GRANULAR

DATA FICHES

Implementing New Data & Methods for Replication, Validation and Upscaling



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GRANULAR

DATA FICHES

The GRANULAR project combines novel data sources — social media, open-source data, and Earth Observation — with methods such as web scraping, data integration, and deep learning to produce comprehensive datasets and indicators for rural policy and development.

Fiche 1 ⏳ European Open Accessibility Indicators

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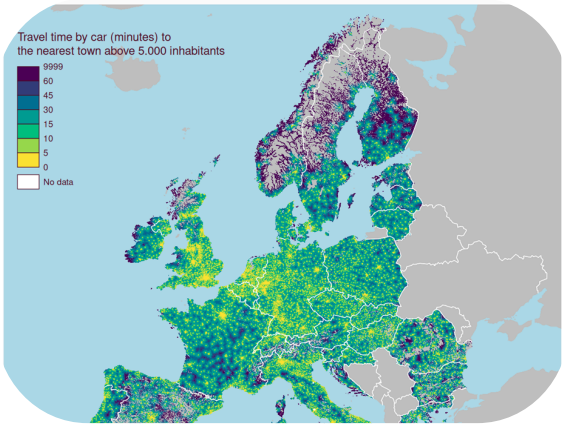
DATA FICHE

European Open Accessibility Indicators

CNRS/RIATE

WHAT IS IT ABOUT?



Objectives of this dataset

Support rural actors and policymakers by prodiving the first reproducible framework for creating **EU-wide accessibility indicators** using only open source solutions, that enable to:

1. Highlight **inequalities in accessibility to resources and facilities** that meet social needs (areas and points of interest e.g. towns and cities, schools) and allow an improved understanding of its heterogeneity in rural areas, across multiple spatial scales
2. Contribute to the **typologies of rural areas**, considering driving times.

Methodology

Accessibility Indicators are a **EU-wide gridded dataset of travel times by car** developed by combining OpenStreetMap (OSM) –a well-known crowd-sourced project which aims to produce a free vector geographic database of the world– and institutional data, including the European 1 km reference grid, giving the travel time between any points in the EU and the ones located in towns and cities considered as a proxy to discuss on little and medium commercial and service centralities in Europe.

The result combines:

👉 A **methodological framework** to establish the infrastructure required for routing calculations and the construction of travel-time matrices using OSM data. The framework is applicable in other points of interest, such as **schooling** and **comparing travel time by bike and cars**.

👉 A set of **30 accessibility indicators for small and medium-sized cities,** to be analysed at different geographical scales, from grid cells to NUTS territorial unit.

👉 **Maps, graphs and interactive visualisation tools,** allowing users to explore and communicate accessibility conditions across European territories.

Data - 3 sets

HOW TO ACCESS AND READ THIS DATASET

- Indicators of spatial accessibility **by car to towns and cities at a European scale**
  from all 1km² populated grid cells // at aggregated levels (NUTS)
- Indicators of spatial accessibility **by car and by bike to secondary schools** for 13 GRANULAR Labs
- A reproducible method for comparing accessibility by car to accessibility by public transportation based on a case study of the French living lab region

SKILLS & DATA MANAGEMENT

Infrastructure needed: The framework relies on R packages, analytical workflows and underlying open datasets.

Skills: Expertise required in data science and geovisualisation for updating or transfering to other point of interests. The methodology is however described in detail through reproducible notebooks. The availability of precomputed indicators and visualisation tools helps make the results accessible to a wider audience.

Implementation in GRANULAR Multi-Actor Labs

This work is dedicated to the replication of travel time calculation to education services at a Living Lab scale. Two main categories of indicators were calculated: accessibility indicators on **travel time to the nearest school by car and by bike** ; and indicators based on **comparison between car and bike.**



The results show that for every Living Lab but the Dutch one, **60 % of the young population have access to a secondary schoo under 20 minutes**, with strong differencies between rural and urban grid cells.

A more direct comparison between car and bike accessibility can highlight further considerations about transport mode shift, for more localised studies.

Check out the geovisualisation tool covering 13 case studies (7 GRANULAR Living Labs and 6 Replication Labs) at three scales geographic granularities (1km grid, LAU, living-replication labs) and the associated notebook!

POLICY IMPLICATIONS

Potential of open-source tools and global data. The result addresses the difficulties researchers and public authorities face in obtaining consistent accessibility data across European regions, particularly when existing data sources are fragmented, methodologies are not transparent or analytical solutions depend on proprietary platforms.

Importance of localised studies. For instance, mapping the difference in travel time between car and bike at a granular level helps identifying areas where car could be substituted by bike and where new facilities for cycling could be implemented.

Discover the two interactive geovisualisation tools for exploring the various datasets generated:

👉 Data Viewer **Accessibility to small and medium-sized cities**

This tool displays at the grid level and at European scale either **travel times to the nearest towns and cities** or the **number of towns and cities that it is possible to reach by car within 30 minutes.** The tool also provides links to the datasets and to the notebooks' documentation on data processing

👉 Data Viewer **Accessibility to intermediate schools in GRANULAR Living and Replication Labs**

This tool allows to view raw and derived indicators at two different scales: at the grid level, not only **travel time by car/bicycle to school** but also the **time difference between car/bicycle** is represented. At the LAU level, the median travel times by car/bicycle are completed by the share of the young population living at less than 20 minutes by car/bicycle.

