Application of artificial intelligence and satellite imagery to support pastoralists for Rangeland management

- Mapping Prosopis *juliflora* -

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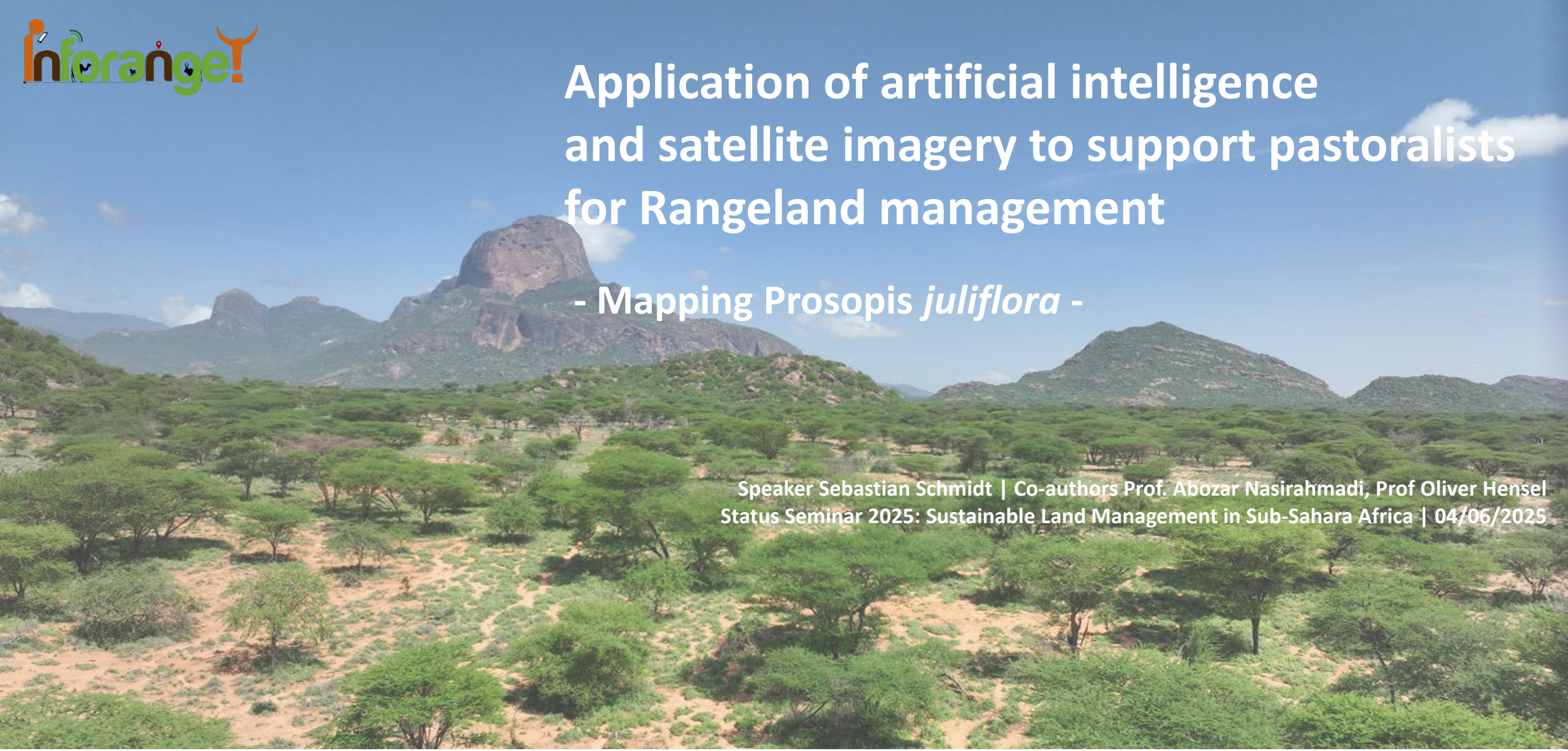
Status Seminar 2025: Sustainable Land Management in Sub-Sahara Africa | 04/06/2025



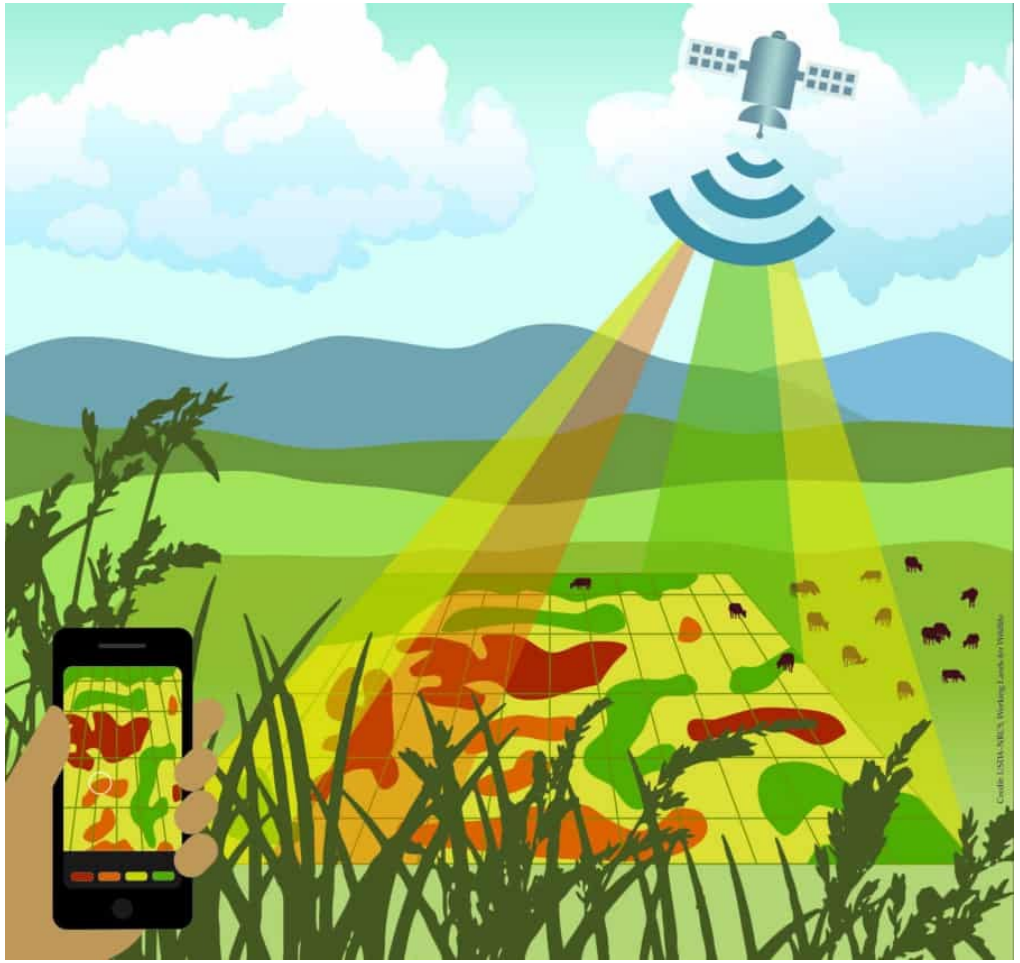
Introduction

Satellite data can provide

- data updated at short intervals
- data on large areas

Vegetation Indices

- provide estimation about pasture availability
- can not differentiate between useful and non useful vegetation



https://www.wlfw.org/publication-alert-next-gen-remote-sensing-tools-level-up-rangeland-conservation/

Introduction

Prosopis juliflora was introduced to Africa

- to counteract desertification (green glue)
- to provide a source of fuelwood, construction timber

Prosopis juliflora

- has no natural competitors
- competes with native flora for resources
- reduces grazing land
- spreads unchecked!

