



Analysis of spatial data and communication of results

**Hinrich Paulsen
(mundialis & terrestris)**

Hinrich Paulsen

Co-Founder of terrestris and mundialis

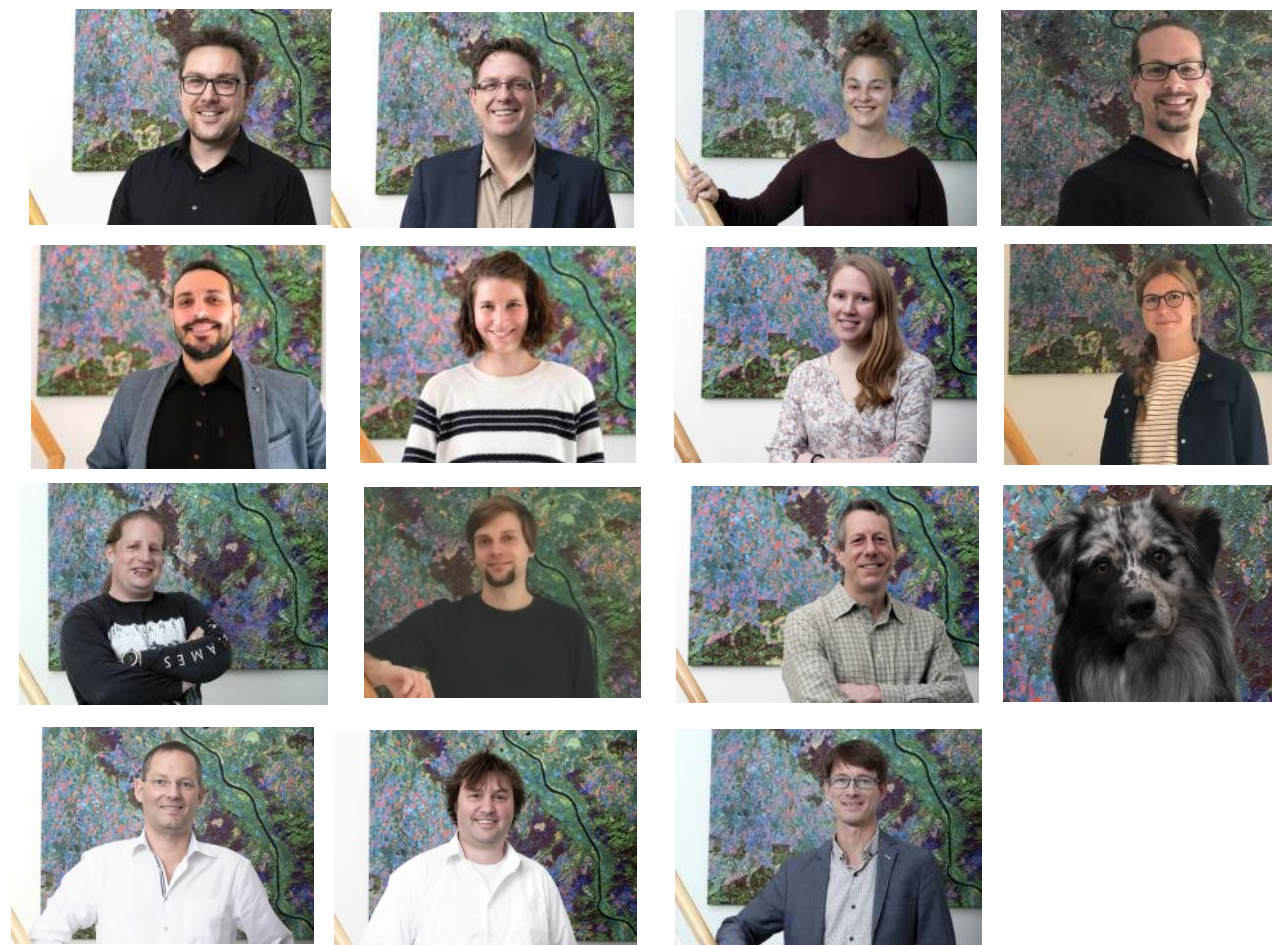


About terrestris



- **Founded in 2002**, located in Bonn, Germany
- 22 experts
 - Focus on Spatial Data Infrastructures and Geoportals
 - Open Source development
- Customers (excerpt): Federal Agency for Waterworks, *Federal Agency for Radiation Protection*, *German Telekom*, *German Railway*, *Van Oord Maritime Engineers*, *Province of Rhineland Palatinate*, *Cities of Aachen*, *Koblenz and Goettingen*

About mundialis



- **Founded in 2015**, located in Bonn, Germany
- 14 experts + 1 specialised in sleeping
 - Focus on Earth Observation and geospatial data analytics
 - Open Source and cloud development
- Customers (excerpt): *ESA, DLR, WHO, Deutsche Telekom, GLZ, Norwegian Env. Agency, Deutsche Bahn, German Archeological Institute*
- Research projects: numerous European (H2020, CEF) and nationally funded projects
<https://www.mundialis.de>

mundialis expertise

Neteler et al. International Journal of Health Geographics 2011, 10:49
<http://www.ij-healthgeographics.com/content/10/1/49>



RESEARCH

Open Access

Terra and Aqua satellites track tiger mosquito invasion: modelling the potential distribution of *Aedes albopictus* in north-eastern Italy

Markus Neteler^{1*}, David Roiz^{2†}, Duccio Rocchini¹, Cristina Castellani¹ and Annapaola Rizzoli¹

Remote Sens. 2010, 2, 333-351; doi:10.3390/rs1020333

OPEN ACCESS

Remote Sensing

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Article

Estimating Daily Land Surface Temperatures in Mountainous Environments by Reconstructed MODIS LST Data

Markus Neteler

IASMA
Edmund

OPEN ACCESS Freely available online

PLOS one

Climatic Factors Driving Invasion of the Tiger Mosquito (*Aedes albopictus*) into New Areas of Trentino, Northern Italy

David Roiz^{1,2,*}, Markus Neteler^{1*}, Cristina Castellani¹, Daniele Arnoldi¹, Annapaola Rizzoli¹

¹Department of Biodiversity and Molecular Ecology, Fondazione Edmund Mach, Research and Innovation Centre, S. Michele all'Adige, Italy; ²Wetland Ecology Department, Doñana Biological Station (CSIC), Seville, Spain

Abstract

Background: The tiger mosquito (*Aedes albopictus*), vector of several emerging diseases, is expanding into more northerly latitudes as well as into higher altitudes in northern Italy. Changes in the pattern of distribution of the tiger mosquito may affect the potential spread of infectious diseases transmitted by this species in Europe. Therefore, predicting suitable areas of future establishment and spread is essential for planning early prevention and control strategies.

