

# EYWA: A key tool to the epidemics arsenal

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**EuroGEO**



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



e-shape



**BEYOND**  
Center of EIT Research & Innovation Future Energy



**ecodev**  
Environmental Applications



**ISV**  
Istituto Nazionale per lo Studio e la Cura dei Tumori

**FONDAZIONE  
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## Introduction | A global problem

- ❑ **Climate Change, globalisation** and other drivers are altering ecological conditions for **mosquitoes**.
- ❑ [Mosquito-Borne Diseases \(MBDs\)](#) are present in **over 100 countries**.
- ❑ [700,000 deaths](#) per year.
- ❑ **Malaria**, most lethal for kids aged under five in the sub-Saharan regions.
- ❑ **Europe** a “hot spot” of **West Nile Virus**.
- ❑ **Chikungunya** and **dengue fever** increased [40% over 1950<sup>1</sup>](#).

## Working towards a solution

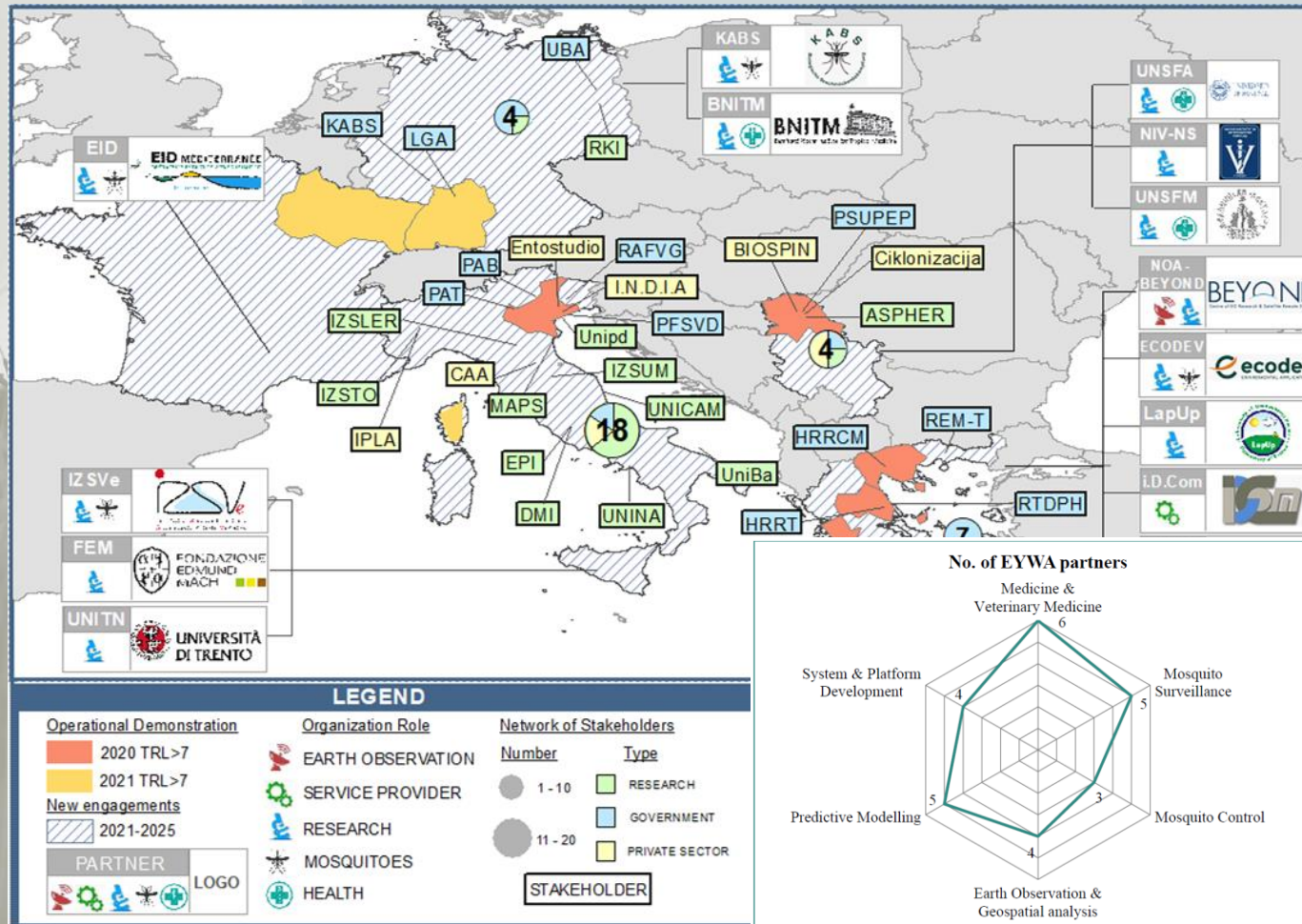
- ❑ **Need to control** this **threat** gave birth to the **EYWA early warning system**.
- ❑ **EYWA**: outcome of a 3-year voluntary action.
- ❑ **Vision**: EYWA as a **key tool** to the epidemics arsenal.
- ❑ **State of the art tool guiding**:
  - Vector preventive/control actions.
  - targeted door-to-door awareness.
- ❑ **Diverse domains of expertise**:
  - **Earth Observation**,
  - Advanced **epidemiological** and **entomological** modeling,
  - **Artificial Intelligence/Machine Learning, Big data** analytics.
- ❑ Operational since **2020**.
- ❑ **2021**: **10 regions** in **5 European countries** (France, Germany, Greece, Italy, Serbia).
- ❑ **2021**: joining e-shape project, expanding to **Cote d'Ivoire** and **Thailand**.
- ❑ **EYWA**: **1st European Innovation Council Horizon Prize on Early Warning for Epidemics!**