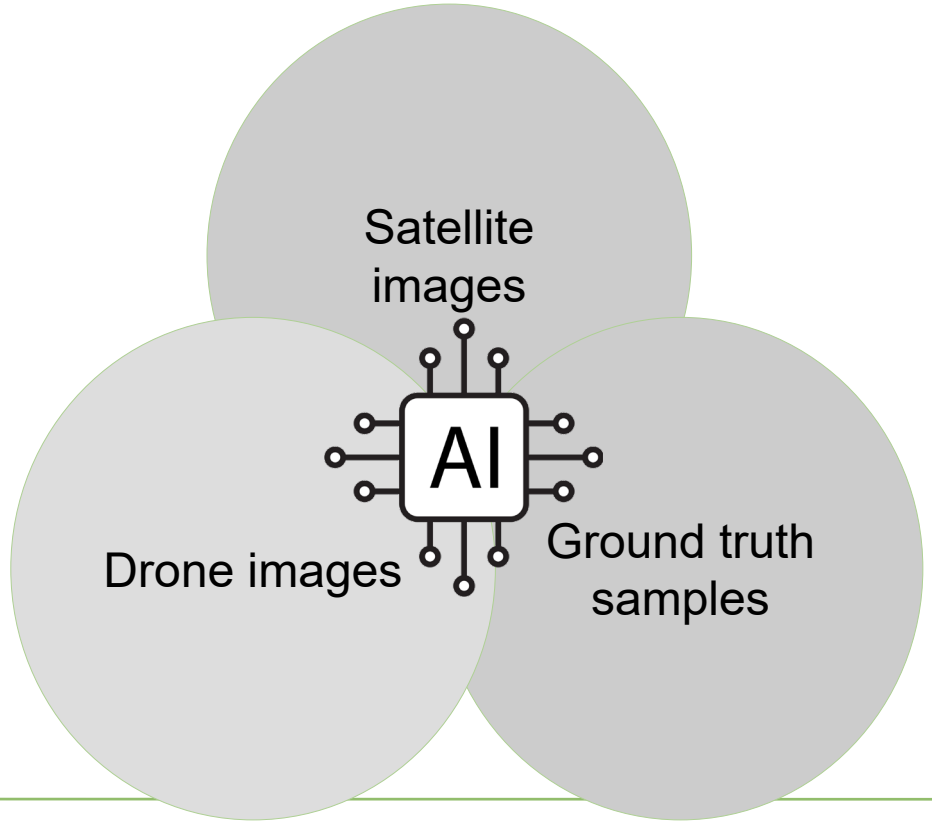
Acacia spp. & Prosopis juliflora

Ng et al.,2016 / Kamiri et al., 2024 / Paliwal et al., 2024

Aim

Enhance vegetation analysis in rangelands by isolating and removing

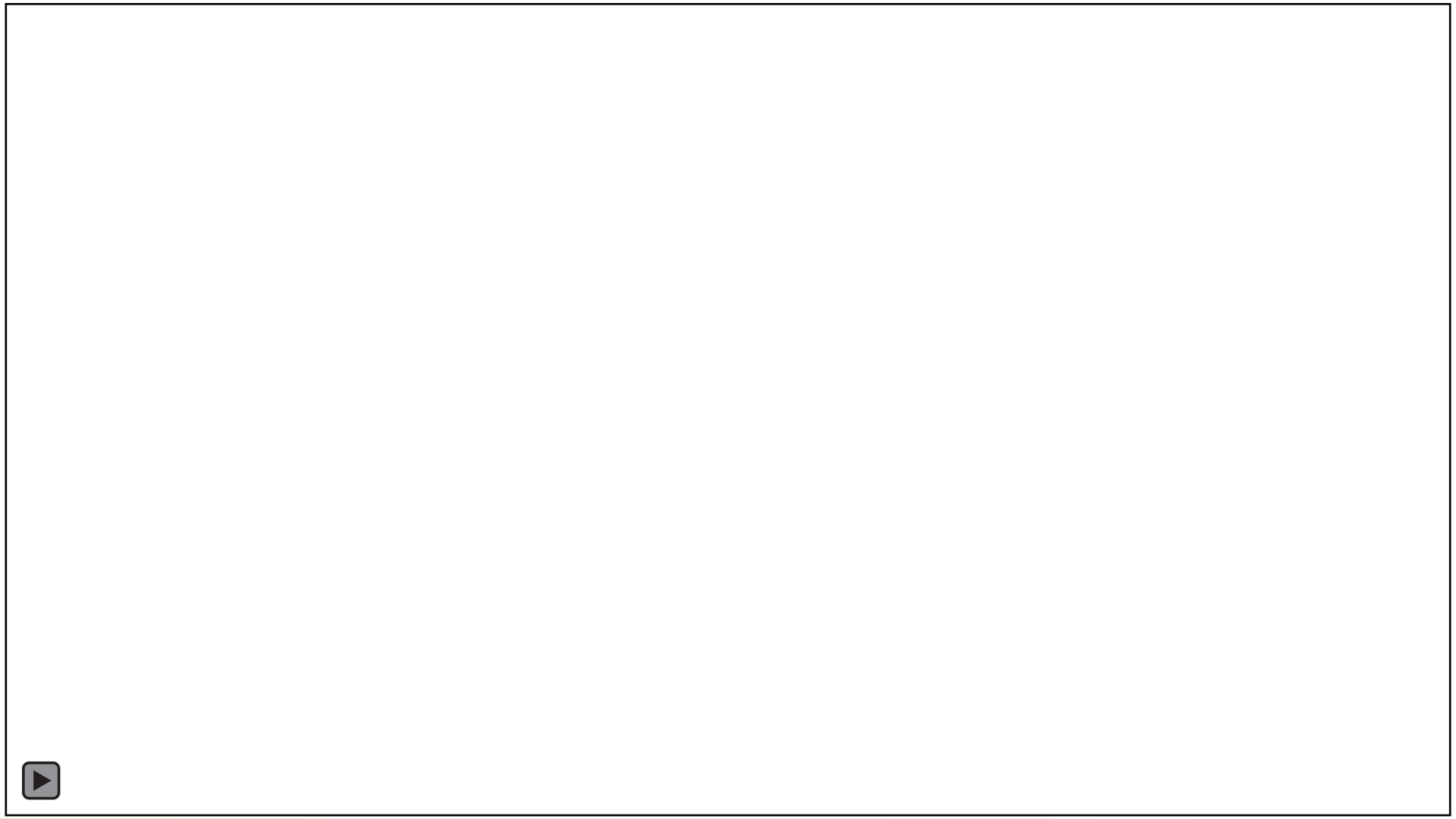
Prosopis *juliflora* from NDVI maps derived from satellite imagery



