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

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

Alessandro Ripani
Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise (IZS-Teramo)

Fortifying institutional resilience against biological threats (FIRABioT) project – 14-16 March 2023 – Nairobi (Kenya)

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But….

What's *ECOREGIONALIZATION*?

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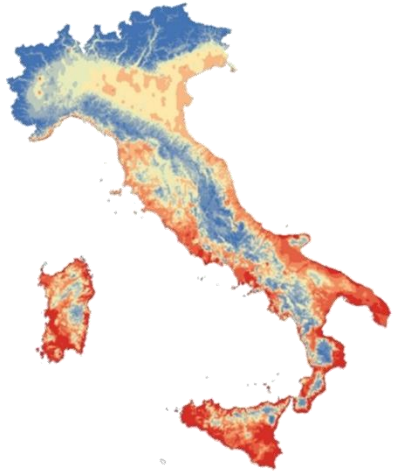
ECOREGIONALIZATION is the process through which a territory is classified into similar areas ("ecoregions") according to specific environmental and climatic factors (e.g., elevation, vegetation, rainfall, temperature).

Elevation

NDVI

Rainfall

Temperature



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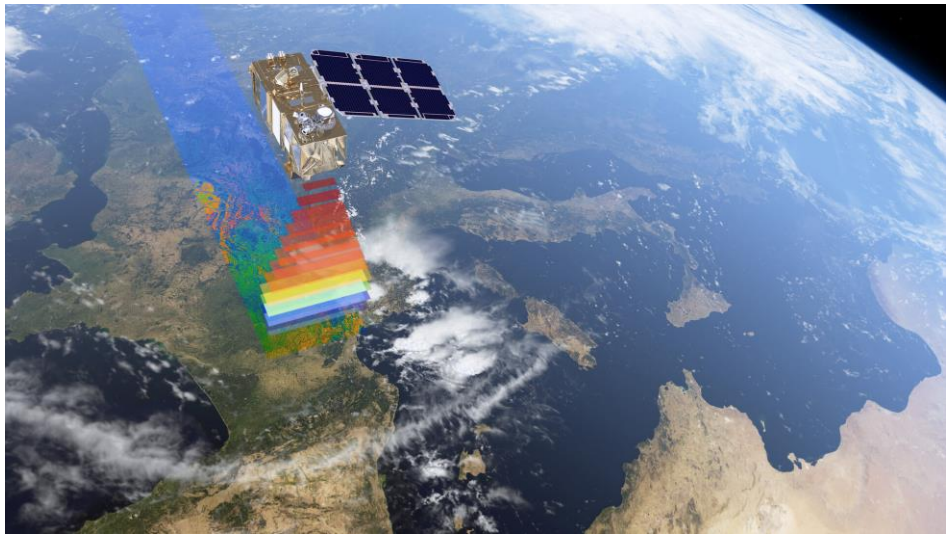
Earth Observation

The ever increasing abundance of remote sensing (RS) and Earth Observation (EO) data, with a variety of spatial and temporal resolutions and biophysical products (land surface temperature, normalized difference vegetation index, soil moisture, etc.) offers enormous opportunities for VBD investigations



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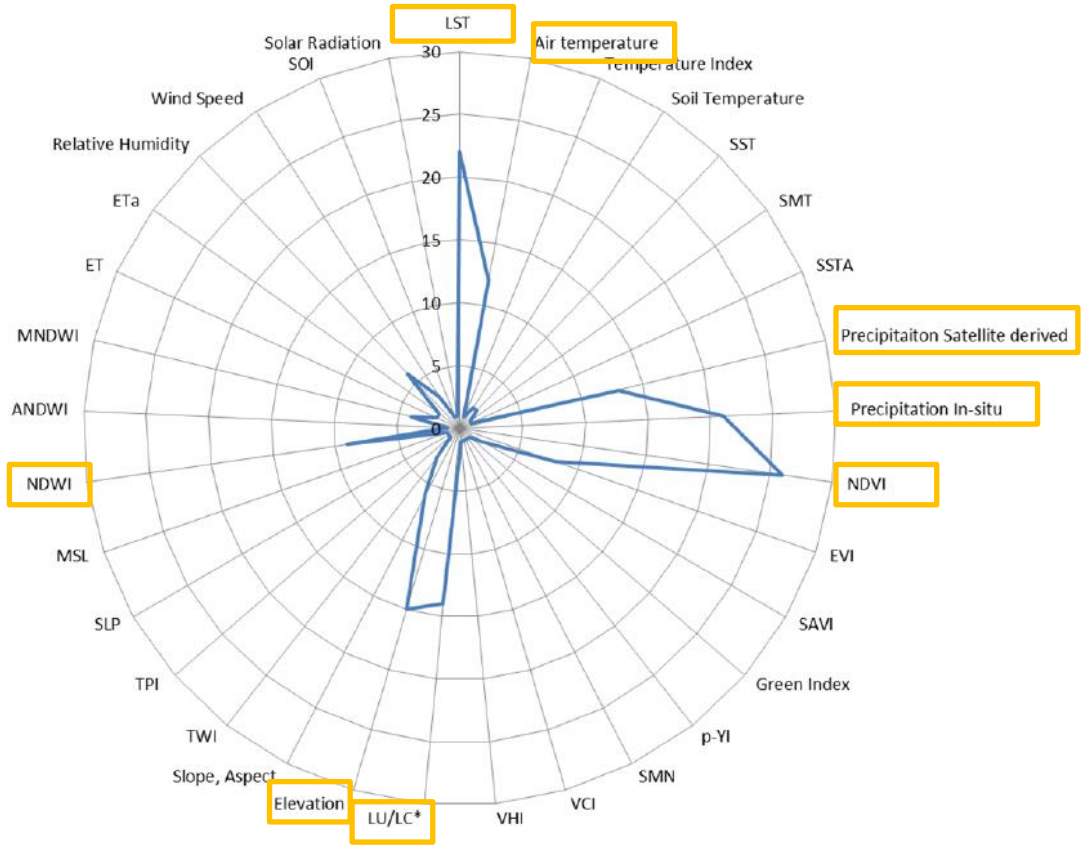
Climatic and Environmental variables in VBDs



