

The MOOD Platform

A novel contribution to epidemiological surveillance

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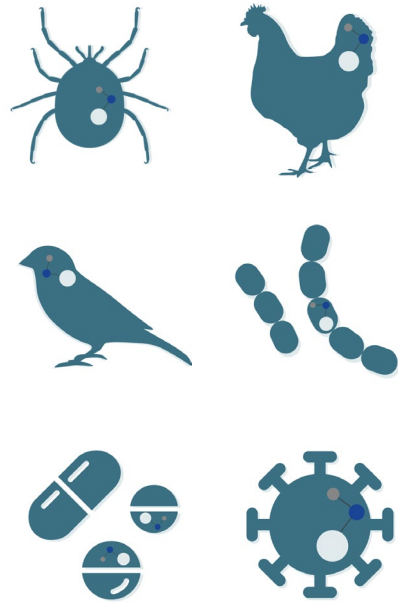


MOOD objectives

- Addressing challenges posed by **global, environmental, and climatic changes**
 - **Assessment and monitoring** of infectious disease threats
 - Monitoring **present and future** infectious diseases across Europe, including emerging diseases of unknown origins
 - Improving **early detection** of infectious diseases and antimicrobial resistance (AMR)
 - Implementing a **One Health** approach
-
- ➔ Development of an **Independent Epidemic Intelligence Platform**
 - ➔ Establishment of **International Non-Profit Association** to run platform

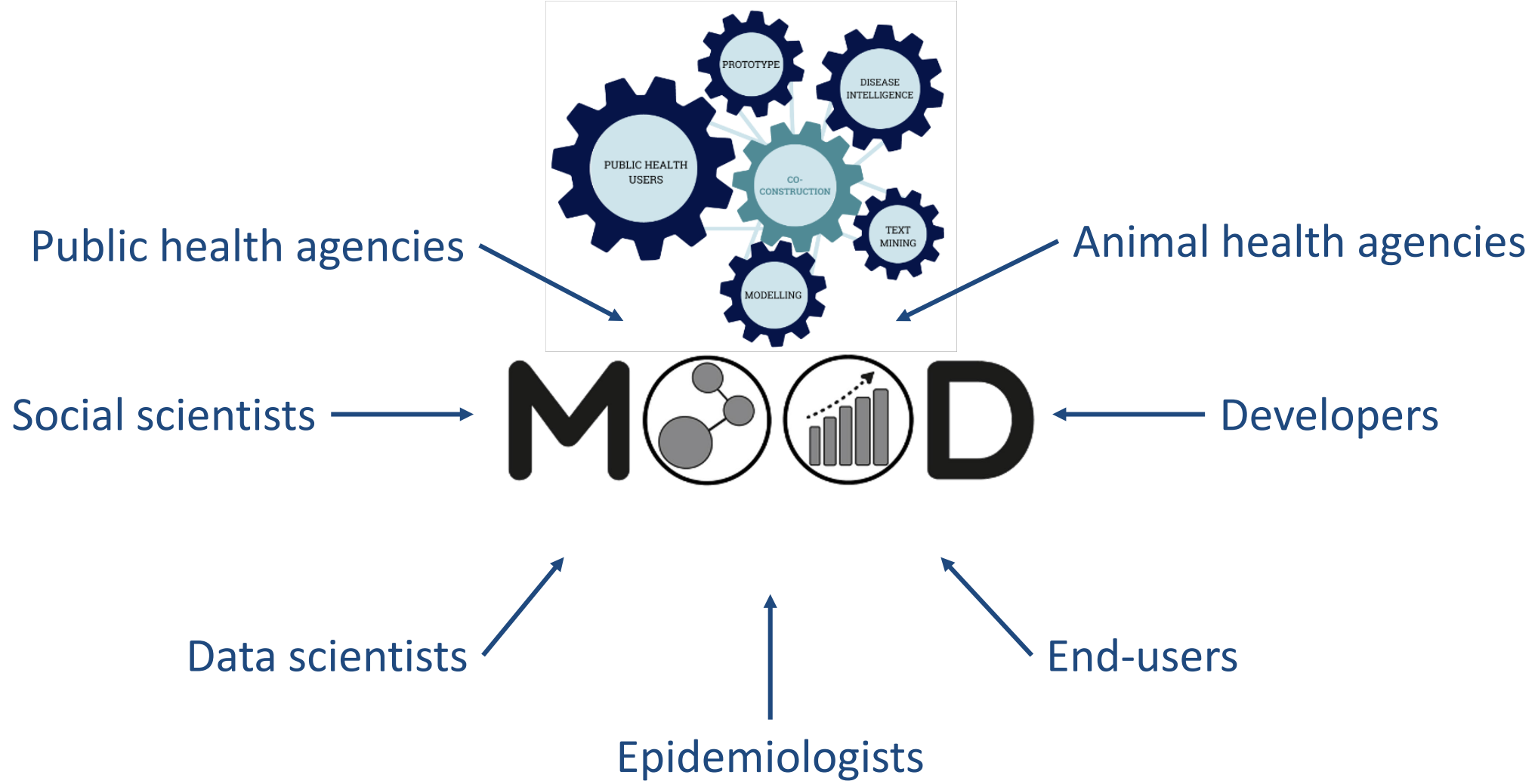
Sustainability!

