Defining Ecoregions and Prototyping on EO-based Vector-borne Disease Surveillance System for North Africa PROVNA 1

- IZSAM - WOAH Collaborating Center for Epidemiology
- WOAH Office North Africa in Tunis

Regional Workshop on Rift Valley Fever surveillance in Northern African countries – PROVNA2
12-14 November 2024- Tunis, Tunisia

IZS.IT

PROVNA *Research objectives*

GENERAL SURVEILLANCE PLANNING

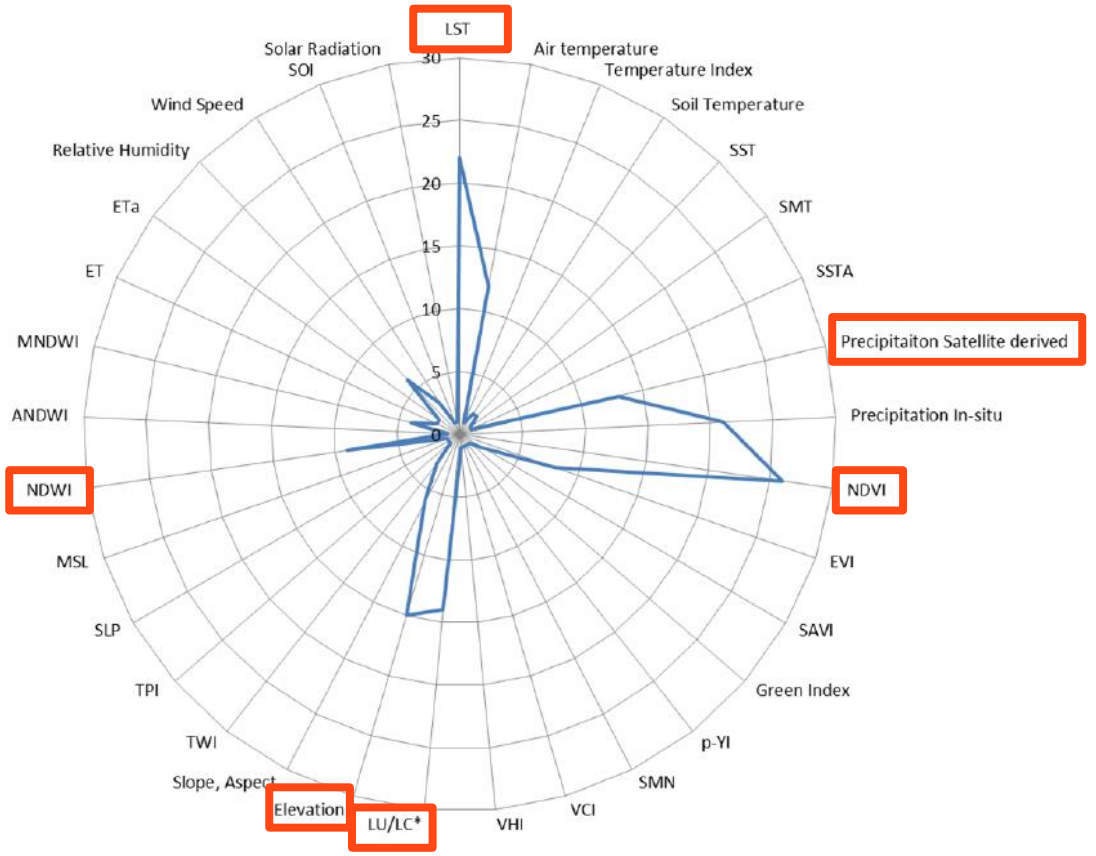
to define the “ecoregions” of the North African territory (Mauritania, Morocco, Algeria, Tunisia, Libya and Egypt), each one characterized by distinct environmental and climatic factors, on the assumption that similar areas (in space and / or time) are subject to similar diseases (especially vector-borne diseases);

SPECIFIC SURVEILLANCE and Risk factor application

to build a customised prototype application to identify areas at risk for RVF in North Africa region. This system combines static inputs with other EO-dynamic variables like NDVI, rainfall to demonstrate this capability and use by various Veterinary Services in the region.

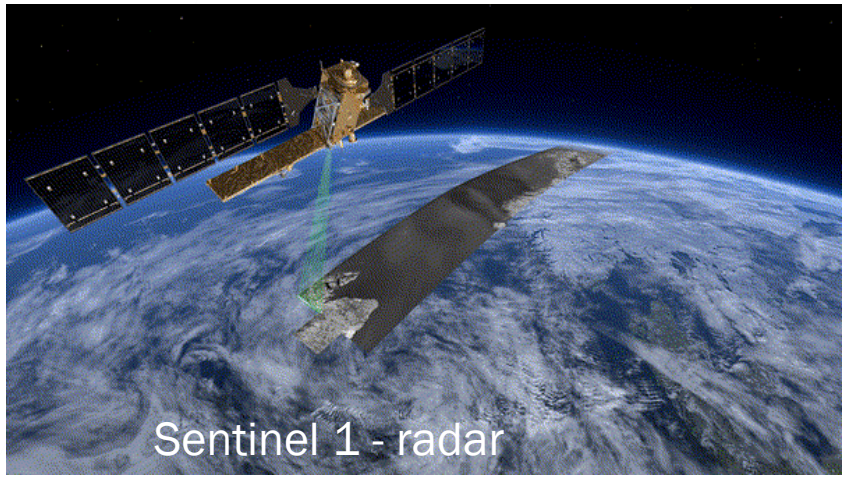

North Africa

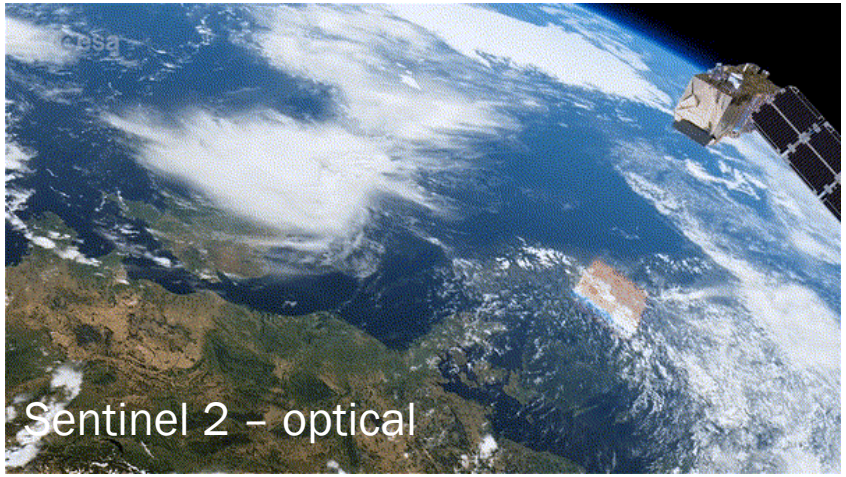
Climatic and Environmental variables in vector-borne diseases



Parselia et al. Satellite Earth Observation Data in Epidemiological Modeling of Malaria, Dengue and West Nile Virus: A Scoping Review. Remote Sens. 2019, 11, 1862; doi:10.3390/rs11161862

Earth Observation





EO provides:

- **accurate** geo-locations for contiguous target areas;
- **objective**, consistent measurements of physical properties of the Earth and its atmosphere that can be interpreted to define its features and conditions;
- **repeated** coverage to enable detection of changes in features and/or their condition.