Data collection – ESA Earth Observation Missions

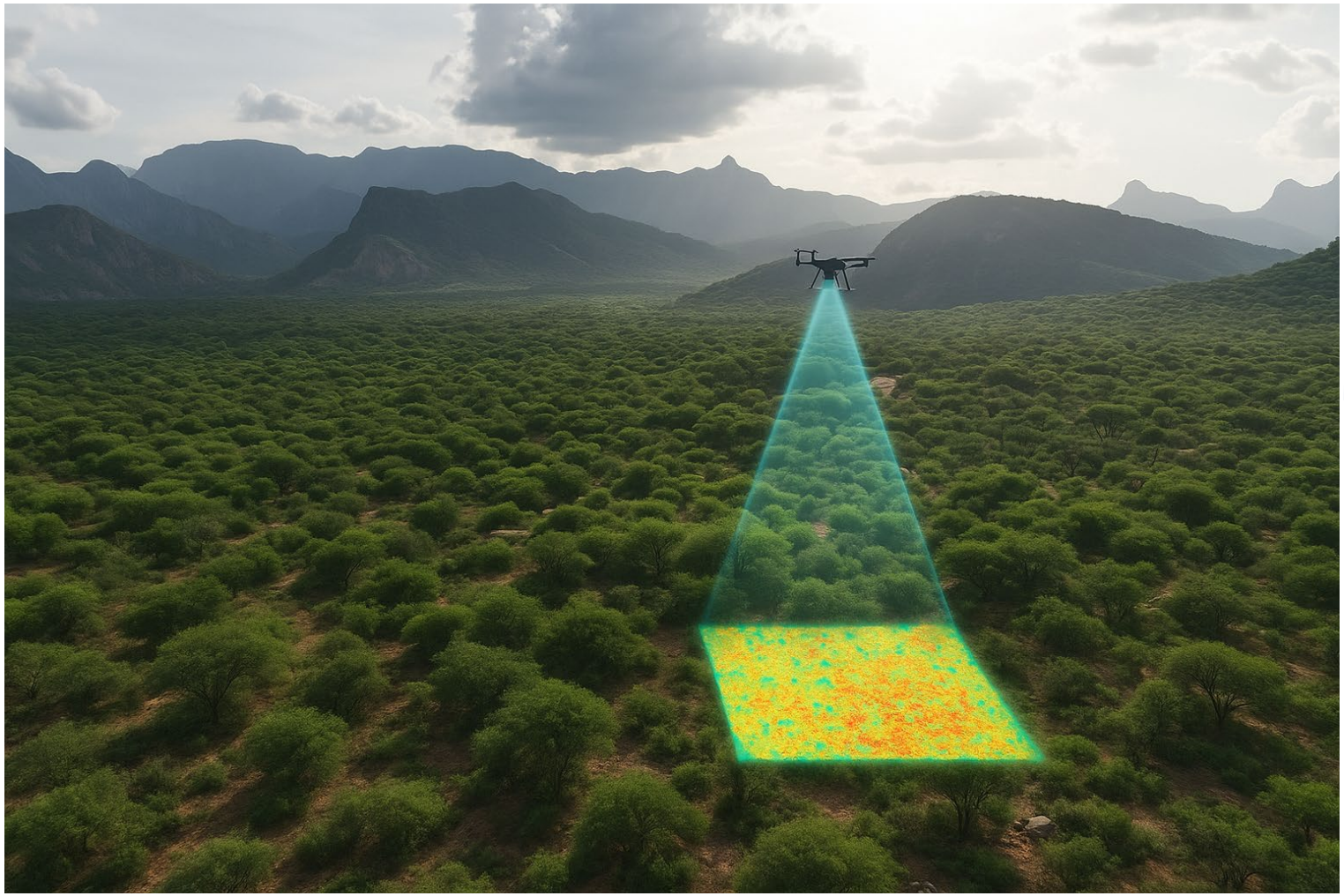
https://www.esa.int/ESA_Multimedia/Images/2019/05/ESA-developed_Earth_observation_missions

Data collection – Sentinel 2



https://www.esa.int/esatv/Videos/2022/08/Europe_s_Copernicus_Programme_-_Sentinel_satellites_animations/
Sentinel-2_satellite_animation

