

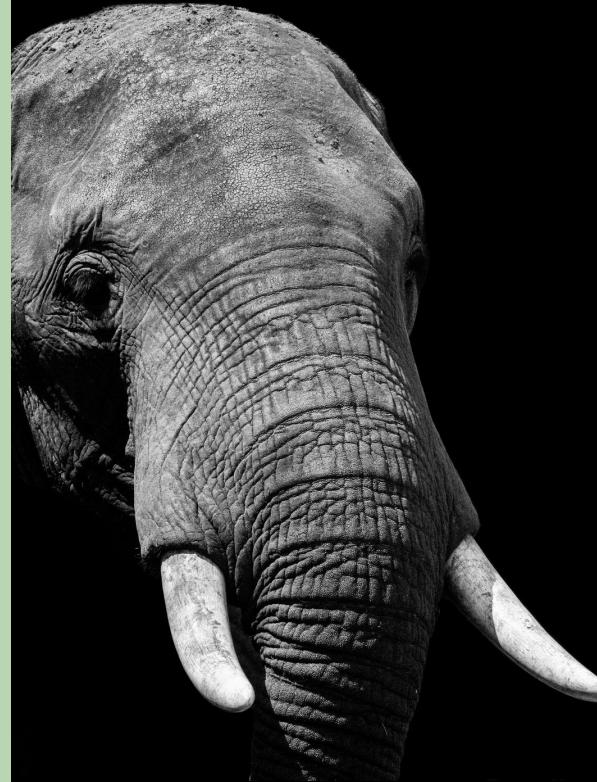
A photograph of a savannah landscape at sunset. In the foreground, a large elephant is grazing on dry grass. A single acacia tree stands prominently on the left. The background features rolling hills and mountains under a warm, golden sky.

Saving the Savannah For a Rainy Day:

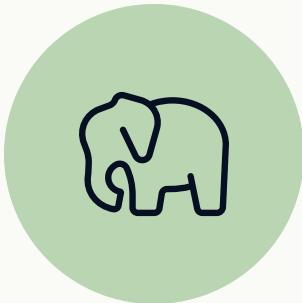
Studying the Impact of Precipitation on Elephant Migration and Savannah Health

Study Overview

- 1 African elephants are the world's largest animal, and play an important role in the East-African ecosystem
- 2 Failure to understand Elephant migration dynamics are likely to lead to increased human-animal conflicts as elephant habitats contract and human populations expand.
- 3 In the past, studying these dynamics was impossible. GPS receivers, satellite imagery, and satellite remote sensing data make it possible
- 4 Our study uses Normalized Difference Vegetation Index (NDVI) data to predict elephant movement and develop strategic insights for elephant conservation.



Theory and Background



Elephant Migration

- Factors include individual traits, population density, and distribution/availability of resources
- Highly water-dependent



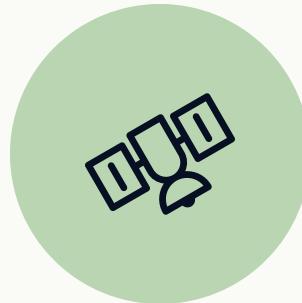
Human-Elephant Conflict

- Historic issues: habitat destruction, ivory poaching
- Elephants enter human settlements and may destroy crops, raid food stores, and damage water stores



