Kruger elephants on the move:

predicting benefits and risks

Rob Fletcher[1], Joe Langley[1], Bob McCleery[2], and Sam Ferreira[3]

[1]University of Cambridge, [2]University of Florida, [3]South African National Parks

Human-elephant conflict

Kruger elephant escapes into neighbouring Matsulu, euthanised

Wildlife conflict peaks in KZN after rangers kill five migrating elephants that posed a danger to human life

Elephants lured to Balule after feeding along R40

CNN World Africa Americas Asia Australia More Watch

World / Africa

Tourist trampled to death by elephant while reportedly trying to save his grandchild at South Africa park

Human-elephant interactions

Ecological Concerns
Changes in vegetation
Changes along perennial rivers
Changes close to seasonal rivers
Interaction with fire

Social Concerns
Damage causing animals
Damage to infrastructure
Poaching hotspots
Pressure from stakeholders

Ecological Benefits
Seed dispersal of valued plants
Soil formation and maintenance
Influence on biodiversity
Creation of habitats / refugia

Social Benefits
Ecotourism
Conservation funding
Community development
Cultural heritage

Van de Water et al. (2021, 2022)

We know a lot about elephants

We know a lot about elephants

What does it tell us about the future?

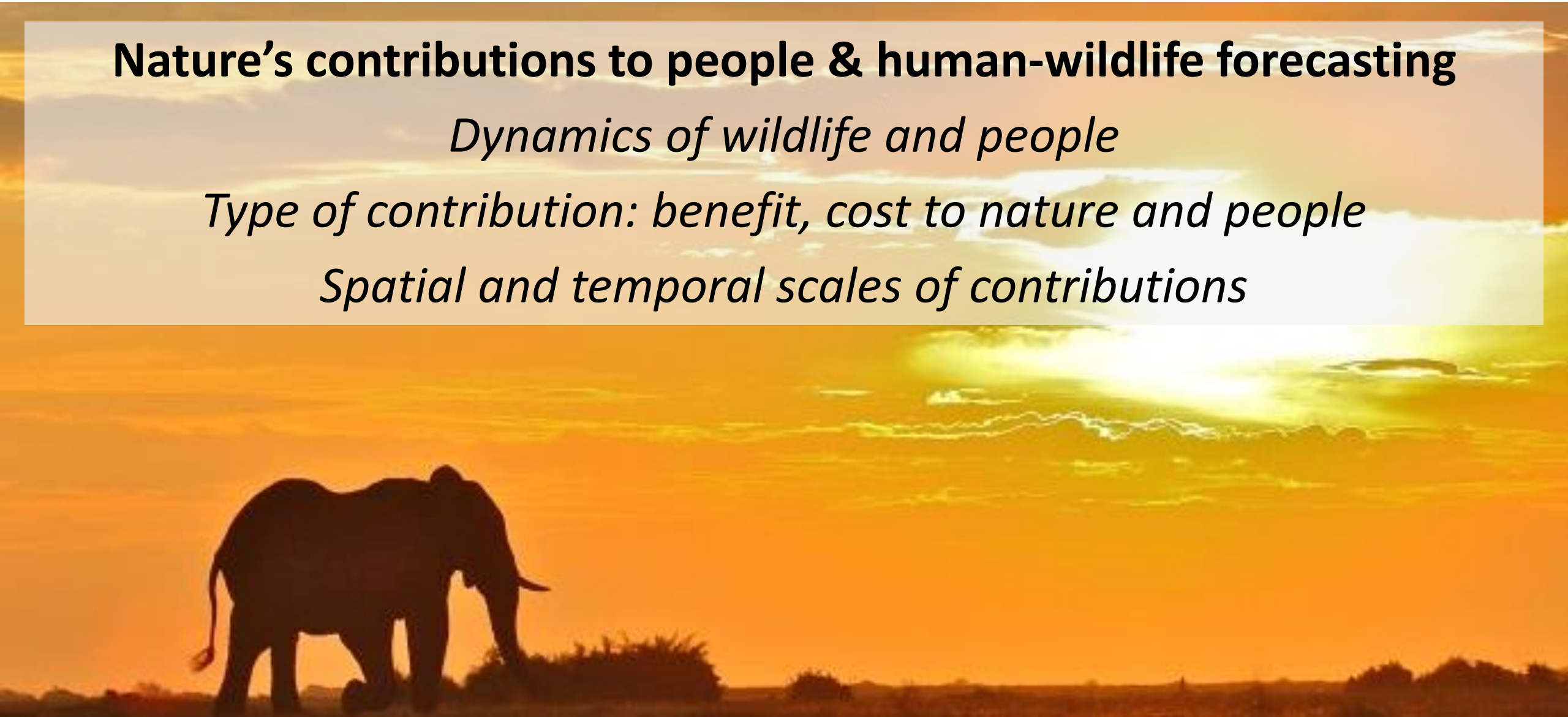
What do we need to know for actionable conservation?

