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Supporting Life Below Water from Space

Parya Pasha Zadeh , May 2024

NL SPACE CAMPUS
Connecting the curious

UNIVERSITY OF TWENTE. | ITC

esa BUSINESS INCUBATION CENTRE NOORDWIJK

3 of 7
people

depend on seafood as their main source of protein.

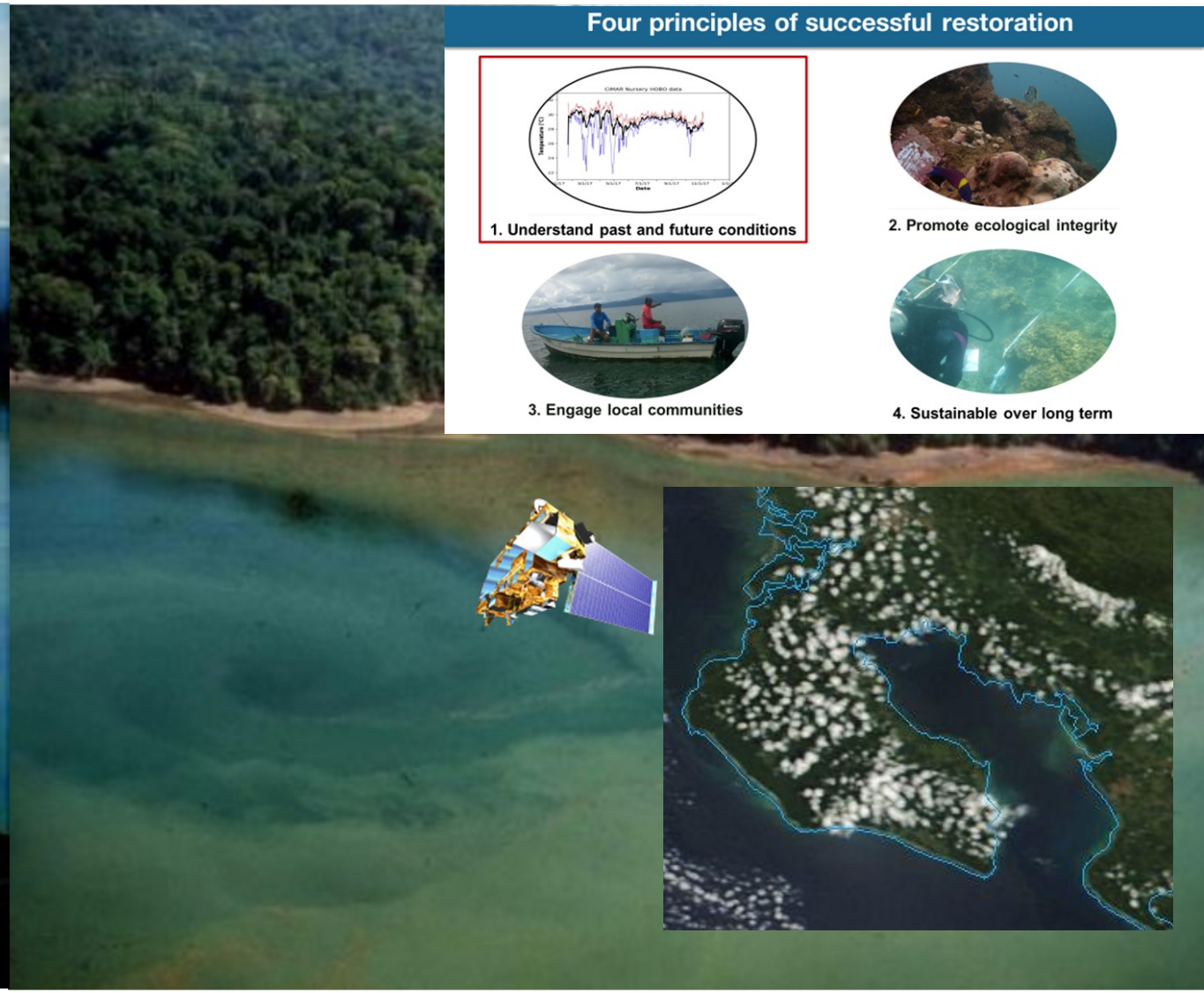
44%
of world's population

lives within 150 kilometres of the ocean.

Up to 10x
more carbon

is stored in coastal habitats than tropical forests per unit area.

UNITED NATIONS DECADE ON
ECOSYSTEM
RESTORATION
2021-2030



Four principles of successful restoration

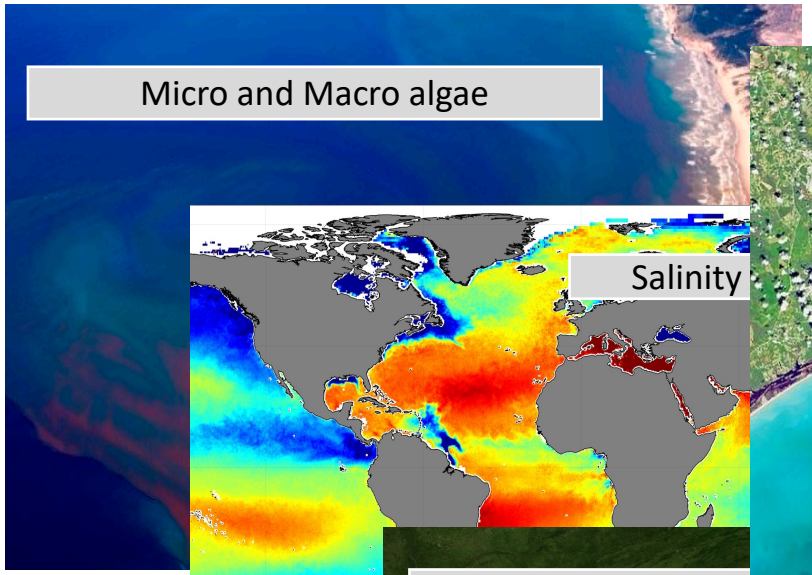
1. Understand past and future conditions