MOOD Disease Use Cases

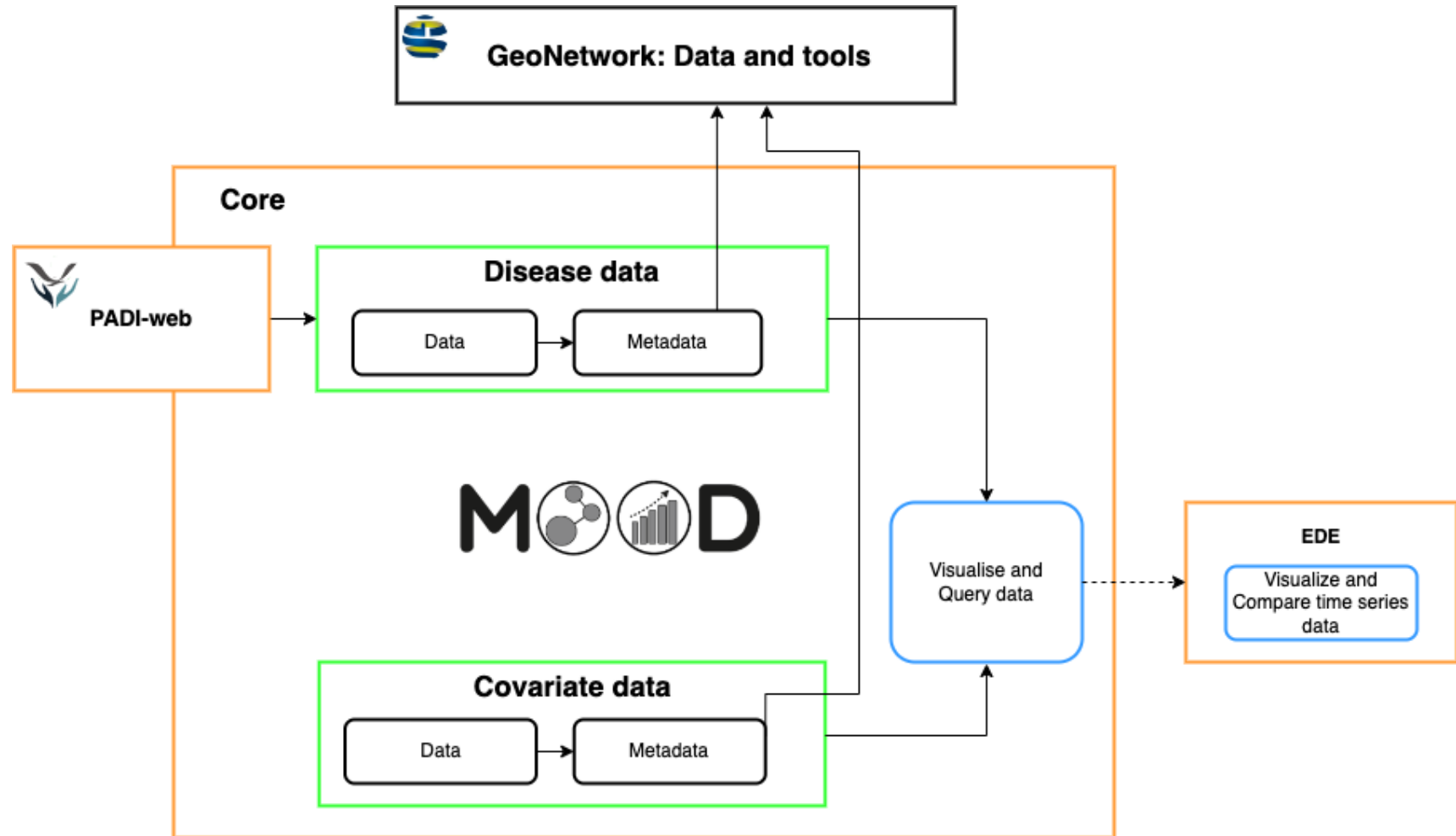


- Highly Pathogenic Avian Influenza (HPAI)
- Vector-borne diseases:
 - West Nile Fever (WNF)
 - Tick-borne encephalitis (TBE)
 - Dengue (DENV)
 - Chikungunya (CHIKV)
 - Crimean-Congo Hemorrhagic Fever (CCHF)
- Antimicrobial Resistance (AMR)
- Leptospirosis
- Covid-19

MOOD co-creation



The MOOD Platform architecture





What can you do with the MOOD platform?

- Access a large set of environmental and other co-variate data:
 - Visualize and configure
 - Compare and query data layers
 - Create and query time series graphs
 - Query, extraction and download data (raster, polygons, CSV)
- Query vector and host suitability model outputs
- Query disease risk maps and prediction model outputs
- Access PADI-web, an integrated disease database based on event-based surveillance (EBS) data and other public disease data sources
- Import your own disease data sets
- Extract data to build your own models
- Access advanced tools: text-mining, normalization, risk-mapping, ...



