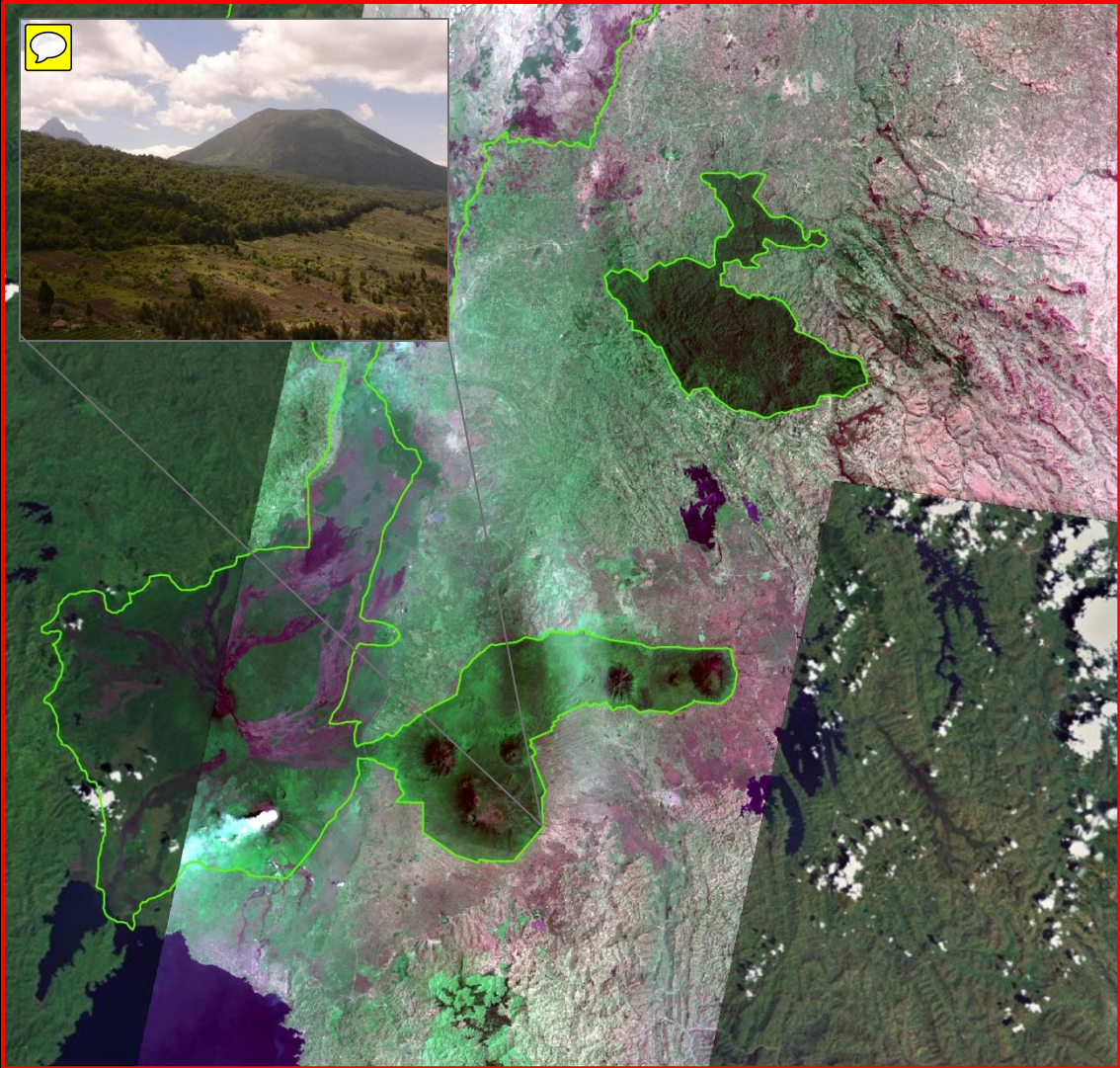


Albertine Rift, Africa



Aster satellite imagery (15-meter)
overlayed on ESRI world imagery

Protected Areas

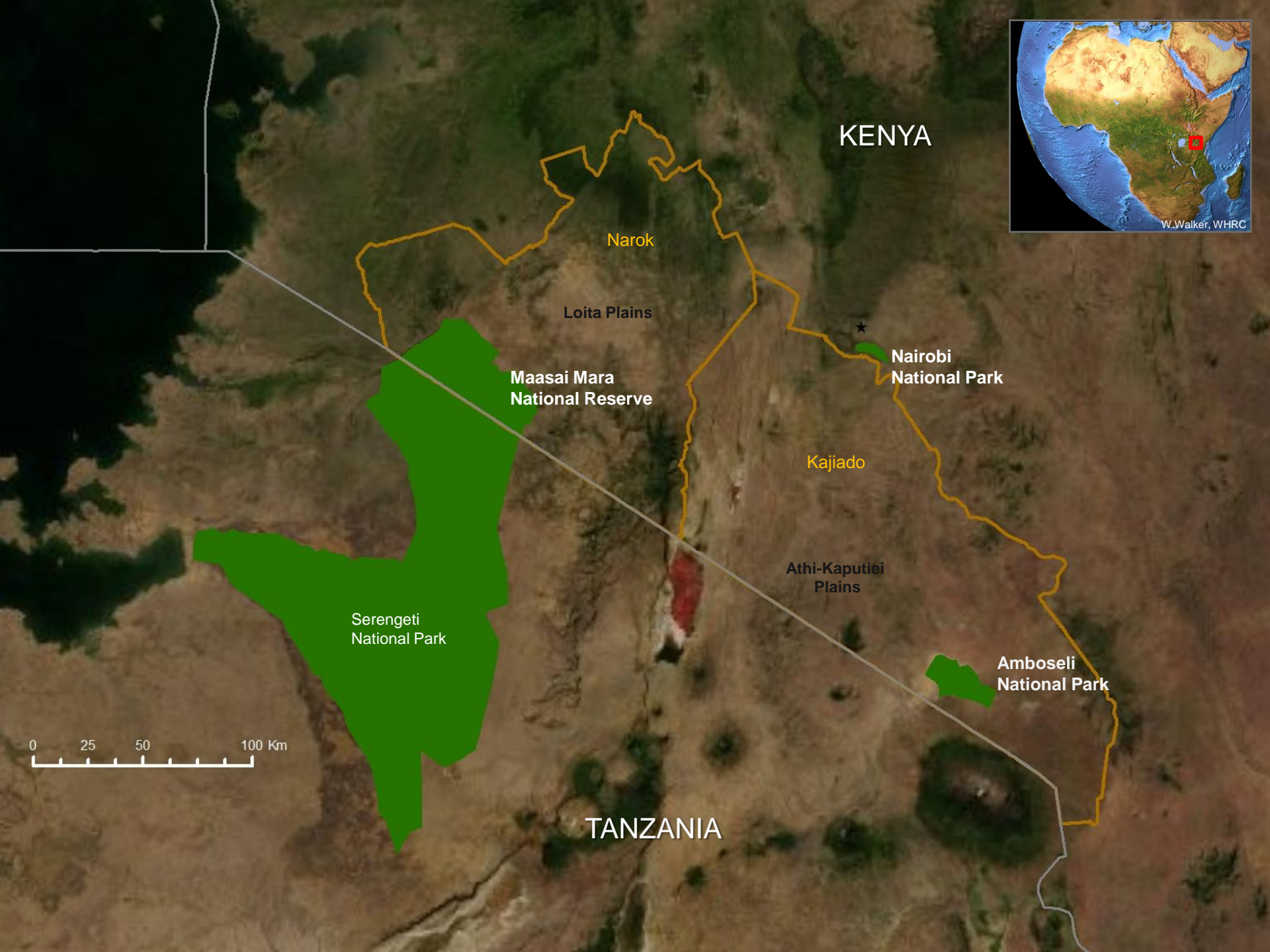


Albertine Rift, Africa



Aster satellite imagery (15-meter) overlaid on ESRI world imagery

*Images courtesy of G.Fiske, W.Walker and G.Bush, WHRC



KENYA

Narok

Loita Plains

Maasai Mara
National Reserve



Nairobi
National Park

Kajiado

Athi-Kaputiei
Plains

Serengeti
National Park

Amboseli
National Park