Conservation forecasts:

Providing real-time guidance for conservation

Conservation forecasts:

Providing real-time guidance for conservation



Nature's contributions to people & human-wildlife forecasting

Dynamics of wildlife and people

Type of contribution: benefit, cost to nature and people

Spatial and temporal scales of contributions

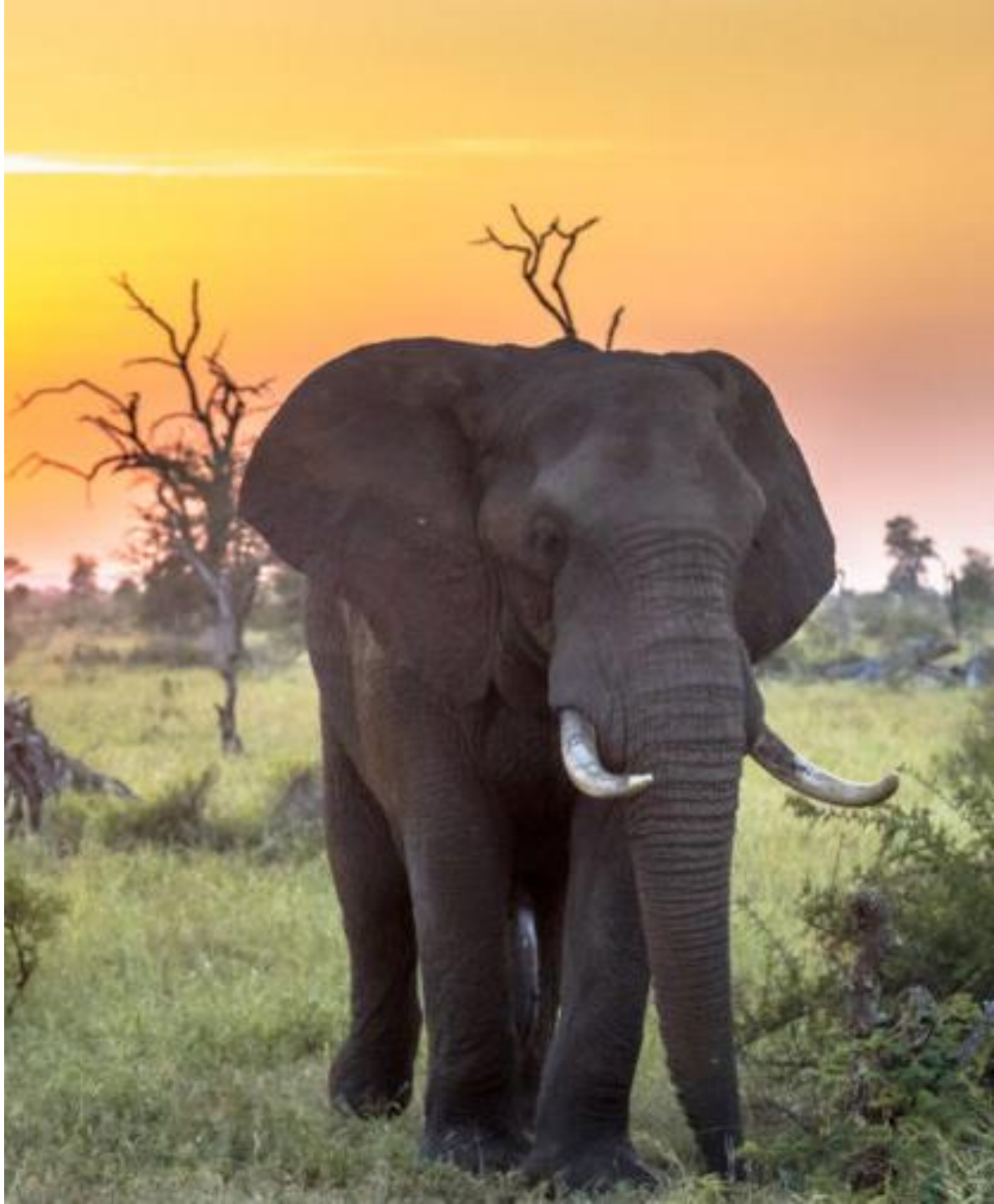
Our goals

1) Predict human conflict and interactions from elephants on the move

2) Forecast in real-time expected changes to inform interventions

3) Assess intervention success
   - *What actions work?*
   - *Which actions reduce conflict and damage over time?*

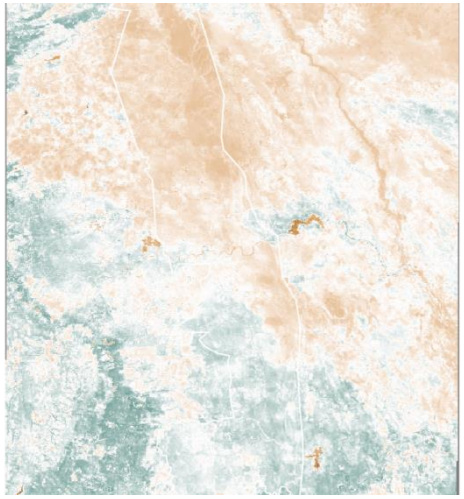
4) Provide real-time alert systems



How can we do this?

Near-term forecasting of human-elephant interactions

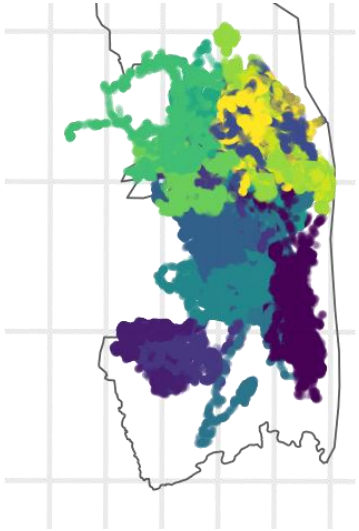
AI-based pattern-focused models
Mechanistic movement models