Methodology/Principal Findings: To identify the areas currently most suitable for the occurrence of the tiger mosquito in the Province of Trento, we combined field entomological observations with analyses of satellite temperature data (MODIS Land Surface Temperature: LST) and human population data. We determine threshold conditions for the survival of overwintering eggs and for adult survival using both January mean temperatures and annual mean temperatures. We show that the 0°C LST threshold for January mean temperatures and the 11°C threshold for annual mean temperatures provide the best predictors for identifying the areas that could potentially support populations of this mosquito. In fact, human population density and distance to human settlements appear to be less important variables affecting mosquito distribution in this area. Finally, we evaluated the future establishment and spread of this species in relation to predicted climate warming by considering the A2 scenario for 2050 statistically downscaled at regional level in which winter and annual temperatures increase by 1.5 and 1°C, respectively.

REVIEW ARTICLES

Lyme borreliosis in Europe

A Rizzoli (annapaola.rizzoli@iasma.it)^{1,2*}, M C Hauke^{1,3}, G Carpi¹, G I Vourc'h¹, M Neteler¹, R Rosà¹

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² Both authors contributed equally to this work.

³ Unité d'Epidémiologie Animale, Institut National de la Recherche Agronomique (INRA), St Genès Champanelle, France

Citation style for this article:

Rizzoli A, Hauke MC, Carpi G, Vourc'h GI, Neteler M, Rosà R. Lyme borreliosis in Europe. Euro Surveill. 2011;16(27):pii=19906. Available online: <http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19906>

Article published on 7 July 2011

Open Access

Feature Paper

Article

A New Fully Gap-Free Time Series of Land Surface Temperature from MODIS LST Data

by  Markus Metz¹,  Verónica Andreo²  and  Markus Neteler^{1,*} 

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Remote Sens. 2017, 9(12), 1333; <https://doi.org/10.3390/rs9121333>

OPEN ACCESS Freely available online

Is Switzerland Suitable for the Invasion of *Aedes albopictus*?

Markus Neteler^{1*}, Markus Metz¹, Duccio Rocchini¹, Annapaola Rizzoli¹, Eleonora Flacio², Luca Engeler², Valeria Guidi³, Peter Lüthy^{2,4}, Mauro Tonolla^{2,3,5}

¹ Department of Biodiversity and Molecular Ecology, Research and Innovation Centre, Fondazione Edmund Mach, S. Michele all'Adige (TN), Italy; ² Mosquito Working Group, Department of Health, Canton Tessin, Bellinzona, Switzerland; ³ Regional Laboratory for Biosafety, Institute of Microbiology, Canton Tessin, Bellinzona, Switzerland; ⁴ Institute of Microbiology, ETH Zurich, Zurich, Switzerland; ⁵ Microbial Ecology Group, Microbiology Unit, Plant Biology Department, University of Geneva, Geneva, Switzerland

zenodo

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Communities

February 18, 2019

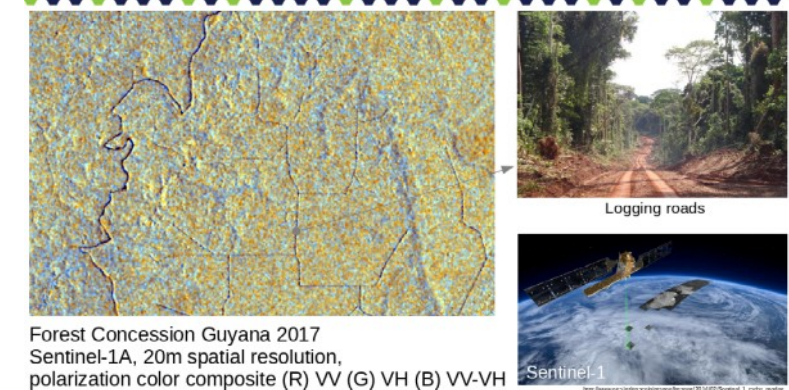
Conference paper

Open Access

Actinia: cloud based geoprocessing

 Neteler, Markus; Gebbert, Sören; Tawaliika, Carmen; Bettge, Anika; Benelcadi, Hajar;  Löw, Fabian; Adams, Till; Paulsen,

Forest Concession Monitoring Sentinel-1 RADAR data in tropical areas



Data and software products by mundialis

Data products

- **LST**, a dataset of seamless and gap-free daily European Land Surface temperature maps – <https://www.mundialis.de/lst/>
- **Landuse** maps – Change detection (Sentinel-2; aerial images)
- **Nightlight data**, visualization and analysis incl. zonal statistics – <https://nightlight.mundialis.de/>
- **Maps mundialis** – <https://maps.mundialis.de/>
- **Flood hazard** (Sendai framework)

Software products

- **actinia**: cloud based geoprocessing engine with REST API – <https://actinia.mundialis.de/>
- **QGIS** plugin development
- **GRASS GIS** software development – <https://grass.osgeo.org/>



From raw to Analysis Ready Data (ARD)

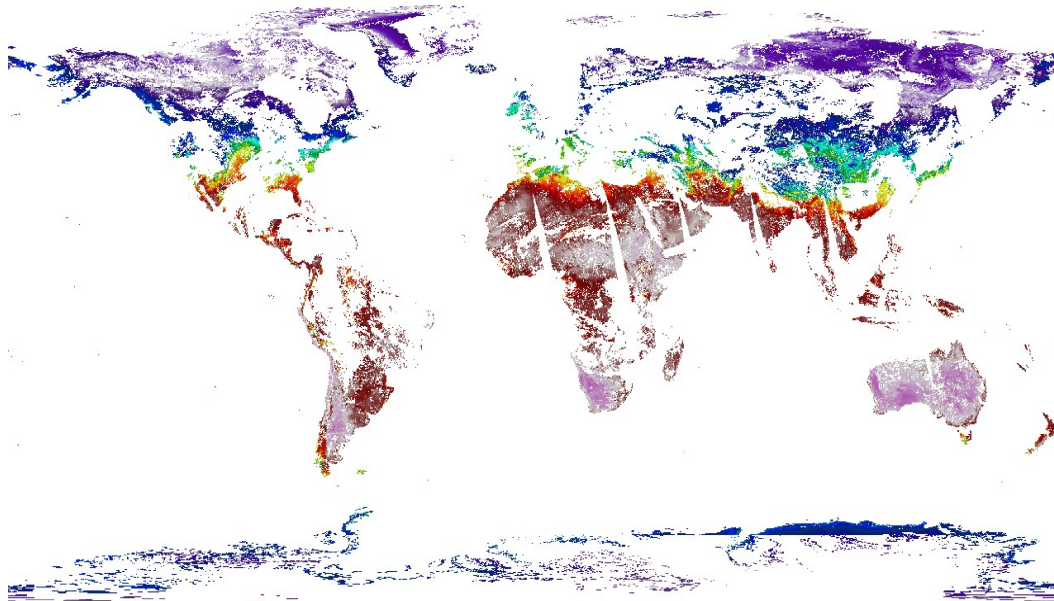
The majority of available data are not analysis-ready

