



# 1. INTRODUCTION

Oases are part of the natural wealth and heritage of Morocco. The Boudenib and Tafilalet oases are among of the biggest palm groves located in the south-eastern part of Morocco. Those oases belong to catchments of the rivers Guir and Ziz respectively.

Morocco has lost more than 2/3 of its oases during the past century, due to a succession of drought periods, water scarcity, climate change and overexploitation of groundwater resources, creating a huge demand for the implementation of sustainable management practises to preserve the last green areas in the desert.







Green and healthy oasis (2015)

Oasis are not a big consumer of water, but they use groundwater using their roots, so if the piezometric level decrease, the palms are obliged to grow up their roots deeper in order to reach the ground water level. Once the water depth is below 9m, the palm trees rely on the use of surface water (rivers or irrigation) for survival, the reason why the protection of groundwater resources and maintaining the volume of water in the aquifer could save more than 50% of surface water.

Improving management and monitoring of oases ecosystems is strongly encouraged by UNESCO Biosphere Reserve and RAMSAR guidelines.

# 2. OBJECTIVE

NDVI and LAI maps derived from various datasets, can be successfully used for deriving timeseries of vegetation dynamics, to assist the decision makers in monitoring and planning water resources in the area in the future, since the oasis development cycle is repeated every 10 years.

# 3. METHODOLOGY & TOOLS

**TREX** – Tool for Raster data EXploration is a Python-GDAL processing tool of ProbaV NDVI images (100m resolution) for analysing vegetation dynamics, developed at the Vrije Universiteit Brussel and available online.

TREX has various applications, but the main functionality is to provide an automating processing of ProbaV satellite images into timeseries of NDVI and LAI, used in vegetation monitoring of user defined points of interest. This study presents the results of application of TREX in the arid ecosystems of Boudenib oasis for the period 2014-2018.



**ProbaV\_images**: These are NDVI maps from the ProbaV satellite managed by VITO.

Reference\_Raster (tif): Presents the area of interest. The reference raster must be located in the folder reference\_maps.

Points\_of\_interest (shp): Contains points of interest. Coordinates of those points will be used for deriving timeseries of LAI.

**ProbaV\_setup.txt:** LAI\_ProbaV\_setup.txt is a key file to control all inputs and outputs generated by scripts.

**ProbaV\_download.py:** First script is used for downloading satellite images from ftp server provided by VITO.

**ProbaV\_processing.py:** Second script calls GDAL functions for processing raster data into format specified by user in LAI\_ProbaV\_setup.txt.

**ProbaV\_visualisation.py:** Third script is focused on producing secondary outputs timeseries or color representation of processed maps.

Main\_folder: Results and scripts outputs.

# APPLICATION OF TREX SCRIPT FOR VEGETATION MONITORING IN AN OASIS ENVIRONMENT USING REMOTE SENSED DATA FROM PROBAV

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Oasis desertification(2017)









LAI [-] monthly agg LAI [-] monthly age AI [-] monthly ag

4.3 LAI\_timeseries/LAI profile (2014-2018)



high LAI

- IHF Delft Institute for Water Education, Delft, Nederlands
- Mohammadia School of Engineers, Rabat, Morocco



Points of interest for deriving LAI timeseries:







### 5. CONCLUSIONS

- lose their greenery.
- water availability

## 6. REFERENCES

Moroccan Hydraulic Basin Agency – ABH, GZR National Institute of Agronomic Research of Morocco Bhattacharjee, Boud Verbeiren All right reserved/https://github.com/VUB-HYDR/TREX



• Low LAI is observed in autumn and summer when the piezometric level is low, and the palm trees

• LAI is depending on NDVI, the reason why the dynamics might also be explained by varying photosynthetic activity of the palms: lower/higher response in NIR as a result of lesser/more

• Low LAI is also correlated to low quantity and quality of dates in October 2015 and October 2017. • Using TREX can hence be applied for monitoring the health of palm trees in Oases environments. • These results have important implications for water management in the area.