Deliverable No. 5.1

Dynamos' Baseline and Monitoring

WP5

RURACTIVE

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[1] Type: Use one of the following codes (in consistence with the Description of the Action):
- R: Document, report (excluding the periodic and final reports)
- DEM: Demonstrator, pilot, prototype, plan designs
- DEC: Websites, patents filing, press & media actions, videos, etc.

[2] Dissemination level: Use one of the following codes (in consistence with the Description of the Action)
- PU: Public, fully open, e.g. web
- SEN: Sensitive, limited under conditions of the Grant Agreement

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RURACTIVE Glossary

Beneficiaries: local communities, including specific groups at risk of exclusion, that will benefit from the solutions developed by the RIEs.

Crosscutting priorities: cutting-edge factors at the basis of rural sustainable transition, including Climate change adaptation and mitigation, Biodiversity, Social justice and inclusion.

Dynamos (Ds): 12 rural pilot areas, in 7 EU, 2 Associated Countries and Switzerland where the RIEs will be established. RURACTIVE Dynamos: D1-Northern Ostrobothnia, FI, PP: UOULU; D2- Südburgenland, AT, PPs: BAB, WAB; D3- Diputacion Zamora, ES, PPs: DZ, CARTIF, D4- North-East Scotland, UK PP: GBIZ, JHI; D5-Andalucia, ES, PP: BALAM; D6- Zagori, GR, PP: EMZ; D7- Zakarpattya, UA, PP: FORZA, D8- Fiastra Valley, IT, PP: BF; D9- Zadar, HR, PPs: URB, CZAD; D10- Abruzzo, IT, PP: BORGHI, D11- Gotland, SE, PPs: RG, UU; D12- Törbel, CH, PP: BFH.

Groups at risk of social exclusion and underrepresentation: Stakeholders at risk of exclusion due to factors like physical disabilities, age, ethnic origins, religious believes and other intersecting aspects. Historically, these groups have been underrepresented and largely excluded from decision-making processes, especially in rural areas. These groups encompass, but are not limited to: 1) Young People (aged 18-29 years); 2) Older people over the age of 65-75 (varying based on national or local retirement age criteria); 3) People with long-term physical, mental, intellectual disabilities, or sensory impairments; 4) Migrants, and individuals belonging to linguistic, ethnic, and religious minorities; 5) Long-term unemployed: individuals who have been jobless and actively seeking employment for at least a year; 6) LGBTQIA+ community (lesbian, gay, bisexual, transgender, queer or questioning, intersex, asexual and more based on sexual orientation or gender identity).

Innovation: the process of developing new solutions or applying them in a new context, that has a significant positive impact in transforming established practices, products, processes, actions, models of governance, decision making practices, and initiatives, while generating added value for rural communities and better responding to their needs.

Local Action Plan (LAP): the document (Del 4.2) detailing the strategic vision of each Dynamo to be implemented in their territories, including the solutions that have been co-developed in WP4 with the RIE stakeholders, their feasibility, financing and the challenges they respond to. The LAP will be the first step towards the implementation of solutions.

Local Community Trainer (LCT): individuals or groups (organizations or informal collectives) who possess digital competences and the attitude of changemakers, that will be trained during the co-development phase, to be then able to train local communities around digital skills.

Local Task Force (LTF): A group of selected stakeholders that are most actively involved in the RIE, consisting of stakeholders that have specific expertise or interest in one or more RDD or that can benefit the most from the project co-development activities.

Rural Innovation Ecosystem (RIE): communities of people, places and practices that share interests in one or more specific RDDs to be established in Dynamos' areas.

Rural Development Drivers (RDDs): Set of drivers that guide rural development. They include Sustainable multimodal mobility; Energy transition and climate neutrality; Sustainable agrifood systems and ecosystem management; Nature-based and cultural tourism; Culture and cultural innovation; Local services, health and wellbeing.

Solutions*: place based established practices, products, processes, actions, models of governance, decision making practices, initiatives, policies and plans made up by one or a combination of various forms of innovations that drive rural communities towards a sustainability transformation.
** Authors and RURACTIVE partners agreed on the change from community-led, as defined in the Grant Agreement, to place based solutions to encompass a greater number of solutions that might not be developed entirely or solely by local communities while retaining strong features of participation.*

Stakeholder: An institution, organization, group or individual that has some interest or impact in one or more of the RDDs of the project, either as possible contributors to the co-development and implementation of solutions, or as a beneficiary of such solutions.

List of Acronyms and Abbreviations

AMT: Adaptive Monitoring Tool. Web application (in the form of Software-as-a-service, SaaS) that supports the monitoring programme
AoA: Areas of action according to "The long-term vision for the EU's rural areas" paper (LTRV), namely: Stronger, Connected, Resilient and Prosperous
BAB: Bundesanstalt fur Agrarwirtschal und Bergbauernfragen
BALAM: Asociación BALAM API
BHF: Berner Fachhochschule
BF: APS Borgofuturo
BORGHI: BorghiIN Rete Di Imprese
CARTIF: Fundación CARTIF
CZAD: Grad Zadar
DSS/DST: Decision Support System/Decision Support Tool
DZ: Diputación De Zamora
EA: Ethics Advisor
EC: European Commission
EMZ: Zagori Eco Museum-Koinoniki Synetairistiki Epicheirisi Syllogikis Kai Koinonikis Ofeleias Oikomouseio Zagoriou
EURICE: European Research and Project Office GmbH
EWI: Early Warning Indicator
F6S: F6S Network Ireland Limited
FORZA: Forza Agency For Sustainable Development Of The Carpathian Region Nonprofit Organizanon
GBIZ: GrowBiz Scotland
IAAC: Institut d'Arquitectura Avançada de Catalunya
IE: Innovation ecosystems
JHI: The James Hutton Institute
KP: Knowledge Partner
KPIs: Key Performance Indicators
KREI: Key Rural Empowerment Indicator
LAP: Local Action Plan
LAU: Local Administrative Unit
LCT: Local Community Trainer
LCP: Local Communication Plan
LTF: Local Task Force
LTRV: "The long-term vision for the EU's rural areas", European Commission initiative to develop a common European vision for 2040
LWS: Local Workshop
M: Month

MP: Monitoring Programme. The programme includes not only the monitoring tool but the assessment over the whole process, for creating the baseline, the initial diagnosis, the monitoring period and the final impact assessment
NUTS: Nomenclature of territorial units for statistics (from the French version *Nomenclature des Unités territoriales statistiques*)
PP: Project Partners
RDD: Rural Development Driver
RG: Region Gotland
RIE: Rural Innovation Ecosystem
UCD: University College Dublin, National University of Ireland
UNIBO: Alma Mater Studiorum_Università di Bologna
URB: Urbanex Doo
UOULU: Oulun Yliopisto - University of Oulu
UU: Uppsala Universitet
WAB: Wirtschalsagentur Burgenland Gmbh
WP: Work Package

1. Executive Summary

This report presents the methodology of the monitoring framework developed for the RURACTIVE project. It details the creation of a comprehensive set of Key Performance Indicators (KPIs) and Early Warning Indicators (EWIs), collectively referred to as Key Rural Empowerment Indicators (KREIs). These indicators, grounded in the conceptual approach from Task 2.1, serve to assess the impact of the project's interventions throughout its implementation.

Firstly, the report outlines an in-depth needs assessment of the Dynamos, offering a structured diagnosis that informs the most effective empowering actions to address identified challenges. The procedure developed over the months for the selection of the most appropriate indicators for the project and specifically for each Dynamo is explained. Likewise, the complexity found in the search for data for these KREIs is addressed, describing the sources from which data are obtained and appropriately translated to obtain the required information.

Additionally, the report includes a description of the monitoring programme, designed to generate quantifiable evidence of how innovation, local resources, grassroots initiatives, creativity, and social inclusion contribute to the transformation of rural areas. The data collected through this programme will be integrated into the RURACTIVE Digital Hub (RDH) and serve as a foundation for tracking the project's long-term impact, developed in upcoming tasks included in WP6.

The final section describes the process of defining and applying the KREIs, along with additional contextual indicators, to establish the baseline for each Dynamo. This baseline represents the initial state of the territories, providing a critical reference point against which future progress will be evaluated. By systematically analysing both qualitative and quantitative data, the report ensures a comprehensive understanding of the Dynamos' environmental and social conditions, measuring aspects related to tourism, employment or connections, as well as an analysis of the current situation of the municipality in terms of climate change mitigation and adaptation.

Task 5.1 plays a central role in RURACTIVE project by establishing a structured monitoring programme and impact assessment framework. The contributions of this Deliverable extend to multiple other WPs, ensuring that the project's objectives are systematically evaluated an improved.

This document defines the KREIs that will help assess how training and capacity-building activities under WP3 enhance local community capabilities. The monitoring data from WP5 (Task 5.3) will guide WP3's training effectiveness assessment, ensuring that Dynamos gain the necessary skills to sustain innovation-driven development. Similarly, Task 5.1 and WP4 (*Co-development of Solutions in Rural Innovation Ecosystems*) have been running in parallel, providing the former a baseline assessment for each Dynamo territory, offering critical insights into social, environmental, tourism, climate change, employments and more conditions. This has informed WP4's co-creation of Local Action Plans (LAPs). The monitoring framework developed in this Deliverable will allow WP4 to track the effectiveness of co-developed solutions and enable necessary mid-term adjustments to maximize impact.

Adaptative Monitoring Tool that will be developed in WP6, will rely on the data structure established in this deliverable, which defines a periodic data collection structured in different categories, which gives meaning to the data in a qualitative and quantitative way.

The outcomes obtained from T5.1 are twofold - a list of 133 Key Rural Empowerment Indicator (KREI) and a series of Baselines providing information on the Dynamos. The final list of KREI was developed after analysing a large number of indicators (936) coming from previously identified and reliable sources, then selecting and filtering them to an intermediate list of 272 indicators according to the RURACTIVE's project interests, and ultimately obtaining the most relevant indicators applying the RACER methodology. A Baseline per Dynamo has been developed, providing information on the Dynamo and allowing for comparison and analysis of the state of the art of the Dynamo across different categories or impacts, including indicators of economic, social, environmental and cultural relevance.

In summary, this document describes the work carried out in the analysis and selection of Key indicators for monitoring the solutions implemented in WP4. D5.1 acting as a backbone for WPs of RURACTIVE, ensuring that action implemented throughout the project, capacity-building efforts in WP3, and digital innovations in WP6 are effectively monitored, evaluated and improved. The insights generated from WP5 will be crucial for policy recommendations (WP7) and long-term sustainability planning, reinforcing RURACTIVE's impact on rural innovation.

2. Introduction

Deliverable D5.1 is the outcome of Task T5.1, dedicated to establishing a comprehensive monitoring programme for the RURACTIVE project. This deliverable lays the groundwork for assessing the initial conditions of the project's regions through an extensive set of indicators. These indicators, meticulously selected from diverse sources and references detailed in Section 3.2, provide a multidimensional perspective on the social, cultural, economic, and environmental aspects of the targeted areas.

As a graphical abstract, Figure 1 shows the whole process when a Dynamo gets to the RURACTIVE Ecosystem and the Adaptive Monitoring Programme is applied. First, a complete baseline is developed describing the Dynamo's current situation, based on the values of the indicators. This modular baseline includes an extensive list of available indicators, but adapts to the specific conditions of the Dynamo being analysed. With the collected information a Dynamo situation diagnosis is elaborated, helping to identify the challenges and define the possible solutions that will be later used in the Local Action Plan (LAP), defined in WP4. Next step is to fine tune the list of indicators, or even include new specific indicators adapted to the solutions, and identify which will be the early warning indicators (EWI). The Monitoring Tool manages data collection and processing, supporting the periodic reporting on the LAP evolution and Dynamo's continuous consultations.

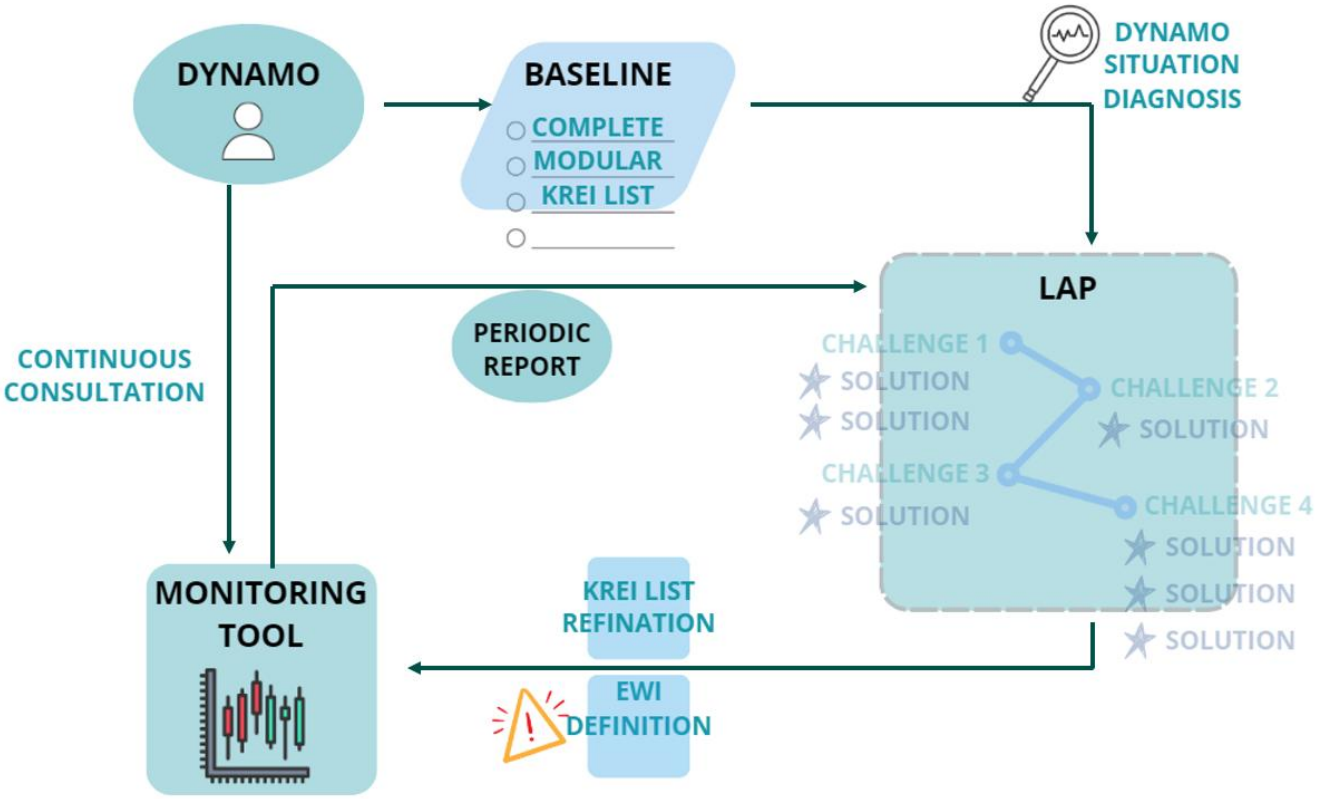


Figure 1: Dynamos' monitoring and assessment process.

The process of defining the monitoring programme involved a rigorous analysis of a large number of potential indicators. Initially, an extensive list of indicators was compiled, covering various aspects of the project regions. These indicators were then filtered and refined, with an emphasis on selecting those most relevant and representative for the project's objectives. The final selection process involved consultations with each Dynamo, ensuring that the chosen indicators aligned with the Challenges identified in Work Package 4 (WP4). As a result, a total of 133 indicators were selected, categorized into different thematic areas that reflect the transversal priorities of each Dynamo.

The selected indicators have been grouped into the following primary categories, or Cross-Cutting Priorities (CCP), each addressing critical dimensions of the RURACTIVE project:

- **Social Justice and Inclusion**. This category includes indicators that assess digital connectivity, road infrastructure, tourism activities, employment trends, and political engagement within each Dynamo. By considering regional disparities and socio-political contexts, this section provides an insightful overview of the existing social structures.
- **Climate Change Mitigation and Adaptation**. Indicators under this category focus on evaluating climate-related challenges and the resilience capacity of each region. These include environmental factors and adaptive strategies.
- **Biodiversity.** This section delves into the state of fauna and flora within each Dynamo. The importance of biodiversity monitoring is underscored, ensuring that future updates integrate more comprehensive datasets.

The last part of this deliverable (Section 5) and the Dynamos annex (Annex D. Crosscutting Priorities Data) are focused on deep analysis and validation of Dynamos' needs and state of the art for a preliminary diagnosis at different dimensions. Dynamos' qualitative and quantitative baseline is analysed from different perspectives: according to the RDDs; focusing on the cross-cutting priorities; or considering the Long-Term Vision for EU Rural Areas (LTVRA) 4 areas of action (AoA) (1). The procedure allows not only to get a baseline, but also to enrich the diagnosis of the current situation, considering reference values at regional, national and European level, helping to position the Dynamo situation according to those reference values. Data have been represented in the most optimal way, using maps, charts or diagrams according to their characteristics.

For each Dynamo, an Overall Description has been provided, offering an introductory overview that includes administrative context and a detailed description of the municipalities that form each Dynamo. This section establishes a foundational understanding of the regional framework before assessing the specific indicators.

The selected indicators provide a crucial baseline assessment of the regions before the implementation of solutions developed by the RURACTIVE project. By establishing this reference point, future evaluations will be able to measure the impact and effectiveness of interventions.

Moreover, throughout the document, certain indicators have been identified as Early Warning Indicators (EWIs), which serve as critical signals for emerging challenges. These indicators, detailed in

Section 0, provide timely insights into potential social, economic, or environmental issues that may require proactive intervention.

D5.1 provides a structured and data-driven approach to regional monitoring. By establishing a robust framework of indicators, this document ensures that the project is well-equipped to assess initial conditions, track progress, and anticipate challenges, thereby fostering more effective and sustainable solutions for the targeted rural regions.

3. Methods and indicators to develop the Dynamos' baseline

This task has developed an integrated evaluation procedure to measure the baseline of the Dynamos' territory. A 'baseline' refers to an established reference point or initial state against which something is measured or compared. Therefore, the baseline is the known starting situation against which to evaluate the results of the actions or interventions that will be carried out. This baseline will then be used as a reference information to assess and evaluate the impacts related with the implementation of the Local Action Plans, developed and implemented in WP4 and WP5 respectively. More specifically, this task has defined a wide range of indicators related to different impact categories and associated technical methodology and tools to measure them, the so called Key Rural Empowerment Indicators (KREI). This task has contributed to the development a smooth diagnosis of the Dynamos' state of the art, based on this first framework of KREIs.

The process followed to define the KREIs reported in this deliverable comprises 4 steps (see *Figure 2* and following sub-sections): firstly, the theoretical framework for KREIs has been established regarding LTVR Areas of Action and its links to RURACTIVE RDDs. Secondly, the impact domains related to the framework have been defined and several sets of indicators for its measurement have been selected and analysed. Thirdly, KREIs have been prioritized by RURACTIVE Knowledge Partners using RACER (Relevant, Accepted, Credible, Easy, Robust) methodology as explained in Section 3.3, in order to select the most suitable ones. And finally, KREIs have been considered according to cross-cutting priorities. Changes on LTVR Areas of Action were also considered as a possible result of the impacts measured by some of the selected KREIs.

A combined top-down and bottom-up approach was used in the process of KREI definition. Top-down approach was useful for identifying the key categories that should be taken into account, while the bottom-up strategy was used to find a set of suitable indicators fitting into the previously defined key categories.

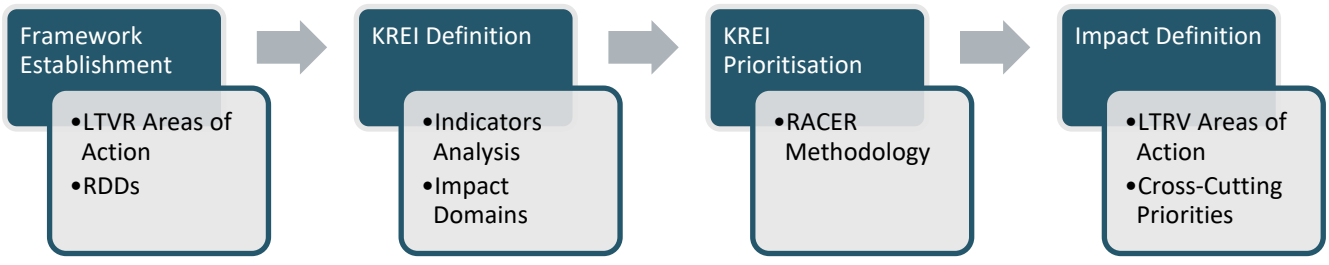


Figure 2: Process for KREI framework definition.

3.1 Framework Establishment

The starting point of KREIs definition was the selection done during proposal stage based on previous related projects, regulations and tailor-made procedures. This initial selection was used for developing the initial state of the art while developing the project proposal and then fine-tuned once the project began. Main information sources in this stage were the LTVR Areas of Action and the Rural Development Drivers.

3.1.1 Long-Term Vision for Rural Areas and Its Four Areas of Action

In 2021 the European Commission developed *The long-term vision for the EU's rural areas* (1) (aka LTVR) as an initiative to develop a common European vision for 2040. The document identifies four areas of action (AoA), namely: Stronger, Connected, Resilient and Prosperous, ten shared goals and six cross-cutting actions addressing issues affecting various themes and sectors covered in the LTVR.

Focussing on the four AoA definitions, a series of keywords or key concepts were proposed covering main sub-topics, as follows:

- Stronger rural areas: Rural areas should be home to **empowered and vibrant local communities**. Enabling both **women and men to take active part in policy and decision-making** processes, involving a broad range of **stakeholders and networks** as well as **all levels of governance**, is key to developing **tailor-made, place-based and integrated policy solutions** and investments. Innovative solutions for the provisions of services should be developed, making the most of the possibilities offered by **digital tools** and encouraging strongly **social innovation**.
- Connected rural areas: The further development of rural areas is dependent on them being **well connected** between **each other and to peri-urban and urban areas**. This makes them **easier to reach** while improving **access to a wider range of services for local communities**. Maintaining or improving public transport services and connections, as well as **deepening digital infrastructures**, are essential to ensure **better-connected EU rural areas**.
- Resilient rural areas: The **preservation of natural resources**, the **restoration of landscapes, including cultural ones**, the **greening of farming activities and supply chains** will make rural areas more **resilient to climate change, natural hazards and economic crises**. As providers of **services that protect ecosystems** and **solutions for carbon neutrality**, rural areas have a key **role to play in the green transition**. The **green and digital transitions should be fair** and take the needs of all rural members into account, **including** those from **disadvantaged groups to strengthen the social resilience** of rural areas. Making rural areas more socially resilient requires tapping into the full breadth of **talents and diversity** in our society.
- Prosperous rural areas: Rural areas can become more prosperous by **diversifying economic activities** to **new sectors with positive effects on employment**, and **improving the value added of** farming, agri-food, forestry and other **bioeconomy activities**. The diversification of economic activities should be based on **sustainable local economic strategies** including measures that

make their environment attractive to companies and **extend digital literacy**. It also requires giving access to digital and hybrid **education and training** for communities to **acquire new skills** and **support entrepreneurial mind-sets**.

Bearing in mind the identified keywords (in bold face), a list of AoA sub-categories was proposed as a suitable way of classifying the indicators in a top-down approach, as show in Table 1.

Table 1: Identified sub-categories in the 4 Areas of Action within the LTVR paper.

LTVR AoA	AoA Sub-categories
Stronger	Local communities
	Gender equality
	Policy and decision-making
	Stakeholders and networks
	Governance
	Tailor-made, place-based and integrated policy solutions
	Digital tools
	Social innovation
Connected	Connected to peri-urban and urban areas
	Easier to reach
	Improved access to services for local communities
	Improved public transport services and connections
	Improved access to services for local communities
	Deepening digital infrastructures
	Better-connected rural areas
Resilient	Preservation of natural resources
	Restoration of landscapes, including cultural ones
	Greening of farming activities and supply chains
	Resiliency to climate change, natural hazards and economic crises
	Services that protect ecosystems
	Solutions for carbon neutrality
	Rural areas' role in the green transition
	Fair green and digital transitions
	Strengthen social resilience considering the needs of disadvantaged groups
	Talents and diversity
Prosperous	Diversification of economic activities
	New sectors positive effects on employment
	Improving added value of bioeconomy activities (farming, agri-food, forestry, etc.)
	Sustainable local economic strategies
	Make the environment attractive to companies
	Extend digital literacy
	Access to digital and hybrid education and training
	Acquire new skills
	Support entrepreneurial mind-sets

3.1.2 Rural Development Drivers (RDD) for Rural Development and Empowerment

The RURACTIVE conceptual framework proposes six Rural Development Drivers (RDDs), based on evidence from 12 Dynamos or pilot areas, allowing the formulation of solutions which can be replicated in a wide variety of contexts across Europe and beyond and mainstreamed in territorial development policies.

Based on Deliverable '*D2.1: RURACTIVE Conceptual Framework for Innovation*' proposal for RDDs and sub-categories (see Table 2), the KREI and the associated baseline should cover as many as possible of these categories, as solutions to be developed into the project will be monitored through the use of such indicators.

Table 2: Rural Development Drivers and their sub-categories.

RDD	RDD Sub-categories
Sustainable Multimodal mobility	Asset sharing
	Ride sharing
	Flexible transport service
	Active travel (walking, cycling)
	Multimodal combinations
	Travel planning
Energy Transition and Climate Neutrality	Energy production, distribution and supply change
	Energy prosumership
	Greening for mitigation of carbon emission
	Carbon markets
	Load balancing
	Energy consumption and efficiency
Sustainable Agri-food Systems and Ecosystem Management	Agroecosystem management
	Ecosystem management
	Automation and IT for production
	Food supply, distribution and food waste reduction
	Sustainable diets and nutrition
	Quality check of raw and processed food
Nature-based and Cultural Tourism	Branding and destination management (DMO + DMC)
	Destination development
	Destination monitoring
	Monitoring and management of the carrying capacity
Culture and Cultural Innovation	Tangible cultural heritage management and conservation
	Valuing intangible cultural heritage
	Short term and long-term cultural events initiative

	Use and reuse of space (public, private, open space and buildings)
	Audience development activities and service diversification in cultural institutions
Local Services, Health and Well-being	Connected devices for care and wellbeing services
	E-governance
	Digital nomadism and remote working
	Employment and employability initiatives
	Education
	Public health and One-health approach
	Bottom-up initiatives for care
	Waste Management

3.2 KREI Definition: Key Rural Empowerment Indicators

When creating a new set of indicators, key performance indicators in this case, the first question that arises is "What is out there already?". So, it is necessary to perform an analysis of available indicators' sets, well known and well established, to avoid starting from scratch. There are several initiatives, many of them focused on cities such as *Cultural and Creatives Cities Monitor* (2) or *Euro Cities Monitor* (3), other working on specific areas, for instance the *EU Tourism Dashboard* (4) or the *UNESCO Framework for Cultural Statistics FCS* (5), but peculiarities of RURACTIVE make it difficult to find pre-developed solution that fits well with the requirements of the project: empowerment of rural territories based on the six selected rural development drivers. The adopted solution goes through the combination of indicators taken from different sources: ISO 37120, Nature-Based Solutions, KPI for rural development in China and previous European projects such as TExTOUR and RURITAGE. The heuristic selection of these specific sources was made based on the expertise and know-how of involved RURACTIVE knowledge partners.

3.2.1 ISO37120

The ISO 37120 standard "*Sustainable Development in Cities - Indicators for City Services and Quality of Life*" (6) establishes a framework for measuring and evaluating the performance of urban services and the quality of life in cities. The standard outlines a comprehensive set of indicators to guide cities in assessing their sustainability and resilience. It is intended for any city, municipality, or local government that aims to monitor and improve its urban performance, and provides a set of indicators to help cities measure the performance of their services and quality of life in a consistent, comparable, and verifiable manner.

The indicators cover various aspects of urban life, including economy, education, energy, environment, finance, fire and emergency response, governance, health, recreation, safety, solid waste, telecommunications and innovation, transportation, urban planning, wastewater, and water and

sanitation. Each category includes both primary indicators, which are essential for demonstrating performance, and supporting indicators, which provide additional context.

While ISO 37120 is primarily designed for urban settings, an adaptation work to rural areas of its principles and methodologies has been done, specifically in economy, energy, solid waste, urban planning, wastewater, water and sanitation, and profile indicators, with the aim of enhancing their sustainability and quality of life. Adapting the ISO 37120 standard to rural areas can help local governments and communities to improve service delivery by identifying gaps in services and infrastructure, allowing targeted improvements. By leveraging the comprehensive framework provided by ISO 37120, rural areas can systematically measure and improve their sustainability and quality of life, aligning with broader regional and national development goals.

3.2.2 Nature Based Solutions handbook

The European Commission has published a comprehensive guide "*Evaluating the Impact of Nature-Based Solutions: A Handbook for Practitioners*" (7) aimed at supporting the implementation and evaluation of nature-based solutions (NBS) to address various societal challenges. This handbook provides a structured framework for assessing the performance and impact of NBS across multiple domains, including environmental, social, and economic aspects. Nature-based solutions are defined as actions inspired and supported by nature, which are cost-effective and provide environmental, social, and economic benefits while helping build resilience. The handbook aims to offer a standardized approach for evaluating NBS, facilitating evidence-based policy-making, and promoting investments in NBS.

The handbook outlines a framework for monitoring and evaluating NBS. This includes:

- Principles and Steps: Guidelines for developing scientifically valid monitoring and evaluation plans.
- Indicators: A detailed set of recommended and additional indicators covering 12 societal challenge areas, such as climate resilience, water management, biodiversity enhancement, air quality, and social cohesion.
- Methodologies: Various methodological approaches are provided, including innovative tools for monitoring and data collection.

To illustrate the practical application of the evaluation framework, the handbook includes several case studies from different European cities. These case studies demonstrate how indicators can be used to assess the impact of NBS on climate resilience, water management, green space management, and other areas.

The data requirements for effective NBS monitoring and evaluation are also addressed. The handbook discusses the types of data needed, possible sources of data, and methods for data collection, including

remote sensing, in-situ observations, and citizen science. It also covers the importance of data integration and management to support comprehensive evaluations.

Although the handbook is primarily oriented towards urban environments, its principles and methodologies can be adapted to rural areas. In rural contexts, NBS can address challenges such as agricultural sustainability, water management, and biodiversity conservation. Adapting the indicators and evaluation methods to the specific needs and conditions of rural areas can enhance the relevance and effectiveness of NBS in these settings.

3.2.3 Key Performance Indicators for Rural Development in China

The document "*Key Performance Indicators for Rural Development in China*" (8) is a detailed analysis prepared by the Sustainable Development Policy and Finance Team at the Roberts Environmental Center. This report, originally focuses in rural territories unlike those previously mentioned, aims to establish a comprehensive framework to assess the effectiveness of rural development projects in China through the use of Key Performance Indicators (KPIs). The context of this study is China's rapid urbanization, which has brought about significant economic growth but also posed considerable challenges to rural areas, including the loss of traditional livelihoods, decreased agricultural land, and increased pollution.

Energy consumption and production are pivotal to understanding rural development. This helps gauge the sustainability of energy practices. Sectoral energy consumption offers insights into how different industries utilize energy, while energy intensity of GDP measures the efficiency of energy use in economic activities. Residential power prices indicate the affordability of energy, which is crucial for assessing the economic well-being of rural residents. These KPIs highlight the intersection of energy practices with economic and environmental sustainability.

Fresh water consumption per unit of industrial output and per capita consumption are also proposed or measuring, reflecting the balance between water use and availability. The compliance rate for water quality standards indicates the effectiveness of water management policies. These KPIs are essential for understanding the sustainability of water resources and the health impacts on rural communities.

Transportation infrastructure is also included as a key driver for rural development. The KPI list considers the capacity of public transport, the extent of road networks, and the availability of rail infrastructure. These indicators reveal the accessibility and connectivity of rural areas, which are vital for economic activities and quality of life. Vehicle ownership is also analysed to understand individual access to transportation and its correlation with living standards. These KPIs provide a comprehensive view of the transportation landscape and its role in facilitating rural development.

With regard to the social dimension of rural development, it is captured through KPIs related to health, poverty, and social support. Life expectancy and the poverty rate are direct indicators of social well-being. Access to healthcare and employment rates reflect the availability of essential services and

economic opportunities. These indicators are crucial for understanding the social fabric of rural communities and designing policies that promote social equity and well-being.

The analysis provides a robust framework for assessing rural development in China. By identifying and analysing a comprehensive set of KPIs, it offers valuable insights into the economic, environmental, and social dimensions of rural development. These indicators are essential for designing and evaluating policies that promote sustainable and inclusive development. The detailed analysis and methodology outlined in the report serve as a guide for policymakers, researchers, and practitioners working towards balanced and sustainable rural development in China, that has been adapted to the European context.

3.2.4 TExTOUR Project

Cultural tourism is the management of cultural heritage and tourism in an integrated manner, working closely with local communities to generate benefits for all stakeholders. This approach helps preserve both tangible and intangible cultural heritage while promoting tourism. The TExTOUR project (9), funded by the EU (G.A. 101004687), aims to co-design pioneering and sustainable cultural tourism strategies and policies to improve deprived areas in Europe and beyond.

To measure the impacts of the project, several categories have been considered: policy impacts (propose new policies and strategies on cultural tourism by assessing current trends and identifying best practices); economic impacts (assess costs and promote sustainable business models through public-private-people partnerships, and advise on better utilization of European Structural Funds); social impacts (preserve Europe's cultural identity, including minority cultures); research impacts (produce actionable data to assess synergies for implementing cultural tourism policies and operations); and cultural impacts (valorise all types of cultural heritage, and understand tourism diversity, site attractiveness, and accessibility through Cultural Tourism Labs).

3.2.5 RURITAGE Project

RURITAGE Project (10) is about harnessing Cultural and Natural Heritage (CNH) for sustainable rural growth, and has been funded by the EU (G.A. 776465). Rural areas in the EU encompass 83 % of its total land area and are home to nearly one-third of the EU population. These regions have long been a harmonious blend of nature and human society, embodying a rich tapestry of natural and cultural heritage. The RURITAGE project was conceived as a mean of recognising the need to protect these areas from economic, social, and environmental threats, while also promoting them as communities of sustainable development.

The impact of RURITAGE is significant (11), and it was assessed by a robust monitoring system (12). The RURITAGE project has successfully demonstrated that cultural and natural heritage can be powerful engines for the sustainable regeneration of rural areas. By fostering community engagement, transferring knowledge, and providing practical tools, the project has laid a foundation for ongoing rural development that respects and enhances cultural and natural heritage.

3.2.6 Rural Observatory

The long-term vision for the EU's rural areas (LTVR) is an initiative by the European Commission aimed at creating a unified European vision for 2040. This initiative acknowledges the diverse nature of rural territories across Europe while highlighting common challenges and opportunities. In developing this vision, the Commission sought input from rural communities and businesses through public consultations and stakeholder-led events. This collaborative effort resulted in the creation of an extensive vision and a comprehensive rural action plan designed to enable rural communities and businesses to achieve their full potential in the coming decades.

The Rural Observatory (13) is part of the rural vision tools. It facilitates the generation of knowledge and strives to enhance data collection and dissemination concerning EU rural areas. It provides relevant statistics, indicators, and analyses derived from multiple data sources and at the most suitable territorial granularity, encompassing economic, social, and environmental dimensions.

The Observatory plays a crucial role in deepening our understanding of rural areas and serves as a vital information source for 'rural proofing'. This process evaluates and assesses the impact of EU legislative initiatives on rural regions, supplying evidence for policymaking related to rural development.

Among the capabilities of the Rural Observatory, it is worth to mention: 'Rural Focus' compares areas classified as 'rural' in each country with those identified as 'urban' or 'intermediate'. When available, the data also consider remoteness, defined as a driving time to an urban centre exceeding 45 minutes; 'My Place' provides a comprehensive overview of any location, whether a region, sub-region, district, or municipality. By selecting your area of interest, you can see how it compares to other places in the EU. The most extensive range of indicators is available at the regional (NUTS2) level; 'Map View' enables easy comparison of a specific indicator across all areas in Europe at various levels of granularity (regions, sub-regions, municipalities) by displaying the information on a map. It also includes trends over time and, for some experimental indicators, future projections; and 'Thematic Analyses' integrate data with analytical capabilities to connect the dots and derive meaningful insights. The ultimate goal is to make sense of geo-spatial statistical information by transforming data mapping into robust multi-dimensional analyses at various territorial levels, with a specific focus on rural areas.

3.2.7 RURACTIVE KREI

After gathering information from the sources mentioned in sections above, a list of 936 indicators resulted. In order to reduce this huge number of possible indicators, a new list was made including all the indicators that were considered relevant for RURACTIVE, thus creating the first draft of KREI according to the AoA and their sub-categories. This first selection of indicators was done using a combined top-down and bottom-up approach. The top-down consisted in searching for indicators fitting in each AoA sub-category, while the bottom-up approach consisted in a deep analysis assigning every indicator its corresponding RDD and Sub-RDD categories. This selection resulted in 272 indicators

and was completed by the Knowledge Partners (KP) based on their expertise and according to the fields described in Table 3. It is worth noting that a minimum of two indicators per AoA sub-category was assured, but repetitions were allowed at this stage, as at that moment there were not enough information for selection making.

Out of the 272 indicators, 36 (13%) are classified as 'Stronger' AoA, addressing sub-categories such as local communities, gender equality, stakeholders and networks, and so on. 17 (6%) refer to Connected, 82 (30%) refer to Resilient and 37 (14%) are related to Prosperous AoA. There are 100 (37%) other indicators not assigned to any of this 4 AoA. Regarding the RDDs, out of the 272 indicators, 14 (5%) refer to Mobility, 18 (7%) to Energy, 39 (14%) to Agrifood, 7 (3%) to Culture, 101 (37%) to Wellbeing, 30 (11%) to Tourism, and 62 (23%) to Transversal. The latter is a new category that was included for those indicators that are necessary for AMT but do not necessarily fit with any of the predefined RDD categories (e.g. ISO134 – Dynamo area, or RO01 – Total population).

Table 3: KREI metadata.

Field	Description
Ref	Indicator unique identifier, composed by a code related to the source of the indicator and a number, in the form: *ISOnnn* for those indicators coming from ISO-37120; *NBSnn.mm* for NBS-based indicators; *IRDnn.mm* for indicators for rural development; *TExTnn.mm* relates to TExTOUR indicators; *RRTG.cc-nn* for RURITAGE-based indicators; *ROnn* for indicators coming from Rural Observatory; and *OTHnn* for other indicators coming for alternative sources or ad-hoc indicators (where *nn* and *mm* are sequential numbers).
LTVR AoA	Relates the indicator with one of the four Areas of Action among the four defined in the Long-Term Vision for Rural Areas: Stronger, Connected, Resilient, and Prosperous.
AoA Sub-category	Main indicator assignment based on LTVR sub-categories (see: *https://rural-vision.europa.eu/action-plan_en* and Section 3.1.1)
Indicator	Name of the indicator
RDD	Main RDD the indicator is related to
Description and Purposes	Textual description of the indicator
Units	Units in which the data that quantify the indicator are measured
Parameters to Calculate the Indicators	Qualitative description of the data
Calculation Method	Data unification work. The formulas necessary to translate the localized data into data that can be managed in the project are described

Geographical Level/Resolution (e.g. NUT3, NUT2, etc.) or (100x100m)	Details the scope of the data, whether it is national, municipal or local
Geographical Coverage (EU, National, Regional)	Origin of the data, European, national or other
Update Frequency	How often data are updated in a regular basis, e.g. yearly, monthly, daily
Most Recent Update	Date of last recording or amendment of data
Official Sources (if available)	Origin from which the data is obtained
Possible alternative sources at local level (e.g. Social media, sensors, crowdsourced app)	Alternative data collection, if a reliable source is not available
Link to the Source	URL to the data source
Dataset Code	Code that identifies the dataset at origin
Data Owner/Provider	Additional information about the source of the data, such as who owns it
Capitals	Characterisation of the data, classified as Cultural, Natural, Built, Social, Human, or Financial Capitals
Level	Level at which the data will be processed, at the project, Dynamo or Solution level
EWI (y/n)	Initial assessment of the importance of the indicator to select it as Early Warning Indicator or not. (Yes/No)

3.3 KREI Prioritisation: RACER Methodology

To ensure a transparent and systematic selection of indicators, the RACER methodology was applied. Originally developed for assessing policy-relevant scientific tools, RACER provides a structured framework to evaluate indicators based on five essential criteria:

- **Relevant**: closely aligned with the project's objectives.
- **Accepted**: recognised and supported by stakeholders, practitioners, and researchers.
- **Credible**: easy to understand, unambiguous, and interpretable by non-experts.
- **Easy**: feasible in terms of data availability and cost of data collection.
- **Robust**: resistant to manipulation and based on reliable or verifiable data.