How to cite

- Ysebaert, R., Laurian, L., & Guerois, M. (2024). Accessibility Indicators to services at EU scale - 1km grid indicators (Version 2.0.1) [Dataset]. GRANULAR. https://doi.org/10.5281/zenodo.17136149
- Ysebaert, R., Laurian, L., & Guerois, M. (2025). Accessibility Indicators to services at EU scale - aggregated indicators (Version 2.0.1) [Dataset]. GRANULAR. https://doi.org/10.5281/zenodo.17136173
- Laurian, L., Ysebaert, R., & Guerois,M. (2025). Accessibility by bicycle and car to secondary schools (Version 1.0.1) [Dataset]. GRANULAR. https://doi.org/10.5281/zenodo.17136075

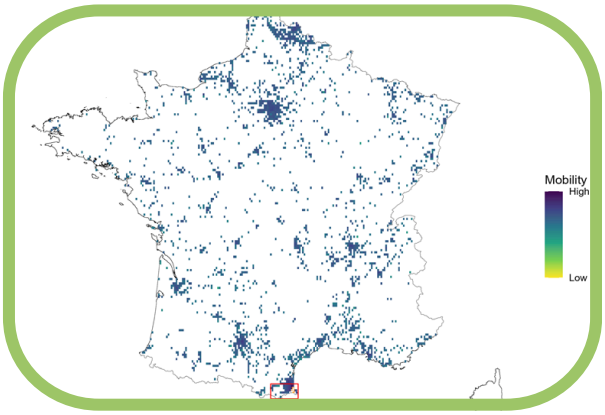
GRANULAR

DATA FICHE

Human Mobility derived from Meta Facebook data

WorldPop Research Group at the University of Southampton
Dipartimento di Scienze della Terra "A. Desio", Università degli Studi di Milano

WHAT IS IT ABOUT?



Objectives of this dataset

Support rural actors and policymakers by providing novel social media-based mobility metrics visualisations that enable to:

1. 1.Facilitating the **quantification of mobility demand and its variability across multiple temporal scales** (weekly, seasonal, and public holidays), providing insights into changes in travel behaviour, and
2. Generating actionable insights to support **evidence-based planning, targeted interventions, and investment decisions.**

Methods

Meta Facebook Activity Space Maps human mobility datasets (ASM), derived from device locations of Facebook users enabling location sharing, were combined with WorldPop Gridded Population Count datasets (WP) to produce **human mobility metrics, maps, and plots.**

The derived mobility metrics can be used to:

👉 capture patterns between populated **urban areas** and less populated **rural regions.**

👉 assess differences in mobility patterns **between seasons** and **holiday vs non-holiday periods.**

👉 support the **identification of short-term events** (e.g. festivals), or the analysis for **longer periods** such as seasonal or longer school holidays.

👉 compare differences potentially linked to **incoming visitors** and **outgoing residents.**

Due to a data-sharing agreement with Meta, ***raw ASM data cannot be disclosed****, but access can be requested.* ***Only derived digital and visual formats can be shared.***

HOW TO ACCESS AND READ THIS DATASET

Animated maps, time series plots, and human mobility metrics derived by combining Meta Facebook Activity Space Maps and WorldPop gridded population data

Data

Type: Rendered incoming and outgoing mobility map as animated GIF files, series plots and connectivity maps as PDF files, and mobility metrics as CSV tables.

Spatial

Resolution: Tile (5.5 km) and LAU-level
Extent: 16 GRANULAR Labs

Temporal

Resolution: Updated weekly, based on a rolling three-week window.
Extent: July 2024 to Dec 2025

SKILLS & DATA MANAGEMENT

Skills: Tabulated human mobility metrics are in comma separated value (CSV) format, which can be opened in a spreadsheet application (e.g., Excel) or a statistical/numerical analysis application (e.g., R or Python). Visual outputs are in PDF files, which can be opened in a PDF viewer (e.g. Acrobat Reader), and GIF files, which can be opened using a standard web browser, an image/photo viewer, or a GIS software.

Implementation in GRANULAR Multi-Actor Labs

The Facebook Activity Space Maps data were combined with WorldPop gridded population count datasets and used to develop **weekly LAU-level animation maps and time series plots, as well as seasonal connectivity maps** for all GRANULAR Living and Replication Labs.

Weekly animation maps are available, separately for inbound visitors and outbound residents for each LAU, as single animated GIF files, for all GRANULAR Labs.

Seasonal connectivity maps were also produced, including span all four seasons and the entire calendar year of 2025.



Check out the general processing outputs for derived mobility metrics, plots and maps that were derived for all Living labs and Replication labs!

POLICY IMPLICATIONS

These metrics contribute to an **improved understanding of the spatio-temporal dynamics of mobility and connectivity** in rural areas.

Examples of local requests that have led to bespoke analyses:

▶️ **Holidays and Events** (Labs in FR, FI, IT): *Specific event periods were identified, in collaboration with the Labs, to determine whether the events-related mobility was higher or lower than typical mobility considering a larger time period around each specific event.*

The mobility analysis was done for **public and school holidays**, **public events** (such as concerts and festivals) and, only for the French Lab, for time periods around the **COVID-19 lockdowns**. Results clearly showed significant changes across different flow metrics with mixed results across time periods, thereby enabling the Labs to anticipate the public services required (particularly public transport).

▶️ **Urban/Rural Mobilities**: *The Scottish Lab sought to gain a better understanding of human mobility between rural and urban areas, as classified according to the Scottish Government definitions, to support transport planning, local tourism and the assessment of seasonal traffic.*

The analysis provided a clearer picture of mobility patterns to and from different areas along the rural-urban spectrum, distinguishing between weekdays and weekends.

▶️ **Regional Mobility Patterns**: *The Finnish Lab wanted to understand mobility patterns between the South Savo region and major urban centres in Southern Finland.*

The analysis contributed to an improved understanding of seasonal and event-driven mobility between urban regions and South Savo. Results were shared and discussed with regional stakeholders to identify implications for tourism planning, mobility services, and regional development strategies.