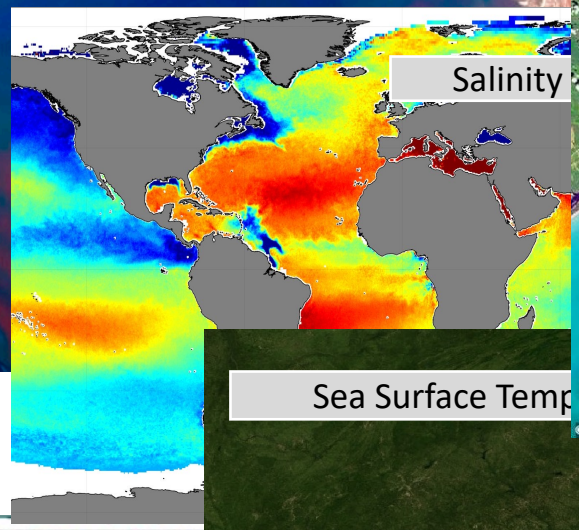
2. Promote ecological integrity

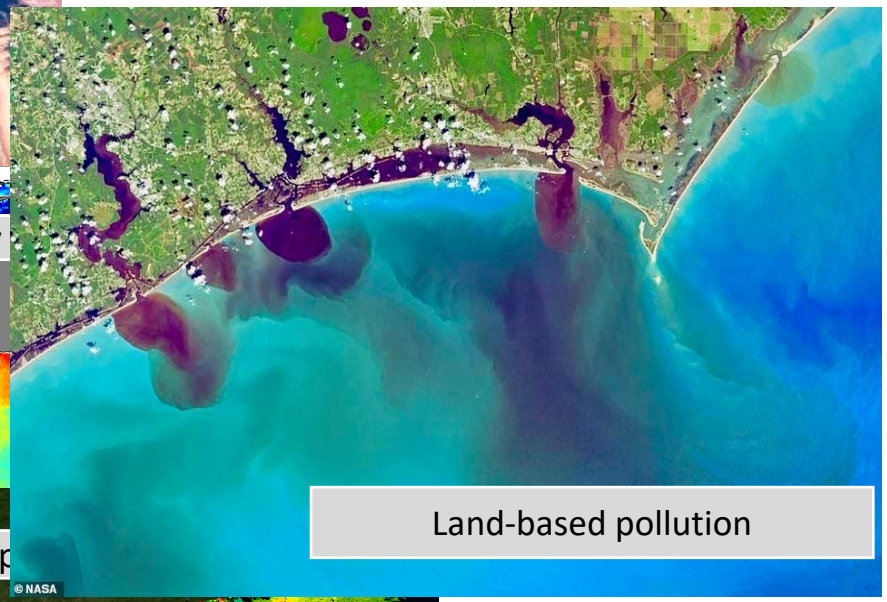
3. Engage local communities

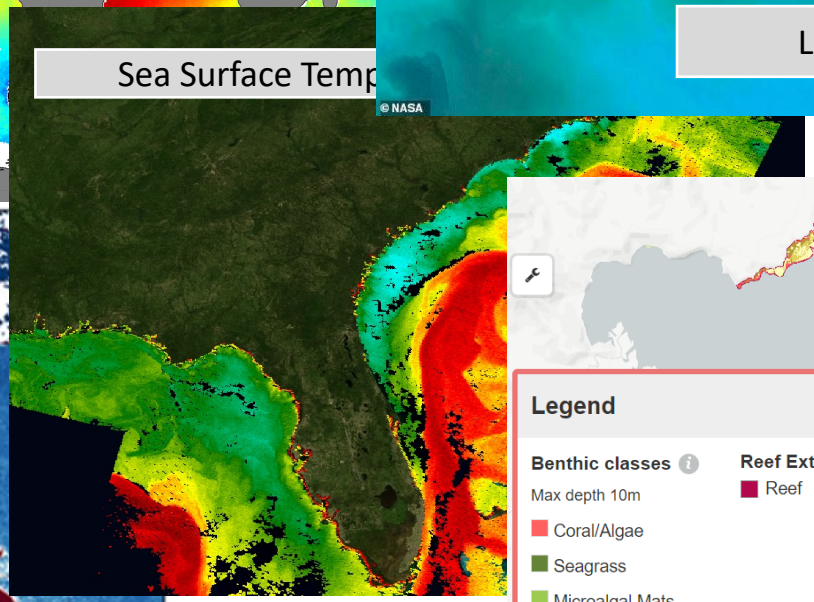
4. Sustainable over long term

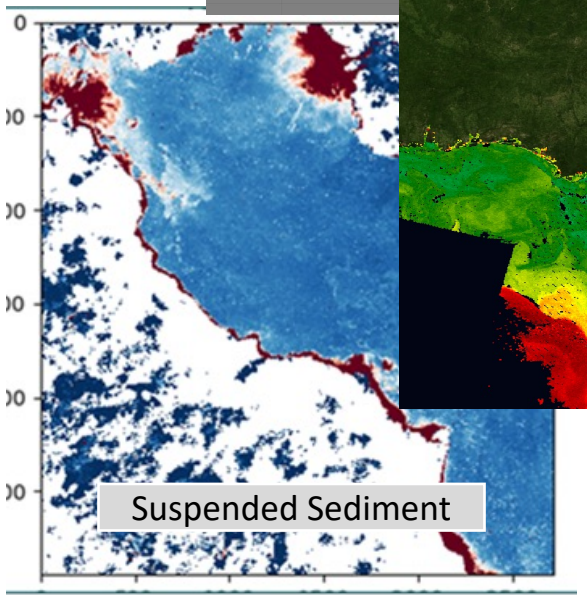
https://www.raisingcoral.org/

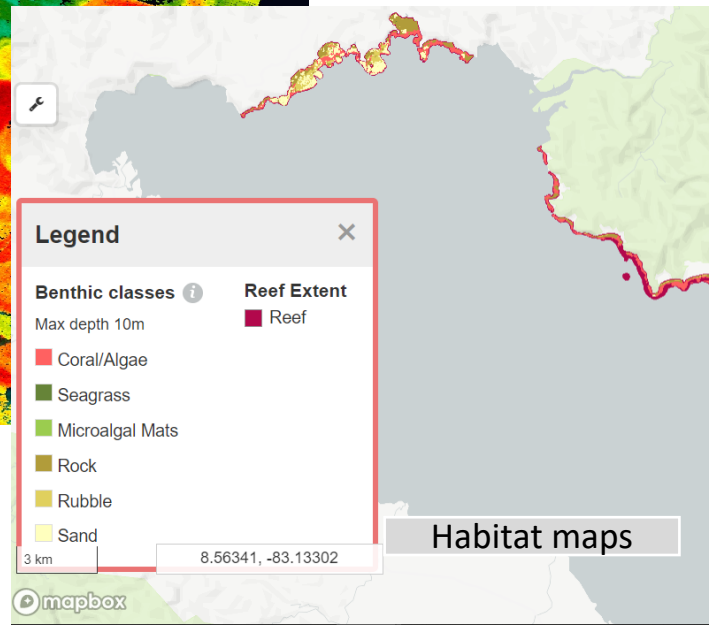