In the RURACTIVE context, the RACER framework was adapted and simplified to assess the suitability of potential KREIs. Each of the five RACER categories was divided into two sub-criteria, resulting in ten sub-criteria in total (see Table 4). Each indicator was evaluated and scored based on these sub-criteria, with a maximum possible score of 100 points.

Table 4: RACER sub-criteria for RURACTIVE KREIs.

RACER Criterion	RURACTIVE Sub-Criterion	Description	Levels	Value
RELEVANCE	Meaningful	Is the indicator meaningful for RURACTIVE objectives?	High/mid/low	20/10/0
	Comparable	Is the indicator comparable across different cases?	Yes/no	10/0
ACCEPTED	Previously Used	Has the indicator been previously used?	Yes/no	5/0
	Standard	Is it a recognised or standardised indicator?	Yes/no	5/0
CREDIBLE	Unambiguous	Is it clearly defined and interpretable?	Yes/no	10/0
	Clear Methodology	Has the indicator a clear methodology?	Yes/no	10/0
EASY	Availability	Are the data easily available?	High/mid/low	15/10/0
	Easy to Calculate	Is the indicator easy to compute?	High/mid/low	15/10/0
ROBUST	Real Data	Does the indicator use real data or robust estimations?	Real/estimations	5/0
	Applicable to Similar Cases	Is it possible to apply the indicator in numerous (similar but different) cases? Has it been used in different circumstances and delivered reasonable results?	Yes/Maybe/no	5/2/0

This evaluation framework builds upon the approach developed in the RURITAGE project (12) and has been tailored to suit the specific goals of RURACTIVE. The indicators were assessed independently by three project partners—UNIBO, UCD, and CARTIF—based on expert judgment and internal analysis within each institution. Each indicator received a score for every sub-criterion. The resulting RACER scores were then averaged across evaluators to produce a final score between 0 and 100. Indicators with large discrepancies in evaluator scores triggered a flag (as noted in the *Warning* column in Figure 3) and were discussed jointly by the three partners to reach consensus.

Ref	LTRV	KREI (Key Rural Empowerment Indicator) (*)	Indicator	RDD	Average RACER Value	RACER VALUE FROM UNIBO	RACER VALUE FROM UCD	RACER VALUE FROM CARTIF	Comments UNIBO	Comments UCD	Comments CARTIF	Warnings: 45
OTH14	Stronger	Local communities	(ETIS) Percentage of the destination's events that are focused on traditional/local culture and heritage	Culture	71,66666667	65	65	85	0	0	0	
NBS18.4	Stronger	Local communities	Active engagement of citizens in decision-making	Wellbeing	53,33333333	40	45	75	0	0	0	
NBS18.1	Stronger	Local communities	Community involvement in planning	Wellbeing	20,66666667	15	35	12	We can have the	0	0	
NBS18.2	Stronger	Local communities	Community involvement in implementation	Wellbeing	14,66666667	15	17	12	We can have the	0	0	
NBS14.7	Stronger	Local communities	Social active associations	Wellbeing	36,33333333	25	37	47	0	0	Same as RRTG.SC-	
ISO134	Stronger	Local communities	Dynamo area (Square kilometres)	Transversal	83,33333333	80	75	95	0	0	0	
ISO101	Stronger	Local communities	Total Dynamo population	Transversal	34	0	2	100	DO we want a	0	0	Warning
ISO101-0	Stronger	Local communities	Total country population (NUTS-0)	Transversal	100	100	100	100	0	0	0	
ISO102	Stronger	Local communities	Population density (per square kilometre)	Transversal	100	100	100	100	Check the comment	0	0	
ISO104	Stronger	Local communities	Percentage of population that are children (0-14)	Transversal	93,33333333	90	100	90	As above	0	RO02	
ISO105	Stronger	Local communities	Percentage of population that are youth (15-24)	Transversal	96,66666667	100	100	90	0	0	0	
ISO106	Stronger	Local communities	Percentage of population that are adult (25-64)	Transversal	96,66666667	100	100	90	0	0	0	
ISO107	Stronger	Local communities	Percentage of population that are senior citizens (65+)	Transversal	100	100	100	100	0	0	RO02	
TExT10.8	Stronger	Local communities	Culture accessibility	Culture	25,66666667	0	7	70	Not sure how to	0	0	Warning
TExT25.1	Stronger	Gender equality	Equality	Wellbeing	0,666666667	0	2	0	Same as above	0	0	
OTH23	Stronger	Gender equality	Gender equality index	Wellbeing	52,33333333	35	55	67	National level is	0	0	
IRD8.6	Stronger	Gender equality	Employment rate of men vs. employment rate of women	Transversal	98,33333333	95	100	100	0	0	0	
ISO041	Stronger	Gender equality	Women as a percentage of total elected to municipality-level office	Transversal	94	95	97	90	0	0	0	

Figure 3. An excerpt of the spreadsheet file (edited for visual clarity) containing the KREI list with the assigned RACER values and the computed average.

The final selection of KREIs was guided by the following exclusion criteria:

- Indicators with a low "Meaningful" score were excluded.
- Indicators not comparable across cases were excluded.
- Indicators with low data availability were excluded.
- Indicators not applicable across different RDDs or similar cases were excluded.
- Indicators with an overall RACER score (computed average value) below 70 were excluded.

This selection process led to a refined set of high-quality indicators that are relevant, feasible, and transferable across RURACTIVE use cases. The resulting list of 133 KREIs is included in **Annex A. KREI List** and a sample of the excel spreadsheet is shown in Figure 3. Additional details on indicator definitions, including their RACER scores, and expert comments can be found in the excel file attached to this deliverable (`KREI - Key Rural Empowerment Indicators.xlsx`), which complements this methodology explanations with the exact data used along the process.

Out of the 133 indicators in the final list of KREI, 16 (12%) are classified as 'Stronger' AoA, 5 (4%) refer to Connected, 33 (25%) refer to Resilient and 17 (13%) are related to Prosperous AoA. There are 62 (47%) other indicators not assigned to any of this four AoA. Regarding the RDDs, out of the 133 indicators, 5 (4%) refer to Mobility, 12 (9%) to Energy, 17 (13%) to Agrifood, 3 (2%) to Culture, 40 (30%) to Wellbeing, 19 (14%) to Tourism, and 37 (28%) to Transversal. Taking into consideration the cross-cutting priorities, out of the 133 KREI, 4 (3%) refer to Biodiversity, 88 (67%) refer to Social Justice and Inclusion, while 20 (15%) refer to Climate Change Adaptation and 20 (15%) to Climate Change Mitigation respectively.

3.4 Impact Definition: KREI and Evaluation Procedures

3.4.1 Data Collection

The Dynamos are the main sources of data, jointly with open data sources such as Eurostat, Copernicus, OpenStreetMap, and Rural Observatory, among other country or sector specific data sources. Dynamos contribute through surveys and questionnaires, and RURACTIVE Data Hub and Monitoring Tool. The reliability of some data sources should be taken into account, but in general terms Dynamos and RURACTIVE Digital Hub provide more specific and updated data, and closer to the source of information. As a contingency plan, when Dynamos are unable to provide local data, it is possible to use information coming from alternative data sources. Although this is also useful for partially automate the data gathering process, as a rule of thumb whenever local data directly provided by the Dynamo are available, these data will be used preferably, and data coming from alternative data sources will be used otherwise.

A key aspect of the data collection process is the active engagement with Dynamos to ensure the accuracy and relevance of the data. Several online sessions were conducted with Dynamos to discuss and gather specific Dynamo-related data, such as Dynamo population, local environmental conditions, and socio-economic indicators. This collaborative approach ensures that the data collected is site-specific to the unique characteristics of each Dynamo. By incorporating such data into the database, the RURACTIVE project has been able to create a more accurate and comprehensive database that reflects the realities of the Dynamos' territories.

There are various issues to consider whenever updated or new information are sought to be included into the database. The identified most critical issues are:

- the format of the new data to be included
- the format used for the representation of data in the database
- the quality of the data
- possible conflicts that result in inconsistencies in the data

The ETL-process (Extract, Transform, Load) provides general guidelines on how the task of including newly available data into the database can be accomplished. The first step is to request the newly available data. The other steps in the ETL-process depend on the success of the first step. In the second step, the data that was extracted or obtained from various sources:

- is checked for possible errors (e.g., formatting errors and inconsistencies), and
- may need to be converted into a common format such that the data can be included in the database

Checking data for errors is another very important issue which requires information about the format, the individual elements in the data, their expected data type, range (whenever is this applicable), and other parameters. Adding incorrect data to the database may lead to severe problems during data analysis and lead to false conclusions on the basis of the analysis. Hence, this important issue can be addressed on the basis of a detailed description of the format of the available data and any expert knowledge associated with the data.

Provided that the entire dataset to be included in the database is in accordance with these constraints, it will be added to the database. Otherwise, if only a part of the dataset is in accordance with the constraints, options are:

- reject lines/parts from the data that are not in accordance with the constraints, but add the remaining valid lines to the database, or
- reject the complete dataset from being inserted into the database

Adding parts of new data into the database might lead to problems and shall only be performed with extreme caution, as the context may be lost resulting in possible problems during the analysis of the

data. Hence, it is often preferred to determine the reason for those parts/lines not being in accordance with the constraints and the Dynamo could then be informed.

Another issue that is closely related to the validation of the data is finding a way of dealing with missing values in the new data to be included. It is likely a good idea to obtain the opinion of experts on how missing values in the datasets shall be dealt with, if such cases occur.

Other tasks that may also need to be included in the second step of the ETL process are:

- transforming individual elements of the data, e.g. transform a value from one unit to another (such as transforming an area from square miles to km2) in order to harmonize the data
- conversion of data types (e.g., converting a string to a double value or to a date)
- deriving new values on the basis of the present values, in order to allow for easier analysis
- sorting the data

The quality of the data is another issue that needs to be considered both when initially building the database and whenever it shall be updated. As it is usually not possible to fully automatically determine if the amount of data is large and representative enough for any assessment task on the basis of the data, the RURACTIVE project needs to ensure that the data from Dynamos are of high quality, representative and can indeed be used for the considered purposes.

3.4.2 Early Warning Indicator (EWI)

Based on the indicators selected in task T2.1 (*Development of a conceptual framework for rural smart and community-led solutions*) and developing the analysis described in the introduction of the document, some KREIs considered important have been selected. These indicators sub-set are the Early Warning Indicators (EWI), and serve as critical signals for emerging challenges. The EWI provide timely insights into potential issues that may require special attention and proactive intervention.

EWI have been selected following different criteria

- At least one from each category, from each RDD and from each Crosscutting Priorities
- Dynamos will have the possibility of identifying some specific indicators as EWI at Solution level, providing information, detecting anomalies and launching alerts as solutions are implemented
- Reflect important indicators within the framework of the RURACTIVE project, focused on rural areas.
- Accessibility, as well as the veracity of the data, has also been taken into account. That it is easy to locate the data and that they also come from a reliable source.

For the monitoring of the EWI, a procedure has been established for each Dynamo to feed the data at least every six months. The feeding of these, as well as the clarity of the data, depends on the

Dynamo. The more specific the data is, the more focused on their regions, the more valid they will be.

Throughout the project, they may change depending on the availability and/or preferences of the project members. This analysis is a dynamic study, which can be modified in order to establish a robust and useful procedure that is adaptive and manageable by the Dynamos. The initially selected EWIs are listed in Table 5.

Table 5: Initial list of EWI.

Ref	Indicator	RDD	Crosscutting Priorities
NBS2.6	Total surface area of wetlands/peatlands	Agrifood	Biodiversity
NBS6.32	Heatwave incidence	Agrifood	Climate Change Adaptation
NBS24.18	Number of new jobs in green sector	Agrifood	Climate Change Adaptation
OTH14	(ETIS) Percentage of the destination's events that are focused on traditional/local culture and heritage	Culture	Social Justice and Inclusion
ISO073	Number of internet connections per 100 000 population	Wellbeing	Climate Change Mitigation
ISO120	Cost of living	Wellbeing	Social Justice and Inclusion
TExT1.2	Accommodation occupancy	Tourism	Social Justice and Inclusion
RO07	Population density	Transversal	Social Justice and Inclusion
ISO024	Greenhouse gas emissions measured in tonnes per capita	Energy	Climate Change Mitigation

3.4.3 Regular Data Collection Campaigns

Data collection and KREI calculation will last for almost 2.5 years, from April 2025 to August 2027 (see Figure 4). Over this time, a full set of data will be collected and task leader will report at M34 (June 2026) about the data collection process, in order to ensure a proper supervision and analysis. This mid-term evaluation will allow corrective actions to be taken and improve solutions with the aim of maximising their impacts. To achieve this objective, regular data collection campaigns will be run every 6 months. An online procedure, similar to the one developed for the Baseline will be available for Dynamos, in order to make easier the data collection process. As in the previous case, results will be collected and uploaded to the database once they are reviewed and validated. AMT will be up and running beyond project end for any additional Dynamo willing to replicate the Monitoring Programme.

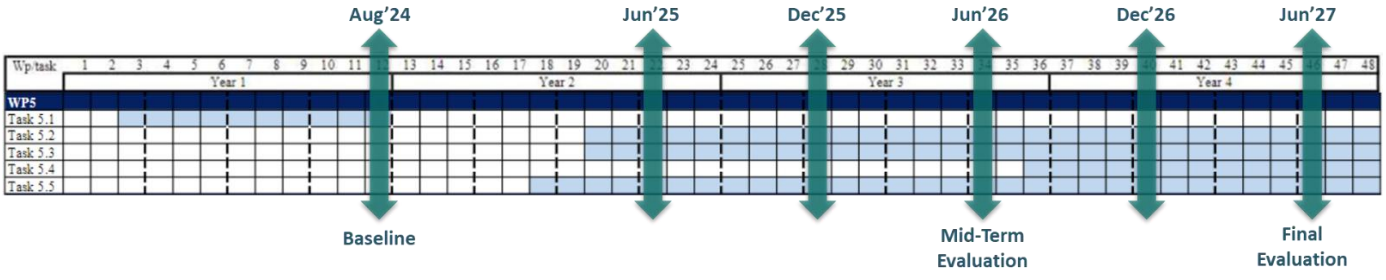


Figure 4: Plan for the Baseline and regular data collection campaigns.

As previously seen, every Dynamo has the possibility to choose the indicators that are relevant for their specific situation. During the Gotland workshop (see **Annex B. Task 5.1 Introductory workshop**), the final list of KREI was presented to the Dynamos so they could carry out a preliminary selection (see **Annex C. Indicators Initial Selection by Dynamo**). Subsequently, the indicators are being refined at the Solution level, considering that selecting between three and five indicators per Solution would be an appropriate number.

Noting the wide diversity of Dynamos and their casuistic, it is also possible to include a few additional indicators for very specific aspects. These additional indicators could come from either the original list of indicators from the considered sources, or brand-new indicators created from scratch by the Dynamos. In either case, these indicators must follow the same rules and structure set for the regular list of indicators, providing all the necessary information in order to include them in the list.

Depending on the type of indicator, it could be necessary to set different frequencies for data collection. For instance, the updating period for those indicators related to statistics could vary from a few weeks to a year or several years. This frequency could be even lower in the case of indicators related to other environments, e.g., indicators linked to results of solutions developed in the Dynamos. These characteristics, i.e., include additional indicators and set the frequency for data collection, make the monitoring programme “adaptive” as it fits with the specific needs of every Dynamo.

3.4.4 Citizen Science

With the proliferation of portable technologies, such as smartphones and wearable technologies, low-cost sensors and increased technological skills among the population, the role of citizens in monitoring their environment has increasingly taken root. Citizens are becoming increasingly active in tackling critical challenges, such climate change mitigation or biodiversity monitoring, that directly affect them, thereby implementing many bottom-up initiatives around the globe (14). They are demonstrating that environmental issues in rural areas can be addressed collaboratively, considering the realities and needs of the communities affected and harnessing their creative capacity and contributions, thereby raising citizens' awareness of environmental issues and increasing the sense of citizenship. This involvement can take many shapes and forms and generally comes together under the umbrella of citizen science. The essence of citizen science is that citizens are involved in one or various stages of a scientific investigation, such as compiling research questions, conducting observations, analysing data and using the resulting knowledge (15). Researchers or scientific institutions can lead or mediate in citizen science projects or have no role, as in extreme citizen science (16). Additional information about its application in RURACTIVE can be found in Annex B. Task 5.1 Introductory workshop.

3.4.5 Demographic trend and projection methodology

The demographic analysis reports the trend and fluctuations in population and growth rates respectively for populations across Dynamos from 1961 to 2021, with a view to long-term population trends, signs of stagnation,

or reduction in population. The main dataset is sourced from the Rural Observatory, which provides historical population records for most Dynamos.
To make the plots clearer and understand the trends better, both the variability of population size and growth rate were categorized into discrete classes. The number of classes used depends on the distribution of values-if the number of LAUs is large and trends vary substantially, more classes were used to capture the diversity in trends.
In one hand, to analyse **population (persons)** data, LAUs have been classified according to their average population across the period 1961–2021 rather than values for individual years. Percentile cutoffs were made; the 50th percentile, or median, was in general considered the critical threshold. Accordingly, depending on distribution, LAUs have been classified. For instance, in case of four classes in D06 (Zagori Greece):

- Very Low Population (<25%)
- Low Population (25% – 50%)
- Moderate Population (50% – 75%)
- High Population (>75%)

On the other hand, **decadal growth rates (%)** were calculated for each LAU for six periods (1961–1971, 1971–1981, 1981-1991, 1991-2001, 2001-2011, 2011-2021). The variability measure is defined as the difference between the maximum and minimum decadal growth rates for each LAU (max-min difference). Based on this variability, LAUs were grouped into classes. For example, in case four classes in D06 (Zagori Greece):

- Lower-fluctuation LAUs (variability<60%)
- Moderately fluctuating LAUs (60%≤variability<85%)
- Highly fluctuating LAUs (85% ≤ variability<100%)
- Extremely fluctuating LAUs (variability≥100%)

These classes can provide insight into long-term stability, fluctuations, and possible influences on demographic development, which are useful in informing policy discussions and regional development strategies.
The **future projection** of the population for LAUs for the years 2051 and 2101 was done based on historical data from 1961 to 2021. First, decadal growth rates were calculated for each LAU i.e., the percentage change in population between each decade. Then, a weighted growth rate approach was applied, whereby more importance was given to recent decades. 20% for the earlier decades and 10% for the most recent decades, 2001–2021. These weighted growth rates were used in projecting future populations by applying the rate to the recent population. The percentage changes between 2021–2051 and 2021–2101 were also calculated.

4. Adaptive Monitoring Programme

4.1 Overall Approach

This subsection describes the technical analysis of the system based on the identified actors and components. It details the interaction between different modules, the technologies used, and the communication flows. A structure based on a standard component diagram has been defined in WP6 and is referenced here to ensure a clear and scalable design (see Figure 5).

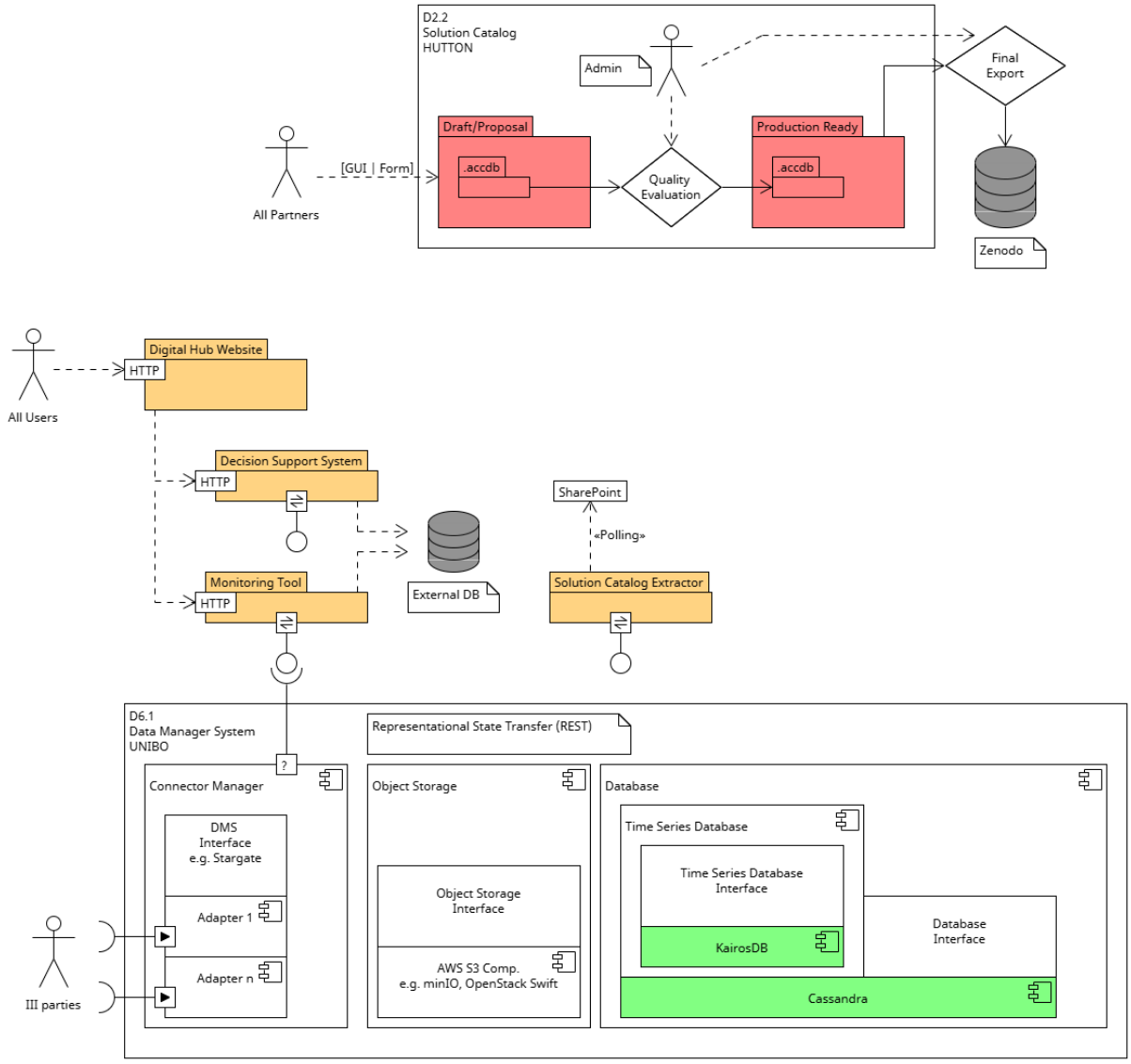


Figure 5: RURACTIVE reference architecture.

4.1.1 System Components

Actors

Three main actors are defined in the system:

- All Users: Users who interact with the system through a web interface. Can be anyone on the internet accessing the public part of the system
- III Parties: External entities that interact with the system through adapters. These users belong to the entities awarded in the Open Call with a grant to develop solutions for the Dynamos
- Dynamos: Users who utilize the Solution Catalog subsystem to address specific issues in each area, such as accessing to solutions or providing values for the indicators in the AMT

The System Interacting with "All Users"

This system is defined through packages and an external database. The first three packages communicate through web services based on HTTP. These packages are:

- Digital Hub Website: This is the main interface through which All Users interact with the system. It uses the HTTP protocol and connects users to the database. It depends on the following two modules for its operation: Decision Support System and Monitoring Tool. There is a client-server relationship, where the Digital Hub Website acts as the client, and the other two modules provide the required services.
- Decision Support System: Analyzes and provides recommendations based on data stored in the External DB.
- Monitoring Tool: Monitors key parameters and detects relevant system events. This module connects to the Data Manager System of the project. It also connects to the External DB database. This tool will be detailed in following sections, as it is the tool developed for the project within this package
- The third package is the Solution Catalog Extractor, which is briefly mentioned here but more information is available in WP2 and Task 6.3 Decision Support Tool.

Architecture of the "Data Manager System"

This system acts as a service for the Digital Hub Website and connects with Dynamos and III Parties actors. The Data Manager System functions as a communication layer based on REST architecture, meaning that all components are accessible using standard HTTP methods (GET, POST, PUT, DELETE). This system consists of three main blocks:

- Manager Connector: This is the user entry point and consists of:
    - DMS Interface: Data management interface.
    - Stargate and Adapters: Facilitate the user's direct connection to the system. Any data provided either by Dynamos' solutions or III Parties' solutions should be stored in the Data Manager through the Connector Manager and the corresponding Adapter.
- Object Storage: Responsible for storing tables, collections, or any object deemed necessary for the functioning of the system, and consists of:
    - Object Storage Interface: Manages interactions with storage.
    - AWS S3 Component: Compatible with systems such as MinIO, OpenStack Swift, among others.
- Database: The database management component, which includes:
    - Time Series Database Interface (KairosDB): A time-series oriented database.
    - Database Interface: The module that provides database access.
    - Database Manager (Cassandra): A highly scalable NoSQL system.

4.2 Monitoring Tool

4.2.1 Conceptual Architecture

The Figure 6 shows a components diagram that illustrates the operation of the Monitoring Tool package and how it interacts with the system.

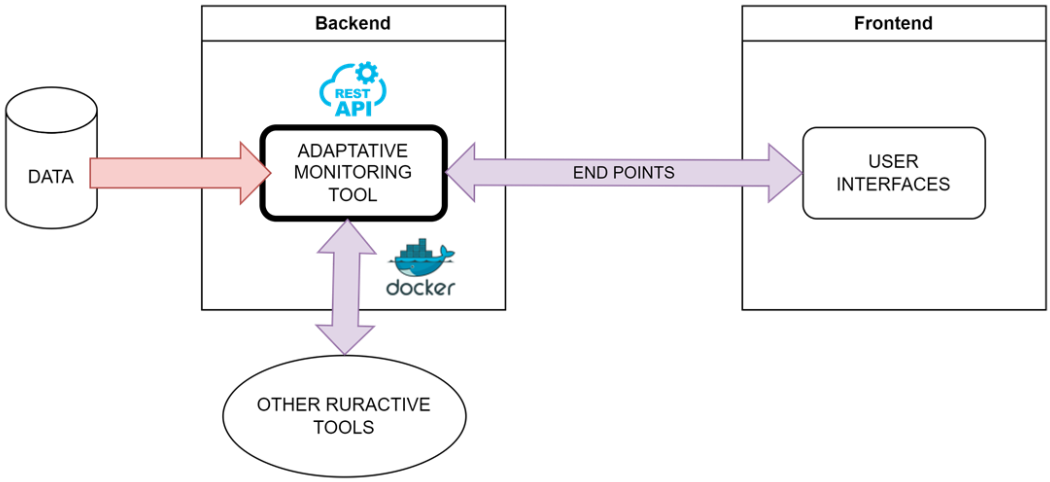


Figure 6: AMT conceptual architecture.

The system consists of two main modules: the Backend and the Frontend. The Backend contains the "Adaptive Monitoring Tool," which serves as the core for processing and monitoring incoming information. Its features include providing services through a RESTful interface, containerization to enhance portability and scalability, and the ability to consume data from an external database. Additionally, it maintains bidirectional communication with the Frontend and integrates with external reactive tools to extend its functionalities or interact with other systems.

On the other hand, the Frontend handles the user interfaces, serving as the system's interaction layer. It is bidirectionally connected to the Backend, enabling a client-server architecture in which the Frontend consumes services exposed by the Backend and sends data for processing. Overall, the diagram represents a modular and scalable architecture where the Backend manages the system's core logic, while the Frontend enhances the user experience. Containerization with Docker and the use of REST APIs ensure interoperability and efficient deployment.

4.2.2 Functionality of the Monitoring Tool

The monitoring tool package is designed to manage the collection, validation, visualization, and analysis of data relevant to the project. The system consists of various actors and use cases that interact with each other to ensure the proper operation of the monitoring system. The actors, main use cases, relationships between them, and additional procedures are described in Figure 7, enabling dynamic and flexible data management.

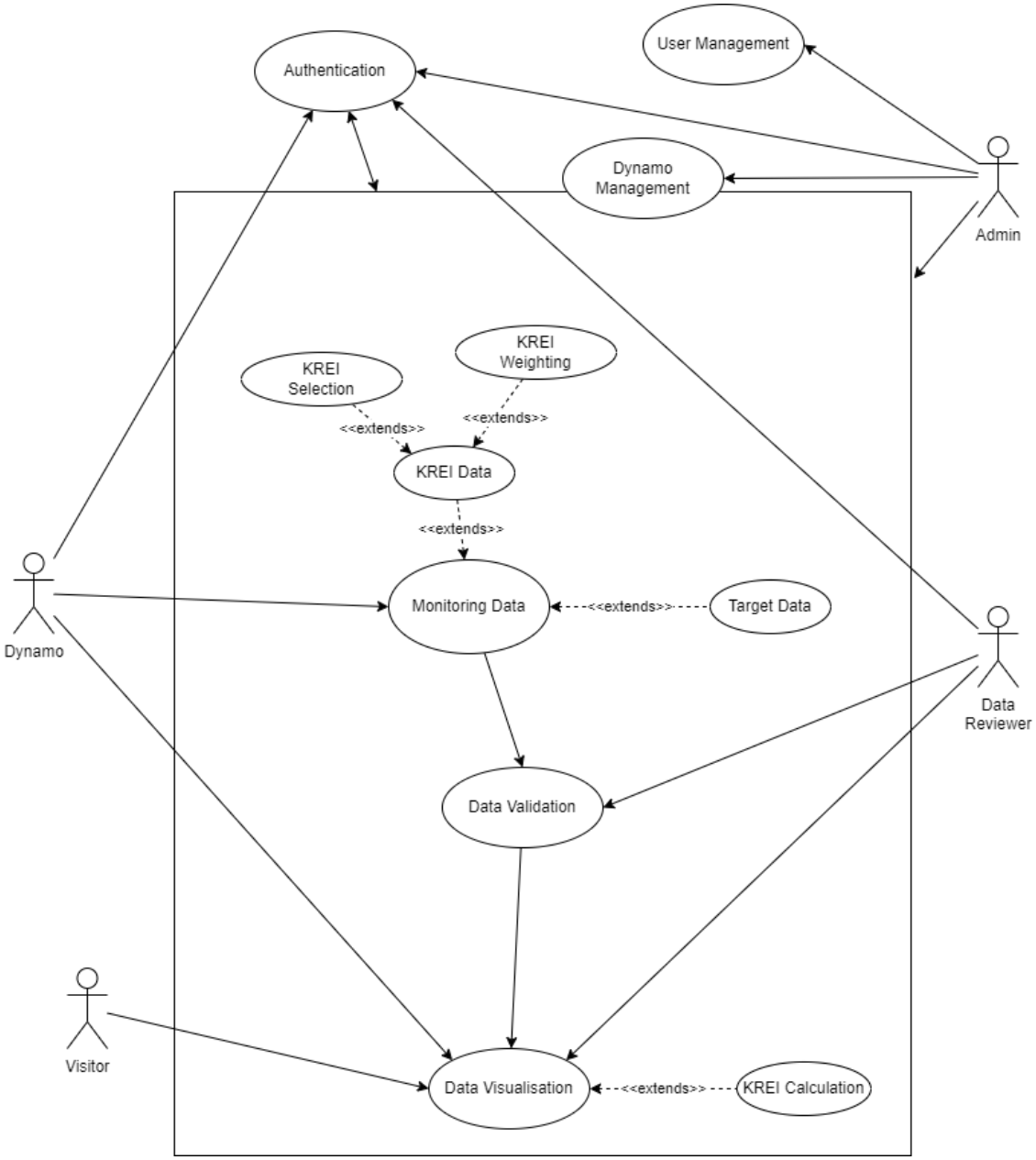


Figure 7: AMT Use Cases diagram.

System Actors

- Dynamo: The Dynamos play a crucial role in data collection during regular monitoring campaigns. These actors select the relevant indicators for their regions, assign a level of relevance, and, if necessary, add additional indicators. In the use case diagram, this activity is associated with the *Monitoring Data* use case, where Dynamos manage both the collection and monitoring of the data, including Early Warning Indicators (EWIs). Additionally, Dynamos have the option to customize the indicators according to their specific needs.
- Data Reviewer: The *Data Reviewer* is responsible for checking, validating, and accepting the collected data. Their role is to ensure that the data is correct before being entered into the

system for later visualization. This actor has access to the authentication, data validation, and visualization modules, playing an essential role in the quality of the data entering the system.

- Visitor (equivalent to *All User*): This actor has limited functionality and can only access the *Data Visualization* module to view the validated and analyzed data. Visitors do not require authentication, which allows them easy access to the information.
- Admin: The *Admin* is in charge of the general management of the system and users. This actor has the ability to oversee the monitoring processes, manage the system configurations, and ensure that data collection procedures are followed correctly. The *Admin* also has access to the *User Manager* use case for managing users and the *Dynamo Manager* use case to oversee and manage the operation of the Dynamos monitoring system.

External Use Cases

- Authentication: This use case manages the authentication process for actors who need to enter the system, ensuring that only authorized users can access certain functionalities. All actors, except the Visitor, require authentication to access the system.
- User Manager: Exclusive to the Admin, this use case allows the management of users within the system, such as adding, deleting, or modifying users and roles. It is crucial for maintaining security and controlling access within the system.
- Dynamo Manager: Related to both the system and an external service, this use case allows the Admin to manage the operation of the Dynamos monitoring system, ensuring its operation, configuration, and control.

Main Use Cases of the System

- Monitoring Data: The *Monitoring Data* use case is where Dynamos select and collect relevant data. This collection includes both standard indicators and EWIs, which must be updated periodically (e.g., every six months). Dynamos also select and weight the relevant indicators through the *KREI Selection* and *KREI Weighting* use cases, following the system's rules and structure.
- Data Validation: In this use case, the *Data Reviewer* validates the data collected by the Dynamos before it is visualized. Data validation is crucial to ensure information accuracy, especially for EWIs that are sensitive indicators that can anticipate problems or deviations. The validation process ensures that the data is reliable before being used for further analysis.
- Data Visualization: Once the data has been validated, it is visualized through the *Data Visualization* module. Both Dynamos and Data Reviewers can access this module to analyze the results of the collected and validated data. Additionally, this use case may extend to the *KREI Calculation* use case whenever it is necessary to update those calculations, i.e. when new data are available.

Integration of Additional Procedures

The frequency of data collection for certain indicators, such as those related to statistics, must be configurable within the system. This adaptive aspect requires dynamic management, where the Admin has the ability to modify frequency settings or add new indicators, including those proposed by the Dynamos.

This flexible approach of the system is reflected in the relationship between *Monitoring Data* and *KREI Selection/KREI Weighting*, as depending on the type of indicator, the system may adjust the monitoring frequency or allow the inclusion of custom indicators. This adjustment is crucial for ensuring that the system can adapt to the changing needs of the Dynamos and guarantee the effectiveness of data collection according to the specific objectives of the project.

Use Case Scenarios

- Adaptive Monitoring Scenario: The Dynamos select the indicators they consider most relevant for their regions, assign a weight to each, and update them regularly (every six months or as necessary). If an EWI is selected, the system ensures that its monitoring is done under special vigilance, and in case of anomalies, automatic alerts are issued for immediate follow-up.
- Data Validation and Visualization Scenario: Once the Dynamos have collected the data, the Data Reviewer validates it to ensure its accuracy before being visualized. Both Dynamos and Data Reviewers can access Data Visualization to analyze the impact of the validated indicators and make informed decisions based on this information.
- Indicator and Collection Frequency Management Scenario: The Admin has the ability to adjust the collection frequencies of data indicators or add new indicators as needed.
- Public access Scenario: Any person can act as a Visitor and access to the public part of the AMT without further requirements, consulting the available open data through the dashboards.

Additional detailed information about the definition of the Use Cases and requirements analysis could be found in Annex F. AMT Requirement Analysis.

4.3 Data Analytics

Data pre-processing is a relevant step in statistic processes. Available data are often obtained in a not well controlled domain. Out-of-range values (e.g. Income: -100), impossible data combinations (e.g. Gender: Male, Pregnant: Yes), missing values, outliers, are often included into datasets. Models that were built with that data can produce misleading results. The improvement of the quality of available data is an essential step that must be carried out in order to obtain accurate results.

An outlier is a value far from most others in a dataset. There are several methods to deal with outliers, depending on the type of variable. For nominal variables, frequency analysis is a common solution, discarding those values with a frequency of 1% or less. If the variable is continuous and normally

distributed, distance from the standard deviation is often used, discarding those values farther than 3 times the standard deviation.

When handling data from different sources, there might be some undesirable effects such as different units for the same measure or different ranges. In order to avoid these effects, it is necessary to employ methods like data normalization or standardization to convert all data into a common format that allows comparing data originating from different sources. Normalization, for instance, is used to scale numeric values to a particular range, usually to the interval [0, 1] or z-score normalization. Data harmonization is based on a detailed description of the individual elements in the data coming from different sources.

Every indicator could have different relevance when calculating the KREI values and the global value for each Dynamo. The proposed way to set the indicators weights is to provide a form to certain users within the Ds who will determine the values for the selected indicators in a specific Dynamo. There will be only one set of weights per Dynamo and this set will be used all along the monitoring programme in order to be coherent with the calculations.

Ref	Indicator	Units	Description and Purposes	Relevant for Dynamo	Baseline Value Provided by the Dynamo	Automated Value	Min	Max	Target	Weight
IRD6.3	Total number of rail crossings and rail stations	No.	Railway transportation infrastructure and accessibility is able to infer connectivity within an area through the use rail services	No						
IRD6.1	Maximum total daily capacity of public transport as a percentage of population	%	Maximum total daily capacity of public transport as a percentage of population	Yes		0,428848466	0	1	0,6	80%
ISO079	Number of personal automobiles per capita	No. Per capita		No		0,88822852				
ISO082	Kilometres of bicycle paths and lanes per 100 000 population	No.		No		0				
RO67	Average distance to train stations	km	Average distance to train stations	Yes	68,95	38,53; 10,78; 60,55	50	70	50	20%

Figure 8. Example with Mobility indicators.

For instance, Dynamo shown in Figure 8 has selected 2 out of 5 possible indicators for Mobility RDD. Among those 2 indicators, it has been set that IRD6.1 has a higher relevance than RO67, i.e. when calculating the KREI value for Mobility, the global performance will be obtained through a weighted average, where IRD6.1 accounts for 80 % of the weight and RO67 the remaining 20 %. Similarly, the global KREI value for a Dynamo will be the result of a weighted average of the KREI values for the different RDDs. In this example:

$$KREI(\text{mobility}) = w(\text{IRD6.1}) * p(\text{IRD6.1}) + w(\text{RO67}) * p(\text{RO67}) = 0.8 * 0.71 + 0.2 * 0.05 = 58.23\ \%$$

Where *w(indicator)* is the weight assigned to the indicator, *p(indicator)* is the performance of the indicator estimated according to the current, minimum, maximum and target values. Specific formula for obtaining the performance depends on every indicator in a case by case basis, considering if "positive" performance evolution is related to an increase or decrease in the indicator value. Typical examples are GDP and unemployment, where an increase in the value of the former is deemed positive while is just the opposite in the latter case. These calculations can be run when developing the baseline and in a regular basis, e.g. every six months, thus obtaining updated values for the global indicators until the end of the monitoring programme.