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# Who are we

EO creates  
opportunities  
for Health &  
Epidemics



## EYWA team

15 partners

5 countries (~30M citizens)

## National/International Roles as Reference Entities

**Data Handling, Mosquito Surveillance & Control, Medical & Veterinary Medicine from all 5 countries:**

BEYOND/NOA, ECODEV, LapUp, AUTH, UTH (GR)

IZSVe, FEM (IT)

UNIFA, UNSFM, NIV-NS (SRB)

KABS, BNITM (GER)

EID-Mediterranee (FR)

**BEYOND/NOA:** Crosscutting role for Big Data manipulation, standardisation, harmonization & storage.

Predictive modelling: BEYOND/NOA, ECODEV, LapUp

System, Web Platform and mobile applications development: BEYOND/NOA, i.D.Com, ECODEV, LapUp

**EYWA engages 40 stakeholders globally**  
up to now & has received **Letters of Support**  
from: Germany, Italy, Serbia, Greece, USA,  
Brazil & India

**211 publications &  
more than 44,450 citations**

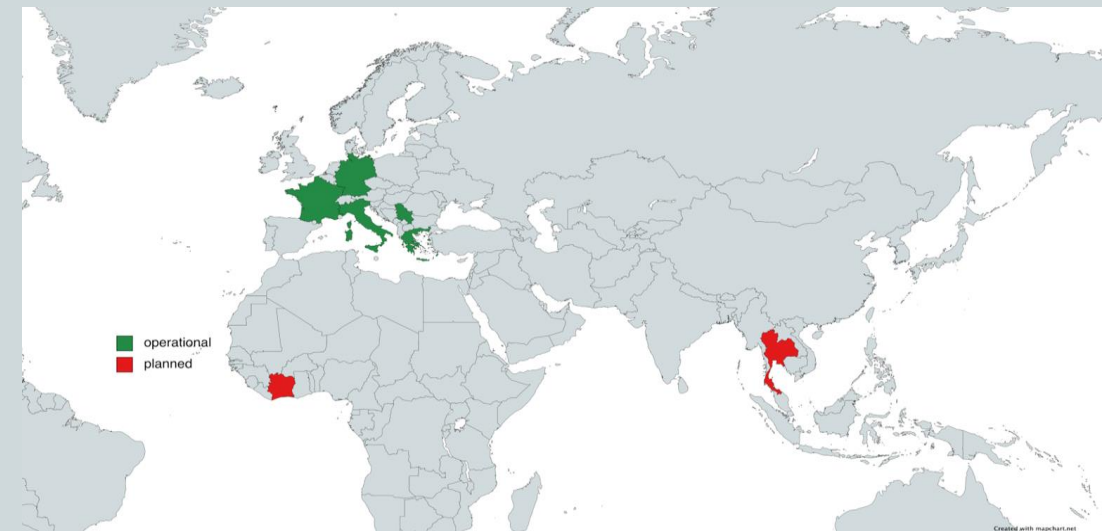
## Reaching out globally

- ❑ **EYWA** engages **>40 stakeholders** at a **European** and **global** level.
- ❑ **EYWA** signed an **MoU** with **EC's Joint Research Center (JRC)** to **expand** and **exploit** the innovation.
- ❑ EYWA to provide support to **European Health Emergency and Response Authority (HERA)**.
- ❑ **Participation** in: **GEO Health Community of Practice, GEO & EuroGEO Symposiums, GEO-CRADLE Initiative, EO4GEO community.**



## Expanding the service to non-European territories

- ❑ **Onboarded to e-shape H2020 project** with the major goal of **expanding** the support of the services to **non-European territories**, specifically **Thailand** and **Côte d'Ivoire**.
- ❑ **Expand the database of entomological & epidemiological data**
- ❑ **Train and adapt** the models to new regions with different **climatic** and **socioeconomic** conditions.
- ❑ **Strengthen the models.**
- ❑ **Supporting awareness campaigns.**



## What does EYWA provide?

- ❑ **MIMESIS, BAr WNV risk models.**
  - Municipality/Settlement level
  - 4 regions in Greece and 1 region in Italy
  - Support preventive actions
  - Door to door awareness
  - 2021: > 31,000 households in Central Macedonia, Greece.
- ❑ **BAd mosquito abundance model.**
  - Settlement level.
  - 4 regions in Greece
  - Mosquito Vision: notifications through app >2400 villages in Greece
- ❑ **MAMOTH mosquito abundance model.**
  - Trap level.
  - 4 European countries in 2021, more in 2022.
  - Culex, Aedes albopictus and Anopheles.