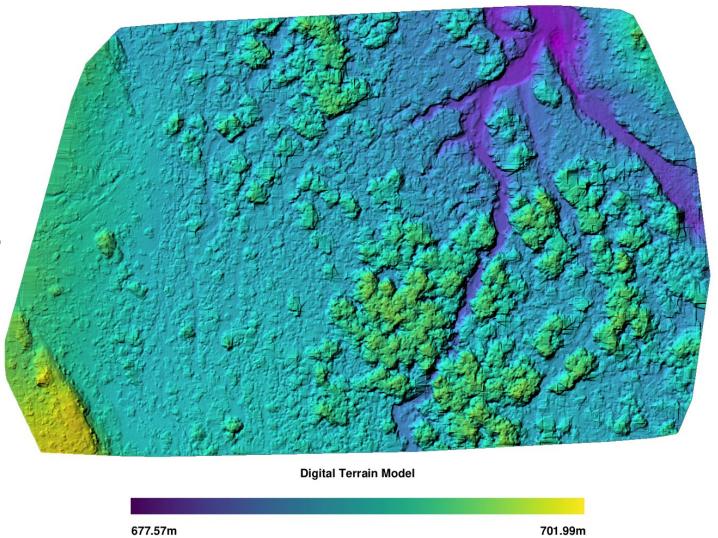
Data collection - UAV



Orthophotos

Orthophoto

Digital Terrain Model



Data collection

Sentinel 2

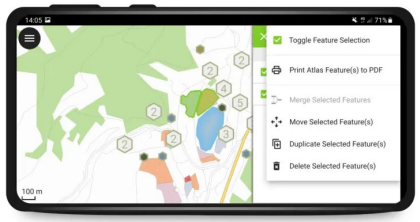
S2 - Zoom

Sentinel 2 / UAV

UAV - Zoom

UAV – single plants are visible

Data collection – ground truth



Ground truth

- collecting of polygon samples
- taking photos

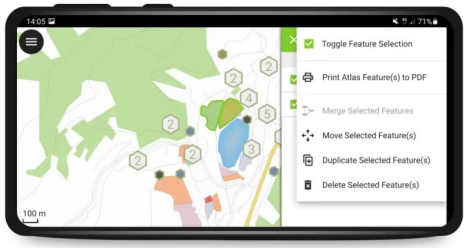
Data processing

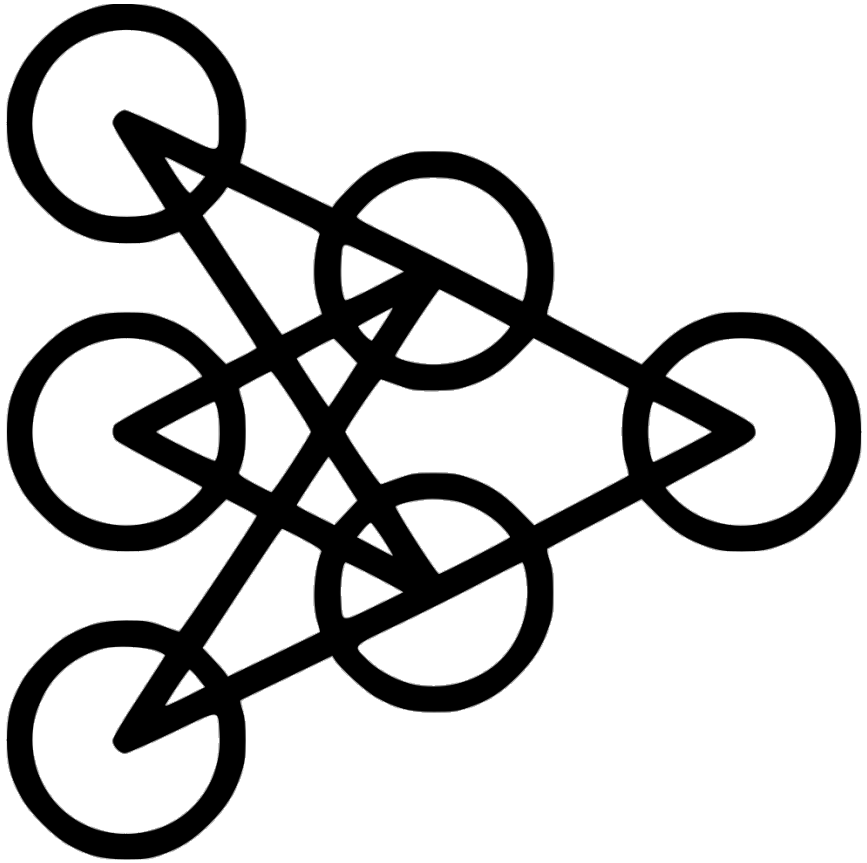
Input

S2 Images

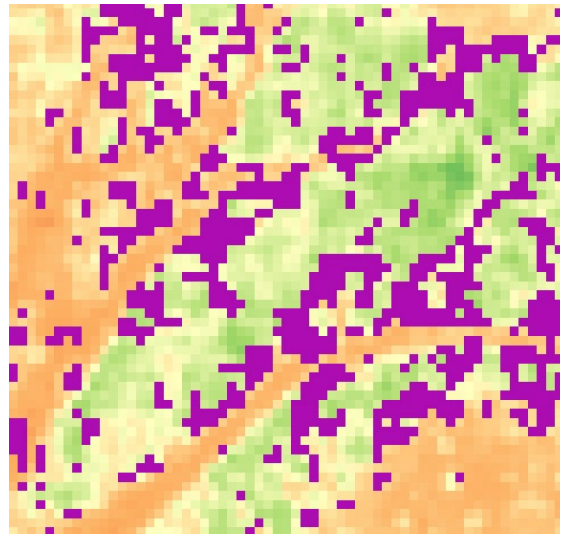
High Resolution Images

Ground truth





Output

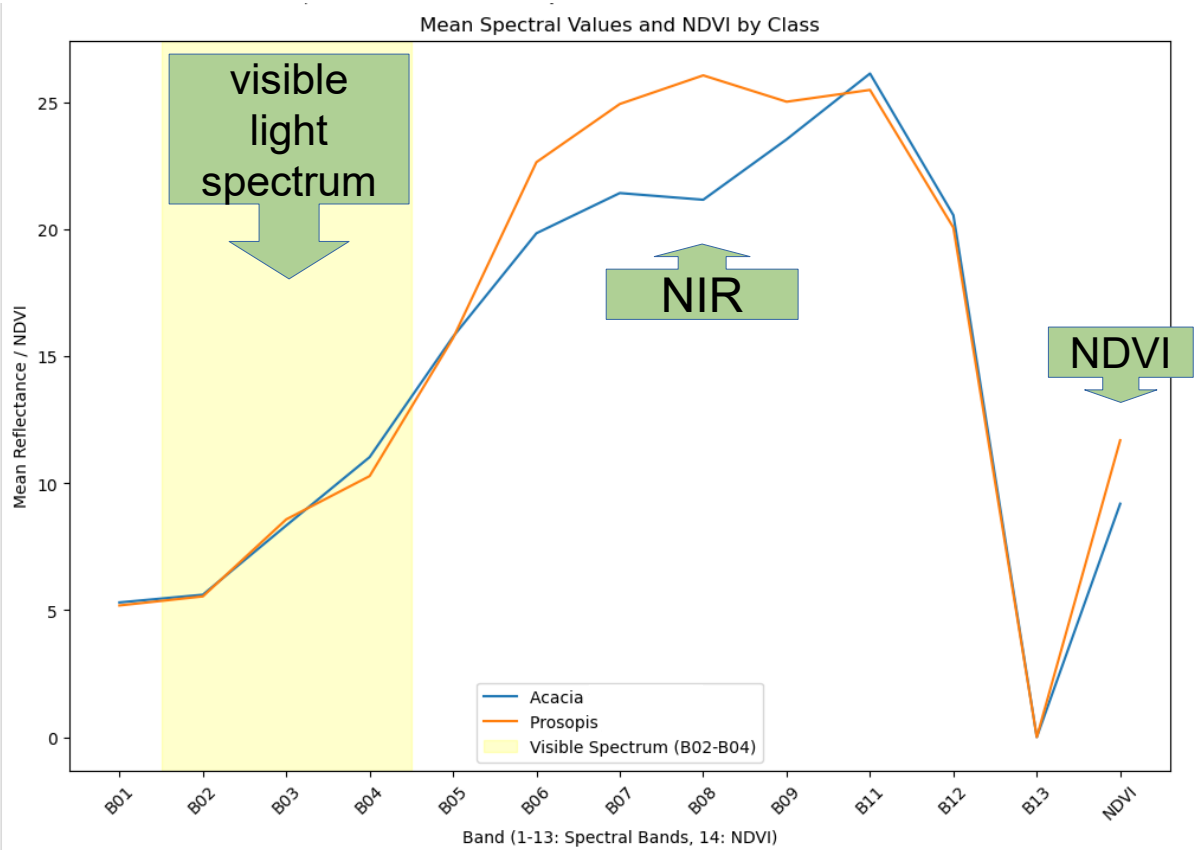


Improved NDVI map

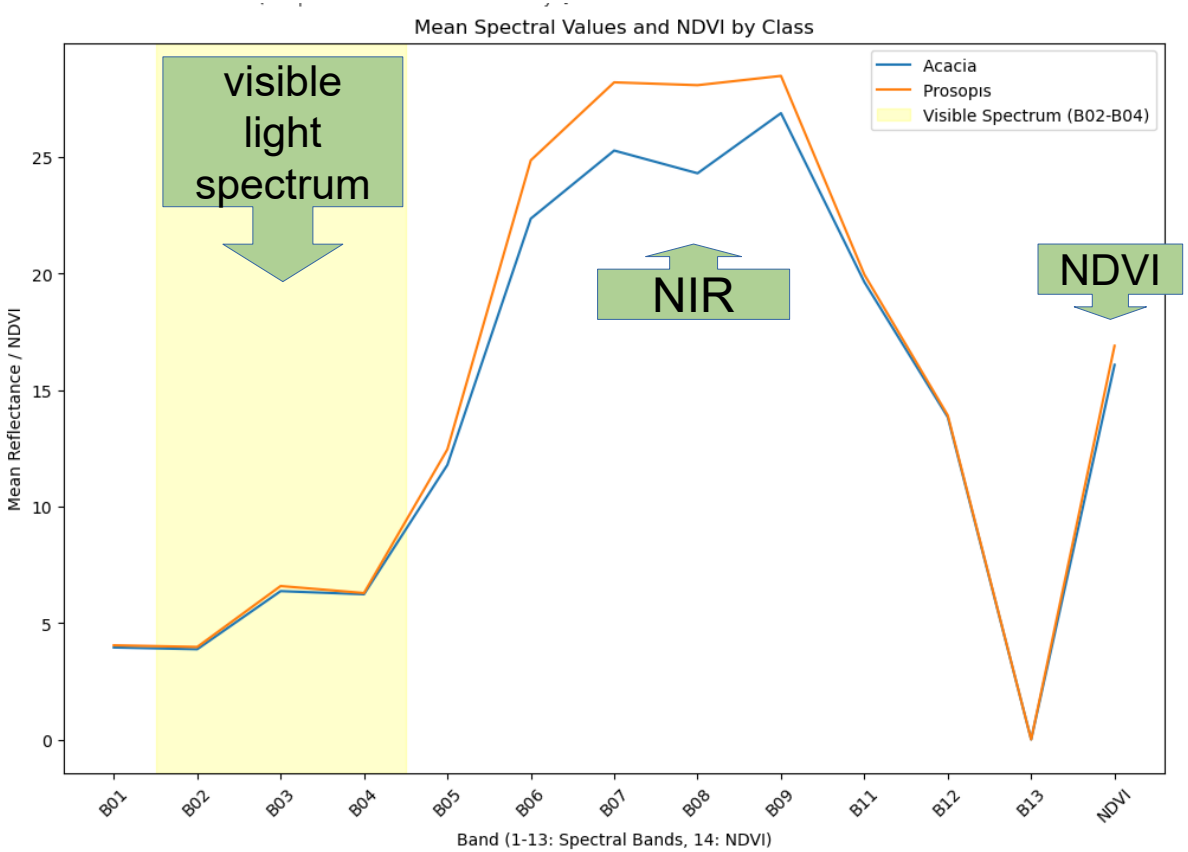
https://de.wikipedia.org/wiki/Sentinel-2
https://webaro.de/produkt/dji-mavic-3m
https://www.opengis.ch/