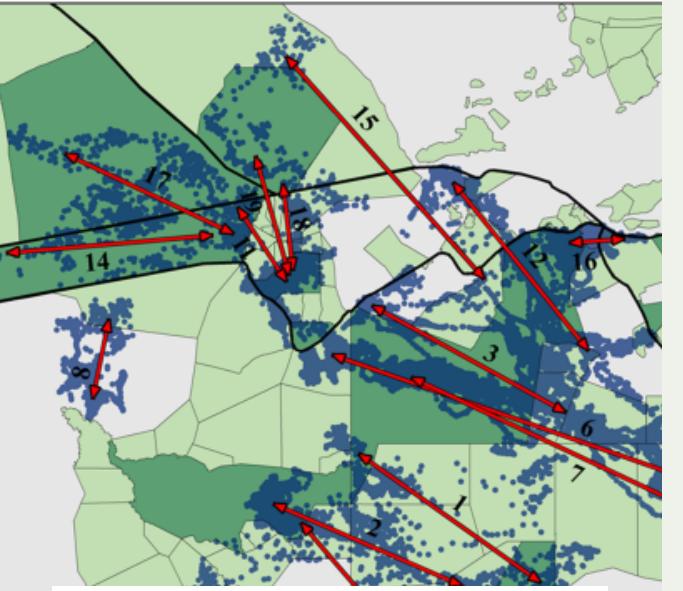
Economic Benefits of Elephant Tourism

- As of 2016 study, elephants could deliver approximately \$25M annually to African nations via tourism

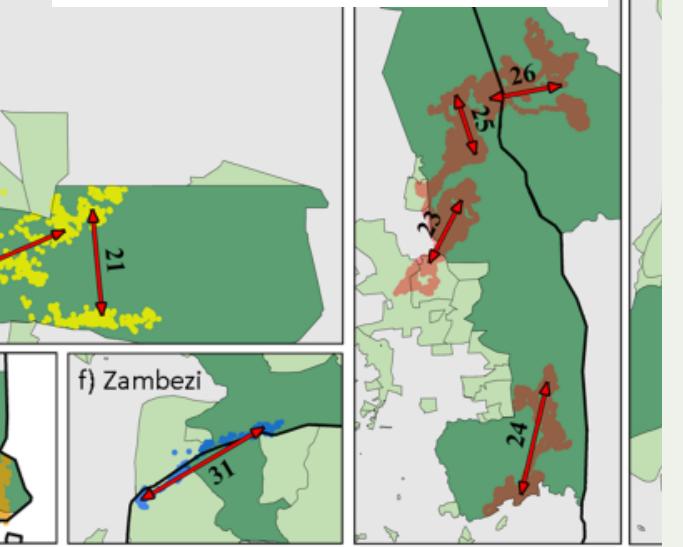


NDVI Data

- NDVI helps understand how vegetation dynamics affect movement patterns and population dynamics



Research Questions



Question One

How do changes in precipitation in the Savannah ecosystem affect elephant migration patterns?

Question Two

Does climate change push of elephants and other species out of old habitats into new ones?

Question Three

Can predicting the migration patterns of elephants help prevent animal-human conflict in the regions where humans and animals coexist?

Our Data



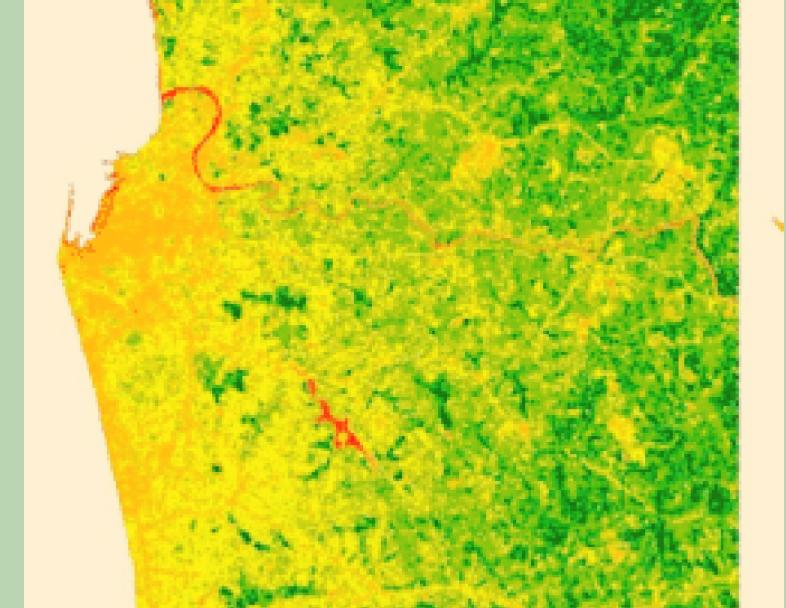
Elephant Movement Data

Collected via GPS monitoring devices to up to 10 elephants in the protected area. This device records each elephant's location every hour, and does not cause any harm to the elephants.



