Predicting the Likelihood of Human-elephant Conflict and Assessing Elephant Habitat Conditions During Extreme Drought and Crop Deficit in the Kavango-Zambezi Area

Abstract

Human-wildlife conflict is increasingly more common due to human population growth, habitat fragmentation, and changing climatic conditions. This conflict is particularly evident in the Kavango-Zambezi area, where over three million people share the landscape with an abundant megafauna population. As the changing climate continues to exacerbate drought severity and subsequently food availability, conflict between humans and wildlife has become more prevalent and has had serious consequences. In the Kavango-Zambezi area, conflict between elephants and humans has resulted in crop loss, property damage, and threats to public safety. In order to manage current and future conflict, The Ecoexist Project and Connected Conservation have been working to empower farmers and conserve natural habitat. This DEVELOP project employed Earth observations to conduct a time series analysis of vegetation health change, elephant movement, and climate conditions, from 2017 to 2020. Data were aggregated data into half-year seasons: November through April represented the wet season and May through October represented the dry season. The resulting analysis demonstrated the potential to use Landsat 8 Operational Land Imager (OLI), Global Precipitation Measurement - Integrated Multi-satellite Retrievals for GPM (GPM-IMERG), and TerraClimate data to identify potential areas of conflict under increased seasonal variability. An improved understanding of conflict drivers will help support sustainable wildlife conservation and food security in the future.

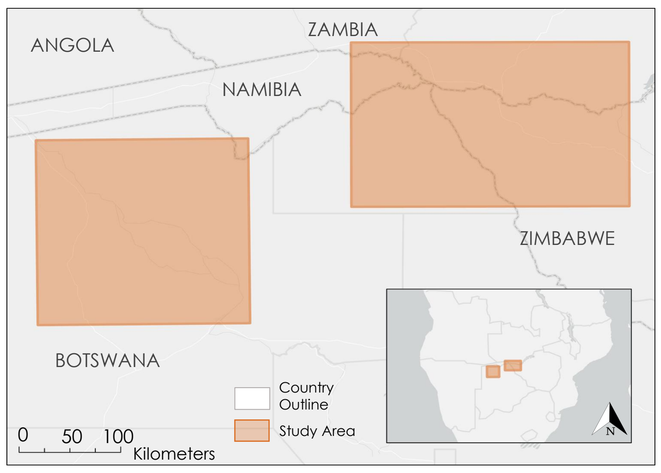
Objectives

Analyze the relationship between elephant movement, vegetation health, & climate conditions

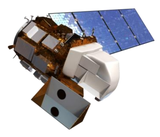
Develop reusable codes for partners to replicate the analysis as more elephant data becomes available

Create elephant kernel density heatmaps to identify human-elephant conflict risk areas

Study Area



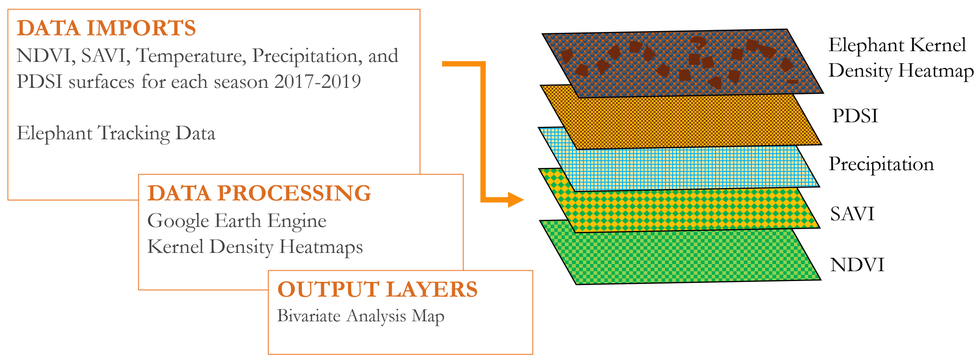
Earth Observations



Landsat 8 Operational Land Imager (OLI)

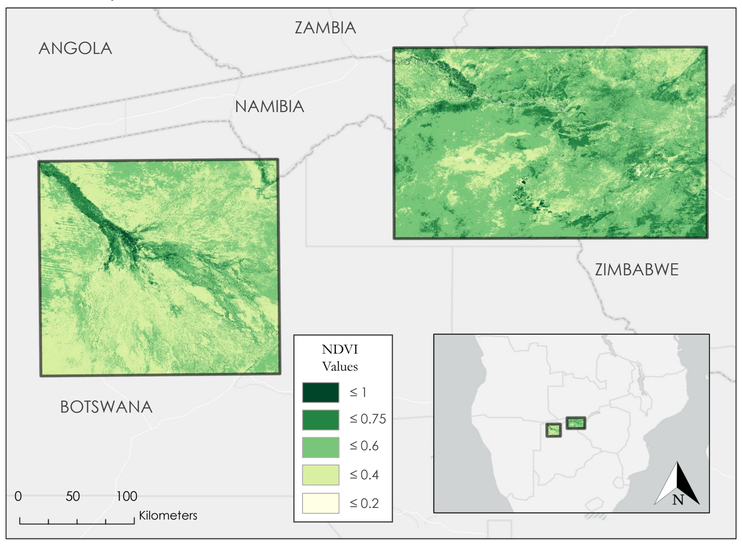
Global Precipitation Core Observatory (GPM)