Micro and Macro algae

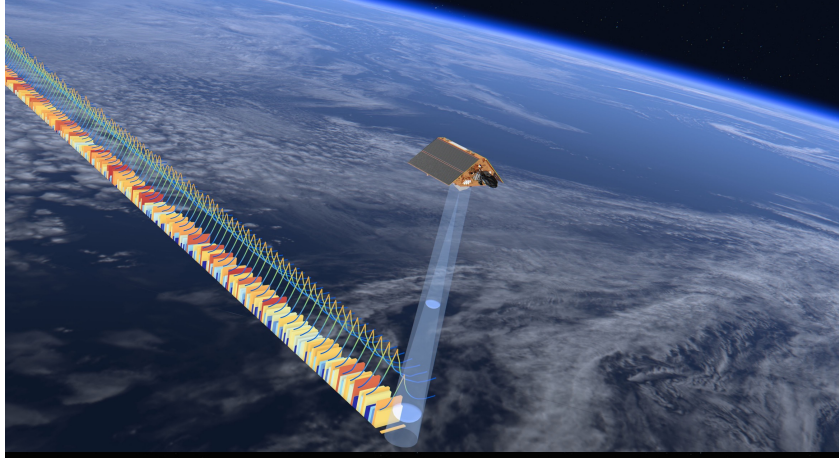

Salinity

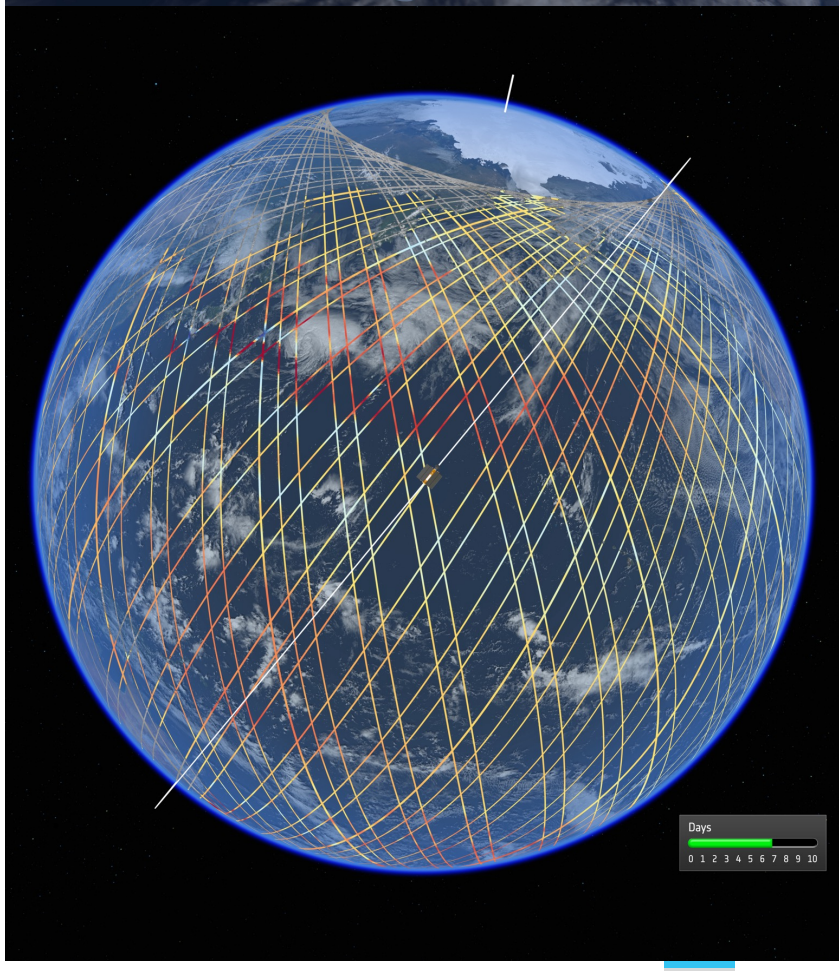

© NASA
Land-based pollution


Sea Surface Temp


Suspended Sediment


Legend
Benthic classes
Max depth 10m
Coral/Algae
Seagrass
Microalgal Mats
Rock
Rubble
Sand
Reef Extent
Reef
3 km
8.56341, -83.13302
mapbox
Habitat maps




