



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

Florent Rumiano^{1,2}, Elodie Wielgus^{3,5,7}, Eve Miguel⁴, Michel De Garine-Wichatitsky^{2,5,6}, Annelise Tran^{1,2,5}, Alexandre Caron^{2,5}

¹, Cirad UMR TETIS – ², Université de Montpellier – ³, CEFE/CNRS – ⁴, IRD UMR MIVEGEC – ⁵, Cirad UMR ASTRE – ⁶, Faculty of Veterinary Medicine, Kasetsart University, Bangkok, Thailand – ⁷, Manchester Metropolitan University

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.

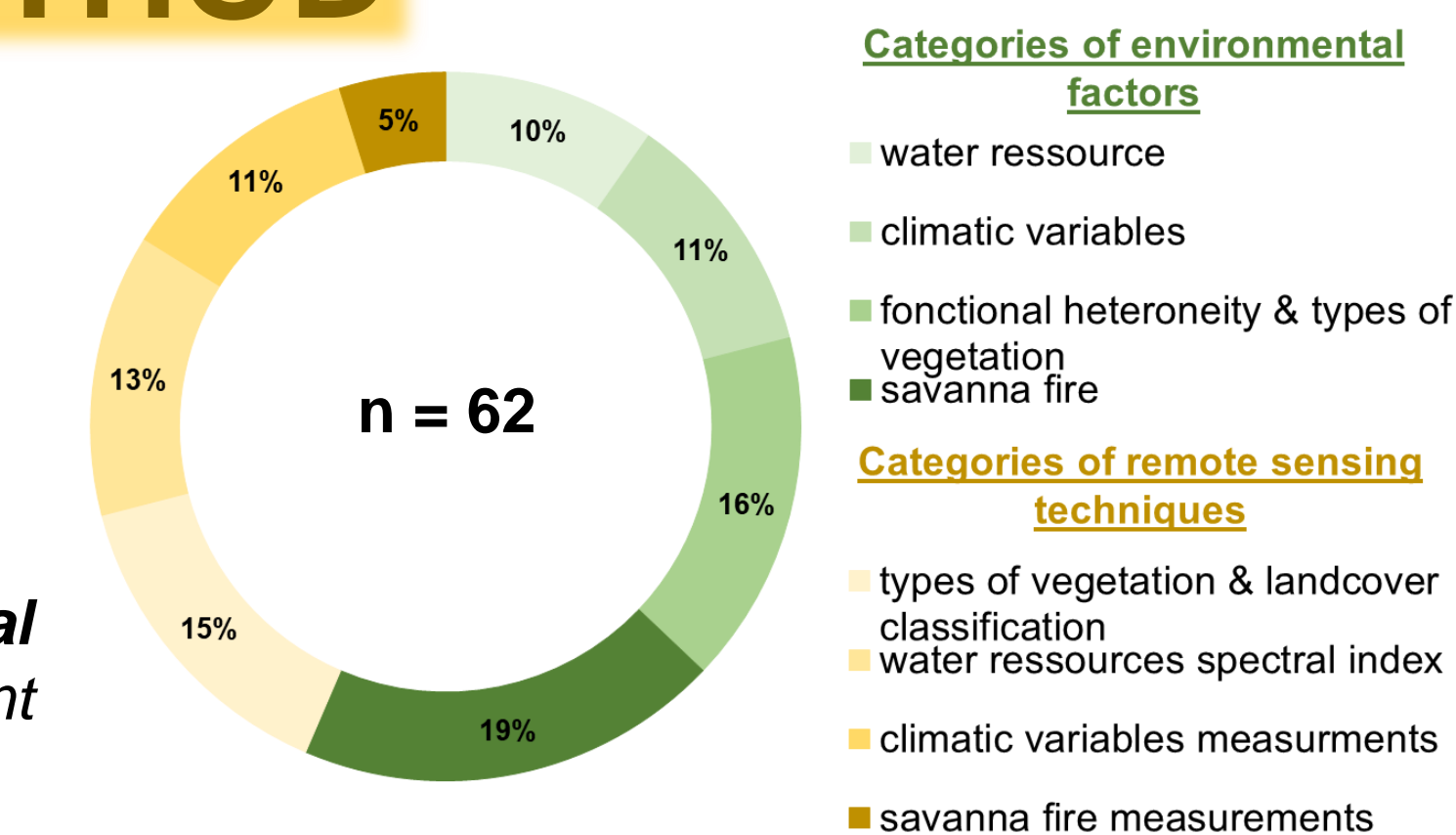
RESEARCH QUESTIONS

- 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

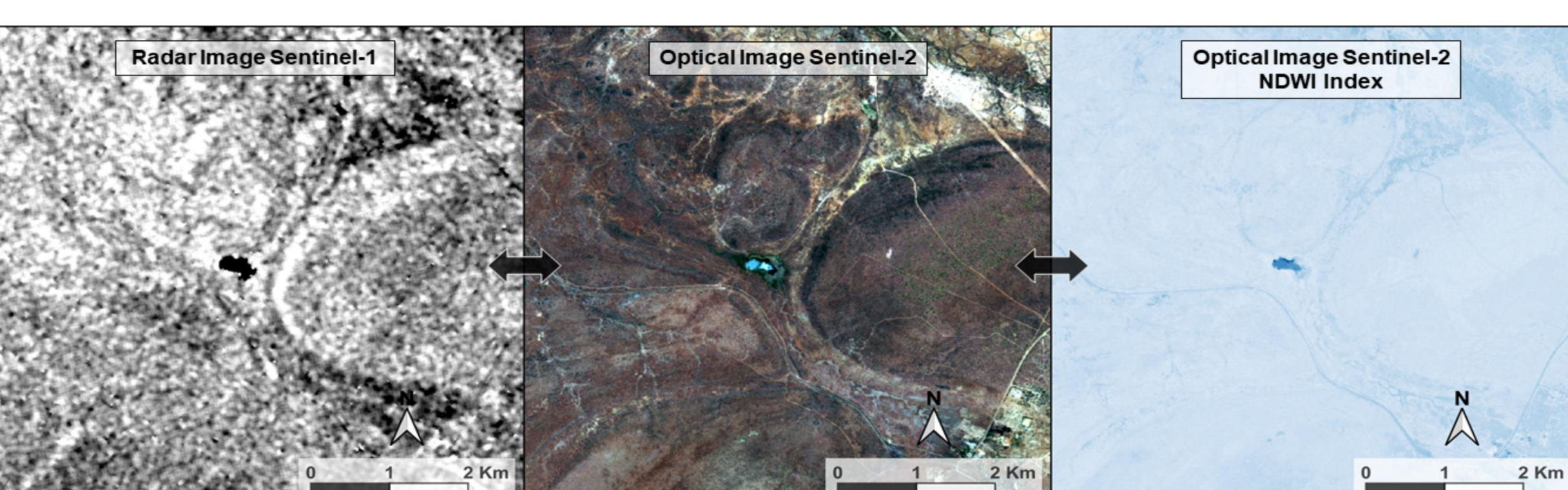
- Extensive **review** of scientific papers
- Bibliographic** approach

