EYWA
Early Warning System for Mosquito Borne Diseases

EO creates opportunities for Health & Epidemics

Earth Observation Data-driven Framework for Mosquito Abundance and MBD Prediction. Implementation in Europe and Africa continents

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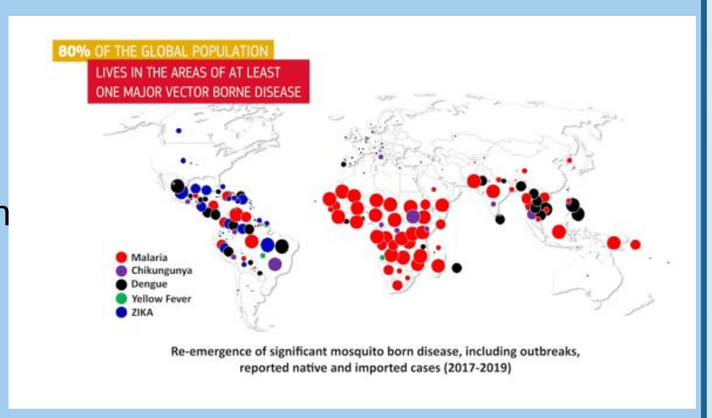
MBDs: A global problem to be addressed

- **Climate Change, globalization** and other drivers are altering ecological conditions for mosquitoes.
- Mosquito-Borne Diseases (MBDs) are present **in over 100 countries**, causing **~700.000 deaths** annually.
- **Malaria**, most lethal for kids **aged under 5** in the sub-Saharan regions.
- Chikungunya and dengue fever increased 40% over 1950[1].



Re-emergence of significant mosquito born disease, including outbreaks, reported native and imported cases (2017-2019)

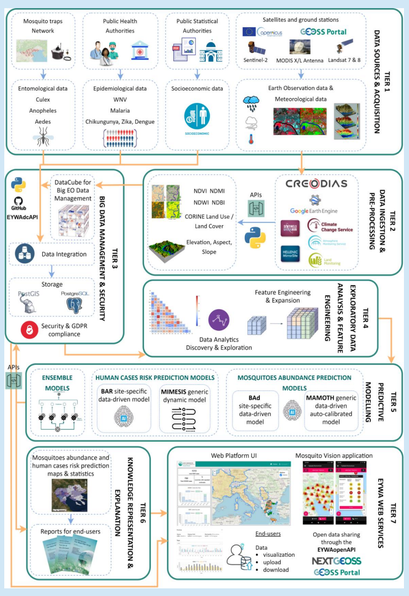
1. https://www.thelancet.com/action/showPdf?pii=S0140-6736(20)32290-X

Working towards a solution

What does EYWA offer?

Produces **mosquito abundance maps** and **disease risk estimation maps** a couple of weeks or a month in advance, helping policy makers in their decision making regarding preventive action against Vector-Borne Diseases.

Exploiting Earth Observation Data



Processing more than **33 TB** of Earth Observation data to generate:

- **Environment proxies** (Sentinel 2, Landsat 7/8)
- **Meteorological Data** (Copernicus ERA-5, MODIS, IMERG)
- **Geomorphological Data** (Alos Palsar, Copernicus Water & Wetness)
- **Land Use / Land Cover Data** (CORINE)

Crawling open-source online Databases to generate:

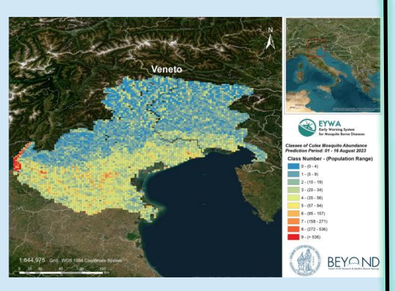
- **Census Information**
- **Trade Data**

A Total of **~100 features** are generated

MAMOTH MODELS

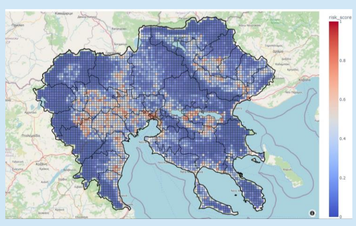
Mosquito Abundance Model

- The model uses **Satellite-Derived Earth Observation** data as it's **input** feature space.
- It is trained using in-situ entomological data as the **target variable** for <u>any</u> mosquito species. (in this case Culex pipiens)
- It is used to **predict** the estimated mosquito population for the next 15-30 days in a 2x2 km Grid.