Co-variate datasets

- Administrative layers:
 - Europe, countries
 - NUTS 0-1-2-3
- Demography and socio-economics:
 - Human population
- Environmental data:
 - Altitude (DEM)
 - Daylight
 - Hydrography
 - Land cover / land use
 - Precipitation
 - Temperature (Land surface, Air, Day, Night)
 - Vegetation indices (NDVI, EVI)

Administrative data: countries and NUTS

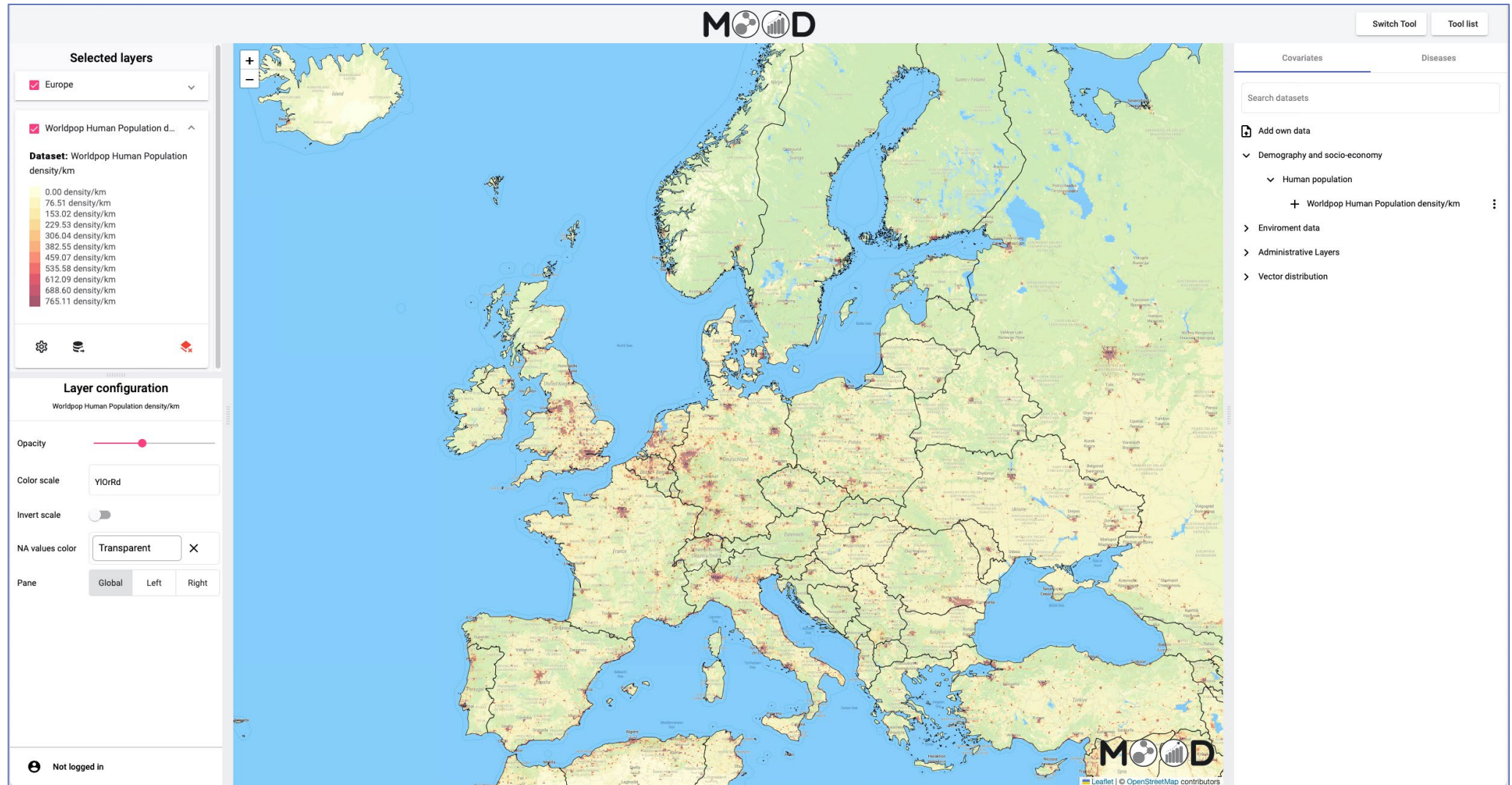
The screenshot displays the MODO web application interface. The central map shows Europe with administrative layers. The left sidebar contains the following panels:

- Selected layers:** Europe (checked), France - NUTS3 (checked). Dataset: France - NUTS3.
- Layer configuration (France - NUTS3):**
 - Border opacity: slider at 100%
 - Border width: slider at 2px
 - Border color: #3388ff
 - Fill opacity: slider at 100%
 - Fill color: #3388ff
 - Pane: Global (selected), Left, Right
 - Property: Data property
 - Color scale: Color scale
 - Invert scale: toggle off
 - Minimum: Minimum value
 - Maximum: Maximum value
 - NA values color: Transparent
- Not logged in**