4.3.1 Tracking the FAIR Principles in the Dynamos Dataset

This section describes the implementation of the FAIR principles (Findable, Accessible, Interoperable, Reusable) in the structure and documentation of the dataset "KREI - Key Rural Empowerment Ind v20240927_UNIBO-UCD.xls". The proper application of these principles ensures that the information contained in the file can be easily identified, accessed, used, and integrated into different systems and platforms. The main objective is to maximize the usability and transparency of the data within the project framework, ensuring that the Key Rural Empowerment Indicators (KREI) are accessible both to team members working on subsequent work packages (WP) and to external users who may benefit from their further exploitation.

Below, we provide a review of the document, classifying the sections according to their influence on each of the FAIR principles:

FINDABLE

To facilitate the search and retrieval of information, various strategies have been implemented in the file's nomenclature, structure, and content.

File Structure:

- The file follows a **clear naming convention** that allows for quick identification, including the acronym describing the data subject of this WP (**KREI** – Key Rural Empowerment Indicators), a brief description (**Key Rural Empowerment Ind**), the document version (**v20240927**), and the responsible institution (**UNIBO-UCD**).
- **Data is organized into structured spreadsheet sheets** such as **"KREI_D01"**, **"KREI_D02"**, etc., allowing information to be segmented according to its category, in this case, its source. The suffix **D0X** indicates each of the **dynamos** studied, numbered from **1 to 12**. Each sheet contains the information corresponding to its specific dynamo.

Unique Indicator Identification:

- Each KPI within the file has a unique identifier in the "Ref" column, ensuring its traceability. Examples: IRD6.3, ISO079, RO67

- Additionally, the indicators follow a structure that identifies their type/category: IR, ISO, RO...

Clear Definition of Data:

- The "Indicator" column specifies the name of each indicator. Example: "Total number of rail crossings"
- A "Units" column is included to define the measurement unit for each indicator. Example: "km" or "No."

Cross-Reference and Categorization:

- The "Baseline" and "Target" columns establish reference values and objectives, facilitating trend identification.
- The categorization of KPIs is defined in the "RDD" column, grouping indicators into relevant project categories: Agrifood, Culture, Energy, Mobility, Tourism, and Well-being, including an additional category: Transversal, for those general context indicators not directly related to any of the previous categories.

ACCESIBLE

Making data accessible is crucial for ensuring its usability across different tools, facilitating integration into automated systems, and enabling researchers, policymakers, and stakeholders to make informed decisions. By structuring data in a clear and accessible manner, we ensure that it can be easily retrieved, analyzed, and shared without restrictions.

File Format and Compatibility:

- The file is provided in Excel format (.xls), which is widely compatible with tools such as Microsoft Excel, Google Sheets, Python (pandas), and R.
- To enhance interoperability, it is recommended to export a version in .csv, allowing seamless integration with data processing and visualization software.

Data Documentation and Traceability:

- The data sources are documented in the "Dynamo's Source" and "Automated Value Source" columns, ensuring transparency regarding the origin of the information.
- The "Status" column indicates the availability of data, using values such as "not yet available," "in progress," or "available." This helps users understand the current state of the dataset.

Structured Accessibility:

- An additional sheet, "Metadata," provides comprehensive information about the dataset, including:
  - **Purpose of the file**, explaining its relevance within the project.
  - **Definition of each column**, ensuring clarity for users unfamiliar with the dataset structure.
  - **Update frequency**, specifying how often the dataset is refreshed.

- **License and usage permissions**, clarifying access rights and restrictions to promote responsible data sharing.

INTEROPERABLE

To ensure data integration across systems and platforms, standardized formats and metadata enhance compatibility. Automated access via APIs further facilitates seamless interoperability.

Standardization of Formats and Nomenclature:

- The "Data Format" column defines the type of data contained in each field (numerical, textual, etc.).
- The "File Format" column documents the formats used, prioritizing open standards such as .csv and .json.

Standardized Tabular Structure:

- Columns have normalized names, facilitating automation in data reading.
- Examples of key columns:
  - **"Indicator"** → Defines the KPI being evaluated.
  - **"Units"** → Indicates the unit of measurement.
  - **"Min" / "Max"** → Establishes permitted value ranges.
  - **"Weight"** → Defines the weight of the indicator in composite analyses.

Integration with Other Systems:

- Data integration with databases and analysis tools is ensured through the "Data Provenance" column, which documents the original data source.
- The use of RESTful APIs is encouraged for automated data querying.

REUSABLE

To maximize the reuse of data in different contexts and ensure its applicability in multiple scenarios:

Clarity in objectives and definitions:

- The "Description and Purposes" column provides detailed documentation on the purpose of each KPI, ensuring that users understand its intended use.
- Example: "Kilometres of bicycle paths and lanes per 100 inhabitants," which describes the infrastructure available for sustainable mobility.

Complete metadata and usage context:

The file includes additional information that facilitates understanding and adapting the data to different projects:

- "Project Objective": Establishes the relationship between each KPI and the strategic objectives of the project.
- “Potential Users": Identifies potential beneficiaries of the data, such as public administrations, researchers, or private companies, promoting its use in different sectors.

Updates and versioning:

To ensure the reliability and relevance of the data over time, update mechanisms have been implemented:

- "Update Frequency": Defines the frequency with which the KPI values are updated, allowing users to know the freshness of the data.
- The "Metadata" sheet documents the file versions and relevant changes, ensuring traceability of modifications and improving transparency in data management.

The implementation of a structured data model and its integration with analysis tools ensure the applicability of the FAIR principles throughout the data lifecycle. Through storage in a relational database, periodic updates of values, and interactive visualization in a dynamic application, accessibility, and reuse of information in different contexts are guaranteed.

5. Dynamos´ Baseline

This section highlights the key findings on Dynamos' Baseline in a easy to read leaflet layout. For full Baseline description, please see **Annex D. Crosscutting Priorities Data**.

5.1 D1. Northern Ostrobothnia, Finland

Pudasjärvi, a vast and sparsely populated municipality in Finland, faces significant challenges related to accessibility, economic sustainability, and environmental resilience. With 14 remote villages, long distances, and a diminishing population.

Figure 9. Snowy Oulu road, by wikimedia

Social Justice and Inclusion Cross-Cutting Priorities

Ensuring social justice and inclusion in Pudasjärvi requires enhancing essential services, improving mobility, and fostering economic resilience. One of the main challenges is the lack of accessible services, especially for elderly residents, who struggle with daily tasks such as firewood preparation, snow shoveling, and running errands.

Beyond household support, transportation remains a major obstacle for local businesses and tourism development. A structured, digital logistics platform could streamline these efforts, allowing for more efficient deliveries of local products, food, recycling materials, and even medication. Improved digital infrastructure would also enhance access to financial and business opportunities, ensuring that Pudasjärvi's communities remain connected and economically viable.

For all these reasons, it is interesting to monitor indicators that reveal the current employment situation or unemployment rates in the region, as well as indicators such as road connections to shopping centres, hospitals or leisure venues.

An optimisation of the region's logistics can improve aspects such as the inclusion of older people, a vulnerable group.

INNOVATION

Financial and business models innovation

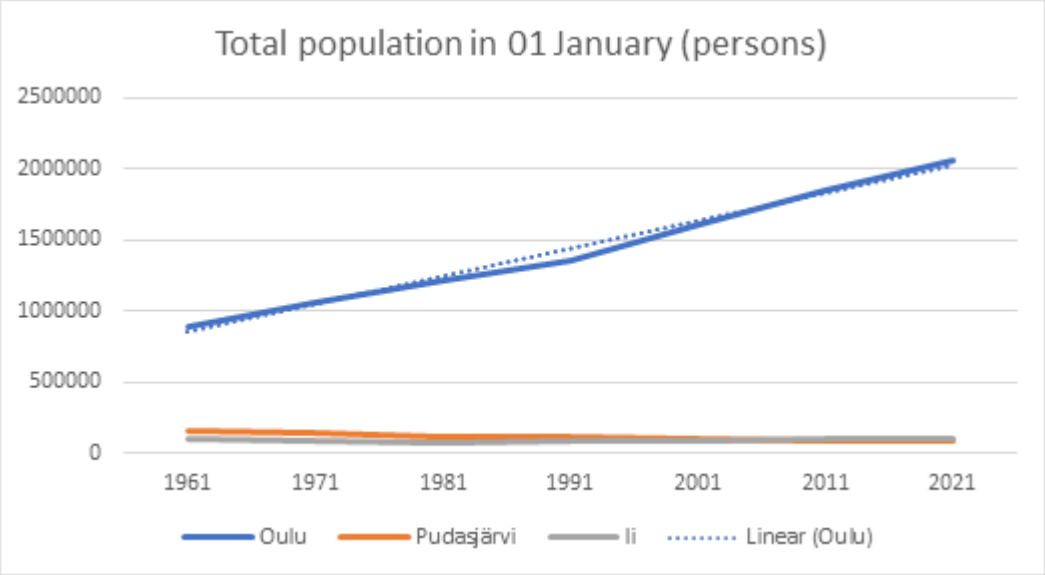
Social organizational and governance

RDD

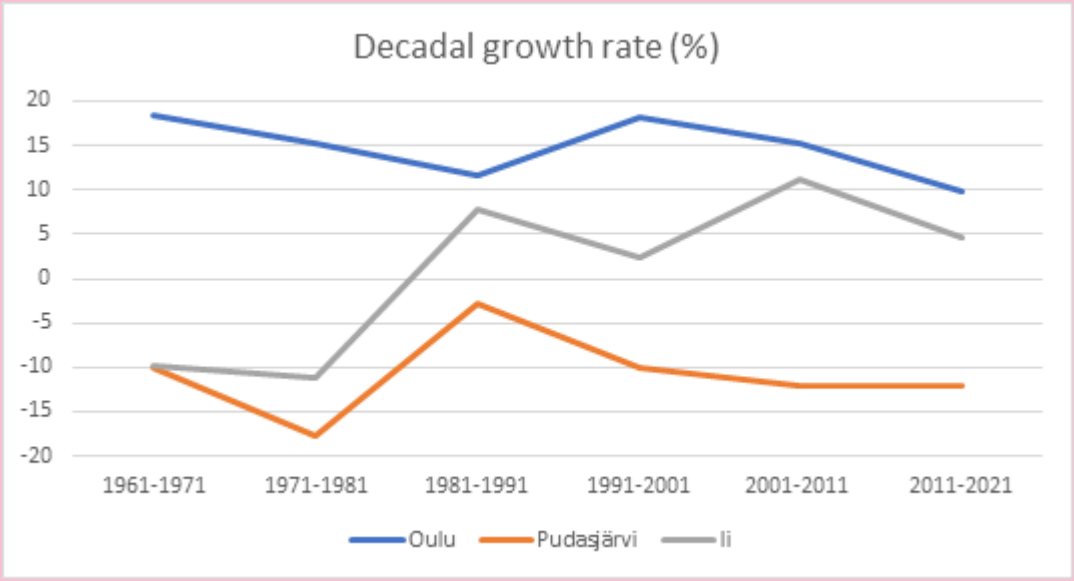
Local services, health and wellbeing

Sustainable multimodal mobility

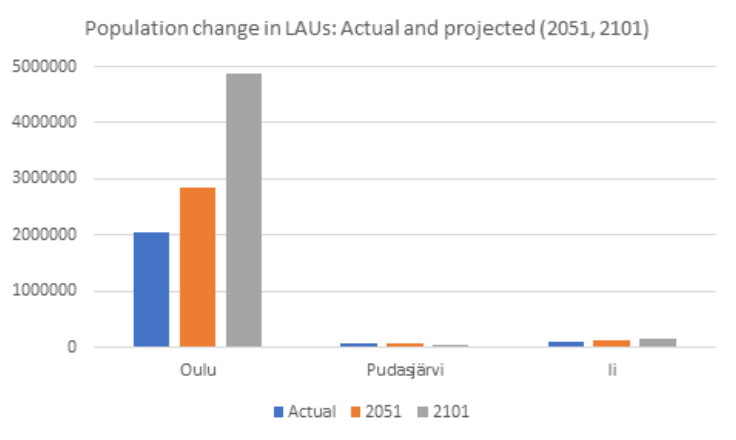
BASELINE



The overall population trends of Oulu, Pudasjärvi, and Ii between 1961 and 2021 are pretty different. While Oulu shows a big and constant growth, with the sharp increase of the population over the decades, Pudasjärvi and Ii have flat trends, with slight fluctuations and small decreases in recent years.

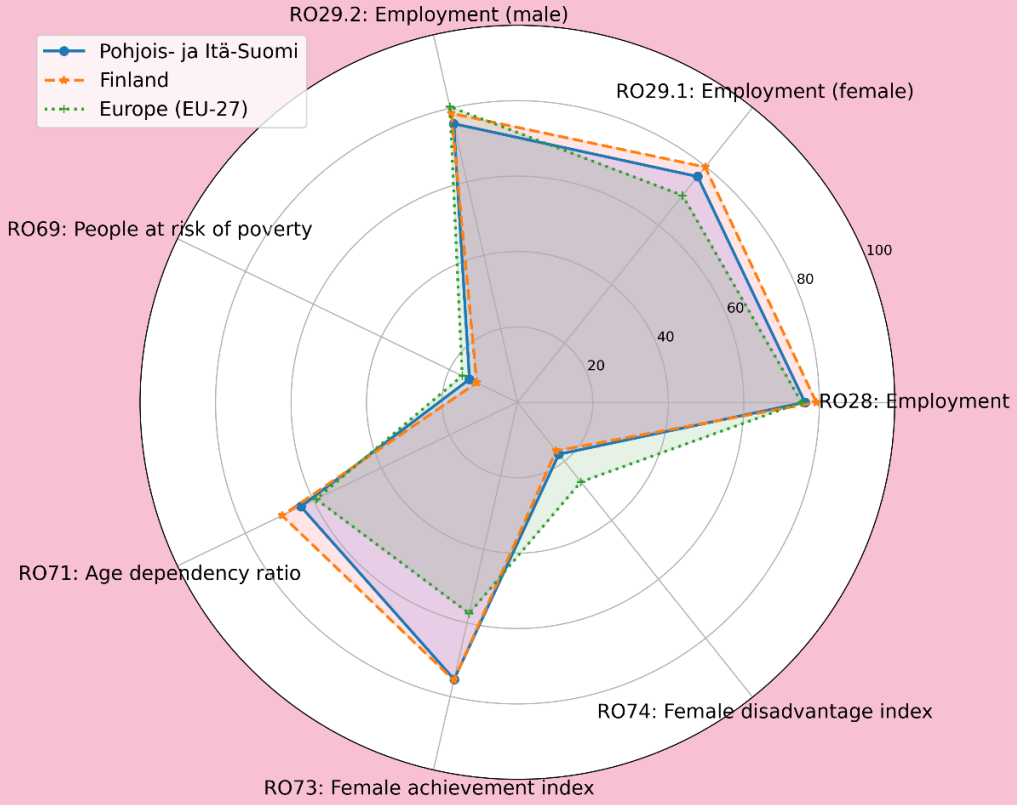


These differences can be seen in the decadal growth rates for these LAUs. Whereas Oulu had a positive growth rate that decreased over time, Pudasjärvi and Ii show consistently negative growth rates in later decades, especially between 1991 -2011.



Looking ahead, the predictions for 2051 and 2101 depict quite different changes in the populations:. Oulu will have a rather high population increase, greatly higher than Pudasjärvi and Ii. The change in population for Oulu will increase by over 500,000 until the year of 2101, while Pudasjärvi and Ii are so small that their increase indicates very little to no growth. These projected figures outline the potential for growth disparity among the three LAUs.

LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
Oulu	2054890	2,837,250	4,888,600	47	179
Pudasjärvi	78730	68,000	53,900	-13	-31
Ii	98440	112,260	141,640	14	44



Biodiversity

Pudasjärvi's natural environment plays a crucial role in the well-being of its residents and the sustainability of its economy. The region is home to extensive forests, wetlands, and diverse ecosystems that support local biodiversity. However, traditional transportation and resource extraction methods have put pressure on these habitats. Sustainable logistics and transportation solutions, such as shared delivery routes and optimized commuting traffic, could reduce habitat fragmentation and minimize disturbances to wildlife.

Furthermore, promoting eco-tourism and responsible land management practices would help protect biodiversity while also creating economic opportunities for local communities. Encouraging sustainable agriculture and forestry practices would further contribute to maintaining the ecological balance of the region, ensuring that natural resources continue to support both human livelihoods and wildlife populations.

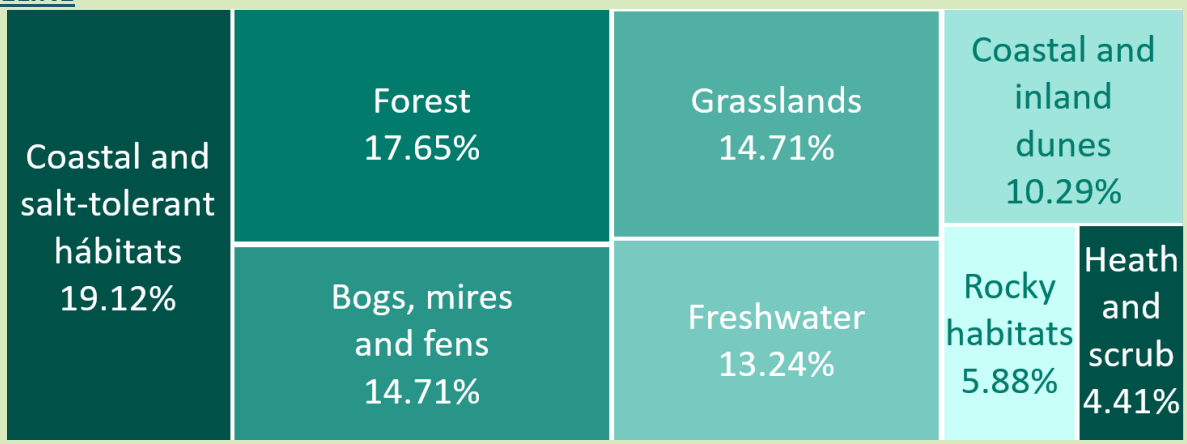
INNOVATION

RDD

Digital and technological innovation

Energy transition and climate neutrality

BASELINE



Percentage composition by group of protected habitats: Finland

Climate change mitigation and adaptation

Developing sustainable mobility solutions, such as a digital logistics system that optimizes transport routes and minimizes unnecessary trips, would help lower carbon emissions while maintaining essential services for residents.

By integrating digital innovation, community-based support systems, and environmental conservation efforts, Pudasjärvi can serve as a model for rural sustainability, balancing social inclusion, economic viability, and environmental responsibility.

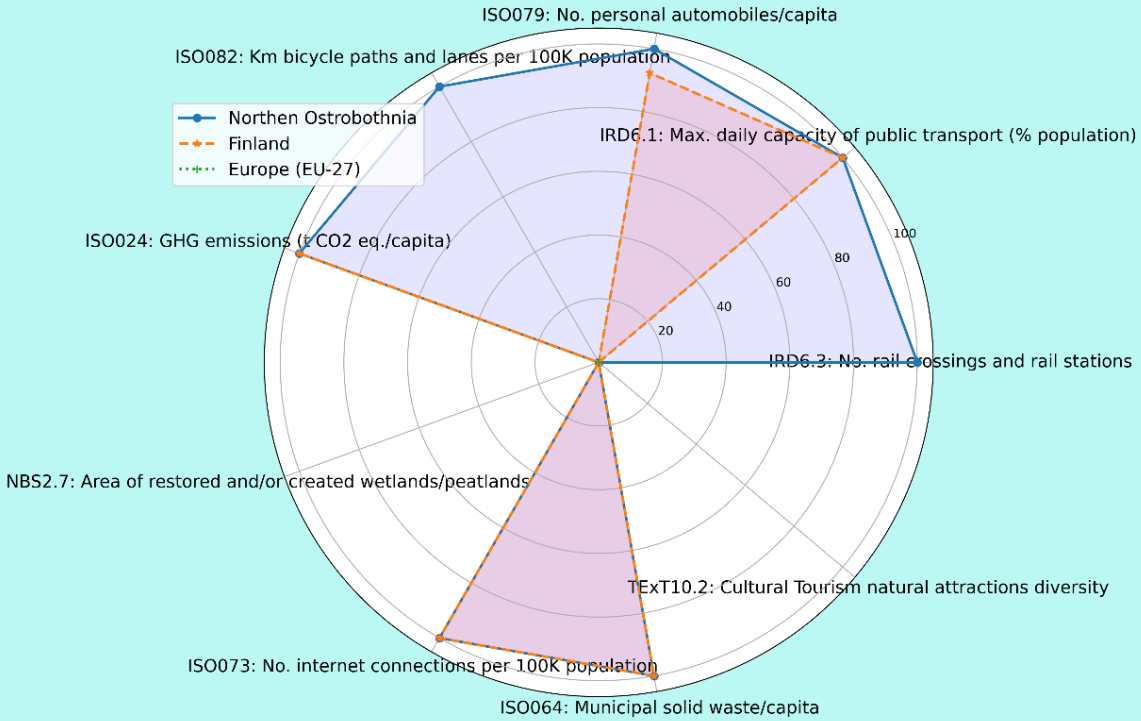
INNOVATION

RDD

Digital and technological innovation

Sustainable multimodal mobility

BASELINE



5.2 D2. Südburgenland, Austria

Südburgenland is a mountainous region in southern Burgenland, home to numerous natural and cultural monuments such as nature parks, castles, palaces, heritage-protected wineries and museums.

Figure 10. Cyclists in the Saalehäuser vineyards, Bad Kösen. By thuecat.org

Social Justice and Inclusion Cross-Cutting Priorities

The population is aging, with a significant proportion of elderly residents, which presents challenges in terms of mobility, healthcare, and social inclusion. Accessibility in the region varies; while the main towns are relatively well-connected, remote villages and countryside areas face limitations in public transport and digital infrastructure. Efforts to improve accessibility, such as inclusive tourism initiatives and better mobility solutions, are crucial to ensuring that all residents, including older adults and individuals with disabilities, can participate fully in social and economic life.

Südburgenland's rich cultural and natural heritage offers significant tourism potential, yet accessibility remains a challenge. Despite nearly 935,000 overnight stays in 2023, visitors tend to stay for less than three nights, indicating the need for improved services and experiences. It is a good idea encourage iniciatives to raise the inclusive infrastructure, and accessible transportation networks, that can encourage longer visits and make tourism more inclusive for families, seniors and people with disabilities.

INNOVATION

Digital and technological innovation

Social organizational and governance

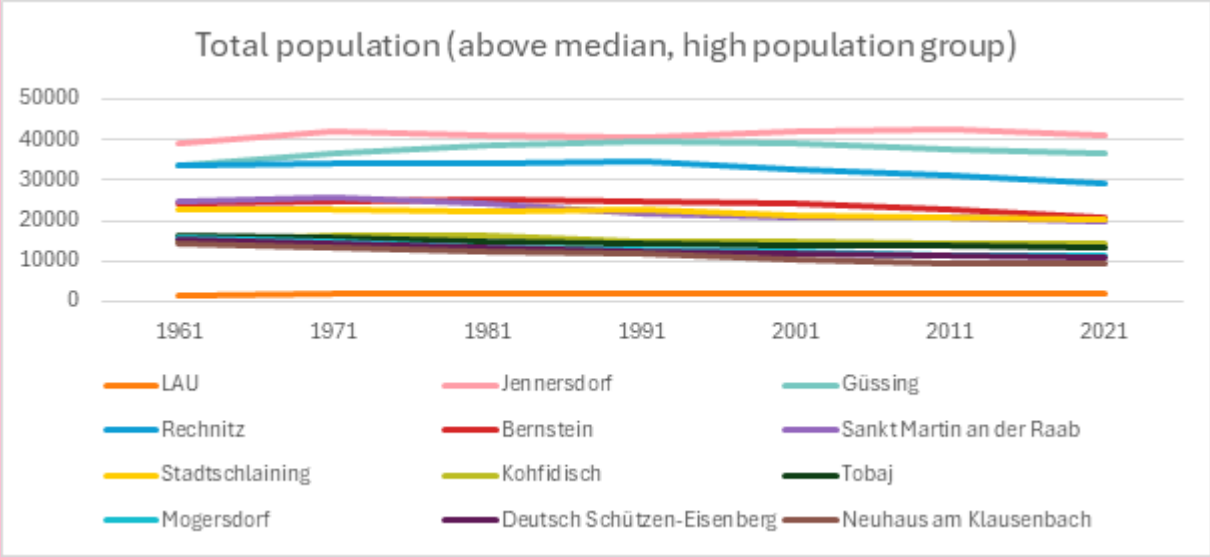
RDD

Local services, health and wellbeing

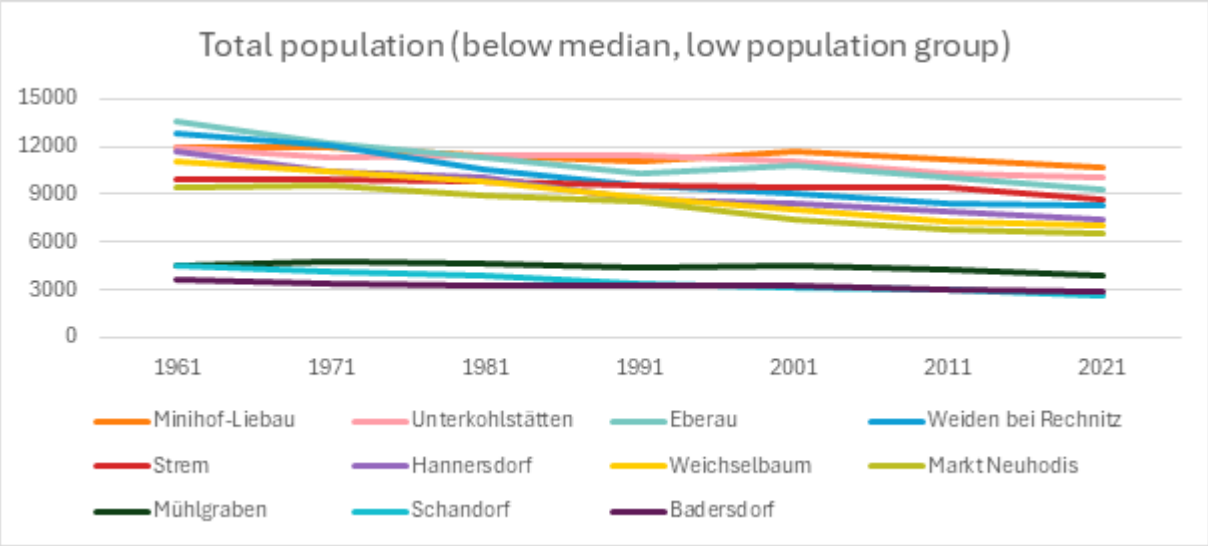
Sustainable multimodal mobility

Culture and cultural innovation

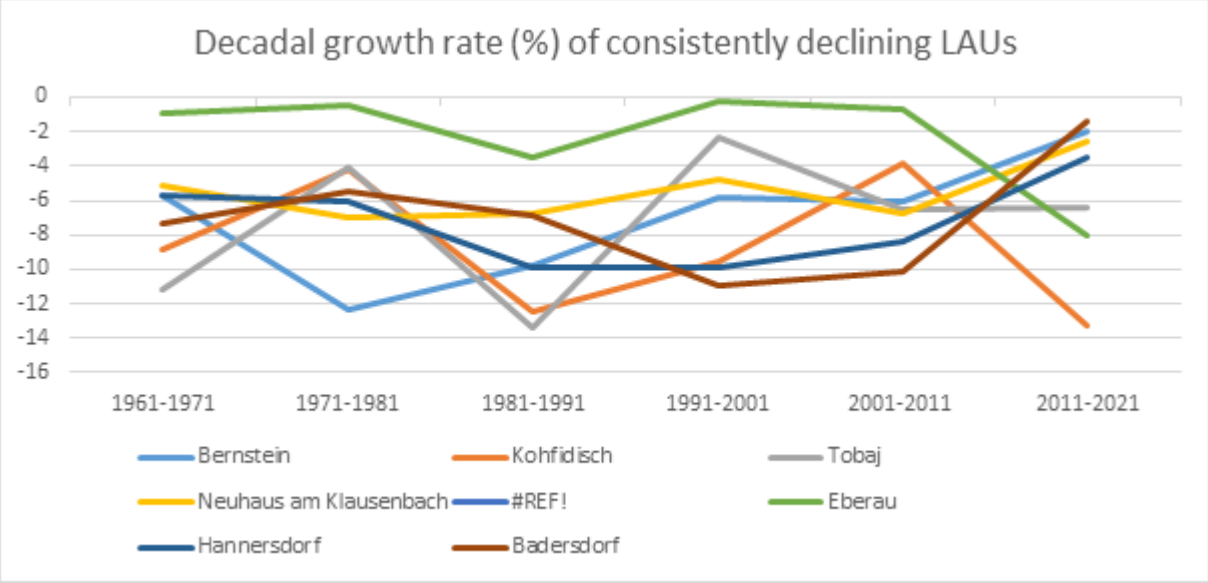
BASELINE

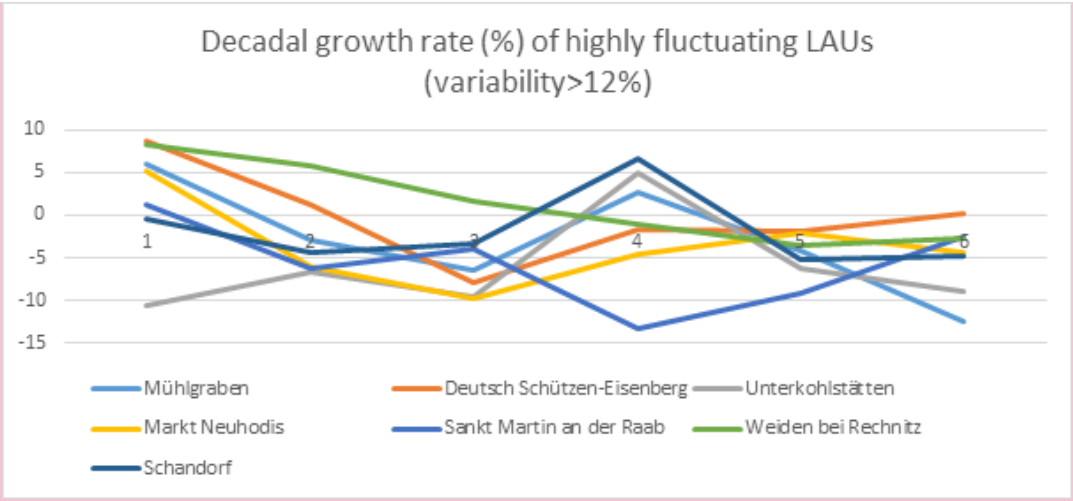


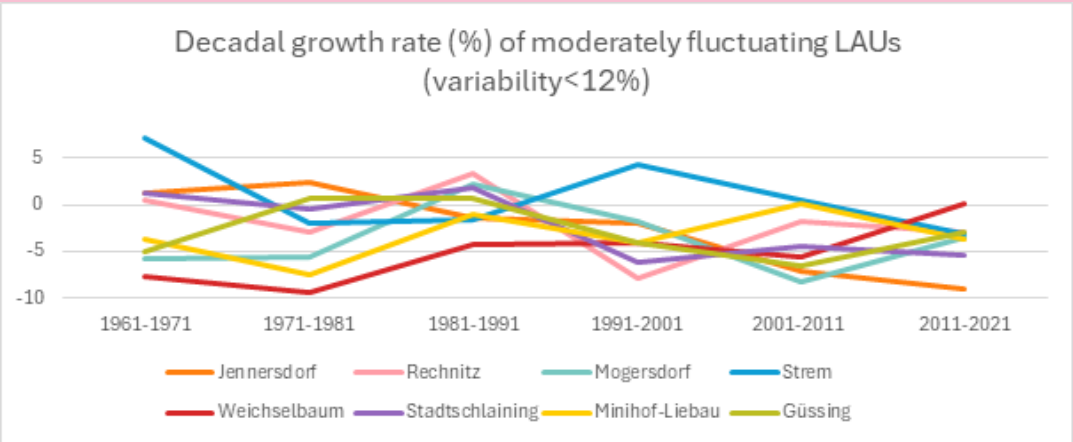
The analysis of the high-population LAUs (the ones above median of averages) shows cities like Jennerdorf, Güssing, and Rechnitz to have increases in total population over time; for 2051 and 2101, further growth can be predicted. These LAUs, particularly Jennerdorf and Güssing, are distinguished because they show just a steady rise, indicating thereby that these may be good representations of strong urbanization trends. Sankt Martin an der Raab and Kohfidisch, among others, demonstrate minimal growth but their population is nevertheless maintained.



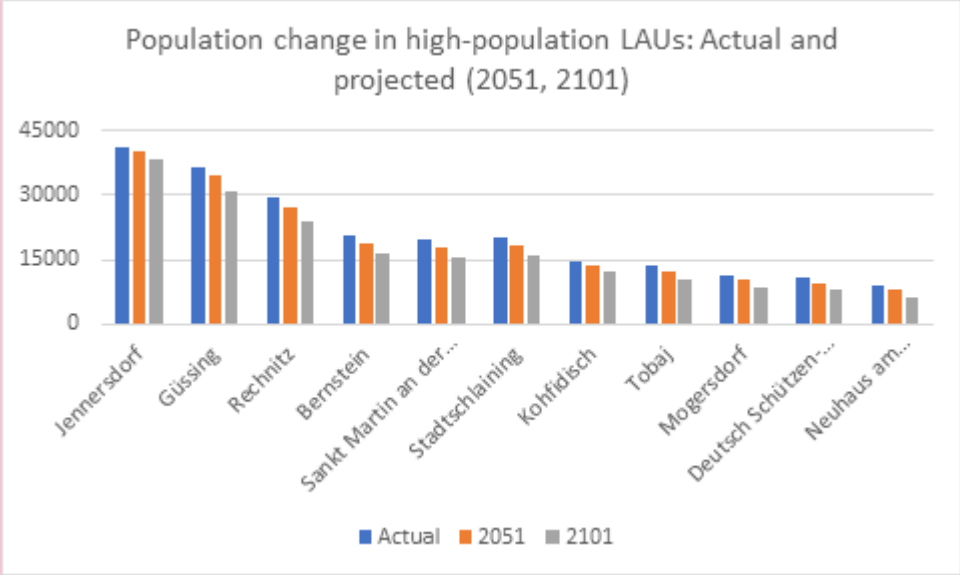
The less-populated LAUs are likely decrease. The trend of depopulation is continuing, which is reflected until 2051 and further into 2101. Projections are that these LAUs will face a very serious decline, especially in the longer term.



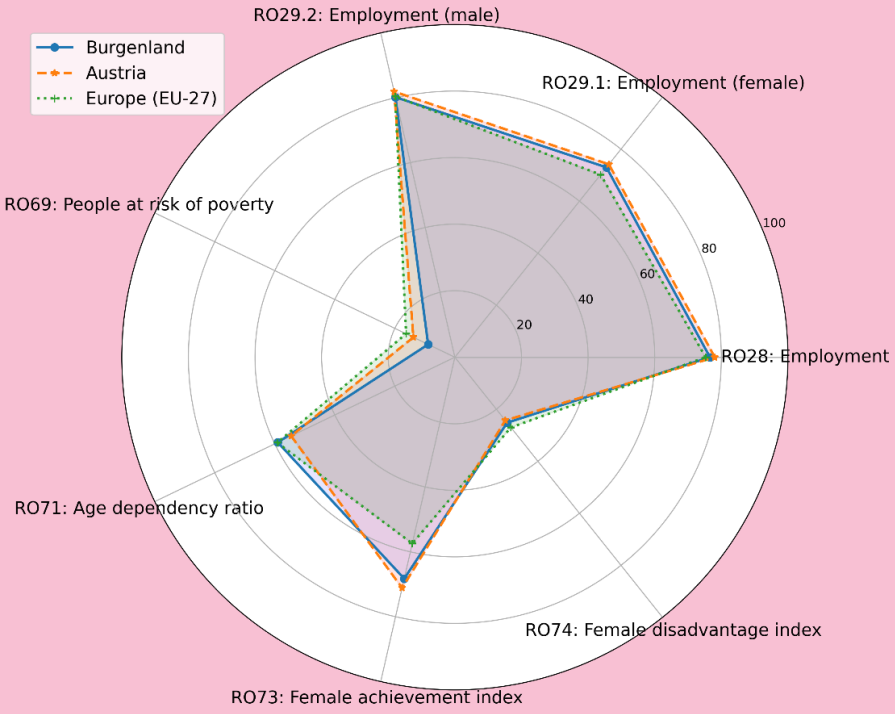




On the other hand, high-population LAUs are showing relatively stable or slightly declining growth, especially in the most populous areas where decadal growth rates have seen some fluctuation but mostly remained stable. Low-population LAUs, however, have been very volatile, with growth rates fluctuating drastically across decades. The high variability in growth rates among the low-population LAUs signals potentially unstable demographic trends.



LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
Jennersdorf	41210	40,180	38,570	-3	-6
Güssing	36650	34,420	30,970	-6	-15
Rechnitz	29370	27,200	24,100	-7.4	-17.9
Bernstein	20790	18,950	16,500	-8.8	-20.6
Sankt Martin an der Raab	19650	17,800	15,300	-9.4	-22.1
Stadtschlaining	20040	18,500	16,100	-7.7	-19.6
Kohfidisch	14480	13,700	12,200	-5.4	-15.8
Tobaj	13420	12,200	10,600	-9.1	-21
Mogersdorf	11480	10,200	8,600	-11.2	-25.1
Deutsch Schützen-Eisenberg	10830	9,600	7,900	-11.4	-27.1
Neuhaus am Klausenbach	9200	7,900	6,400	-14.1	-30.4
Minihof-Liebau	10650	9,100	7,500	-14.5	-29.6
Unterkohlstätten	10020	9,200	8,100	-8.2	-19.2
Eberau	9280	8,100	6,700	-12.7	-27.8
Weiden bei Rechnitz	8310	7,300	6,100	-12.2	-26.6
Strem	8720	7,800	6,700	-10.6	-23.1
Hannersdorf	7460	6,400	5,300	-14.2	-29
Weichselbaum	7070	6,000	5,000	-15.1	-29.3
Markt Neuhodis	6590	5,600	4,600	-15	-30.2
Mühlgraben	3830	3,200	2,600	-16.4	-32.1
Schandorf	2640	2,200	1,800	-16.7	-31.8
Badersdorf	2880	2,400	2,000	-16.7	-30.6



Biodiversity

It is a region rich in biodiversity, with a landscape characterized by rolling hills, forests, vineyards, and wetlands. The region is home to diverse flora and fauna. Traditional agricultural practices, including organic farming and small-scale viticulture, help maintain biodiversity by supporting soil health and preserving native plant varieties. However, biodiversity in Südburgenland faces challenges due to habitat fragmentation, land use changes, and climate change. Conservation efforts focus on restoring natural habitats, promoting sustainable agriculture, and integrating biodiversity-friendly practices into tourism and local industries.