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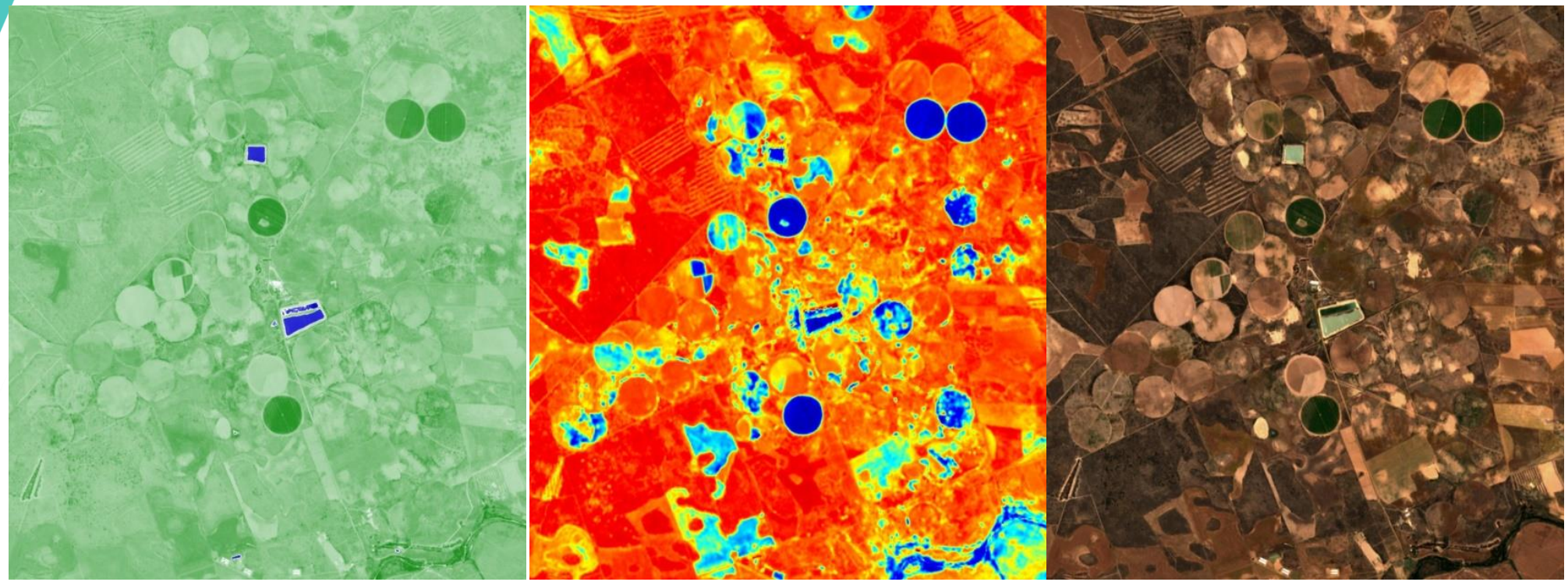
Copernicus programme

Copernicus
Europe's eyes on Earth

NDWI | Moisture index | True color



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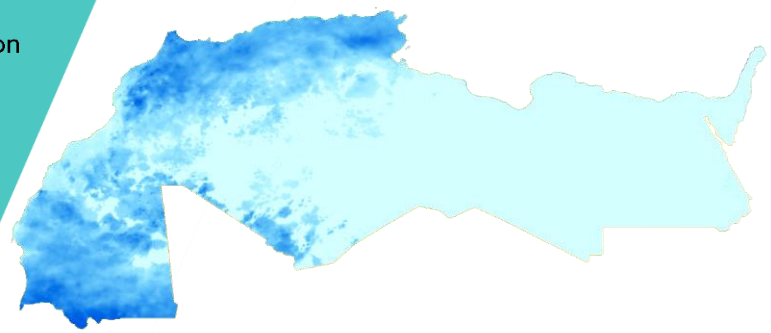
Area of Interest

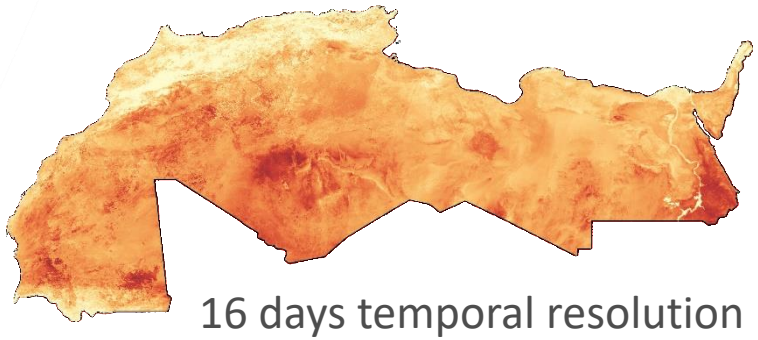
ECOREGIONALIZATION in North Africa

Earth Observation data (2018-2022)

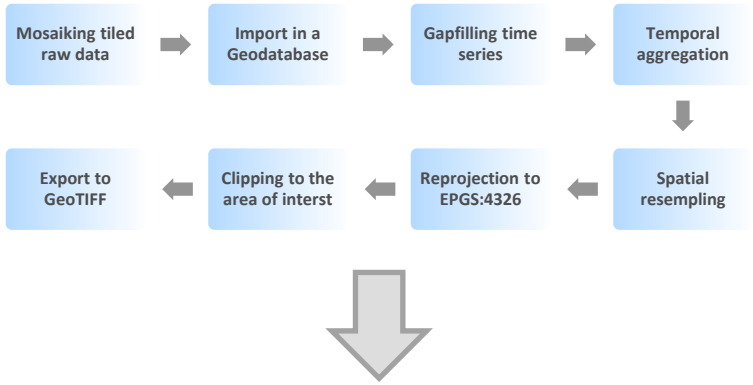
rainfall

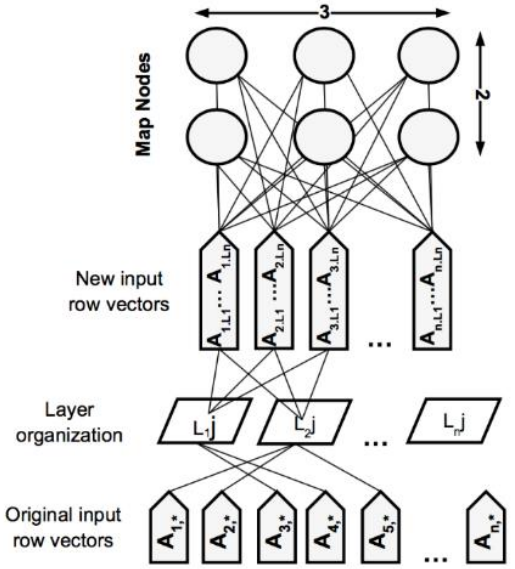


250 mt spatial resolution



16 days temporal resolution





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ISTITUTO ZOOPROFILATTICO SPERIMENTALE DELL'ABRUZZO E DEL MOLISE "G. CAPORALE" TERAMO

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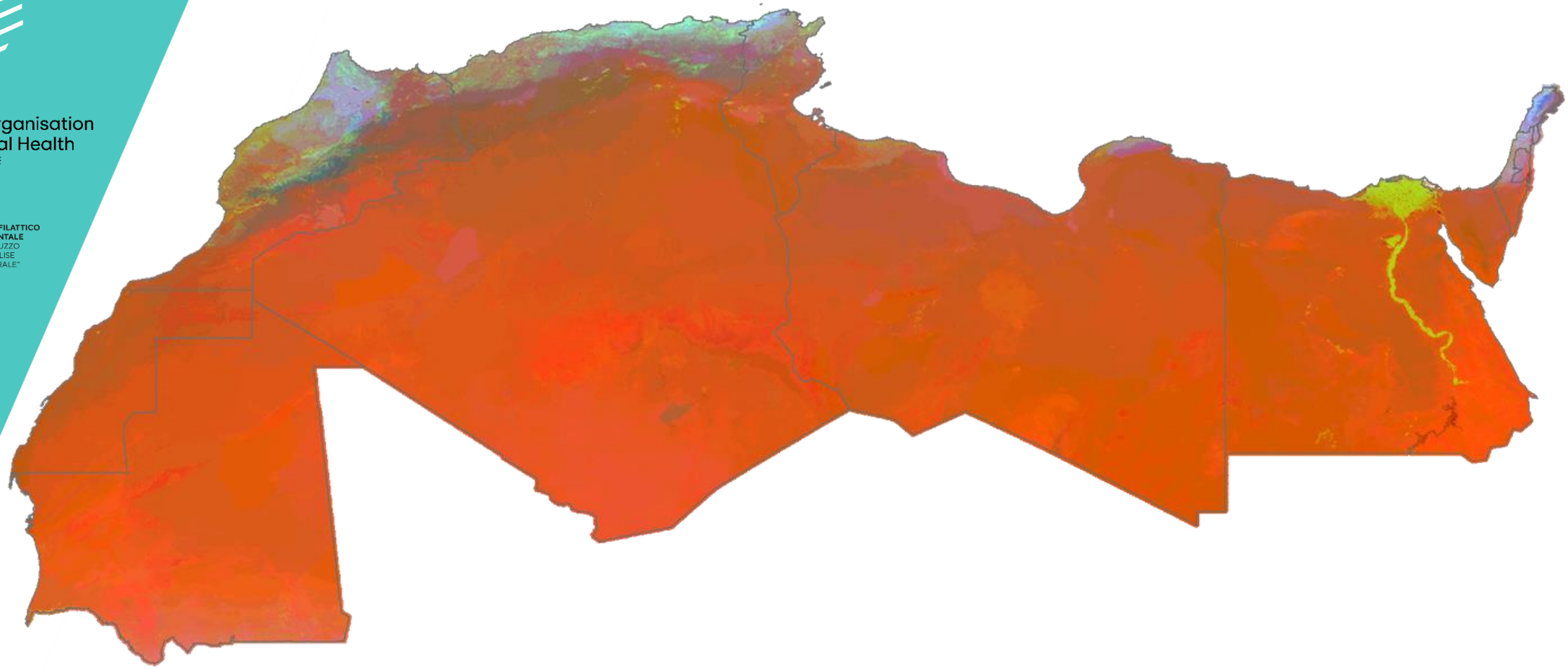
ECOREGIONALIZATION in North Africa
150 million pixels