Savannah Precipitation Data

Publicly available precipitation data from the Savannah region. Will contain historical data to facilitate the identification of long term trends and patterns. Validate the data with multiple local and international weather data sources.



Normalized Difference Vegetation Index (NDVI)

Satellite sensing data allows us to analyze vegetation information in the Savannah, which will allow for correlations between migration patterns and historical vegetation growth.

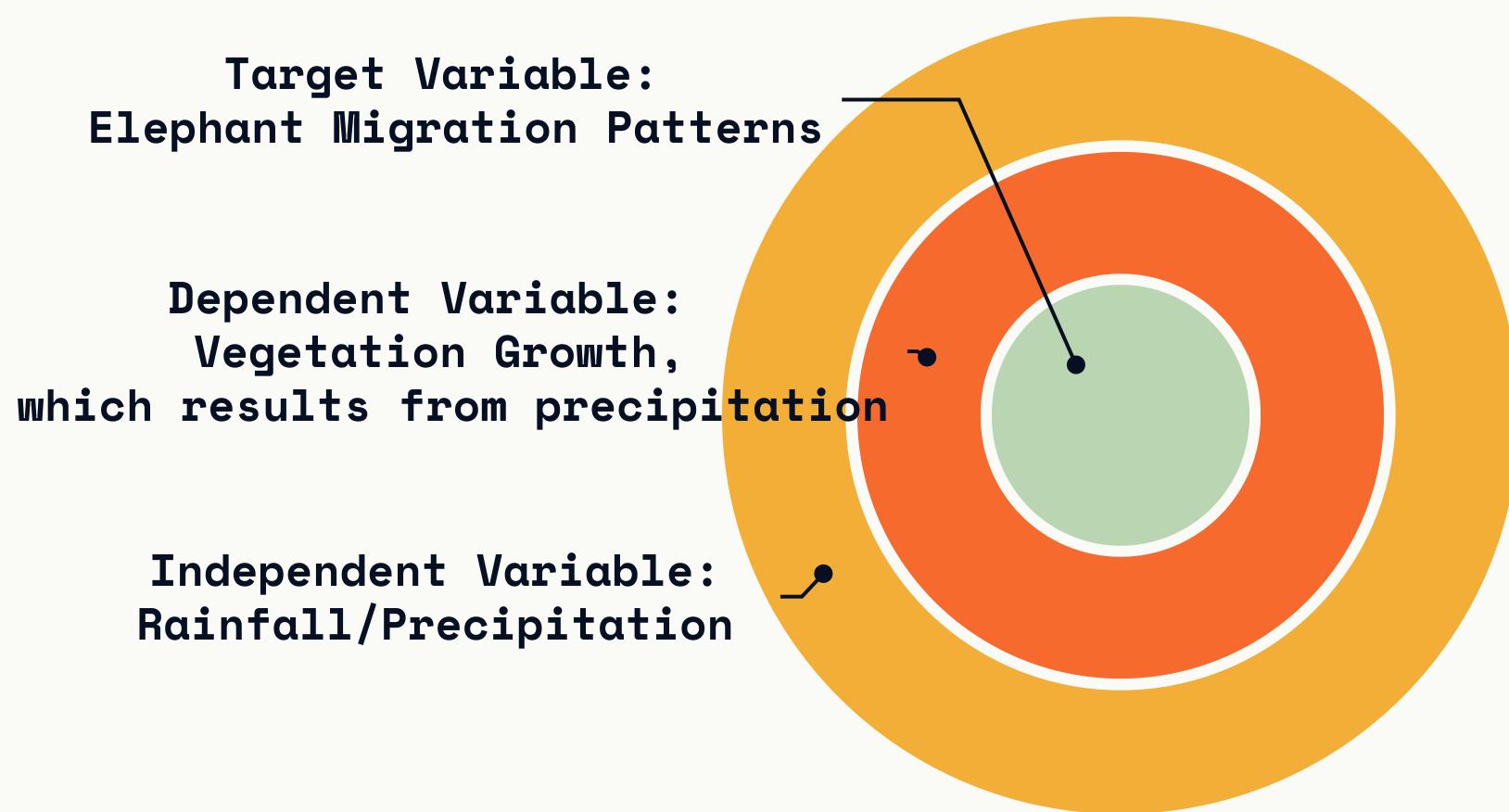
Our Sample

- Consult with Wildlife Specialists
 - Use Powers Analysis to determine sample size