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

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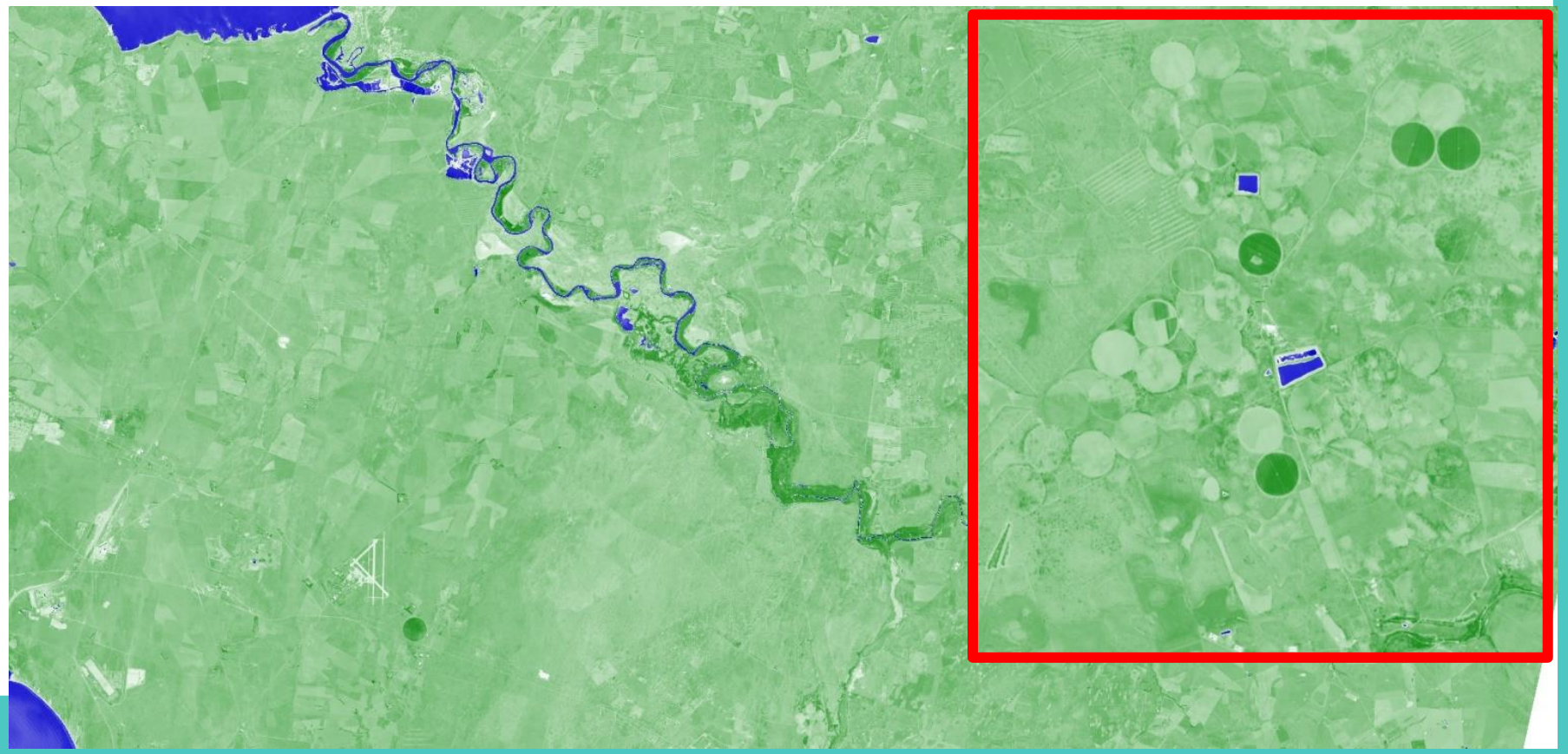
COPERNICUS programme