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

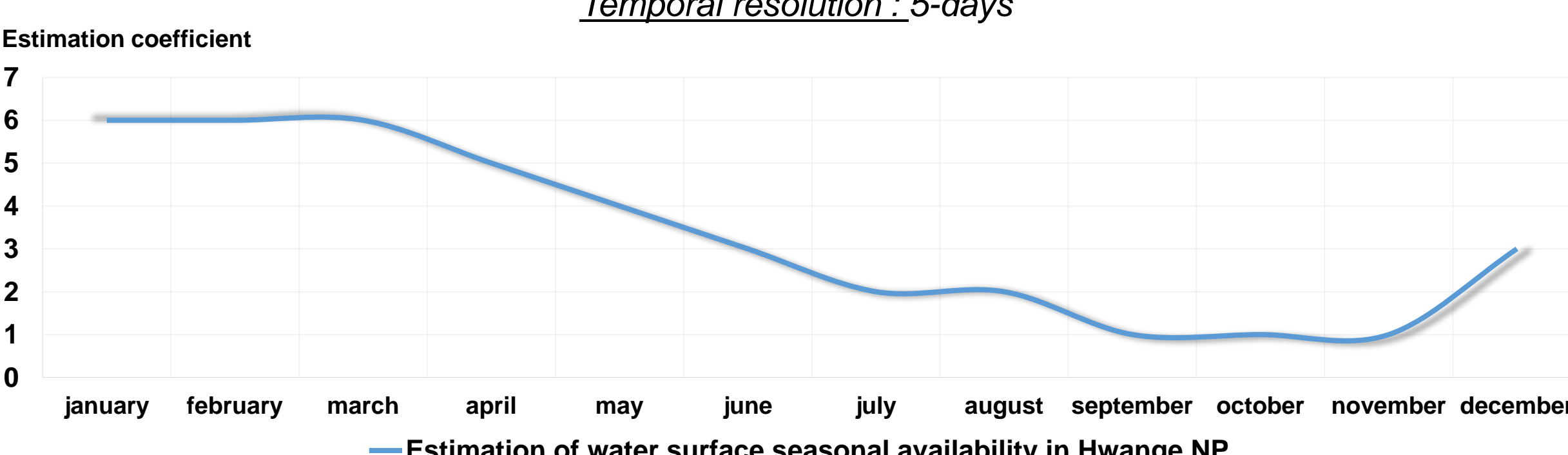


KEY FACTOR: THE WATER RESSOURCE

- seasonal variation
- Impact the vegetation distribution and quality



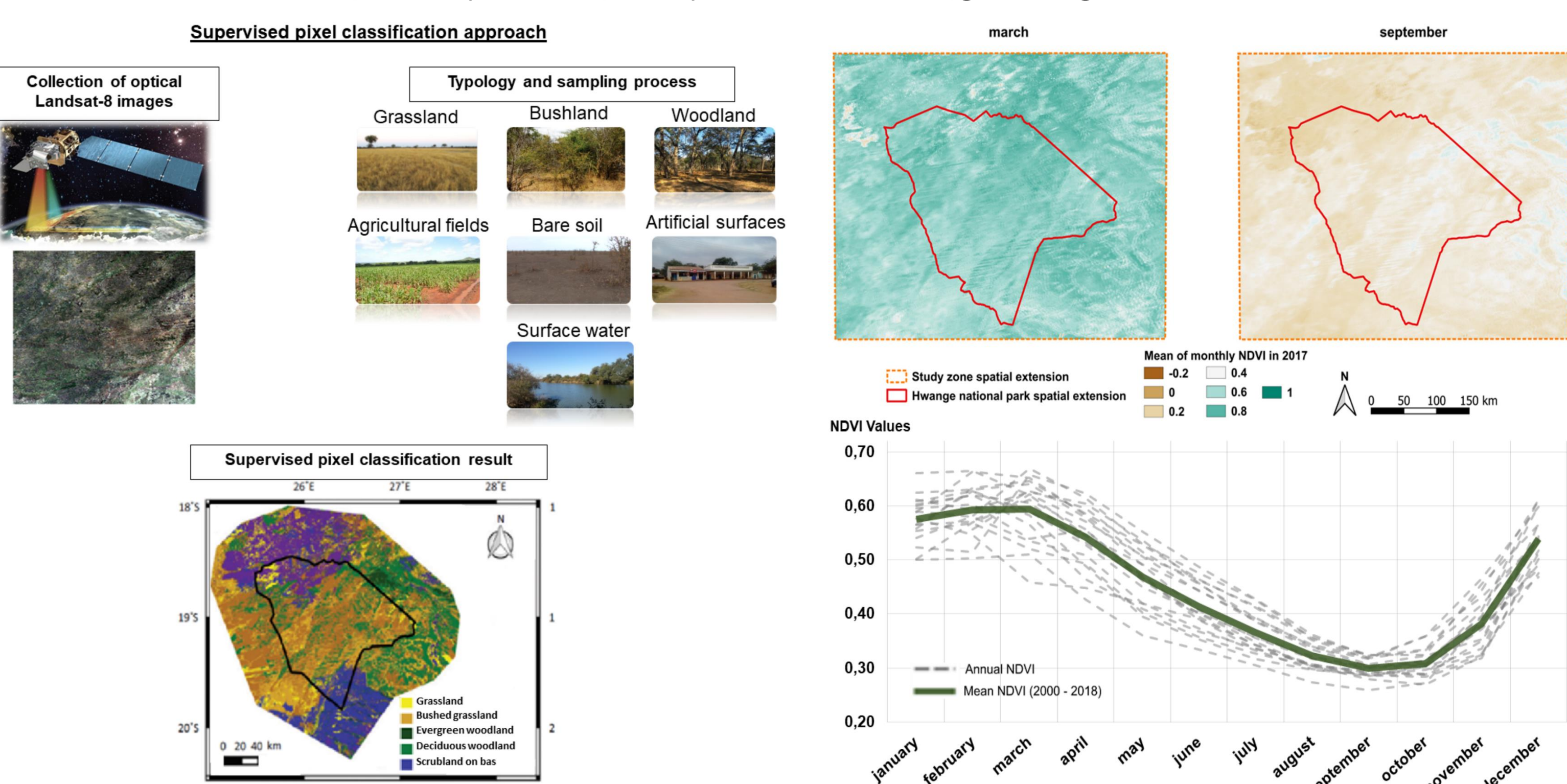
Source : ESA, Copernicus
Optical and radar imagery : Product : Sentinel-2 - Sentinel-1 / Spatial résolution : 10 m
Temporal résolution : 5-days