INNOVATION

Technical innovation

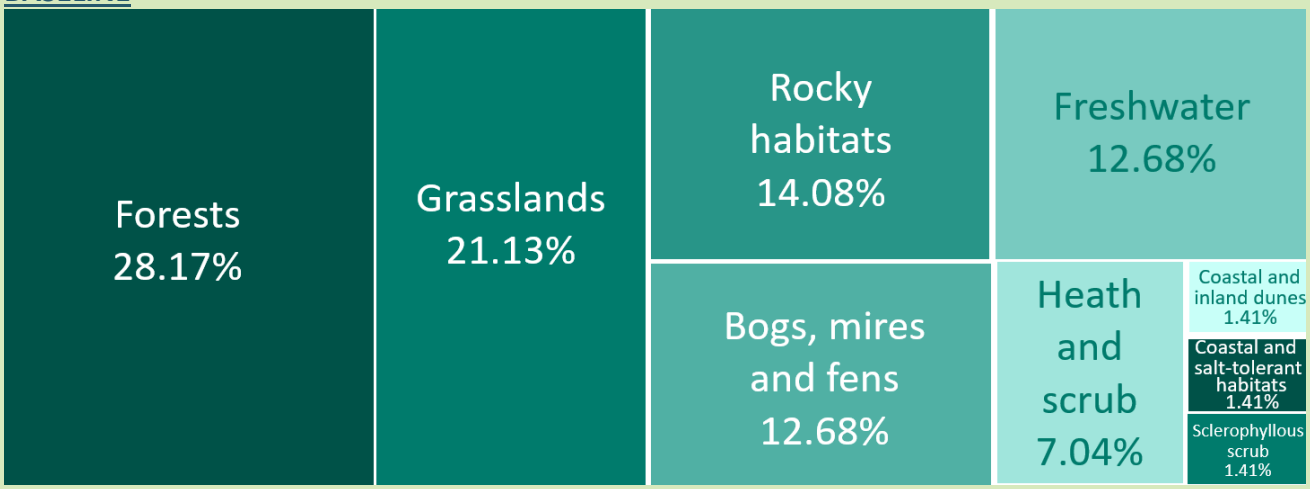
RDD

Energy transition and climate neutrality

Sustainable multimodal mobility

Nature-based and cultural Tourism

BASELINE



Percentage composition by group of protected habitats: Austria

Climate change mitigation and adaptation

Südburgenland, like many rural regions, is increasingly affected by climate change, with rising temperatures, changing precipitation patterns, and extreme weather events impacting agriculture and natural ecosystems. One of the most pressing concerns is the impact on viticulture, as higher temperatures accelerate grape ripening and affect wine quality.

Furthermore, promoting sustainable mobility initiatives would contribute to reducing emissions.

INNOVATION

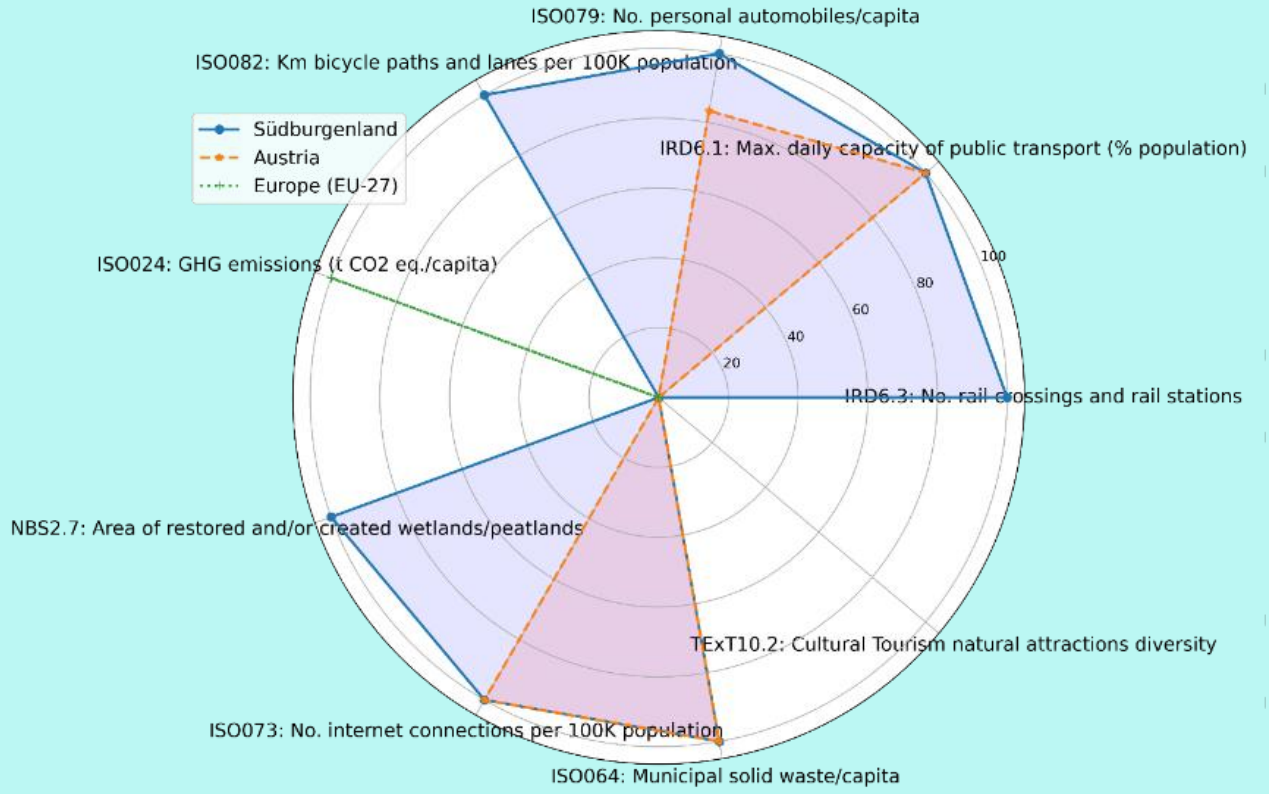
RDD

Technical innovation

Sustainable agrifood systems and ecosystem management

Sustainable multimodal mobility

BASELINE



5.3 D3. Zamora, Spain

This Dynamo is made up of rural areas in the province of Zamora, which face significant challenges in terms of social justice and inclusion. The population is ageing and most municipalities have fewer than 1,000 inhabitants, leading to a progressive depopulation of the area. In particular, the Tierras de Campos-Pan-Lampreana area requires attention in aspects such as accessibility.

Figure 11. Tierra de Campos, by StockPhotoAstur

Social Justice and Inclusion Cross-Cutting Priorities

The demographic decline has resulted in a weakening of essential services, such as public healthcare, as geographical isolation and poor transportation infrastructure make it difficult for residents to access medical assistance in a timely manner.

Digital connectivity is also uneven, hindering the development of telemedicine solutions that could bridge this gap.

Simultaneously, cultural and historical sites, such as the Templar Castle of Castrotorafe, are underutilized due to poor preservation, lack of modern digital experiences, and inadequate road infrastructure—especially in adverse weather conditions.

Revitalizing these cultural treasures through digital tools and improving road access could stimulate tourism, engage younger generations, and enhance the sense of belonging among residents. Addressing these barriers is vital to fostering social cohesion and providing equal opportunities for all inhabitants.

BASELINE

INNOVATION

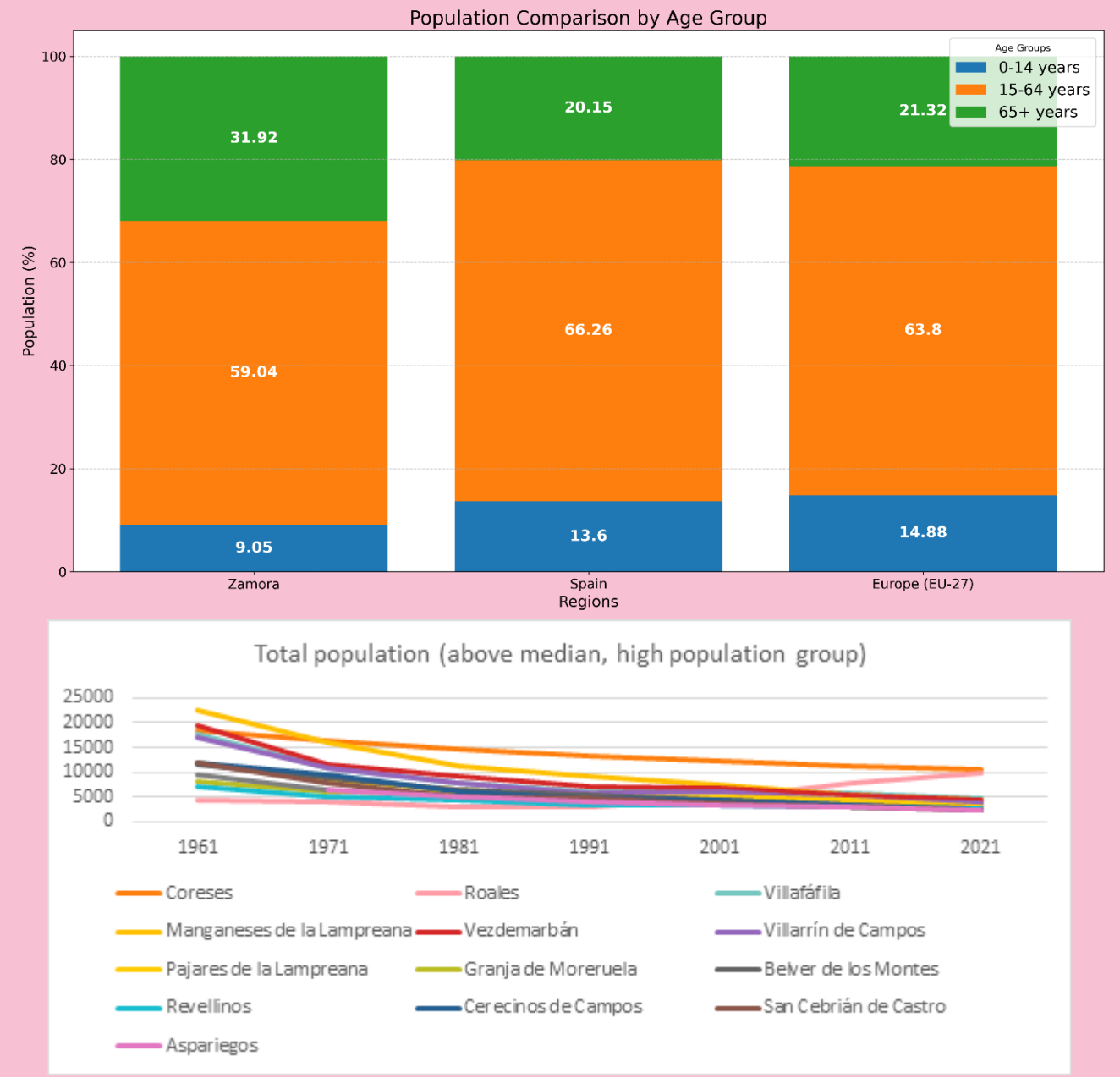
Digital and technological innovation

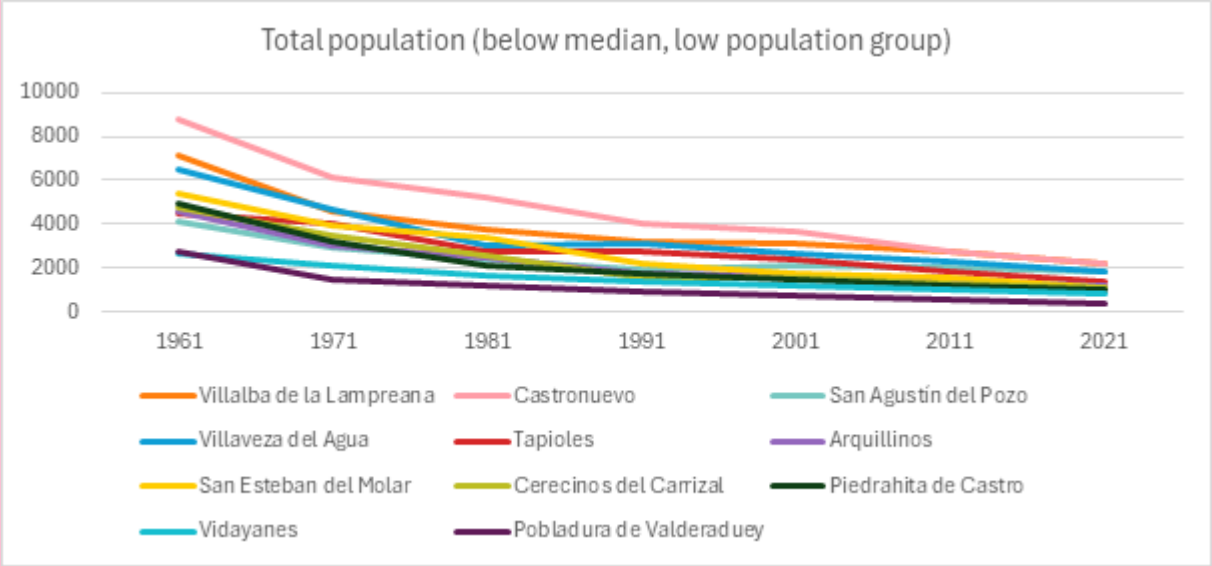
Social organizational and governance

RDD

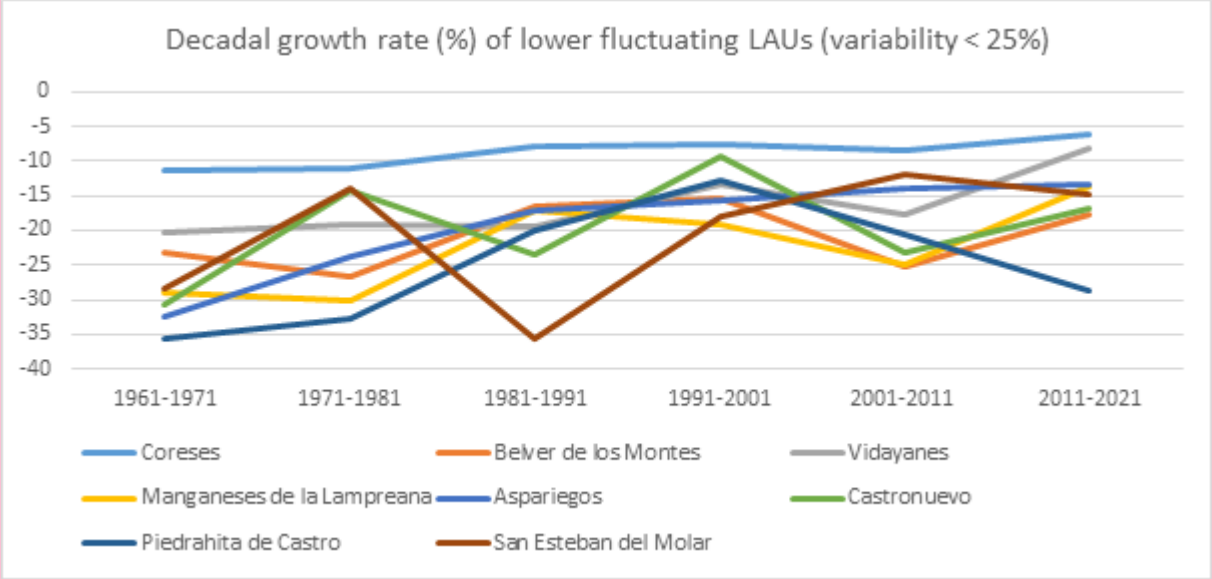
Local services, health and wellbeing

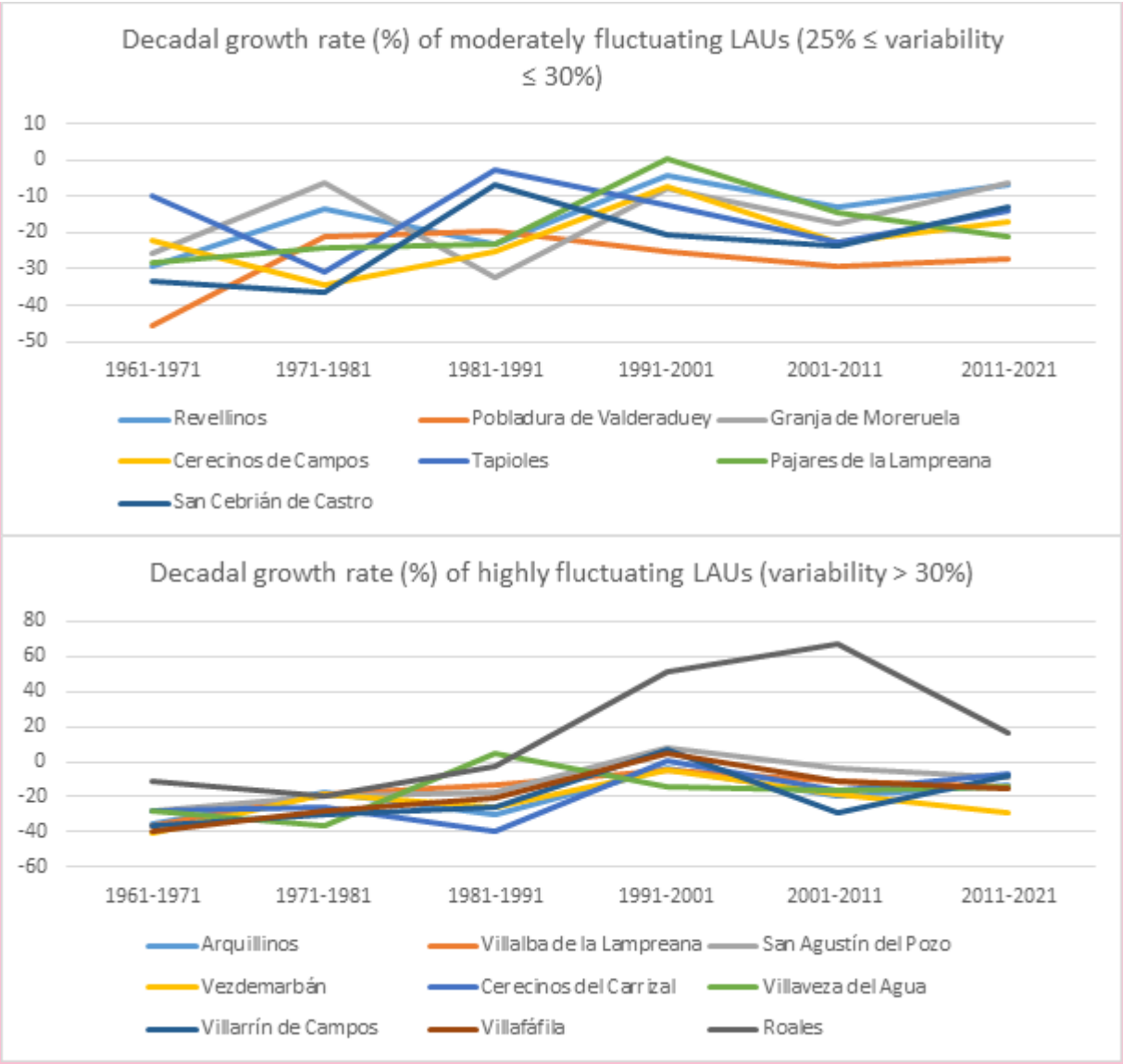
Culture and cultural innovation


Population Comparison by Age Group
Age Groups
0-14 years
15-64 years
65+ years
Population (%)
100
80
60
40
20
0
31.92
59.04
9.05
20.15
66.26
13.6
21.32
63.8
14.88
Zamora
Spain
Europe (EU-27)
Regions
Total population (above median, high population group)
25000
20000
15000
10000
5000
0
1961
1971
1981
1991
2001
2011
2021
Coreses
Roales
Villafáfila
Manganeses de la Lampreana
Vezdemarbán
Villarrín de Campos
Pajares de la Lampreana
Granja de Moreruela
Belver de los Montes
Revellinos
Cerecinos de Campos
San Cebrián de Castro
Asparriegos

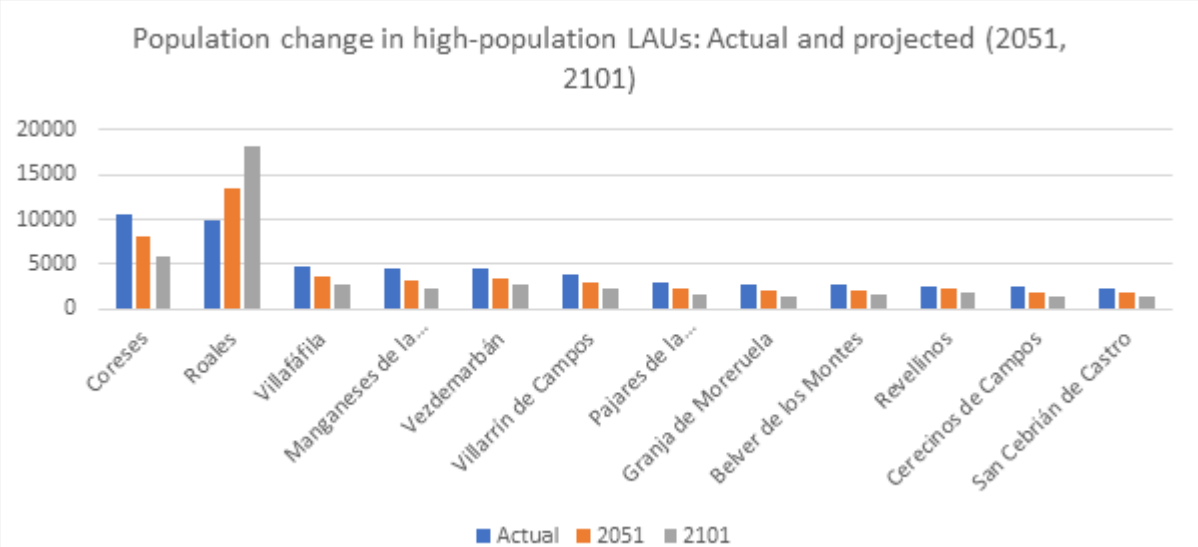


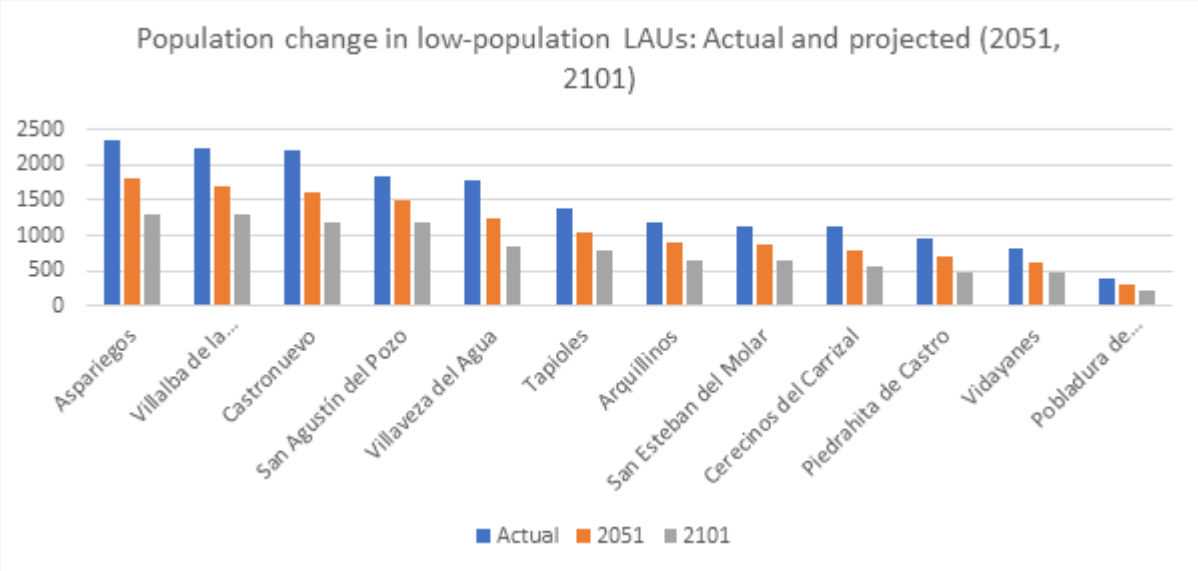
The general trens shows a stable population decline for high and low population LAUs. In the high-population group, areas such as Coreses, Roales, Villafáfila, Manganeses de la Lampreana, and Vezdemarbán show a constant decrease, although in Villarrín de Campos and Revellinos, the ratios of decline are slower. In the low-population group, the main majority correspond to areas where this decline follows similarly, although Villalba de la Lampreana and Castronuevo present a regular decline. Nevertheless, Piedrahita de Castro, Vidayanes, and Pobladura de Valderaduey show more dramatic decreases.





The general trend reveals a mixed pattern in growth rates. For the high-population group, the growth rate of most LAUs fluctuates, with some periods of decline and recovery, though generally maintaining a negative trend. Vezdemarbán, Coreses, and Manganeses de la Lampreana exhibit the steepest declines, while Revellinos and Villarrín de Campos show milder fluctuations. In the low-population group, the growth rates are predominantly negative, with Pobladura de Valderaduey, Vidayanes, and Piedrahita de Castro facing consistent losses. However, San Esteban del Molar and Villaveza del Agua experience periods of more moderate change.





The population projections for the LAUs from 2021 to 2101 show a general trend of decline, with some variations. For high-population areas, Roales and Villafáfila are expected to experience significant population growth until 2051, followed by a slight decrease by 2101. On the other hand, Manganeses de la Lampreana and Granja de Moreruela show a steady decline in population over the decades, with projections indicating a further reduction by 2101. Villaveza del Agua and Piedrahita de Castro also demonstrate moderate population decreases, continuing a downward trend throughout the period. This suggests that while some areas may experience growth in the near future, the overall trend for these LAUs is a gradual population decline over the next 80 years.

LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
Coreses	10590	8,000	5,900	-24.5	-44.3
Roales	9870	13,400	18,200	35.8	84.4
Villafáfila	4750	3,700	2,800	-22.1	-41.1
Manganeses de la Lampreana	4480	3,200	2,300	-28.6	-48.7

Vezdemarbán	4480	3,500	2,700	-21.9	-39.7
Villarrín de Campos	3870	3,000	2,300	-22.5	-40.6
Pajares de la Lampreana	2980	2,200	1,600	-26.2	-46.3
Granja de Moreruela	2650	2,000	1,400	-24.5	-47.2
Belver de los Montes	2630	2,000	1,500	-24	-43
Revellinos	2570	2,200	1,800	-14.4	-30
Cerecinos de Campos	2470	1,800	1,300	-27.1	-47.4
San Cebrián de Castro	2380	1,800	1,300	-24.4	-45.4
Aspariegos	2340	1,800	1,300	-23.1	-44.4
Villalba de la Lampreana	2230	1,700	1,300	-23.8	-41.7
Castronuevo	2200	1,600	1,200	-27.3	-45.5
San Agustín del Pozo	1830	1,500	1,200	-18	-34.4
Villaveza del Agua	1790	1,250	850	-30.2	-52.5
Tapioles	1390	1,050	790	-24.5	-43.2
Arquillinos	1200	890	650	-25.8	-45.8
San Esteban del Molar	1130	870	650	-23	-42.5
Cerecinos del Carrizal	1120	800	550	-28.6	-50.9
Piedrahita de Castro	970	700	490	-27.8	-49.5
Vidayanes	830	630	470	-24.1	-43.4
Pobladura de Valderaduey	390	300	230	-23.1	-41

Biodiversity

The biodiversity of Zamora's rural landscape is closely linked to its traditional land use, forested areas, and agricultural fields. However, the declining human presence and reduction in livestock farming have led to the abandonment of lands and the accumulation of undergrowth, increasing the risk of large forest fires. These fires, which have affected the western part of the province in recent years, pose a significant threat to both ecosystems and local communities. The loss of biodiversity resulting from such fires damages habitats, disrupts wildlife, and depletes the region's natural resources. Preserving biodiversity requires a combination of sustainable land management practices, such as encouraging extensive livestock grazing to reduce undergrowth, and implementing monitoring systems to prevent the spread of forest fires. Protecting Zamora's biodiversity is not only crucial for maintaining ecological balance but also supports rural livelihoods that depend on natural resources.

BASELINE

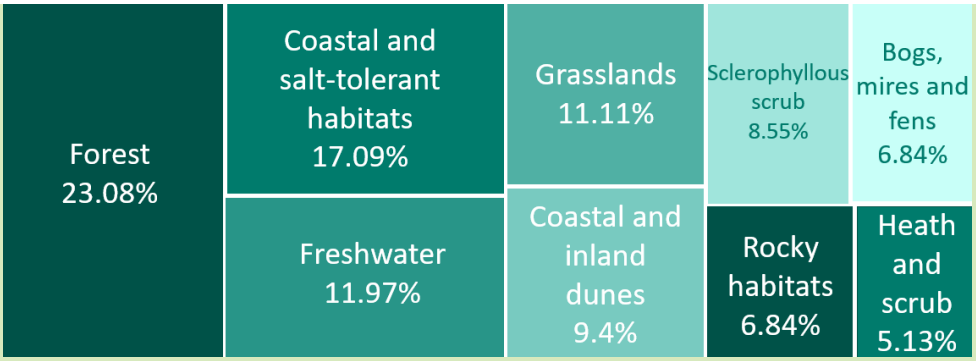
INNOVATION

RDD

Digital and technological innovation

Sustainable agrifood systems and ecosystem management

Local services, health and wellbeing



Percentage composition by group of protected habitats: Spain

Climate change mitigation and adaptation

Zamora is increasingly vulnerable to climate change, with hotter and drier summers contributing to the growing frequency and intensity of forest fires. These environmental changes threaten both the natural landscape and the safety of rural communities. The combination of reduced land maintenance and climate variability has led to more severe fire outbreaks, highlighting the need for proactive adaptation strategies.

While local emergency services from the Junta de Castilla y León and the *Diputación de Zamora* are available, municipalities lack advanced fire detection technologies and real-time monitoring systems.

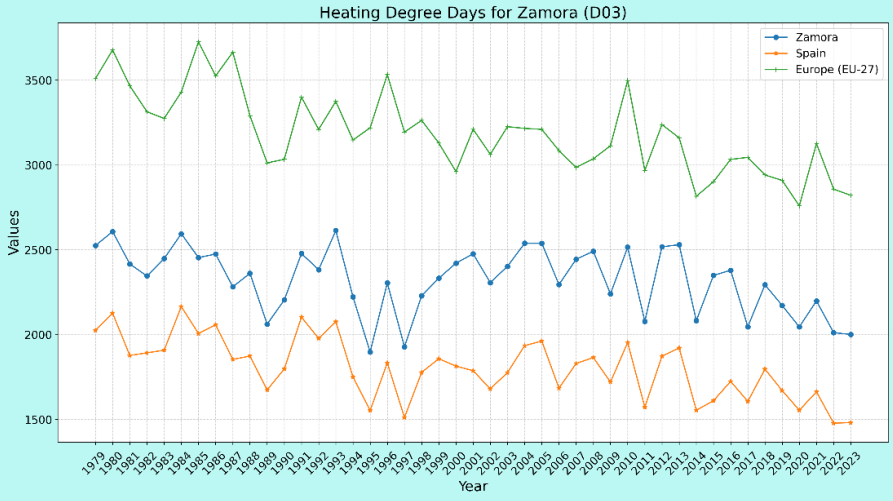
INNOVATION

Technical innovation

RDD

Sustainable agrifood systems and ecosystem management

BASELINE



5.4 D4. North-East Scotland, United Kingdom

North East Scotland is characterised by diverse landscapes of coastal areas, rolling hills and fertile agricultural land.

Agriculture remains a vital component of the region's economy. North East Scotland accounts for approximately 16% of Scotland's agricultural land, producing almost half of the country's crops, one-third of its fattening cattle and two-thirds of its pigs.

The population is ageing and the birth rate is declining. This demographic shift poses challenges for the region, including potential labour shortages and increased pressure on healthcare services.

Figure 12. Baling Hay, Netherwood, by geograph.org

Social Justice and Inclusion Cross-Cutting Priorities

Rural areas in North-East Scotland, including districts like Perth and Kinross, face demographic challenges characterized by an aging population and the depopulation of rural communities. These trends contribute to social isolation and loneliness, particularly among older residents, which are known risk factors for neurodegenerative diseases such as Alzheimer's and dementia. Accessibility to health services can be limited due to the remoteness of some villages, and digital connectivity remains inconsistent in certain rural parts.

There is a growing need for proactive solutions that enhance the well-being of older people by promoting mental and physical health. Furthermore, improving transport links and ensuring reliable digital infrastructure would enhance healthcare access, reduce isolation, and foster greater inclusion.

INNOVATION

Social organizational and governance

RDD

Local services, health and wellbeing

Biodiversity

The agricultural landscape of North-East Scotland, which plays a central role in the region's economy and cultural identity, is increasingly under pressure from unsustainable land management practices and the effects of climate change. Farmers are struggling to adapt to evolving environmental conditions, leading to soil degradation, biodiversity loss, and reduced ecosystem resilience. Enhancing biodiversity both above and below ground is crucial to restoring ecological balance.

Involving rural residents in conservation projects and fostering a sense of stewardship over the land can create a more biodiverse and sustainable rural environment. Art-based initiatives and landscape engagement activities can also promote ecological awareness among older residents, further bridging the connection between biodiversity and well-being.

INNOVATION

Digital and technological innovation

Social organizational and governance

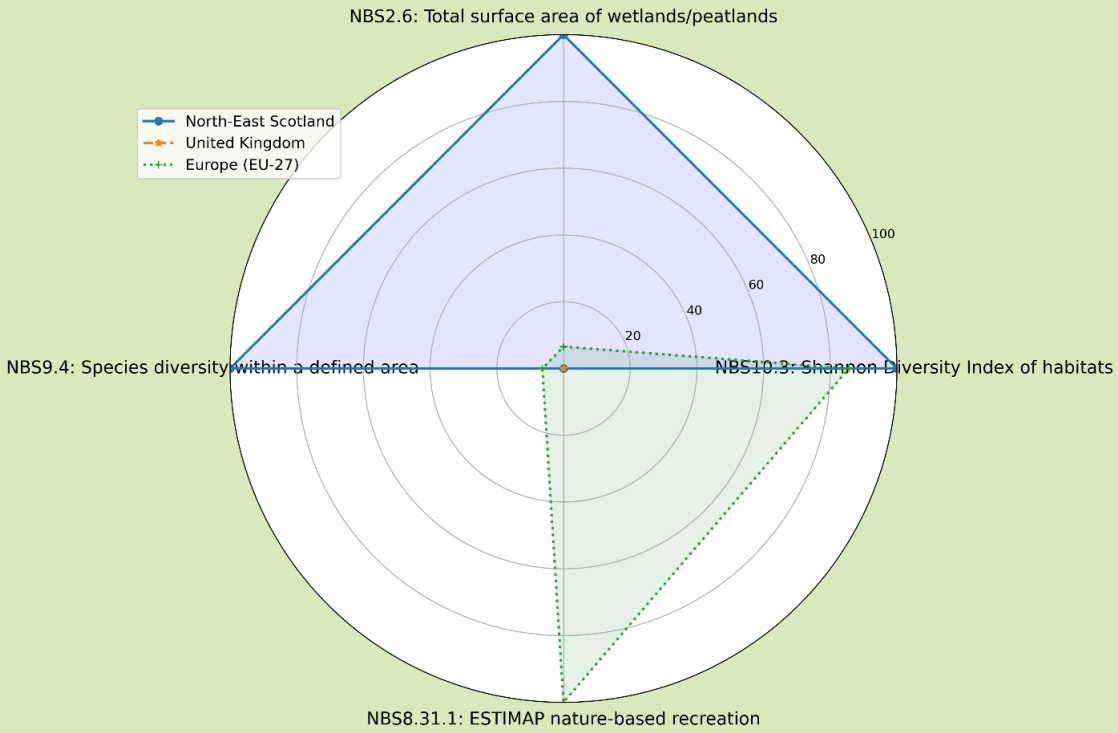
RDD

Sustainable agrifood systems and ecosystem management

Local services, health and wellbeing

BASELINE

D04 - Biodiversity radar chart



Climate change mitigation and adaptation

Climate change poses a growing threat to North-East Scotland's rural landscape, impacting agricultural productivity, water resources, and land stability. Farmers are increasingly required to adapt to these changes while also contributing to climate change mitigation.

Rural communities directly affected by renewable energy infrastructure need support to ensure that the economic and social benefits of the green transition are fairly distributed, fostering equity and local empowerment.

Digital platforms can equip residents with knowledge on mitigating these effects while ensuring that local communities receive a fair share of the economic benefits from green energy projects.

INNOVATION

Digital and technological innovation

Social organizational and governance

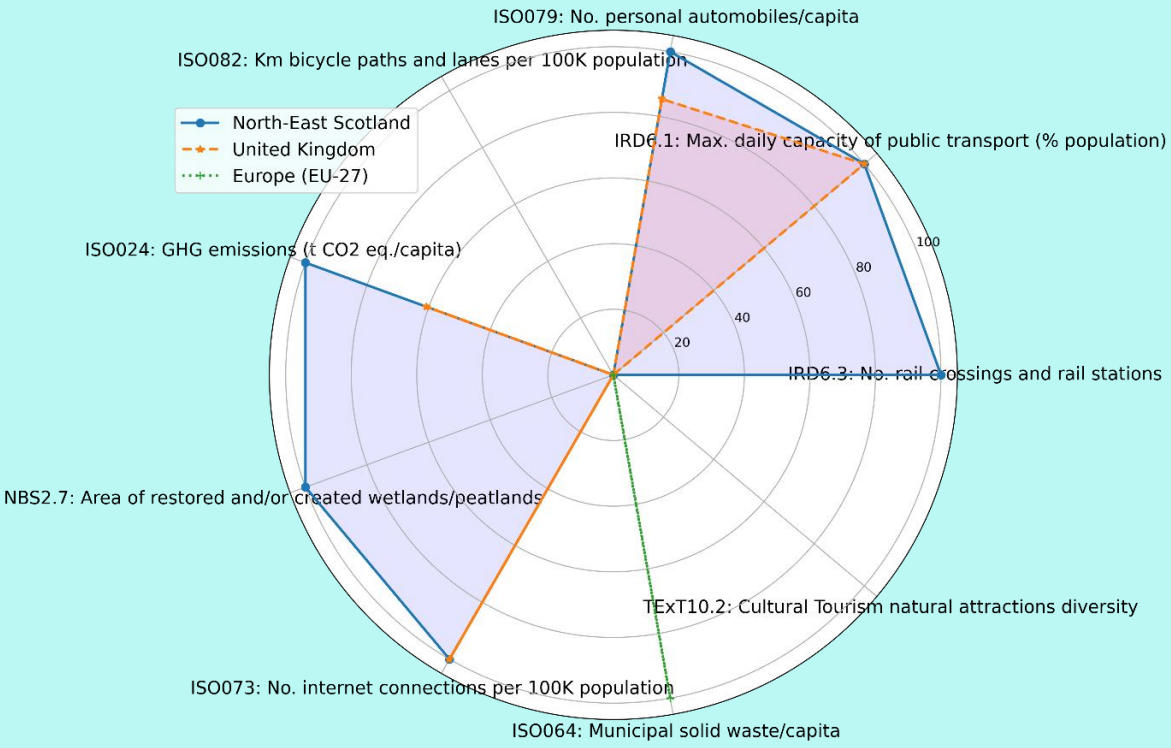
RDD

Sustainable agrifood systems and ecosystem management

Energy transition and climate neutrality

BASELINE

D04 - Climate Change Mitigation radar chart



5.5 D5. Andalucía, Spain

Córdoba, located in southern Spain, is a region historically exposed to high temperatures. These villages face growing concerns related to climate change and its effects on daily life, especially for vulnerable populations. The expected rise in temperatures by approximately 2°C and a reduction in annual precipitation by about 100 mm by 2040 will likely exacerbate existing inequalities.

Figure 13. Reservoir of Iznájar, by flickr.com

Social Justice and Inclusion Cross-Cutting Priorities

Rural communities, small farmers and low-income families may experience greater difficulties in accessing water and food resources, which are affected by climate change and the extreme weather in the region. There is a growing need to empower citizens through educational programs that highlight the relationship between water consumption, food production, and their role as consumers. Public awareness campaigns targeting food waste and water-saving practices can enhance community resilience.

Furthermore, improving digital connectivity and road infrastructure can ensure that remote populations are not left behind in accessing resources and knowledge, promoting fairness and inclusion across the region.