True color

Moisture index

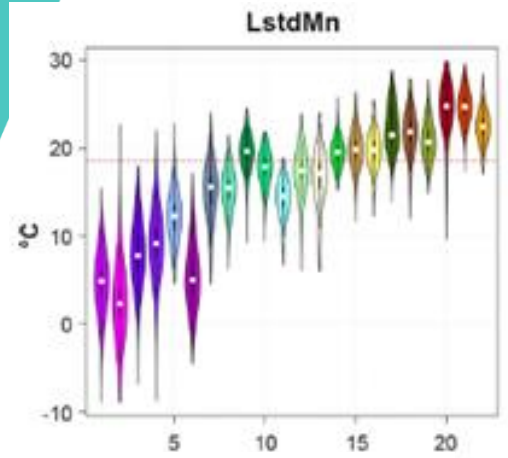
NDWI



Spatial resolution S-2:
10 m, 20m, 60m

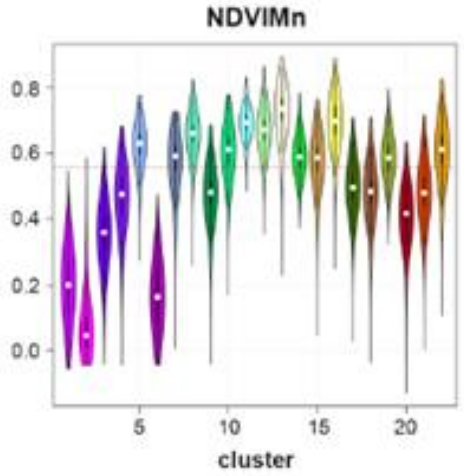
Temporal resolution:
5 days

Ecoregions in Italy

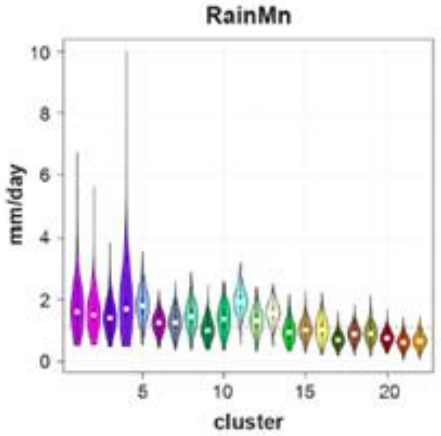


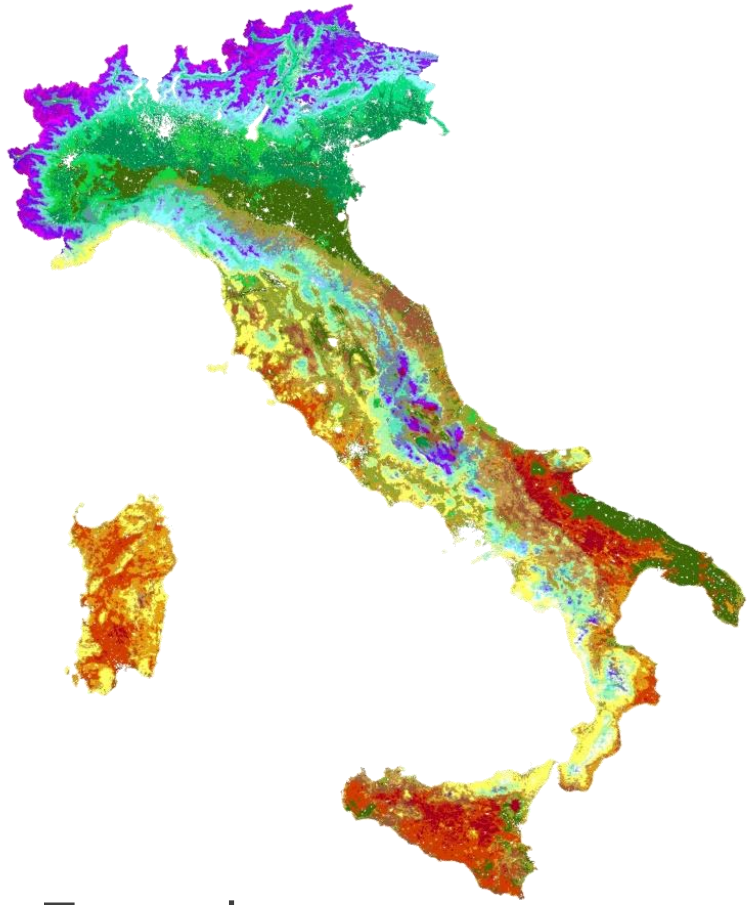
temperature

NDVI



rainfall





Ecoregions

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Ippoliti et al. PLoS ONE 14(7): e0219072.