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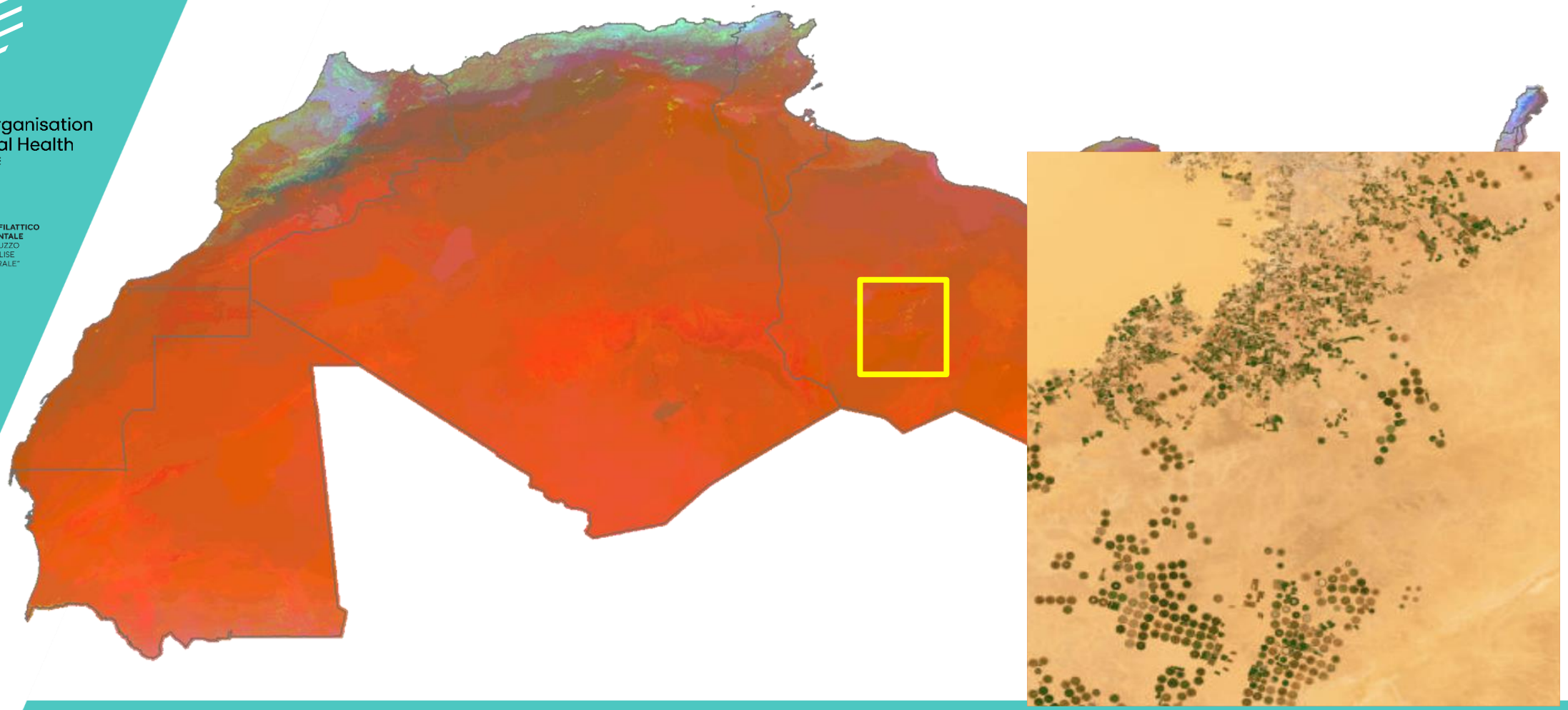
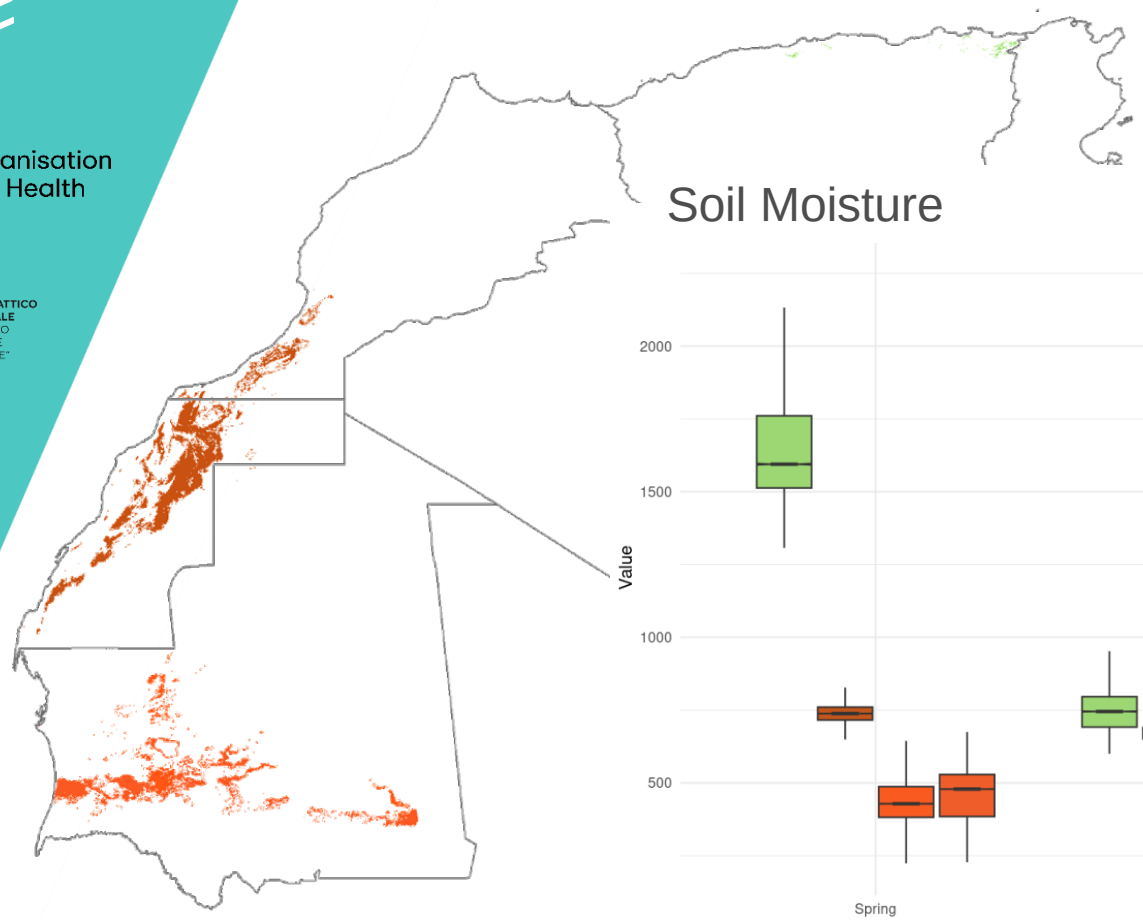
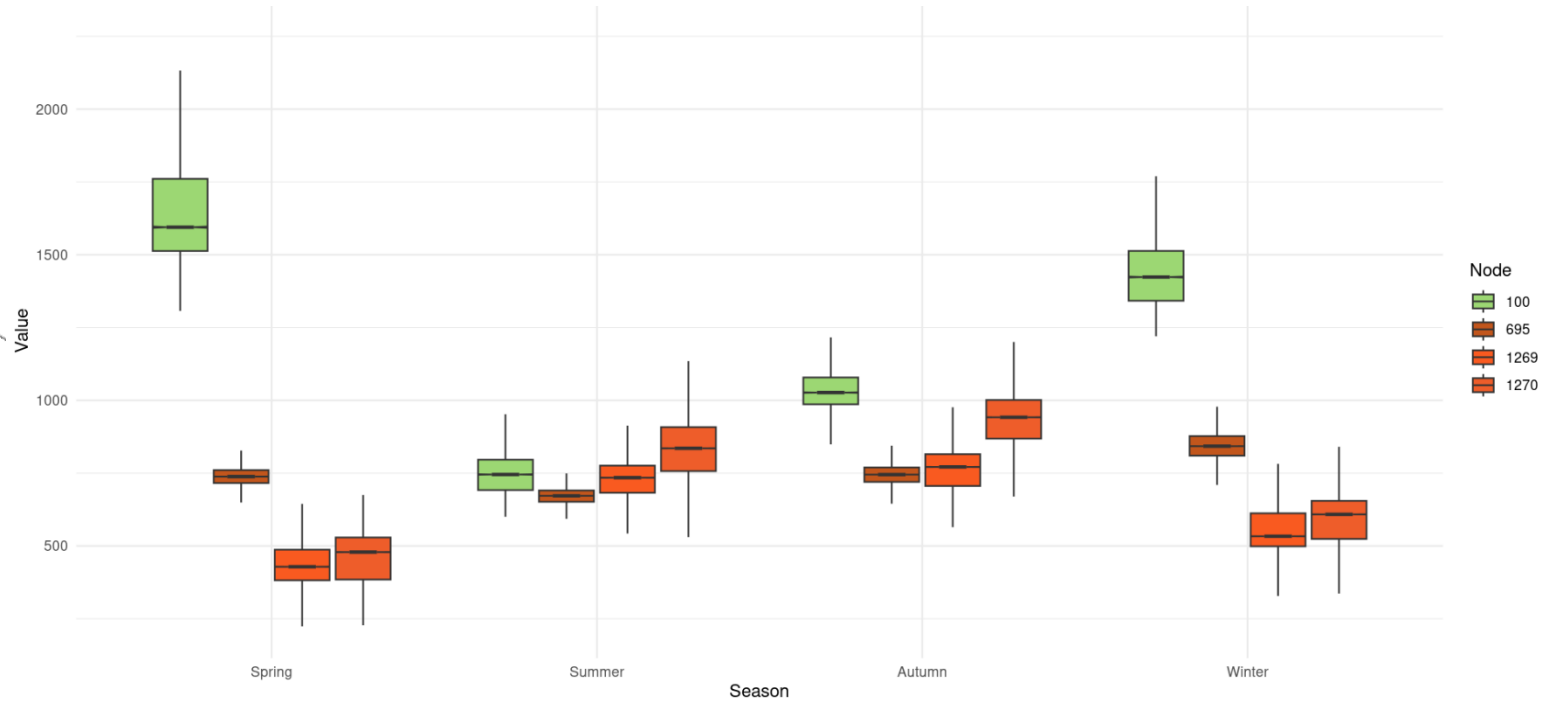
ECOREGIONALIZATION in North Africa