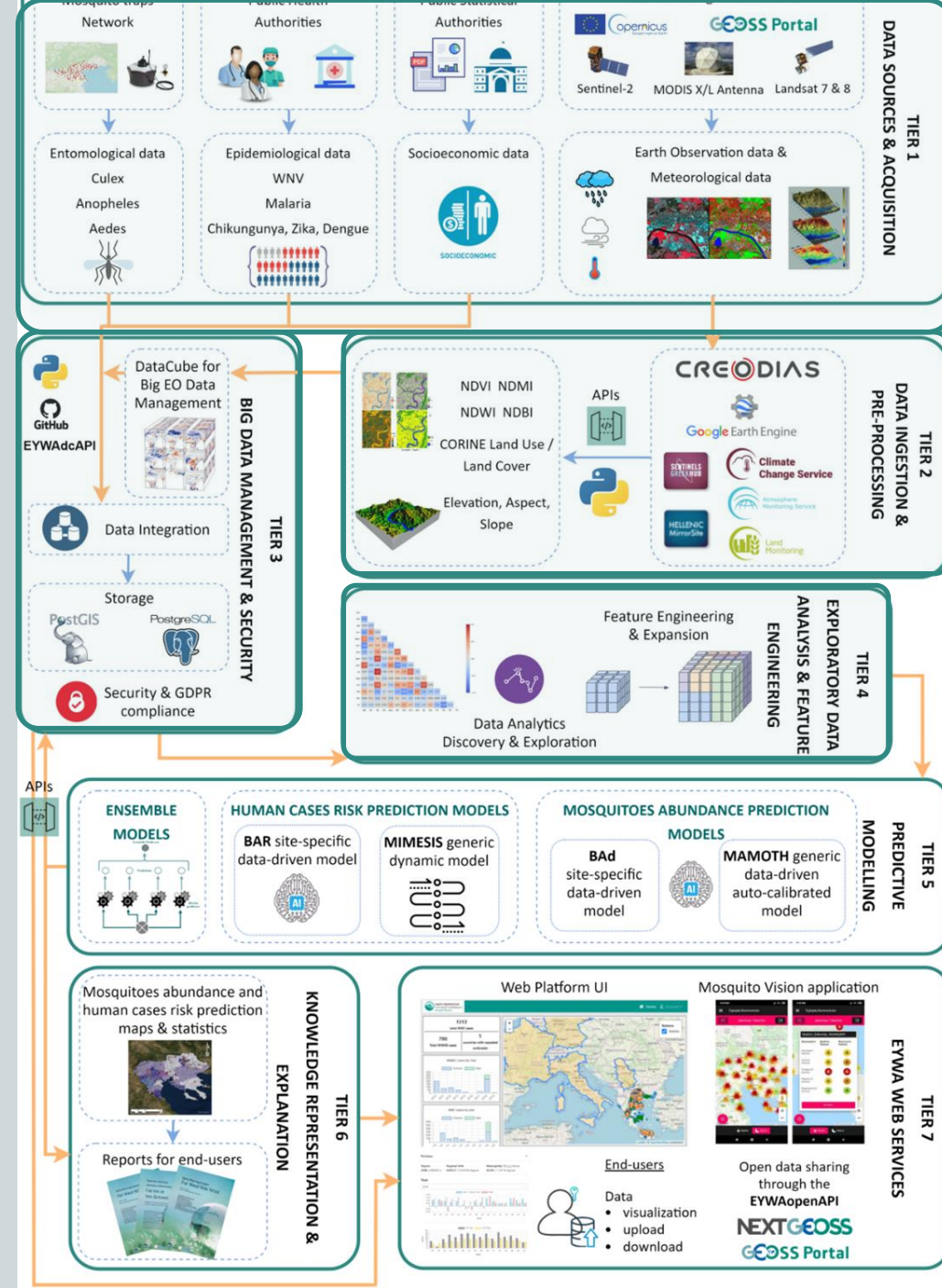
## Using Satellite Earth Observation

- ❑ **Environmental variables** (geographical, climatological, and hydrological) that influence MBDs can be monitored from satellites[1].
- ❑ **West Nile Virus specific:**
  - **Temperature** (positive correlation)
  - **Rainfall** (positive correlation)
  - **Elevation** (negative correlation)
  - **Normalized Difference Vegetation Index** (positive correlation)
  - **Land use, specifically irrigated crops and populated forests** (positive correlation)



# Making it work

- ❑ Time-series **entomological, epidemiological, socio-economic, satellite Earth Observation, meteorological and geomorphological** data
- ❑ 36 features for each of the 39.000 mosquito collections in our database.
- ❑ A “MAMOTH” feature space **10-years time series of data** for mosquito-traps network in **10 regions** in Europe.
- ❑ **Environment proxies** (Sentinel 2, Landsat 7/8):
  - Normalized Difference Vegetation Index (**NDVI**)
  - Normalized Difference Moisture Index (**NDMI**)
  - Normalized Difference Water Index (**NDWI**)
  - Normalized Difference Build-Up Index (**NDBI**)
- ❑ **Meteorological Data** (Copernicus ERA-5, MODIS, IMERG):
  - Wind, Land Surface Temperature (**LST**), Rainfall
- ❑ **Geomorphological Data** (Alos Palsar, Copernicus Water & Wetness):
  - Elevation, Aspect, Slope
  - Composite features



# EYWA outreach after our distinction Prize European Commission

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# EYWA Press Release



## EYWA system wins the 1st EIC Horizon Prize on Early Warning for Epidemics

In April 2018, the European Commission launched a €5 million prize for an early warning system for epidemics.

The prize rewards the development of a scalable, reliable and cost-effective early warning prototype system based on Earth Observation data to forecast and monitor outbreaks of vector-borne diseases.