Estimation of water surface seasonal availability in Hwange NP

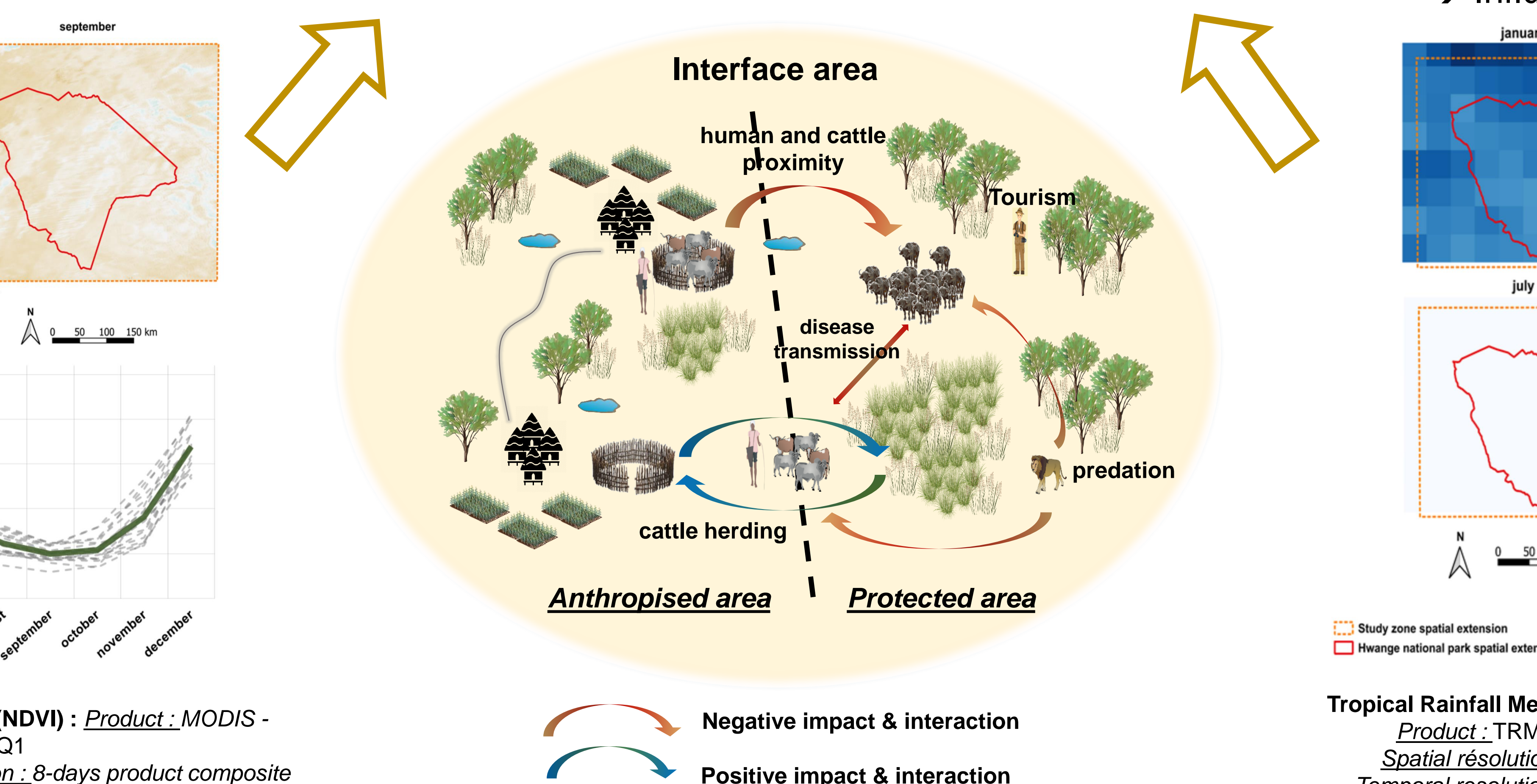