ECOREGIONALIZATION in North Africa





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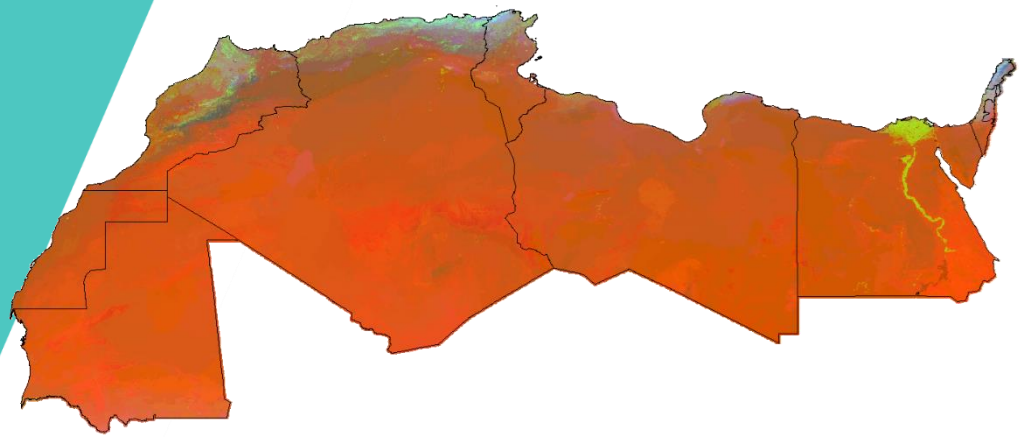
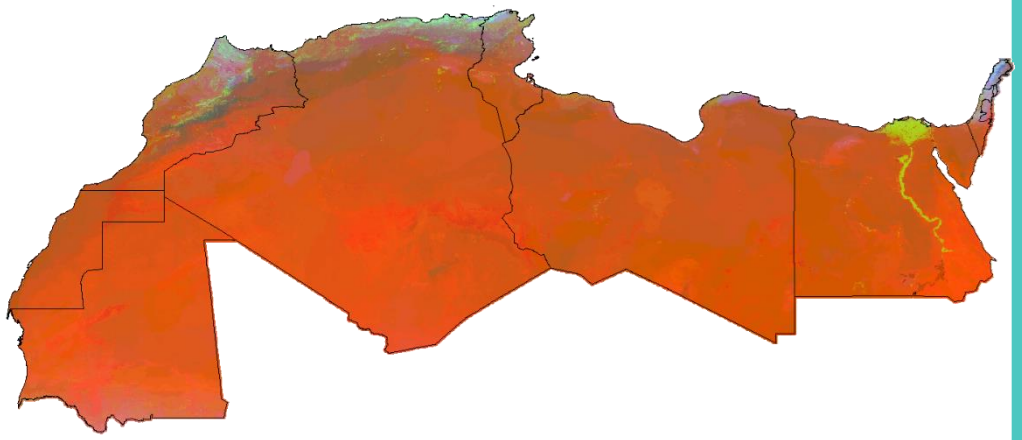
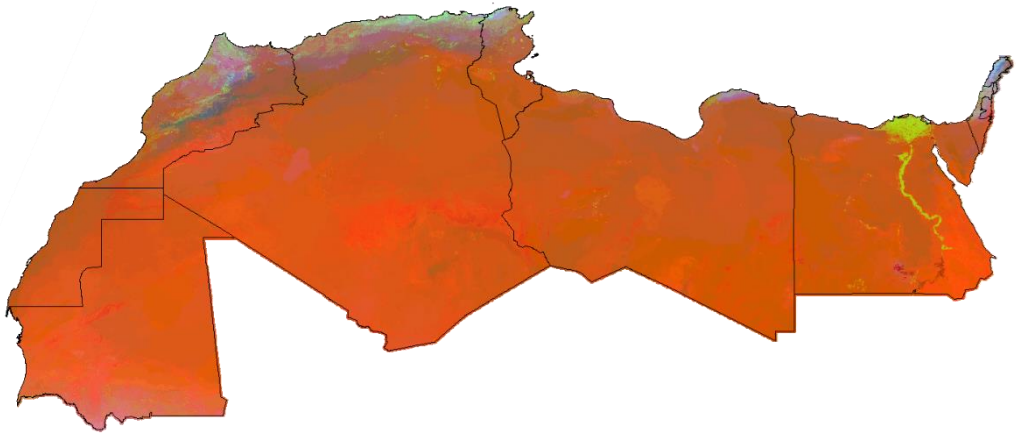
2019