Methodology

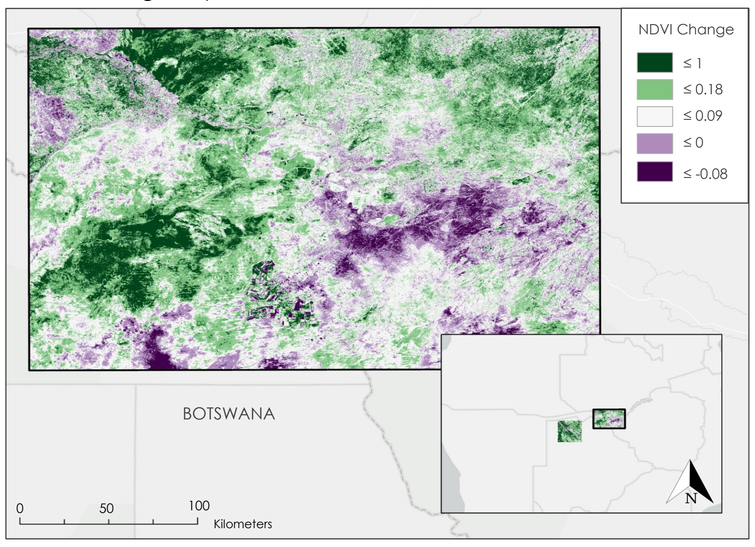


Results

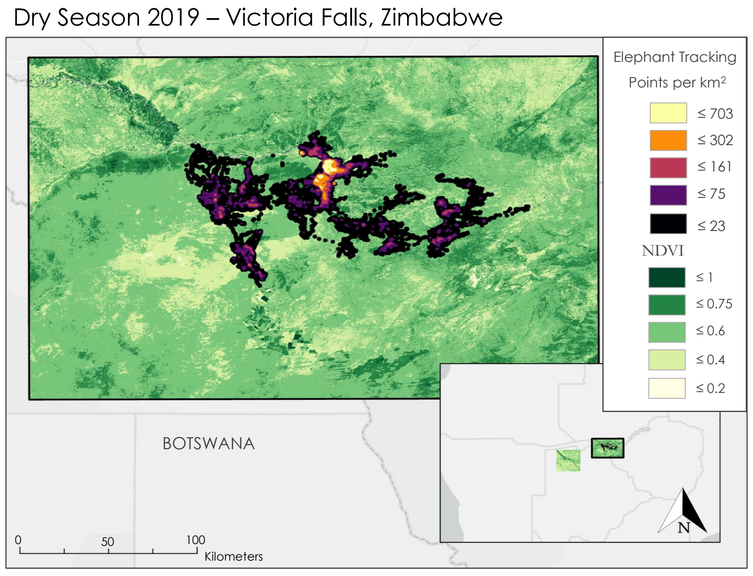
NDVI Dry Season 2019



NDVI Change Dry Season 2017-2019 – Victoria Falls, Zimbabwe



Dry Season 2019 – Victoria Falls, Zimbabwe



Conclusions

- Kernel density heatmaps show that elephants **travel greater distances** during the wet season and congregate around water sources and agricultural land during the dry season
- The produced code showed **wide-spread increases** in NDVI, SAVI, and precipitation measurements in the wet seasons compared to dry, directly observing yearly fluctuations that likely influence elephants' different movements between the seasons
- The study area experienced a **19.6% decrease** in mean NDVI from 2017 to 2019, indicating strong drought conditions that may have had an impact on elephant movements

Project Partners

- **Connected Conservation** – Victoria Falls, Zimbabwe
  - "Conserving animals, enhancing livelihoods in areas of human – animal conflict"
- **Ecoexist Project** – Okavango Delta, Botswana
  - "Reducing conflict and fostering coexistence between elephants and people"

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Acknowledgements

Crystal Wespestad, NASA *DEVELOP Fellow*
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Southern Africa Food Security & Agriculture

GA – Athens

Fall 2020

DEVELOP

This material is based upon work supported by NASA through contract NNL16AA05C. Any mention of a commercial product, service, or activity in this material does not constitute NASA endorsement. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration and partner organizations.