- In mundialis, we develop “data interfaces” to many providers
- Data projection, pixel geometry, consistency, units, metadata, etc. are checked and corrected as needed
- For time series, we apply gap-filling
 - This requires research and analytical capabilities as well as automated processing
- From ARD, we then generate derived products (e.g., aggregated data)

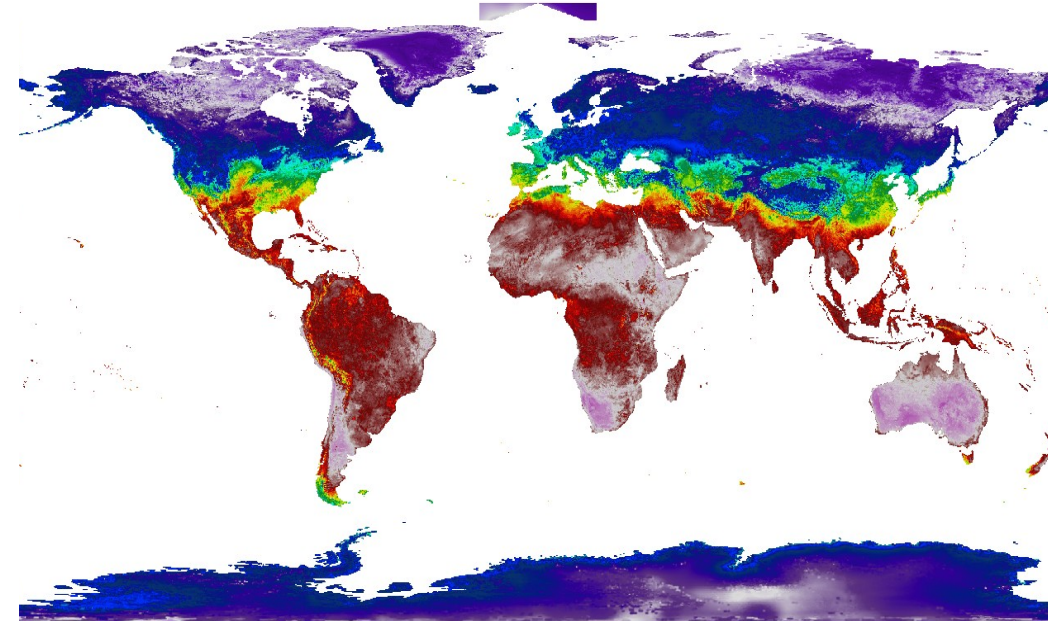
Time series reconstruction: Temperature

Example: MODIS Land Surface Temperature

raw data



gap-filled data

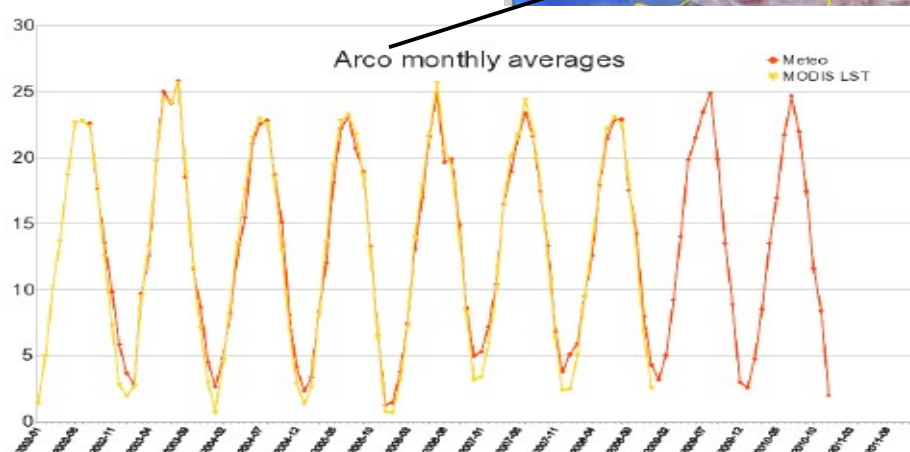
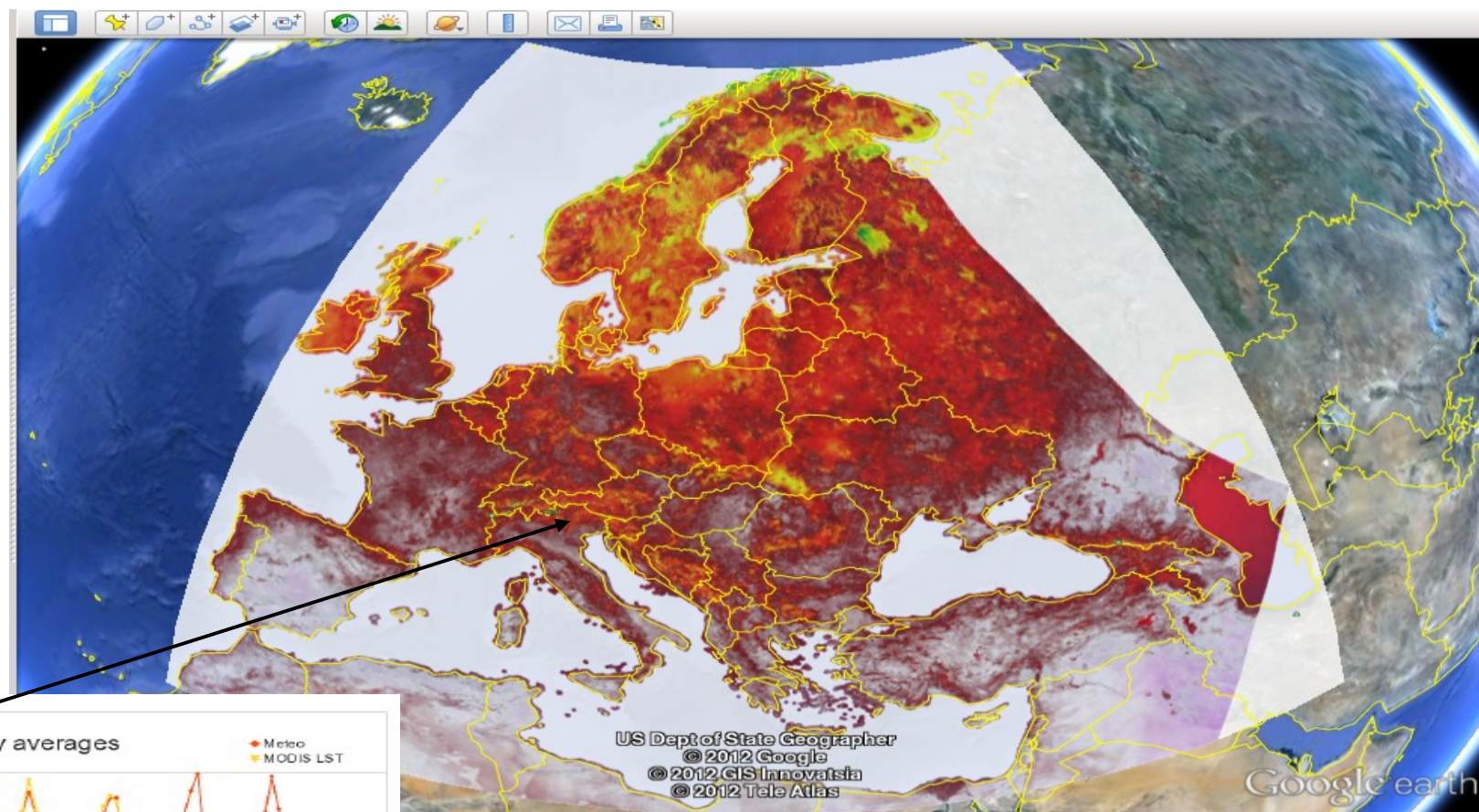


temporal + spatial processing

MODIS LST daily time series



Pixel-wise time series
(meteo stations versus
MODIS LST maps):