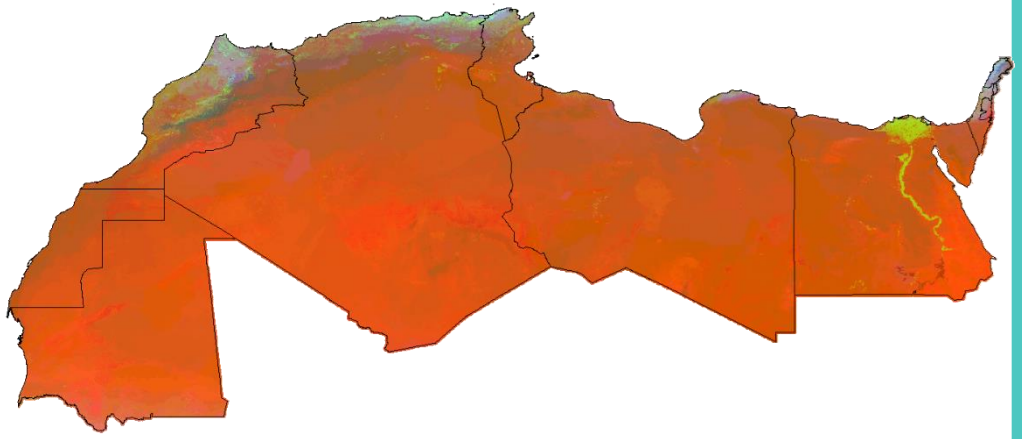
2020



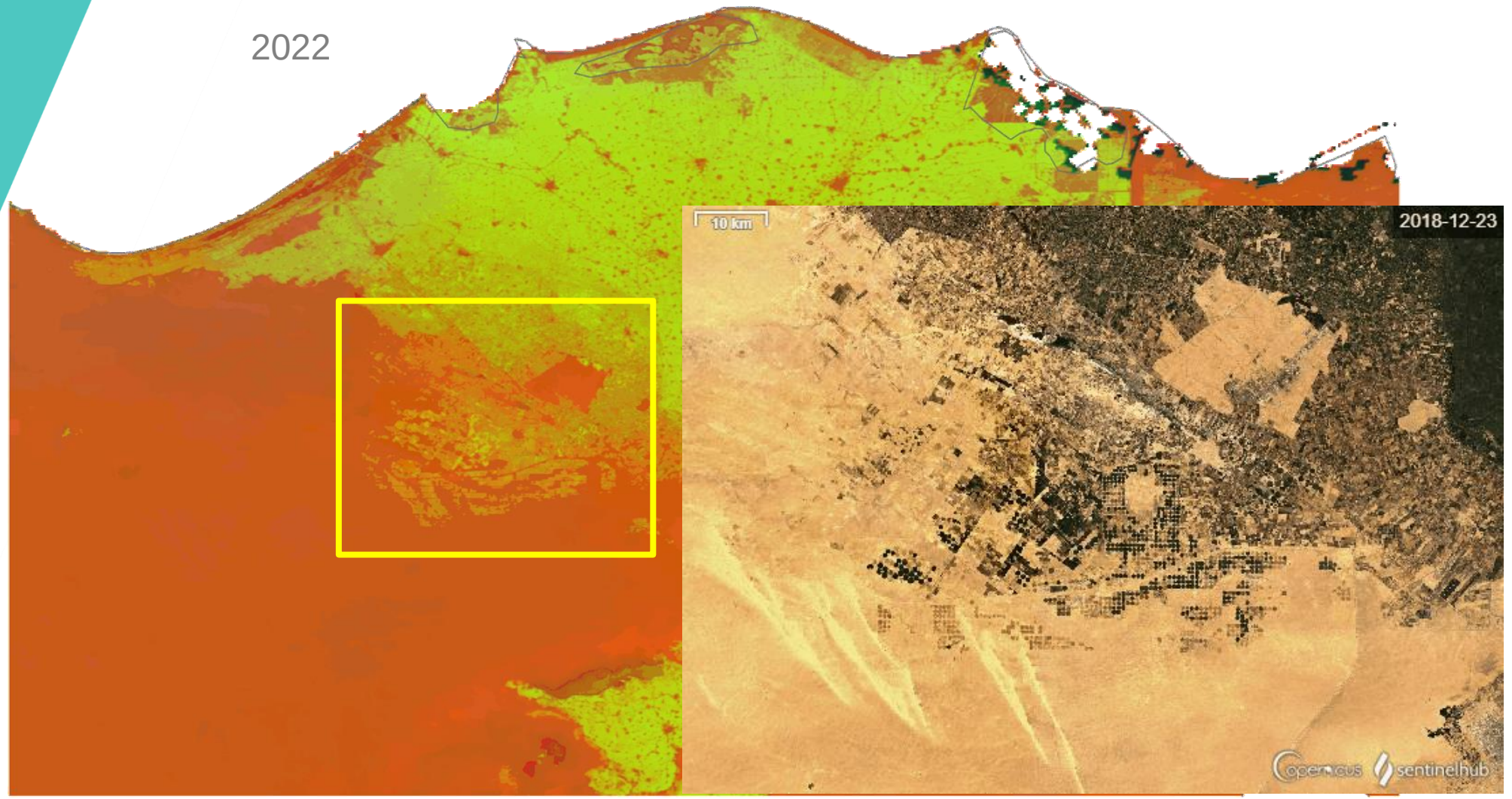
2021



2022



ECOREGIONALIZATION in North Africa



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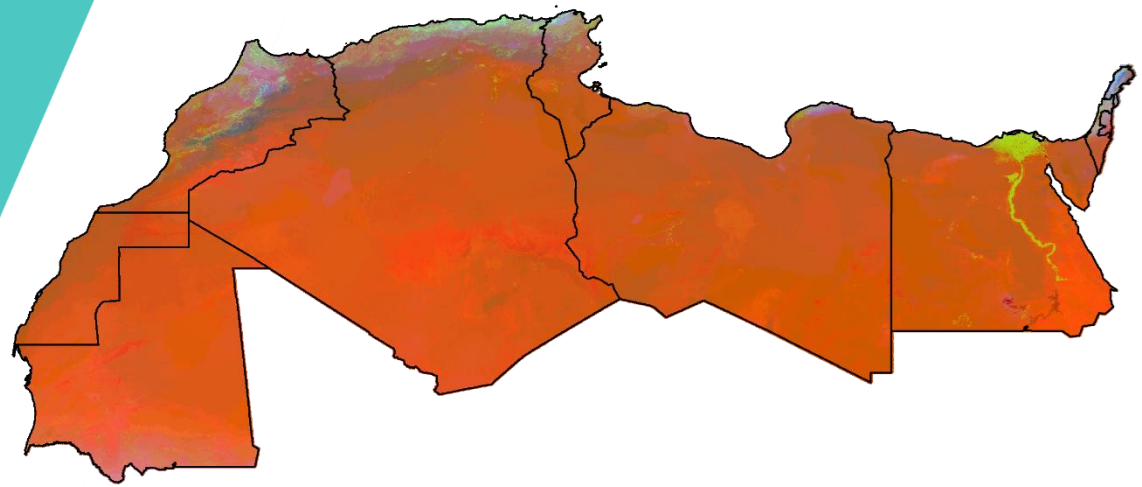
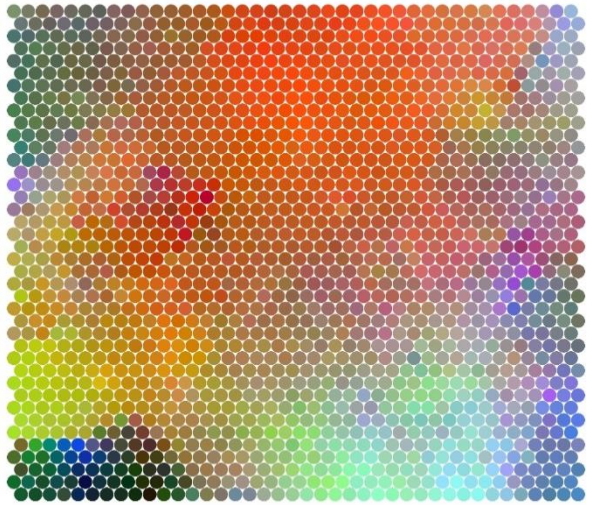
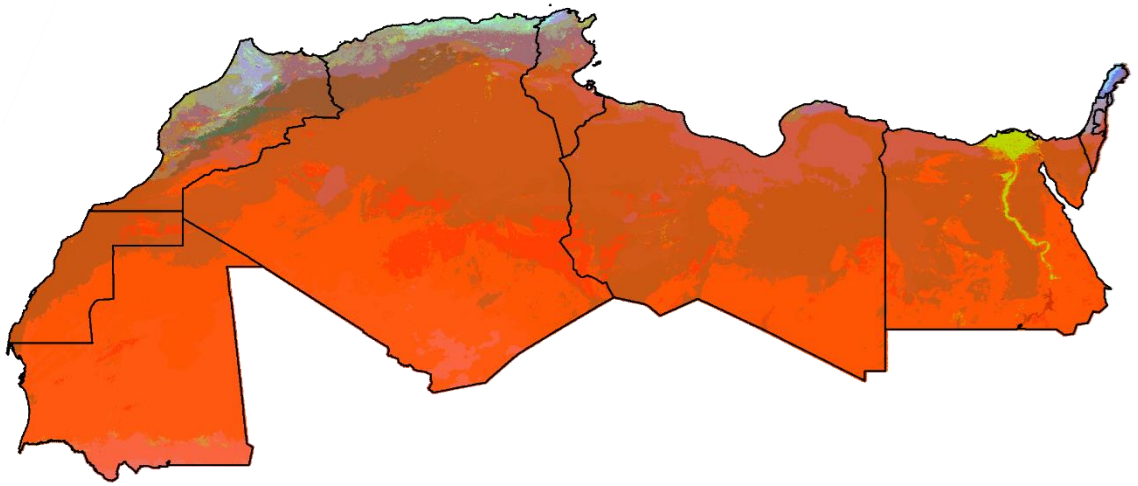
1600 ecoregions