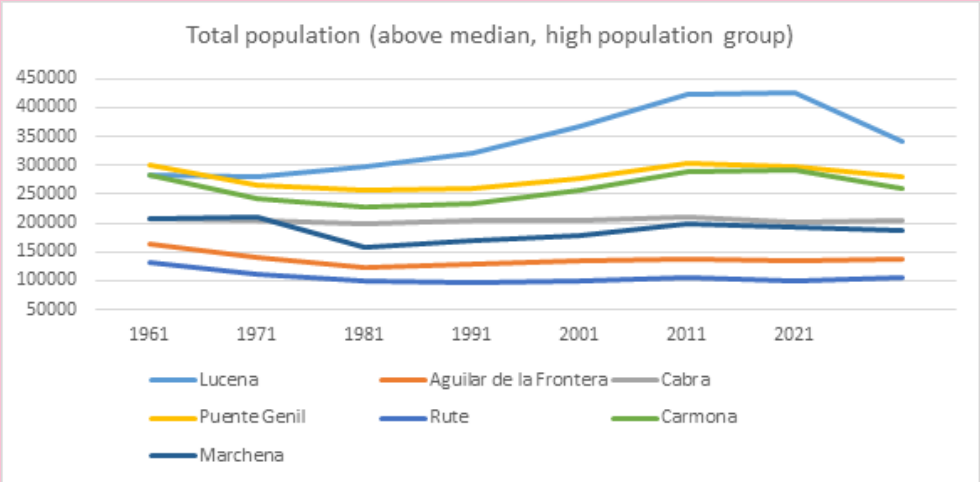
INNOVATION

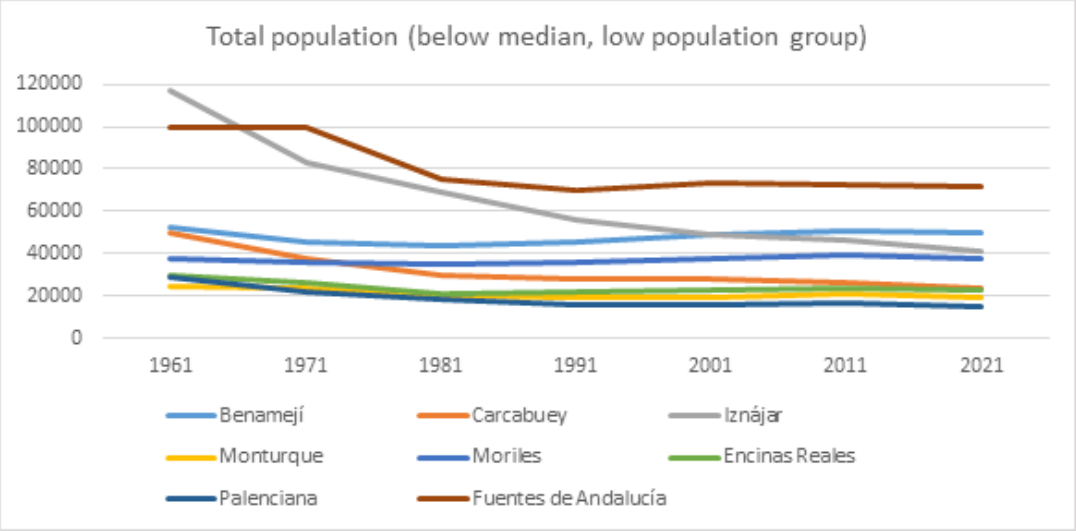
Social organizational and governance

RDD

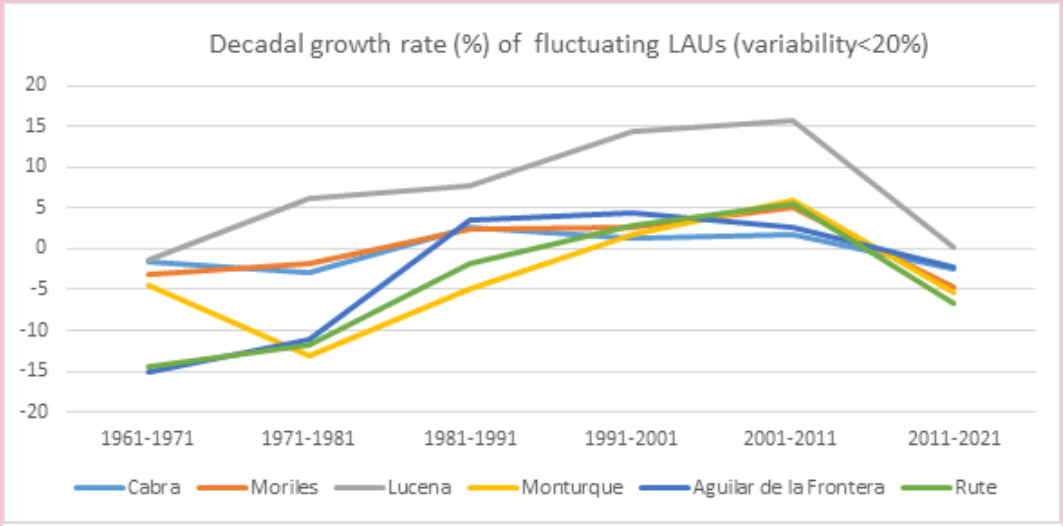
Local services, health and wellbeing

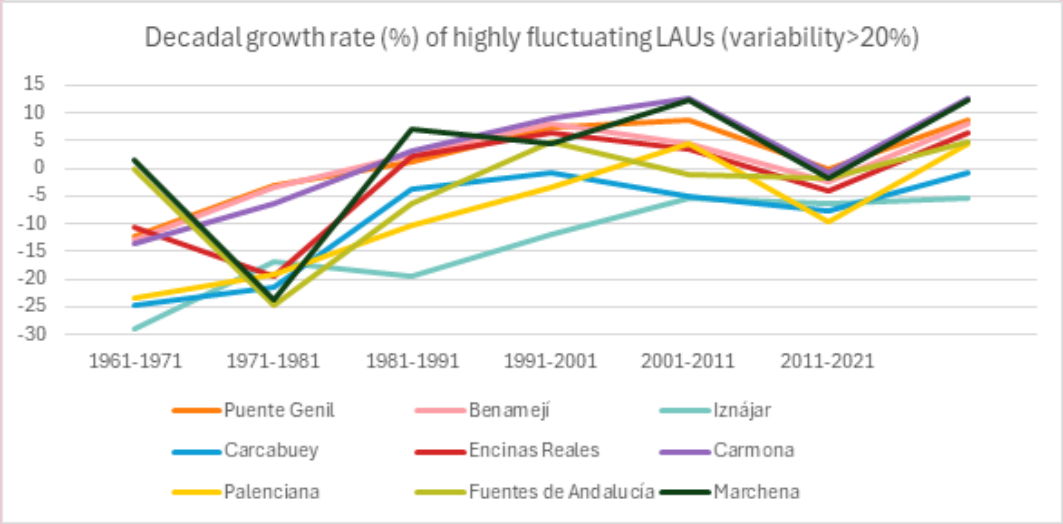
BASELINE



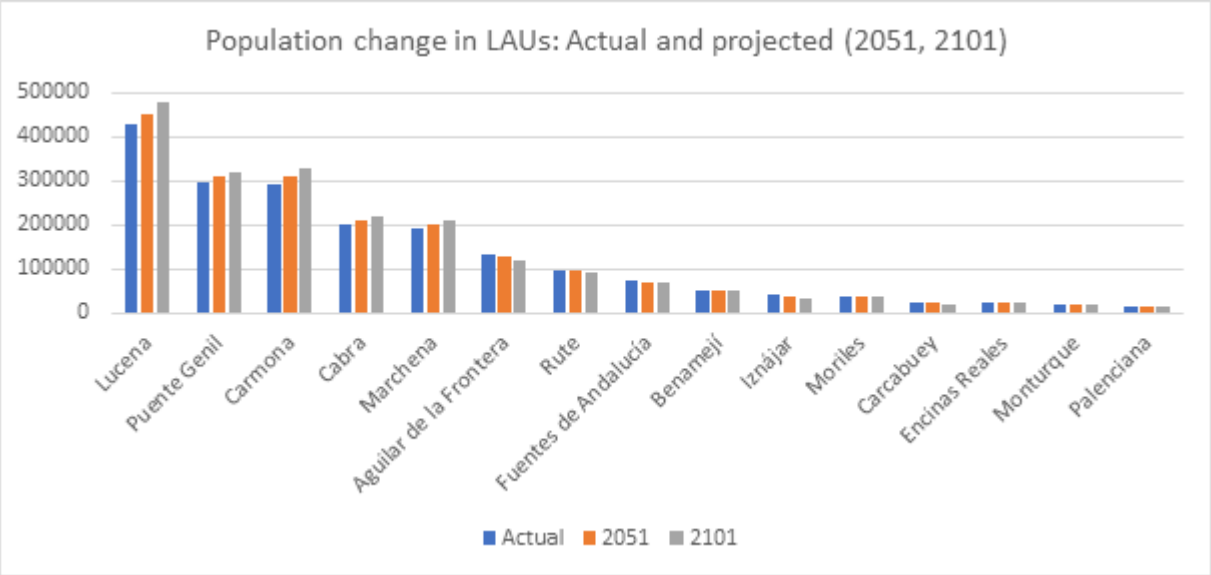


This Dynao shows dynamic population tendencies, with quite modest growth marked in cities like Lucena and Carmona, while smaller LAUs like Iznajar and Fuentes de Andalucía present declines.



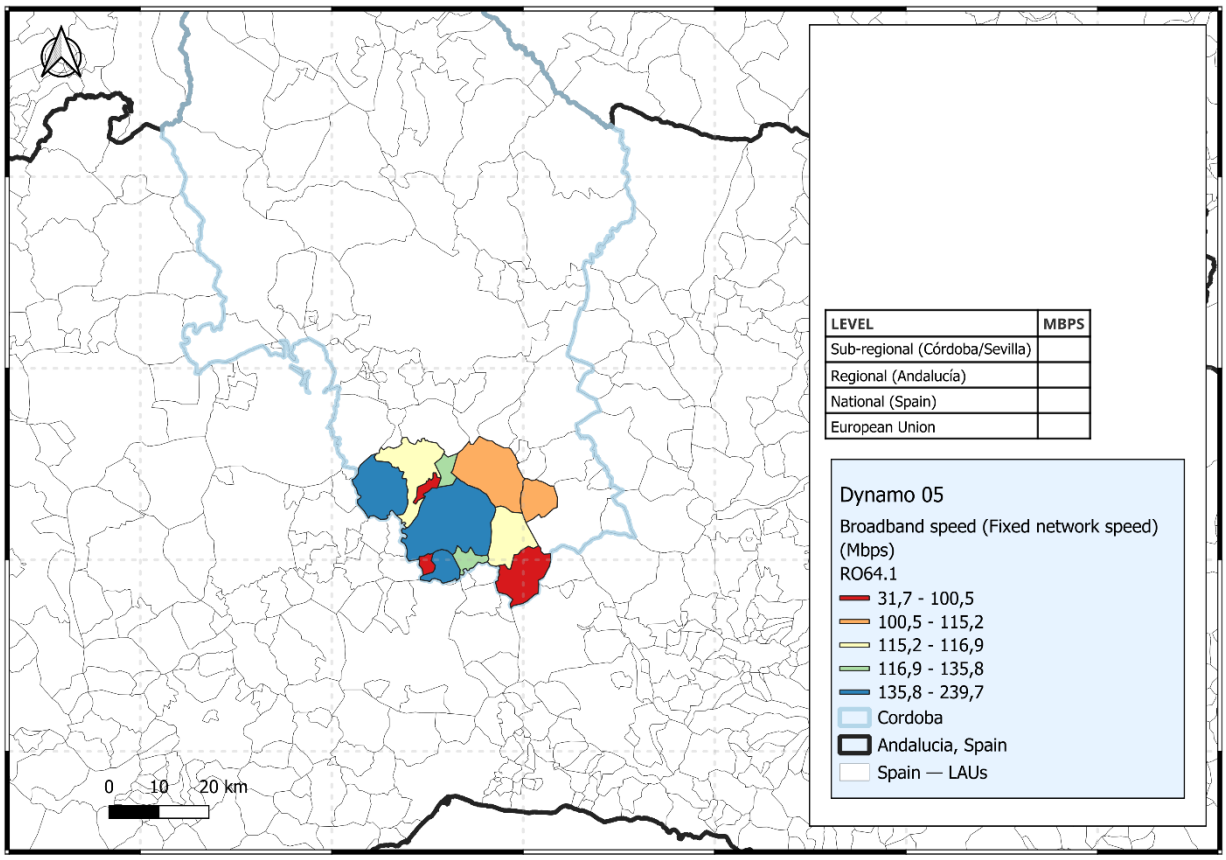


Decadal growth rates are quite different for every decade, which is especially important in highly fluctuating LAUs, noting instability in demographic trends.



The future projection indicates an increase in population for larger LAUs like Lucena, Puente Genil; while smaller ones like Aguilar de la Frontera and Rute may continue with slight declines due to the current difficulties these areas are facing with regard to maintaining a population.

LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
Lucena	427120	450,000	480,000	5.4	12.4
Puente Genil	297670	310,000	320,000	4.1	7.5
Carmona	291230	310,000	330,000	6.5	13.3
Cabra	202450	210,000	220,000	3.7	8.7
Marchena	193170	200,000	210,000	3.5	8.7
Aguilar de la Frontera	133980	130,000	120,000	-3	-10.4
Rute	98350	95,000	90,000	-3.4	-8.5
Fuentes de Andalucía	71600	70,200	69,000	-2	-3.6
Benamejí	49820	50,000	52,000	0.4	4.4
Iznájar	41060	38,000	35,000	-7.4	-14.8
Moriles	37210	37,700	38,500	1.3	3.5
Carcabuey	23740	22,000	20,000	-7.3	-15.8
Encinas Reales	22560	23,200	24,100	2.8	6.8
Monturque	19480	19,300	18,800	-0.9	-3.5
Palenciana	14630	13,800	12,900	-5.7	-11.8



Biodiversity

The region's changing climate conditions, marked by prolonged droughts and heatwaves, pose a threat to local biodiversity. Decreasing water availability and more frequent extreme weather events can harm the natural habitats of flora and fauna, reducing species diversity.

Agriculture, a key economic activity, could also face biodiversity loss due to water scarcity and unsustainable farming practices. Supporting the transition to agroecological methods and promoting sustainable land management can help preserve local ecosystems. Restoring native vegetation and encouraging water-efficient crops can protect biodiversity while enhancing the resilience of agricultural landscapes.

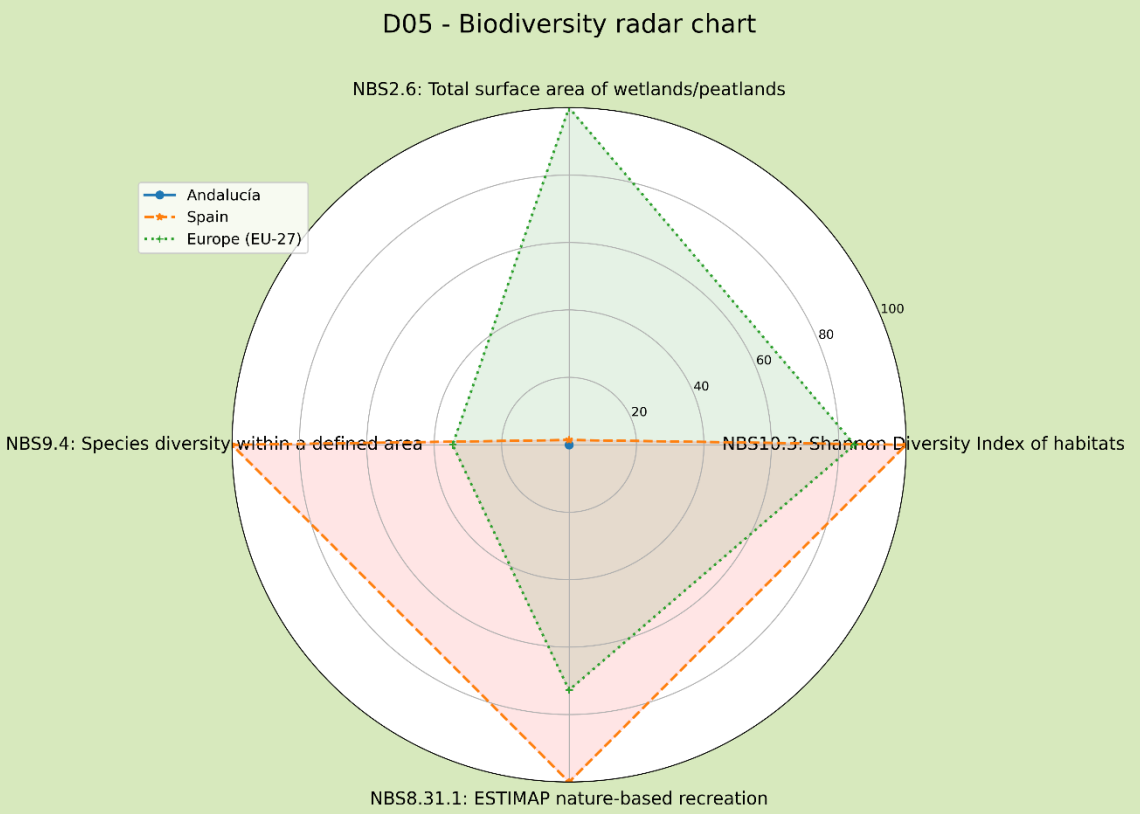
BASELINE

INNOVATION

Social organizational and governance
Technical innovation

RDD

Energy transition and climate neutrality



Climate change mitigation and adaptation

Climate change projections for Andalucia necessitate both mitigation and adaptation strategies.

On the mitigation front, reducing food waste can significantly lower greenhouse gas emissions along the supply chain. Educational initiatives can encourage consumers and businesses to adopt more responsible consumption habits. Adaptation measures, such as investing in modern irrigation systems, promoting drought-resistant crops, and improving water storage infrastructure, can safeguard agricultural productivity.

Additionally, enhancing water management systems and integrating climate awareness into local policies will help ensure the region can cope with future challenges, securing the well-being of both residents and the environment.

INNOVATION

Social organizational and governance

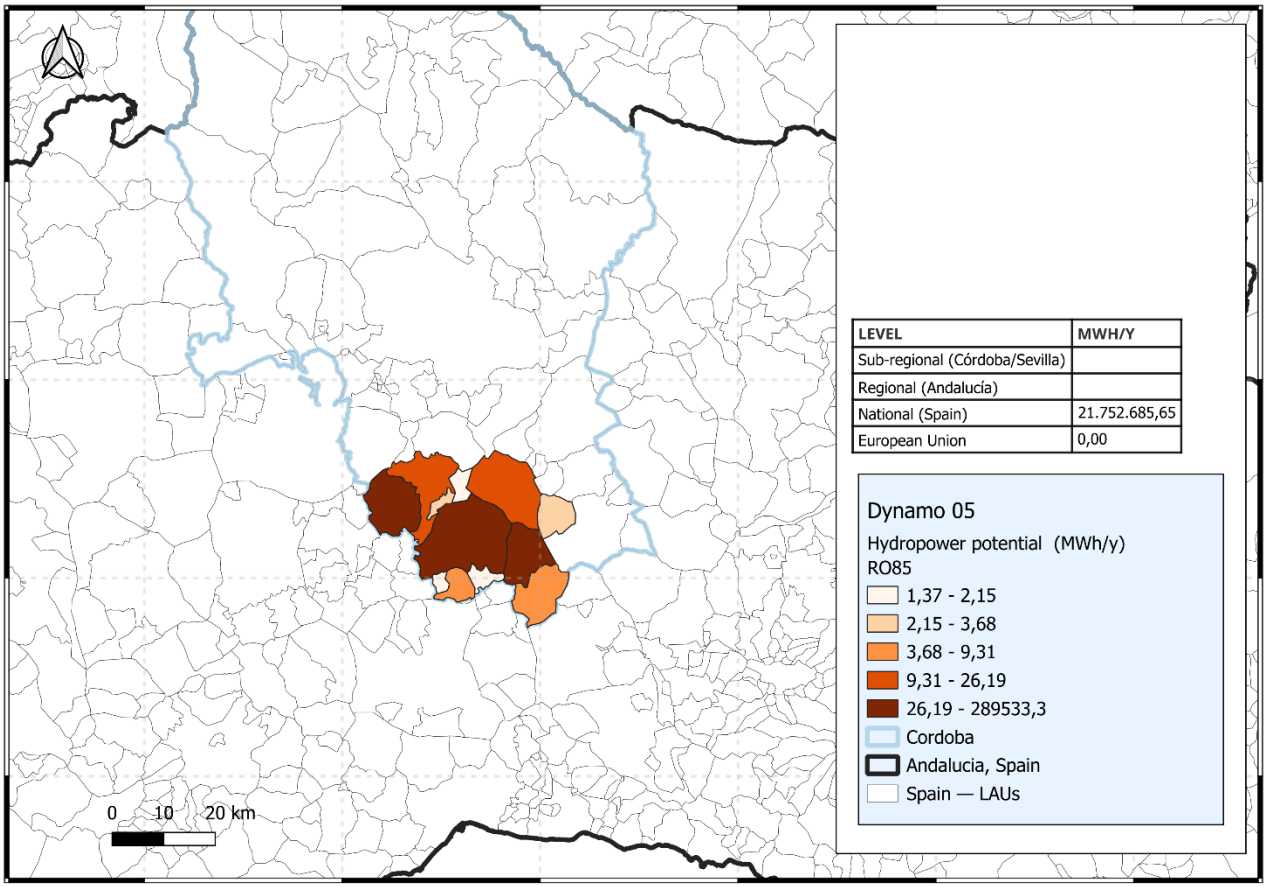
Technical innovation

RDD

Sustainable agrifood systems and ecosystem management

Energy transition and climate neutrality

BASELINE



5.6 D6. Zagori, Greece

Zagori is a mountainous region located in the Epirus region of northwestern Greece. It is known for its rugged and dramatic geographical features, shaped by its position within the Pindus Mountain Range.

Figure 14. Megas Lakkos, Zagori, by flickr

Social Justice and Inclusion Cross-Cutting Priorities

Zagori, with its picturesque stone villages and mountainous terrain, offers a rich cultural and natural heritage, yet faces significant challenges regarding accessibility and social inclusion. The region is heavily reliant on private vehicles due to limited public transportation, creating barriers for older people, youth, and individuals with disabilities. The rising costs of fuel and the isolation of certain villages exacerbate inequalities, making it difficult for residents to access essential services and limiting tourism opportunities for those with mobility or visual impairments.

Furthermore, improving tourism infrastructure to include tactile pathways, Braille signage, and audio guides would enable visually impaired visitors to enjoy the region's natural and cultural landmarks. Such initiatives would not only foster social inclusion but also strengthen Zagori's position as an accessible and welcoming destination.

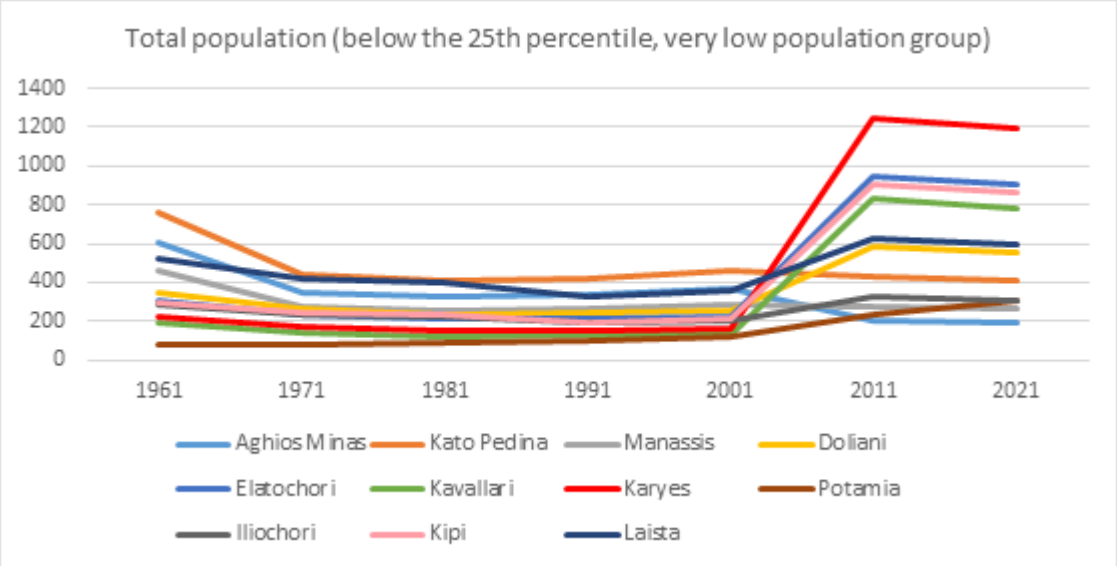
INNOVATION

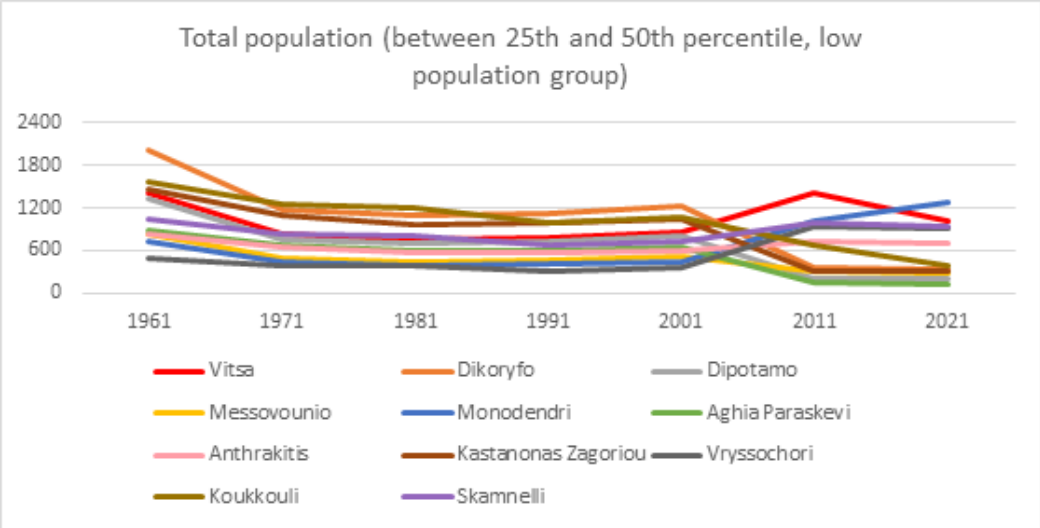
- Digital and technological innovation
- Social organizational and governance
- Financial and business models innovation

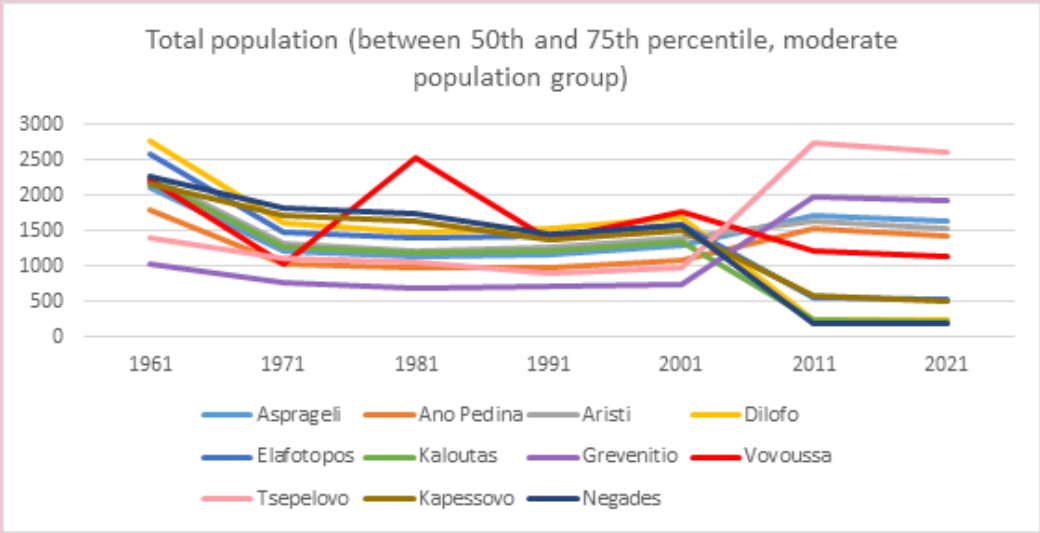
RDD

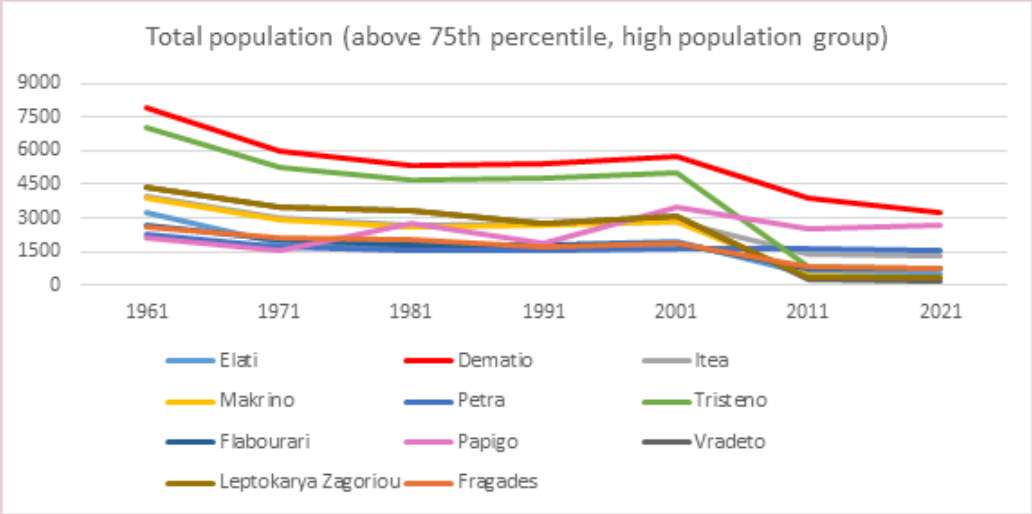
- Culture and cultural innovation
- Local services, health and wellbeing
- Sustainable multimodal mobility

BASELINE

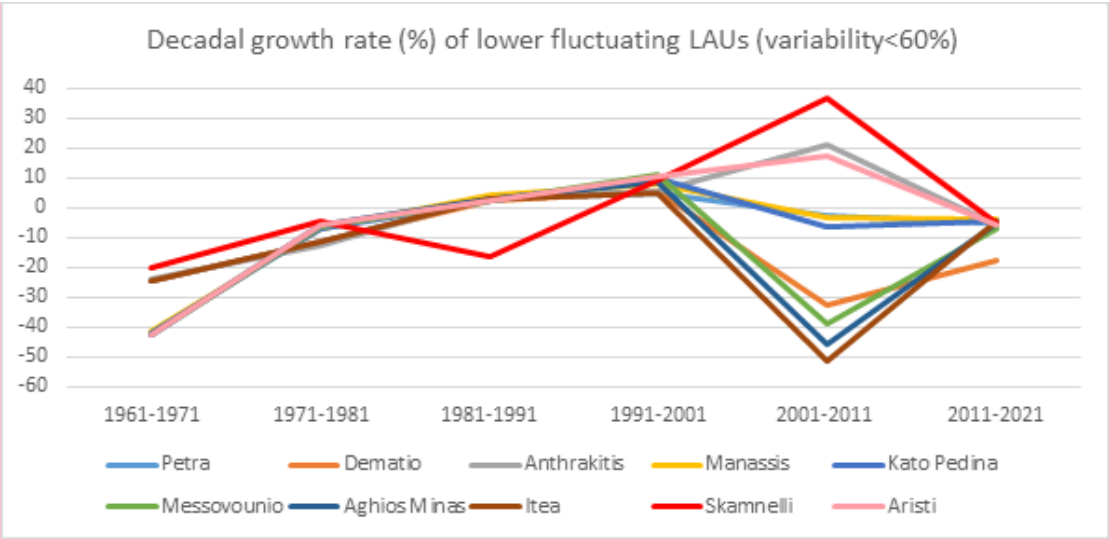


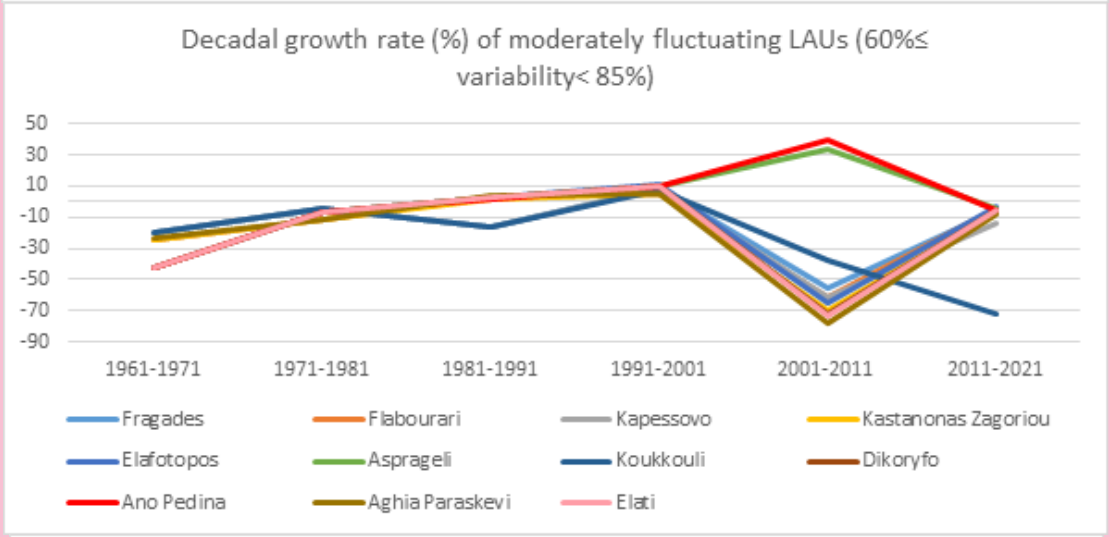


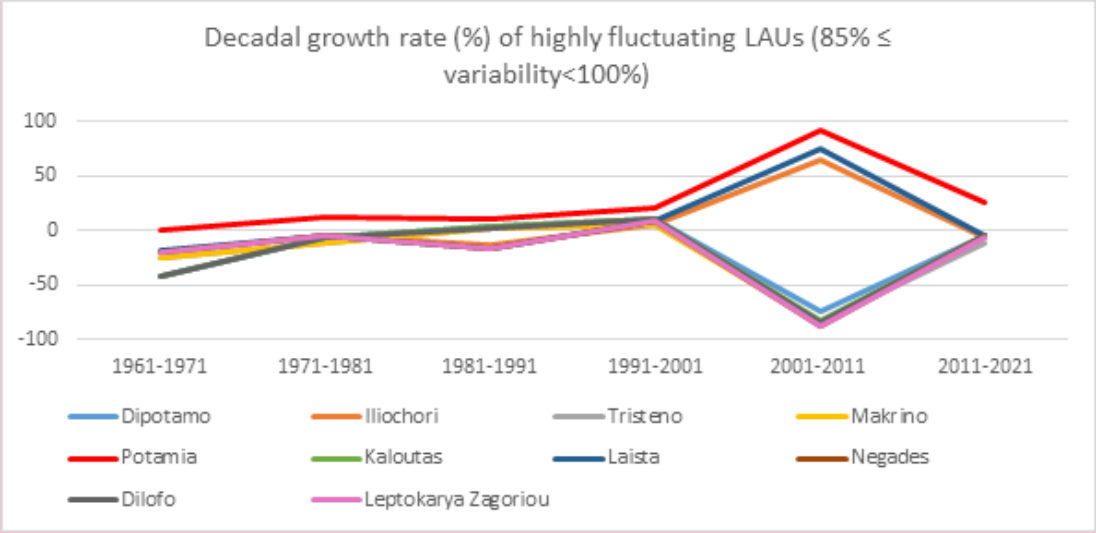


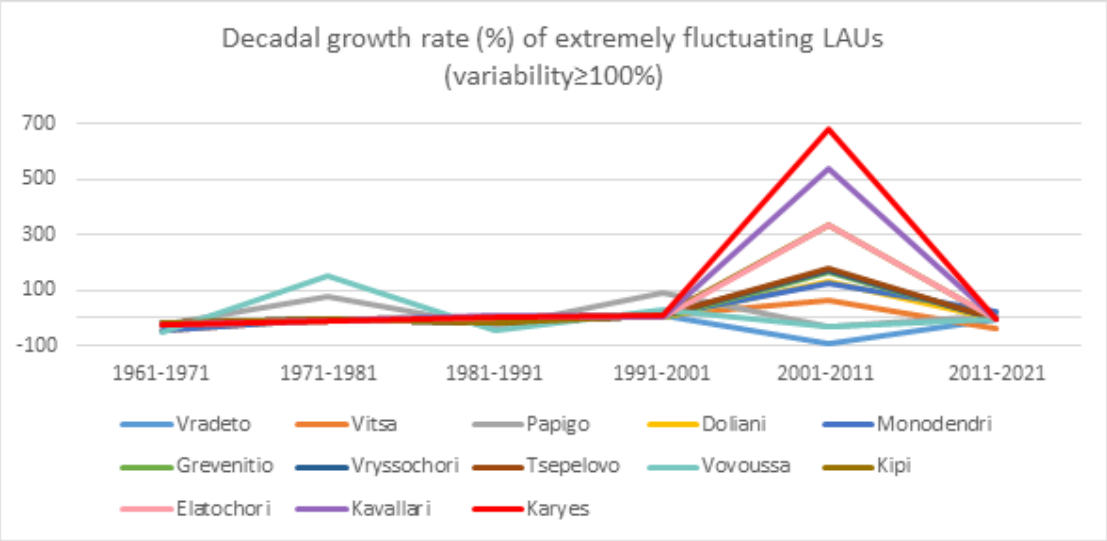


In D6, the population trends are very disparate; while certain LAUs are growing in specific decades, like Karyes in and Vitsa in from 2001 to 2011, others are either in decline or stagnation like Trestino in the same decade.