Days
0 1 2 3 4 5 6 7 8 9 10

GIS &Earth Observation for Decision making

Baseline Mapping

Timeseries and pattern recognition

Change Detection

Data Integration

Analysis and Scenarios

Informed Decisions

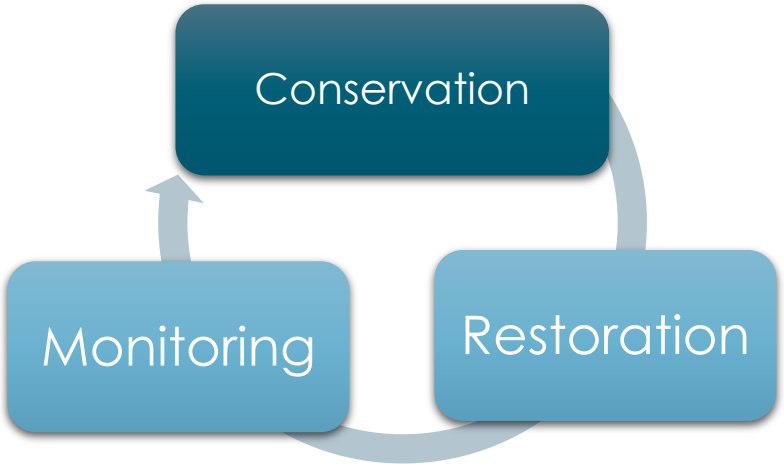
Management Decisions

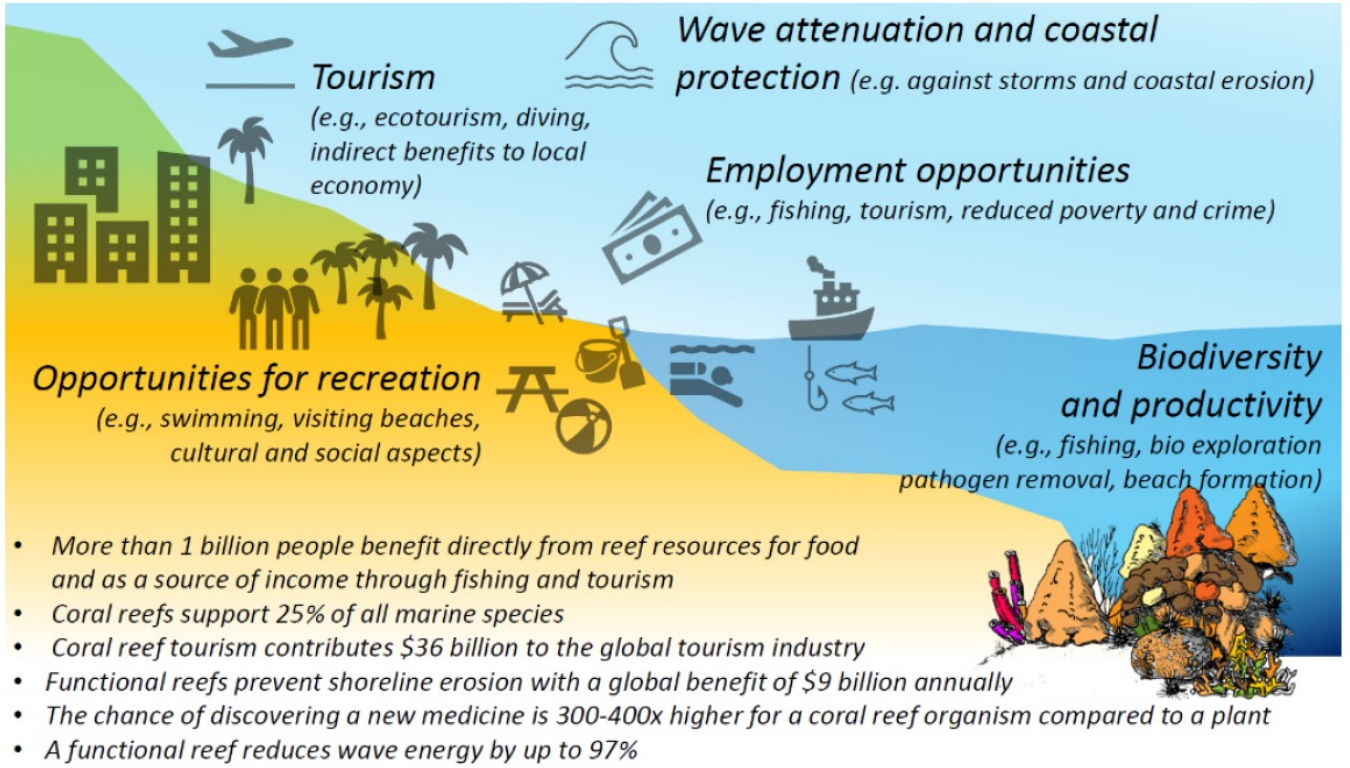