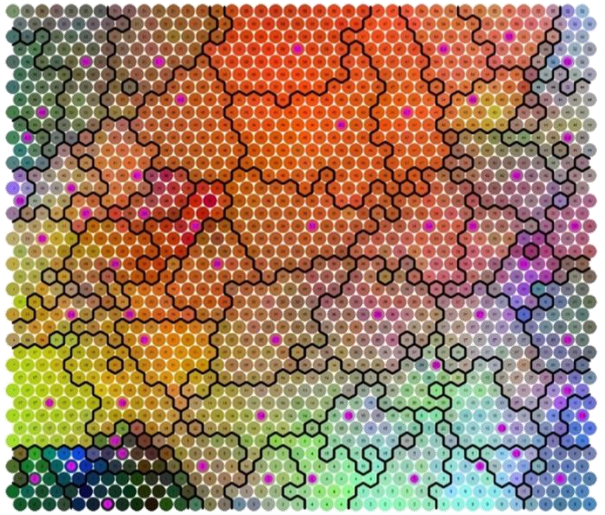




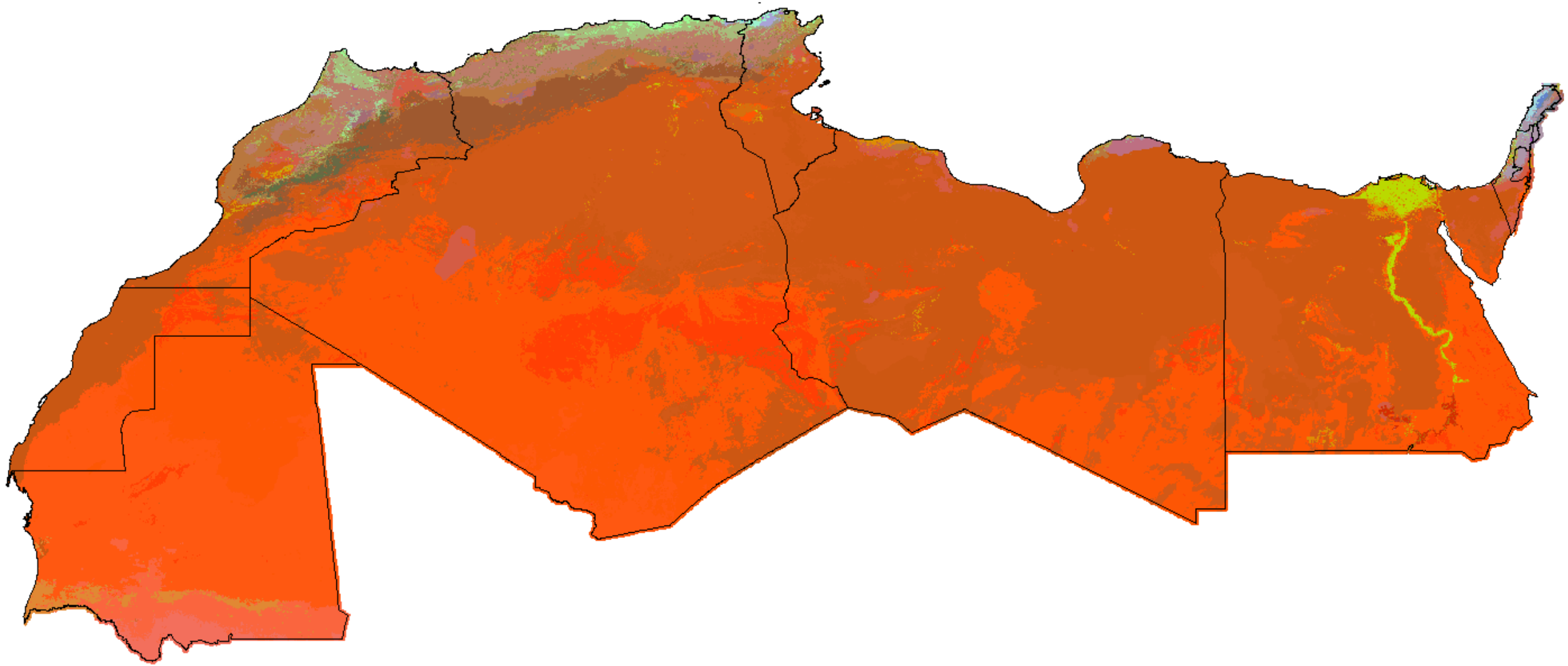
Cluster : Affinity propagation

55 ecoregions

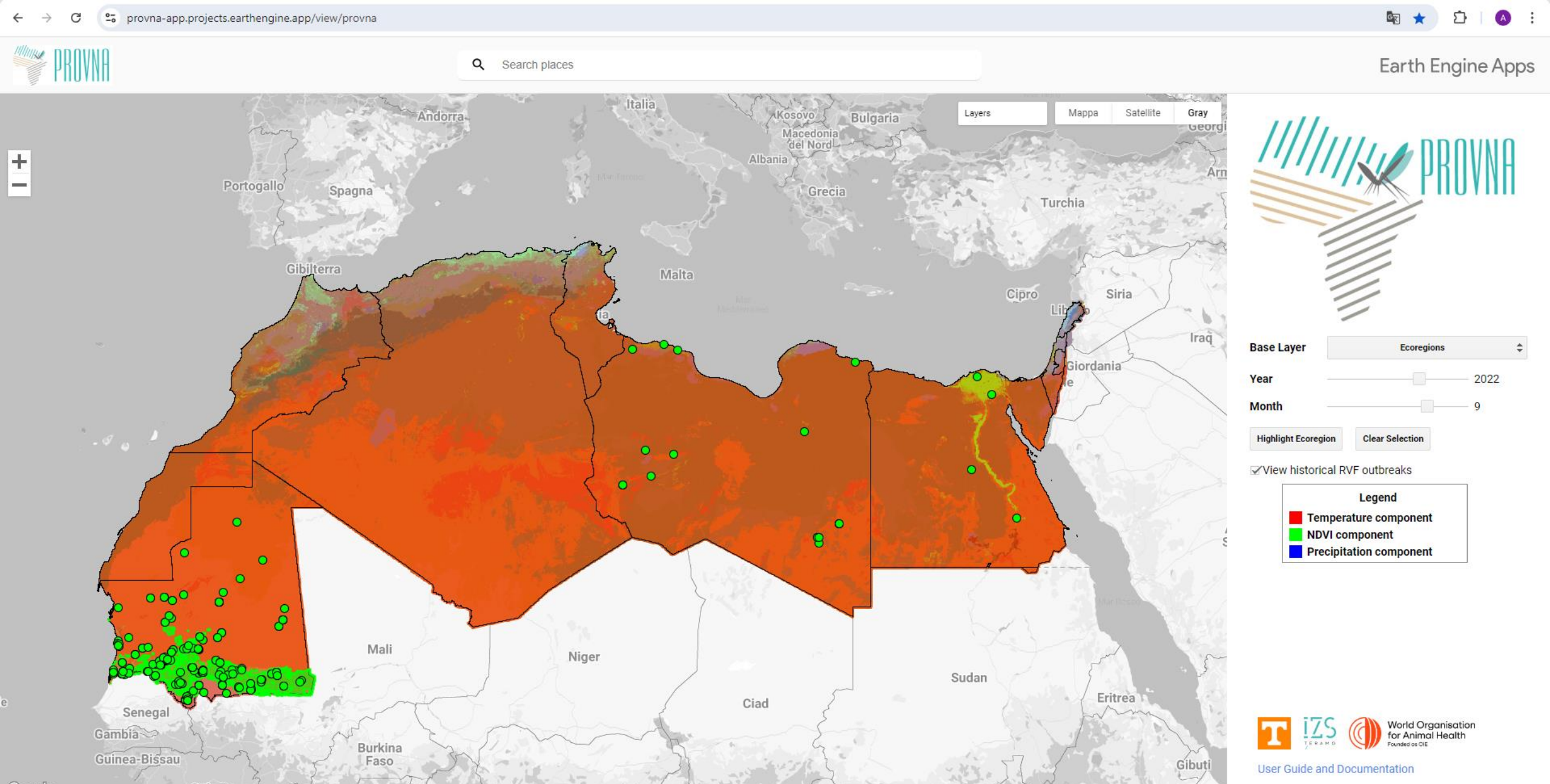




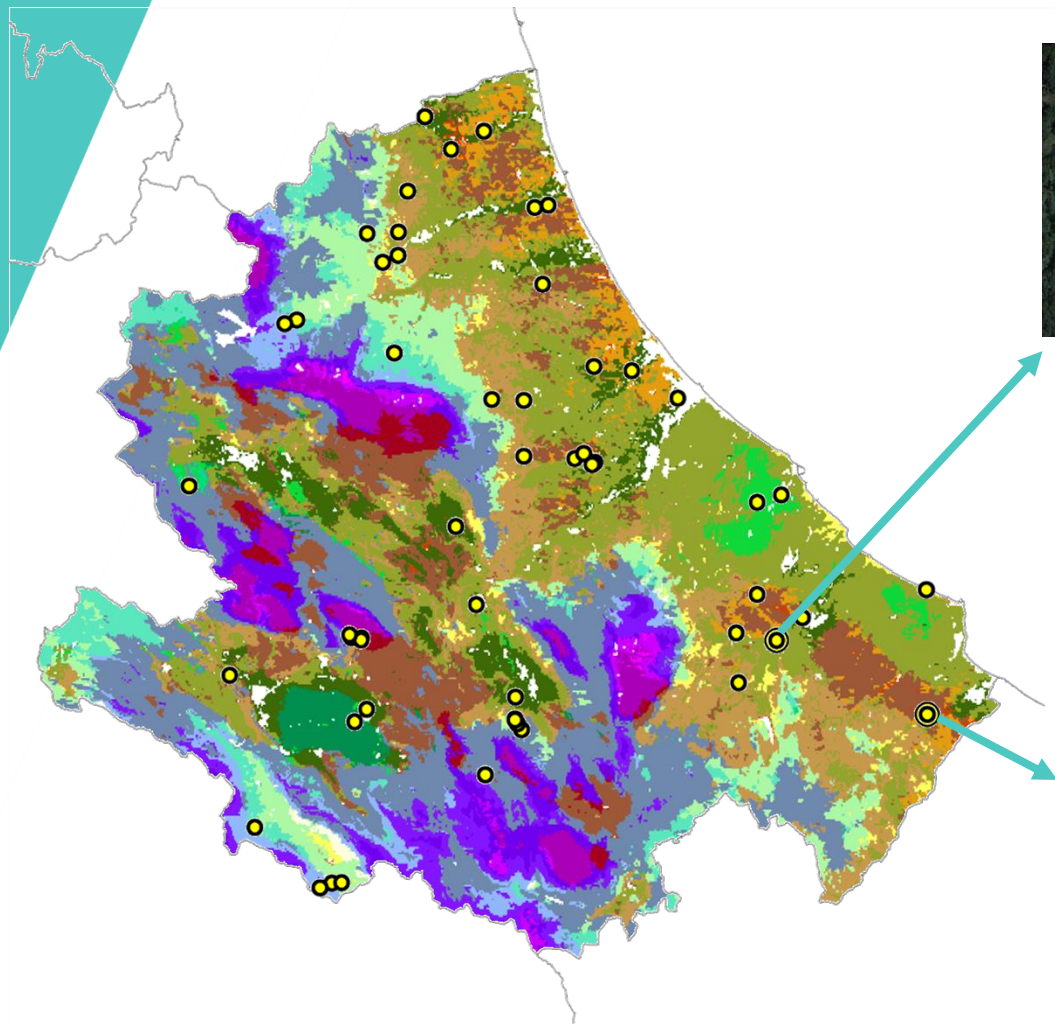
ECOREGIONS in North Africa 2022



Google Earth Engine Application