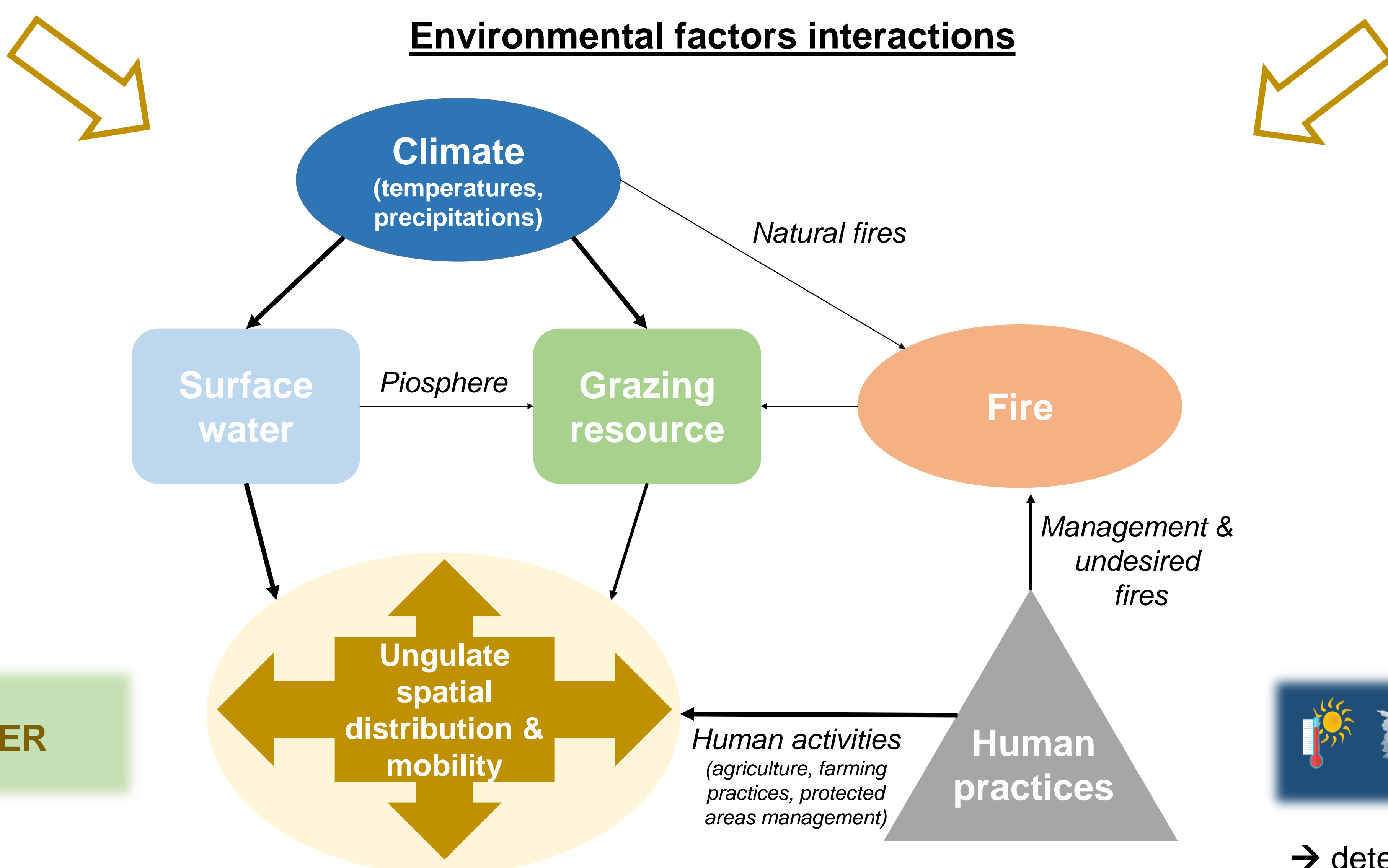
KEY FACTOR: VEGETATION AND LANDCOVER