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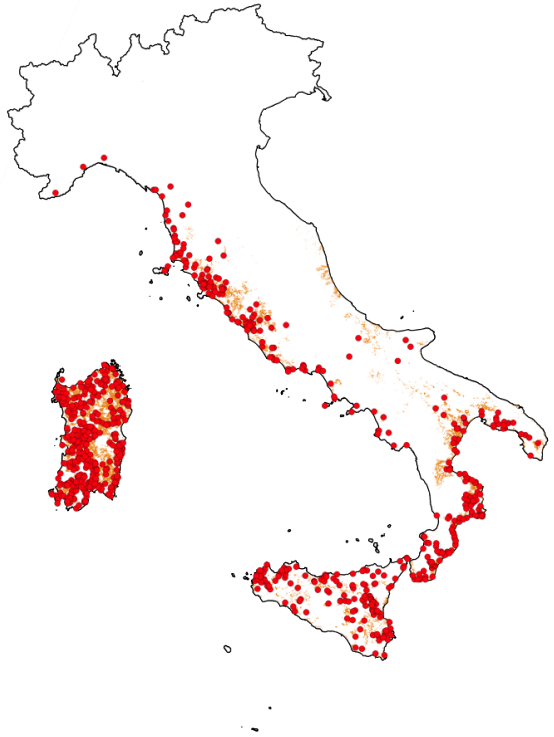
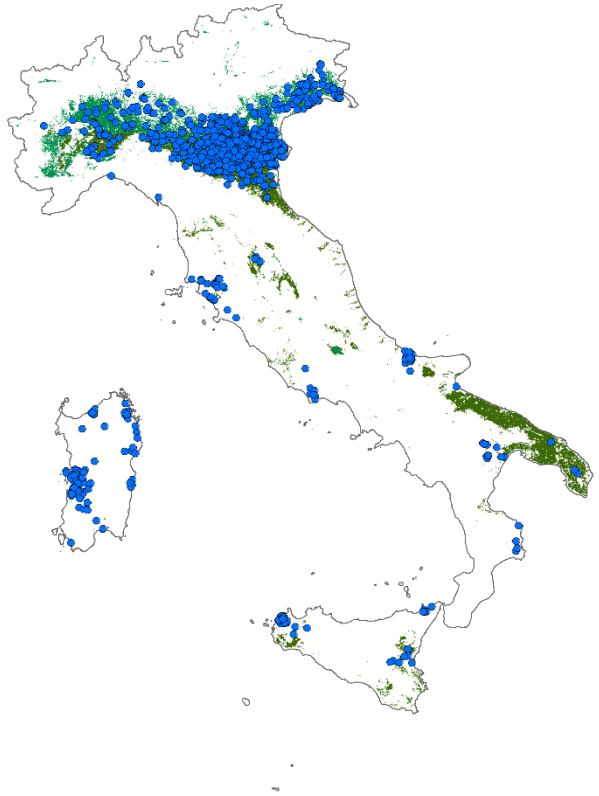
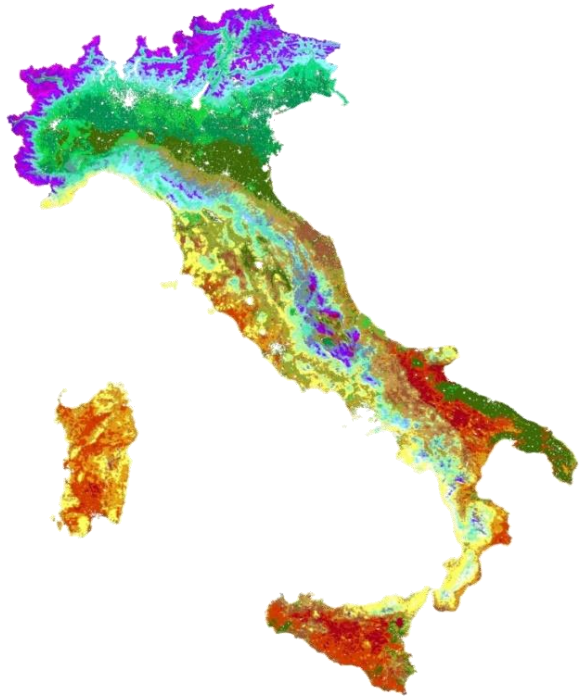
Such an approach…what for?

C. imicola



WND cases





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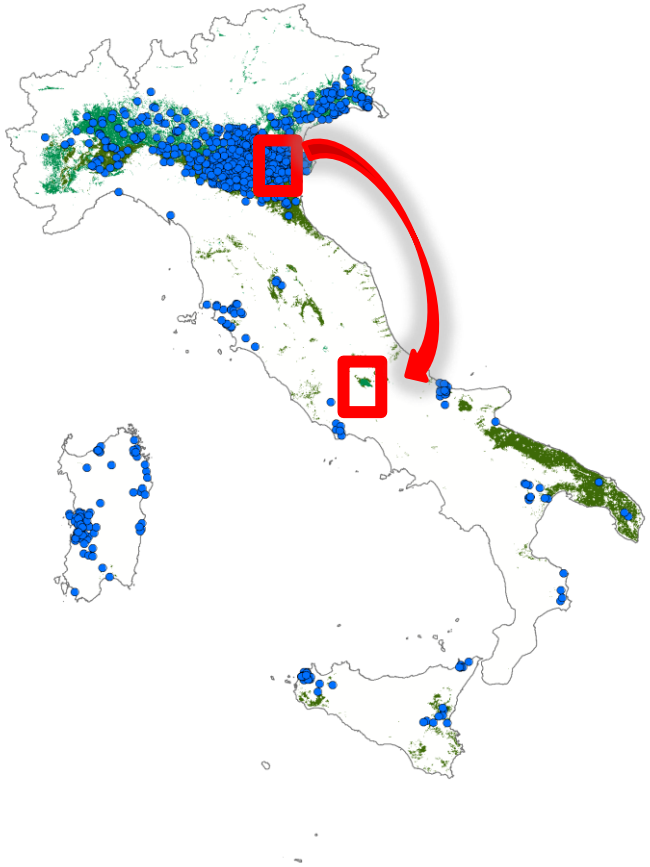
Such an approach…what for?

