Photo : Joe McDonald

Remote sensing and the mobility of buffalo and cattle in Southern Africa: A review of the key environmental factors and their characterization from Earth observation satellite imagery

Photo : Drovers

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GENERAL CONTEXT

Increasing **interactions** between **protected** and **anthropised** areas in southern Africa create challenges for **biodiversity conservation** and **local development**. An improved **management** of these areas is required to promote the **coexistence** between **human activities**, including livestock farming, and **wildlife**. **Remote sensing** may offer a means to characterize these **interfaces** across wide area.

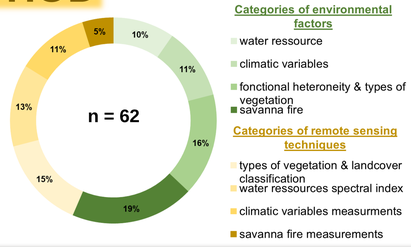
RESEARCH QUESTIONS

- ❑ What are the **environmental factors** affecting the **mobility** of **buffalo** (*Syncerus caffer*) and **cattle** (*Bos taurus*, *Bos indicus*), two key species for **conservation** and **local development** in Southern Africa ?
- ❑ What are the different **methodologies** offered by **remote sensing** to discriminate and characterize, in space and time, these **environmental factors** ?

METHOD

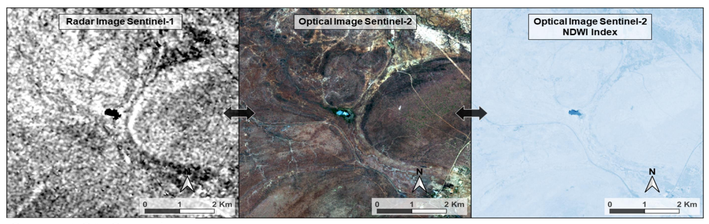
- ❑ Extensive **review** of scientific papers
- ❑ **Bibliographic** approach

*To facilitate lisibility, only **Hwange National Park (Zimbabwe)** is shown in the different poster figures.*



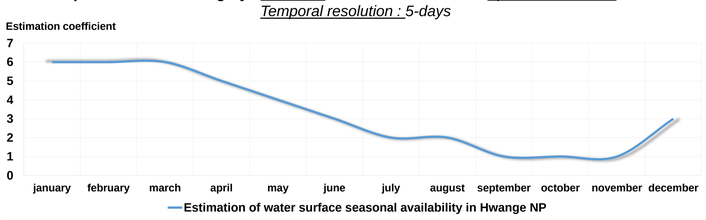
KEY FACTOR: THE WATER RESSOURCE

→ seasonal variation
→ Impact the vegetation distribution and quality



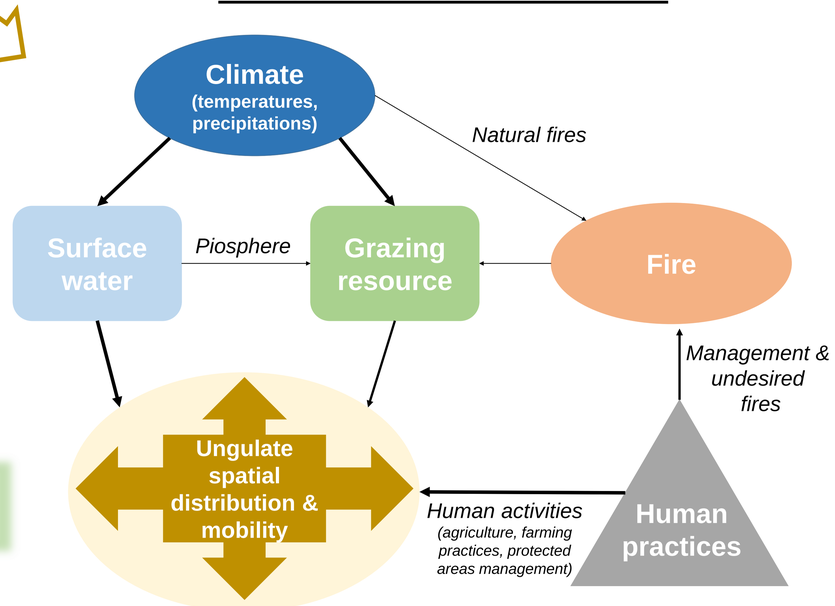
Source : ESA, Copernicus

Optical and radar imagery : *Product :* Sentinel-2 - Sentinel-1 / *Spatial résolution :* 10 m
Temporal resolution : 5-days