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



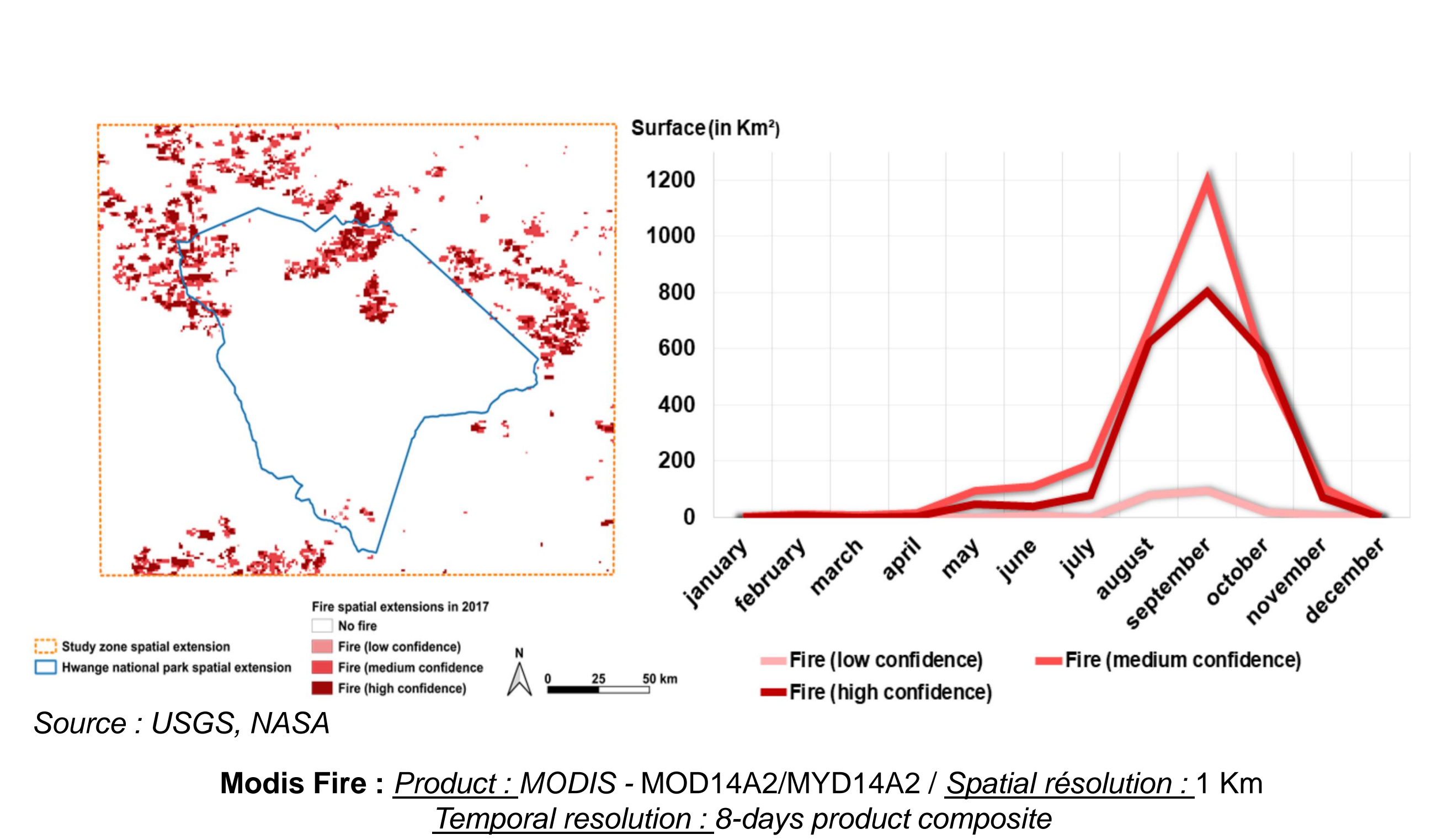
Source & photos : Arrault et al, 2018
Supervised pixel classification : Product : Landsat / Spatial résolution : 30 m
Temporal résolution : 16-days
Normalized Difference Vegetation Index (NDVI) : Product : MODIS - MOD13Q1/MYD13Q1
Spatial résolution : 250 m / Temporal résolution : 8-days product composite