TANZANIA

0 25 50 100 Km



W. Walker, WHRC

Study Area

Maasai Mara NR

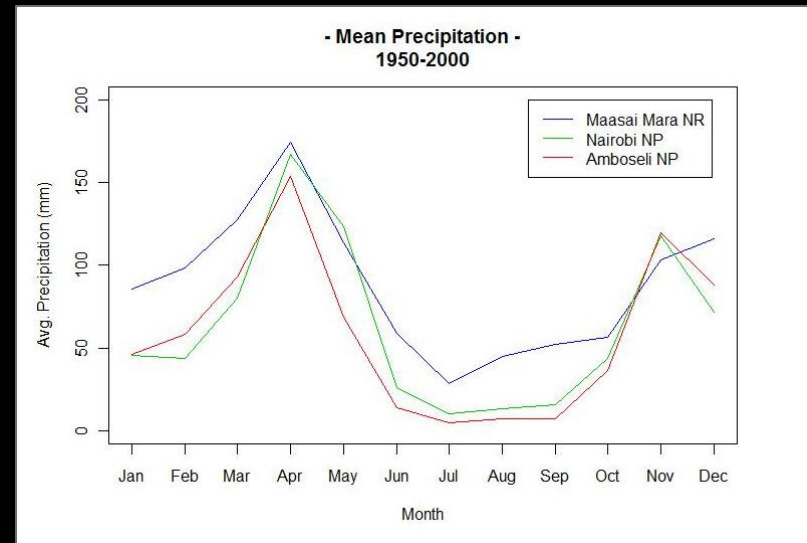
- Park Area: 1506 km²; Dispersal Area: ~6000 km²
- Precipitation range: 550-1850 mm^{-yr} (**High**)*
- Medium levels of Fragmentation
- 81% population decline, 1977 – 1997**

Nairobi NP

- Park Area: 66 km² ; Dispersal Area: ~2500 km²
- Precipitation range: 300-1000 mm^{-yr} (**Medium**)*
- High levels of Fragmentation
- 72% population decline, 1972 – 2002***

Amboseli NP