### EYWA | The Winner of the EIC Horizon Prize on Early Warning for Epidemics

Developed in the context of EuroGEO Action Group "Earth Observation for Epidemics of Vector-borne Diseases - EO4EViDence", Early Warning System for Mosquito-borne Diseases (EYWA) is a game changer in the domain of epidemics. It transforms scientific knowledge into decision-making and contributes significantly to combating and controlling the threat of mosquito-borne diseases.

The solution enhances mosquito surveillance and control at various spatio-temporal scales and in different climatic zones, and guides day to day prevention and mitigation actions. It significantly reduces the entomological risk and results in the aversion of human cases in thousands of villages where EYWA is employed.

The technological novelty of EYWA lies in the efficient handling of multiple data sources such as entomological, epidemiological, Earth Observation, crowd and ancillary geospatial data, along with dynamic and data driven models to generate knowledge on the mosquitoes' abundance and pathogens' transmission. Thanks to data provided by Copernicus satellites and Copernicus Core Services, EYWA reliably depicts the dynamics of mosquito habitats and breeding sites. The system capitalizes on European investments in Earth observation and cloud-based data repositories and capacities (i.e. DIAS, GEOSS, NextGEOSS).



EYWA was recently onboarded as a pilot to the [e-shape](#) community with the main objective to further augment the database of entomological data from non-European territories and evolve the suite of predictive models to include non-European areas where the climate conditions are very different to those found in Europe.

This accomplishment is a significant milestone and an exceptional example of the unlimited Earth Observation power and the societal benefits that can derive from harnessing space technology.

### EYWA partners

Partner	Country
National Observatory of Athens (NOA) – BEYOND Centre of Earth Observation Research and Satellite Remote Sensing	Greece
Ecodevelopment S.A. (ECODEV)	Greece

University of Patras, Physics Department, Laboratory of Atmospheric Physics (LapUp)	Greece
Dimitris Vallianatos (i.d.Com)	Greece
Aristotle University of Thessaloniki (AUTH)	Greece
University of Thessaly (UTH), Medical School, Laboratory of Hygiene and Epidemiology	Greece
Istituto Zooprofilattico Sperimentale delle Venezie (IZSVe)	Italy
Edmund Mach Foundation (FEM)	Italy
University of Trento (UNITN), Department of Mathematics	Italy
University of Novi Sad, Faculty of Agriculture, Laboratory for Medical and Veterinary Entomology (UNSFa)	Serbia
Scientific Veterinary Institute "Novi Sad" (NIV-NS)	Serbia
Kommunale Aktionsgemeinschaft zur Bekämpfung der Schnakenplage (KABS) e.V.	Germany
Bernhard Nocht Institute for Tropical Medicine (BNITM)	Germany
EID Méditerranée	France
University of Novi Sad, Faculty of Medicine (UNSFm)	Serbia

### Useful links:

- <https://www.youtube.com/watch?v=RNZFRNDSBVY>
- [https://ec.europa.eu/info/news/eic-horizon-prize-early-warning-epidemics-commission-awards-eu5-million-winning-project-2022-jan-17\\_en](https://ec.europa.eu/info/news/eic-horizon-prize-early-warning-epidemics-commission-awards-eu5-million-winning-project-2022-jan-17_en)
- <http://beyond-eocenter.eu/index.php/web-services/eywa>