How to cite

Voepel, H., Sorichetta, A., & Lai, S. (2026). Human Mobility for Living Labs and Replication Labs Derived from Meta Facebook Activity Space Maps (Version 1.0) [Dataset]. GRANULAR. https://doi.org/10.5281/zenodo.23198203

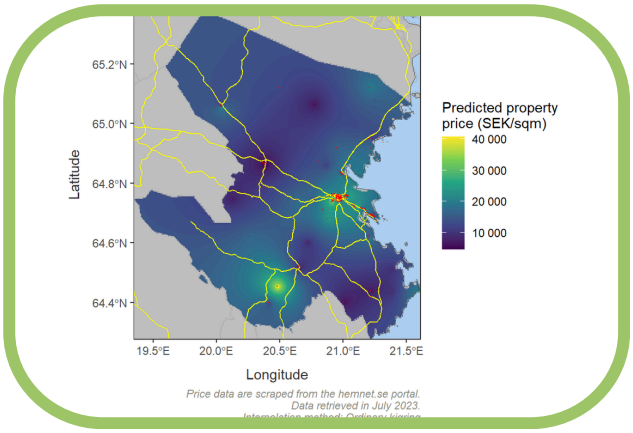
GRANULAR

DATA FICHE

Real-time Data to Monitor Housing Markets

Nordregio

WHAT IS IT ABOUT?



Objectives of this dataset

Support rural actors and policymakers by providing high-frequency, fine-grained information on housing prices that enable to:

1. Analyse the **performance of local housing markets**, particularly in areas where tensions are expected to emerge as a consequence of external shocks
2. Help to monitor **rural population dynamics** and understand the **impact of redevelopment projects on local markets.**

Methodology

This Data Fiche describes an experimental work to collect and analyse **real-time data on property transactions in Sweden's northernmost counties of Norrbotten and Västerbotten**. Housing registry data was scraped from the Hemnet database –the largest digital marketplace for housing in Sweden– producing a dataset of 520 geolocated transactions for year 2022 and the first half of 2023.

The importance of this study lies in understanding how housing market dynamics will evolve in these remote regions as they attract population from other areas.

👉 Production of an **interactive map illustrating the evolution of housing prices during 2023**, revealing substantial drops in property values for some rural areas and price increases in urban cores

HOW TO ACCESS AND READ THIS DATASET

- Static version of the demo (See Section 3 of the Report)
- Dynamic version of the demo generated with Rmarkdown

Data

Class: Raw public web data
Type: Web scraped data from online real estate portals
License: CC BY-SA 4.0
DOI: 10.5281/zenodo.21706065

Spatial

Resolution: Micro-level/point granularity (addresses)
Extent: Sweden

Temporal

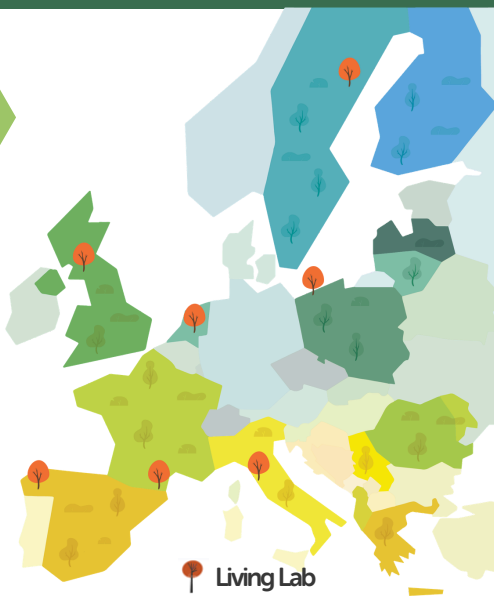
Resolution: Real-time / High-frequency
Extent: Jan 2022-June 2023

SKILLS & DATA MANAGEMENT

Skills: Its use requires expertise in Web Scraping to extract high-frequency real estate listings from online portals, and in scheduling scripts to replicate the housing market monitoring methodology.

Implementation in GRANULAR Living Labs

The demo was developed for the Swedish Living Lab, including the Swedish northernmost counties of Norrbotten and Västerbotten. These two remote and mostly rural regions in Sweden are expected to attract population as a consequence of ongoing processes of green re-industrialisation in the area.



Housing markets in both regions are hence likely to suffer important changes in the years to come. The results indicate a relationship between population growth from re-industrialisation activities and the observed trends in housing market dynamics within Skelleftiå municipality.

However, the availability of observational data in specific areas seems to be a major limitation. The accuracy of the modelling results depend on the abundance, precision and reliability of the sampled data. Fewer property registrations in remote and isolated areas challenges the deployment and interpretation of interpolation models.

POLICY IMPLICATIONS

The primary goal of this work was to document a non-conventional data collection, processing and use workflow as a proof-of-concept, rather than producing datasets directly usable for policy analysis

Potential of web-scraping tools. Although highly experimental, the work demonstrates the use of non-conventional data sources for the calculation of indicators usable in a policy context.

How to cite

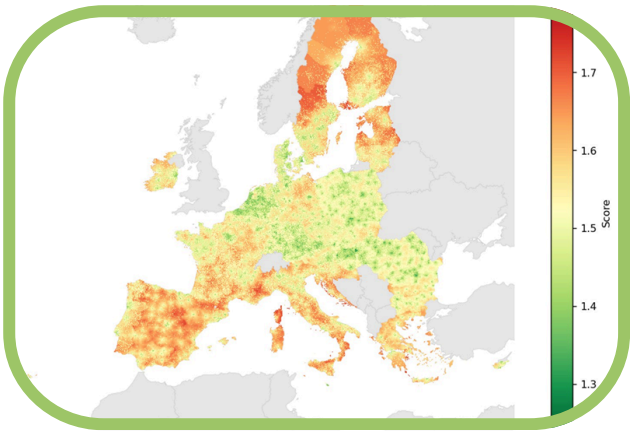
Tapia, C. (2026). GRANULAR Supplementary Report - Implementing Web scraping for replication, validation & upscaling. GRANULAR. https://doi.org/10.5281/zenodo.21706065

GRANULAR

DATA FICHE
Transport Poverty Risk Index

Nordregio

WHAT IS IT ABOUT?