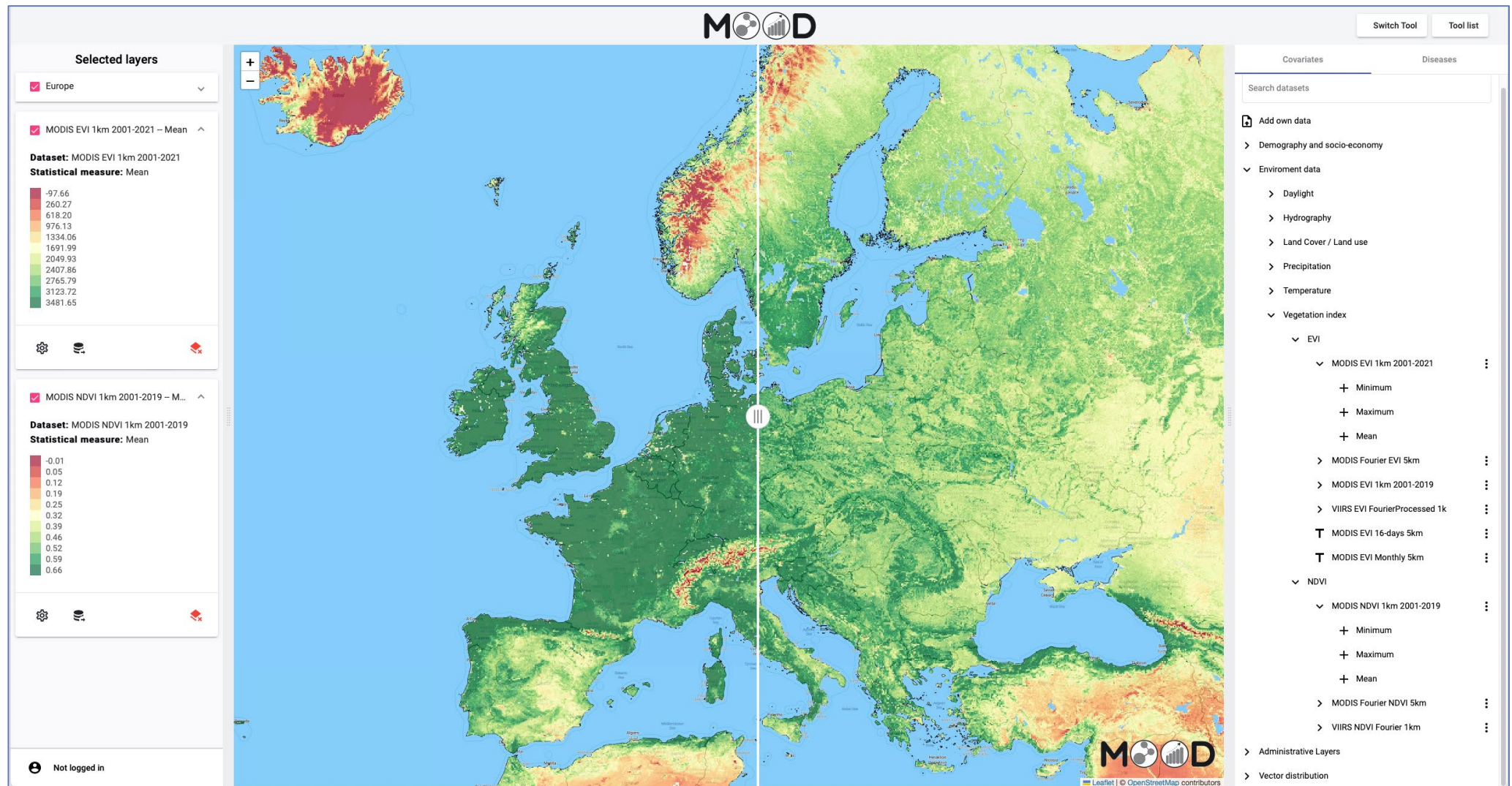
The right sidebar contains the following panels:

- Switch Tool** and **Tool list** buttons.
- Covariates** and **Diseases** tabs.
- Search datasets** input field.
- Add own data** button.
- Demography and socio-economy** (expanded)
- Environment data** (expanded)
- Administrative Layers** (expanded):
 - Eurostat** (expanded):
 - Europe region (+)
 - Albania (>)
 - Austria (>)
 - Belgium (>)
 - Bulgaria (>)
 - Croatia (>)
 - Cyprus (>)
 - Czechia (>)
 - Denmark (>)
 - Estonia (>)
 - Finland (>)
 - France (expanded):
 - NUTS0 (+)
 - NUTS1 (+)
 - NUTS2 (+)
 - NUTS3 (+)
 - Germany (>)
 - Greece (>)
 - Hungary (>)
 - Iceland (>)
 - Ireland (>)
 - Italy (>)
 - Latvia (>)