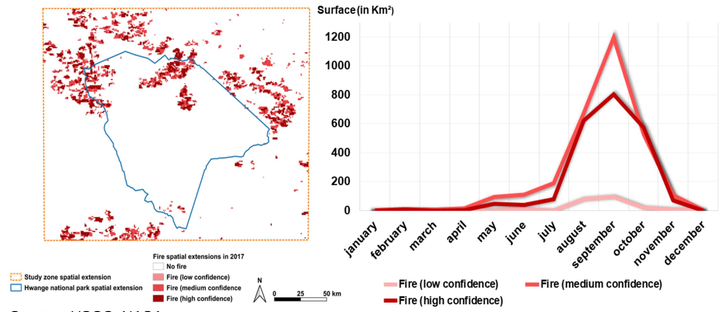
KEY AND SECONDARY ENVIRONMENTAL FACTORS ♦ EXEMPLES OF CHARACTERIZING REMOTE SENSING TECHNIQUES

Environmental factors interactions



SECONDARY FACTOR: THE SAVANNA FIRE

→ determine the vegetation repartition and accessability
→ Impact the cattle and buffalo natural habitats sustainability

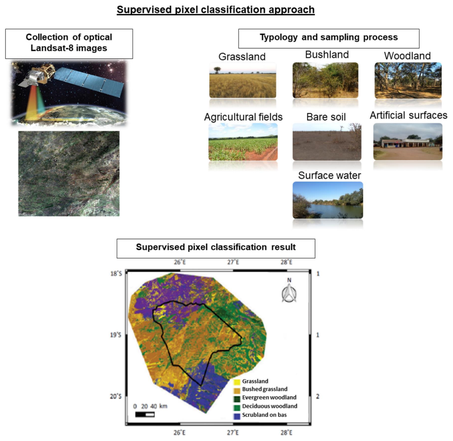


Source : USGS, NASA

Modis Fire : *Product :* MODIS - MOD14A2/MYD14A2 / *Spatial résolution :* 1 Km
Temporal resolution : 8-days product composite

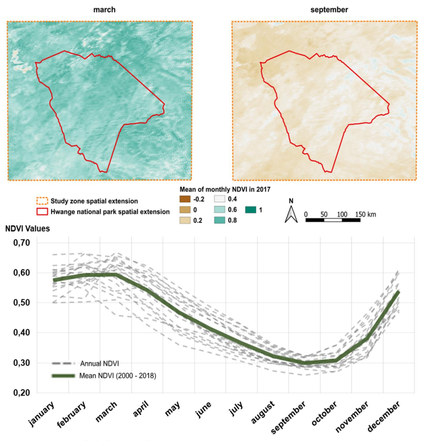
KEY FACTOR: VEGETATION AND LANDCOVER

→ structure the landscape in space and time
→ determine the quantity and quality of the food (grazing) ressources



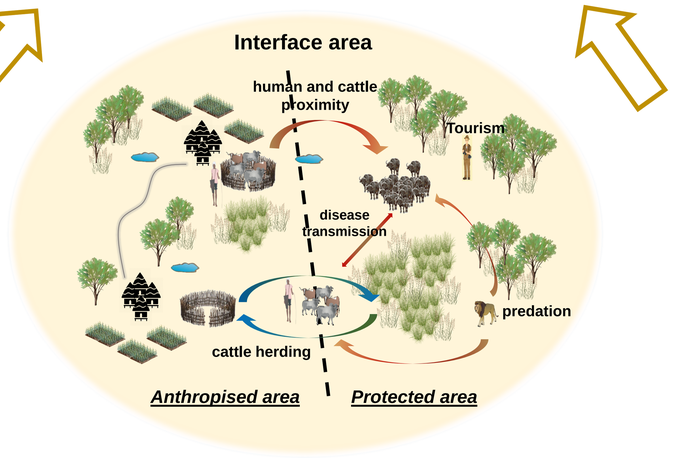
Source & photos : Arrault et al, 2018

Supervised pixel classification : *Product :* Landsat / *Spatial résolution :* 30 m
Temporal resolution : 16-days