 - Random sample selection
 - Monitor randomly selected elephants using commercially-available GPS trackers
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Our Variables

Precipitation will be used to predict the target variable, elephant migration patterns. To do this, we will analyze an intermediate variable: vegetation growth as a function of precipitation.





Assumptions and Ethics Considerations

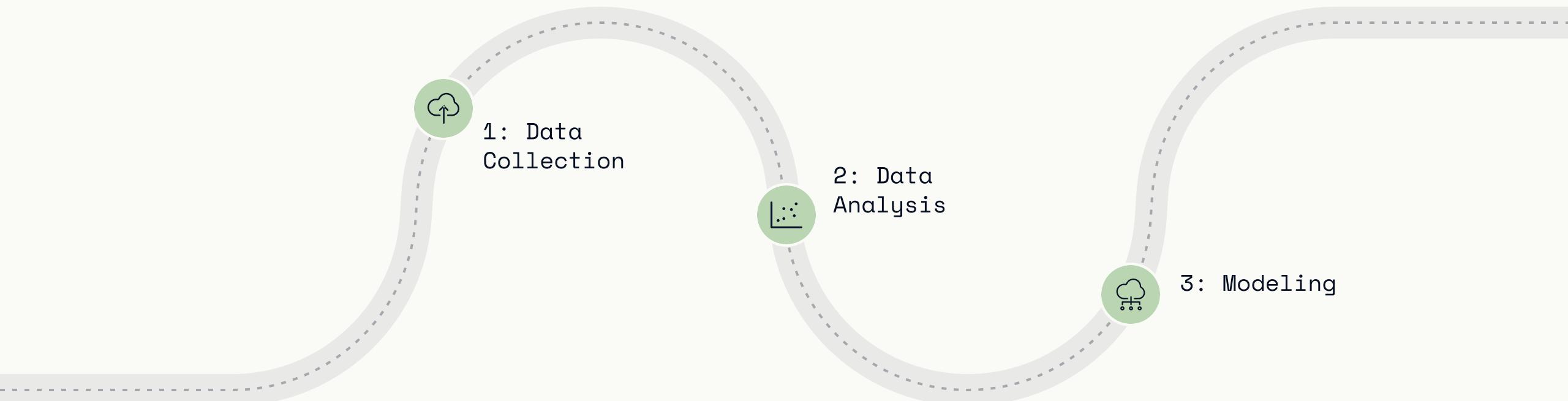
Assumptions

- Randomly selected elephants are representative of the population
- Elephant migration has a strong impact on the ecosystem
- Precipitation is a measurable factor of climate change