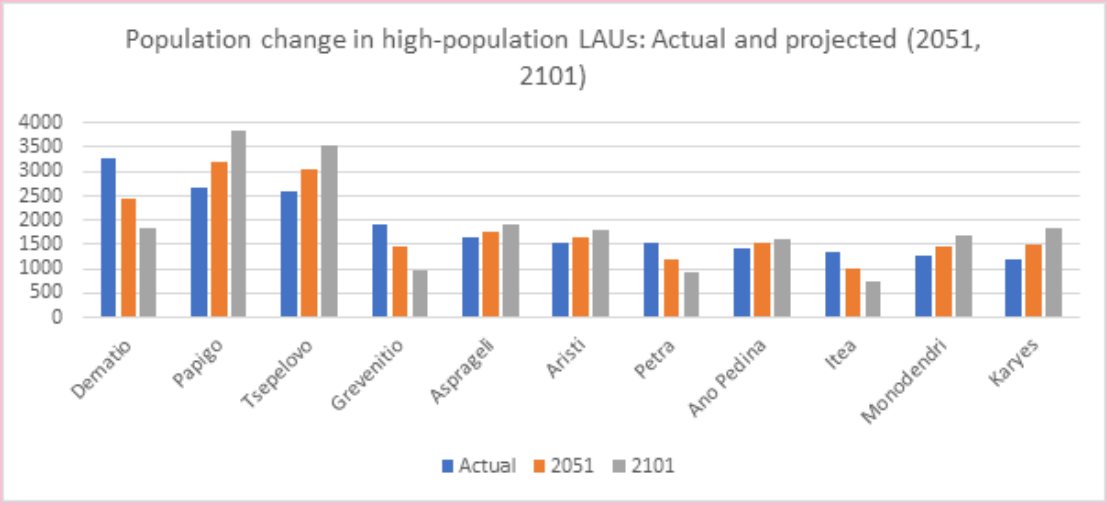

Decadal growth rate (%) of lower fluctuating LAUs (variability<60%)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1961-1971
1971-1981
1981-1991
1991-2001
2001-2011
2011-2021
Petra
Dematio
Anthrakitis
Manassis
Kato Pedina
Messovounio
Aghios Minas
Itea
Skamnelli
Aristi


Decadal growth rate (%) of moderately fluctuating LAUs (60%≤ variability< 85%)
50
30
10
-10
-30
-50
-70
-90
1961-1971
1971-1981
1981-1991
1991-2001
2001-2011
2011-2021
Fragades
Flabourari
Kapessovo
Kastanonas Zagoriou
Elafotopos
Aspragli
Koukkouli
Dikoryfo
Ano Pedina
Aghia Paraskevi
Elati


Decadal growth rate (%) of highly fluctuating LAUs (85% ≤ variability<100%)
100
50
0
-50
-100
1961-1971
1971-1981
1981-1991
1991-2001
2001-2011
2011-2021
Dipotamo
Iliochori
Tristeno
Makrino
Potamia
Kaloutas
Laista
Negades
Dilofo
Leptokarya Zagoriou



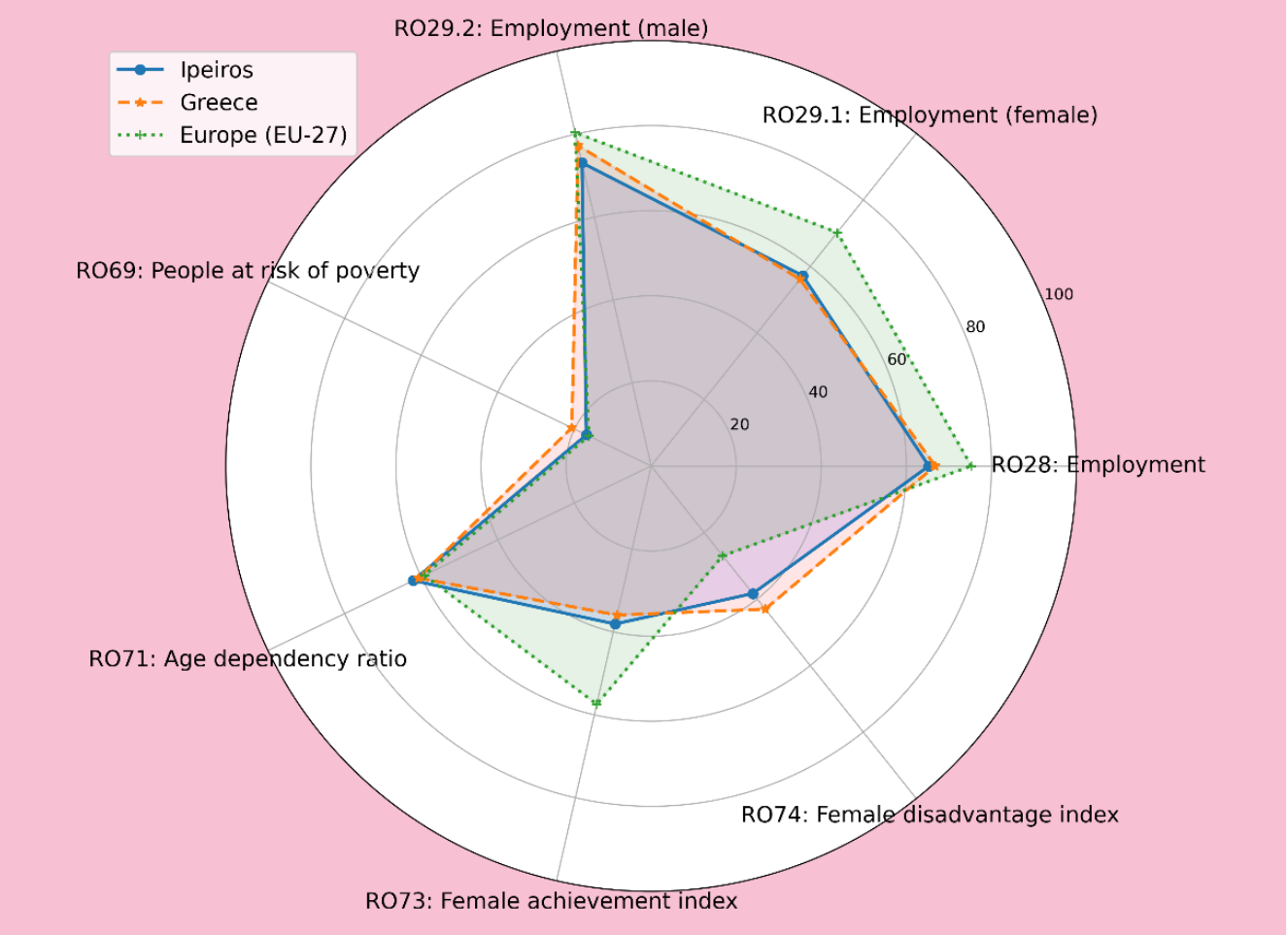
Regarding the decadal growth rates, while some areas present a stable or slightly declining trend, other areas present a high variability in their growth rates. Most of the LAUs present a significant increase or decrease from 2001 to 2011except Koukkoli, which continued as its normal behavior.



Future projections show a mixed results. Some LAUs like Vryssochori and Tsepelovo are expected to see population increases, whereas others like Kato Pedina, are likely to continue experiencing a downward trend. These variations indicate both opportunities and challenges for the region in terms of long-term population stability.

LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
Dematio	3270	2450	1850	-25.1	-43.4
Papigo	2670	3205	3852	20.06	44.28
Tsepelovo	2610	3040	3530	16.4	35.3
Grevenitio	1930	1450	980	-24.9	-49.2
Aspragеli	1650	1,770	1,910	7.3	15.8
Aristi	1540	1,660	1,790	7.8	16.2
Petra	1530	1210	940	-20.9	-38.6
Ano Pedina	1440	1,530	1,630	6.2	13.2

Itea	1330	990	740	-25.6	-44.4
Monodendri	1290	1,460	1,670	13.2	29.5
Karyes	1190	1,480	1,820	24.4	53
Vovoussa	1150	970	820	-15.7	-28.7
Vitsa	1020	910	830	-10.8	-18.6
Skamnelli	950	1,020	1,100	7.4	15.8
Elatochori	900	560	330	-37.8	-63.3
Vryssochori	900	1,080	1,270	20	41.1
Kipi	860	960	1,080	11.6	25.6
Kavallari	780	470	270	-39.7	-65.4
Fragades	770	594	459	-22.86	-40.57
Tristeno	710	530	380	-25.4	-46.5
Anthrakitis	700	630	560	-10	-20
Flabourari	700	540	416	-22.86	-40.57
Laista	600	670	730	11.7	21.7
Doliani	550	350	230	-36.4	-58.2
Elafotopos	530	320	190	-39.6	-64.2
Kapessovo	510	410	320	-19.6	-37.3
Elati	490	350	240	-28.6	-51
Kato Pedina	410	300	220	-26.8	-46.3
Koukkouli	390	220	120	-43.6	-69.2
Makrino	360	270	190	-25	-47.2
Dikoryfo	330	220	150	-33.3	-54.5
Leptokarya Zagoriou	320	242	183	-24.38	-42.81
Potamia	310	420	540	35.5	74.2
Iliochori	310	300	280	-3.2	-9.7
Kastanonas Zagoriou	300	200	130	-33.3	-56.7
Messovounio	290	200	130	-31	-55.2
Manassis	260	190	140	-26.9	-46.2
Dilofo	240	160	100	-33.3	-58.3
Kaloutas	230	140	80	-39.1	-65.2
Vradeto	210	158	118	-24.84	-43.9
Dipotamo	200	140	90	-30	-55
Aghios Minas	190	130	80	-31.6	-57.9
Negades	190	140	90	-26.3	-52.6
Aghia Paraskevi	130	70	40	-46.2	-69.2



Biodiversity

The biodiversity of Zagori is deeply intertwined with its traditional land management practices and water systems. The region's ecosystems, including mountain forests, rivers, and valleys, support diverse flora and fauna. However, increasing human-wildlife conflicts, driven by car dependency and habitat fragmentation, pose threats to animal populations. Additionally, the decline of traditional irrigation systems and the abandonment of old mills have affected local biodiversity, as these systems historically maintained water flow and provided microhabitats for aquatic and plant species.

Revitalizing these traditional practices alongside the adoption of modern conservation techniques could help restore ecological balance. Preserving and expanding green corridors would safeguard wildlife, while promoting coexistence between human activity and nature.

INNOVATION

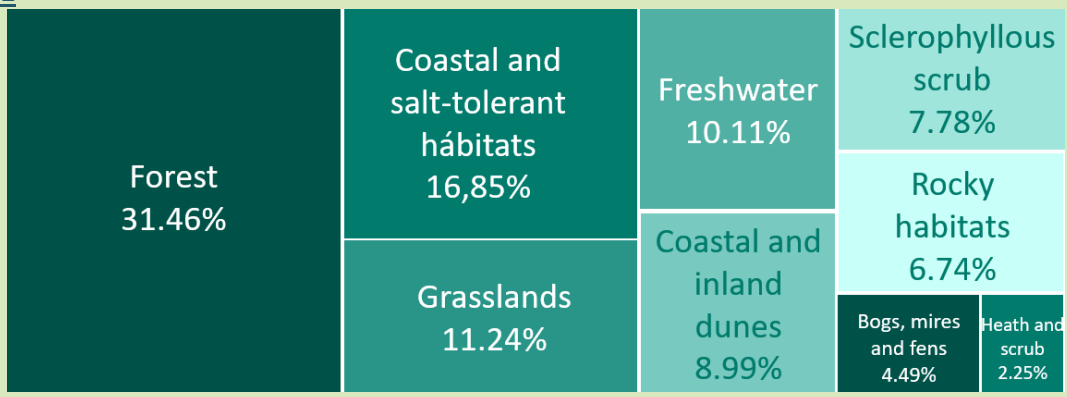
RDD

Technical innovation

Nature-based and cultural Tourism

Energy transition and climate neutrality

BASELINE



Percentage composition by group of protected habitats: Greece

Climate change mitigation and adaptation

Drought conditions place pressure on both local communities and the growing number of visitors. Sustainable water management is crucial, requiring the integration of modern water-saving technologies with traditional systems like stone aqueducts and irrigation channels.

Additionally, reducing car dependency through eco-friendly transport options would cut emissions, contributing to climate change mitigation.

INNOVATION

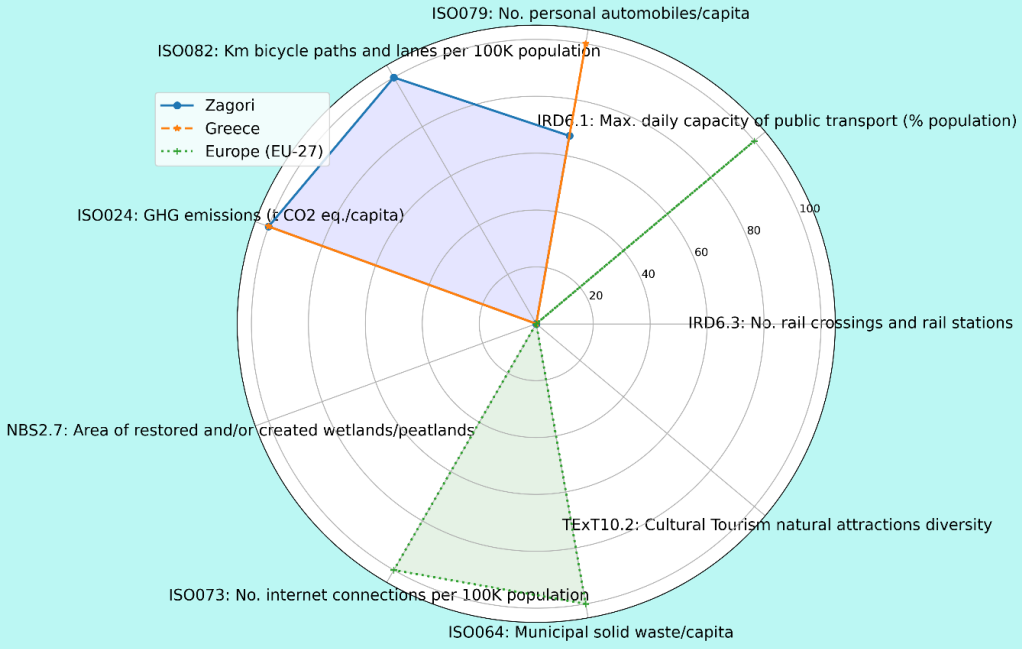
Technical innovation

RDD

Energy transition and climate neutrality

Sustainable multimodal mobility

BASELINE



5.7 D7. Zakarpattya, Ukraine

Zakarpattia is located in the westernmost part of Ukraine, bordering Romania to the south, Hungary to the southwest, Slovakia to the west, and Poland to the northwest. It is a predominantly mountainous area, with approximately 80% of its territory covered by the Carpathian Mountains and over 50% covered by forests. The region is known for its rich biodiversity, picturesque landscapes, and important natural resources, including rivers, dense forests, and alpine meadows.

Demographically, Zakarpattia is characterized by its multicultural and multiethnic composition. The population is predominantly rural, with many small towns scattered across the mountainous landscape. Migration patterns reflect a population decline in some rural areas. The population tends to be older, as younger generations often seek employment opportunities abroad.

Figure 15. Ukraine. Zakarpattia. Autumn Waterfall Shipot, by deviantart

Social Justice and Inclusion Cross-Cutting Priorities

Dynamo faces significant challenges in accessibility and mobility due to a lack of public transport and adequate road infrastructure.

Villages within the community are connected by long stretches of unlit and underdeveloped roads. Residents, especially vulnerable groups such as the elderly and children, often walk several

INNOVATION

Digital and technological innovation

kilometres in poorly lit conditions, increasing the risk of accidents and limiting their mobility.

Digital infrastructure could also be improved, increasing quality of life, encouraging social inclusion, local tourism and business development.

RDD

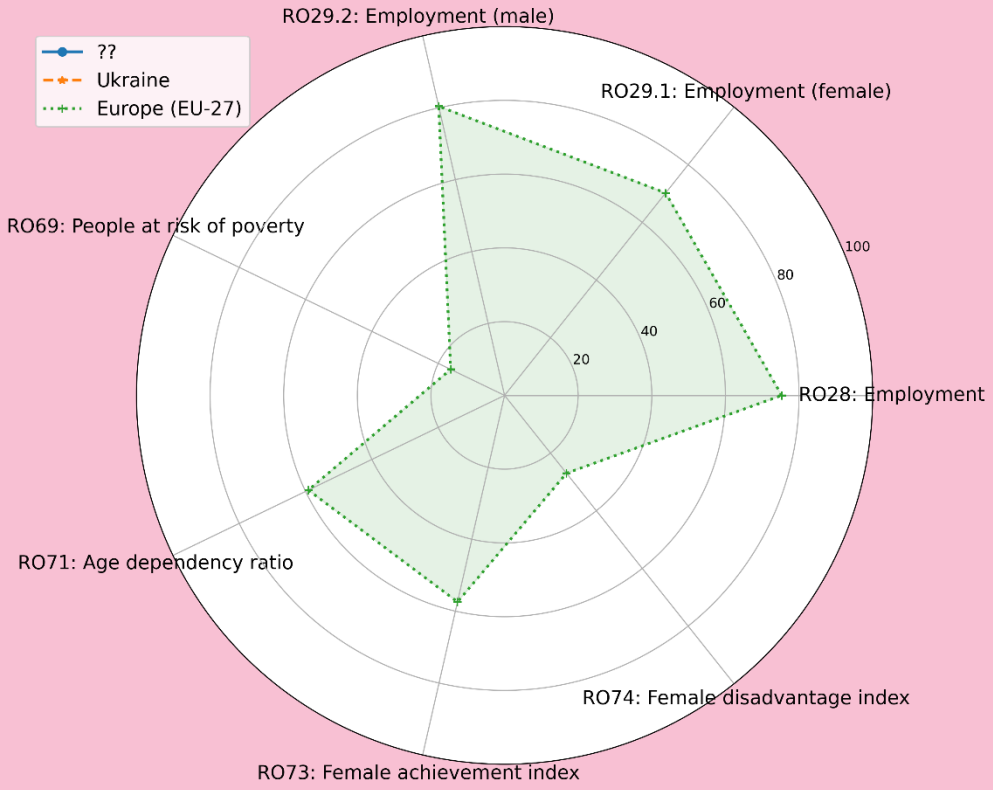
Financial and business models innovation

Local services, health and wellbeing

Sustainable multimodal mobility

Sustainable agrifood systems and ecosystem management

BASELINE



Biodiversity

The Zakarpattya region is renowned for its rich biodiversity, with over 50% of its territory covered by forests and 80% made up of mountains.

Traditional beekeeping, particularly involving the Carpathian honey bee (*Apis mellifera carpatica*), plays a vital role in maintaining local biodiversity. However, this practice is threatened by disease, inadequate pest management and a lack of monitoring systems.

The development of tourism with an emphasis on nature-based experiences, combined with systems to track visitor numbers and environmental impacts, can further protect and highlight the region's biodiversity.

INNOVATION

RDD

Digital and technological innovation

Local services, health and wellbeing

Nature-based and cultural Tourism

Climate change mitigation and adaptation

Zakarpattya's mountainous environment is increasingly vulnerable to the impacts of climate change, including extreme weather events and changing ecological conditions.

Communities that rely on traditional agriculture and beekeeping are particularly susceptible to temperature fluctuations and changes in flowering cycles, which affect honey production and crop yields.

Increasing the use of renewable energy-powered systems can reduce emissions and contribute to climate change mitigation.

Additionally, promoting sustainable tourism and implementing water-efficient practices in local businesses can help adapt to future climate challenges.

Integrating modern technologies with traditional ecological knowledge will be crucial to enhancing community resilience, safeguarding natural resources and ensuring the long-term sustainability of the region.

INNOVATION

RDD

Digital and technological innovation

Sustainable multimodal mobility

5.8 D8. Fiastra Valley, Italy

The Fiastra Valley is located in the inner part of the Le Marche region in central Italy, at the foothills of the Apennine Mountains. It is characterized by a hilly landscape with the Fiastra River running through it. The area is largely rural, with agricultural fields dominating the land cover, alongside patches of forests in steeper and riparian zones.

Figure 16. Borgofuturo festival, by mcnet.tv

The area is known for traditional farming practices, particularly the cultivation of ancient grains and vineyards, which contribute to both biodiversity and food heritage.

In addition to its natural tourist appeal, the region is characterised by a community identity led by festivals such as Borgofuturo, which since its inception has promoted cultural revival and rural regeneration.

Social Justice and Inclusion Cross-Cutting Priorities

The Fiastra Valley, with its small and dispersed population, faces challenges in ensuring equitable access to local resources, particularly food produced in the valley. The complexity of distributing local products reduces access to fresh, locally grown produce. This lack of access disproportionately affects vulnerable groups, such as elderly residents or those without private transportation. Establishing an accessible and cooperative system that facilitates the direct sale and distribution of valley products can promote social inclusion by connecting local farmers and consumers, strengthening community ties, and supporting small-scale agricultural livelihoods.

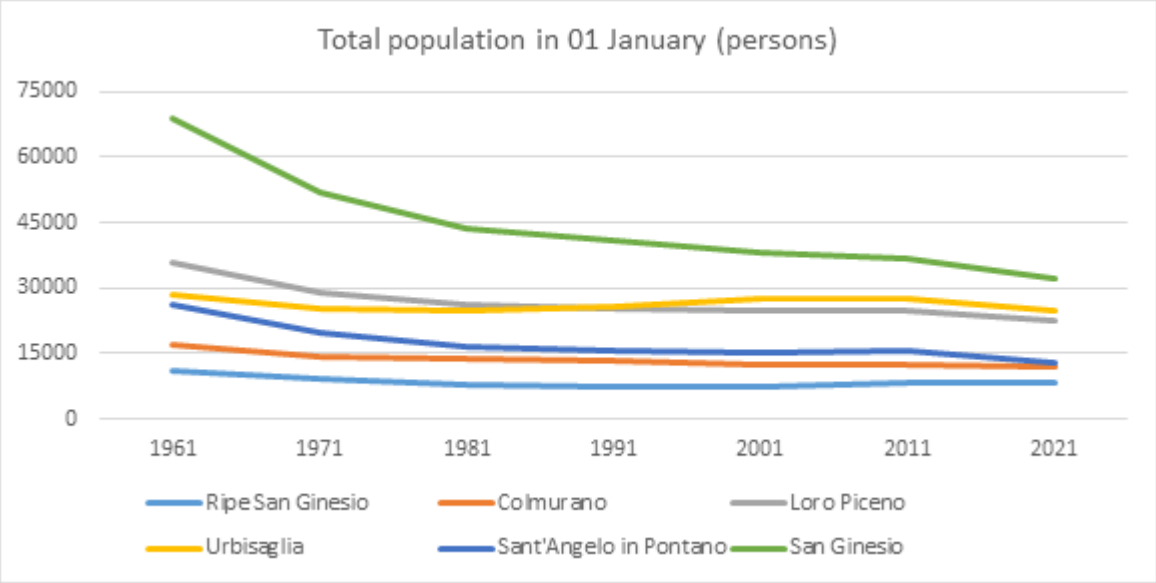
INNOVATION

- Financial and business models innovation
- Social organizational and governance

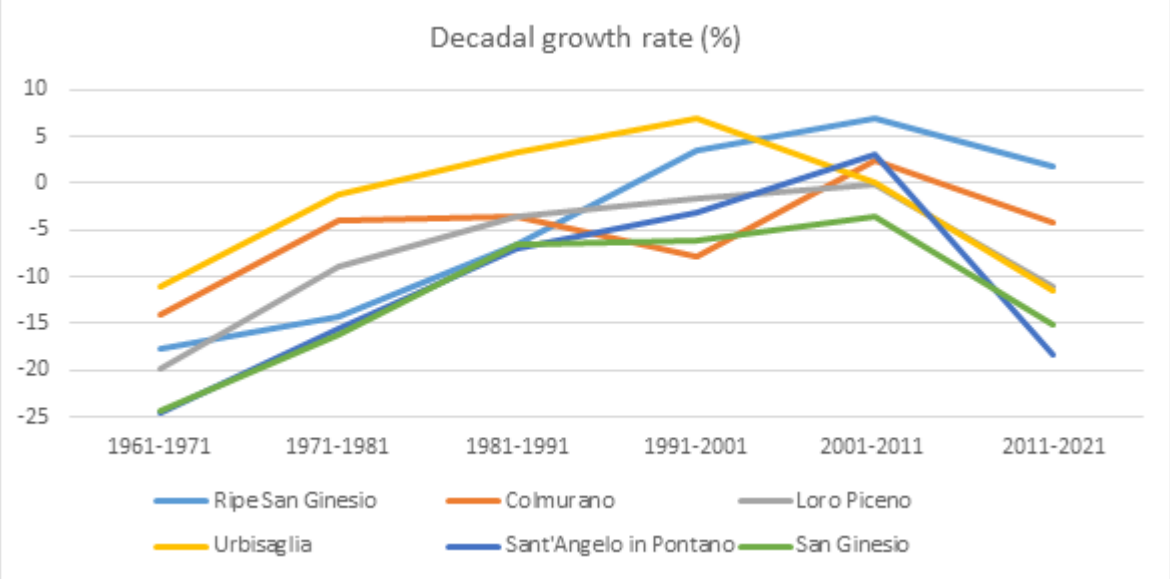
RDD

- Local services, health and wellbeing
- Culture and cultural innovation

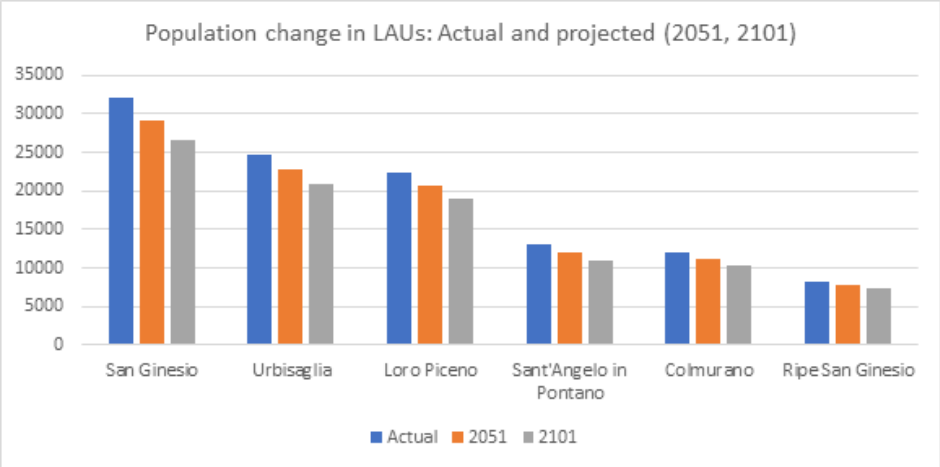
BASELINE



The population in D8 is constantly falling, and in some LAUs, like San Ginesio and Sant'Angelo in Pontano, this downward trend is likely to continue well into the future.

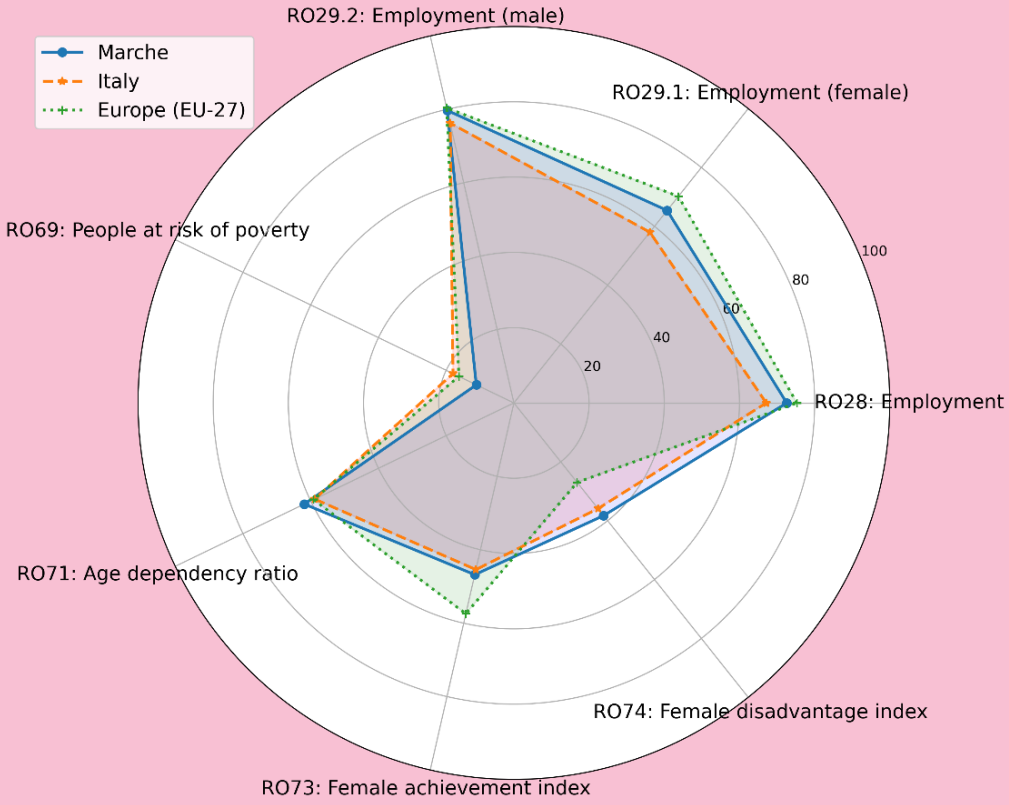


Municipalities like Ripe San Ginesio show negative growth rates for the period 1961-2001, recover in the decade 2001-2011, even reaches a positive growth rate. On the other hand, municipalities like San Ginesio always decline, with a sharp decline from 2011 to 2021. decades.



The long-term projections are that this Dynamo will also continue to face difficulties in holding its resident population, with decreases in all LAUs.

LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
San Ginesio	31980	29185	26633	-8.75	-16.73
Urbisaglia	24630	22715	20951	-7.77	-14.96
Loro Piceno	22400	20667	19075	-7.75	-14.86
Sant'Angelo in Pontano	13060	11964	10961	-8.38	-16.04
Colmurano	12080	11174	10339	-7.51	-14.42
Ripe San Ginesio	8220	7742	7294	-5.8	-11.26



Biodiversity

Promoting the consumption and production of local agricultural products in the Fiastra Valley directly contributes to preserving biodiversity and mitigating climate change.

Supporting smallholder farmers to grow indigenous and ancient crop varieties fosters agricultural diversity and helps maintain the region's genetic heritage.

Furthermore, encouraging sustainable agricultural practices improves soil health and reduces the need for synthetic fertilizers and pesticides, supporting pollinators and improving local ecosystem resilience.

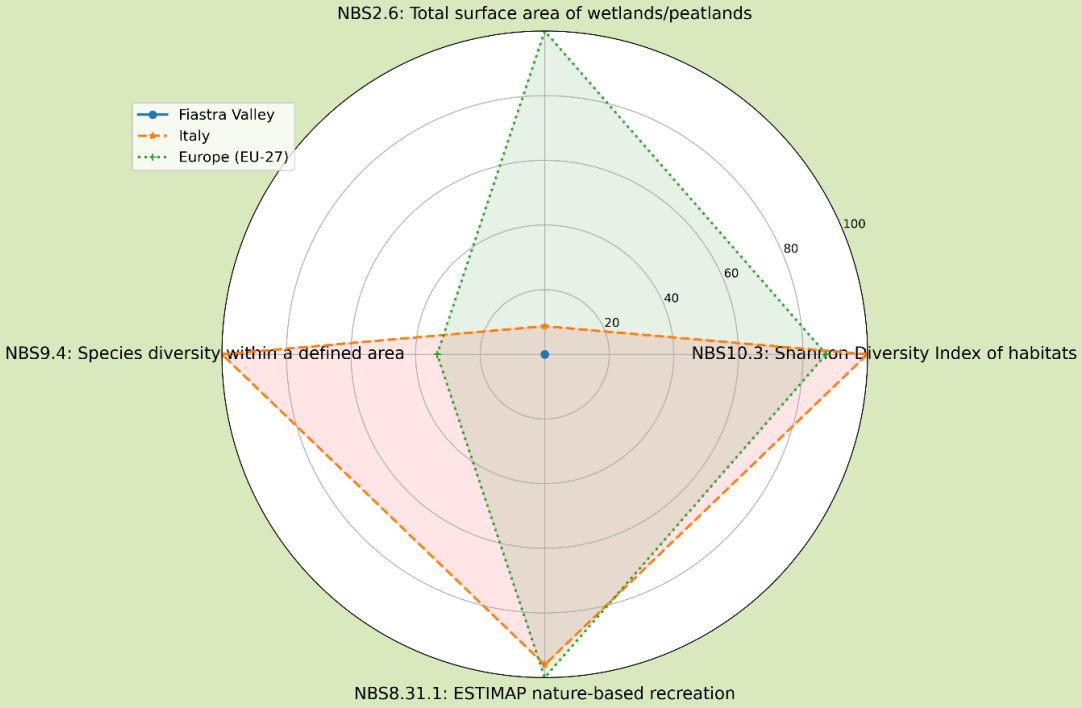
INNOVATION

Digital and technological innovation

RDD

Nature-based and cultural Tourism

BASELINE



Climate change mitigation and adaptation

Rising temperatures and increased incidence of droughts threaten agricultural productivity and the ecological balance of the Fiastra Valley. Adaptation strategies are essential to ensure the resilience of local farmers and the ecosystem at large.

Implementing water-saving irrigation technologies and promoting agroecological techniques can help farmers manage water scarcity more effectively.

INNOVATION

Social organizational and governance

Digital and technological innovation

RDD

Nature-based and cultural Tourism

Sustainable agrifood systems and ecosystem management

Reduced reliance on long-distance food transport reduces greenhouse gas emissions, thereby decreasing the valley's carbon footprint. These practices collectively contribute to climate change mitigation and the long-term stability of the valley's agroecosystem.

Furthermore, ensuring the climate resilience of outdoor cultural events, through heat mitigation strategies such as shaded areas and rain shelters, can support the valley's cultural vitality while also preparing the community for extreme weather conditions.

These adaptation measures collectively strengthen the region's ability to withstand climate challenges.

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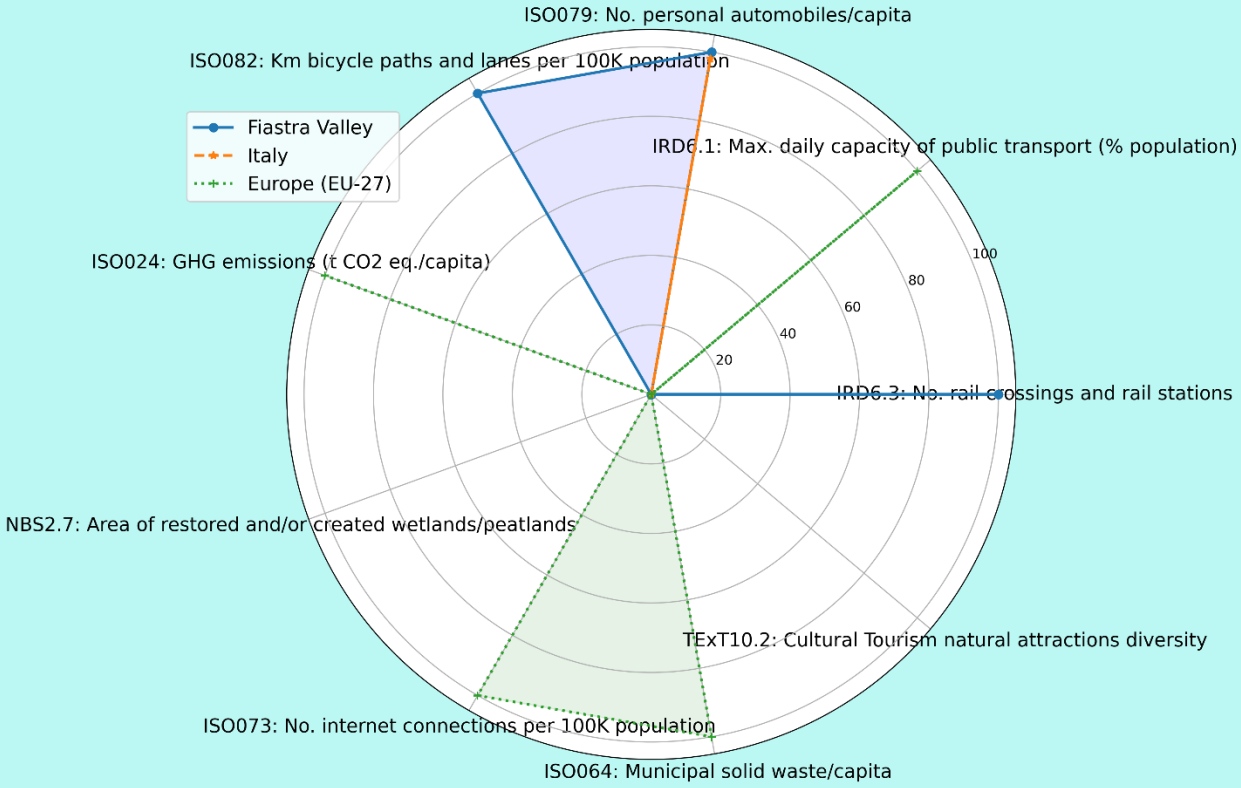


5.9 D9. Zadar, Croatia

The **Zadar region** is located in **central Dalmatia, Croatia**, stretching from the Adriatic Sea to the mountainous inland areas. It is renowned for its **diverse natural landscapes**, which range from rugged coastlines and crystal-clear waters to karst plains, fertile valleys, and forested hills. The region is dotted with **over 300 islands and islets**, including the **Zadar Archipelago**, with some of the most notable islands being **Dugi Otok, Ugljan, Pašman, and Silba**. Many of these islands are sparsely populated and remote, featuring small fishing villages and agricultural communities.

Figure 17. Panoramic View of Zadar, Croatia at Sunset. Photo via: Pexels

Social Justice and Inclusion Cross-Cutting Priorities

The islands of Zadar face significant challenges related to social inclusion and community resilience, particularly due to their remote and isolated nature. Limited infrastructure, inefficient public services, and seasonal population fluctuations create disparities in access to resources, employment, and quality of life. Older residents often face social isolation, while younger generations are increasingly migrating to the mainland in search of better opportunities, threatening the long-term sustainability of these island communities.

To combat these issues, fostering community-driven initiatives that enhance local cooperation, empower residents through education and skills development, and promote inclusive governance is key.

Investing in sustainable agri-tourism and local entrepreneurship could create job opportunities while strengthening the connection between residents and their cultural and natural heritage.