- Park Area: 400 km²; Dispersal Area: ~3000 km²
- Precipitation range: 150-900 mm^{-yr} (**Low**)*
- Low levels of Fragmentation
- 93% mortality in 2010****



*Hijmans et al. 2005 (WorldClim)

**Ottichilo et al. 2001

***Reid et al. 2008

****Worden et al. 2010, unpublished

Study Area

Maasai Mara NR

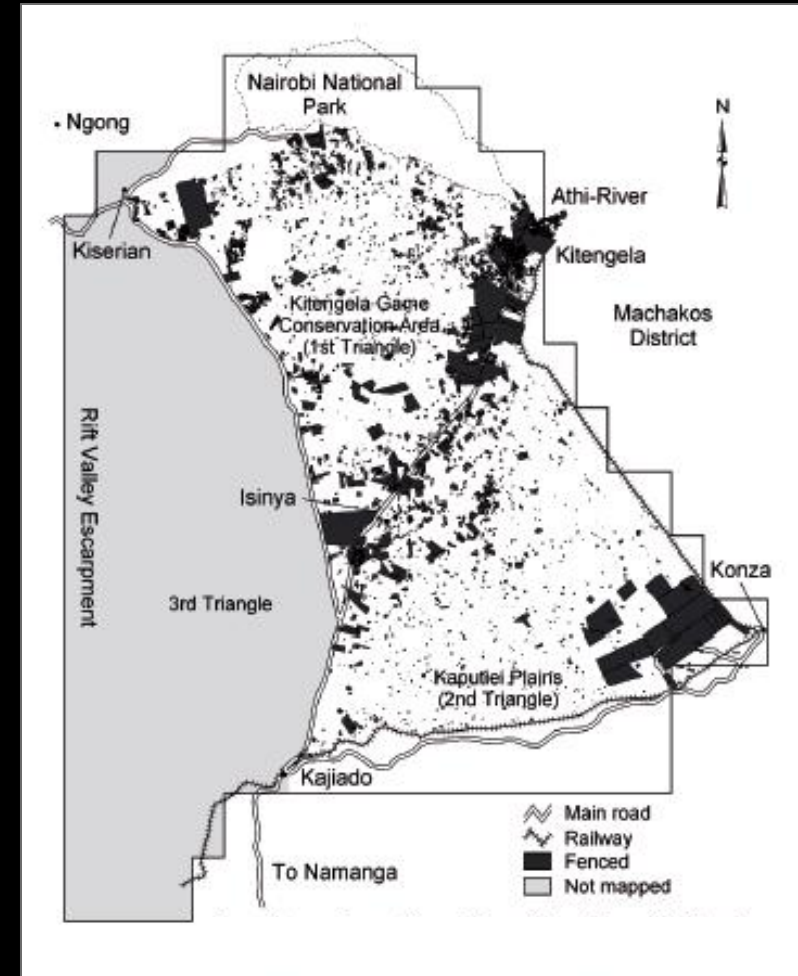
- Park Area: 1506 km²; Dispersal Area: ~6000 km²
- Precipitation range: 550-1850 mm^{-yr} (High)*
- **Medium** levels of Fragmentation
- 81% population decline, 1977 – 1997**