Monitoring and Evaluation

Policy Recommendations

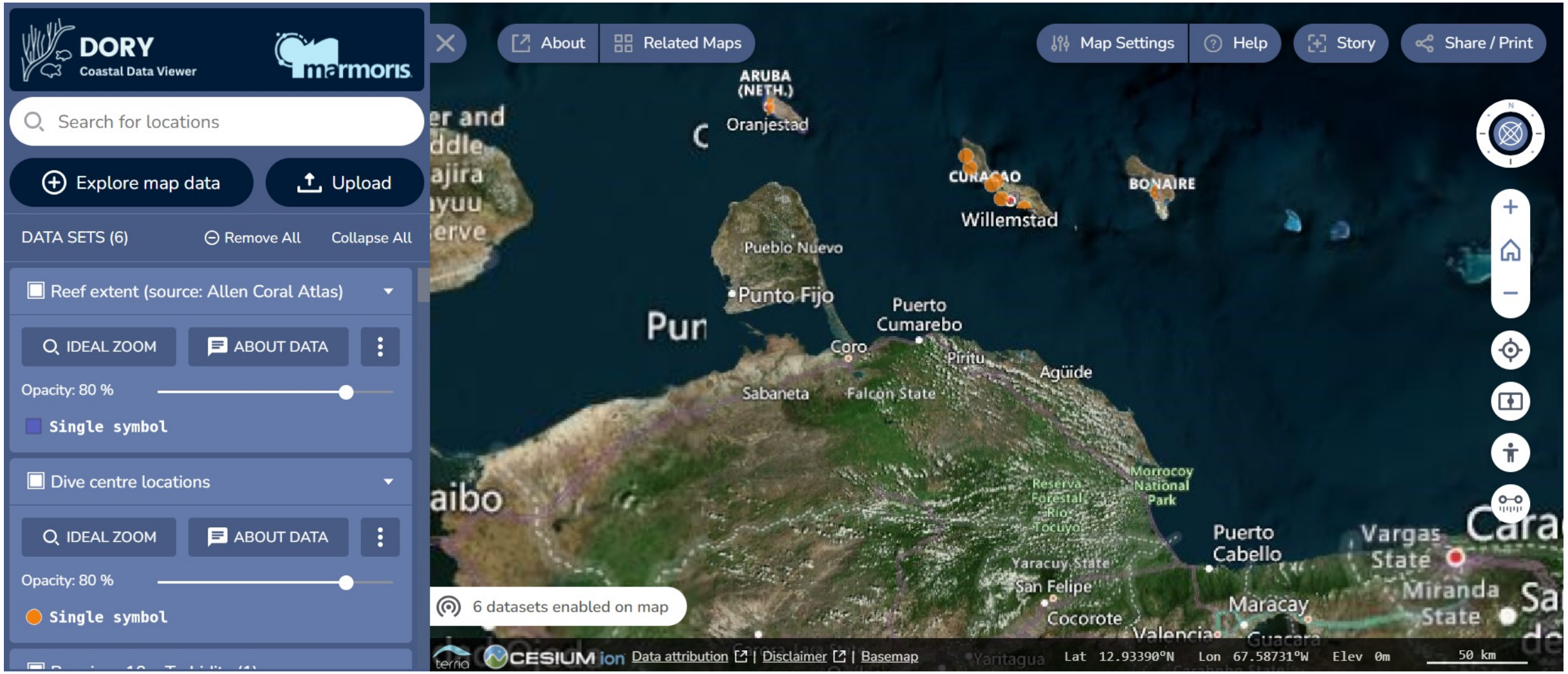
Dutch Caribbean projects

- Caribbean research programmes receives boost of more than 7 million euros
- Champions group > Dutch Innitiative for sharing expertise in effective management of climate change
- ESA and EU investements…