Results

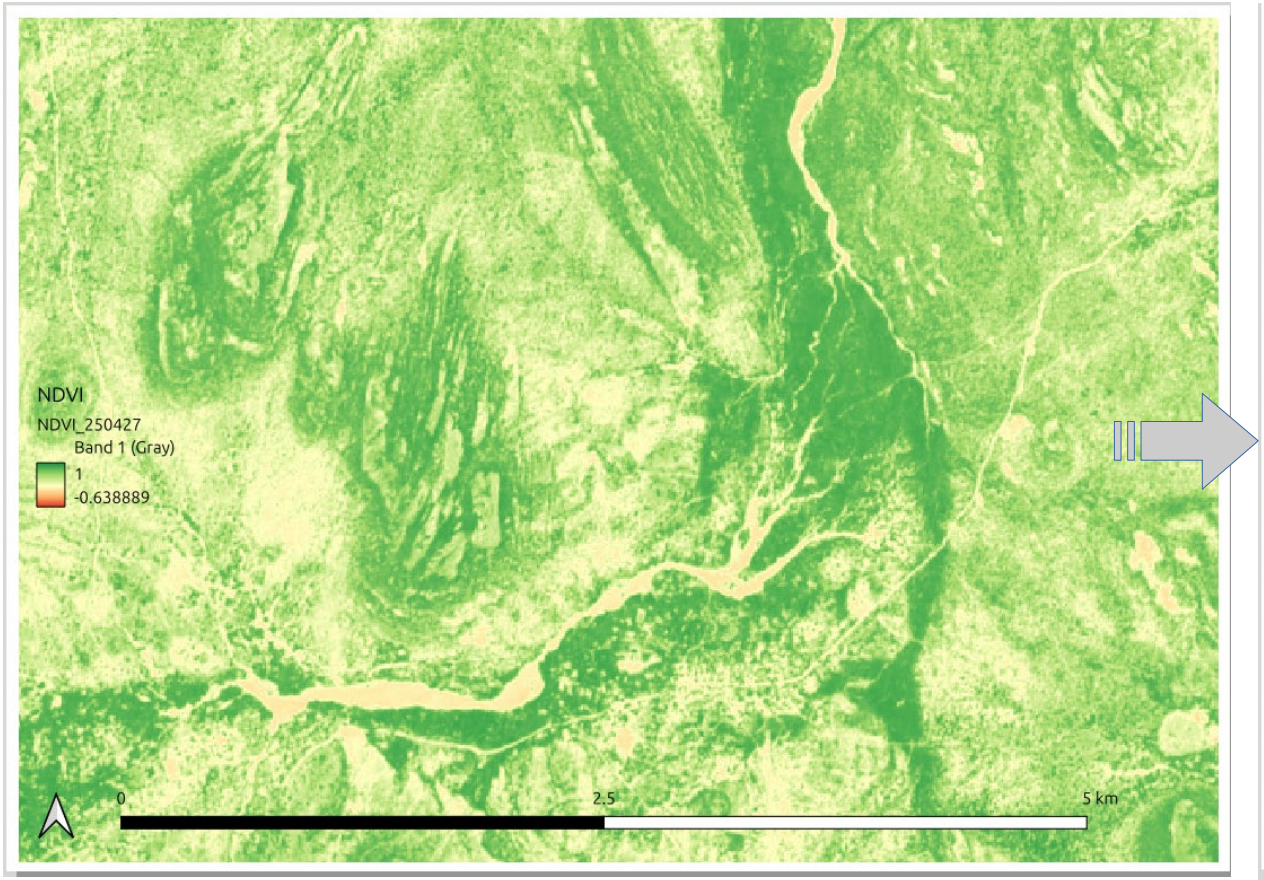
Dry season

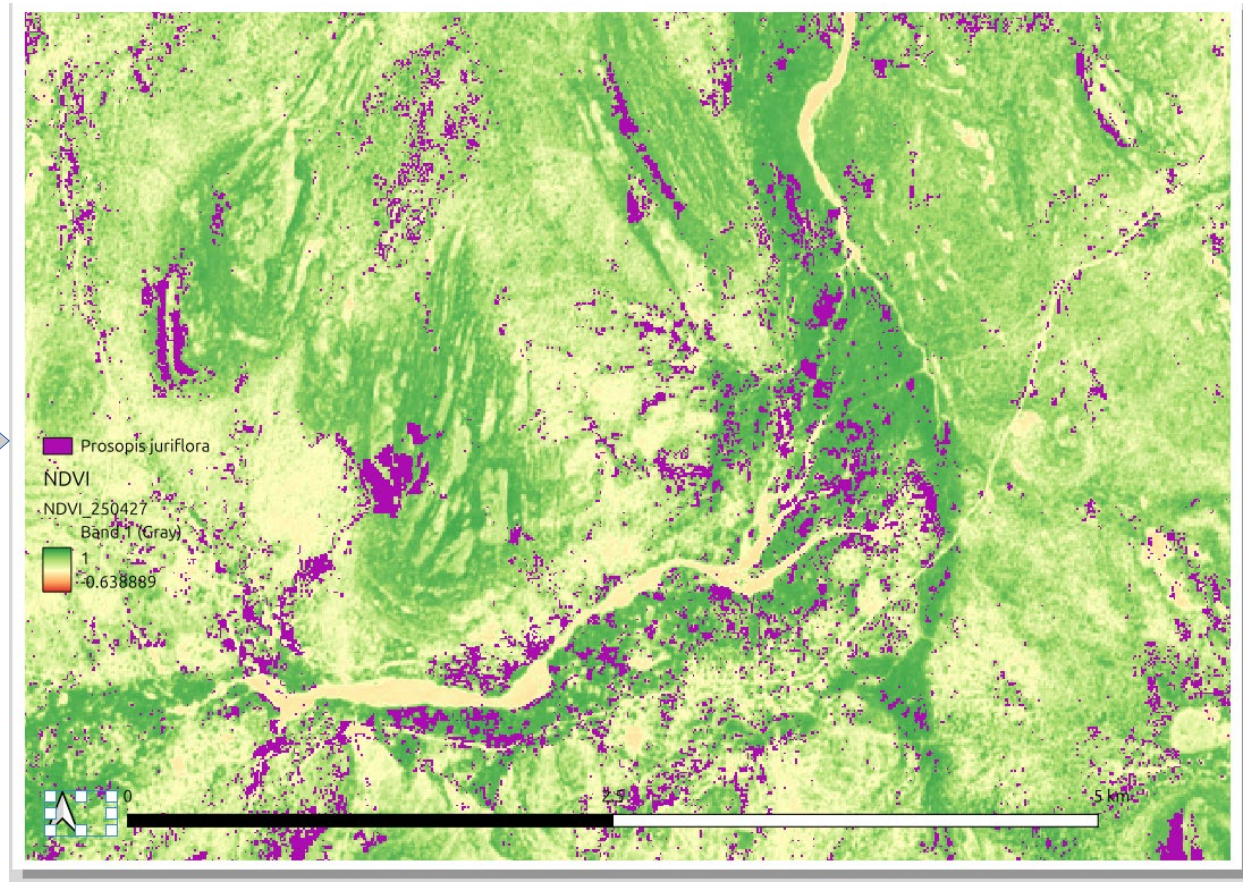


Wet season



Preliminary Results





NDVI map April 27th 2025 - with Prosopis detection

Conclusion & next steps

- Detection of *Prosopis juliflora* is possible
- Classified NDVI maps can provide more information

- Extend training data set & refine model
- Compare different ML and Deep Learning algorithms
- Share results with communities as map layers for Inforange App