European LST mosaic
... usable as **virtual
meteorological stations**
for temperature

250m resolution,
4 maps per day,
data since 2000

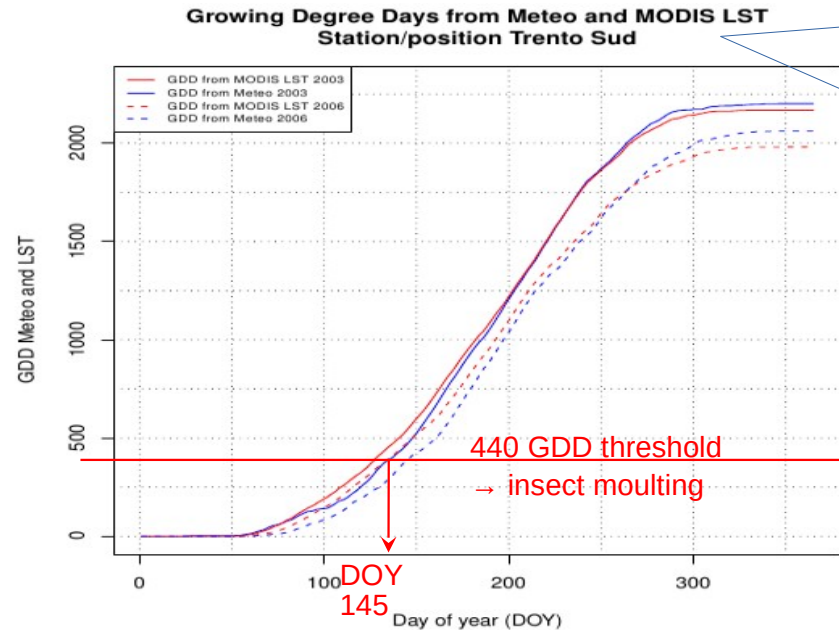
Metz, Andrea & Neteler, 2017 [[DOI](#)]

Neteler, M., 2010: Estimating daily LST...
Remote Sensing 2(1), 333-351 [[PDF](#)]

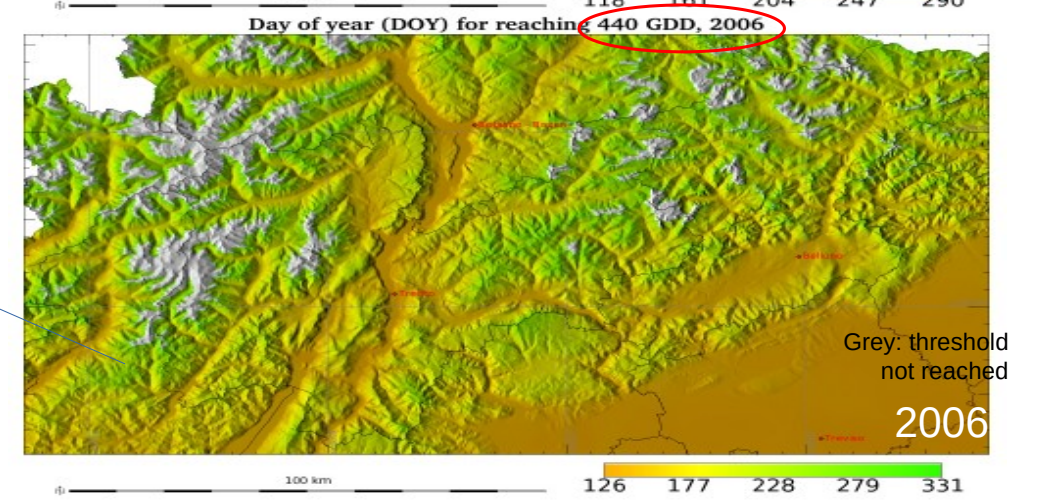
Land Surface Temperatures from Space

GDD as a heuristic tool in phenology

- Heat accumulation above the threshold value for predicting the development rates of plants and animals (flowering, insect development or time of plant maturity).
- Example: Determining the anniversary (DOY) when 440 GDD was reached in 2003 and 2006