Realtime forecasting of NDVI

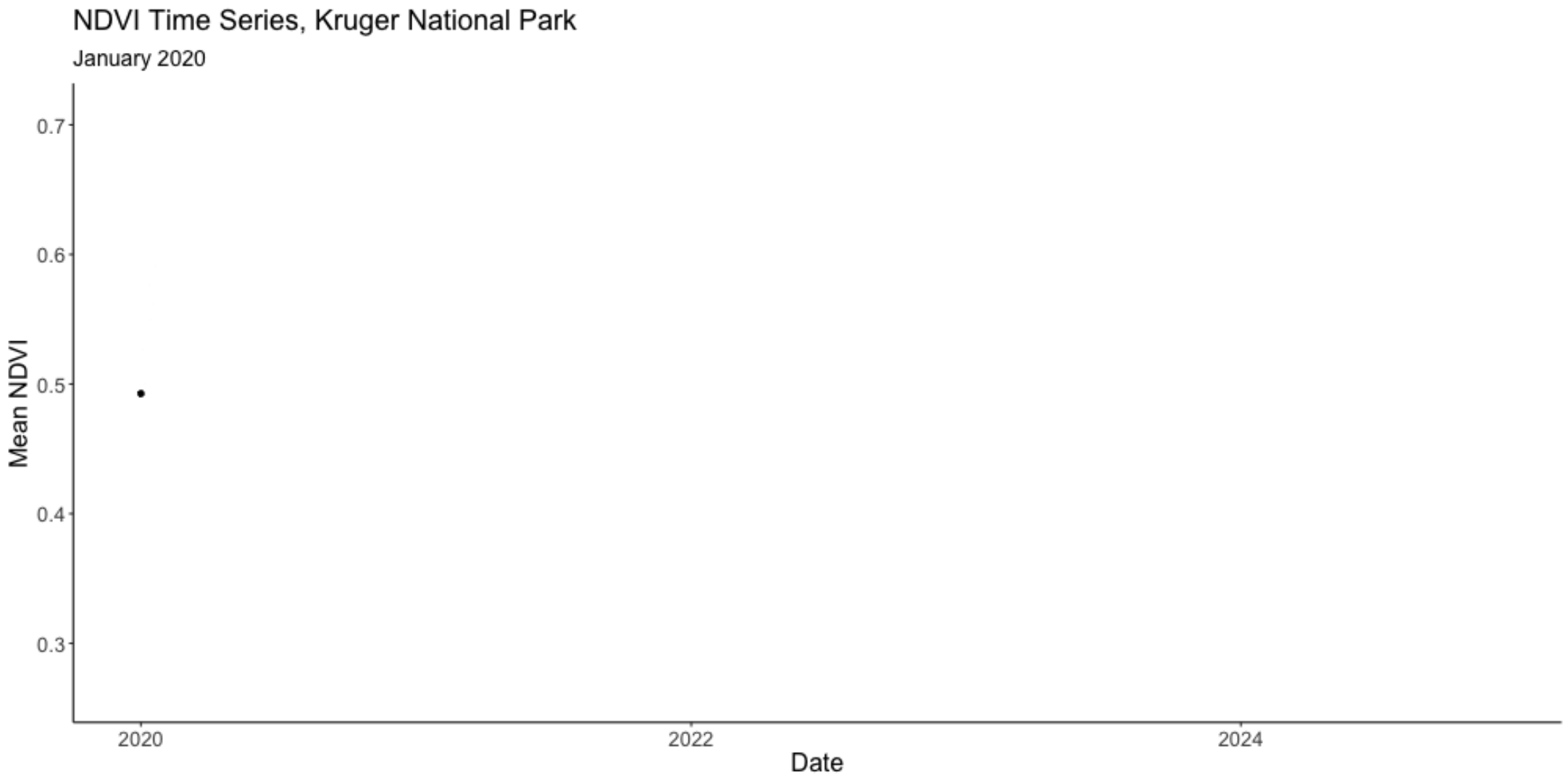
Scraping data about human density (e.g., world pop) human activity and conflict