Ethics

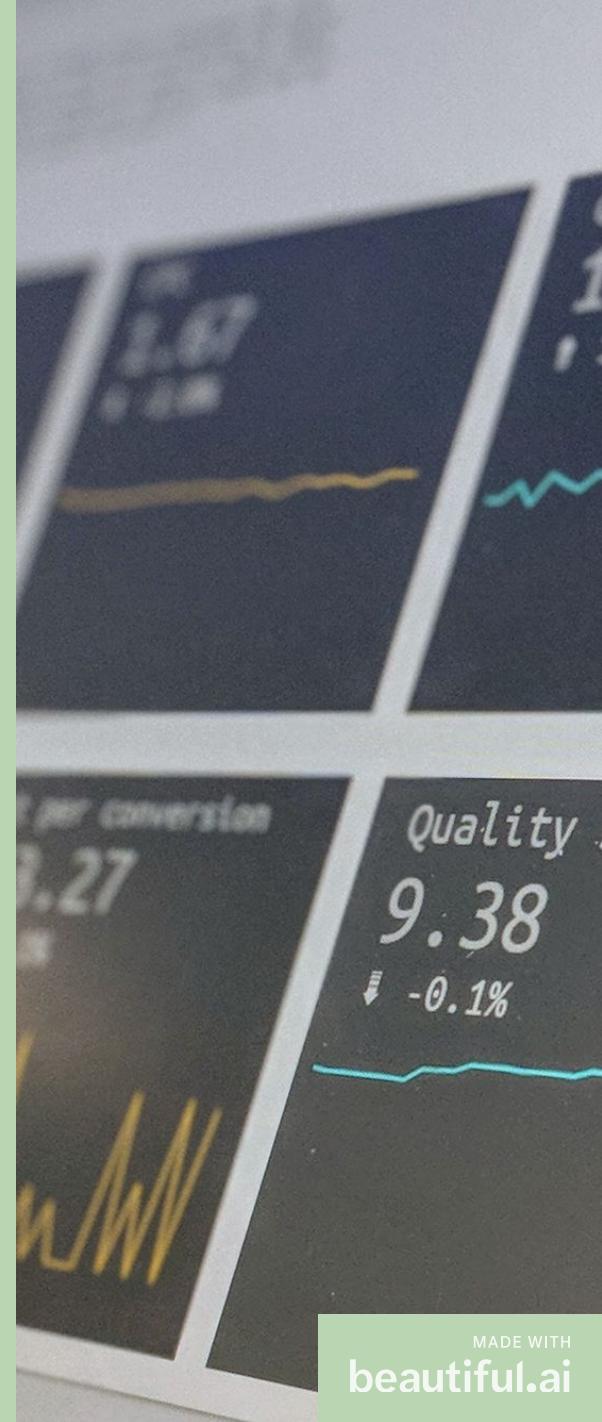
- Cooperate with local and regional authorities to consider justice, beneficence, and respect
- Include local representatives in the study process to ensure collaboration toward justice and economic beneficence
- Consult with wildlife specialists to mitigate harm to animals

Study Design Tasks



Statistical Methods

- 1 Linear Regression
- 2 T-Testing
- 3 Powers Analysis
- 4 Descriptive Statistical Analysis





Potential Risks

Scientific Validity

1. May be unexpected data and outliers based on raw nature of collected data
2. Possible erroneous or inaccurate data

Elephant Data Collection

1. Possibility of GPS device malfunction
2. Possible device breakage or loss
3. Environmental factors such as fences, artificial waterholes, or other interventions

Law and Ethics

1. Consideration of local and regional laws and regulations
2. Care and consideration for wildlife
3. Accreditation of local institutions

Deliverables

Phase One

Duration: 2 Years
Deliver public datasets resulting from sustained collection

Phase Two

Duration: 1 Month
Deliver Exploratory Analysis Visualization

Phase Three

Duration: 3 Months
Deliver Analytic Models and Initial Conclusions

Phase Four

Duration: 1 Week
Deliver final technical report and presentation

Future Areas for Research



Strategic Construction of Waterholes



Research Relationship Between Local Human Populations and Elephants