Objectives of this dataset

Support rural actors and policymakers by providing a novel data source and a spatial diagnostic framework that enable to:

1. Identify **territories with concentrated transport poverty risk**
2. Understand **which dimensions** (cost shocks, exposure, transport alternatives, socio-demographic factors) **contribute most to the risk explanation** in specific areas
3. Develop **targeted public action and policy responses** based on local contexts and realities of rural, peripheral, and sparsely populated territories across Europe

Methodology

The Transport Poverty Risk Index combines **official territorial statistics** with **high-frequency energy-price data** to identify where transport poverty risk is likely to be higher, how it changes over time, and which dimensions contribute most to territorial vulnerability.

The dataset is designed for use **at multiple analytical scales.**

👉 At European level, it supports **cross-national comparison of transport poverty risk profiles** and the **monitoring of temporal trends** across the 2022–2026 period.

👉 At regional and sub-regional level, it enables the **identification of high-risk grid cells** within specific territories, facilitating the targeting of policy interventions and the prioritisation of investment.

HOW TO ACCESS AND READ THIS DATASET

Dataset & code package for the development and application of the Transport Poverty Risk Index

Data

Class: Spatial Grid Data
Type: Raster
License: CC BY-SA 4.0
DOI: 10.5281/zenodo.21352799

Spatial

Resolution: 1 X 1 km
Extent: EU27
Coordinate System: ETRS89-LAEA

Temporal

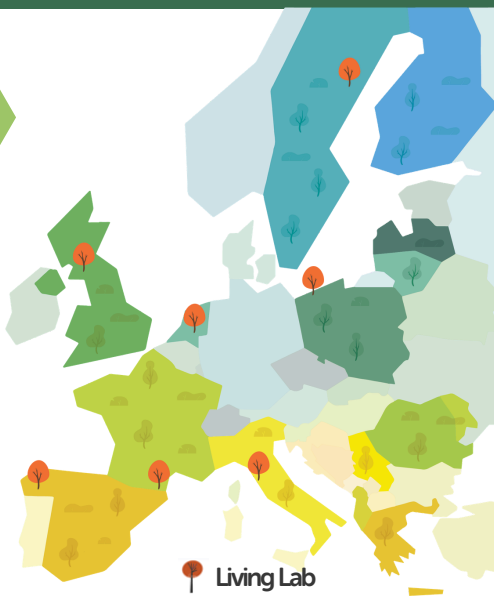
Resolution: Monthly
Extent: Jan 2022-Apr 2026

SKILLS & DATA MANAGEMENT

Infrastructure needed / Data storage: Any raster capable GIS software for data use; R & Python for reproducibility.

Skills: Its use requires a certain expertise in in Grid-based Spatial Data Analysis. Skills in R and Python programming will be needed to reproduce the pipeline to regenerate or update the data.

Implementation in GRANULAR Living Labs



The Living Lab analysis illustrate how similar overall risk scores can conceal different territorial risk profiles:

Accessibility is a central spatial differentiator of transport poverty risk. Across the case studies, areas farther from urban centres and service nodes tend to show higher risk scores, particularly where limited public transport and car dependence coincide.

Rural and peripheral areas may remain structurally vulnerable even when aggregate indicators appear stable. The **distinction between structural and dynamic components of risk** matters for interpretation and policy.

Check out the analyses, visualisations, and mapping tools using case studies from selected Dutch regions, Ourense (Spain), Pays Pyrénées (France), Val di Cecina (Italy), West Pomeranian (Poland), Upper Norrland and adjacent northern Swedish regions!

POLICY IMPLICATIONS

By decomposing risk into distinct dimensions, the index supports a **diagnostic interpretation of transport poverty**. It can help distinguish areas where risk is mainly associated with high fuel-cost exposure, poor accessibility, limited public transport alternatives, socioeconomic fragility, or demographic dependency.

Transport poverty as a multidimensional rural challenge. Measures that reduce the cost of mobility are important, but may be insufficient where service access is poor or public transport alternatives are weak.

Importance of temporal monitoring. The TPRI can help policymakers identify where short-term support may be needed and where longer-term structural interventions are required.

Policy responses should be tailored to the dominant risk profile of each territory

- Areas where risk is driven mainly by fuel-cost exposure may require affordability support and transition-sensitive mobility policies.
- Areas where risk is driven by accessibility gaps may require improved local service provision, better public transport connectivity, demand-responsive transport, or measures that reduce the need for long-distance travel.
- Areas where risk is driven by social vulnerability may require targeted support for low-income households, older residents, lone-parent households, and other groups with limited adaptive capacity..

How to cite

Tapia, C., Berbert, K., & Berbert, K. (2026). High-Resolution Transport Poverty Risk Index (TPRI) for European Rural Areas [Dataset]. GRANULAR. https://doi.org/10.5281/zenodo.22129376

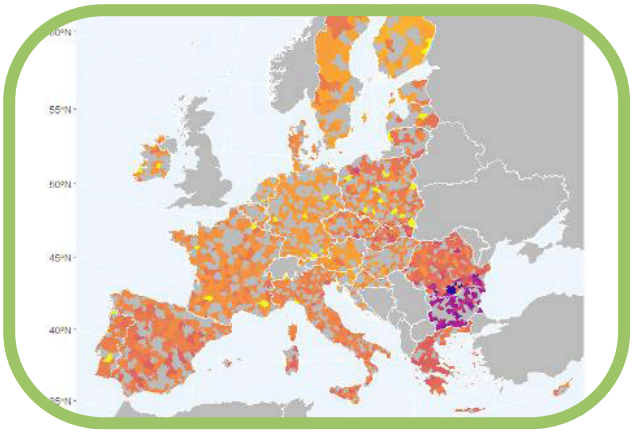
GRANULAR

DATA FICHE

Estimate Economic Diversity in Functional Rural Areas

Nordregio

WHAT IS IT ABOUT?