Agriculture, resources and seasonality

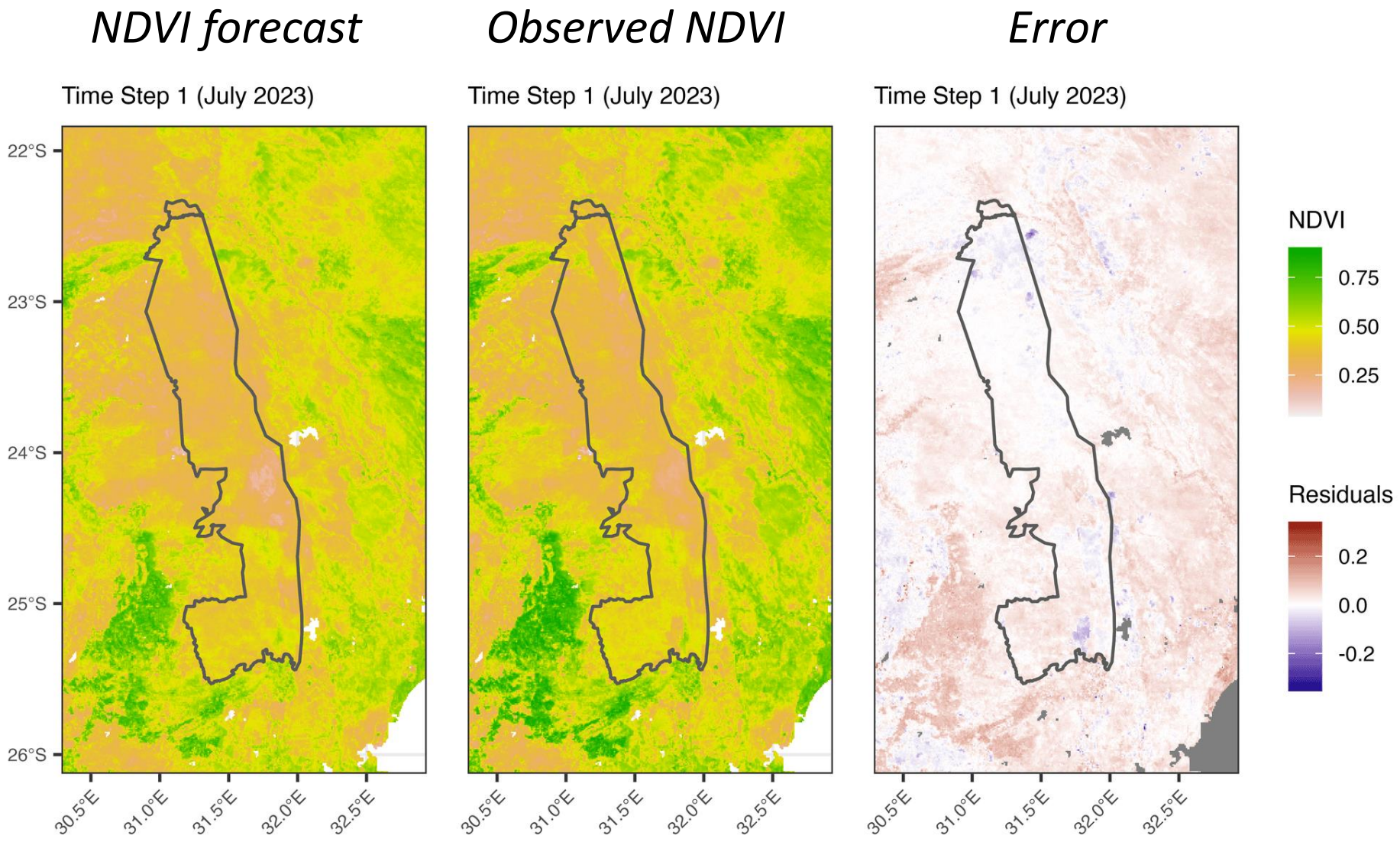


GPS tracking data (Slotow et al 2019)

