SMITHSONIAN'S NATIONAL ZOO & CONSERVATION BIOLOGY INSTITUTE

An Ecological Toolbox to Inform Livestock Grazing Allotments Across Wildlife Conservancies in Kenya

EARTH SCIENCE APPLIED SCIENCES

Award: 80NSSC23K1537

Jared Stabach, PhD
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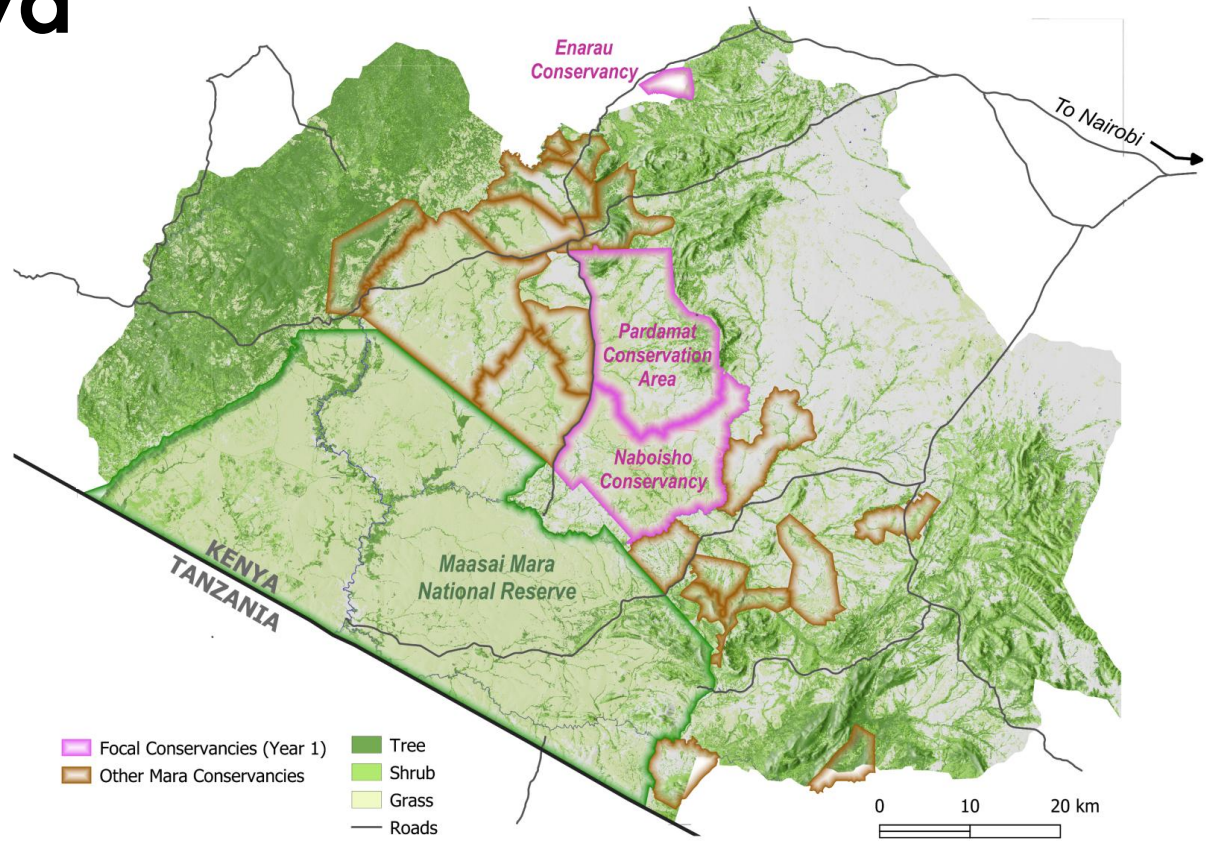
Conservation Ecology Center
Smithsonian National Zoo & Conservation Biology Institute



Project Team

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Quantitative Lead
SCBI

Qiongyu Huang
Remote Sensing Lead
SCBI

Katie LaJeunesse
Project Mgmt
SCBI

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UCC

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Wildlife Dynamics/AI2

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Eugene Kuloba
Data Manager
Mara Elephant Project