ECOREGIONS and mosquitoes



Altino (CH) 2019-2022
6407 mosquitoes 13 species
5395 (84,2%) *Cx. pipiens* s.l.

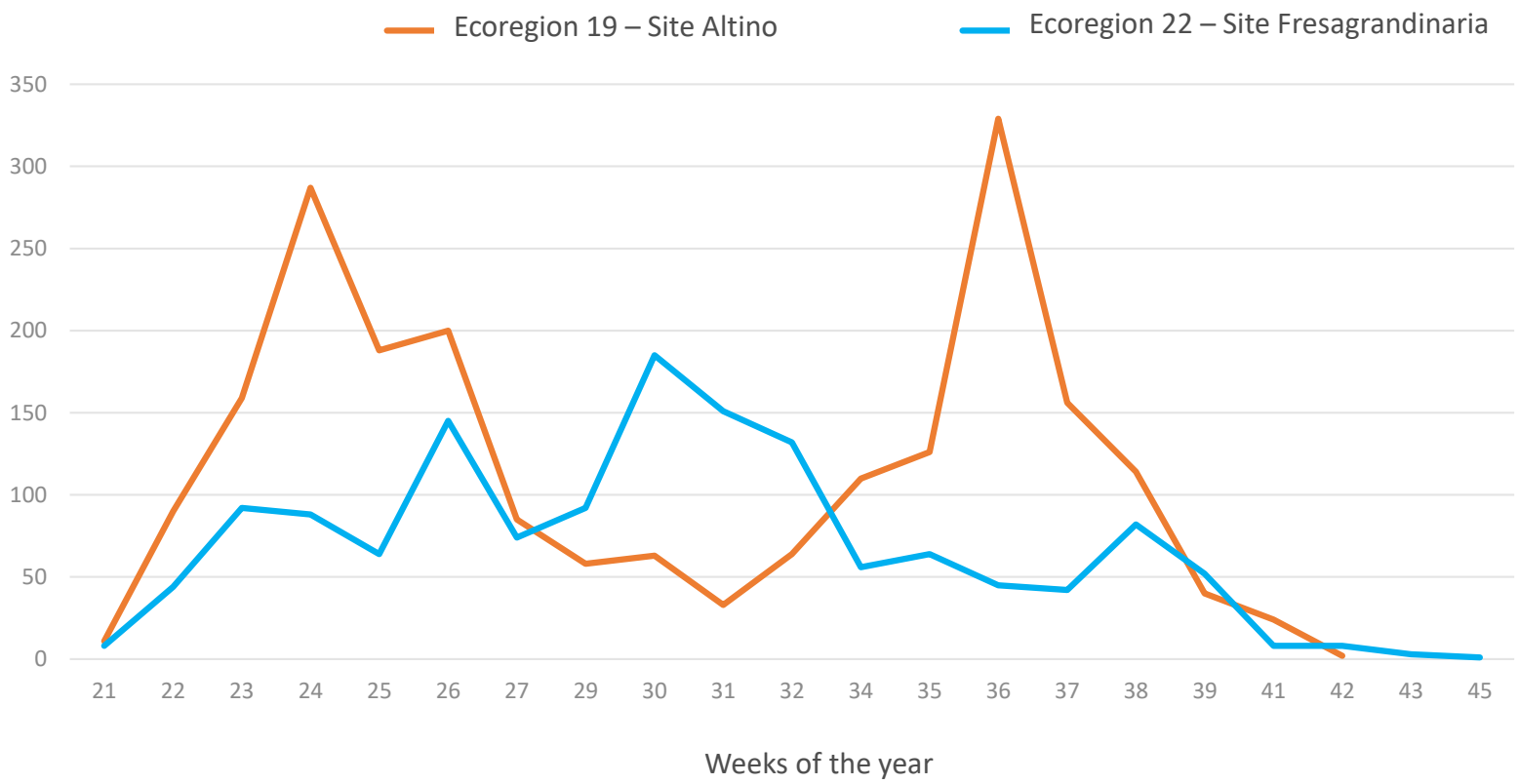
ecoregion 19

ecoregion 22

Fresagrandinaria (CH) 2019-2022
4478 mosquitoes 16 species
3486 (77,8%) *Cx. pipiens s.l.*