Ecoregions 9, 17



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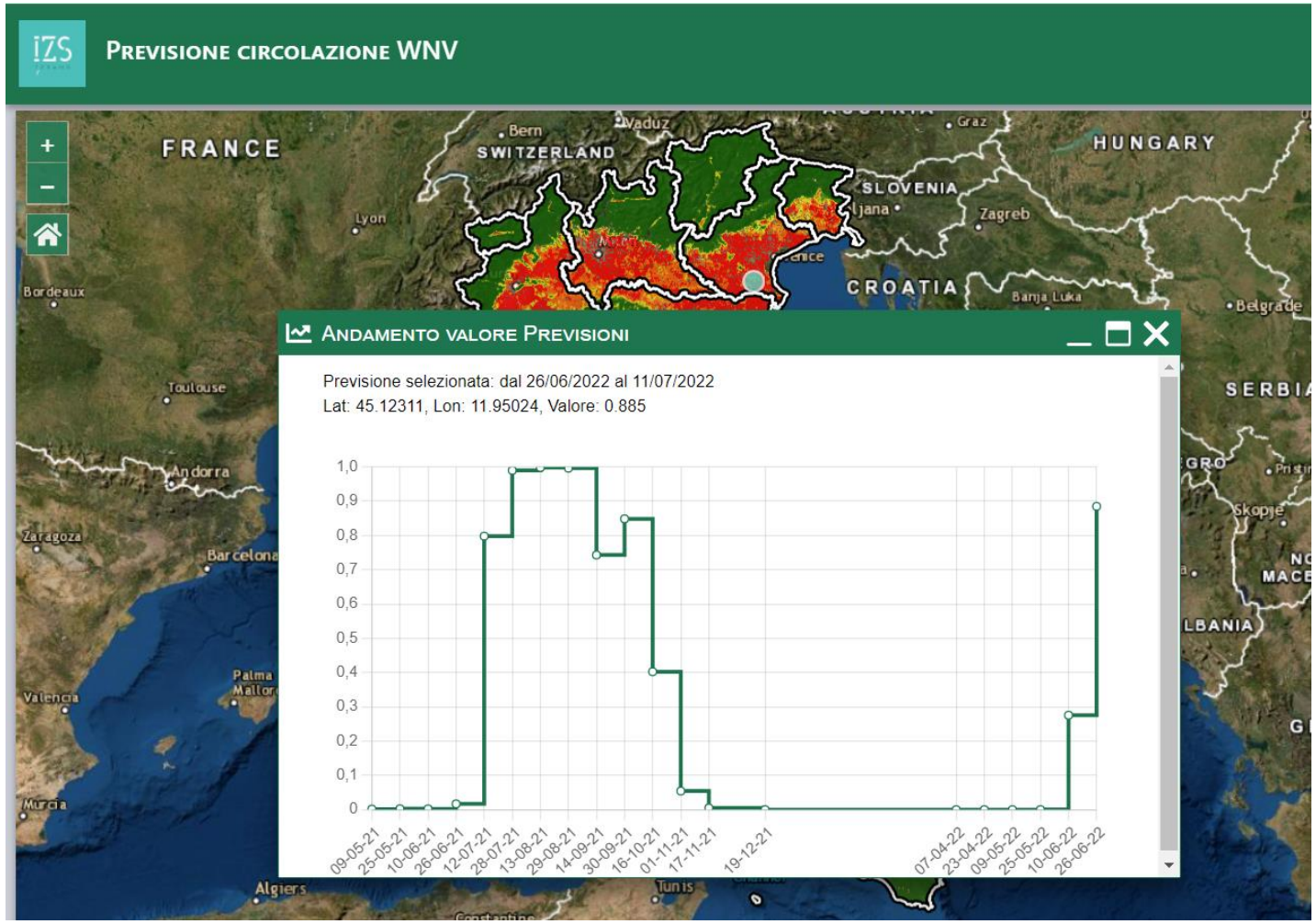
WND predictive tool



remote sensing

MDPI

Article

Predicting WNV Circulation in Italy Using Earth Observation Data and Extreme Gradient Boosting Model

Luca Candeloro [1,*], Carla Ippoliti [1], Federica Iapaolo [1], Federica Monaco [1], Daniela Morelli [1], Roberto Cuccu [2], Pietro Fronte [2], Simone Calderara [3], Stefano Vincenzi [3], Angelo Porrello [3], Nicola D'Alterio [1], Paolo Calistri [1] and Annamaria Conte [1]

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Back to….