Demographic data: Human population



Vegetation: e.g. comparison NDVI-EVI



Temperature: e.g. time-series LST night

MOD

Switch Tool Tool list

Covariates Diseases

Search datasets

Add own data

- Demography and socio-economy
- Environment data
 - Daylight
 - Hydrography
 - Land Cover / Land use
 - Precipitation
 - Temperature
 - Air temperature (AT)
 - Land surface temperature (LST)
 - ERA5 LST Average Weekly, Enhanced to 1km
 - ERA5 LST Minimum Weekly, Enhanced to 1km
 - VIIRS LST Daytime 1km 2012-2020
 - MODIS LST Nighttime 1km 2001-2021
 - ERA5 LST Maximum Weekly, Enhanced to 1km
 - MODIS LST Daytime Fourier 5km
 - MODIS LST Daytime Daily 5km
 - MODIS LST Nighttime Daily 5km
 - MODIS LST Nighttime Fourier 5km
 - MODIS LST Daytime Decadal 5km
 - MODIS LST Daytime 1km 2001-2019
 - MODIS LST Nighttime Decadal 5km
 - MODIS LST Nighttime 1km 2001-2019
 - MODIS LST Daytime Monthly 5km
 - MODIS LST Nighttime Monthly 5km
 - Vegetation index
 - Administrative Layers
 - Master distribution

Selected layers

- Europe
- MODIS LST Nighttime Decadal 5k...
 - Dataset: MODIS LST Nighttime Decadal 5 km
 - Period: 01/01/2010 - 09/01/2010
 - Legend:
 - 51.65 °C
 - 40.85 °C
 - 30.05 °C
 - 19.25 °C
 - 8.45 °C
 - 2.35 °C
 - 13.15 °C
 - 23.95 °C
 - 34.75 °C
 - 45.55 °C
 - 56.35 °C
- MODIS LST Nighttime Decadal 5k...
 - Dataset: MODIS LST Nighttime Decadal 5 km
 - Period: 27/12/2022 - 04/01/2023
 - Legend:
 - 51.65 °C
 - 40.85 °C
 - 30.05 °C
 - 19.25 °C
 - 8.45 °C
 - 2.35 °C
 - 13.15 °C
 - 23.95 °C
 - 34.75 °C
 - 45.55 °C
 - 56.35 °C
- Belgium - NUTS3

Not logged in

Info Data

Key	Value
id	BE342
na	Arr. Bastogne

Timeseries

Choose a start date: 01/01/2018

Choose an end date: 12/27/2022

Legend

- MODIS LST Nighttime Decadal 5km (Max)
- MODIS LST Nighttime Decadal 5km (Mean)
- MODIS LST Nighttime Decadal 5km (Median)
- MODIS LST Nighttime Decadal 5km (Min)

mm/day

Fluor(temperature)(°C)

2020-12-26

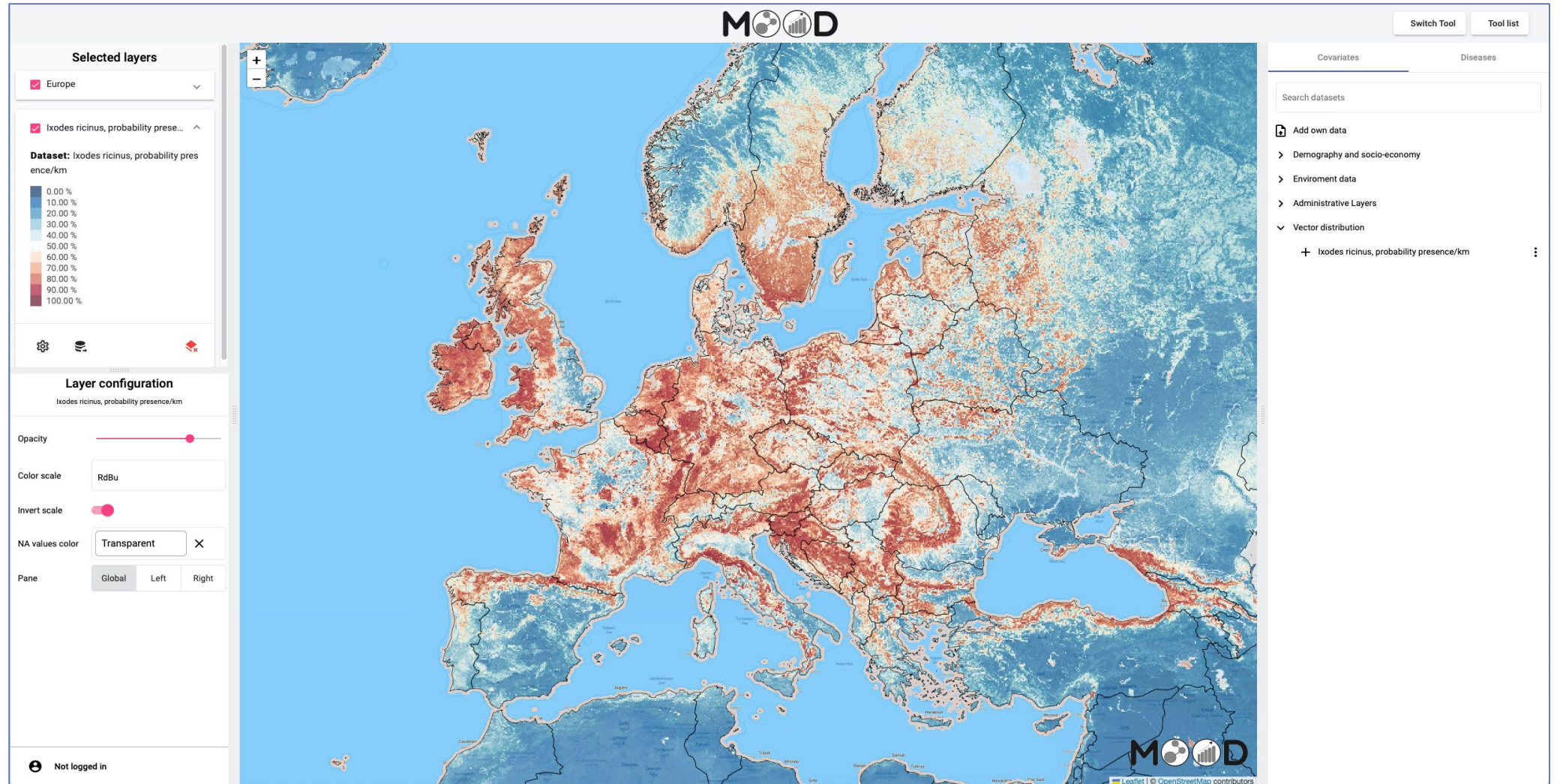
- MODIS LST Nighttime Decadal 5km (Min) -15.21 °C
- MODIS LST Nighttime Decadal 5km (Max) -6.23 °C
- MODIS LST Nighttime Decadal 5km (Mean) -9.75 °C
- MODIS LST Nighttime Decadal 5km (Median) -9.31 °C