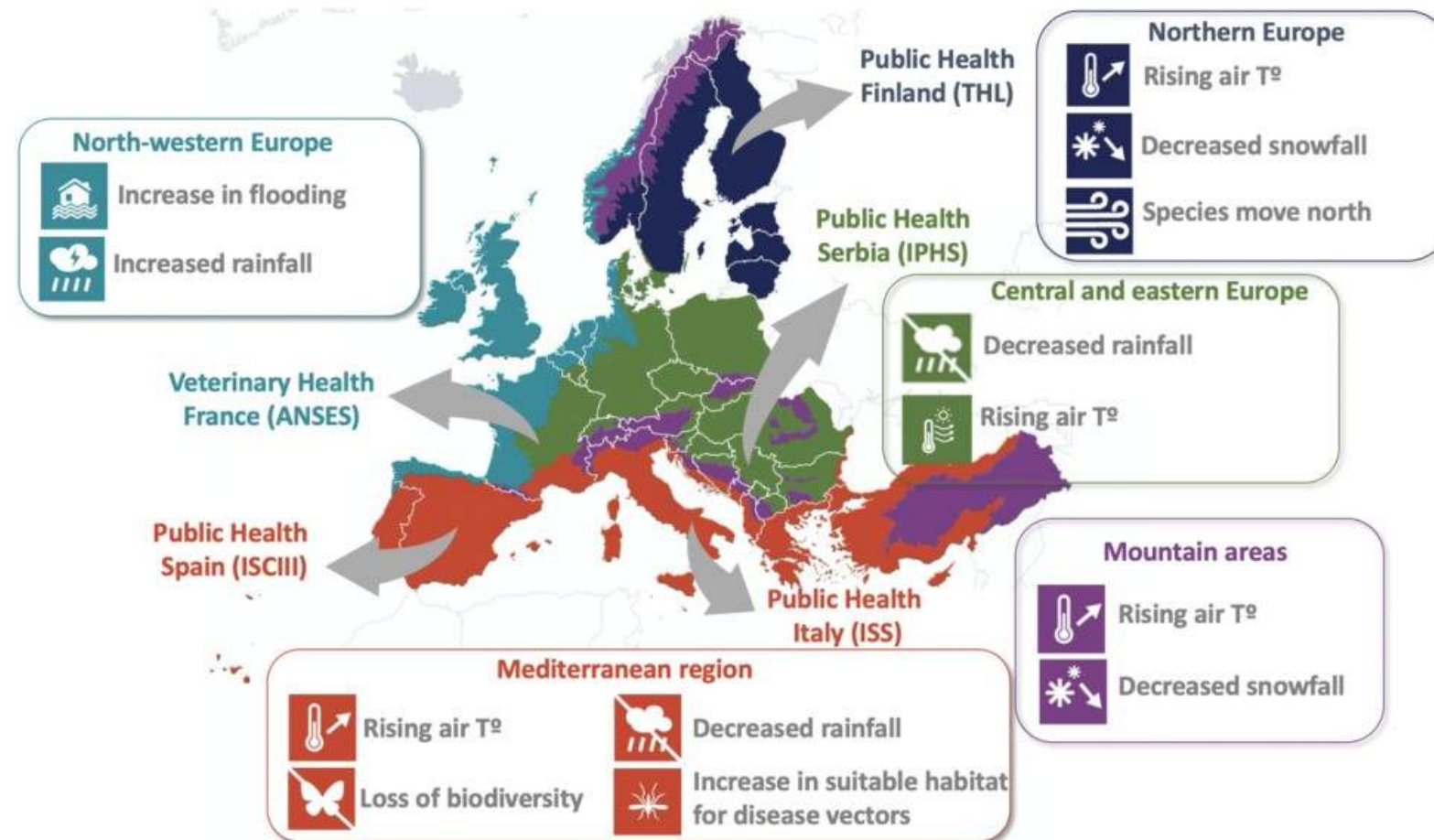
Drosophila suzukii



Data: EuroLST

MOOD H2020 EU project:

MOnitoring Outbreak events for Disease surveillance in a data science context



MOOD H2020 EU project:

MOonitoring Outbreak events for Disease surveillance in a data science context



Diseases and vectors

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

■ Viruses

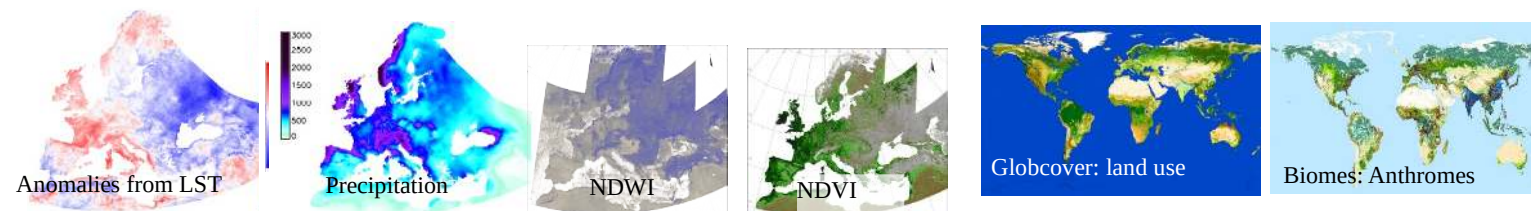
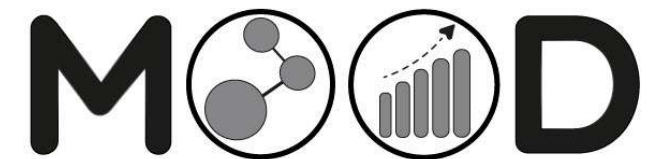
- Influenza: Seasonal Influenza + Avian Influenza
- Tick-Borne Encephalitis (TBE) virus
- Chikungunya virus | mosquito-borne
- Dengue virus | mosquito-borne
- Zika virus | mosquito-borne
- West Nile Fever (WNV) flavivirus | mosquito-borne
- Usutu flavivirus | mosquito-borne
- COVID-19 virus | mode of transmission

■ Bacteria

- Tularaemia (rabbit fever) - bacterium Francisella tularensis | spread by ticks, deer flies, or contact with infected animals
- Leptospirosis - bacterium Leptospira | mode of transmission
- Lyme - bacterium Borrelia | tick-borne