PROVNA project

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PROVNA project

- This project – funded by WOAH - was build within the framework of the Mediterranean Animal Health Network (**REMESA**).
- REMESA recognised **Vector-borne diseases** a priority topic for the Mediterranean region.
- WOAH entrusted the IZS of Teramo as WOAH Reference Center for several domains to implement the project in collaboration with University of Tennessee, Knoxville, United States.
- **General Objective**: Supporting the local competent authorities in North Africa (Mauritania, Morocco, Algeria, Tunisia, Libya and Egypt) for the identification of specific areas (*ecoregions*) on which to carry out entomological/serological surveillance for vector-borne diseases. The disease selected for the first application is **Rift Valley Fever**.

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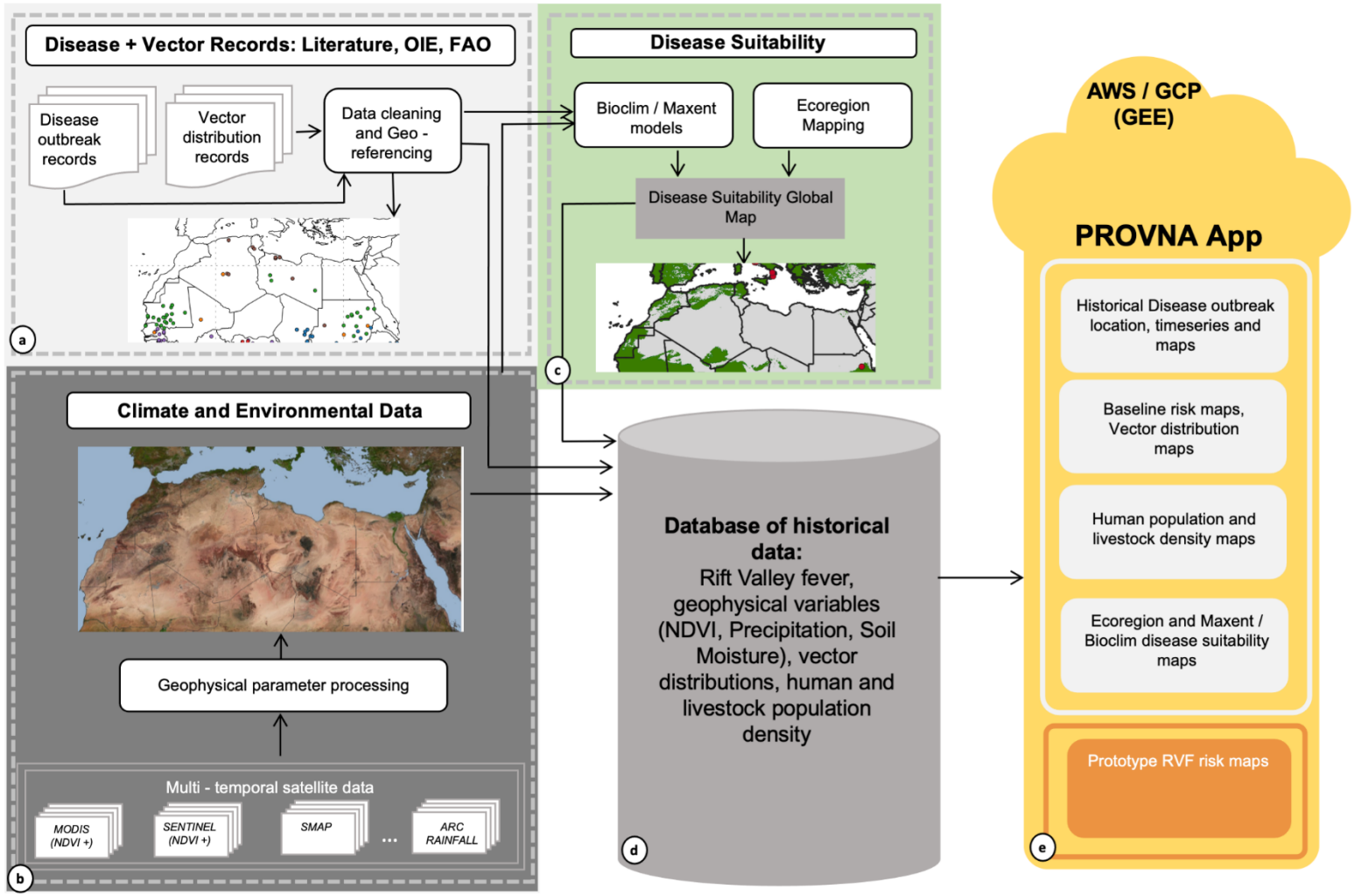
PROVNA project