Source : USGS, NASA

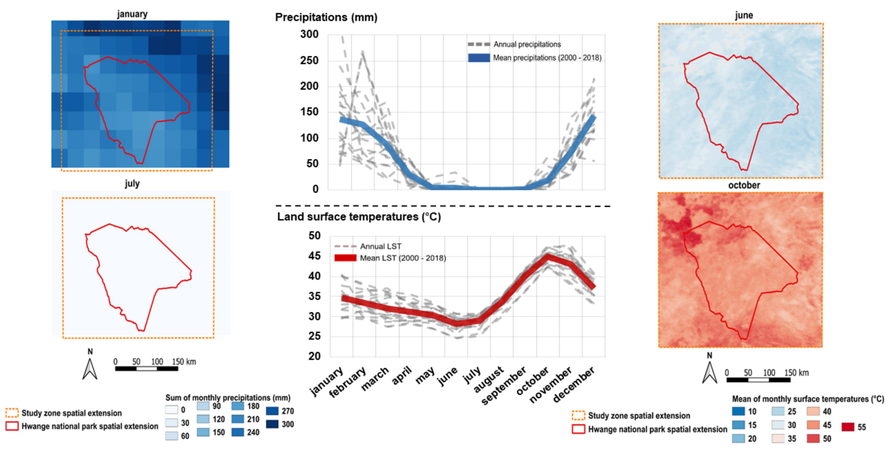
Normalized Difference Vegetation Index (NDVI) : *Product :* MODIS - MOD13Q1/MYD13Q1
Spatial résolution : 250 m / *Temporal resolution :* 8-days product composite



Negative impact & interaction
Positive impact & interaction

SECONDARY FACTOR: TEMPERATURES AND PRECIPITATIONS

→ determine the vegetation seasonality
→ Influence the availability of the water ressource



Tropical Rainfall Measuring Mission :
Product : TRMM 3B42 RT
Spatial résolution : +/- 28 Km
Temporal resolution : Daily product

Source : USGS, NASA

Land surface temperatures :
Product : MODIS - MOD11A2/MYD11A2
Spatial résolution : 250 m / *Temporal resolution :* 8-days product composite

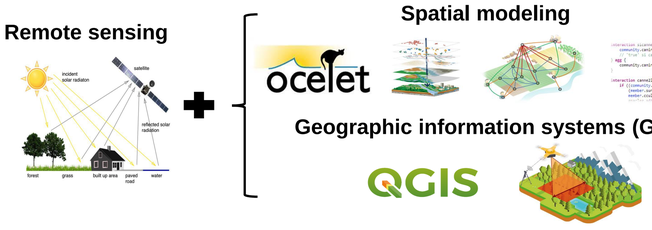
CONCLUSIONS

- ❑ Environmental factors → impact each other and determine the shape of the environment where the **mobility of cattle and buffalo** occurs
- ❑ **Remote sensing techniques** → map the **key** and **secondary environmental factors**

LIMIT : **Human practices** and **infrastructures** (boreholes, fences,…) need also to be taken into account to describe the **mobility of buffalo and cattle**.

PERSPECTIVES

- ❑ Remote **sensing techniques** → can potentially be complemented by **spatial modeling** and **geographic information systems (GIS)**
- ❑ Increase number of **satellite captors** → offers many **applications possibilities** in **open-access**



TEMPO — Remote sensing and spatial modelling of animal mobility

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https://tempo.cirad.fr/en

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