MangMap, an online platform using Earth Observation data for local-scale mangrove monitoring and management. Current up-grades and future orientations.

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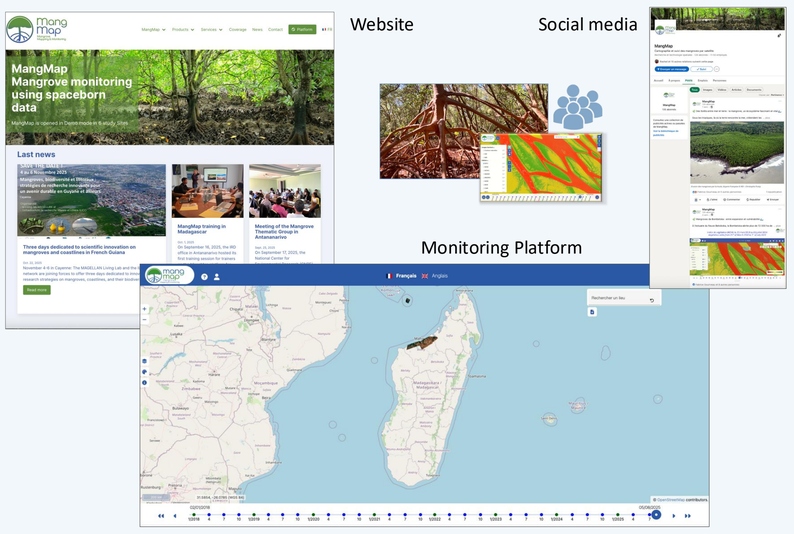
INTRODUCTION

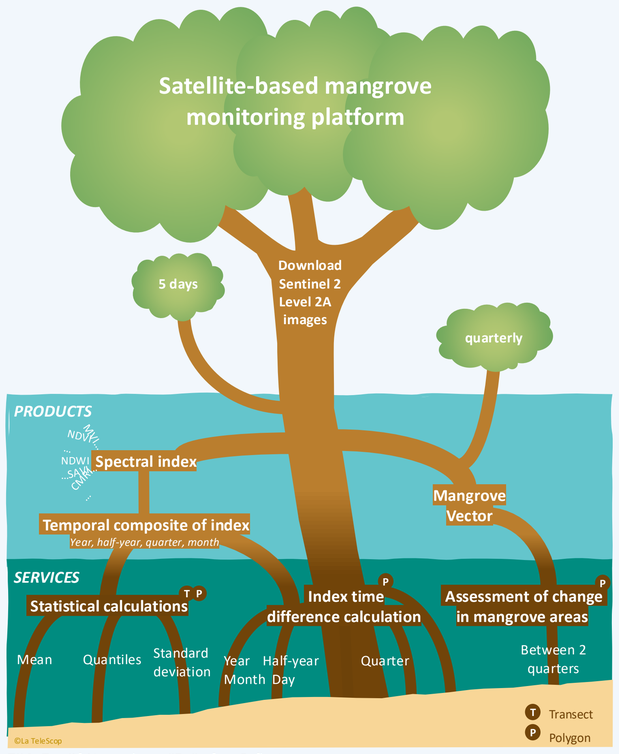
MangMap is an online monitoring platform opened in demo mode in summer 2024 that produces and distributes data derived from satellite time series to inform on mangrove status of health and distribution.

- MangMap offers on-demand services useful to scientific studies, preservation management plans, mangrove forests monitoring plans carried out by scientists or public authorities.
- The platform is opened to all publics and easily accessible. Products are standardized, reliable and updated every few days according to Sentinel2 satellite acquisition plans. They characterize spatial and temporal dynamics affecting mangroves, helping to identify risks and threats to mangrove ecosystem.
- MangMap is complementary to existing on-line tools: the platform provides an interactive dashboard dedicated to satellite datasets focused on mangrove areas, exposing imageries, indexes and temporal composites. It performs on-line computations according to end-user specifications.
- Generic processing services exploit standardized Sentinel-2 time series starting in 2018 at 10m resolution, renewed every 5 days, in order to assess mangrove dynamics at local scales inside end-user Areas Of Interest (AOI) and timeline definitions.