Conservancy Managers

Alistair Nicklin
Naboisho

Dalton Karia
Enarau

Jackson Sasine
Pardamat

Masai Mara Ecosystem, Kenya

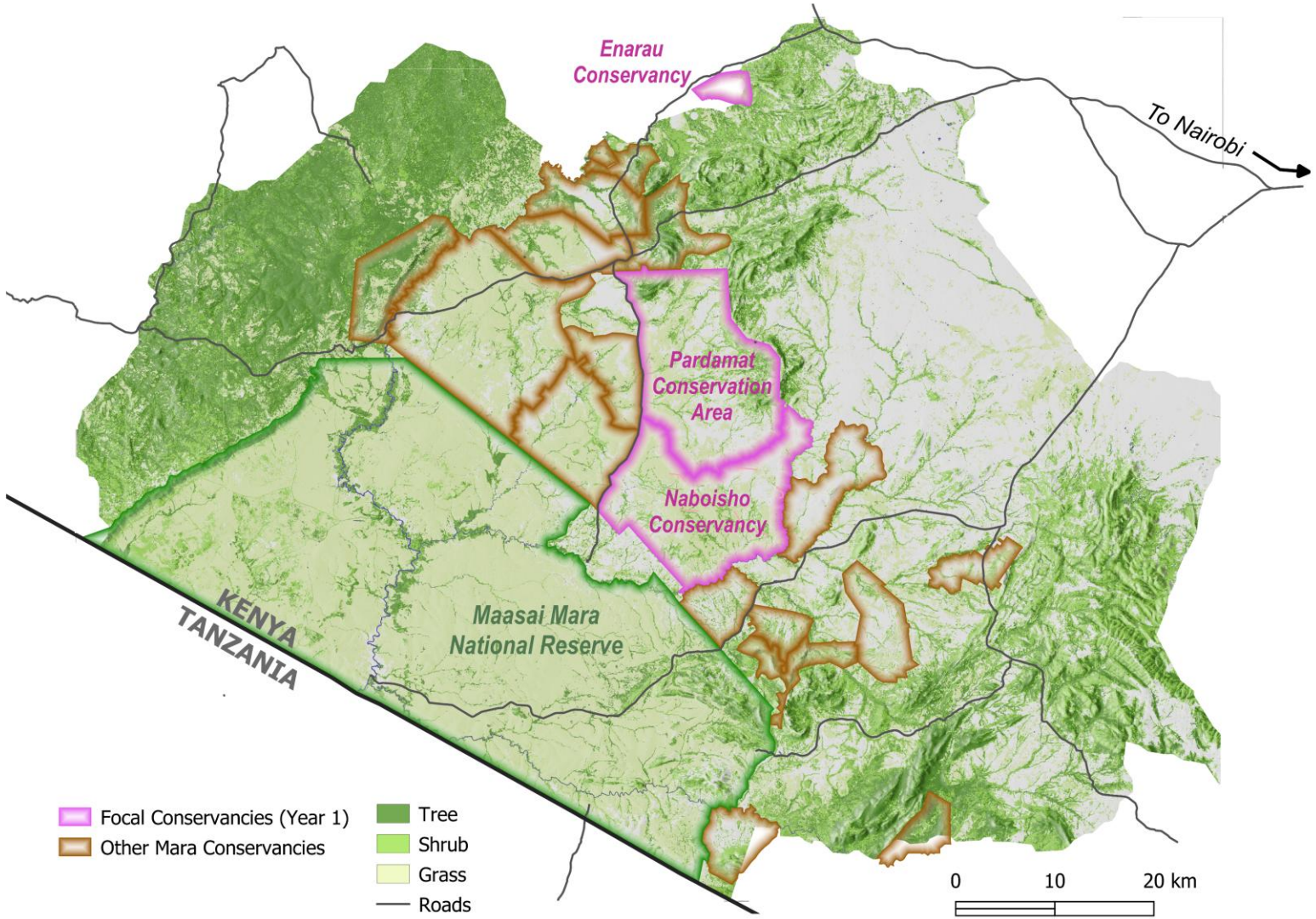
National Reserve - 1506 km^2

Wildlife Conservancies - 1421 km^2

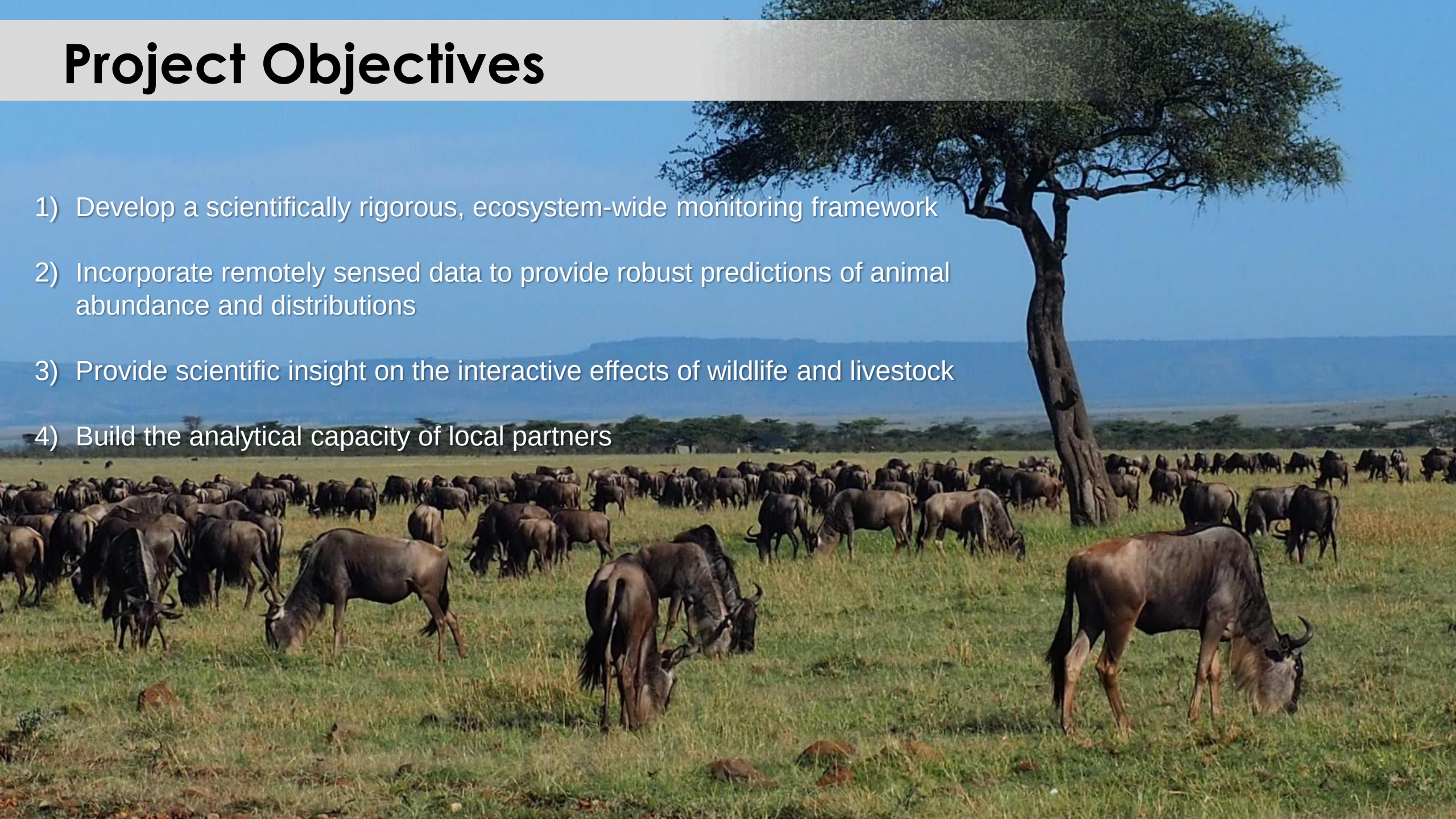
Enarau (15 km^2)
- Undergoing grassland restoration

Pardamat (234 km^2)
- Mixed use conservation
- Heavily settled/fenced

Naboisho (209 km^2)
- Managed for Wildlife Tourism



Project Objectives



1) Develop a scientifically rigorous, ecosystem-wide monitoring framework

2) Incorporate remotely sensed data to provide robust predictions of animal abundance and distributions

3) Provide scientific insight on the interactive effects of wildlife and livestock

4) Build the analytical capacity of local partners

Project Activities

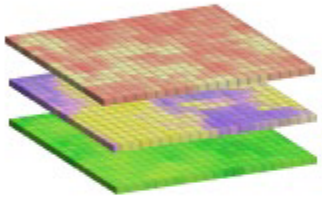
African Journal of Ecology
RESEARCH ARTICLE | Open Access
Monitoring spatiotemporal dynamics of large herbivores across an African rangeland using hierarchical multi-species distance sampling
Ramiro D. Crego, Harry B. M. Wells, Grant Connette, Jared A. Stabach, Naitareu Solt, Stewart Thompson