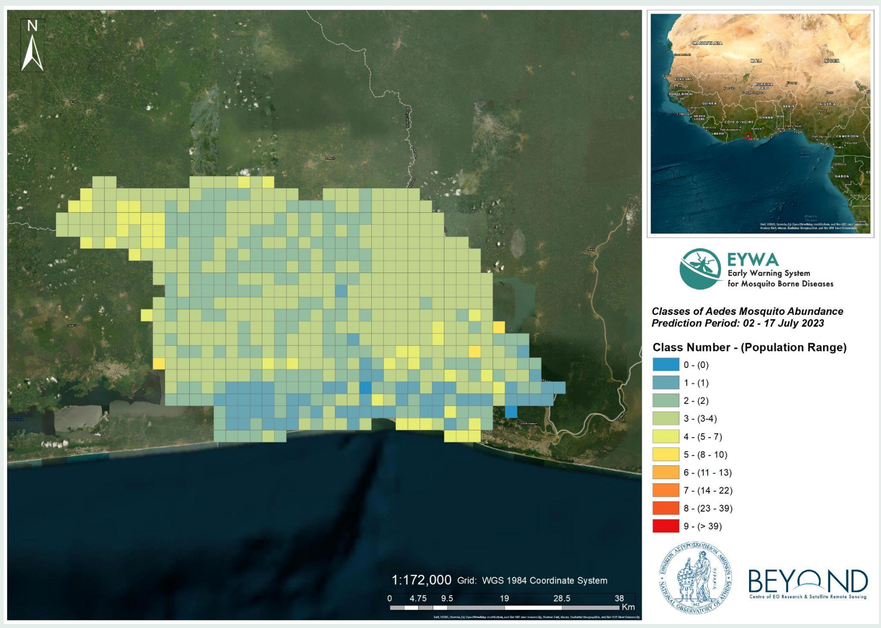
WNV Risk Estimation Model

- The model uses **Satellite-Derived Earth Observation** data as it's **input** feature space.
- It is trained using in-situ epidemiological data as the **target variable** for <u>any</u> mosquito-borne disease. (in this case West Nile Virus)
- It is used to **predict** the estimated risk for an MBD case to appear for the next month in a 2x2 km Grid.



- Both models are **agnostic** to the target variable and can be trained to predict **any mosquito species** or **mosquito borne disease** wherever the in-situ information is available.
- Both models rely on satellite-derived **Earth Observation** data. This information can be generated for any place on earth making the models **easily transferable**

MAMOTH in Africa:



Mosquito Abundance Model Predictions for July 2023

Transferring of the MAMOTH mosquito abundance model to Africa.

Limitations:

- Limited and/or outdated entomological data (mosquitoes)
  - Resulting in **absent validation data** for recent predictions
  - And **inability to update** the models with new information
- Complete Lack of MBD epidemiological data (human cases)

How to apply MAMOTH on Africa without or with limited data?

- Transfer Learning methods are employed to overcome limitations
- The model **is pretrained in another region** and applied in Africa

The **EYWA** journey up to date… in a nutshell

2020 — EYWA started its operations with **5 regions in 2 European Countries** (Greece/Italy).

2021 — EYWA expanded to include **10 regions in 5 European** Countries (France, Germany, Greece, Italy, Serbia).

2022 — EYWA wins the **1st EIC Horizon Prize** on Early Warning for Epidemics & further expands to support **another region in Italy** and **Cote d'Ivoire** in Africa operationally and in **Thailand** pre-operationally.

Winner of the first "EIC Horizon Prize on Early Warning for Epidemics"

2023 — EYWA in **discussions** to support: **Ghana, East Germany, Milan**. Also planned cooperation with **Pasteur Network** to potentially expand to its member countries.

2024 — EYWA is fostering partnerships with stakeholders from countries in **Sub-Saharan Africa**, as well as **Latina America** to expand the system in these affected regions.

EYWA Early Warning System for Mosquito Borne Diseases

Earth Observation for Epidemics of Vector-borne Diseases / EuroGEO Action Group

EuroGEO

GEO CRADLE INITIATIVE

copernicus Framework Partnership Agreement for Copernicus User Uptake

BEYOND Centre of EO Research and Satellite Remote Sensing

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