July 2019 July 2020 July 2021 July 2022 July

Vector & host suitability model outputs

- Vector suitability models:
 - Ticks: *Ixodes ricinus*, *I. persulcatus*, *Hyalomma marginatum*, *H. lusitanicum*
 - Mosquitoes: *Aedes albopictus*, *Ae. aegypti*, *Culex pipiens*, *Cx. torrentium*, *Cx. Perexiguus*, *Cx. Modestus*
- Host suitability models:
 - Rodents: *Apodemus flavicollis*, *Myodes glareolus*
 - Hares: *Lepus europeus*, *L. timidus*
 - Ruminants: *Cervus elephus*, *Capreolus capreolus*, *Dama dama*
 - Birds: 18 species linked to WNF and 10 species linked to HPAI

Vector suitability: *Ixodes ricinus*

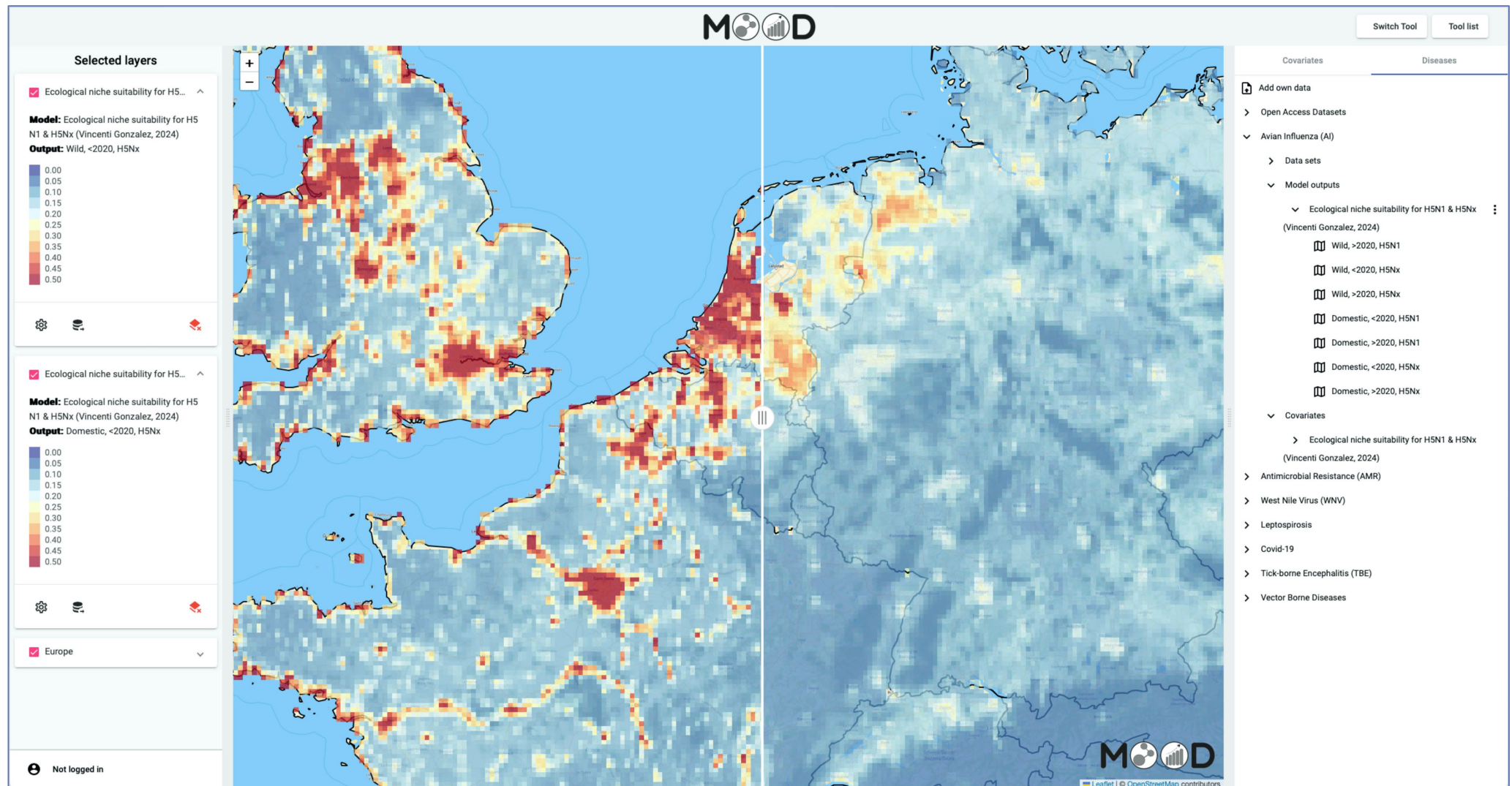




MOOD Disease Data

- Links to Open Access disease data sets:
 - Empres-I, PADI-web, (TESSy, WAHIS)
- MOOD disease model outputs:
 - Highly Pathogenic Avian Influenza (HPAI)
 - West Nile Fever (WNF)
 - Tick-borne encephalitis (TBE)
 - Dengue (DENV)
 - Chikungunya (CHIKV)
 - Crimean-Congo Hemorrhagic Fever (CCHF)
 - Antimicrobial Resistance (AMR)
 - Leptospirosis
 - Covid-19

Diseases: HPAI suitability wild vs. domestic





Work with disease data from other sources

- Data sources:
 - Own data
 - Indicator-based surveillance data (IBS): EMPRES-i (TESSy, WAHIS)
 - Event-based surveillance data (EBS): PADI-Web
- Download external data via side-menu MOOD platform
 - e.g. HPAI data from EMPRES-i
- Import disease outbreak data in MOOD platform
- Add available disease model if applicable
 - e.g. suitability for H5Nx in wild bird populations
- Add co-variate data as required for analysis
 - e.g. temperature, precipitation, vegetation index
- Extract co-variate data for each outbreak


Import and extract data

The screenshot displays the MOOD web application interface. At the top center is the MOOD logo, which includes a globe and a bar chart. The main area is a map of Europe with a heatmap overlay and several yellow circular markers containing numbers. The left sidebar, titled "Selected layers", contains a list of data layers with checkboxes: ERA5 Monthly Precipitation Four..., VIIRS LST Daytime 1km 2012-202..., MODIS NDVI 1km 2001-2019 - M..., Ecological niche suitability for H5..., Europe, and HPA_EMPRES. The right sidebar has tabs for "Covariates" and "Diseases", a search box for datasets, and a section for "Add own data" with expandable categories: Demography and socio-economy, Environment data, Administrative Layers, and Vector distribution. At the bottom left, it says "Not logged in". At the bottom right, there is a MOOD logo and a small attribution for "Leaflet | © OpenStreetMap contributors".

Import and extract data

Selected layers

- ERA5 Monthly Precipitation Four...
- VIIRS LST Daytime 1km 2012-202...
- MODIS NDVI 1km 2001-2019 - M...
- Ecological niche suitability for H5...
- Europe
- HPA1_EMPRES