Objectives of this dataset

Support rural actors and policymakers by providing more accurate assessments of **business diversity in non-standard geographical units**, particularly functional rural areas, that enable to:

1. Transcend administrative boundaries and delve into the **functional relationships between economic actors** within rural contexts
2. Develop **targeted public action and policy responses** that promote long-term regional resilience and sustainable growth in rural economies.

Methodology

This dataset presents **a set of economic diversity indices for Europe's Functional Rural Areas (FRAs)**, generated by combining crowdsourced geospatial data (OpenStreetMap data) with bi-directional transformers, generative large language models and statistical correction techniques.

The study investigates whether this type of crowd-sourced data can be effectively used to **estimate economic diversity in functional areas**, where conventional administrative statistics often fall short due to spatial dispersion, timeliness constraints, and functional relevance requirements for targeted rural policy analysis.

HOW TO ACCESS AND READ THIS DATASET

- Data and software scripts underpinning this analysis
- Additional details of the approach and results for the Living labs (See Section 2 of the Report)

Data

Class: Spatial Grid Data
Type: Vector
License: CC BY-SA 4.0
DOI: 10.5281/zenodo.22869057

Spatial

Resolution: 1 X 1 km
Extent: EU27
Coordinate System: ETRS89-LAEA

Temporal

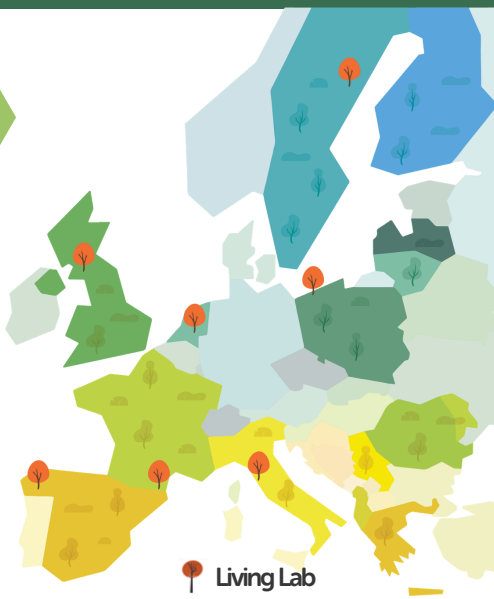
Resolution: Yearly
Extent: 2025

SKILLS & DATA MANAGEMENT

Infrastructure needed / Data storage: Any GIS software for data use. R & Python for reproducibility.

Skills: Its use requires a certain expertise in GIS and Spatial Data Analysis. Skills in R and Python programming, machine learning and LLM will be needed to reproduce the pipeline.

Implementation in GRANULAR Living Labs



The analysis was performed at the Functional Rural Area level for all GRANULAR Living Labs, to capture functional relationships between economic entities in rural settings.

A more granular view of rural economic structures. The findings suggest higher business concentration in parts of Eastern Europe and lower concentration in several Northern and Central European regions, particularly Germany.

Applying the best-performing models to Functional Rural Areas produced **high-resolution estimates of business concentration** across Europe.

This demonstrates the potential of OSM-based methods to **complement official statistics** and **support functional, place-sensitive analysis of rural economic resilience.**

POLICY IMPLICATIONS

The work responds to a central challenge in rural development: understanding the structure and diversity of local economies in territories that are often data-scarce, spatially dispersed and exposed to sector-specific shocks.

Beyond the boundaries of traditional economic analysis. OpenStreetMap-derived diversity indicators should not be treated as substitutes for official statistics, but rather as complementary tools that can improve spatial granularity, timeliness and functional relevance where traditional data are insufficient.

Predicting economic concentration rather than diversity. With the futhre refinements, the methodology could become a valuable component of rural observatories, territorial monitoring systems and policy tools aimed at strengthening rural resilience and competitiveness.

The insights from this study and the analytical workflow can be utilised in various ways for decision-makers and researchers

- Classified economic activities (e.g. using NACE - Statistical Classification of Economic Activities in the European Community) obtained from OpenStreetMap data and Large Language Models serve as a robust foundation for further analysis of business diversity in rural settings, complementing existing datasets
- Comparing the results with official statistics or previous research on business diversity in similar contexts allows for validation and cross-verification of findings, strengthening confidence in our estimates.
- The analytical workflow can be adapted for the calculation of economic diversity metrics in other settings.

How to cite

Tapia, C., Tapia, C., Yantseva, V., & Dzhavatova, K. (2026). OSM-based Economic Diversity Analysis for Europe's Functional Rural Areas [Dataset]. GRANULAR. https://doi.org/10.5281/zenodo.22869057

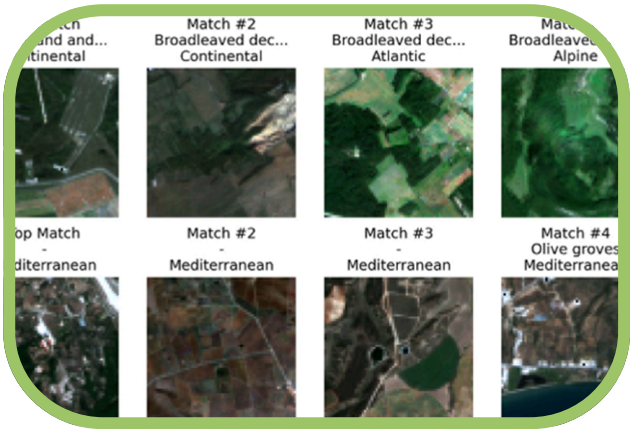
GRANULAR

DATA FICHE

Land Cover and Land Use: Sen2LUCAS & TimeSenCLIP

CIHEAM-IAMM

WHAT IS IT ABOUT?