DATA, METHODS, PRODUCTS AND SERVICES

The processing chain of the MangMap platform: from Sentinel 2 images to products and services



TOA: Top Of Atmosphere, **SR**: Surface Reflectance

Spectral Indexes

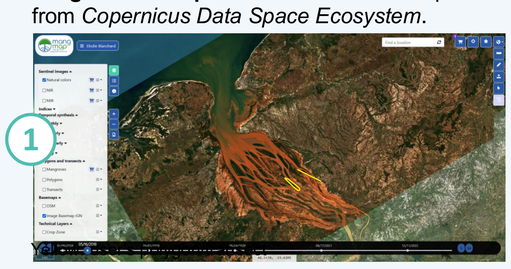
- *NDVI: Normalized Difference Vegetation Index*
- *NDWI & NDWI2: Normalized Difference Water Index*
- *MNDWI & MDWI2: Modified Normalized Difference Water Index*
- *NDRE: Normalized Difference Red Edge index*
- *BIGR: Brightness Index Green Red*
- *CMRI: Combined Mangrove Recognition Index*
- *IRECI: Inverted Red-Edge Chlorophyll Index*
- *MVI: Mangrove Vegetation Index*
- *SAVI: Soil Adjusted Vegetation Index*

Method for mangrove delineation

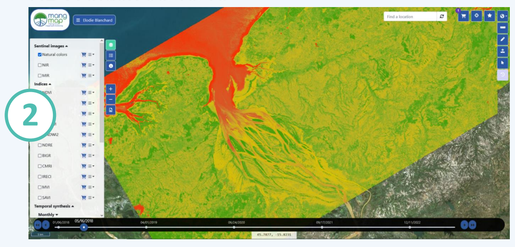
1. Vegetation pixel: double thresholding with NDWI2 raster and NDVI raster
2. Mangrove pixel: double thresholding with SWIR1 raster (B11) and COPDEM raster
3. Vectorization of the mangrove raster

On the shelf Product dissemination: examples

Imageries 2018-present : Sentinel 2 L2A products from *Copernicus Data Space Ecosystem*.

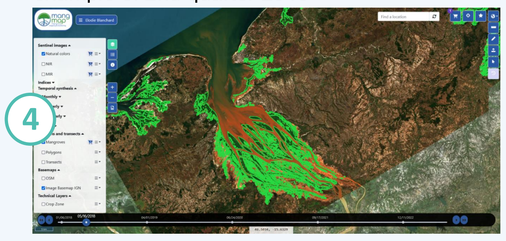


Spectral indexes 2018-present: example of an NDVI index 05/16/18



Index Temporal composites: example of NDWI2, first half-yearly synthesis 2018

Quarterly vector delineation of mangrove: example of 2nd quarter 2018



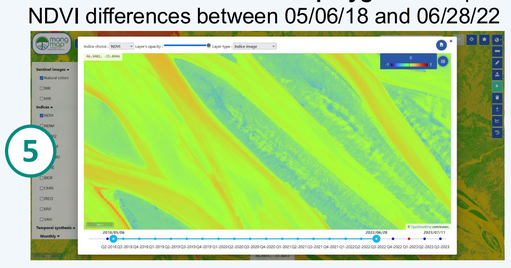
1. Sentinel 2 **reflectance** data (level 2A): every 5 days (raster)
2. **11 spectral indexes** defining mangrove environments: every 5 days (raster)
3. **Temporal composites** for all indexes: month, quarter, half-year, year (raster)
4. **Mangrove delineation**: quarterly (vector)
5. Date to date **raster differences** in temporal composites values: within polygons, image
6. Statistics: **evolution in temporal composites values**: within polygons (6a) or along transects (6b)
7. Estimation of **mangrove spatial evolutions**: within polygons, image and table

End-users browse and download all data and products freely. They upload to the platform their own areas of interest, or draw over the products on screen, and specify a timeline of interest to launch on-demand services accordingly to their needs.

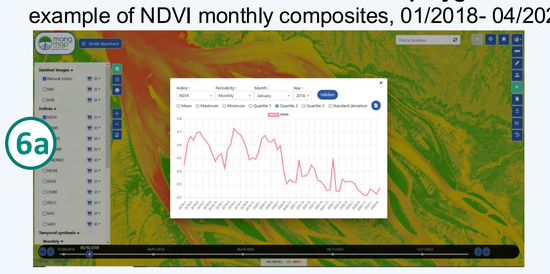
All Screenchots illustrations: Bombetoka Delta, Madagascar

On-demand Services

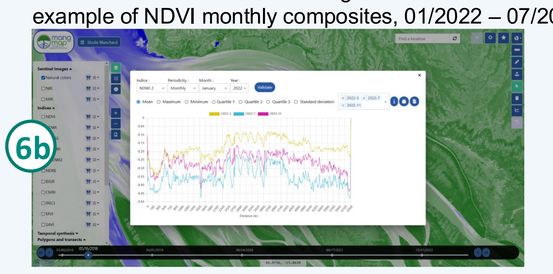
Index Difference inside **user polygon**: example of NDVI differences between 05/06/18 and 06/28/22