Switch Tool Tool list

Covariates Diseases

Search datasets

B3

Influenza - Avian

	A	B	C	D	E	F	G	H	I	J	M	T	U	V	W	X
1	Event.ID	Disease	Serotype	Region	Subregion	Country	Admin.level.1	Locality	Latitude	Longitude	Animal.type	Suitability	Rainfall	NDVI	LST_Day	
90	352002	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Hungary	Bacs-kiskun	Kiskunhalas	46.4164	19.437296	Domestic	0.21	56	0.51	20.03	
91	352032	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Poland	Mazowieckie	GA KI	52.250833	22.008333	Wild	0.16	60	0.47	12.35	
92	352033	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Poland	Malopolske	ZDARZEC	50.131277	20.784833	Wild	0.09	65	0.48	14.67	
93	352034	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Poland	Opolskie	MALERZOWICE	50.569982	17.48768	Wild	0.14	61	0.45	14.57	
94	352035	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Poland	Slaskie	ROSZOK/1W	49.96955	18.298502	Wild	0.33	65	0.44	13.65	
95	352036	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Poland	Slaskie	BABICE	50.13633	18.27735	Wild	0.2	no_data	no_data	no_data	
96	352037	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Czech Republic	Vychodocesky	BOHUMILE	50.10743	15.85629	Wild	0.19	62	0.5	14.95	
97	352038	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Czech Republic	Severomoravsky	TROUBKY	49.41883	17.32412	Wild	0.42	59	0.4	13.79	
98	352039	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Czech Republic	Severocesky	RAICE	50.4495	14.33285	Wild	0.42	51	0.45	14.09	
99	352040	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Austria	Wien	WIEN	48.19819	16.46783	Wild	0.61	58	0.48	15.81	
100	352041	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Austria	Oberosterreich	RIED IM INNKREIS	48.308363	13.303894	Wild	0.24	90	no_data	no_data	
101	352042	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Austria	Oberosterreich	RIED IM INNKREIS	48.283656	13.59262	Wild	0.16	88	0.56	14.23	
102	352043	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Austria	Wien	WIEN	48.173527	16.462278	Wild	0.61	58	0.28	17.13	
103	352044	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Austria	Niederosterreich	BRUCK AN DER LEITHA	48.176245	16.948769	Wild	0.32	56	0.49	15.47	
104	352215	Influenza - Avian	H5N1 HPAI	Europe	Northern Europe	U.K. of Great Britain an	Wales	Montgomery Powys	52.58	-3.24	Domestic	0.11	78	0.74	13.17	
105	352248	Influenza - Avian	H5N1 HPAI	Europe	Northern Europe	U.K. of Great Britain an	Wales	Montgomery Powys	52.58	-3.24	Domestic	0.11	78	0.74	13.17	
106	352283	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Mecklenburg-Vorpommern	BERGEN AUF RYUGEN	54.41	13.52	Wild	0.41	68	0.57	11.09	
107	352284	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Mecklenburg-Vorpommern	BOIENSDORF	54	11.54	Wild	0.19	0	0.54	12.17	
108	352346	Influenza - Avian	HPAI	Europe	Western Europe	Belgium	Vlaams Gewest	Deinze	50.97731	3.5745	Wild	0.57	68	0.62	16.23	
109	352347	Influenza - Avian	HPAI	Europe	Western Europe	Belgium	Vlaams Gewest	Gavere	50.91871	3.69068	Wild	0.23	67	0.64	15.55	
110	352348	Influenza - Avian	H5N1 HPAI	Europe	Eastern Europe	Czech Republic	Severomoravsky	Rychvald	49.85089	18.40207	Domestic	0.26	71	0.52	14.99	