Objectives of this dataset

Support rural observatories, environmental agencies, land managers and policymakers for rural landscape analysis by **making earth observation data accessible without requiring specialised remote sensing expertise** via:

1. The establishment of a **common reference dataset for land cover and land use monitoring across Europe**
2. The creation of a **deep learning framework** that enables users to find relevant satellite observations by typing simple descriptions (e.g. "irrigated agricultural fields", "forests showing seasonal change")

Methodology

This work combines **satellite observations, ground-level information, and advanced AI methods** to build openly available datasets and AI models that contribute to improved landscape understanding at local, regional, and continental scales. Three complementary developments are available:

👉 **Sen2LUCAS Dataset**, a large-scale benchmark dataset pairing Sentinel-2 imagery with georeferenced ground-level photographs and observations from the 2018 LUCAS survey (Land Use/Cover Area frame Survey) across Europe.

👉 **SenCLIP Framework**, an AI model that bridges natural language and satellite imagery, enabling users to search large archives of Sentinel-2 data using simple text descriptions.

👉 **TimeSenCLIP Extension**, a second AI model that incorporates the temporal dimension by analysing monthly Sentinel-2 observations throughout the year, providing a richer representation of landscapes.

HOW TO ACCESS AND READ THIS DATASET

- Data to be used for training, benchmarking and evaluating machine learning models for land-use and land-cover analysis
- Associated SenCLIP and TimeSenCLIP models providing reusable tools for text query and transfer-learning applications

Data

Class: Spatial Grid Data
Type: Raster (image patches)
License: CC BY 4.0
DOI: 10.5281/zenodo.14259723

Spatial

Resolution: 10 m (RGB), 100x100-pixel image patches (1x1 km)
Extent: EU27 + UK

Temporal

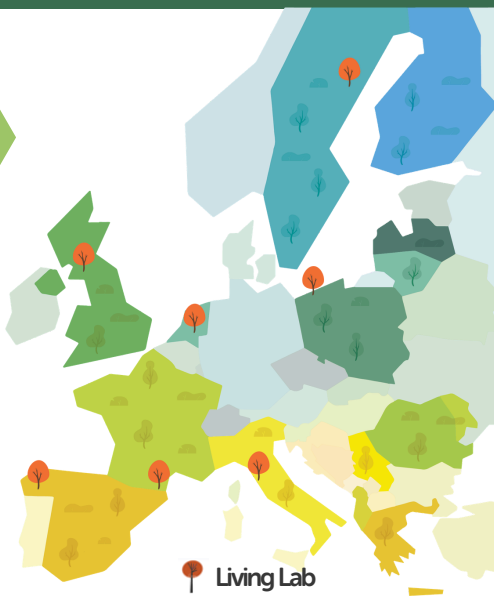
Resolution: Survey month
Extent: 2018

SKILLS & DATA MANAGEMENT

Skills: Its use requires a certain expertise in Python programming, GIS, remote-sensing fundamentals. Users who would like to reproduce the SenCLIP research must have skills in deep learning and vision-language models.

Data storage: ~31 GB (full archive).

Implementation in GRANULAR Living Labs



Experiments were conducted across benchmark datasets representing diverse environmental conditions, agricultural systems, and geographic regions within Europe.

Fine-grained ecological and land-use understanding. Users can interact with the models through natural-language queries for various applications, including land-cover classification, land-use classification, crop mapping, habitat mapping, scenicness prediction, and semantic retrieval.

The models were developed and evaluated using Sentinel-2 satellite imagery and LUCAS field observations collected within the EU. As a result, their performance in regions with different climatic conditions, vegetation dynamics, agricultural systems, and land management practices remains to be fully assessed.

POLICY IMPLICATIONS

The work contributes to improve the **availability, accessibility, and usability of Earth observation data** for rural monitoring and land-use assessment.

Digital transformation of rural monitoring. By enabling users to interact with satellite imagery through natural-language descriptions rather than requiring specialised expertise in remote sensing or machine learning, the framework lowers technical barriers and facilitates the use of Earth observation data by policymakers, rural observatories, environmental agencies, and land managers.

Importance of temporal monitoring. By capturing seasonal patterns, crop growth cycles, and vegetation dynamics, the TimeSenCLIP AI model provides a richer representation of landscapes and improves the discrimination of land uses that may appear similar in single-date imagery.

How to cite

Jain, P., Ienco, D., Interdonato, R., Berchoux, T., & Marcos, D. (2024). Sen2LUCAS Dataset [Dataset]. GRANULAR. IEEE/CVF Associated paper: Jain et al. (2025), SenCLIP, IEEE/CVF WACV 2025, Tucson, USA. https://doi.org/10.5281/zenodo.14259723

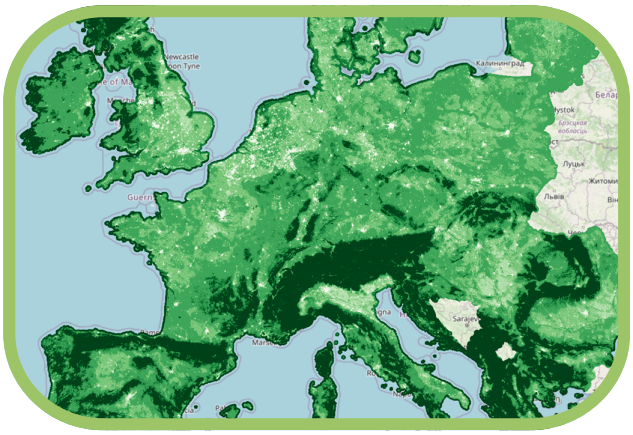
GRANULAR

DATA FICHE

European Landscape Attractiveness Indicator

IIASA

WHAT IS IT ABOUT?