In Situ BIOLOGICAL DATA COLLECTION

- Livestock abundance
- Wildlife species detections
- Distance to observation

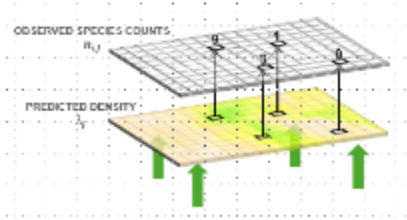
EARTH OBSERVATIONS

- Water availability (OPERA)
- Woody backscatter (ALOS PALSAR)
- Vegetation productivity (MODIS NDVI)



HIERARCHICAL DISTANCE SAMPLING MODEL

- Correct for observation bias
- Predict species abundance



Decision Support Toolbox

- Current wildlife population estimates
- Temporal trends in wildlife populations
- Current vegetation condition (NDVI)
- Temporal trends in vegetation (ΔNDVI)
- Interactive maps and data summaries
- Wildlife population projections and associated livestock stocking rates

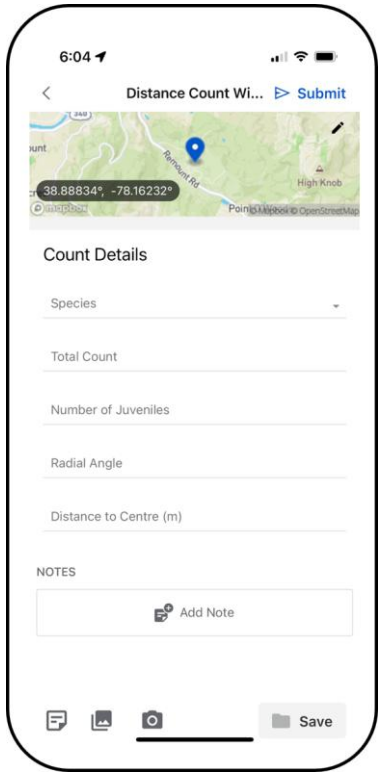
Capacity Building

- Annual training workshops
- Annual Smithsonian internships

GOAL: Expand protocol across entire conservancy network by 2027

Achievements – Protocol Established

- Developed Data Infrastructure
- Extended Long-Term Data Collection Capabilities



EARTHRANGER

BRITISH ECOLOGICAL SOCIETY | Methods in Ecology and Evolution

APPLICATION | Open Access

EarthRanger: An open-source platform for ecosystem monitoring, research and management

Jake Wall et al.