Acknowledgment

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CRDD

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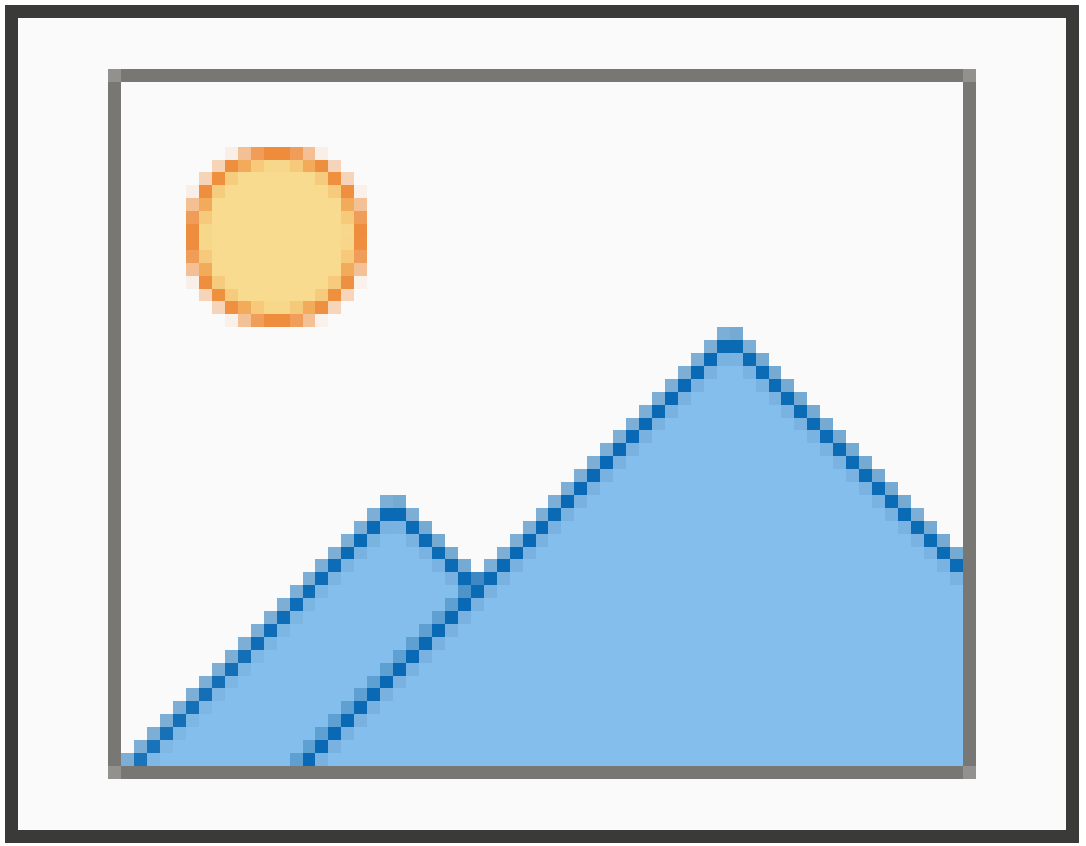
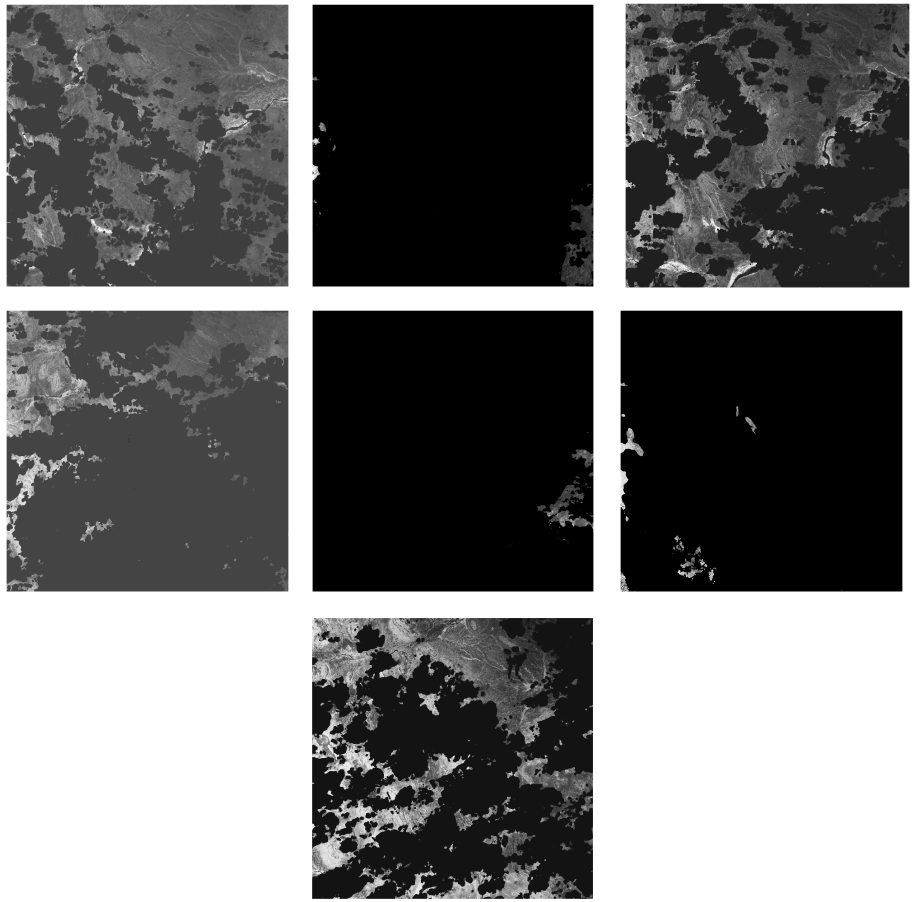
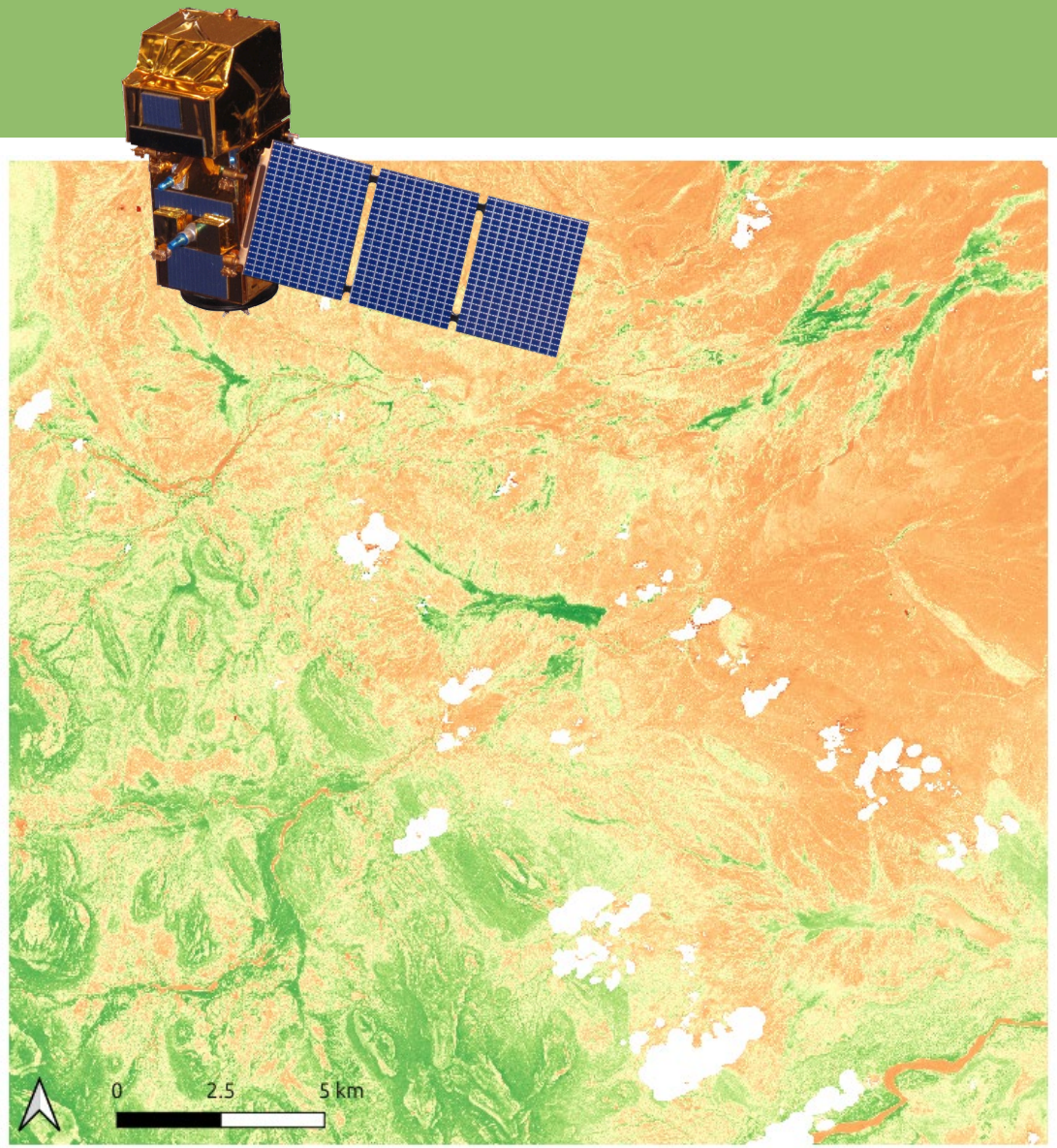
Data