Nairobi NP

- Park Area: 66 km² ; Dispersal Area: ~2500 km²
- Precipitation range: 300-1000 mm^{-yr} (Medium)*
- **High** levels of Fragmentation
- 72% population decline, 1972 – 2002***

Amboseli NP

- Park Area: 400 km²; Dispersal Area: ~3000 km²
- Precipitation range: 150-900 mm^{-yr} (Low)*
- **Low** levels of Fragmentation
- 93% mortality in 2010****



*Hijmans et al. 2005 (WorldClim)

**Ottichilo et al. 2001

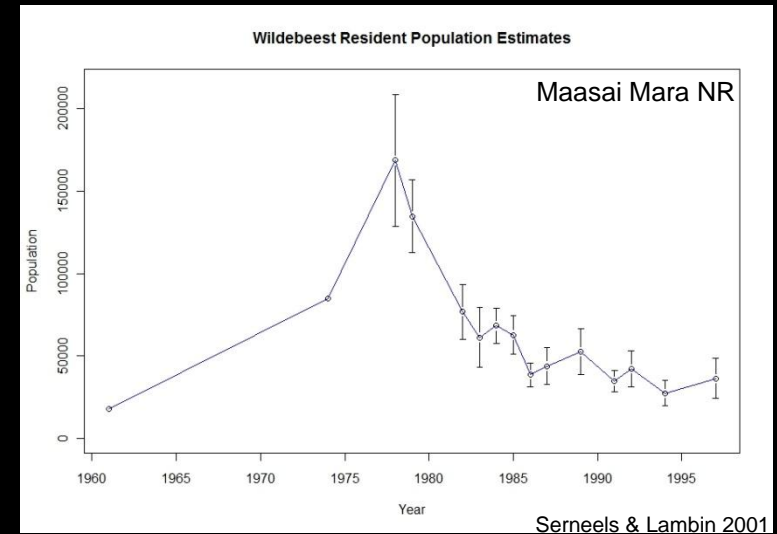
***Reid et al. 2008

****Worden et al. 2010, unpublished

Study Area

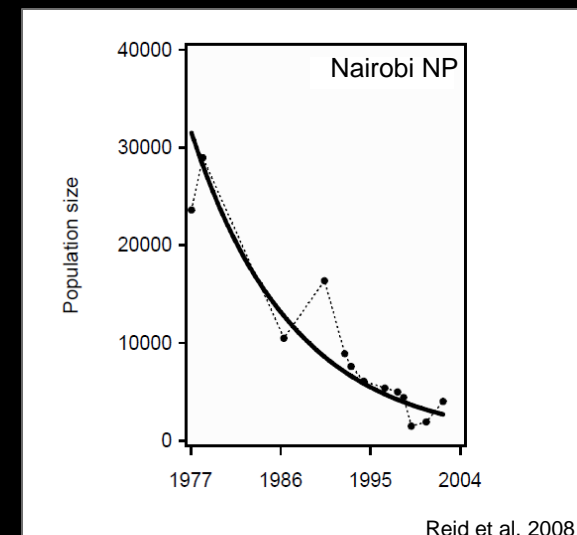
Maasai Mara NR

- Park Area: 1506 km²; Dispersal Area: ~6000 km²
- Precipitation range: 550-1850 mm^{-yr} (High)*
- Medium levels of Fragmentation
- **81% population decline**, 1977 – 1997**