BASELINE

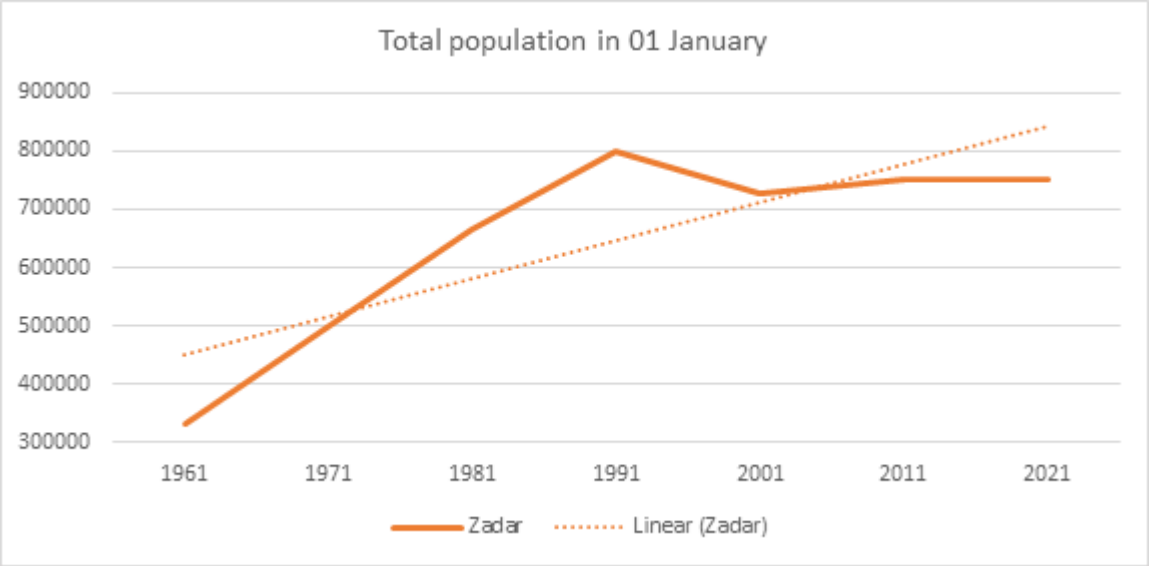
INNOVATION

Social organizational and governance

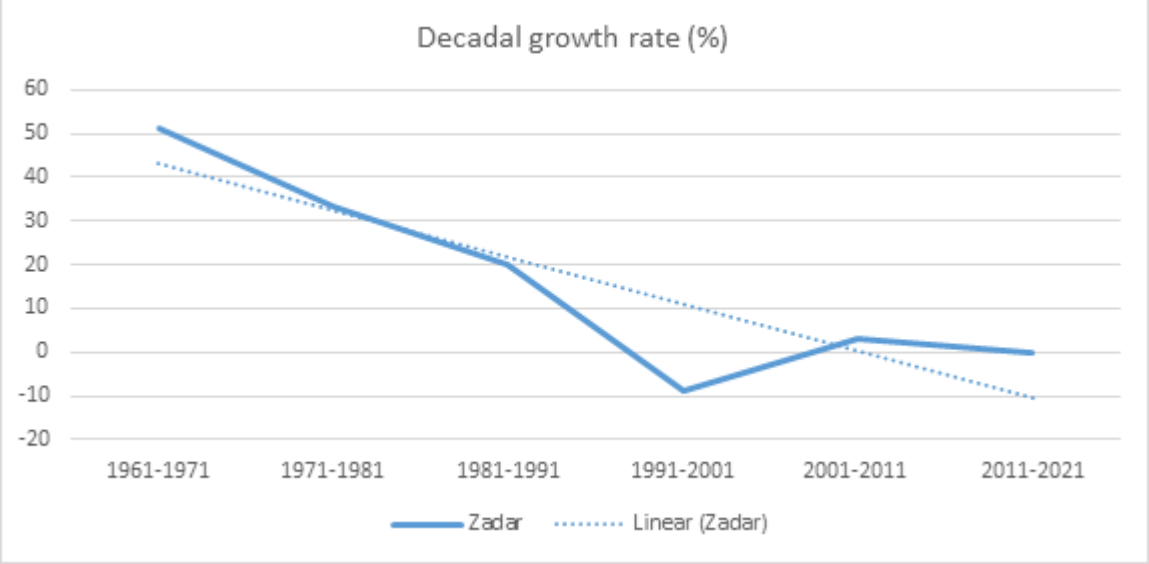
RDD

Local services, health and wellbeing

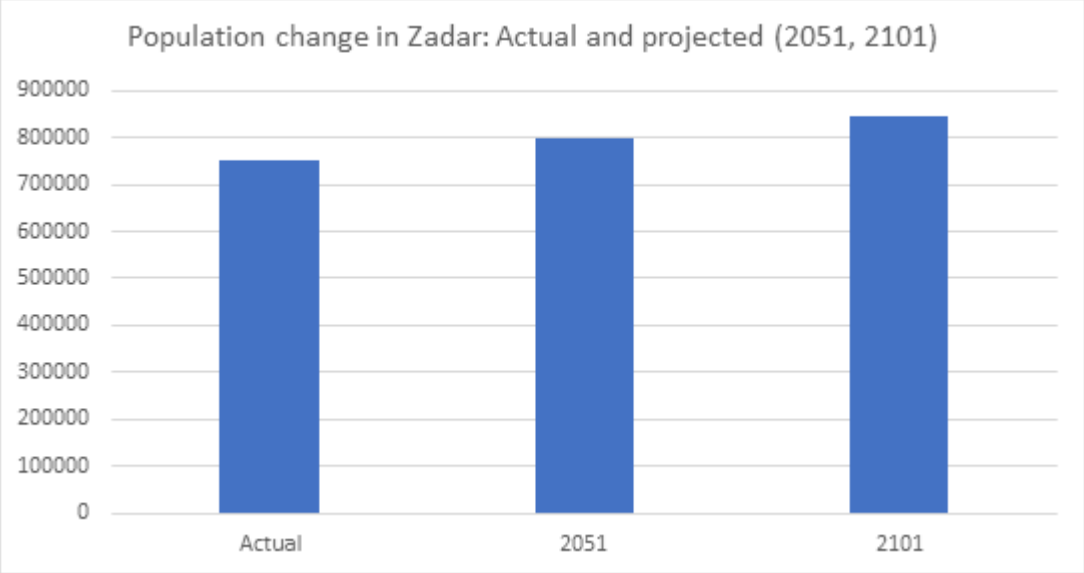
Sustainable multimodal mobility



Zadar showed significant growth over the past decades. The increase between 1961 and 1971 was 51%, further growing in subsequent decades, especially between 1971 and 1981. In the period from 1991 to 2001, a slight reduction of the population took place.



During the last two decades, between 2001 and 2021, the growth of the population of Zadar considerably decelerated; the growth practically stabilized, having increased only by 0.08% between 2011 and 2021.



The future projections of D9 are for further growth, although at a moderate rate. It is foreseen to increase by 6.23% by 2051 and by 12.88% by 2101. These figures mean that, notwithstanding the slower growth during recent years, the population of Zadar can still be expected to increase over the next few decades.

LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
Zadar	750620	797307	847339	6.23	12.88

Biodiversity

Biodiversity conservation on the islands is under threat due to poor waste management practices, pollution from septic tanks, and the degradation of agricultural land. Illegal dumping and nutrient runoff harm the fragile marine ecosystems, which are home to diverse flora and fauna. Overreliance on imported products and unsustainable land use further strain the environment.

Implementing circular waste management systems, particularly by composting bio-waste for agricultural use, could reduce pollution and regenerate soil fertility.

Protecting marine habitats through pollution control and community-led conservation projects can ensure the islands retain their ecological value while supporting sustainable fishing and eco-tourism.

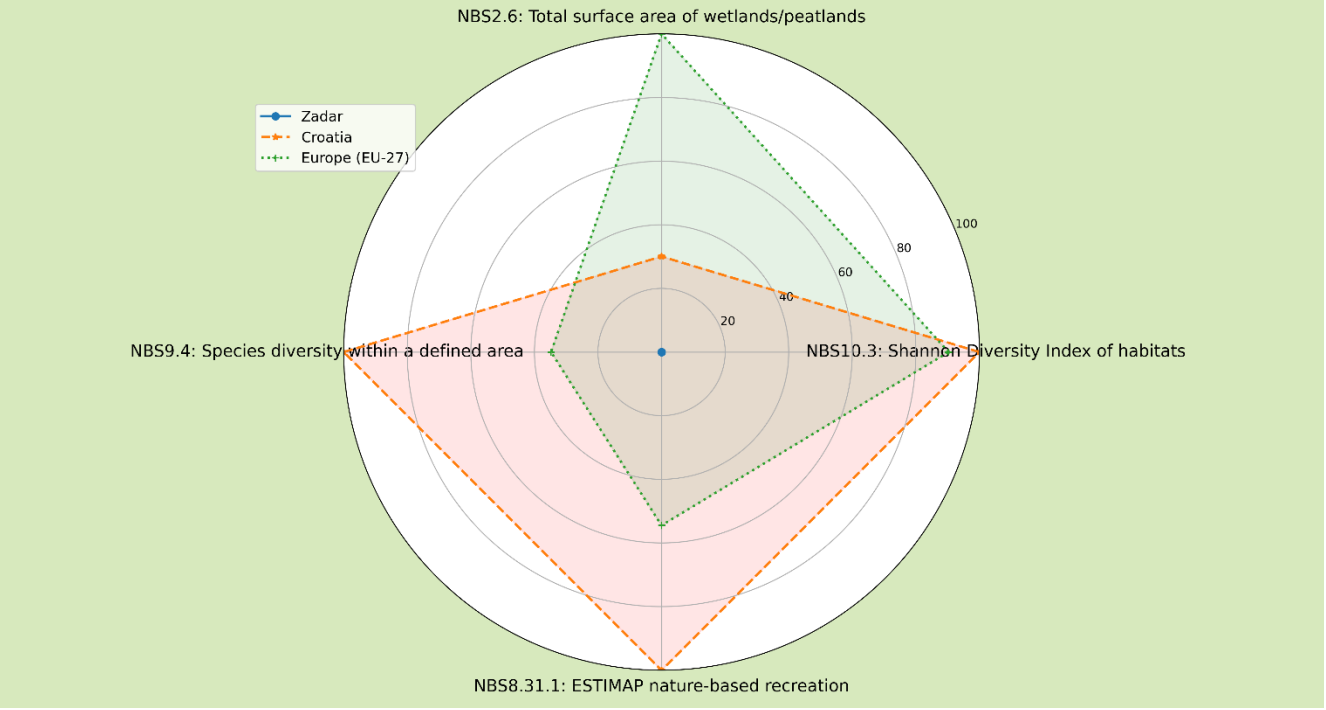
BASELINE

INNOVATION

Technical innovation

RDD

Energy transition and climate neutrality



Climate change mitigation and adaptation

The islands are vulnerable to water scarcity, extreme weather events, and rising sea levels. The lack of freshwater sources forces reliance on costly water imports, restricting agricultural potential and increasing the islands' carbon footprint.

Developing rainwater harvesting systems and greywater recycling for irrigation can enhance water security, while promoting climate-resilient agricultural practices, such as drought-tolerant crops and permaculture, can restore soil health and reduce dependency on external resources.

Supporting renewable energy solutions, like solar power, will lower emissions and contribute to the islands' energy self-sufficiency, fostering long-term resilience against climate change.

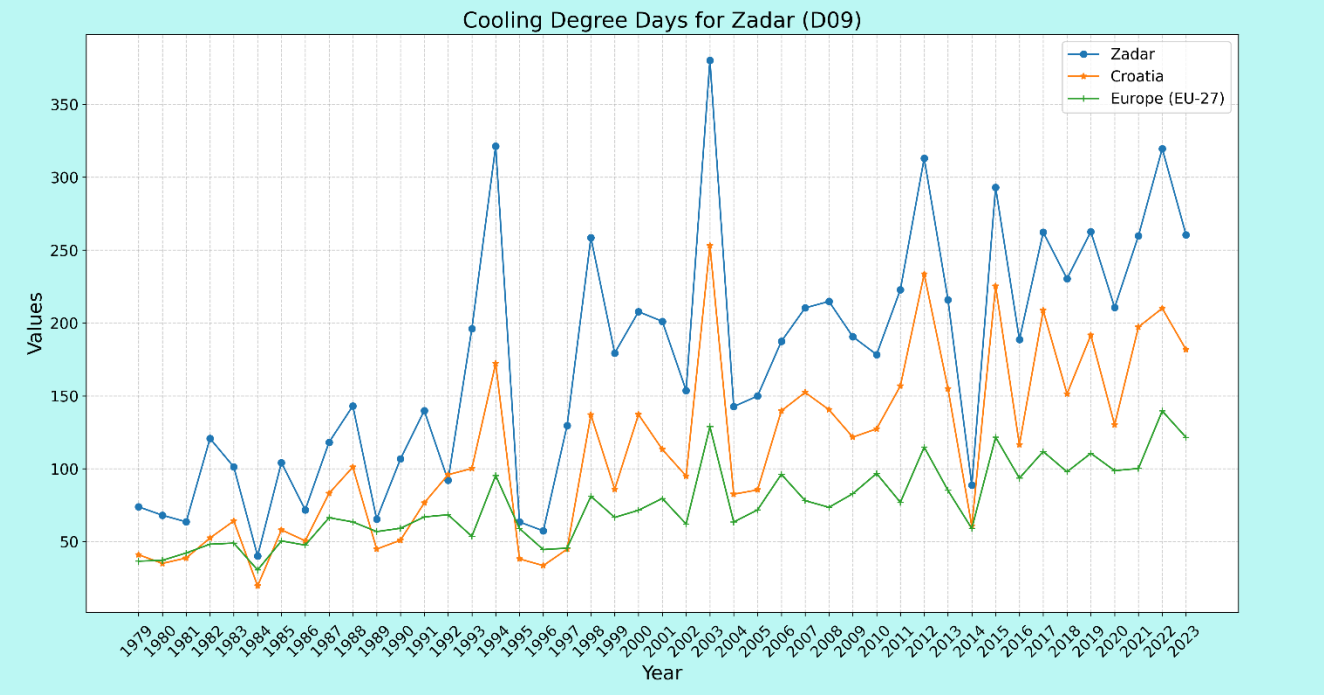
BASELINE

INNOVATION

RDD

Technical innovation

Energy transition and climate neutrality



5.10 D10. Abruzzo, Italy

Abruzzo is known for its diverse and rugged landscape, stretching from the Apennine Mountains in the west to the Adriatic Sea in the east. The mountainous area is dominated by the Gran Sasso and Maiella massifs, which are the highest peaks of the Apennines, with snow-capped summits in winter and lush meadows in summer. The eastern side transitions into rolling hills and a narrow coastal strip along the Adriatic Sea, where sandy beaches and seaside resorts attract tourists.

Figure 18. Ofena, Abruzzo. Photo, by Flickr

Social Justice and Inclusion Cross-Cutting Priorities

The Abruzzo region faces pressing challenges related to social inclusion, driven by demographic decline and aging populations in rural and mountainous areas.

Many small villages, particularly in the Apennines, suffer from depopulation and isolation, making it difficult for residents—especially the elderly—to access essential services like healthcare, education, and public transportation. The COVID-19 pandemic exacerbated these issues, increasing social isolation and exposing gaps in support systems.

Key strategies to combat these challenges include strengthening community networks, expanding the reach of community cooperatives, and developing accessible public services to improve residents' quality of life and encourage younger generations to remain or return to rural areas.

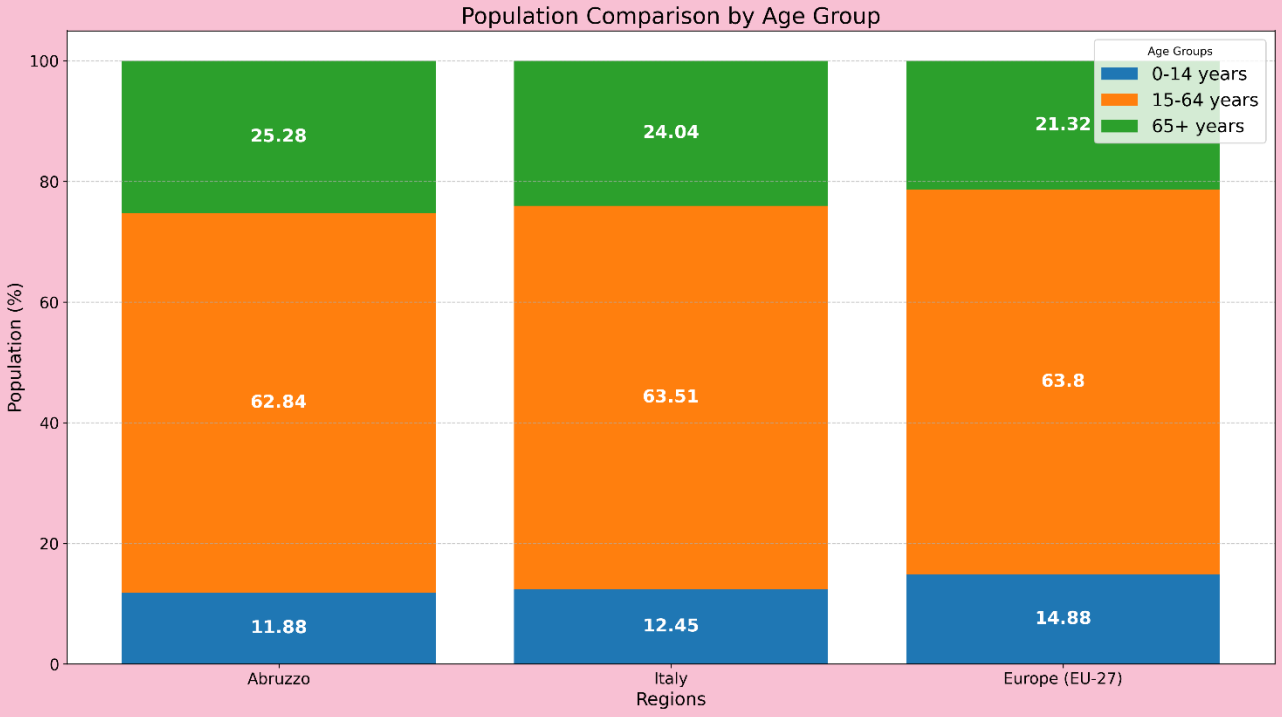
INNOVATION

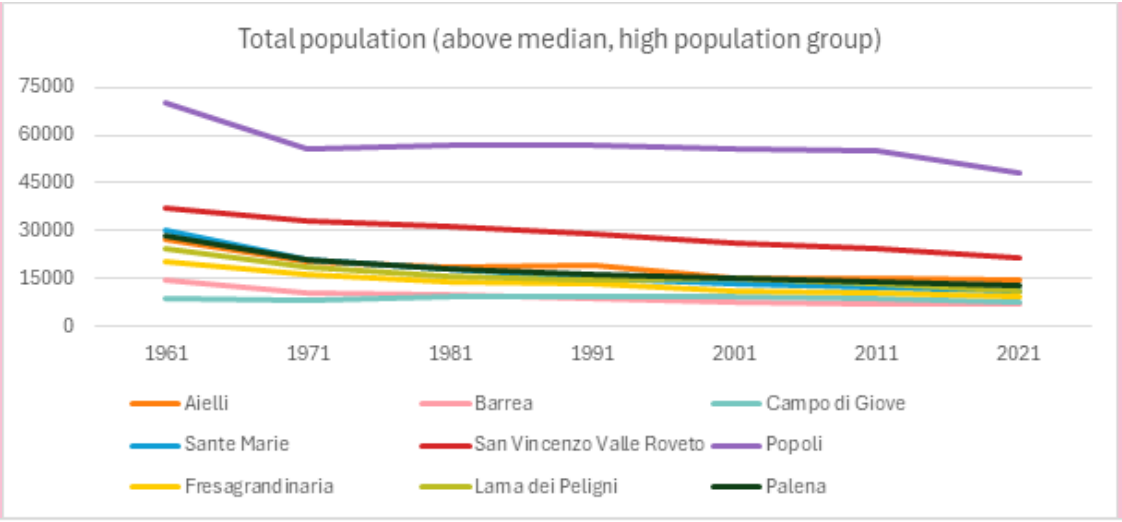
- Social organizational and governance
- Digital and technological innovation

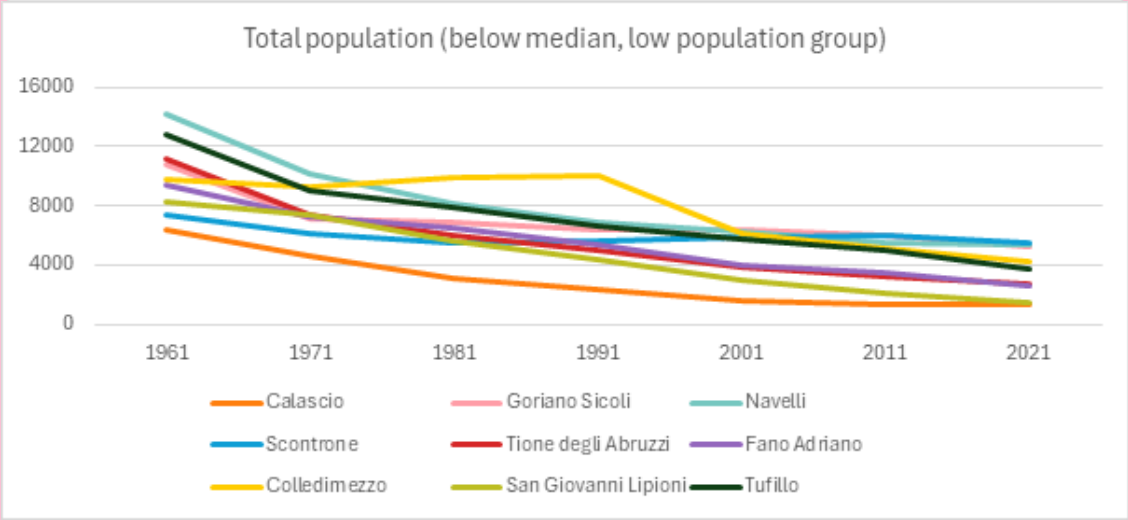
RDD

- Local services, health and wellbeing
- Sustainable multimodal mobility

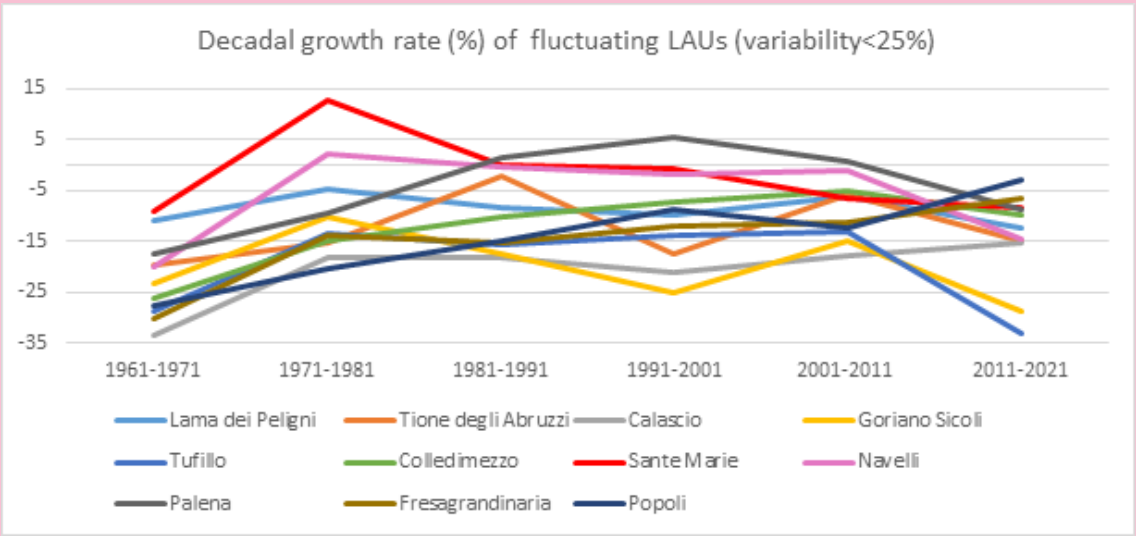
BASELINE

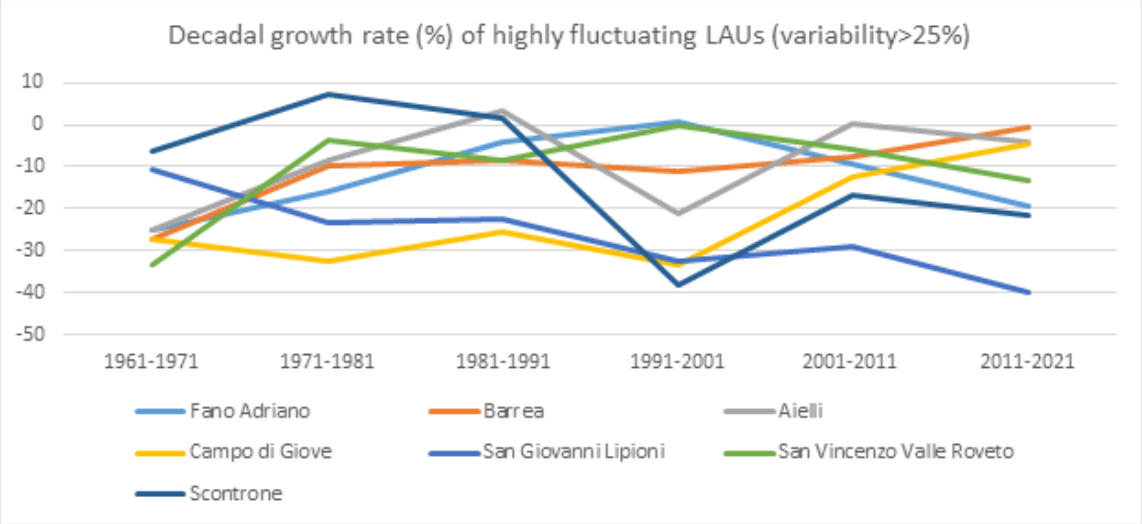






This Dynamo has a mixed population trends among the LAUs. Most have suffered very sharp declines throughout the decades and stabilised. Exeptionally, Colledimezzo experience a sharp decline between 1991 and 2001 before stabilising.





Actual and future projections are not showing the continuious declines. The entire Dynamo, in fact, is characterized by continuous demographic strain, showing overall a common decline in most of the LAUs which will may occur within the coming decades.

LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
Popoli	48050	43347	39112	-9.79	-18.62
San Vincenzo Valle Roveto	21680	19147	16909	-11.7	-22
Aielli	14530	13542	12625	-6.79	-13.11
Palena	12840	11169	9715	-13.01	-24.34
Lama dei Peligni	11310	9845	8563	-12.94	-24.28
Sante Marie	11280	10088	9025	-10.57	-19.97
Fresagrandinaria	9060	8034	7122	-11.33	-21.55
Campo di Giove	7810	7315	6851	-6.34	-12.27
Barrea	7220	6863	6528	-4.94	-9.61
Scontrone	5480	5190	4890	-5.29	-10.78
Navelli	5350	5020	4710	-6.16	-12
Goriano Sicoli	5280	4960	4660	-6.07	-11.78
Colledimezzo	4240	3990	3760	-5.91	-11.33
Tufillo	3730	3450	3180	-7.51	-14.74
Tione degli Abruzzi	2760	2460	2190	-10.87	-20.65
Fano Adriano	2650	2340	2050	-11.66	-22.68
San Giovanni Lipioni	1500	1300	1100	-13.33	-26.67
Calascio	1300	1086	907	-16.44	-30.23

Biodiversity

Biodiversity conservation is both an asset and a challenge for Abruzzo, as almost half of its territory is under environmental protection, with three national parks and numerous reserves. While this rich natural heritage is a source of pride and a driver for tourism, increased human activity and tourism development can strain ecosystems, threaten wildlife, and lead to habitat degradation.

To address this, sustainable tourism practices, ecosystem restoration, and policies promoting responsible land management are crucial for preserving biodiversity while fostering economic growth.

INNOVATION

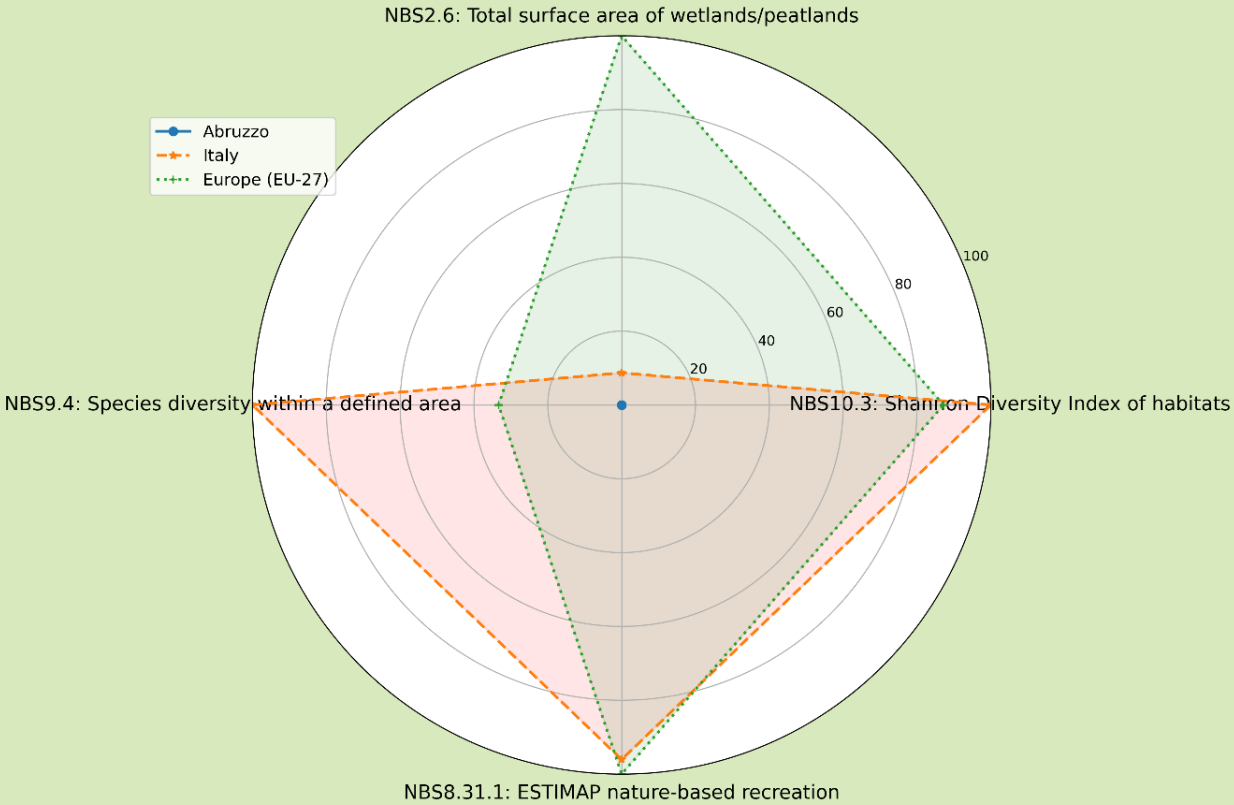
Social organizational and governance

RDD

Local services, health and wellbeing

Sustainable multimodal mobility

BASELINE



Climate change mitigation and adaptation

Abruzzo is increasingly vulnerable to extreme weather events, including heatwaves, droughts, and heavy rainfall, which threaten both agriculture and infrastructure. Rural and mountainous communities, dependent on traditional farming and livestock, are particularly exposed.

Key measures to enhance climate resilience involve promoting sustainable agriculture, investing in climate-smart infrastructure, and developing efficient public transportation to reduce emissions. Additionally, leveraging data-driven solutions can help monitor environmental changes and optimize resource management, fostering a more adaptive and low-carbon future for the region.

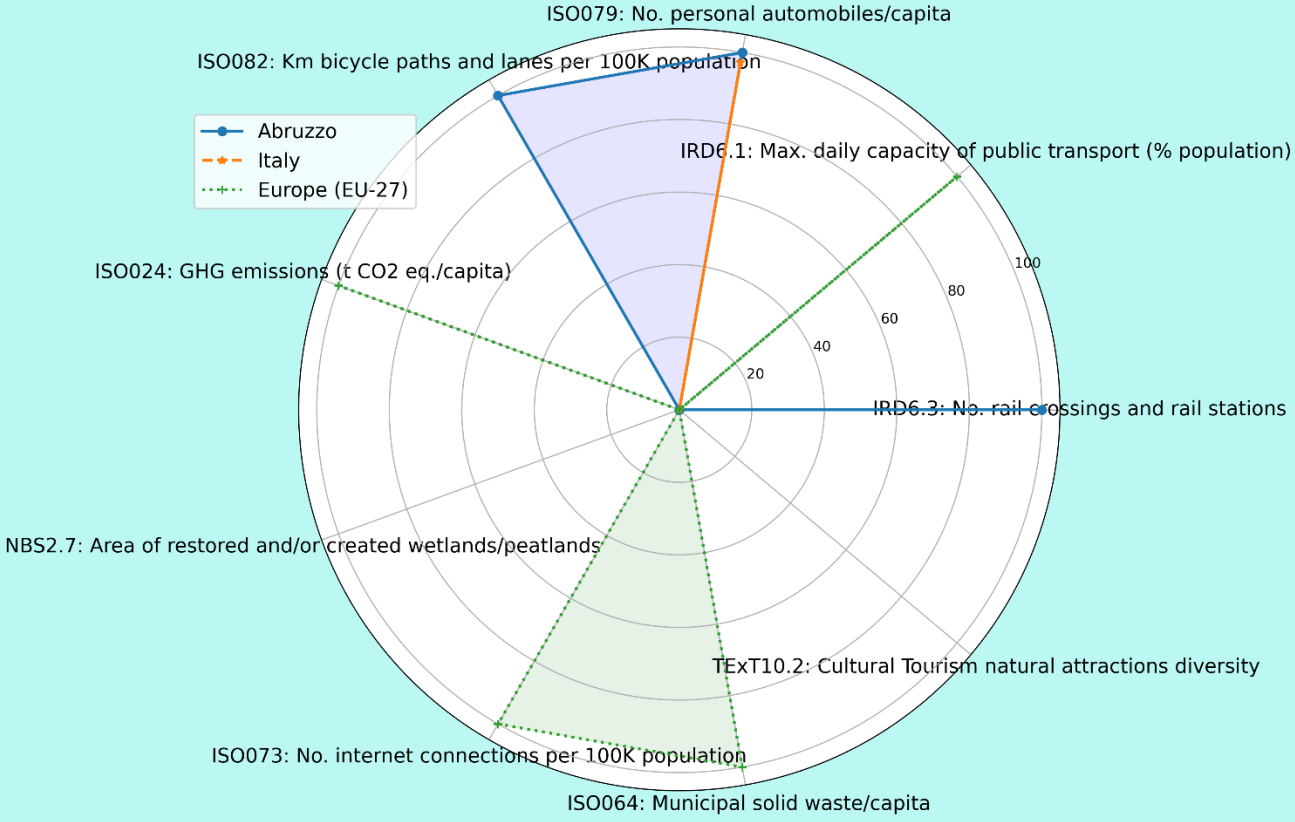
INNOVATION

Digital and technological innovation

RDD

Sustainable multimodal mobility

BASELINE



5.11 D11. Gotland, Sweden

Gotland is Sweden's largest island, located in the Baltic Sea, about 90 kilometers off the southeastern coast of the Swedish mainland. It covers an area of approximately 3,140 square kilometers, with a coastline characterized by rugged cliffs, sandy beaches, and unique limestone formations called "rauks." Gotland's mild maritime climate contributes to long, warm summers and relatively mild winters, though water scarcity can occasionally be a concern.

Dynamo's population is spread across small villages and rural farms, with many settlements having fewer than a few hundred inhabitants. Its economy revolves around agriculture, tourism and local crafts, while some residents commute to Visby for work.

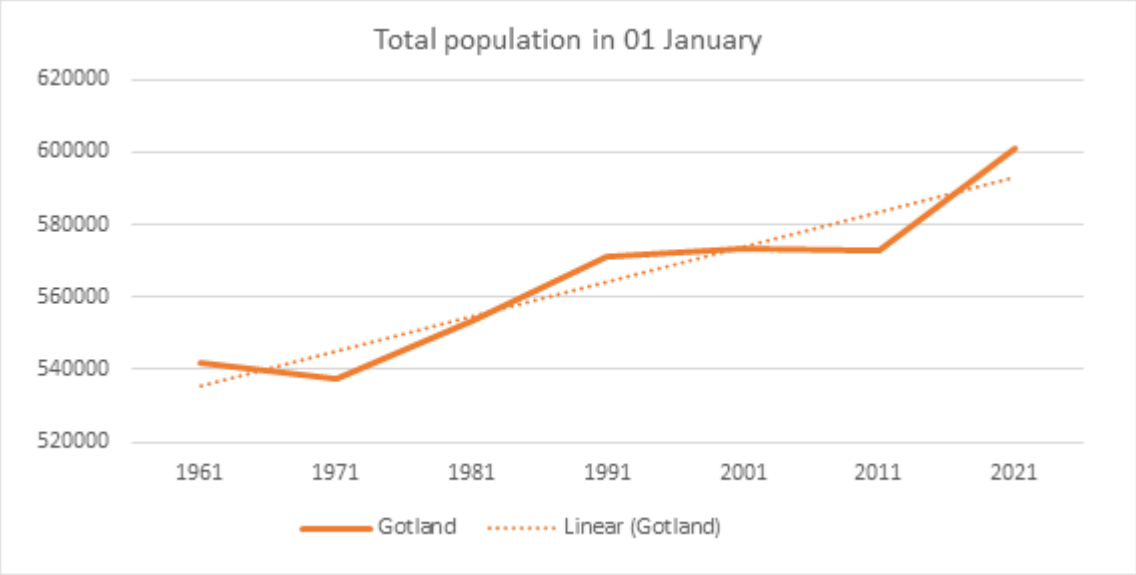
Figure 19. Ottenby Nature Reserve grazing Gotland sheep Öland Kalmar County Sweden, by wikimedia

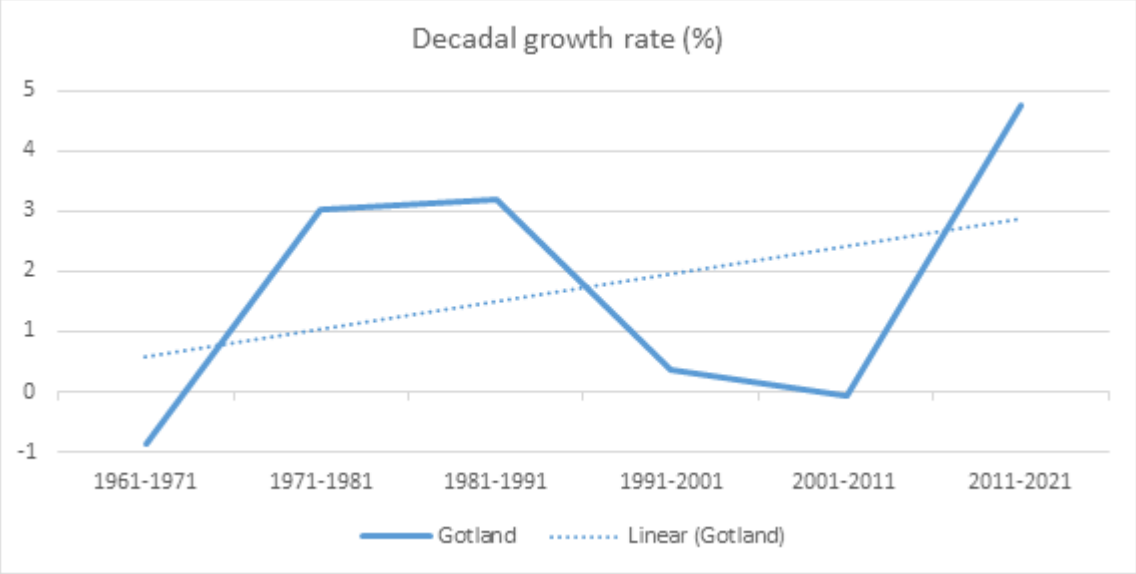
Social Justice and Inclusion Cross-Cutting Priorities

The island of Gotland faces several social and environmental challenges, particularly due to its sparsely populated rural areas and dependency on private cars for transportation. Limited public transportation isolates older residents, youth, and those without access to a vehicle, reducing their mobility and restricting access to education, jobs, and social activities. This car-centric culture also contributes to increased emissions, exacerbating climate change impacts on an island already vulnerable to coastal erosion and rising sea levels.

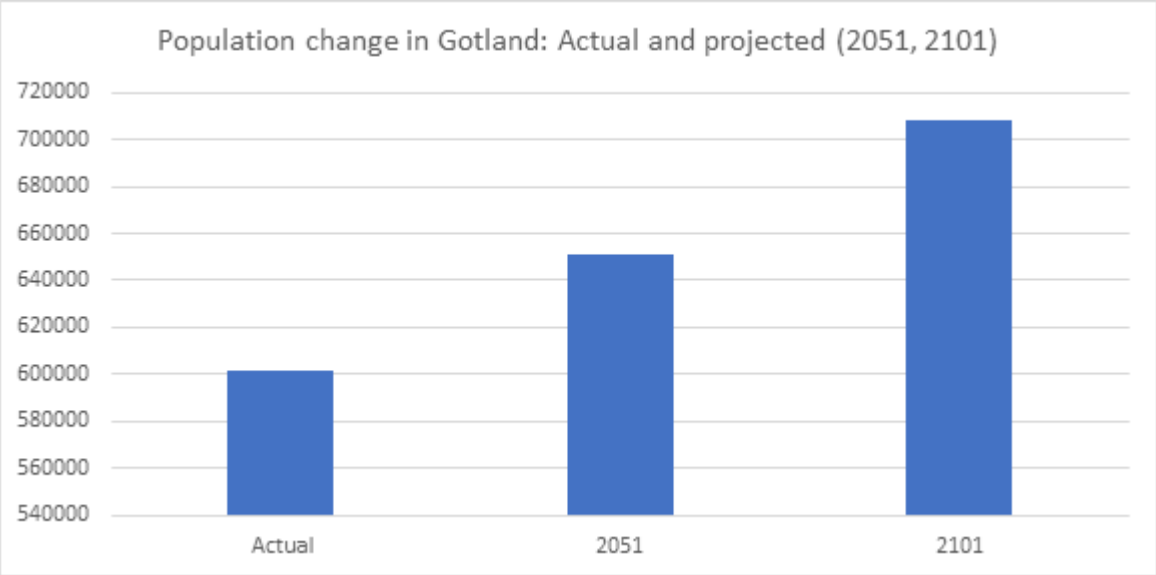
Key strategies to address this include developing flexible public transport solutions, promoting carpooling initiatives, and introducing shared electric vehicle systems to reduce emissions while improving accessibility for residents.