Data - Preprocessing



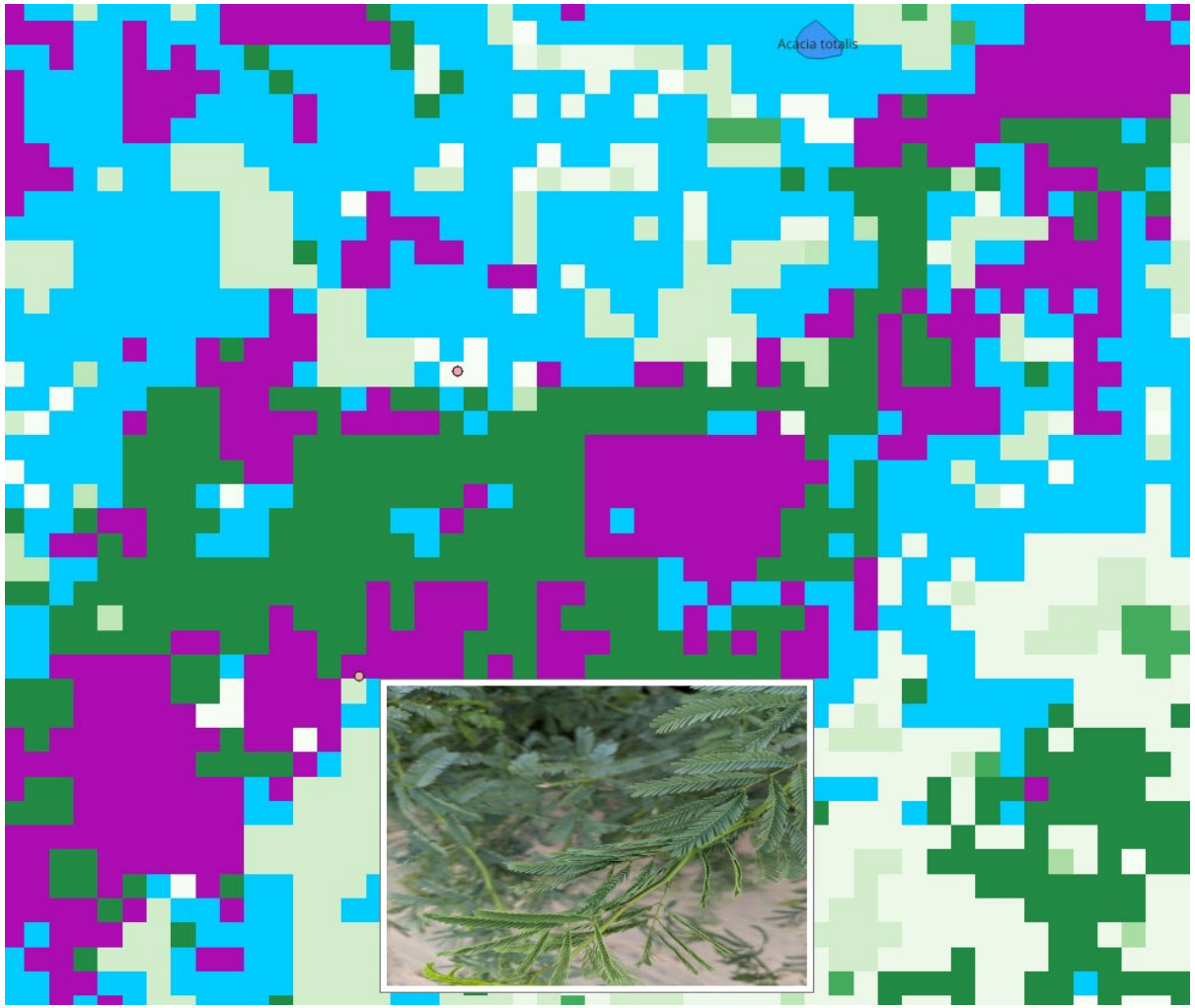


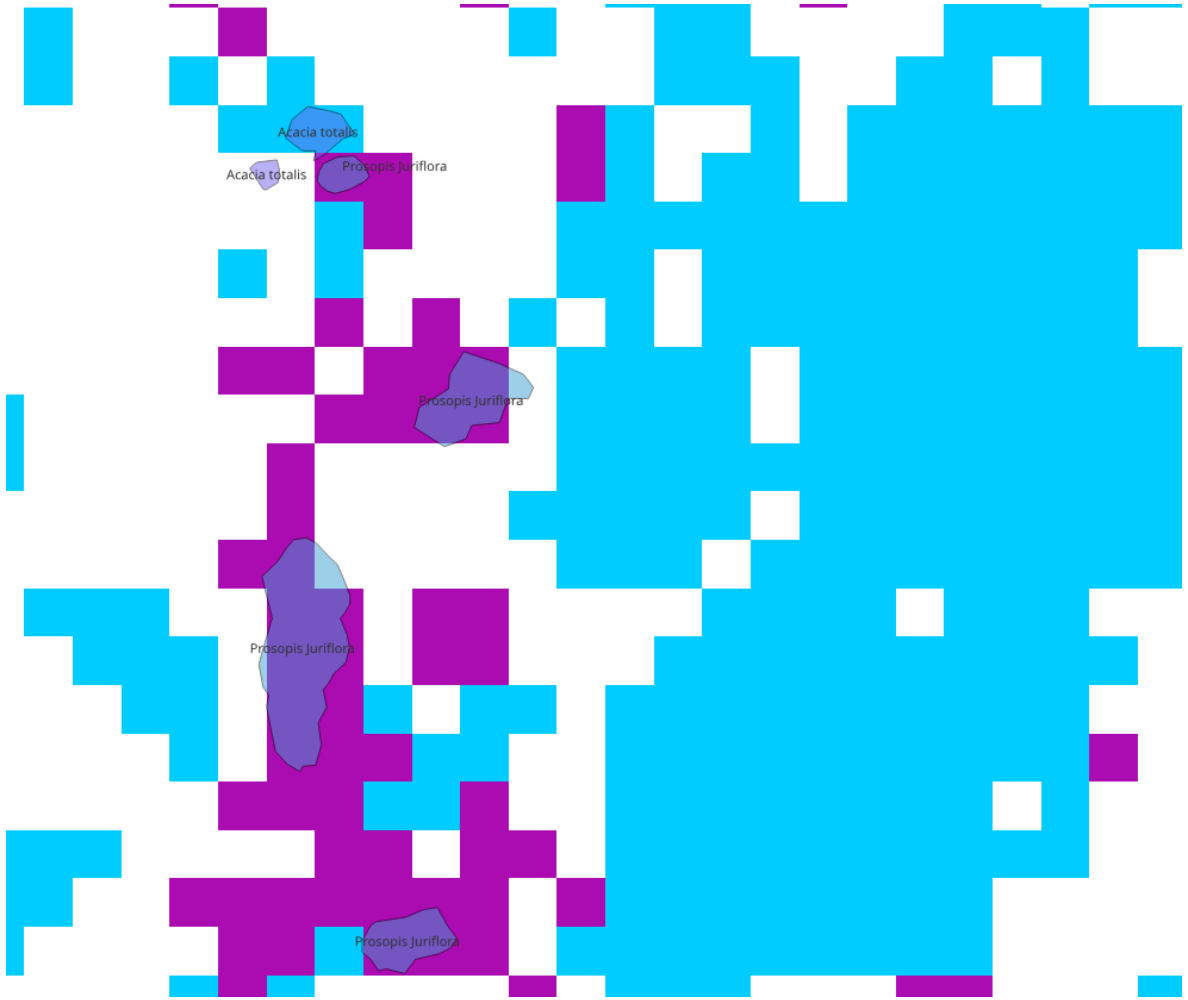
S2 NDVI 08/03/2025 – 07/04/2025 composite