KEY AND SECONDARY ENVIRONMENTAL FACTORS EXEMPLES OF CHARACTERIZING REMOTE SENSING TECHNIQUES



SECONDARY FACTOR: THE SAVANNA FIRE

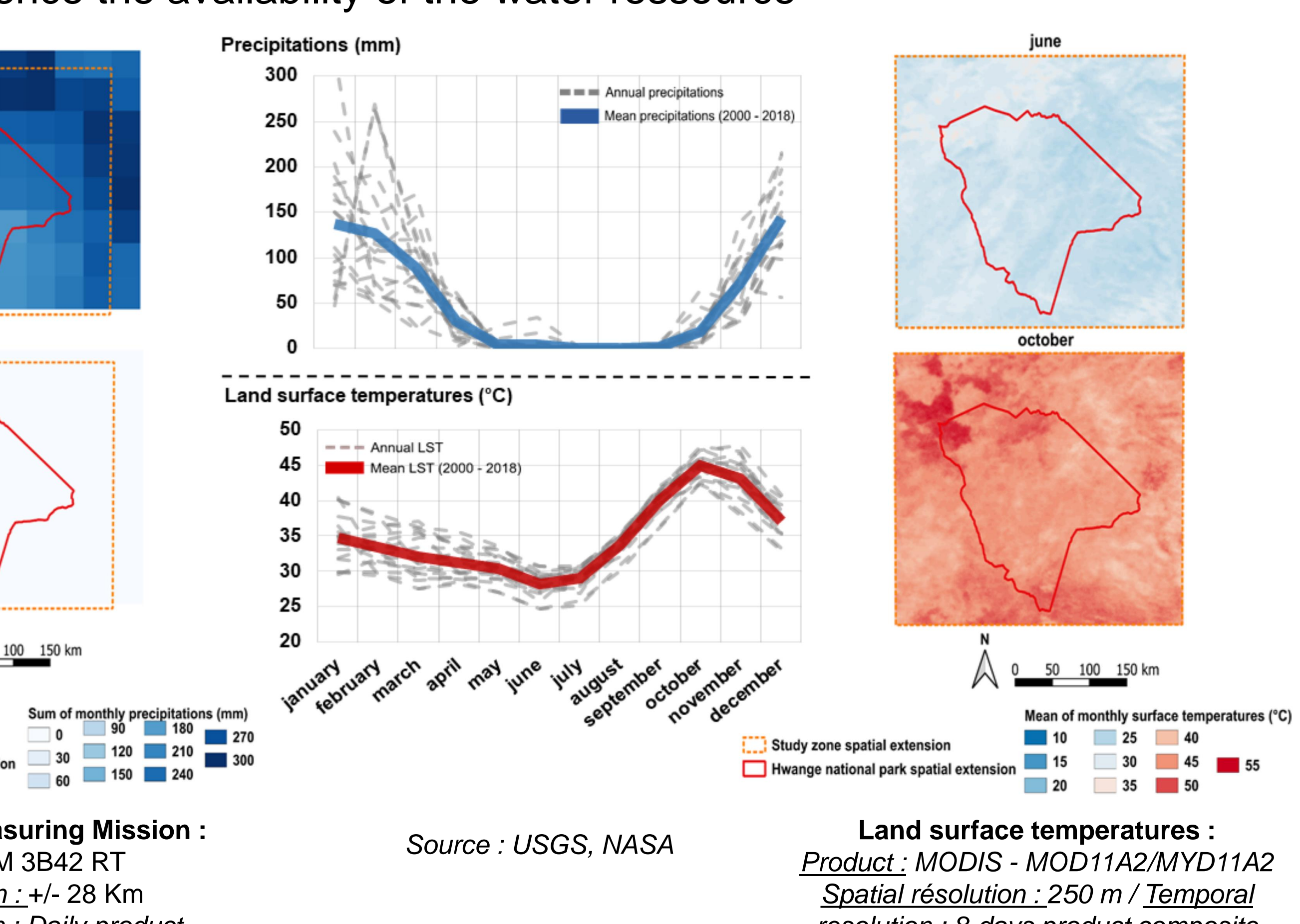
- determine the vegetation repartition and accessibility
- Impact the cattle and buffalo natural habitats sustainability



Source : USGS, NASA
Modis Fire : Product : MODIS - MOD14A2/MYD14A2 / Spatial résolution : 1 Km
Temporal résolution : 8-days product composite

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 résolution : Daily product
Source : USGS, NASA
Land surface temperatures : Product : MODIS - MOD11A2/MYD11A2
Spatial résolution : 250 m / Temporal résolution : 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**