©Chags Photography

Achievements – Data Collection Expanded

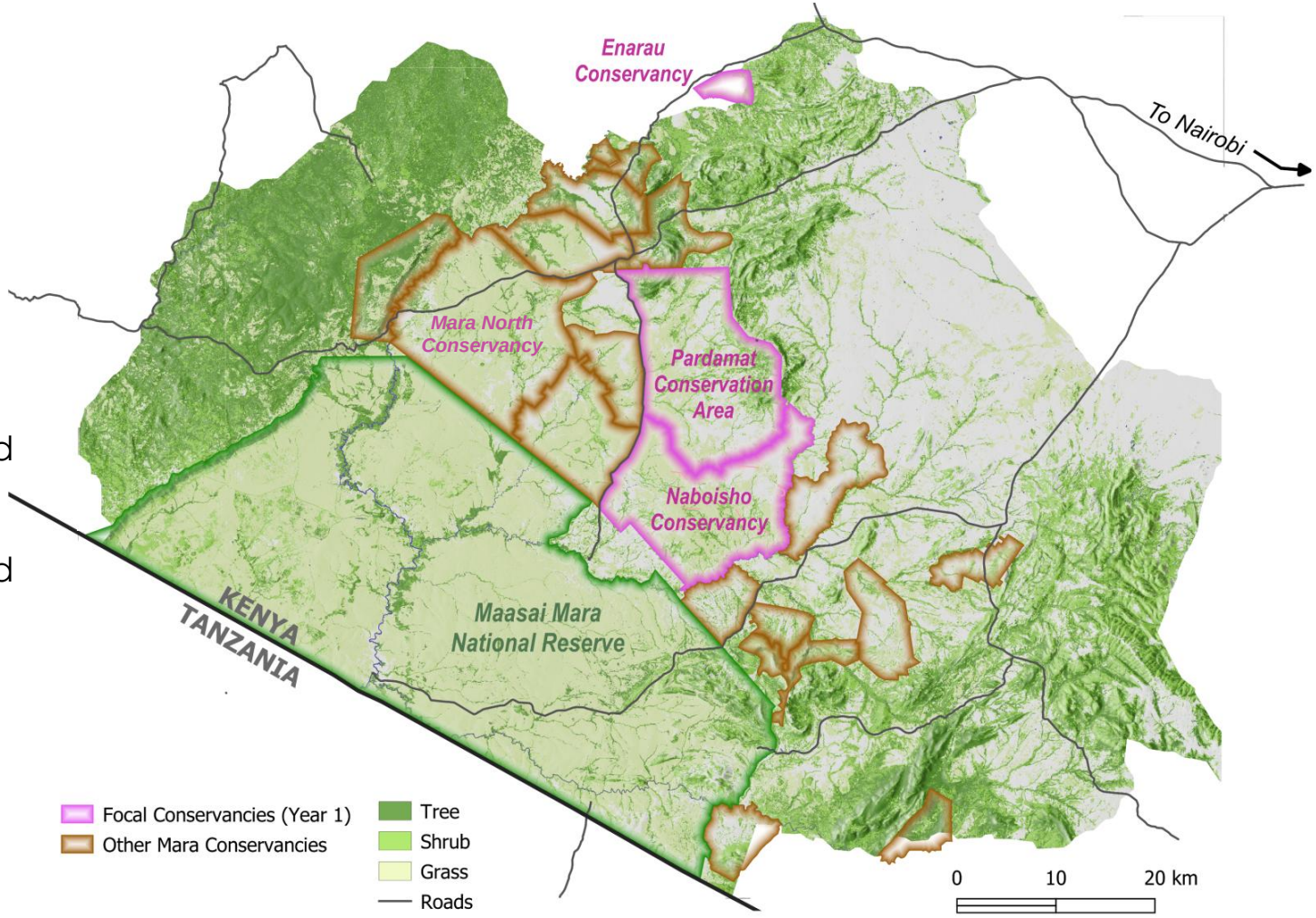
Quarterly Ground Surveys

- November 2024
- February 2025
- May 2025

Enarau (15 km^2)
- 10 Transects Proposed -> **6** Transects Established

Pardamat (234 km^2)
- 10 Transects Proposed -> **12** Transects Established

Naboisho (209 km^2)
- 10 Transects Proposed -> **51** Transects Established



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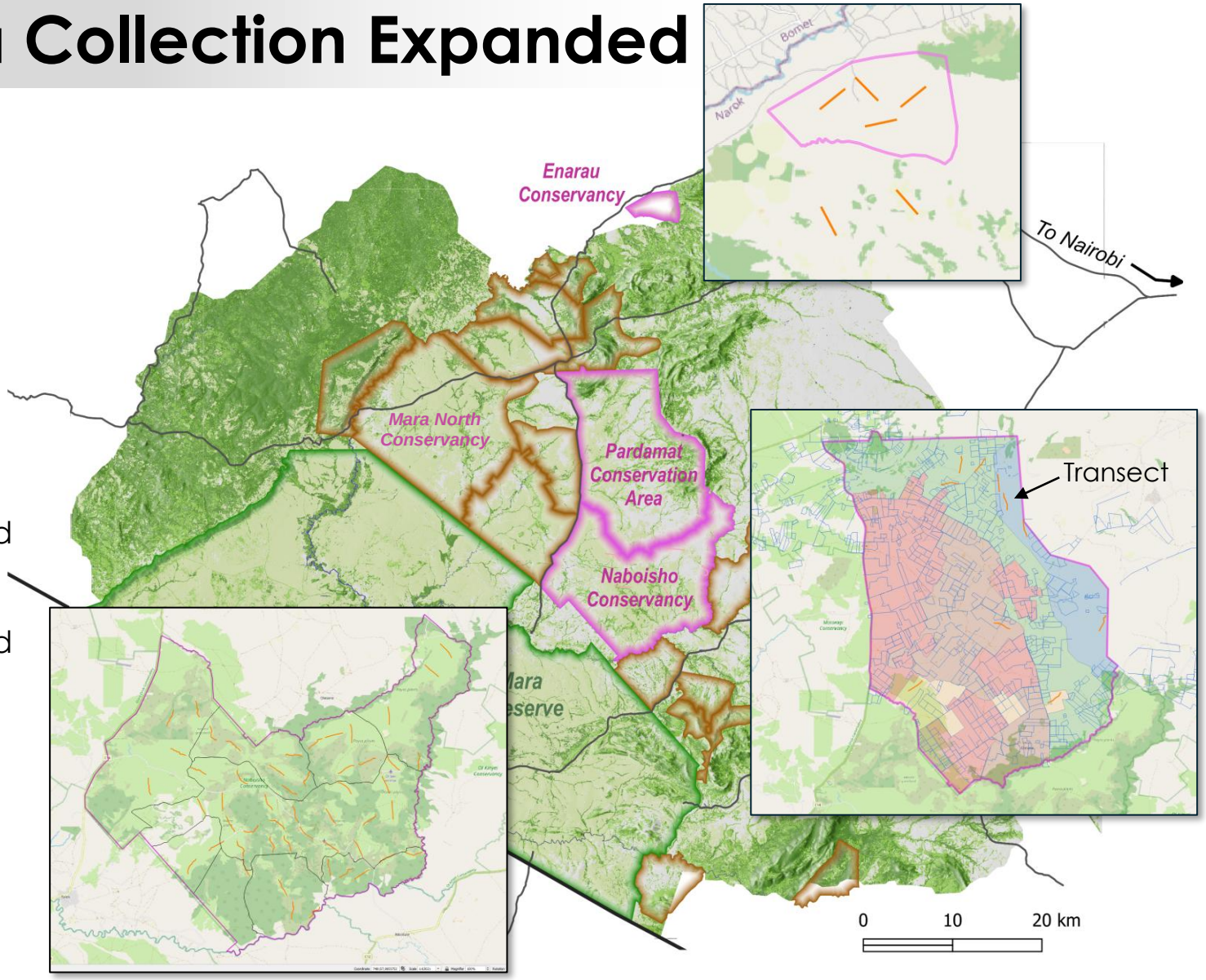