■ AMR - Antimicrobial resistance

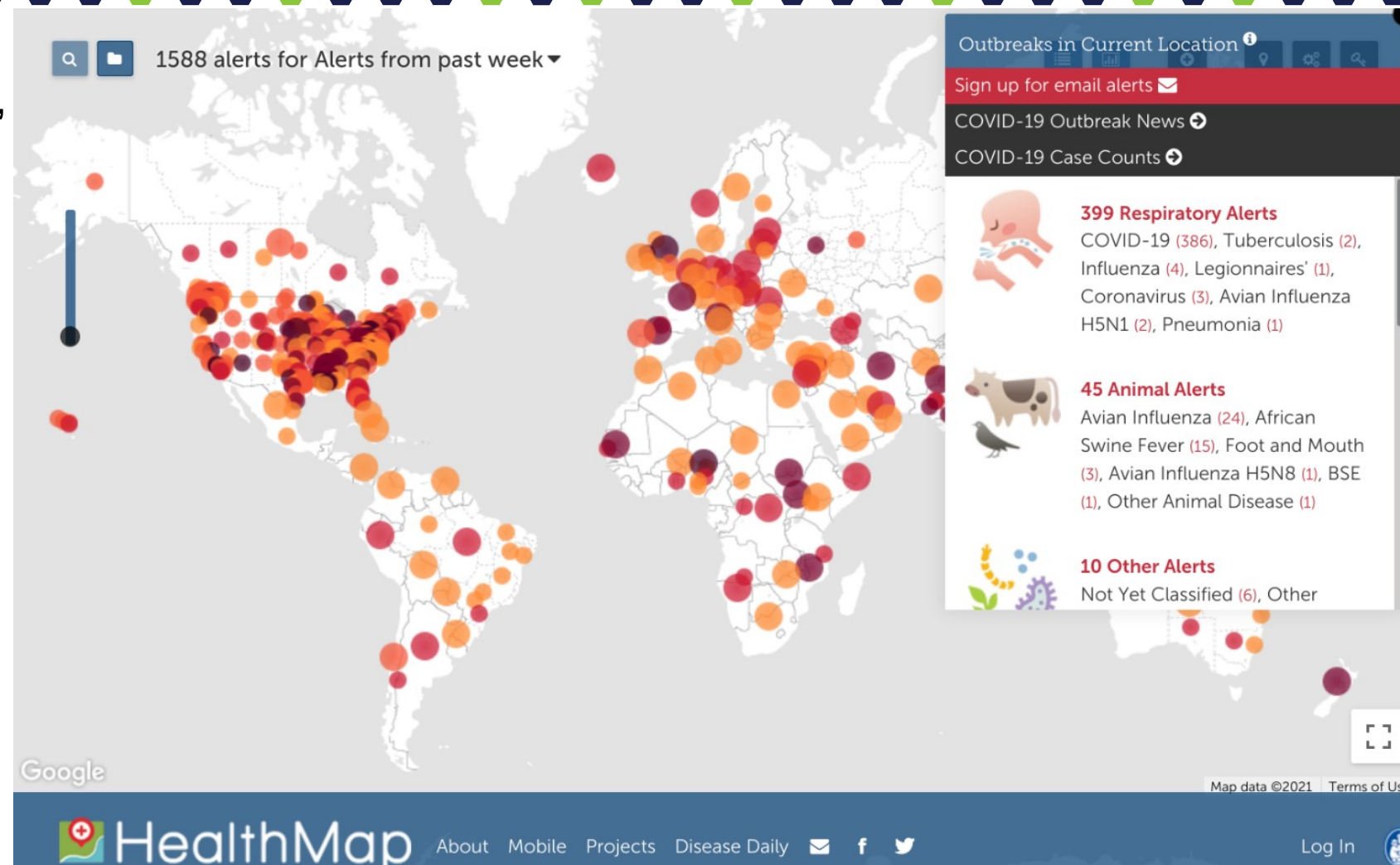
■ Disease X



The problem: Emerging infectious diseases

Focus on zoonotic diseases

- transmitted from animals to humans, usually by a vector (e.g., ticks, mosquitoes)
- reservoir hosts: wildlife and domestic animals
- zoonoses involve all types of agents (bacteria, parasites, viruses and others)
- Zoonotic diseases cause major health problems in many countries.
- They are driven by environmental and pathogen changes as well as political and cultural changes.



Environmental factors derived from satellite data



(incomplete view)