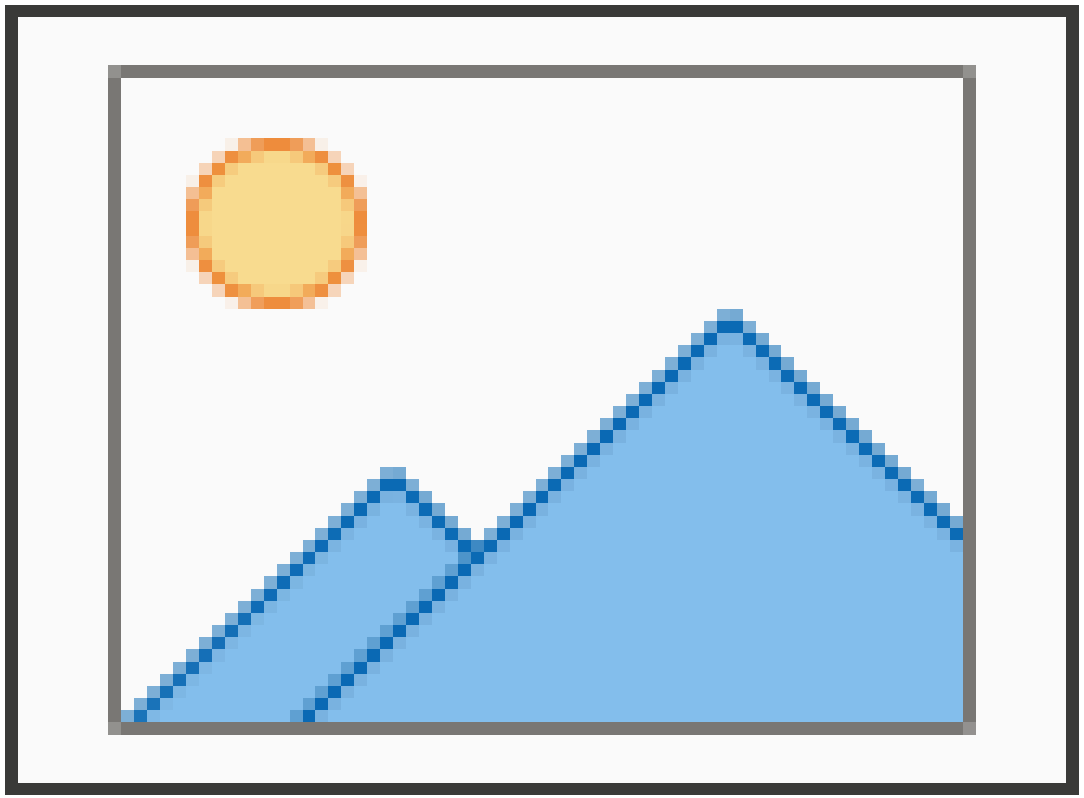
vs

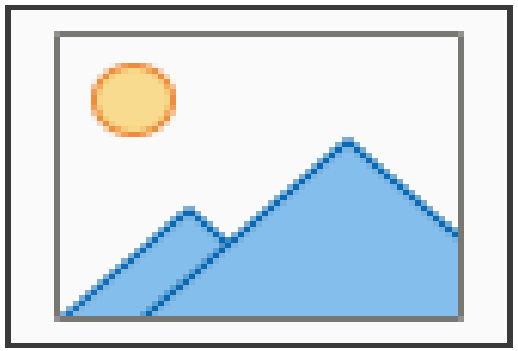
‘cloud-free’

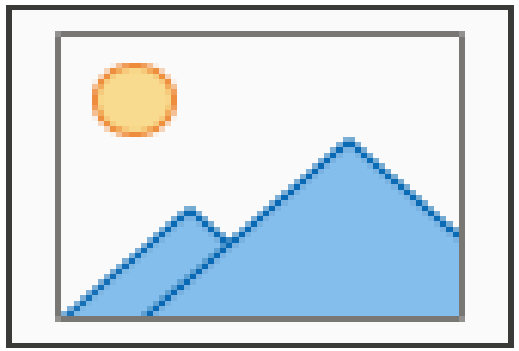
Data validation

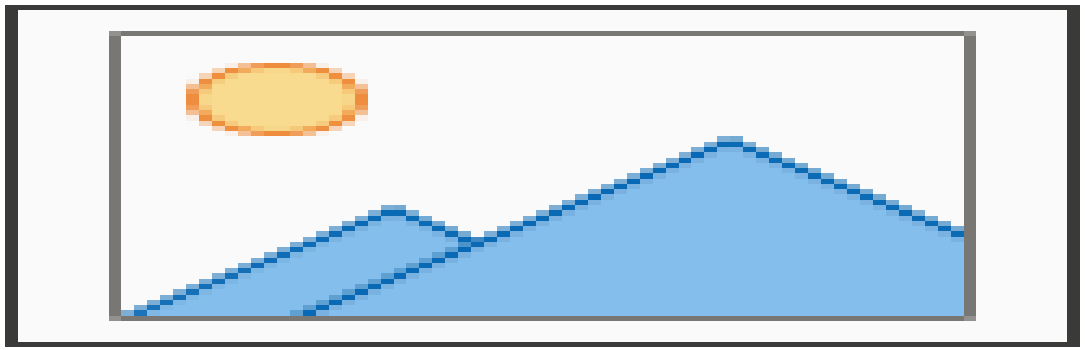




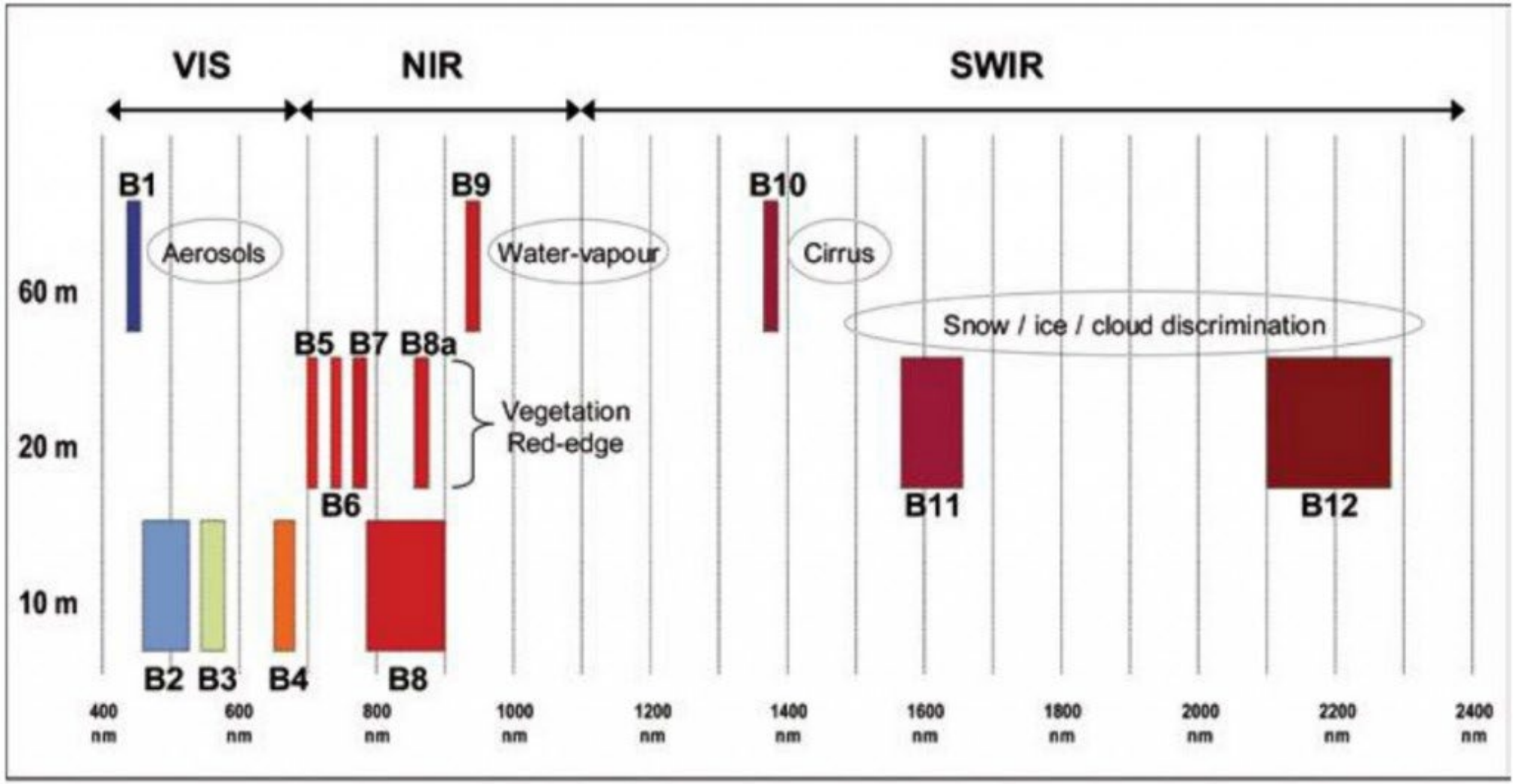








Sentinel 2 Bands



https://www.spectralcam.com/2019/02/12/maia-s2-and-sentinel-2-multispectral-images-for-agriculture/