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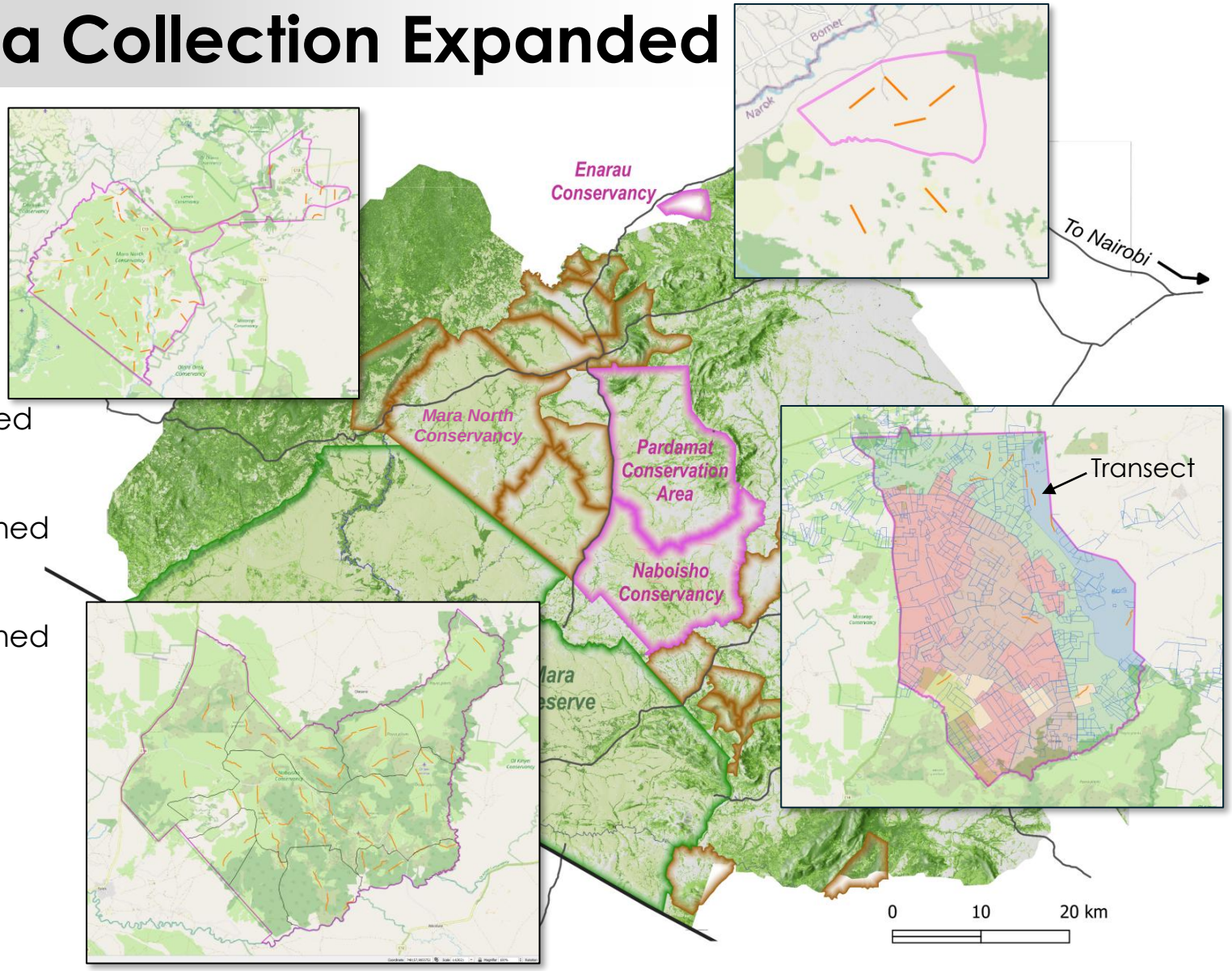
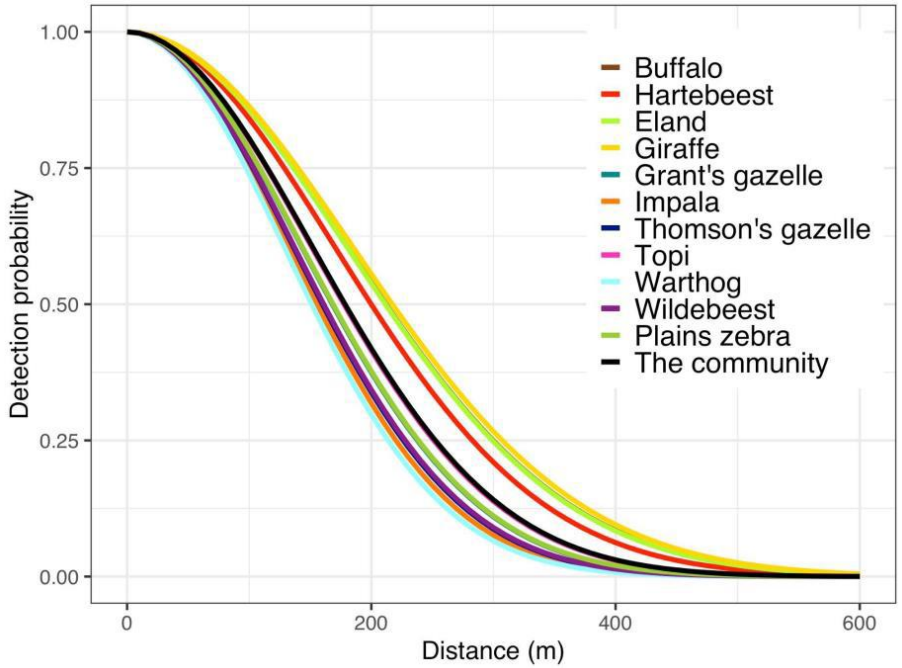
Mara North (297 km^2) – May 2025
- **41** Transects Established