111	352350	Influenza - Avian	H5N1 HPAI	Europe	Northern Europe	Lithuania	Alytaus	National park	54.463596	23.634667	Wild	0.2	no_data	no_data	no_data	
112	352351	Influenza - Avian	H5N1 HPAI	Europe	Northern Europe	Lithuania	Marijampoles	Marijampoles city	54.573496	23.373105	Wild	0.31	60	0.36	12.83	
113	352467	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Bayern	KIRCHROTH	48.92	12.51	Wild	0.27	75	0.47	14.43	
114	352468	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Bayern	NEU/NTTING	48.24	12.68	Wild	0.19	87	0.44	15.85	
115	352469	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Bayern	WEIDING	49.25	12.77	Wild	0.14	80	0.63	13.89	
116	352470	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Bayern	CHAM	49.22	12.69	Wild	0.2	80	0.56	15.17	
117	352471	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Bayern	NEU-ULM	48.36	10.04	Wild	0.31	79	0.57	15.11	
118	352472	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Bayern	LINDAU (BODENSEE)	47.551	9.6898	Wild	0.52	no_data	no_data	no_data	
119	352474	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Bayern	SCHWANDORF	49.29	12.1	Wild	0.14	66	no_data	no_data	
120	352475	Influenza - Avian	H5N1 HPAI	Europe	Western Europe	Germany	Bayern	STEINBERG	49.288	12.161	Wild	0.25	66	0.54	12.91	
121	352478	Influenza - Avian	H5N1 HPAI	Europe	Southern Europe	Italy	Veneto	Trecenta	45.042	11.462	Wild	0.18	81	0.52	20.01	
122	352479	Influenza - Avian	H5N1 HPAI	Europe	Southern Europe	Italy	Veneto	Verona	45.52	11.07	Wild	0.14	99	0.66	18.57	

MOOD

Leaflet | OpenStreetMap contributors

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MOOD_export_20240604_1319_adap

MOOD GeoNetwork

Catalogue of additional resources developed by MOOD partners

PADI-web	Platform for Automated extraction of Disease Information from the web
Covid-19 tweets	Spatial Opinion Mining of COVID-19 Tweets through H-TFIDF and other features
Classification of news articles	Avian Influenza relevant articles and irrelevant articles classification
GeospaCy	Relative spatial information extraction and its geographical referencing
arbocartoR	Modeling the risk of emergence of aedes-borne diseases - Shiny interface
epiCurve	Model the force of infection in the case of seasonal vector-borne pathogens
Gazetteer Access Tool	MOOD data normalisation tool
EpiDCA	Links epidemiological data from EBS systems with environmental risk factors to classify and detect outbreak events in textual data
Different source disease data linking	Framework to compare official and unofficial disease data
GeoNLPlify	Generate new labelled data for text classification related to crises using Language Models.
SNEToolkit	Spatial named entity disambiguation toolkit
MOOD Press Tweets Collector	Python script designed to gather tweets
Extension of actinia for COG import	Cloud based geoprocessing platform
EpiNorm	MOOD structured data normalisation tool
EpidBioBERT	BioSurveillance Document Classifier
EpidBioELECTRA	Enhanced and Explainable BioSurveillance Document classifier

Save the date!

M D FINAL WORKSHOP

Wed October 23rd – Thu October 24th 2024
Institute of Tropical Medicine (Antwerp) + On-line

Final testing and launch of the platform



<https://mood-h2020.eu/about-mood/>

Thank you for your questions!