Nairobi NP

- Park Area: 66 km² ; Dispersal Area: ~2500 km²
- Precipitation range: 300-1000 mm^{-yr} (Medium)*
- High levels of Fragmentation
- **72% population decline**, 1972 – 2002***



Amboseli NP

- Park Area: 400 km²; Dispersal Area: ~3000 km²
- Precipitation range: 150-900 mm^{-yr} (Low)*
- Low levels of Fragmentation
- **93% mortality**, 2010****

*Hijmans et al. 2005 (WorldClim)

**Ottichilo et al. 2001

***Reid et al. 2008

****Worden et al. 2010, unpublished

Research Hypotheses

H₁: Fragmentation restricts the movements and homerange of wildebeest

H₂: Animal stress is significantly different between study areas with high fragmentation than those with low fragmentation

H₃: Wildebeest population trajectories decline as levels of fragmentation increase



Research Goals

- Compare the home range and movements of wildebeest in each of the three study areas
 - Lotek™ WildCell GPS Collars
 - 16 locations per animal per day for 2 years
 - Dry season vs wet season
- Use Agent-based modeling to re-create historical population declines/simulate movements in relation to different scenarios
- Quantify physiological stress
 - Fecal glucocorticoid analysis
 - Fragmented vs. Non-fragmented



October 2010 – February 2011

36 Animals Collared

Maasai Mara NR

n = 15

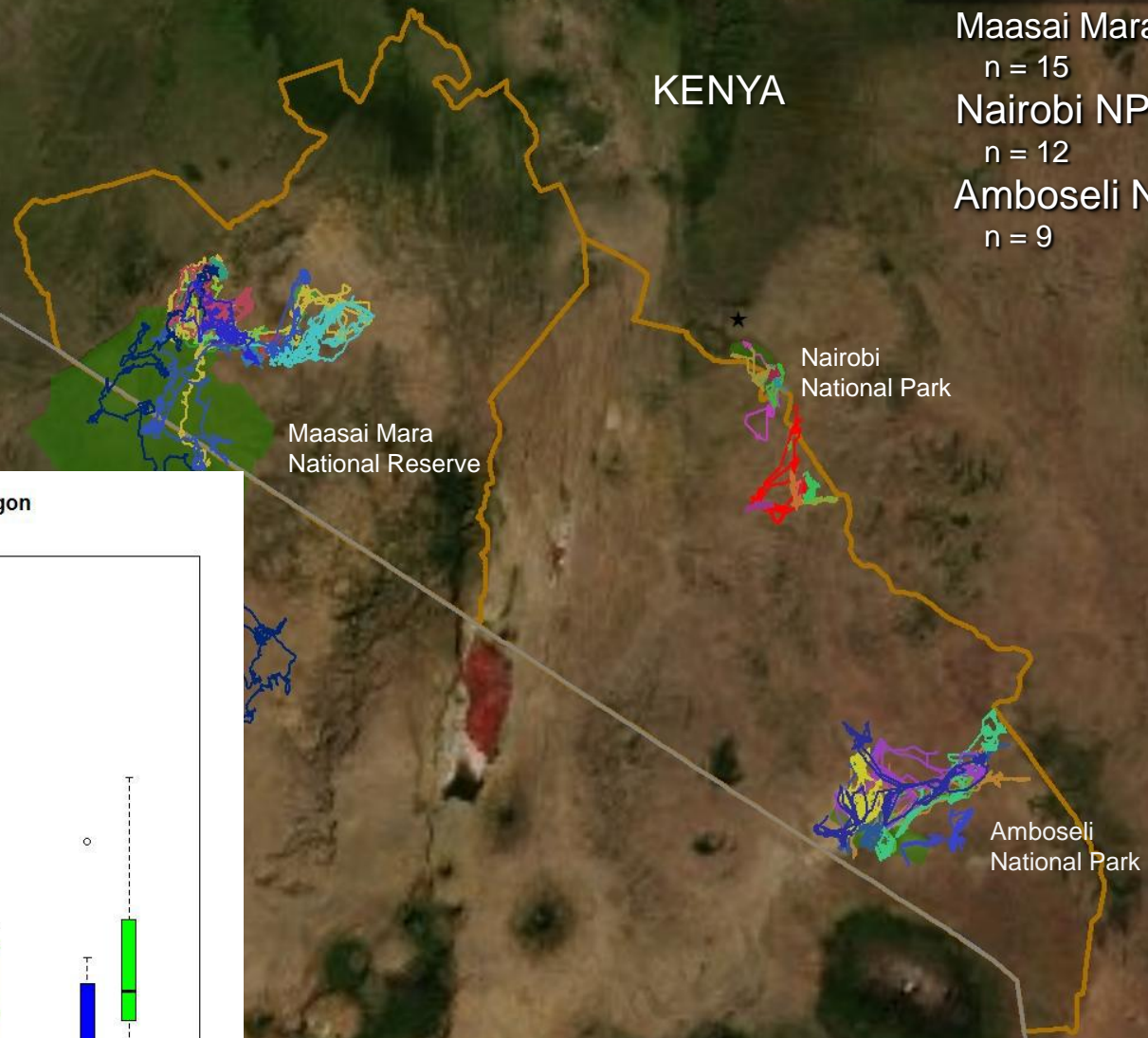
Nairobi NP

n = 12

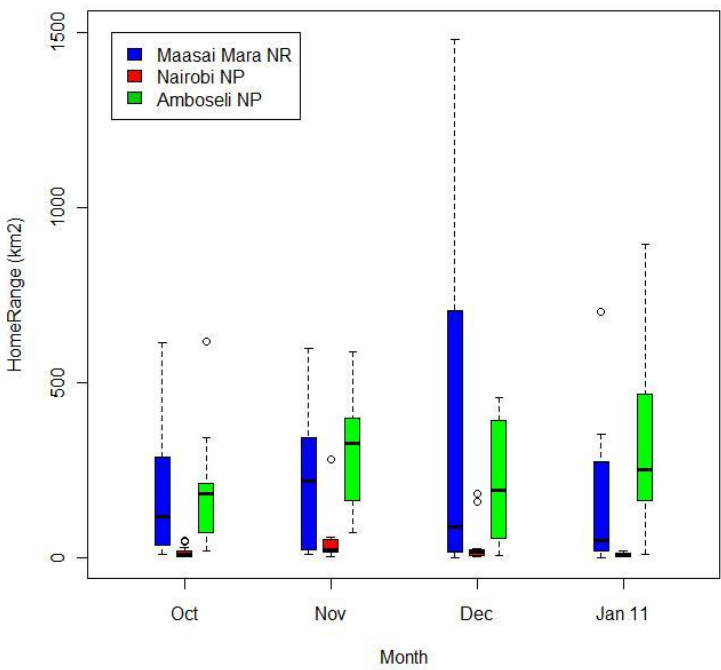
Amboseli NP

n = 9

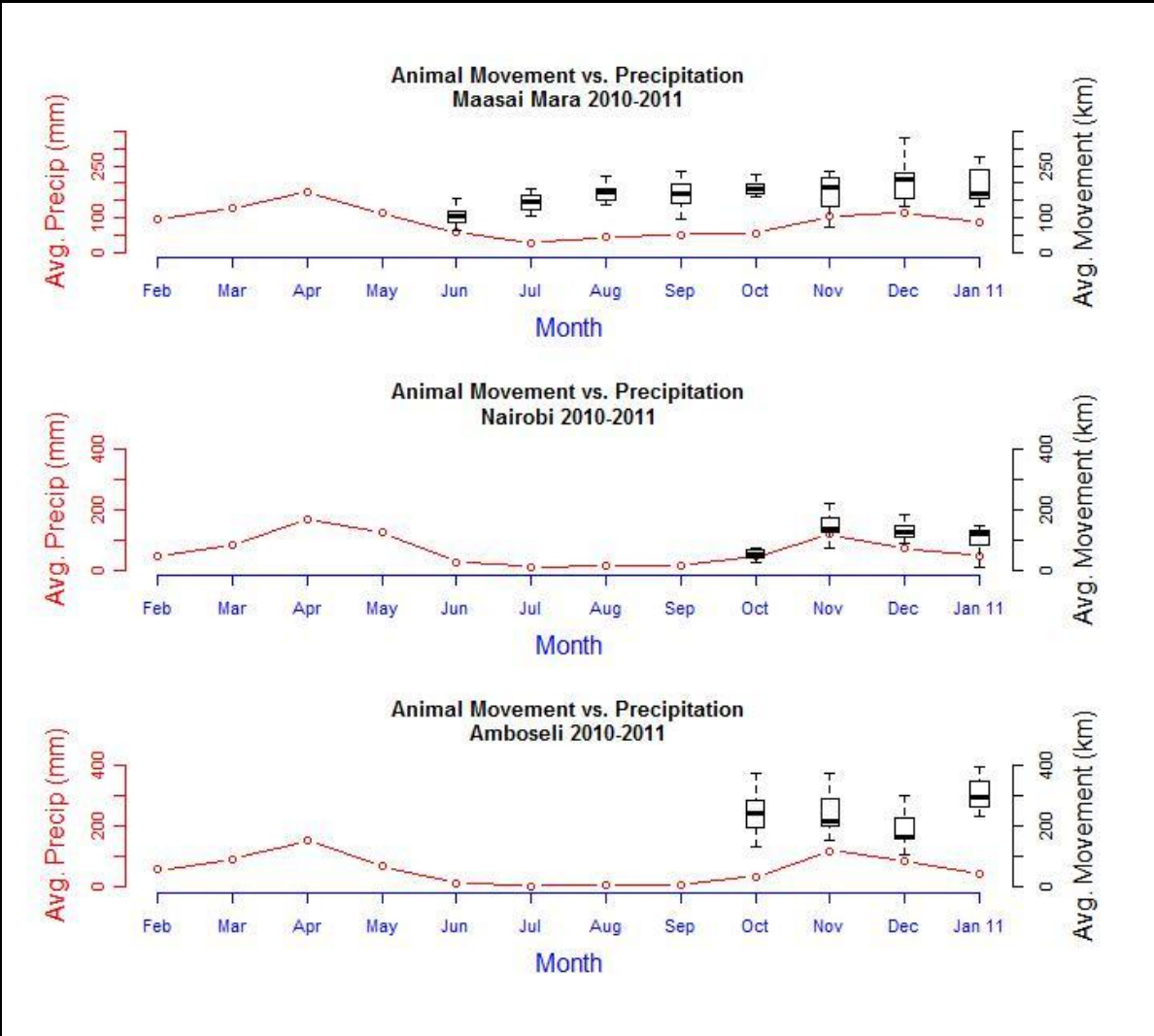
KENYA



**Minimum Convex Polygon
Homeranges**



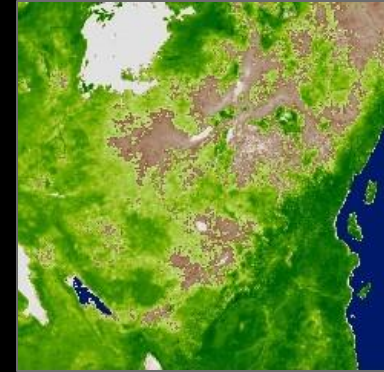
Animal Movements



*Precipitation (RFE) from NOAA-CPC

Next Steps

- Field data collection
 - Collect habitat variables related to wildebeest movement
 - Vegetation/animal species composition
 - Distance to nearest road/fenced rangeland
 - What are the factors influencing differences in movement?
- Continue to gather the underlying layers for modeling purposes
- Find additional funding for the glucocorticoid analysis



MODIS 16-day NDVI composite



Photo: R Reid, CSU-CCC

Acknowledgements

Colorado State University
Natural Resource Ecology Laboratory

Africa Conservation Centre
Dr. Jeffrey Worden

Funding Sources

National Science Foundation
Spot Imaging – Planet Action Initiative

Collaborators

African Conservation Centre
Center for Collaborative Conservation
Kenya Wildlife Service
University of Maine





Visit our project website at:

<http://www.nrel.colostate.edu/projects/gnu/>

or 

“Gnu Landscapes”