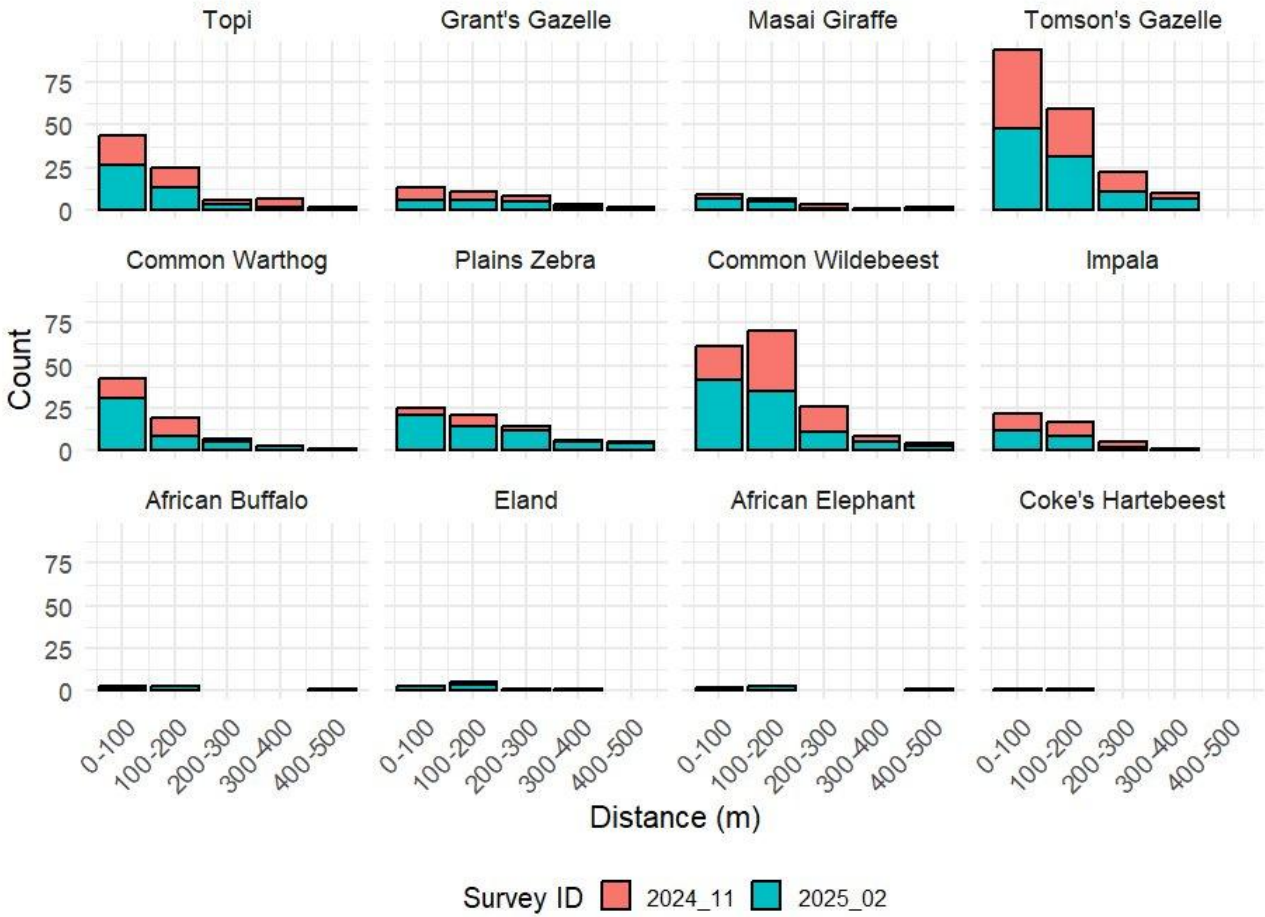


Achievements – Initial Results

Results Confirm Expectations

Counts Decline as Distance from Transect Increases

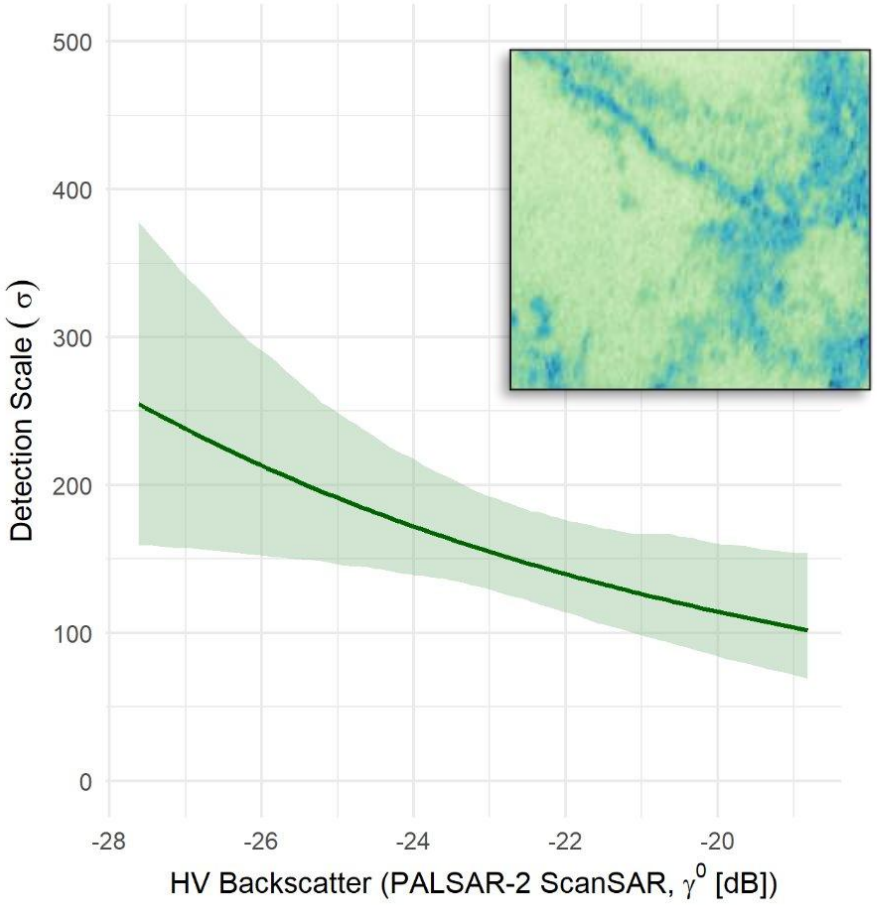




*Results for Naboisho Conservancy

Achievements – Correcting for Imperfect Detection

HV Backscatter – PALSAR-2 ScanSAR



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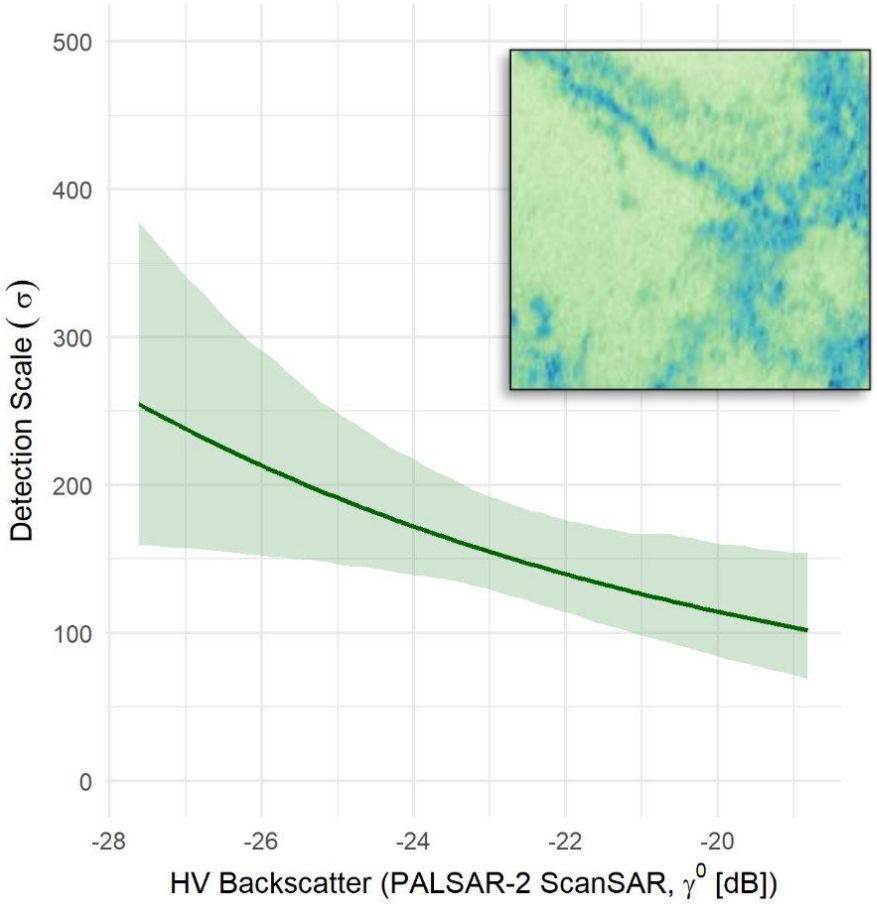