Temperature

e.g. MODIS LST

Precipitation

e.g. CHMORP

Moisture / Humidity
proxies

e.g. ASCAR

Topography

SRTM,
ASTER GDEM

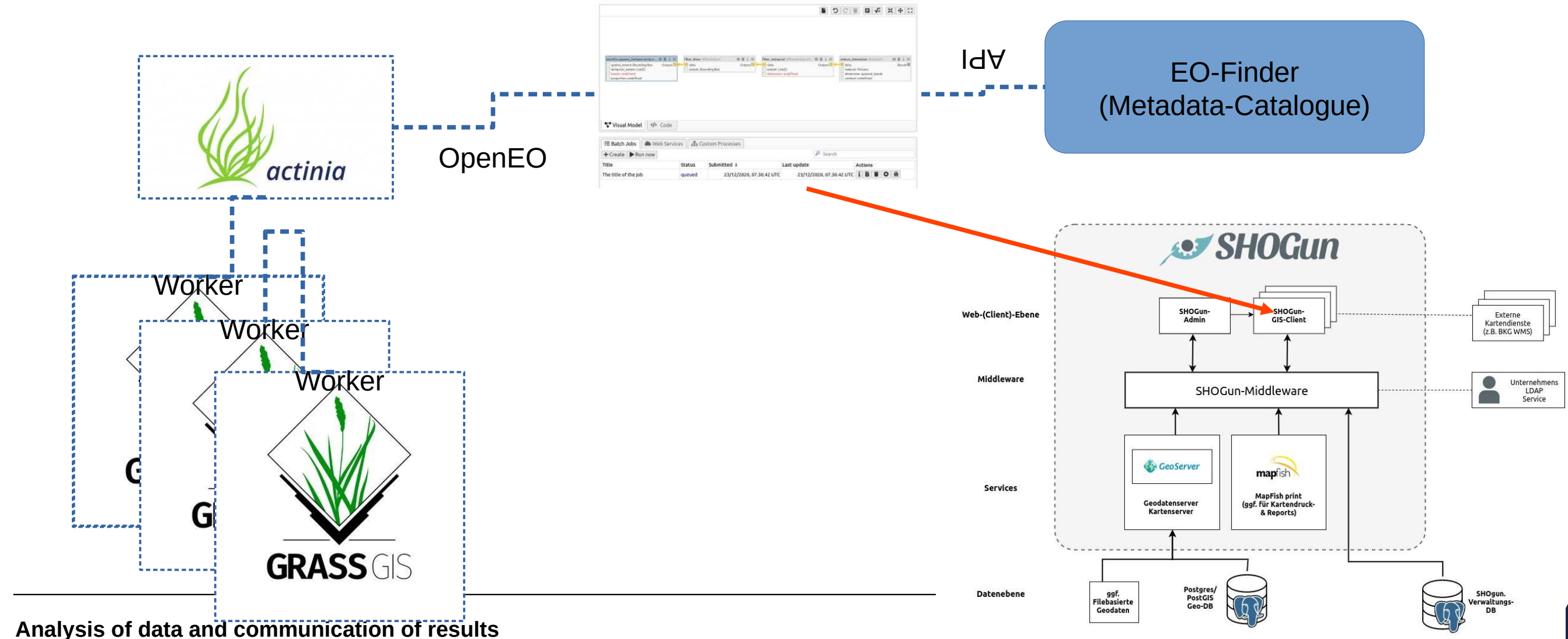
Vegetation cover

e.g.
MODIS based

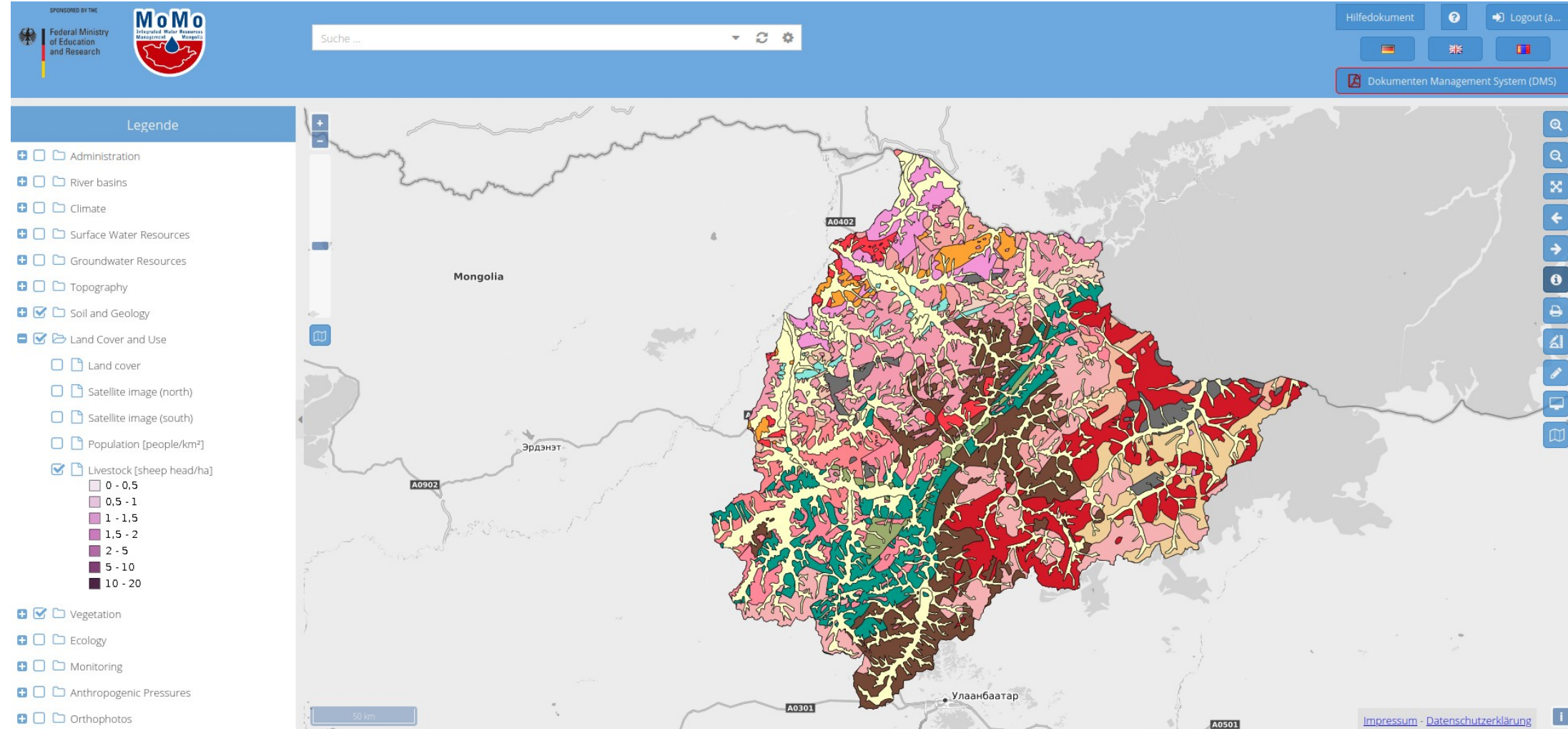
Land use

e.g.
MODIS based

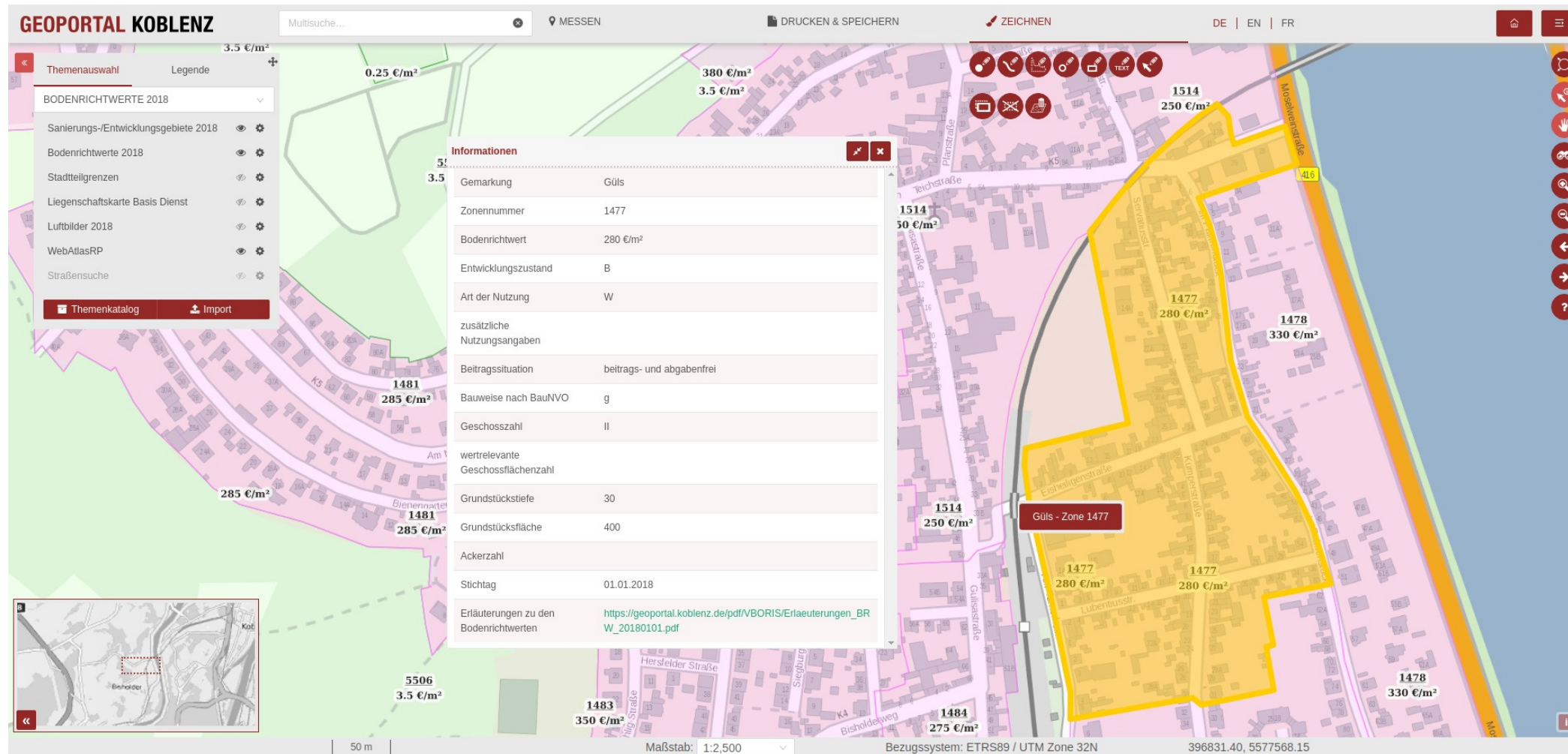
terrestris expertise: Spatial Data Infrastructures (SDI)