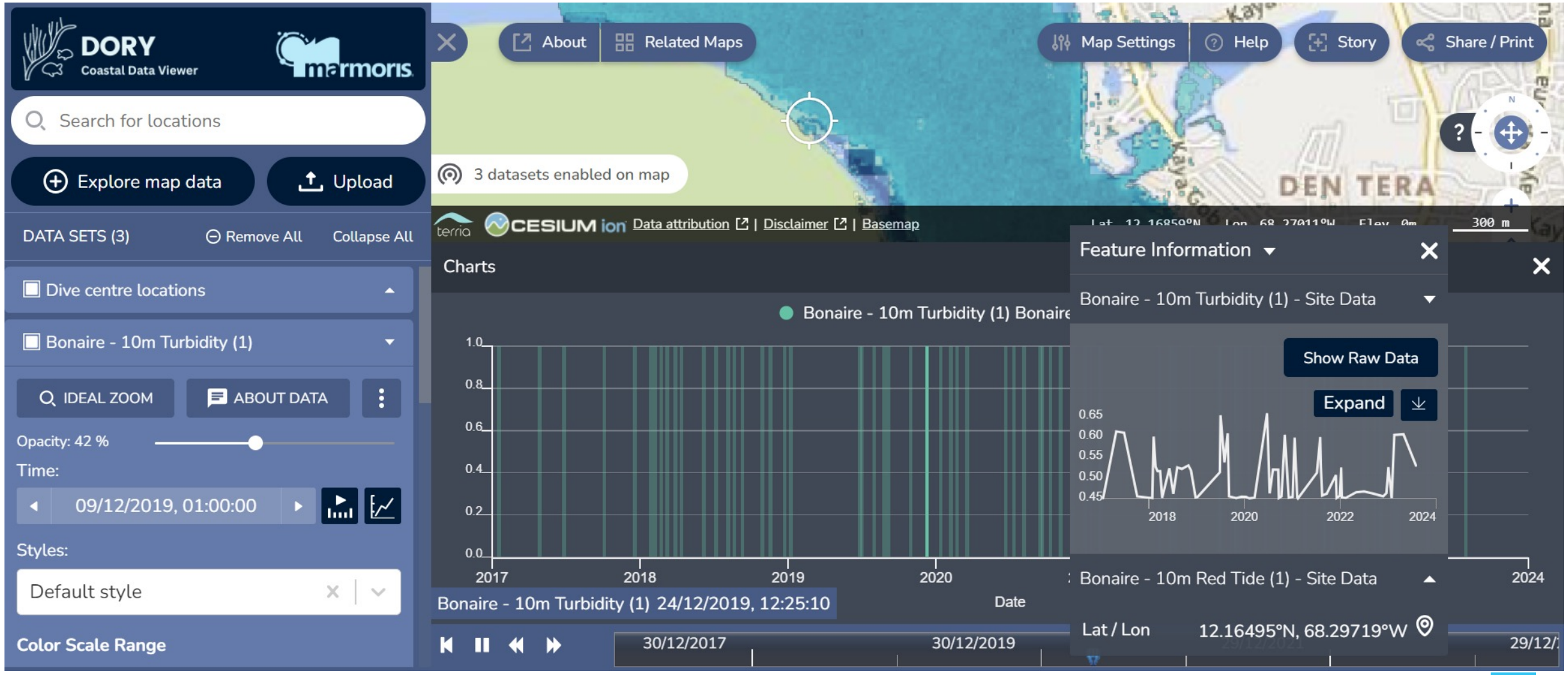




Dutch Caribbean projects



Dutch Caribbean projects

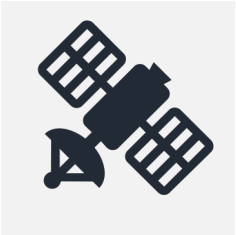


Reducing the barriers…

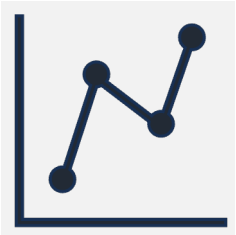
Potential end-users:

- NGO working on conversation and restoration
- Companies providing solutions for conservation and restoration practices (3d printed reefs!)
- Local and regional management of natural resources
- International development programmes
- Global conservation and development agencies

Easy access comprehensive data overview



Additional data-driven insights



Data integration multi-criteria analysis

Predictive modelling and decision support

Filling in the gaps

Data Integration

IoT and sensor integration

Drone deployment

Alerted Inspections

Sensor Integration

Commercial VHR satellite

Radar data (SAR)

Aerial imagery

Validation

Improving methods through ground truthing

Adjusting methods to local specifications

Marmoris

Parya

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1	intro	2
1	coral and coastal habitat importance	2
1	problem statement and Jose Andres	3
1	solution satellite suspended sed	2
1	how we get info using AI from imagery - what we can extract out of it	5
1	details solution timeseries, anomaly, discovering land based pollutions land source	3
1	what other info ?	2
1	decision making, monitoring, evaluation	3
1	dutch carribean examples and investments	1
	Questions?? think about use cases together - refer to the morning session	5
1	Eyes in the Sky	3
1	limitations and considerations	2
1	complementary data	2
	write up in the cards	5
	needs from audience? What stops you?	3
1	wrapup, way forward, and needs from space sector	1

Limitations

Availability and Cloud cover

- You don't always have data/good data to see what you want to inspect!

Temporal resolution

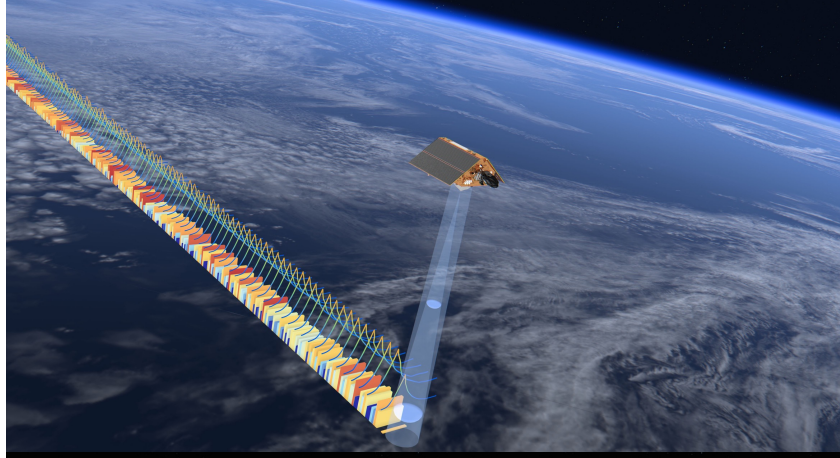
- Many applications require frequent observation throughout season (i.e. Mapping & change assessment)