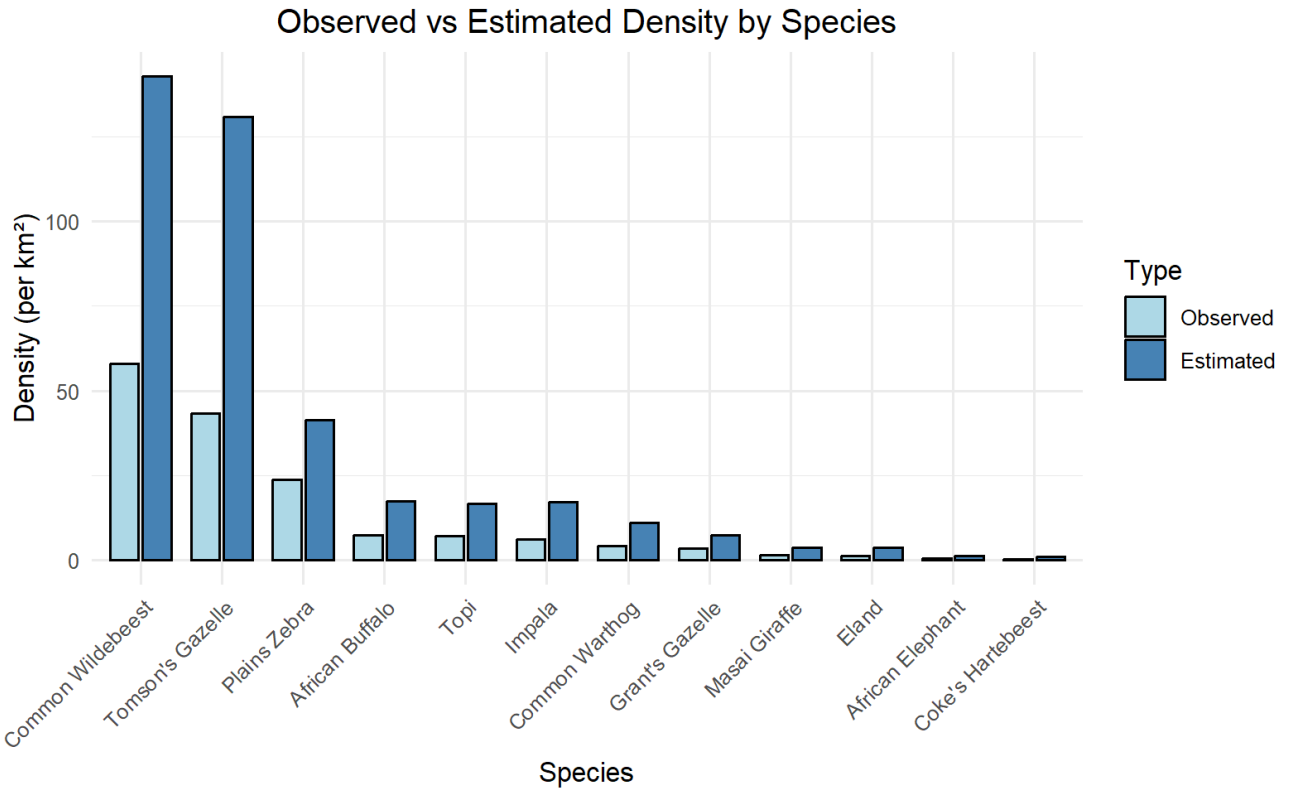

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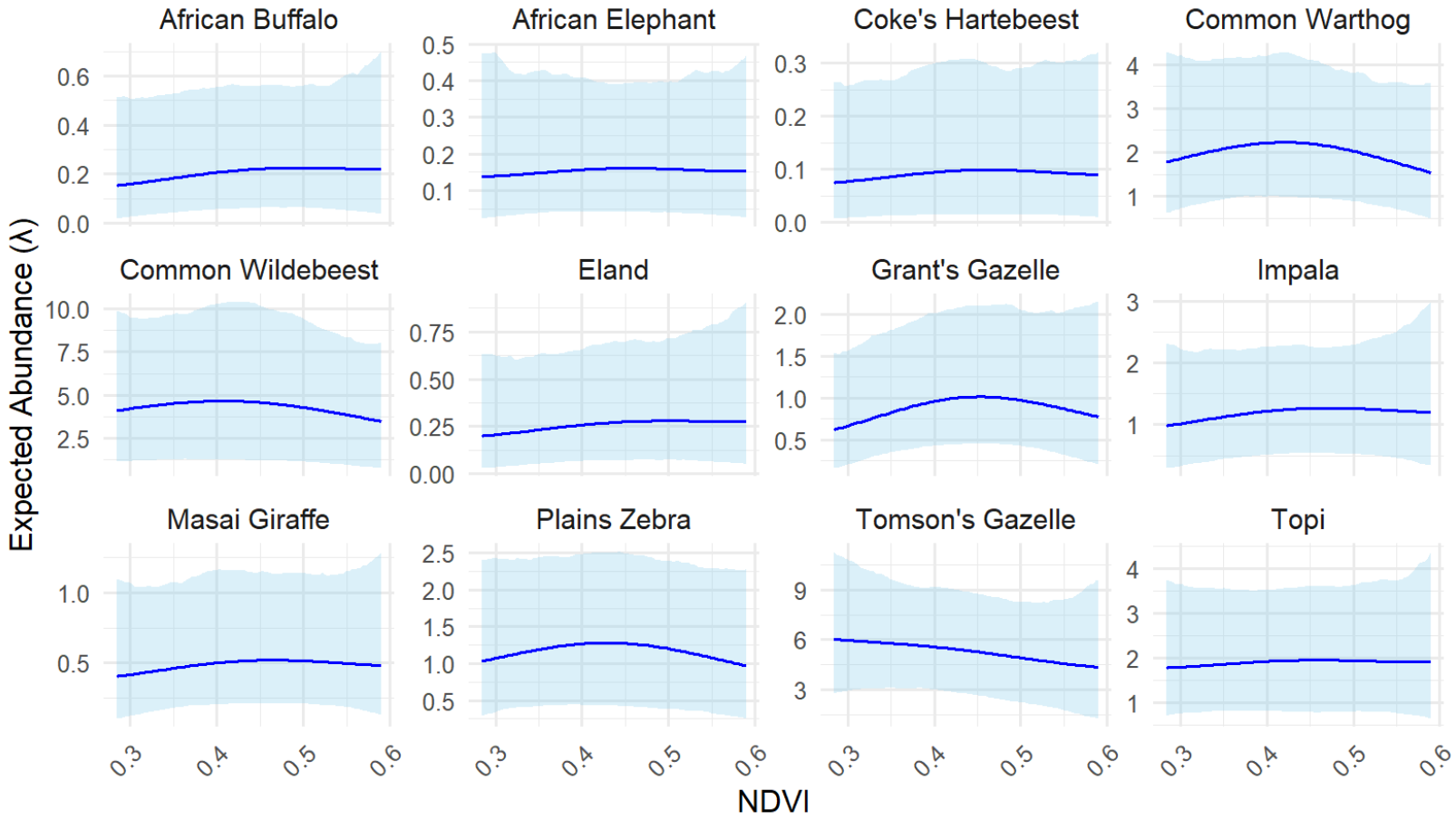
Achievements – Covariate Effects