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What for

PROVNA will support:

- Risk based surveillance
- Early warning systems
- Assessment of risks of VBD introduction and persistence

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Project phases

26/04/2022

Phase 1. Definition of the requirements

Activity 1.1: literature review
Activity 1.2: definition of EO data
Activity 1.3: definition of system architecture and statistical analysis

Phase 2: EO data preparation

Activity 2.1: data retrieval
Activity 2.2: manipulation and processing of EO data

Phase 3: Statistical model/analyses

Activity 3.1: multivariate clustering at regional/multi-country level, at a multiresolution scale
Activity 3.2: multivariate seasonal clustering at regional/multi-country level, at a multiresolution scale

Phase 4: Ecoregion map evaluation/validation/application and prototype development

Activity 4.1: entomological data/risk areas and ecoregions comparison
Activity 4.2: Web Based Prototype Application Development

Phase 5: Communication and dissemination

31/10/2023

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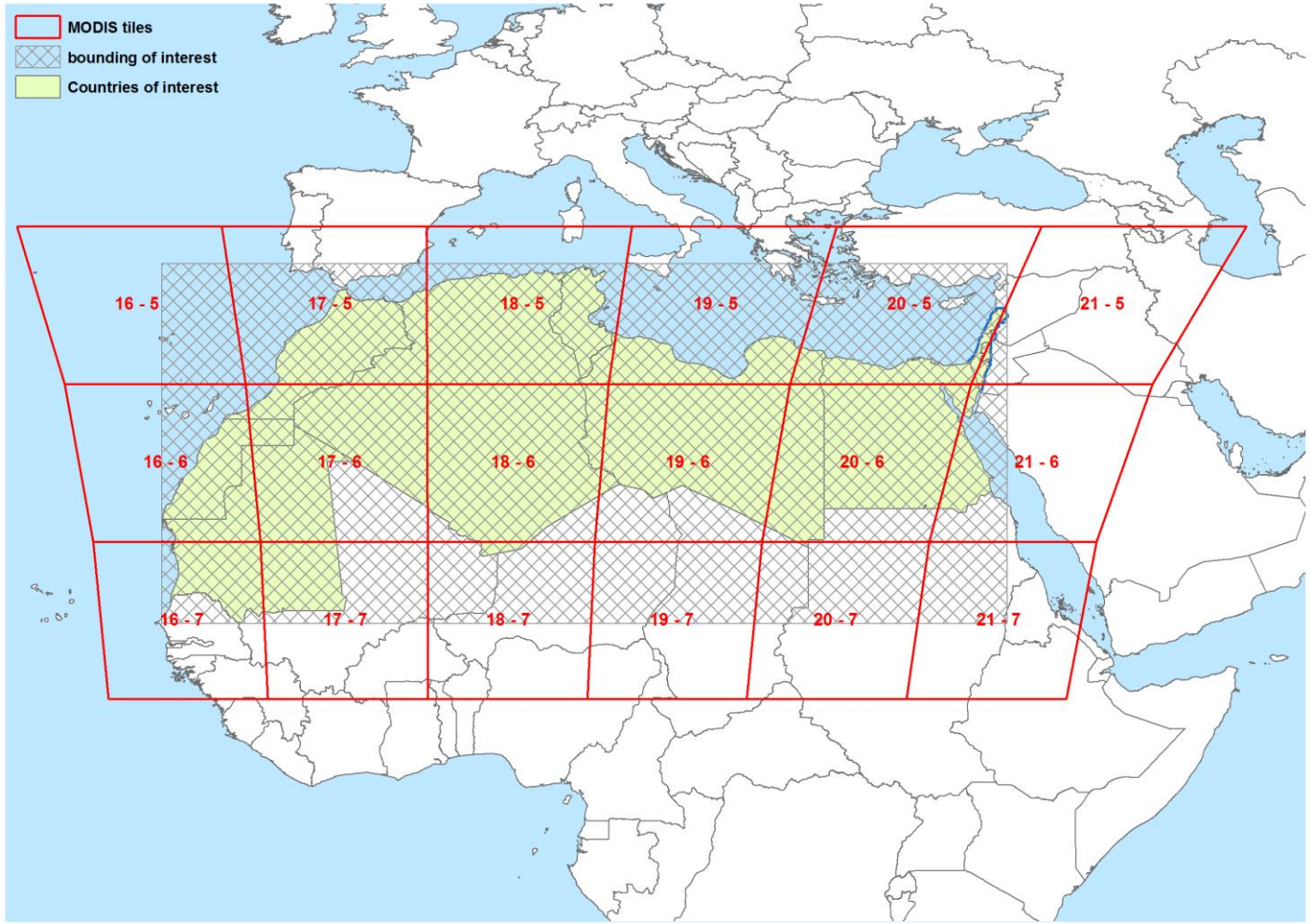
Study Area