### Contact us:

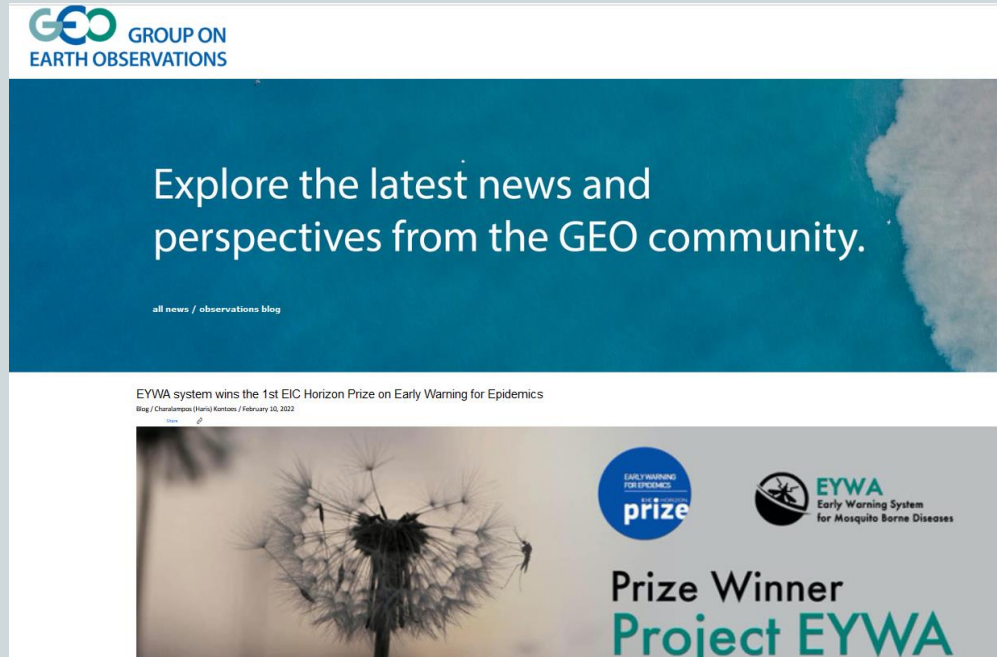
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# EYWA outreach after our distinction Prize International publicity

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[https://earthobservations.org/geo\\_blog\\_obs.php?id=545](https://earthobservations.org/geo_blog_obs.php?id=545)



<https://ec.europa.eu/research-and-innovation/en/horizon-magazine/observations-space-help-scientists-get-one-step-ahead-tiny-deadly-mosquito>

# EYWA outreach after our distinction Prize

## Useful links:

- ❑ <http://beyond-eocenter.eu/index.php/web-services/eywa>
- ❑ <https://www.youtube.com/watch?v=RNZFRNDSBVY>
- ❑ [https://ec.europa.eu/info/news/eic-horizon-prize-early-warning-epidemics-commission-awards-eu5-million-winning-project-2022-jan-17\\_en](https://ec.europa.eu/info/news/eic-horizon-prize-early-warning-epidemics-commission-awards-eu5-million-winning-project-2022-jan-17_en)
- ❑ <https://e-shape.eu/index.php/showcases/pilot-2-4-eywa-early-warning-system-for-mosquito-borne-diseases>
- ❑ <https://e-shape.eu/index.php/news-events/eywa-our-new-onboarded-pilot-wins-the-1st-eic-horizon-prize-on-early-warning-for-epidemics>

## Contact us:

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(Coordinator of EuroGEO Action Group  
for Epidemics | Lead Partner of EYWA)







**EYWA**  
Early Warning System  
for Mosquito Borne Diseases

Prize Winner  
**Project EYWA**



**Thank you!**

## 15 Partners | 5 Countries

### Greece

*National Observatory of Athens (NOA) – BEYOND  
Centre of EO Research & Satellite Remote Sensing  
Ecodevelopment S.A*

*University of Patras – Physics Department - Laboratory  
of Atmospheric Physics (LapUP)*

*Dimitrios Vallianatos (IDCOM)*

*Aristotle University of Thessaloniki*

*University of Thessaly, Medical School. Laboratory of  
Hygiene and Epidemiology*

### Italy

*Istituto Zooprofilattico Sperimentale delle Venezie  
(IZSVe)*

*Edmund Mach Foundation*

*University of Trento*

### Serbia

*University of “Novi Sad”, Faculty of Agriculture,  
Laboratory for Medical and Veterinary Entomology*

*Scientific Veterinary Institute “Novi Sad”*

*University of Novi Sad, Faculty of Medicine*

### Germany

*German Mosquito Control Association (KABS)*

*Bernhard Nocht Institute for Tropical Medicine*

### France

*EID Méditerranée*