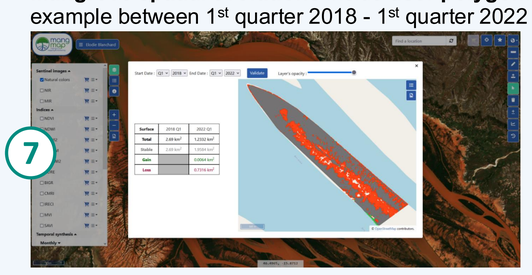
Evolution of index values inside **user polygon**: example of NDVI monthly composites, 01/2018- 04/2023



Evolution of index values along **user transect**: example of NDVI monthly composites, 01/2022 – 07/2023

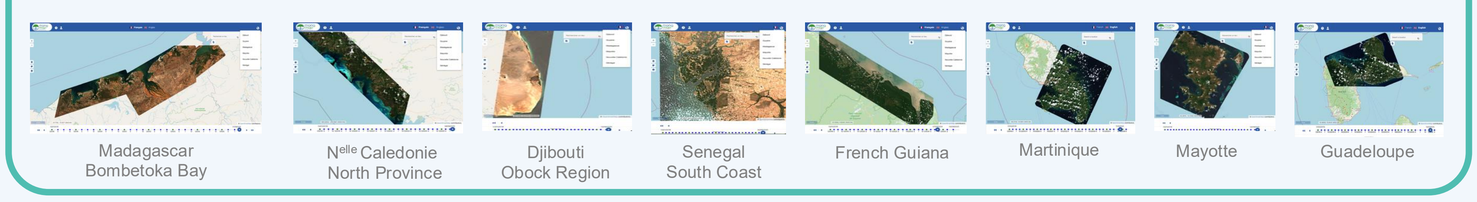


Mangrove spatial evolutions inside **user polygon**: example between 1st quarter 2018 - 1st quarter 2022



STUDY SITES (DEMO MODE)

The platform is opened in **8 locations** spread over South America, Africa, Asia and Oceania regions.



Madagascar Bombetoka Bay | N[elle] Caledonie North Province | Djibouti Obock Region | Senegal South Coast | French Guiana | Martinique | Mayotte | Guadeloupe

END-USERS

Scientists & engineers, academic personnel & students, public authorities GIS analysts, Parks & protected Areas staff, NGOs….

→ Building a **Network**

- Scientific Partners willing to share reference datasets
- Local Relays willing to co-organize awareness-raising activities, training sessions
- Endusers willing to share feedback, needs, suggestions

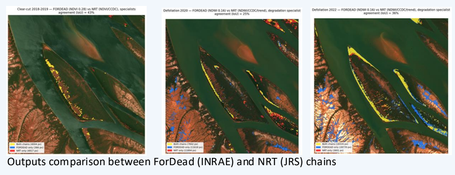
DEVELOPMENTS IN PROGRESS

Alert system for automated near real time change detection in mangroves (Bombetoka Bay, Madagascar)

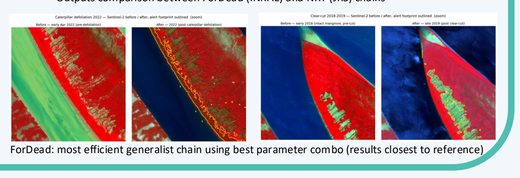
- Selection of 2 on the shelf processing chains and adaptation to mangrove context : ForDead (INRAE) and NRT (JRC)
- Training on reference datasets (clearcuts, defoliation/degradation) and experimenting best parameters: spectral index candidates, harmonic fitting methods, thresholds values, hit count trigger values…
- Benchmarking, selection of most efficient chain / parameter combos
- Recommendations for further developments

Occurency	Trainig Polygons	Control polygons	Trainig pixels	Control pixels	Time serie for training	Time serie for monitoring
Clearcut	26	12	273	597	2016-2017	2018-2019
Defoliation 2020	21	8	340	140	2018-2019	2020
Defoliation 2022	14	14	840	790	2020-2021	2022
TOTAL	61	34	1453	1527	—	—

Data sets for training and controling detection in time



Outputs comparison between ForDead (INRAE) and NRT (JRS) chains



ForDead: most efficient generalist chain using best parameter combo (results closest to reference)

CURRENT ORIENTATIONS

Ramp-up phase in 3 directions with support from CNES Agency through the Space Climate Observatory (SCO) initiative:

- **Acculturation, awareness and and training**
  Webinar program for discovery and hand-on training. Workshops for training of trainers.
- **Geographical expansion** to new sites
  Up to 16 sites in total with full mangrove coverages of oversea French territories, Madagascar, Cambodia, Brazilian Amazon region
- **New features for the interface**
  Ready to use training courses, ergonomics improvements, integration of Alert System Proof of Concept (POC), if and when conclusive

#rootsofhope

Access MangMap !