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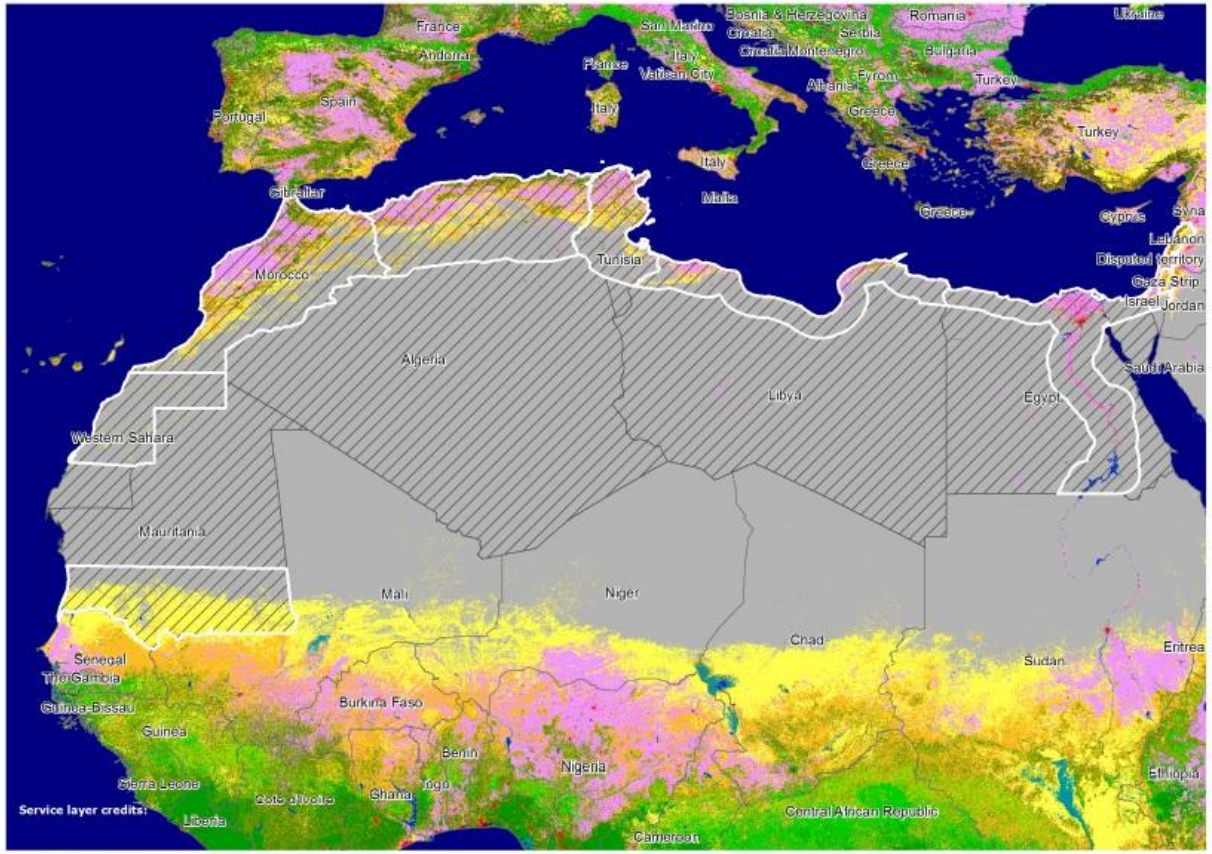
Project phases

Milestones/achievements



Potential mask area (white boundary area)

Phase 1 has been completed, although it may be further implemented (if necessary)

Phase 2 has begun, with the acquisition of datasets currently underway

Phase 3 and 4 have yet to be developed

Phase 5 has already started and will continue throughout the course of the project

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EO datasets

Parameter	Dataset	Coverage		Resolution		Source
		Spatial	Period	Spatial	Temporal	
Rainfall	TAMSAT (Tropical Applications of Meteorology using SATellite data and ground-based observations)	Africa	1983 - Present	4km x 4km	Daily	University Reading/NCAS/NCEO
Land Surface Temperature	Moderate Resolution Imaging Spectroradiometer (MODIS)	Global	2000 - Current	1 Km x 1 Km	8-days	NASA
Vegetation Index (NDVI)	Moderate Resolution Imaging Spectroradiometer (MODIS)	Global	2000 - Current	0.25 Km x 0.25 Km	16-days	NASA
Soil Moisture	Soil Moisture Active Passive (SMAP) Level 4 (L4) data product Surface and Root Zone Soil Moisture Geo physical Data	Global	2015 – Current	9km x 9km	3-hours, daily	NASA
NDWI	Normalised Difference Water Index (NDWI) from MODIS surface reflectance	Global	2000 - Current	0.25 Km x 0.25 Km	8-days	NASA

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What for

The tool developed by the project will support Veterinary Services in:

- ❑ developing a customized predictive and innovative model to improve the risk-based targeted surveillance of VBDs
- ❑ optimizing financial and human resources through strategic planning.

Future activities

- ❑ On-field implementation of the predictive model with entomological and serological surveillance
- ❑ Implementation of a predictive model for the surveillance of other VBDs.

Thank you