Objectives of this dataset

Support researchers and landscape planners by providing a layer making scenic and cultural landscape quality available as a spatially explicit indicator that enables them to:

1. Contribute to **environmental and economic research** and spatial analysis related to human landscape preferences
2. Support **rural development, tourism and landscape policy analysis.**

Methodology

This indicator represents a **machine learning-based prediction of perceived attractiveness across Europe.** The dataset replicates and retrains the German landscape attractiveness model of Roth et al. (2021) using pan-European predictor variables, so that the German attractiveness scale could be extrapolated consistently to the whole of Europe.

👉 Values indicate **how people are likely to rate the attractiveness of a landscape** on the basis of visible features such as land cover, infrastructure and elevation.

👉 EU-wide indicator can be aggregated to grid cells or administrative units and used for **modelling purposes as one predictor of e.g. rural well-being.**

HOW TO ACCESS AND READ THIS DATASET

Data to be downloaded and imported into GIS software for further spatial analysis

Data

Class: Spatial Grid Data
Type: Raster
License: CC BY-SA 4.0
DOI: 10.5281/zenodo.18618619

Spatial

Resolution: 1 X 1 km
Extent: EU27
Coordinate System: ETRS89/UTM 32N

Temporal

One-off static layer
Extent: 2018

SKILLS & DATA MANAGEMENT

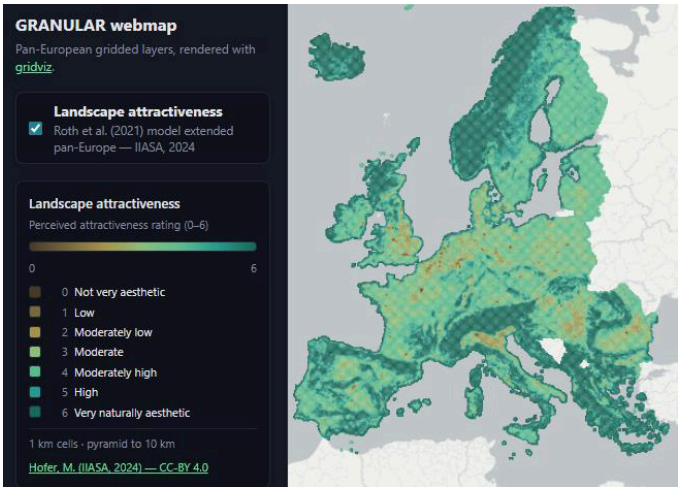
Infrastructure needed / Data storage: Any raster capable GIS software.

Skills: Its use requires a certain expertise in the world of GIS and spatial analysis. Skills in Python programming will be needed to automate analysis across many regions or process large datasets.

Implementation in GRANULAR

Predictions of the German reference model were used as the training target. A machine learning model was then fitted on Europe-wide covariates describing land cover, infrastructure and terrain, and **applied across the full European extent.**

Check out the visual analysis via the GRANULAR Viewer!



POLICY IMPLICATIONS

The work contributes to improve the **availability, accessibility, and usability of data acquired via citizen engagement** for rural monitoring. This also helps to explain the location and extent of land across Europe that is deemed attractive for both residents and visitors.

How to cite

Hofer, M. (2026). European Landscape Attractiveness Indicator (Version 1) [Dataset]. GRANULAR. https://doi.org/10.5281/zenodo.18618619

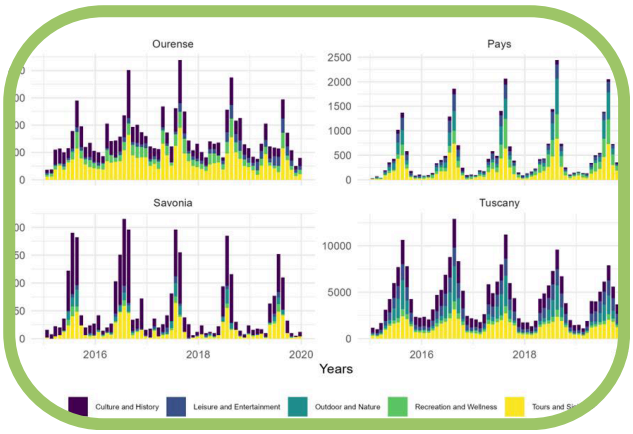
GRANULAR

DATA FICHE

TripAdvisor and Tourism Behaviour

IIASA

WHAT IS IT ABOUT?



Objectives of this dataset

Support rural actors and policy-makers by providing a novel data source, namely web-scraping of social media data, to gain additional **insights on the movements and activities of people, particularly tourists,** at the region's most popular rural tourist destinations.

Methodology

This work explores **rural attractions** using TripAdvisor data –a well-known travel website that offers user-generated reviews and comparisons for hotels, restaurants, and attractions worldwide.

Data extracted from TripAdvisor record concerns:

👉 **Attraction types and popularity,** i.e. rural attractions and amount of visits per month and from where visitors originate for the available TripAdvisor record (2012-2023). TripAdvisor data is indeed advantageous in that it records the frequency and timing of visits to specific attractions and provides this data via an Application Programming Interface while also lending itself to web scraping.

👉 **Number of visitors**, i.e. who frequent each attraction, along with the exact month and year of their visit

Tutorial and source code

HOW TO ACCESS AND READ THIS DATASET

Data

Class: GIS & tabular
Type: API
License: Proprietary API

Spatial

Resolution: 1 X 1 km
Extent: Global
Coordinate System: WGS 84

Temporal

Resolution: Monthly
Extent: 2015 -
Frequency: realtime

SKILLS & DATA MANAGEMENT

Skills: Basic Python knowledge is needed to modify and run the scraper or accessing the API. Anyone applying this method should expect to spend time maintaining the scraping workflow, adapting it to website changes, and checking data quality.

Implementation in GRANULAR Living Labs

TripAdvisor data was analysed across the EU in four regions (within GRANULAR Labs in Spain, France, Finland and Italy),

Exploring rural tourist attractions. Interesting patterns, including preferences for certain categories of tourism along with seasonal fluctuations, emerge across the regions driven most probably by the available attractions, the types of visitors, the prevailing climate and more.