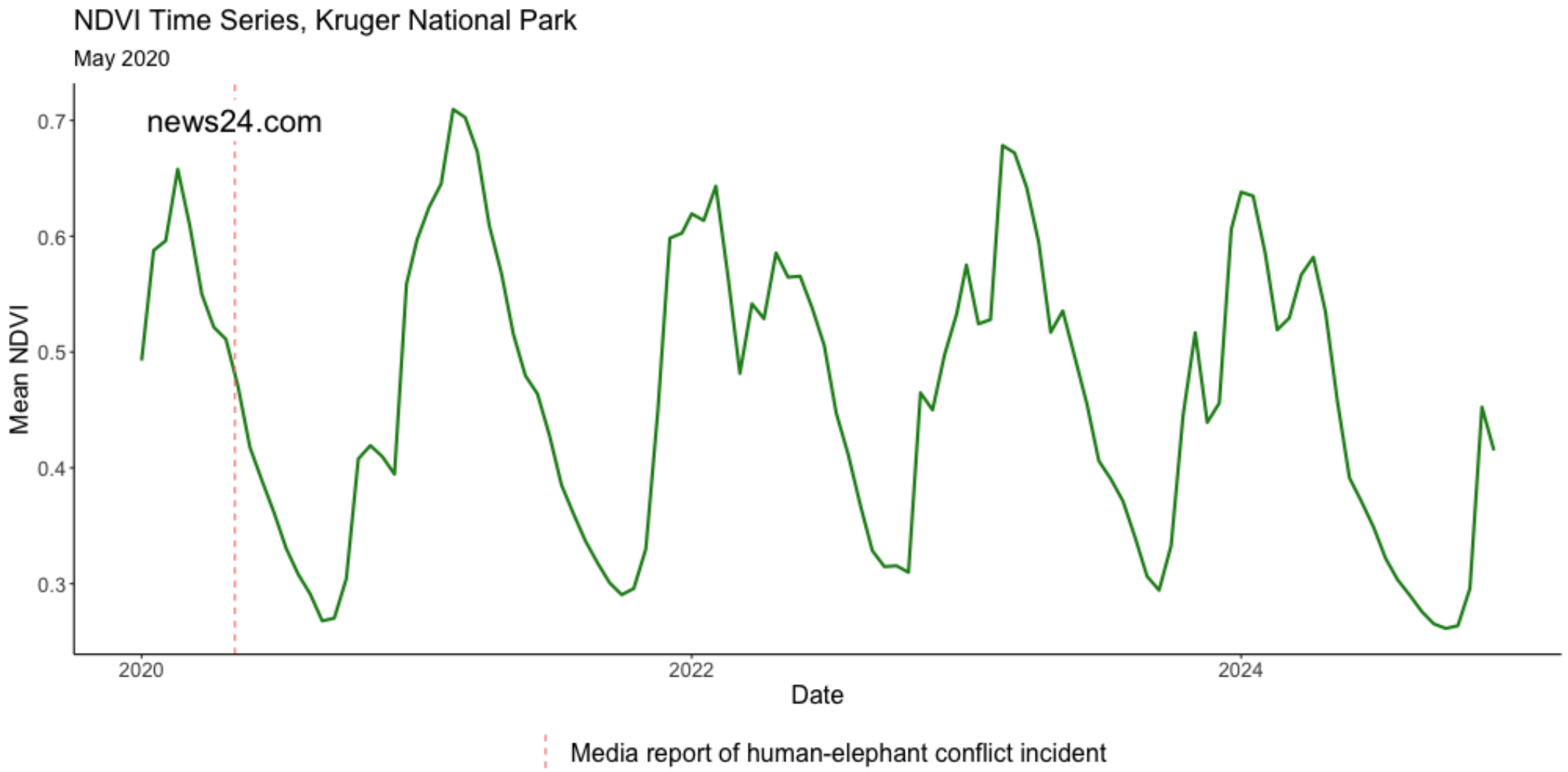
AI-based, pattern-focused models



AI-based, pattern-focused models



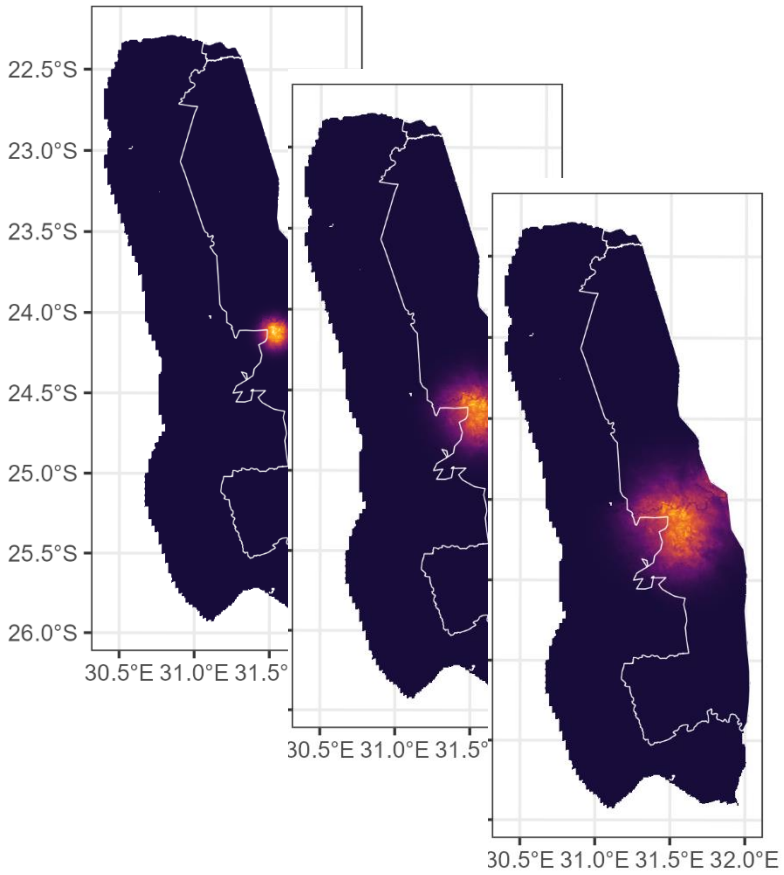
AI-based, pattern-focused models



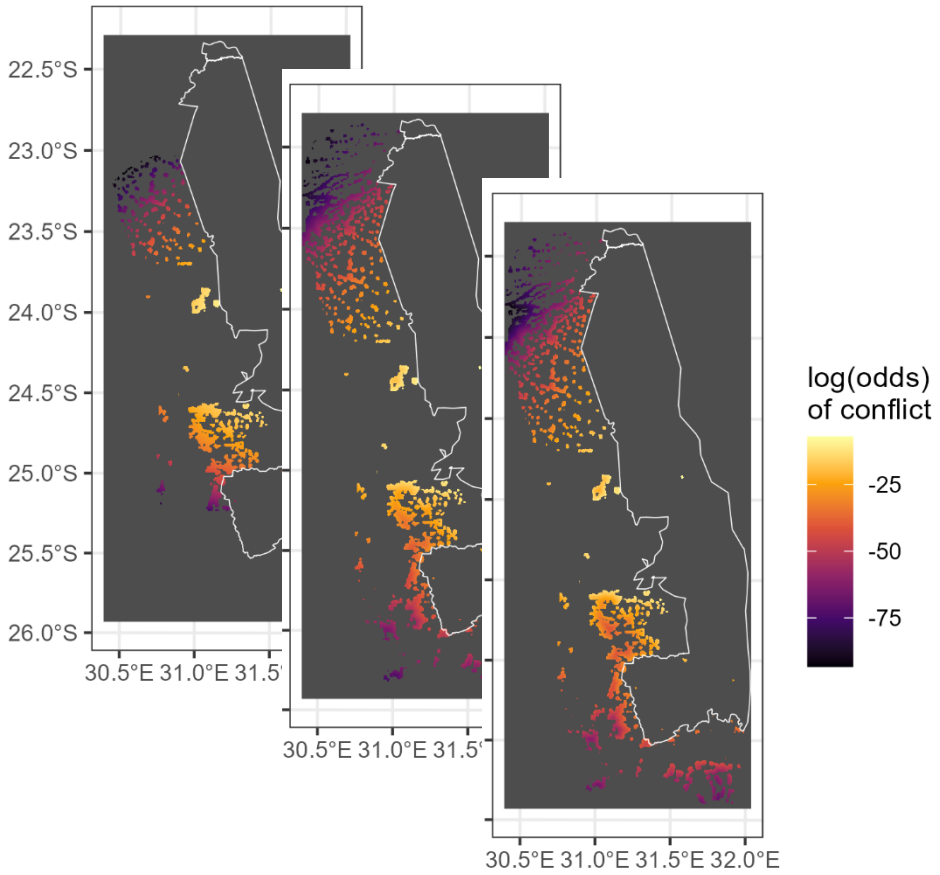
Mechanistic movement models

- Tracking data, resource selection, and movement models
- Dynamically predict movement and different types of conflict

Expected movement over time



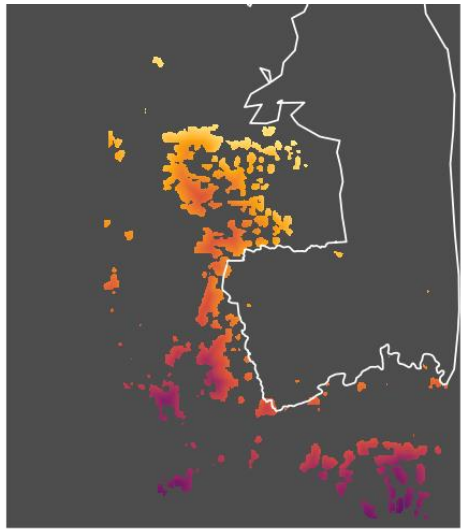
Expected conflict with human encounters over time



Fletcher et al. (2019), Vasudev et al. (2023)

Potential outcomes

Identify real-time priority areas



Assess intervention success

Human-elephant alerts

Charging ahead: next steps

Information gathering and needs:

Elephant and environment

- Elephant data relevant to conflict
- Locations of known damage or conflict areas

Human interactions

- Human mobility data for predicting activity
- Human interactions

Refining forecasts and their value:

- Predictions relevant to action
- Iterative updating

Acknowledgments

SanParks
Scientists working on elephants around KNP
U.S. National Science Foundation
Cambridge Conservation Initiative

UNIVERSITY OF CAMBRIDGE

CONSERVATION RESEARCH INSTITUTE

South African NATIONAL PARKS

UF IFAS UNIVERSITY of FLORIDA

Wildlife Ecology and Conservation University of Florida