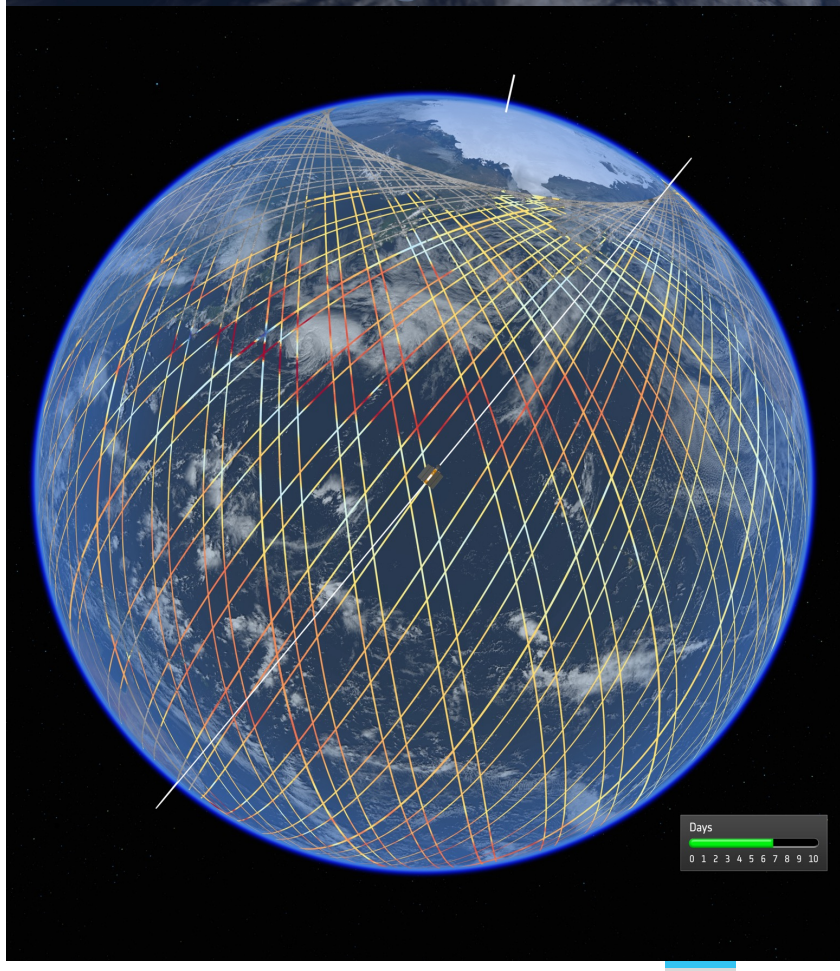
Spatial Resolution

- Higher details, shorter timeseries, higher costs

Images are great, but …≠ information

- generating products requires effort:
  - expertise in processing and dealing with large data amounts
- Validation and reliability
  - compare products against ground truth?
  - accuracy of products and methods(depending also on application)



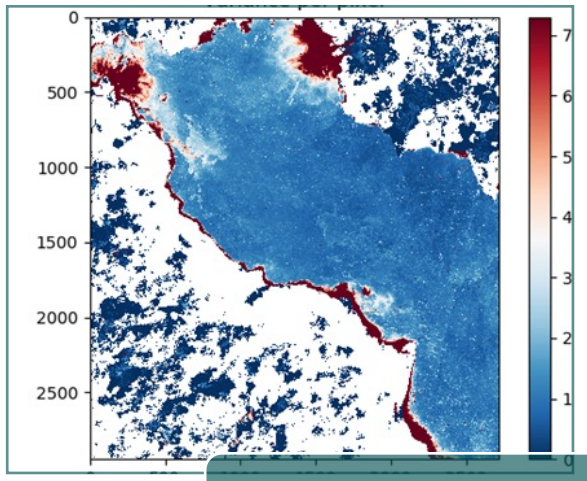


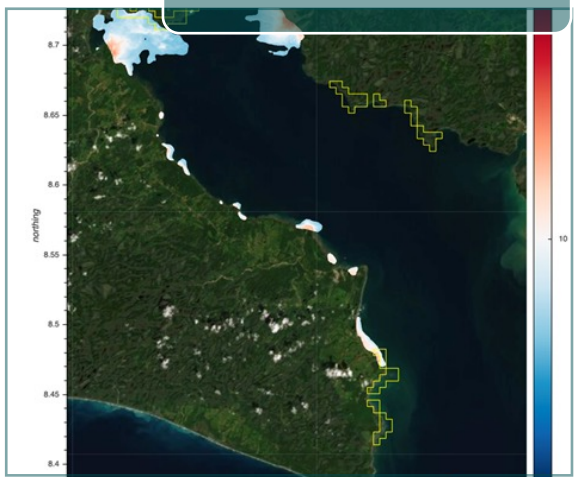
Other ideas

- Tourism industry (hotels, diving schools, ecotourism)
- Nature-based solutions for disaster resilience (mangroves, reefs, etc)
- Land-sea interactions (waste, pollution and nutrient run-off, sedimentation) for marine spatial planning, ridge-to-reef management, impact on policy dev
- Coastal debris detection, identification for clean-up and management
- Coral engineering (identification of location of resilient corals)
- Farming (fish, kelp, seagrass, solar and wind energy)
- Capacity building and local engagement (decolonization of science)
- Certification scheme for restoration projects
- Translating local knowledge to aps using participatory GIS