ECOREGIONALIZATION and vector-borne disease

DIFFERENT ECOREGIONS
Culex pipiens 2020



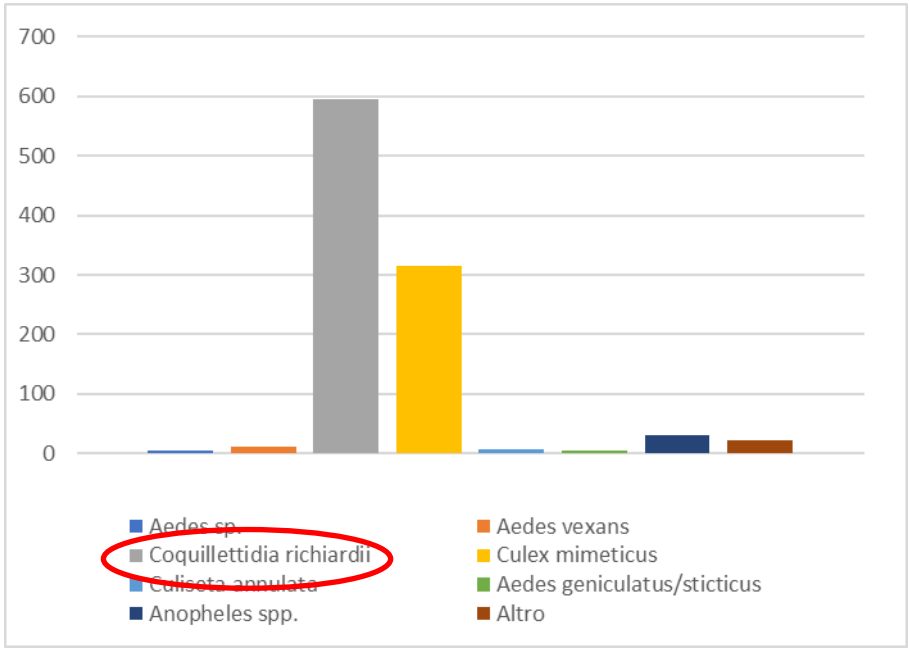
ECOREGIONALIZATION and vector-borne disease

DIFFERENT ECOREGIONS

Cx pipiens removed

Ecoregion 19 – Site Altino

Cx. pipiens removed



Ecoregion 22 – Site Fresagrandinaria

DIFFERENT ECOREGIONS means:

1. Different vectors and different vector species
2. Possibility of different viruses and diseases
3. Different seasonality and vector population dynamic
4. Different surveillance strategies to be implemented
5. Different changes in the next decades to be monitored

PROVNA project
Research objectives

1. to define the “ecoregions” of the North African territory (Mauritania, Morocco, Algeria, Tunisia, Libya and Egypt), each one characterized by distinct environmental and climatic factors, on the assumption that similar areas (in space and / or time) are subject to similar diseases (especially vector-borne diseases);
2. to build a customised prototype application to identify areas at risk for RVF in North Africa region. This system combines static inputs with other EO-dynamic variables like NDVI, rainfall to demonstrate this capability and use by various Veterinary Services in the region.

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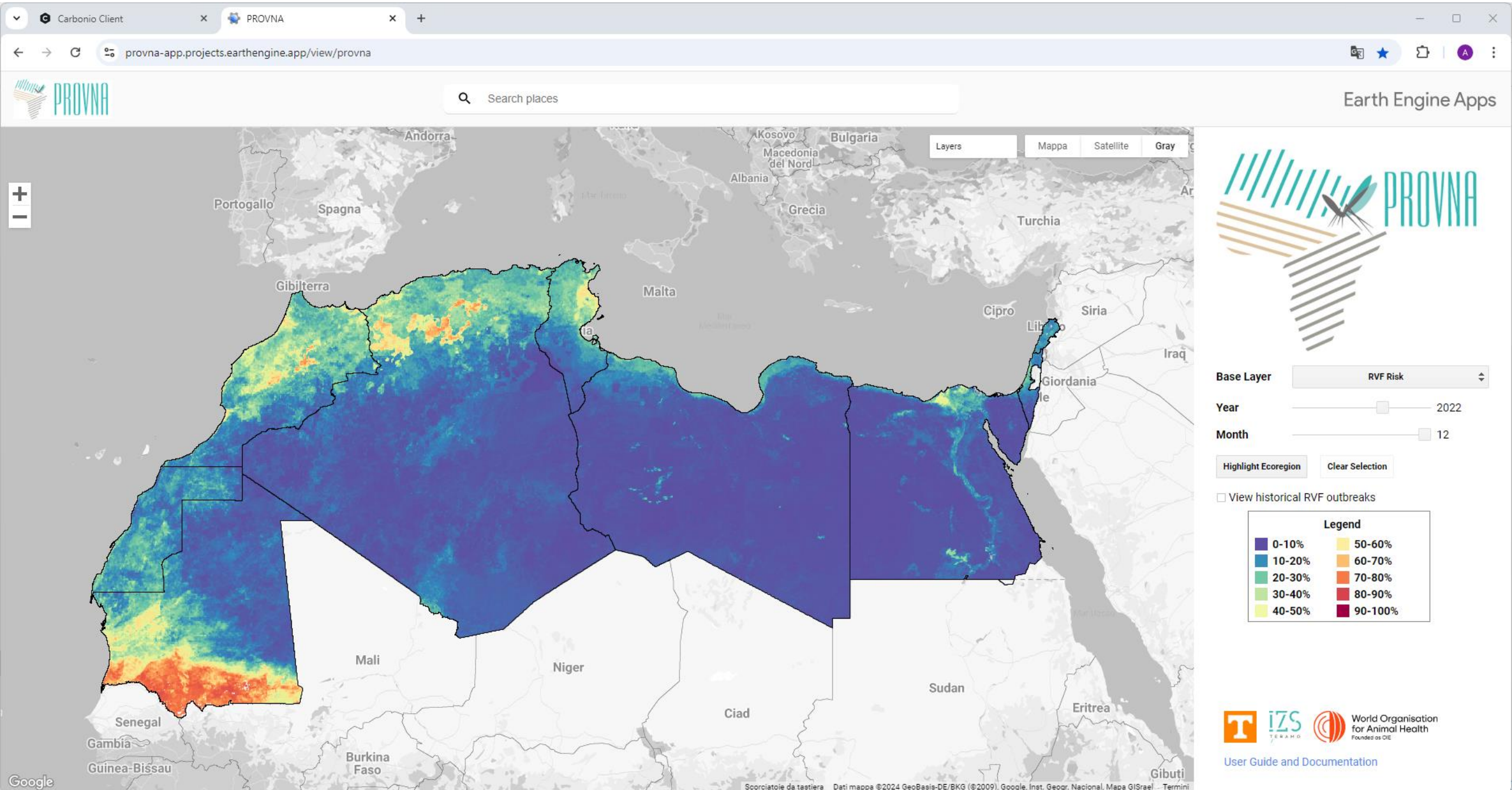

PROVNA phase 2

Given the work done, it is now crucial to combine the decision-making tools based on eco-regionalization and risk factors with data from in-field surveillance.

This step is essential to strengthen the capacity of the National Veterinary Authorities to effectively **prevent**, **predict**, **detect** and **respond** to diseases.

PROVNA phase 2

General Objective

To establish a **risk-based surveillance system** across the six North African countries, using the eco-regionalization method, **to monitor the emergence and spread of key animal and zoonotic diseases** transmitted by mosquitoes.