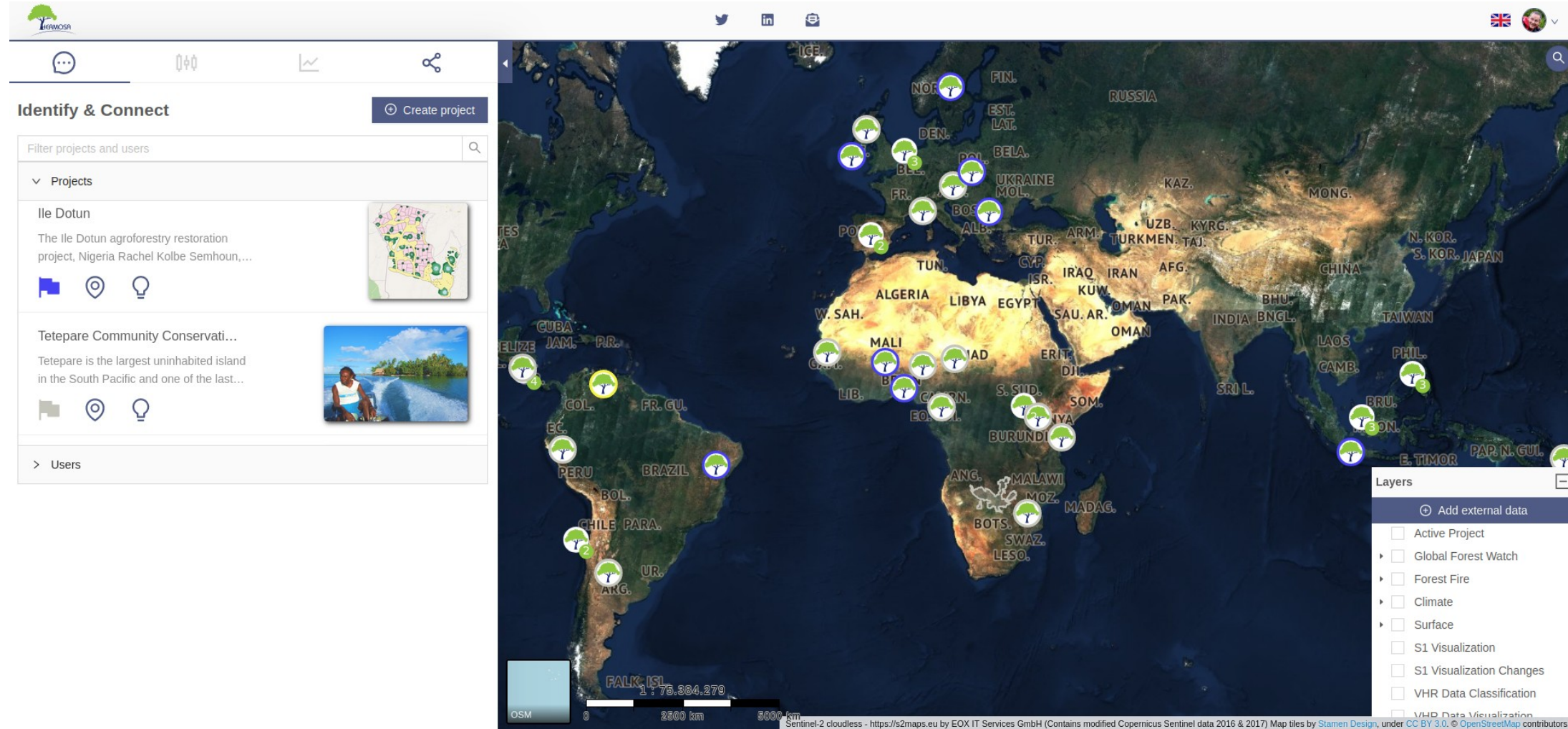
Environmental and anthropogenic data from our Mongolia project 2010 – 2018



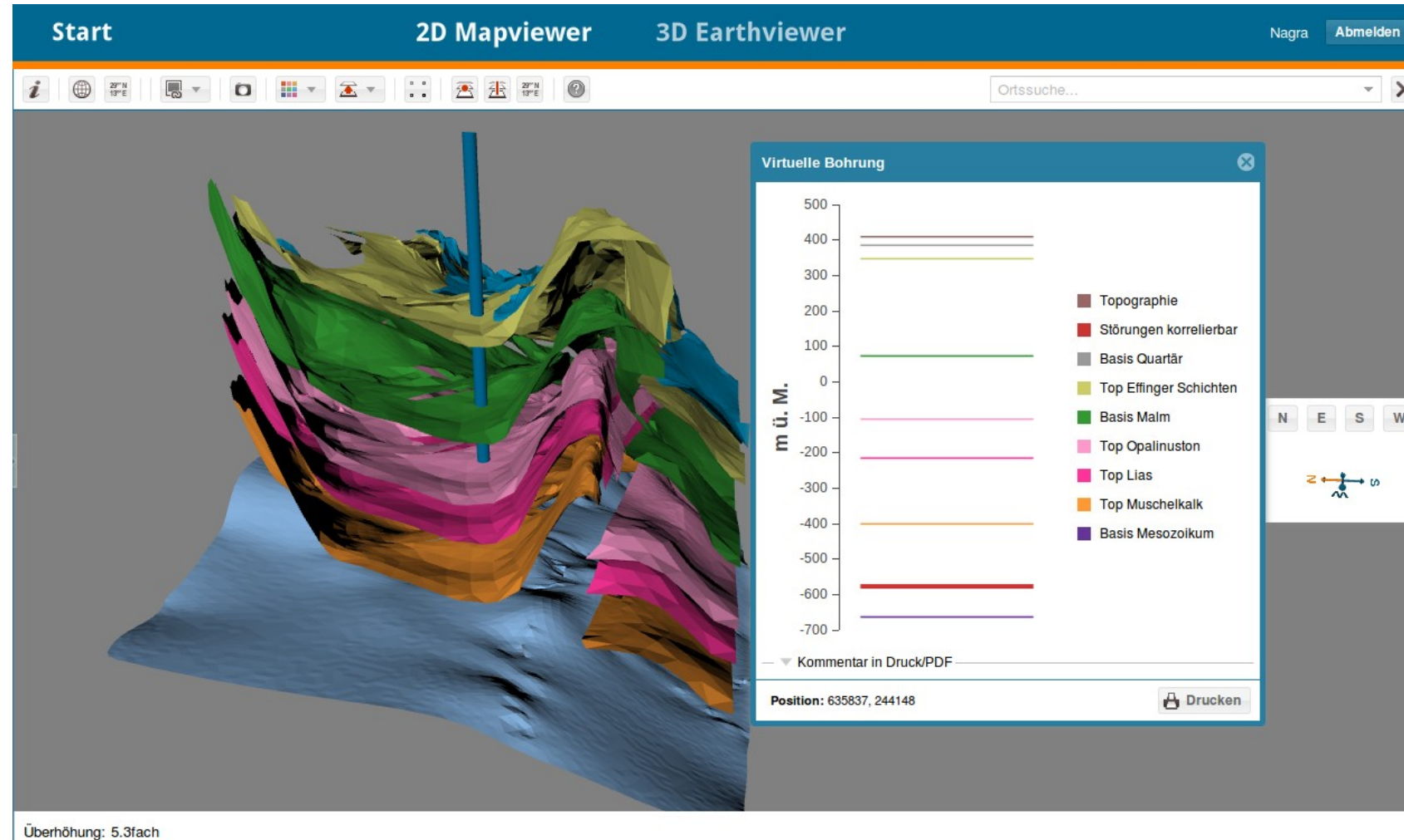
Geoportal Koblenz



Portal for Ecosystem Restoration



3D visualisation of geological strata



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