MODIS NDVI & Palsar-2 ScanSAR

With just two surveys,
time and NDVI are confounded

Strong Response to Woody Cover



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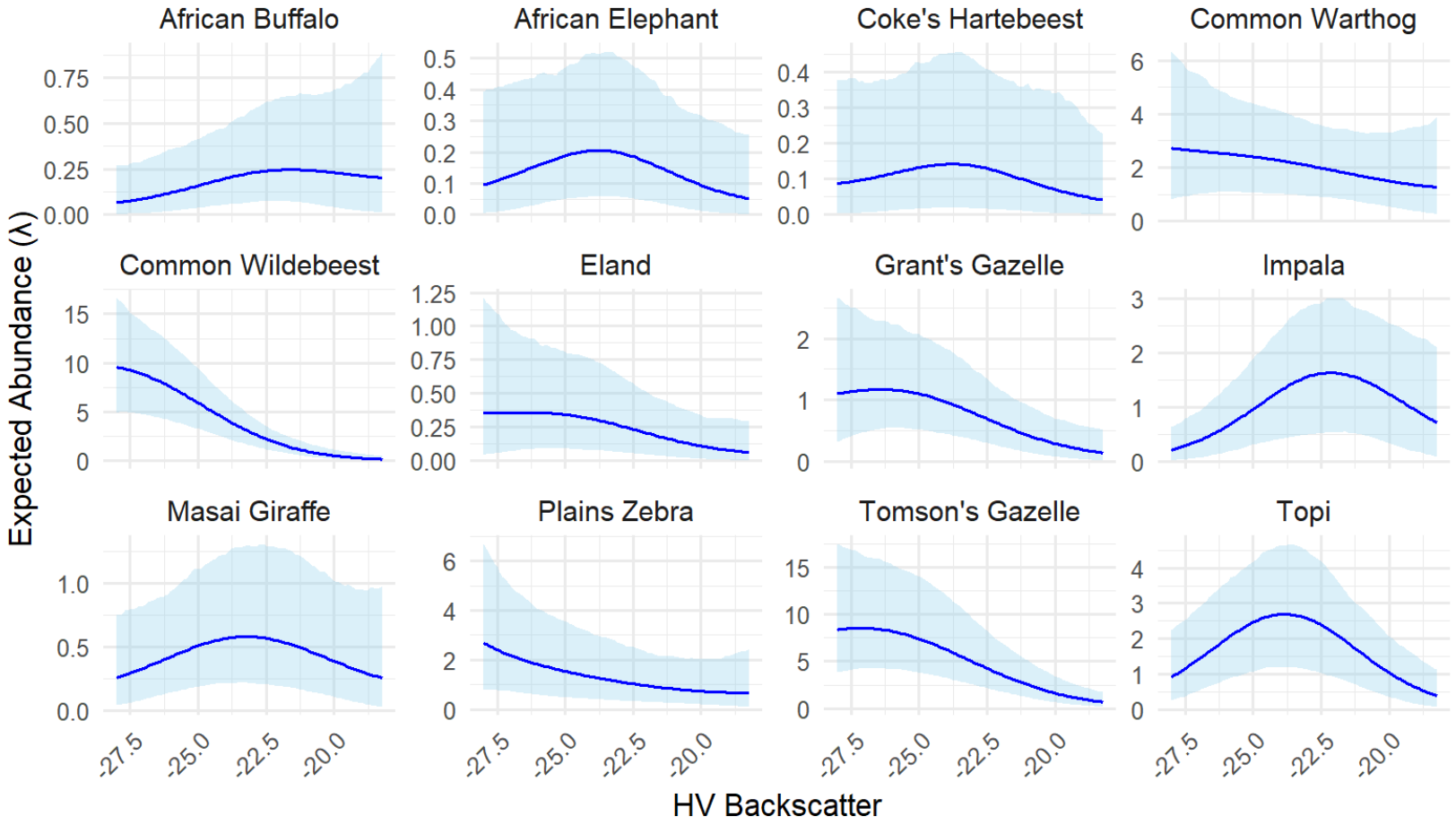

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Next Steps

EARTH SCIENCE
APPLIED SCIENCES

Incorporate Livestock

- Create digital log to relate to wildlife counts

Create Interactive Dashboard

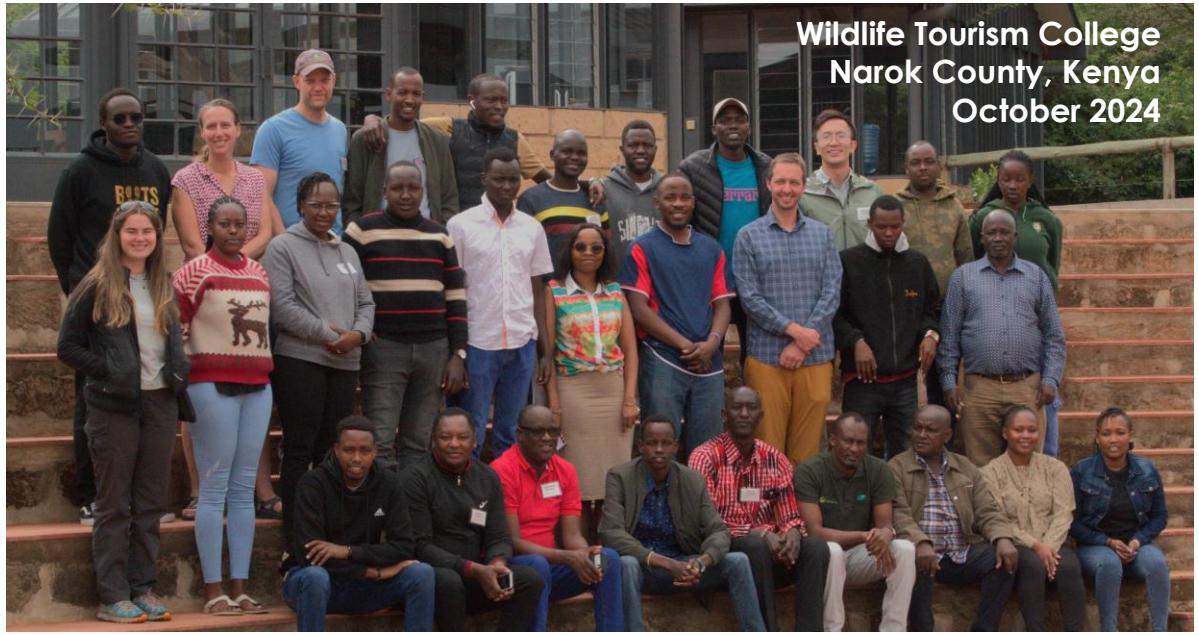
- Summarize findings in near real-time

Add Remotely Sensed Data

- OPERA/ECOSTRESS
- Transition MODIS to VIIRS
- Calculate grass height model

Scheduled Capacity Building Training

- October 2025



Current ARL 5