Pre-processing

Values





Data Acquisition

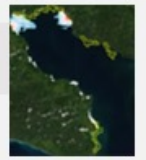
Data analysis

Nemo

Monitoring and Early Warning System for Reef Management

Select location | by name | by X, Y coordinate | draw polygon

Start date | End date



Water Quality Indicators

- (●) Sedimentation (SPM)
- ( ) Chlorophyll Algae
- ( ) Sargassum (Macroalgea)
- ( ) Salinity
- ( ) Acidity

Weather

- ( ) Rainfall
- ( ) Wind speed
- ( ) Sea surface temperature
- ( ) Solar intensity

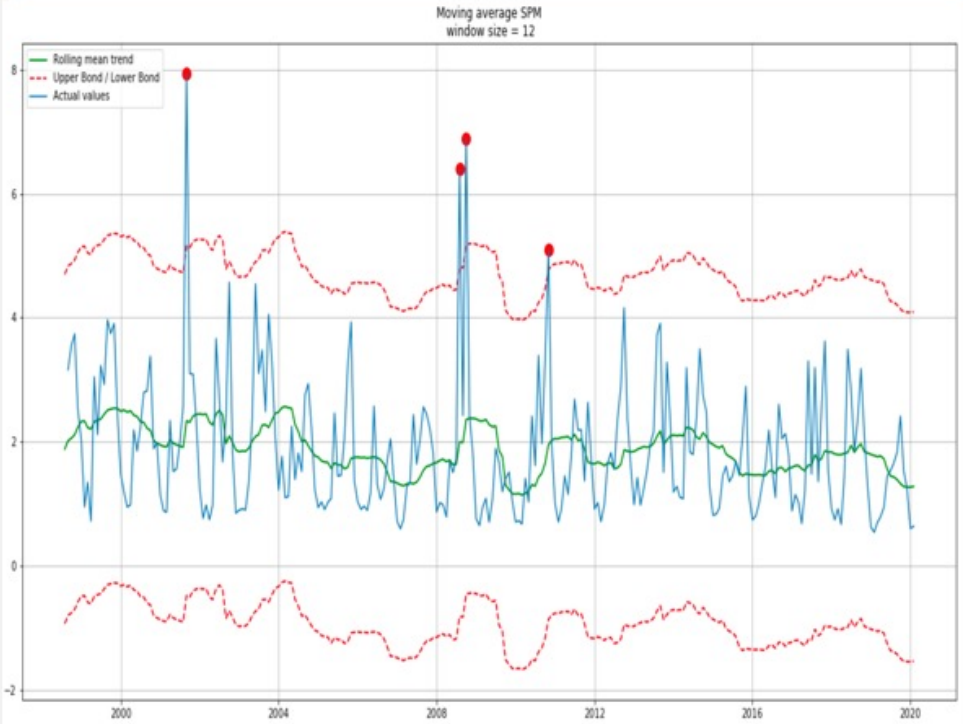
User-specific data

- ( ) Location of nurseries
- ( ) Location of existing plantation
- ( ) Location of planned plantation
- ( ) Below surface temperature

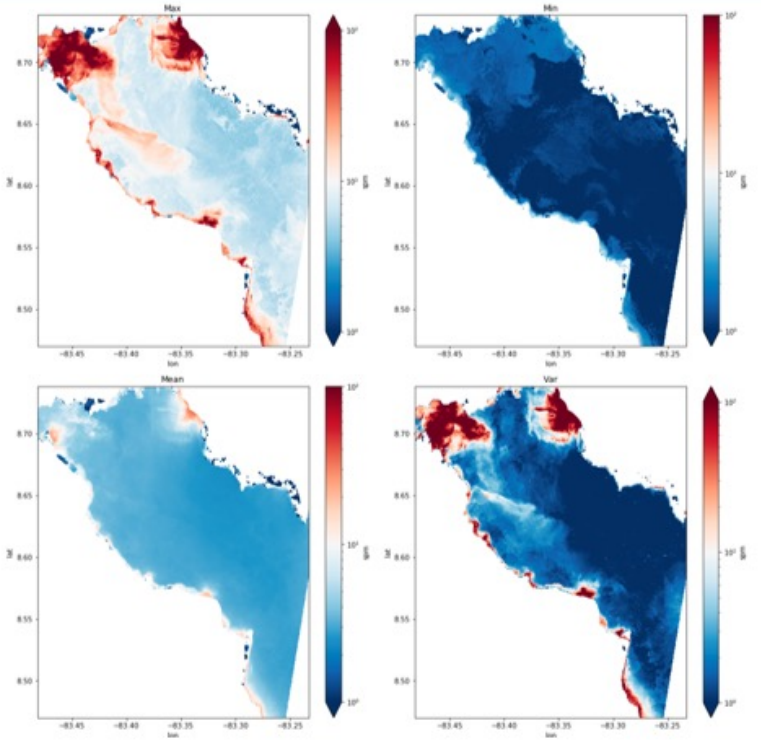
Add data

- ✚ Sensor recordings
- ✚ Photos; Comments

Time series decomposition for the selected location



Statistics aggregated per pixel over time



Current Alert Status

Alert level:	Normal
Current value:	Below alert level
Length of time above alert levels:	-

Set New Alert

Parameter	
Value range condition	
Duration	