Additional effort was undertaken here to use both TripAdvisor data together with Meta Facebook data to understand mobility related to holidays.

The resulting datasets supported tourism mapping and regional analysis and were presented during Living Lab activities. Feedback confirmed that the approach provides **useful local tourism information that is often missing from official statistics.**

POLICY IMPLICATIONS

By making visitor patterns visible to the people managing a destination, the method supports the **digital transition of rural tourism management**, and indirectly its ecological dimension, since seasonality and visitor concentration are the starting point for keeping tourism within local environmental limits.

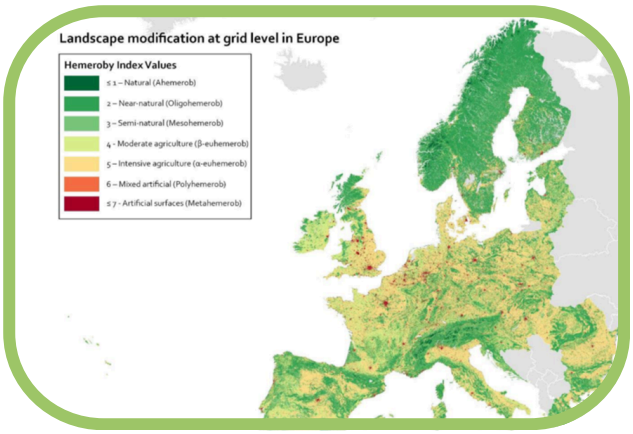
GRANULAR

DATA FICHE

Human disturbance intensity in Europe (Hemoroby index)

CIHEAM-IAMM

WHAT IS IT ABOUT?



Objectives of this dataset

Support researchers and landscape planners by providing a scientifically robust alternative to structural land cover classifications across European countries in order to:

1. Contribute to **analyses of rurality, land-use intensity, and environmental pressures**
2. Support **rural development and landscape policy analysis** by distinguishing rural management intensities.

Methodology

The **hemeroby index** is a measure of human modification of landscapes, reflecting potential environmental impact and land-use intensity in a single metric. This dataset provides a harmonised **map of human disturbance intensity for Europe in 2018,** quantifying how far current land cover deviates from potential natural vegetation due to human activities.

👉 Derived from CORINE Land Cover classes, the index uses a seven-level scale from ahemerobic (1, natural) to metahemerobic (7, artificial surfaces), with intermediate levels capturing increasingly intensive agricultural and forest use.

👉 Nitrogen input and livestock density are used as intensity modifiers (Paracchini & Capitani, 2011), addressing the main limitation of CORINE-based systems by integrating actual management practices, not only structural characteristics.

Data, code and full processing workflow

HOW TO ACCESS AND READ THIS DATASET

Data

Class: Spatial Grid Data
Type: Raster
License: CC BY 4.0
DOI: 10.5281/zenodo.20447948

Spatial

Resolution: 1 X 1 km
Extent: European
CRS: ETRS89-LAEA (EPSG:3035)

Temporal

One-off static layer
Reference year: 2018

SKILLS & DATA MANAGEMENT

Infrastructure needed / Data storage: any raster-capable GIS software (e.g. QGIS); 3.7 MB download.

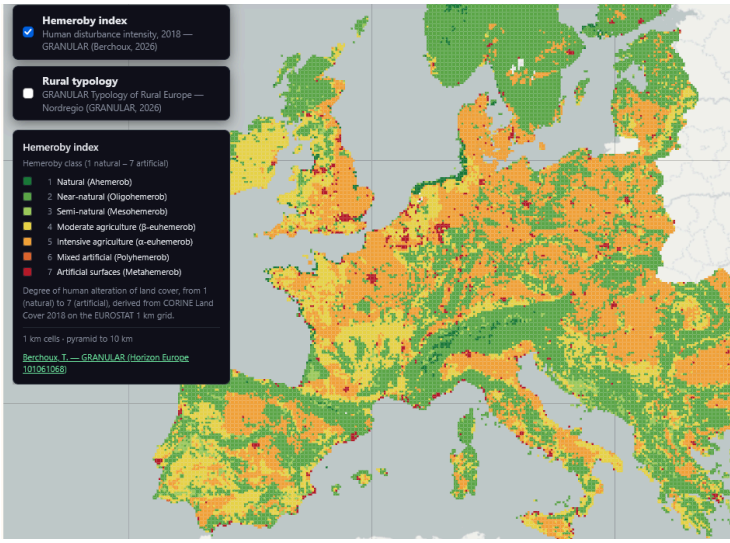
Skills: Its use requires a certain expertise in the world of GIS and spatial analysis. Skills in R programming will be needed to reproduce the workflow detailed in the accompanying script. The availability of visualisation tools helps make the results accessible to a wider audience.

Implementation in GRANULAR

The hemeroby index offers a 1 km grid **across the full European extent.**

Designed for GRANULAR analyses of rurality, land-use intensity and environmental pressures, and for integration with other indicators on the same 1 km grid.

Including the degree of human-induced landscape modification enables **integration of the GRANULAR rural typology with environmental monitoring systems** already functioning across Europe, facilitating coordinated implementation of territorial policies.



Check out the visual analysis via the GRANULAR Viewer!

POLICY IMPLICATIONS

The degree of human-induced landscape modification directly responds to growing recognition within EU policy frameworks that **rural areas function not merely as production zones but as providers of ecosystem services** requiring integration into biodiversity conservation, sustainable land-use planning and green infrastructure development strategies.

Beyond structural land cover. Studies in Germany, Austria and Portugal report strong correlations between hemeroby values and biodiversity indicators (e.g. Walz & Stein, 2014), supporting its use alongside rural classifications.

How to cite

Berchoux, T. (2026). Human disturbance intensity in 2018 in Europe (hemeroby index) [Dataset]. GRANULAR. https://doi.org/10.5281/zenodo.20447948