BASELINE



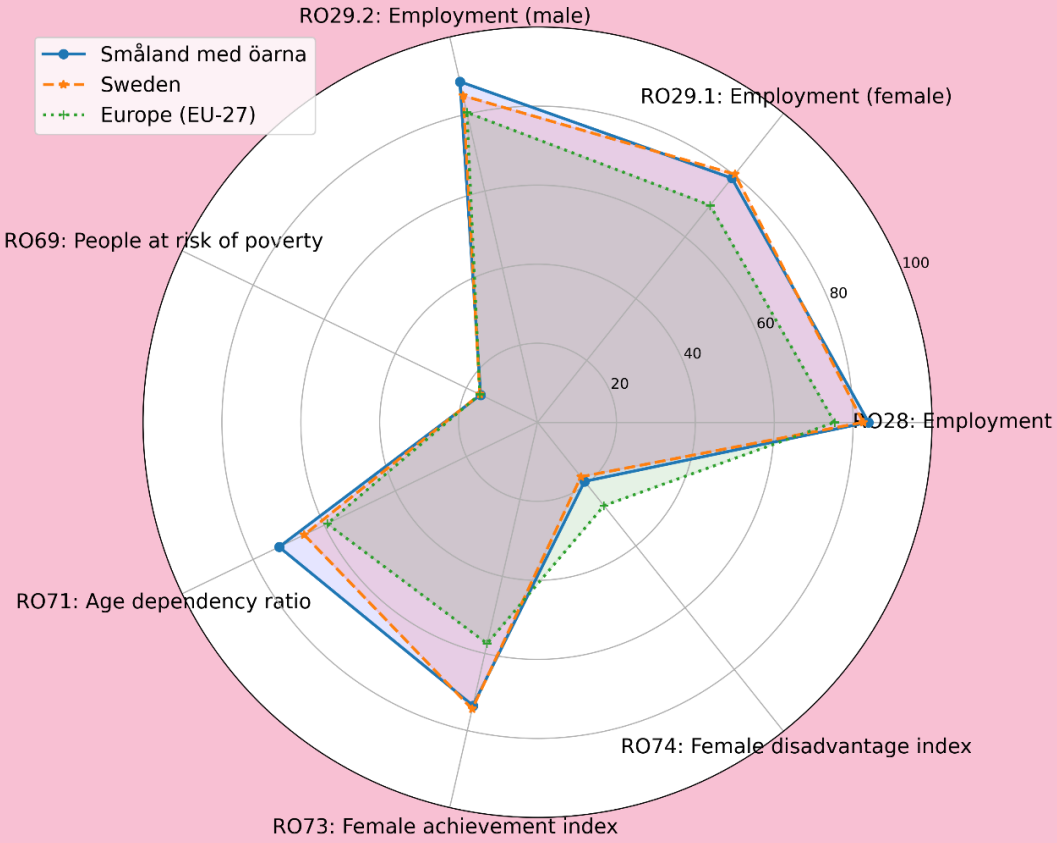


Gotland has relatively stable population growth, with fluctuations in the growth rate across decades. From 1961 to 1971, the population slightly declined but started increasing afterwards with a very considerable increase between until 1991. During the 1991-2011 period, the population was stable, but it increased in the last decade with a growth rate of 4.75% from 2011 to 2021.



The future projection shows an ongoing increase, i.e., 8.29% by 2051, up to 17.77% by 2101. This shows that, despite minor decreases in some of the past years, the population is still supposed to increase positively over the coming years in Gotland.

LAU	Actual	2051	2101	Change (2021–2051) (%)	Change (2021–2101) (%)
Gotland	601240	651100	708340	8.29	17.77



Biodiversity

Biodiversity conservation is another pressing issue, as agriculture and land use changes put pressure on Gotland's ecosystems. The island's unique habitats, such as coastal meadows and limestone-rich landscapes, are home to rare plant species and birdlife, but intensified farming and human activity threaten this delicate balance. Combining nature conservation with eco-tourism initiatives can promote environmental stewardship while supporting local economies, helping Gotland adapt to climate change while safeguarding its rich natural heritage.

INNOVATION

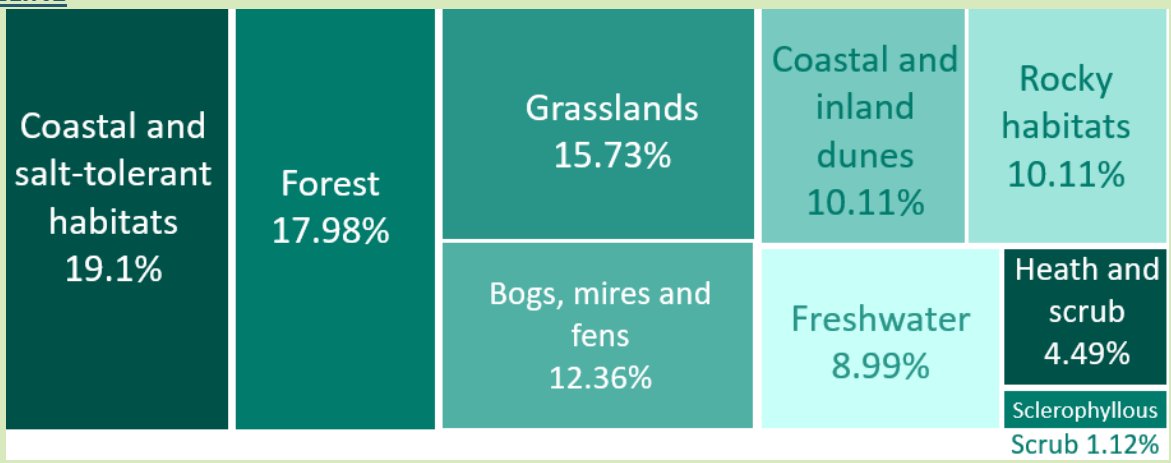
RDD

Technical innovation

Sustainable multimodal mobility

Energy transition and climate neutrality

BASELINE



Percentage composition by group of protected habitats: Sweden

Climate change mitigation and adaptation

Gotland's non-profit associations and community organizations play a vital role in maintaining social cohesion, but they struggle with the energy transition due to limited funding and knowledge. These groups often manage sports facilities, community centers, and other buildings, which require energy efficiency improvements and renewable energy solutions.

Key points to combat this challenge involve providing financial support and training to these organizations, developing cooperative energy projects such as solar panels on community buildings, and creating partnerships between local governments and associations to ensure long-term sustainability.

INNOVATION

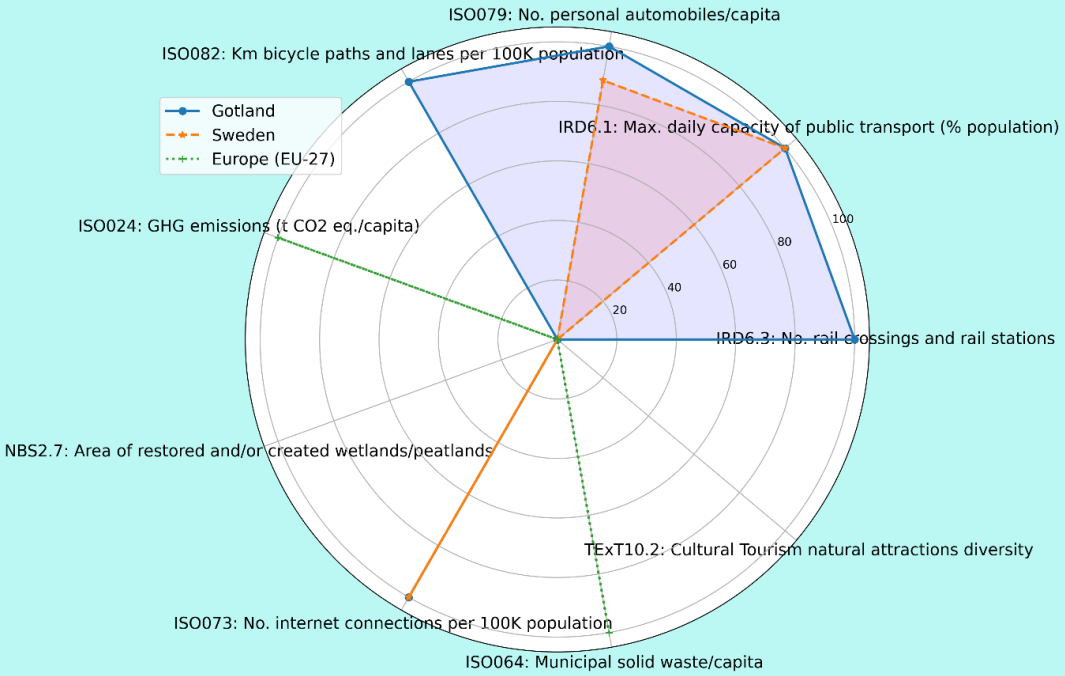
RDD

Technical innovation

Energy transition and climate neutrality

Sustainable multimodal mobility

BASELINE



5.12 D12. Törbel, Switzerland

The Törbel-Moosalp region is characterised by high-altitude villages and striking natural beauty. It features rugged mountain landscapes, lush meadows, forests and protected moorland biotopes. The environment is shaped by the region's unique climatic conditions, with abundant sunshine and limited rainfall.

Despite the scenic beauty, the population of this region is small: Törbel is home to around 500 residents. The villages, built into the mountainsides, are closely knit together, but face the challenges of the modern era, especially as younger generations seek opportunities outside the village.

Figure 20. Typical Valais mountain village, Törbel, by rhonezeitung

Social Justice and Inclusion Cross-Cutting Priorities

Törbel faces significant social issues, particularly in terms of community cohesion and heritage conservation.

The village's traditional wooden houses, while historically important, struggle to meet modern living standards, creating a dilemma between preserving cultural identity and meeting current needs. Integrating new structures that respect the cultural landscape while also meeting the needs of modern inhabitants has become a challenge for the population.

The absence of a central gathering place, such as the old village square, contributes to a sense of isolation, as community interactions now rely heavily on the underfunded village shop.

Ways need to be found to revitalize the village center, encourage interaction, and support sustainable development that preserves the region's heritage and adapts to modern demands.

INNOVATION

Social organizational and governance

RDD

Local services, health and wellbeing

Culture and cultural innovation

Biodiversity

Maintaining biodiversity is important for the region, particularly in protected moorland biotopes, and the pressure to meet the region's agricultural demands is high. Consequently, Törbel and its neighbouring villages must develop innovative solutions to ensure efficient water use, perhaps by modernising irrigation methods or incorporating water storage systems, while protecting the environment.

Promoting sustainable tourism, improving local farming practices through modern technology, and maintaining biodiversity protection efforts are critical to balancing environmental, social, and economic needs in this remote mountain village.

INNOVATION

Technical innovation

RDD

Nature-based and cultural Tourism

Energy transition and climate neutrality

Climate change mitigation and adaptation

Törbel faces several interconnected challenges, stemming primarily from climate change and an overstretched agricultural system. The region's reliance on traditional farming practices, such as the use of historic irrigation systems (the "bisses"), is increasingly under threat. With longer dry periods and reduced snowmelt, the region's water resources are declining, exacerbating irrigation inefficiencies and impacting agricultural productivity.

Designing effective climate adaptation measures, such as improving water conservation, boosting the efficiency of traditional irrigation systems, and exploring alternative sources such as rainwater harvesting or water storage facilities is of interest to this Dynamo.

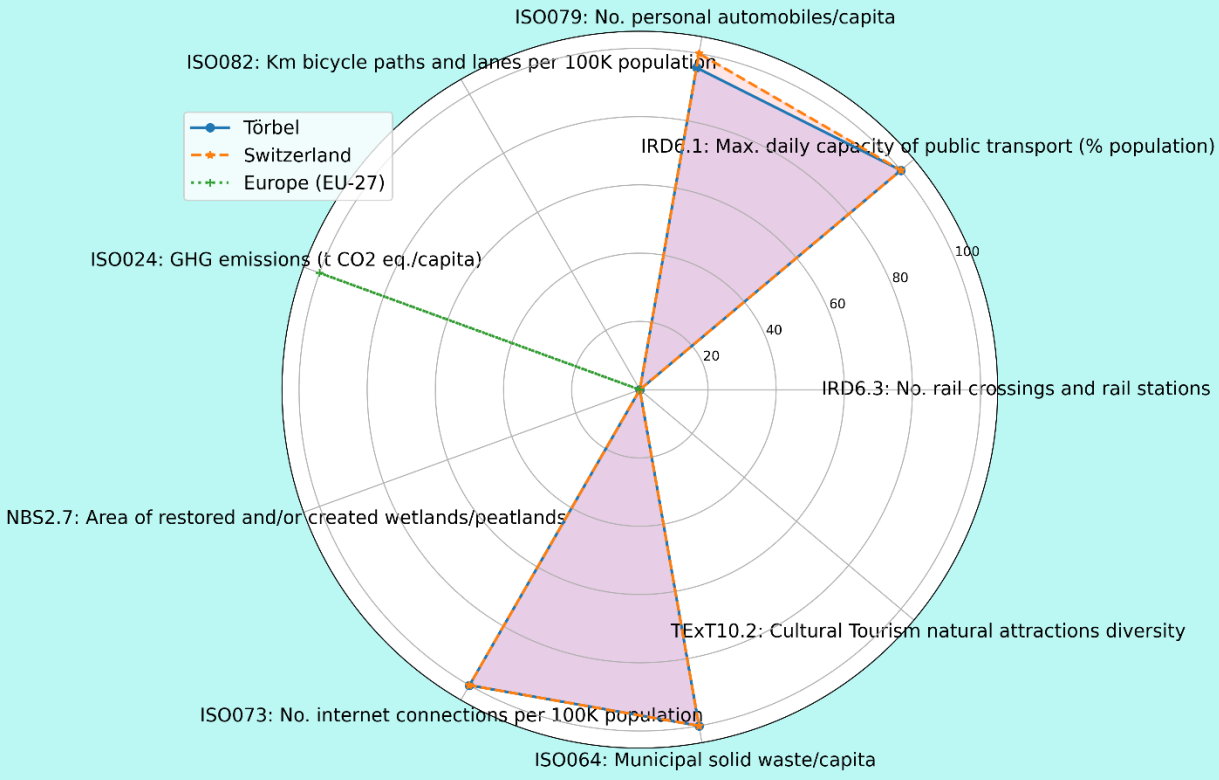
INNOVATION

Technical innovation

RDD

Energy transition and climate neutrality

BASELINE



6. Conclusions

The objective of this task was twofold. On the one hand, describing the monitoring programme, whose main objective is to provide quantifiable evidence of the role of innovation, local resources, grassroots action, creativity and social inclusion as drivers for rural territories to transition towards vibrant centres for sustainable, balanced, and inclusive development. On the other hand, detailing the baseline for the Dynamos, covering data in the 4 impact domains (economic, social, environmental and cultural), presenting a coherent state of the art of the Dynamos territories allowing a coherent comparison and a valuable impact and performance assessment after the implementation phase.

The monitoring programme focuses on defining a comprehensive set of KPIs and EWIs to assess the relevant impact of the deployed solutions, considering the conceptual approach developed in T2.1 (*Development of a conceptual framework for rural smart and community-led solutions*). This set of indicators has been called RURACTIVE KREI (Key Rural Empowerment Indicators) and have been fine-tuned based on relevant data collected in the Dynamos through place-based data sources. Moreover, citizens' science and participatory sensing approach have been explored also.

The process of defining the KREI involved a rigorous analysis of a large number of candidate indicators. An extensive list of indicators was compiled (936 in total), covering several aspects of the Dynamos. These indicators were filtered, selecting those most relevant for the project's objectives, resulting in 272 indicators. The final selection process used the RACER methodology, and involved consultations with technology partners and Dynamos, ensuring that the chosen indicators aligned with the Challenges identified in WP4. As a result, a total of 133 indicators were selected. The full list of resulting KREI is available in **Annex A. KREI List** and the attached excel spreadsheet for consultation. Out of the 133 indicators, 9 (7%) has been preselected as Early Warning Indicators (EWI) candidates. This selection of EWI will be fine-tuned by the Dynamos at a later stage.

The monitoring data that will be collected over the 2.5 years of monitoring period, will be integrated in the RURACTIVE Digital Hub (RDH) that is being developed in WP6, and will be made available according to the Data Management Plan (D1.2). Moreover, this task set the basis for defining the targets to assess the enhanced capacities of local communities thanks to the training and capacity building activities taking place at local level in WP3.

The work done to obtain Dynamos' baseline applying the KREIs, and some additional context data (see **Annex C. Indicators Initial Selection by Dynamo**), is also reflected in this report. This baseline also contains a deep analysis and validation of Dynamos' needs and state of the art, for a preliminary diagnosis at different dimensions. Dynamos' qualitative and quantitative baseline have been analysed considering different approaches, i.e. the four Areas of Action (AoA) in the LTVR paper (Stronger, Connected, Resilient, Prosperous), the RDDs or the Cross-cutting priorities. The procedure allows not only getting a baseline, but also enriching the diagnosis of the current situation and detecting the most suitable empowering actions to be developed, mitigating the identified problems.

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Annexes

Annex A. KREI List

The KREIs used in the project are described in detail below. In addition, it can be seen in the right column where the indicators have been represented within the deliverable.

Crosscutting Priorities: CCP

- Biodiversity: B
- Climate Change Mitigation: CCM
- Climate Change Adaptation: CCA
- Social Justice and Inclusion: S

Ref	LTRV AoA	AoA Sub-categories	Indicator	Units	RDD	CPP	EWI
IRD6.3	Connected	Connected to peri-urban and urban areas	Total number of rail crossings and rail stations	No.	Mobility	CCM	
IRD6.1	Connected	Improved public transport services and connections	Maximum total daily capacity of public transport as a percentage of population	%	Mobility	CCM	
ISO079	Connected	Improved public transport services and connections	Number of personal automobiles per capita	No. Per capita	Mobility	CCM	
ISO082	Resilient	Restoration of landscapes, including cultural ones	Kilometres of bicycle paths and lanes per 100 000 population	No.	Mobility	CCM	
RO67	-	Rural Observatory	Average distance to train stations	km	Mobility	S	
ISO024	Resilient	Resiliency to climate change, natural hazards and economic crises	Greenhouse gas emissions measured in tonnes per capita	tonnes	Energy	CCM	EWI
OTH21	Resilient	Solutions for carbon neutrality	Energy produced from renewable sources	GWh	Energy	CCM	
ISO018	Resilient	Solutions for carbon neutrality	Percentage of total energy derived from renewable sources, as a share of the Dynamo's total energy consumption	%	Energy	CCM	
ISO019	Resilient	Solutions for carbon neutrality	Total electrical energy use per capita (kWh/year)	kWh/y	Energy	CCM	
RO78	-	Rural Observatory	Solar photovoltaics production	MWh/y	Energy	CCM	

RO79	-	Rural Observatory	Solar PV technical potential	MWh/y	Energy	CCM	
RO80	-	Rural Observatory	Suitable area for solar photovoltaics	km2	Energy	CCM	
RO81	-	Rural Observatory	Onshore wind production	MWh/y	Energy	CCM	
RO82	-	Rural Observatory	Onshore wind technical potential	MWh/y	Energy	CCM	
RO83	-	Rural Observatory	Suitable land for onshore wind	km2	Energy	CCM	
RO84	-	Rural Observatory	Hydropower production	MWh/y	Energy	CCM	
RO85	-	Rural Observatory	Hydropower untapped potential	MWh/y	Energy	CCM	
NBS4.20	Resilient	Preservation of natural resources	Water Exploitation Index	%	Agrifood	CCA	
NBS2.7	Resilient	Restoration of landscapes, including cultural ones	Surface area of restored and/or created wetlands/peatlands	ha	Agrifood	CCM	
NBS10.3	Resilient	Restoration of landscapes, including cultural ones	Shannon Diversity Index of habitats	Number (unitless)	Agrifood	B	
NBS5.3	Resilient	Resiliency to climate change, natural hazards and economic crises	Mean annual direct and indirect losses due to natural and climate hazards	€	Agrifood	CCA	
NBS1.3	Resilient	Resiliency to climate change, natural hazards and economic crises	Monthly mean value of daily maximum temperature (TXx)	°C	Agrifood	CCA	
NBS1.4	Resilient	Resiliency to climate change, natural hazards and economic crises	Monthly mean value of daily minimum temperature (TNn)	°C	Agrifood	CCA	
NBS1.5	Resilient	Resiliency to climate change, natural hazards and economic crises	Heatwave incidence: Days with temperature >90thpercentile, TX90p	No./y	Agrifood	CCA	
NBS2.6	Resilient	Resiliency to climate change, natural hazards and economic crises	Total surface area of wetlands/peatlands	ha	Agrifood	B	EWI
NBS2.17	Resilient	Resiliency to climate change, natural hazards and economic crises	Rate of evapotranspiration	mm/day	Agrifood	CCA	
NBS6.32	Resilient	Resiliency to climate change, natural hazards and economic crises	Heatwave incidence	No./y	Agrifood	CCA	EWI
NBS8.1	Resilient	Services that protect ecosystems	Ecosystem services provision	N/A; descriptive	Agrifood		
NBS8.3	Resilient	Services that protect ecosystems	Edge density	m/ha	Agrifood	CCA	
NBS9.4	Resilient	Services that protect ecosystems	Species diversity within a defined area	Number	Agrifood	B	
NBS24.18	Prosperous	New sectors positive effects on employment	Number of new jobs in green sector	%	Agrifood	CCA	EWI

NBS24.22	Prosperous	Improving the value added of bioeconomy activities (farming, agri-food, forestry, etc.)	Employment in agriculture: women employed in agriculture	AWU	Agrifood	S	
RO75	-	Rural Observatory	Land use (detailed)	ha	Agrifood	CCA	
NBS2.1.3	Resilient	Resiliency to climate change, natural hazards and economic crises	Total leaf area	m2	Agrifood	CCA	
OTH14	Stronger	Local communities	(ETIS) Percentage of the destination's events that are focused on traditional/local culture and heritage	%	Culture	S	EWI
RRTG.BC-10	Resilient	Strengthen social resilience considering the needs of disadvantaged groups	Number of sites or events accessible by people with disabilities	No.	Culture	S	
RO68	-	Rural Observatory	Average distance to cinemas	km	Culture	S	
ISO134	Stronger	Local communities	Dynamo area (Square kilometres)	km2	Transversal	S	
ISO102	Stronger	Local communities	Population density (per square kilometre)	Per/km2	Transversal	S	
ISO104	Stronger	Local communities	Percentage of population that are children (0-14)	%	Transversal	S	
ISO105	Stronger	Local communities	Percentage of population that are youth (15-24)	%	Transversal	S	
ISO106	Stronger	Local communities	Percentage of population that are adult (25-64)	%	Transversal	S	
ISO107	Stronger	Local communities	Percentage of population that are senior citizens (65+)	%	Transversal	S	
IRD8.6	Stronger	Gender equality	Employment rate of men vs. employment rate of women	%	Transversal	S	
ISO041	Stronger	Gender equality	Women as a percentage of total elected to municipality-level office	%	Transversal	S	
ISO108	Stronger	Gender equality	Male to female ratio (number of males per 100 females)	No.	Transversal	S	
NBS18.12	Stronger	Stakeholders and networks	Diversity of stakeholders involved	%	Wellbeing	S	
NBS17.3	Stronger	Tailor-made, place-based and integrated policy solutions	Adoption of new forms of participatory governance: PPPs activated	No.	Wellbeing	S	
OTH25	Stronger	Digital tools	#solutions included in the Solutions' Catalogue	No.	Transversal	S	
OTH26	Stronger	Digital tools	#users of the RURACTIVE Digital Hub	No.	Transversal	S	
OTH27	Stronger	Social innovation	Population dependency ratio (Total age dependency ratio?)	%	Wellbeing	S	
ISO073	Connected	Deepening digital infrastructures	Number of internet connections per 100 000 population	No.	Wellbeing	CCM	EWI
ISO064	Resilient	Preservation of natural resources	Total collected municipal solid waste per capita	kg per capita	Wellbeing	CCM	
ISO097	Resilient	Resiliency to climate change, natural hazards and economic crises	Total domestic water consumption per capita (litres/day)	litres/day	Wellbeing	CCA	
ISO098	Resilient	Resiliency to climate change, natural hazards and economic crises	Total water consumption per capita (litres/day)	litres/day	Wellbeing	CCA	

NBS2.10.2	Resilient	Resiliency to climate change, natural hazards and economic crises	Number of combined tropical nights and hot days	No.	Wellbeing	CCA	
NBS6.1	Resilient	Resiliency to climate change, natural hazards and economic crises	Potential areas exposed to risks	ha	Wellbeing	CCA	
NBS6.37	Resilient	Resiliency to climate change, natural hazards and economic crises	Effective Drought Index	unitless	Wellbeing	CCA	
NBS7.1	Resilient	Fair green and digital transitions	Green space accessibility	%	Wellbeing	CCA	
NBS8.31.1	Resilient	Fair green and digital transitions	ESTIMAP nature-based recreation	%	Wellbeing	B	
IRD8.1	Resilient	Strengthen social resilience considering the needs of disadvantaged groups	Life expectancy at birth (years)	y	Wellbeing	S	
NBS15.1	Resilient	Talents and diversity	Citizen involvement in environmental education activities	No. of people	Wellbeing	CCA	
NBS24.27	Prosperous	New sectors positive effects on employment	Upskilling and related earnings increase	Increase in employment earnings per person per year	Wellbeing	S	
ISO005	Prosperous	New sectors positive effects on employment	Youth unemployment rate	%	Wellbeing	S	
IRD7.4	Prosperous	New sectors positive effects on employment	Proportion or number of science and technology personnel	No.	Wellbeing	S	
OTH01	Prosperous	Sustainable local economic strategies	(NEW) Land & residential prices	Index (2015=100) (NSA)	Wellbeing	S	
OTH02	Prosperous	Sustainable local economic strategies	(NEW) Prices of commodity	Index (EU=100)	Wellbeing	S	
ISO120	Prosperous	Sustainable local economic strategies	Cost of living	Index (EU=100)	Wellbeing	S	EWI
ISO121	Prosperous	Sustainable local economic strategies	Income distribution (Gini Coefficient)	No. (0-100)	Wellbeing	S	
OTH30	Prosperous	Extend digital literacy	Individuals' level of digital skills (from 2021 onwards)	%	Wellbeing	S	
OTH31	Prosperous	Extend digital literacy	Share of individuals having at least basic digital skills, by sex	%	Wellbeing	S	
OTH32	Prosperous	Acquire new skills	Adult participation in learning in the past four weeks by sex	%	Wellbeing	S	
OTH38	Prosperous	Acquire new skills	#people trained in Dynamos	No.	Transversal	S	
RO01	-	Rural Observatory	Total population (on 1st January)	Persons	Transversal	S	
RO02.1	-	Rural Observatory	Total population by age group (0-14)	Inhabitants	Transversal	S	

RO02.2	-	Rural Observatory	Total population by age group (15-64)	Inhabitants	Transversal	S	
RO02.3	-	Rural Observatory	Total population by age group (65+)	Inhabitants	Transversal	S	
RO03.1	-	Rural Observatory	Total population by sex (Female)	Inhabitants	Transversal	S	
RO03.2	-	Rural Observatory	Total population by sex (Male)	Inhabitants	Transversal	S	
RO04	-	Rural Observatory	Crude rate of natural change	‰	Transversal	CCA	
RO06	-	Rural Observatory	Crude rate of total population change	‰	Transversal	S	
RO07	-	Rural Observatory	Population density	Inhabitants/km2	Transversal	S	EWI
RO08	-	Rural Observatory	Median age	Years	Transversal	S	
RO09.1	-	Rural Observatory	Median age by sex (Female)	Years	Transversal	S	
RO09.2	-	Rural Observatory	Median age by sex (Male)	Years	Transversal	S	
RO10	-	Rural Observatory	Crude rate of net migration	‰	Wellbeing	S	
RO12	-	Rural Observatory	Foreign population over 15 years old (EU27 vs Extra-EU)	Inhabitants	Wellbeing	S	
RO19	-	Rural Observatory	GDP per capita at current prices	EUR	Transversal	S	
RO28	-	Rural Observatory	Employment rate	%	Transversal	S	
RO29.1	-	Rural Observatory	Employment rate by sex (Female)	%	Transversal	S	
RO29.2	-	Rural Observatory	Employment rate by sex (Male)	%	Transversal	S	
RO30	-	Rural Observatory	Total employment (workplace based)	Employed persons	Transversal	S	
RO31.1	-	Rural Observatory	Employment by sex (20-64) (Female)	Employed residents (20-64)	Transversal	S	
RO31.2	-	Rural Observatory	Employment by sex (20-64) (Male)	Employed residents (20-64)	Transversal	S	
RO32	-	Rural Observatory	Employment by sector (Agriculture, Forestry and Fishing (A))	Employed persons	Transversal	S	
RO36	-	Rural Observatory	Unemployment rate	%	Transversal	S	
RO37.1	-	Rural Observatory	Unemployment rate by sex (Female)	%	Transversal	S	
RO37.2	-	Rural Observatory	Unemployment rate by sex (Male)	%	Transversal	S	
RO64.1	-	Rural Observatory	Broadband speed (Fixed network speed)	Megabits per second (Mbps)	Wellbeing	S	
RO64.2	-	Rural Observatory	Broadband speed (Mobile network speed)	Megabits per second (Mbps)	Wellbeing	S	
RO65	-	Rural Observatory	Average distance to primary schools	km	Wellbeing	S	
RO66	-	Rural Observatory	Average distance to secondary schools	km	Wellbeing	S	
RO69	-	Rural Observatory	Persons at risk of poverty	%	Wellbeing	S	
RO70	-	Rural Observatory	Persons at risk of poverty or social exclusion	%	Wellbeing	S	
RO71	-	Rural Observatory	Age dependency ratio	%	Wellbeing	S	

RO72.1	-	Rural Observatory	Age dependency ratio by age class (old / young) - Young Age (<15)	%	Wellbeing	S	
RO72.2	-	Rural Observatory	Age dependency ratio by age class (old / young) - Old Age (over 65)	%	Wellbeing	S	
RO73	-	Rural Observatory	Female Achievement Index	Performance	Wellbeing	S	
RO74	-	Rural Observatory	Female Disadvantage Index	Performance	Wellbeing	S	
RO76	-	Rural Observatory	Cooling Degree Days	Index	Wellbeing	S	
RO77	-	Rural Observatory	Heating Degree Days	Index	Wellbeing	S	
OTH37	Stronger	Stakeholders and networks	#stakeholders involved in the RIEs	No.	Transversal	S	
RO68.5	Connected	Improved access to services for local communities	Average distance to healthcare facilities	km	Wellbeing	S	
TExT10.2	Resilient	Restoration of landscapes, including cultural ones	Cultural Tourism natural attractions diversity	%	Tourism	CCM	
NBS8.31.2	Resilient	Fair green and digital transitions	Number of visitors to recreational areas	No.	Tourism	S	
TExT1.2	Prosperous	Diversification of economic activities	Accommodation occupancy	%	Tourism	S	EWI
NBS24.15	Prosperous	Diversification of economic activities	Increase in tourism	Mean no. visitors/day per year	Tourism	S	
TExT9.1	Prosperous	Diversification of economic activities	Visitors from outside the pilot area	%	Tourism	S	
TExT12.1	Prosperous	Make the environment attractive to companies	Touristic routes development	km/km2	Tourism	S	
RO48	-	Rural Observatory	Nights spent at tourist accommodation establishments	Nights	Tourism	S	
RO49.1	-	Rural Observatory	Nights spent at tourist establishments by accommodation typology (Hotels and similar accommodation)	Nights	Tourism	S	
RO49.2	-	Rural Observatory	Nights spent at tourist establishments by accommodation typology (Camping grounds and RV parks)	Nights	Tourism	S	
RO49.3	-	Rural Observatory	Nights spent at tourist establishments by accommodation typology (Other short-stay accommodation)	Nights	Tourism	S	
RO50	-	Rural Observatory	Arrivals at tourist accommodation establishments	Arrivals	Tourism	S	
RO51.1	-	Rural Observatory	Arrivals at tourist establishments by accommodation typology (Hotels and similar accommodation)	Arrivals	Tourism	S	
RO51.2	-	Rural Observatory	Arrivals at tourist establishments by accommodation typology (Camping grounds and RV parks)	Arrivals	Tourism	S	
RO51.3	-	Rural Observatory	Arrivals at tourist establishments by accommodation typology (Other short-stay accommodation)	Arrivals	Tourism	S	

RO52	-	Rural Observatory	Nights spent in tourist accommodation establishments per inhabitant	Nights/capita	Tourism	S	
RO53.1	-	Rural Observatory	Nights spent at tourist accommodation establishments by country of residence (Domestic tourists)	%	Tourism	S	
RO53.2	-	Rural Observatory	Nights spent at tourist accommodation establishments by country of residence (Foreign tourists)	%	Tourism	S	
RO54	-	Rural Observatory	Tourism capacity	Rooms	Tourism	S	
RO55	-	Rural Observatory	Nights in short-term rentals	NR	Tourism	S	
OTH40	Resilient	Resiliency to climate change, natural hazards and economic crises	#climate adaptation initiatives	No.	Transversal	CCA	

Annex B. Task 5.1 Introductory workshop

The workshop, held on **April 12, 2024**, during the **third day of the consortium meeting in Gotland, Sweden**, brought together **Dynamo representatives, Technical Partners, and Work Package partners** to focus on key elements of Task 5.1 within the RURACTIVE project.

The primary objectives of the workshop were to:

1. Introduce **Task 5.1**, including its purpose, scope, and significance within the RURACTIVE project.
2. Explain the **Monitoring Programme** and provide an overview of the **Long-Term Vision for Rural Areas (LTVR)**, developed by the European Commission, and its four Areas of Action (Stronger, Connected, Resilient, and Prosperous).
3. Highlight the role of **Key Rural Empowerment Indicators (KREIs)** in measuring progress and impact.
4. Co-define, as first reflection exercise, the baseline of the Dynamos, connecting their current state with existing or potential solutions.
5. Identify existing and potential indicators for each of the **KREI**

Methodology

The workshop began with a formal presentation introducing **Task 5.1**. where CARTIF used slides to explain the task's purpose, scope, and importance within the RURACTIVE project.

In the second part, participants engaged in a collaborative session using a ***Miro board***. This digital tool facilitated brainstorming, co-defining the baseline for the Dynamos, and aligning strategies with LTVR and the KREIs.

Step-by-Step Collaborative Session:

1. **Introduction to the Miro Board**:

   IAAC began by introducing the Miro board as a collaborative tool for brainstorming, organizing ideas, reflection, data collection and visualization.

2. **Warm-Up Activity: Identifying Dynamos and Existing Solutions**

   To kickstart engagement, Dynamo representatives were asked to place their own **Dynamo** on the board. Each participant then added at least one **existing solution** they were familiar.


0
ADD YOUR DYNAMO AND SOLUTION NAME
Use yellow notes for existing indicators
Use blue notes for new/potential indicators
Dynamo # adopt an olive tree
Dynamo 11 Energy bag
Dynamo #4 Perthshire Artisans
Dynamo3 Remote Monitoring of Elderly
Dynamo # adopt an olive tree
Dynamo # Add your solution name
Dynamo 6 Soundscape App
Dynamo # Add your solution name
D.2 akzente HAND:WERK
Dynamo #4 Perthsire Artisans

3. **Introduction to the Long-Term Vision and KREIs**
   CARTIF and IAAC introduced the **Long-Term Vision for Rural Areas (LTVR)**, explaining its four Areas of Action: **Stronger, Connected, Resilient, and Prosperous**. Each area was paired with its corresponding **Key Rural Empowerment Indicators (KREIs)** to provide context on how progress is measured. Participants were then asked to interact with these concepts by contributing relevant indicators:

- **Yellow Post-its**: Existing indicators that they already use or know of in their regions.
- **Blue Post-its**: New or potential indicators that could be relevant but are not yet in use.

This exercise allowed participants to connect the technical key concepts from the adaptive monitoring programme with their local realities, ensuring practical applicability.

1

Stronger Rural Areas

Use yellow notes for existing indicators

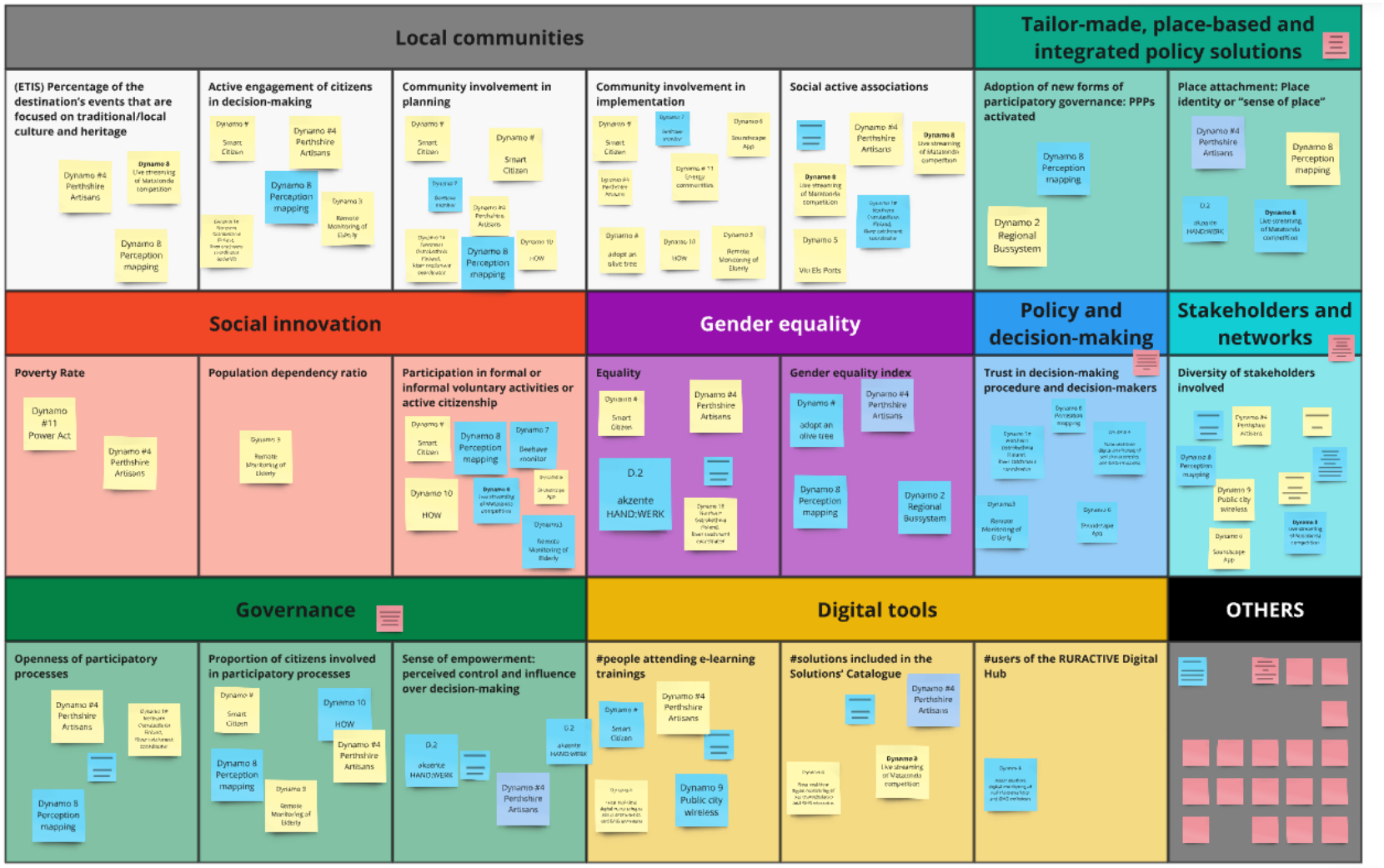
Dynamo #

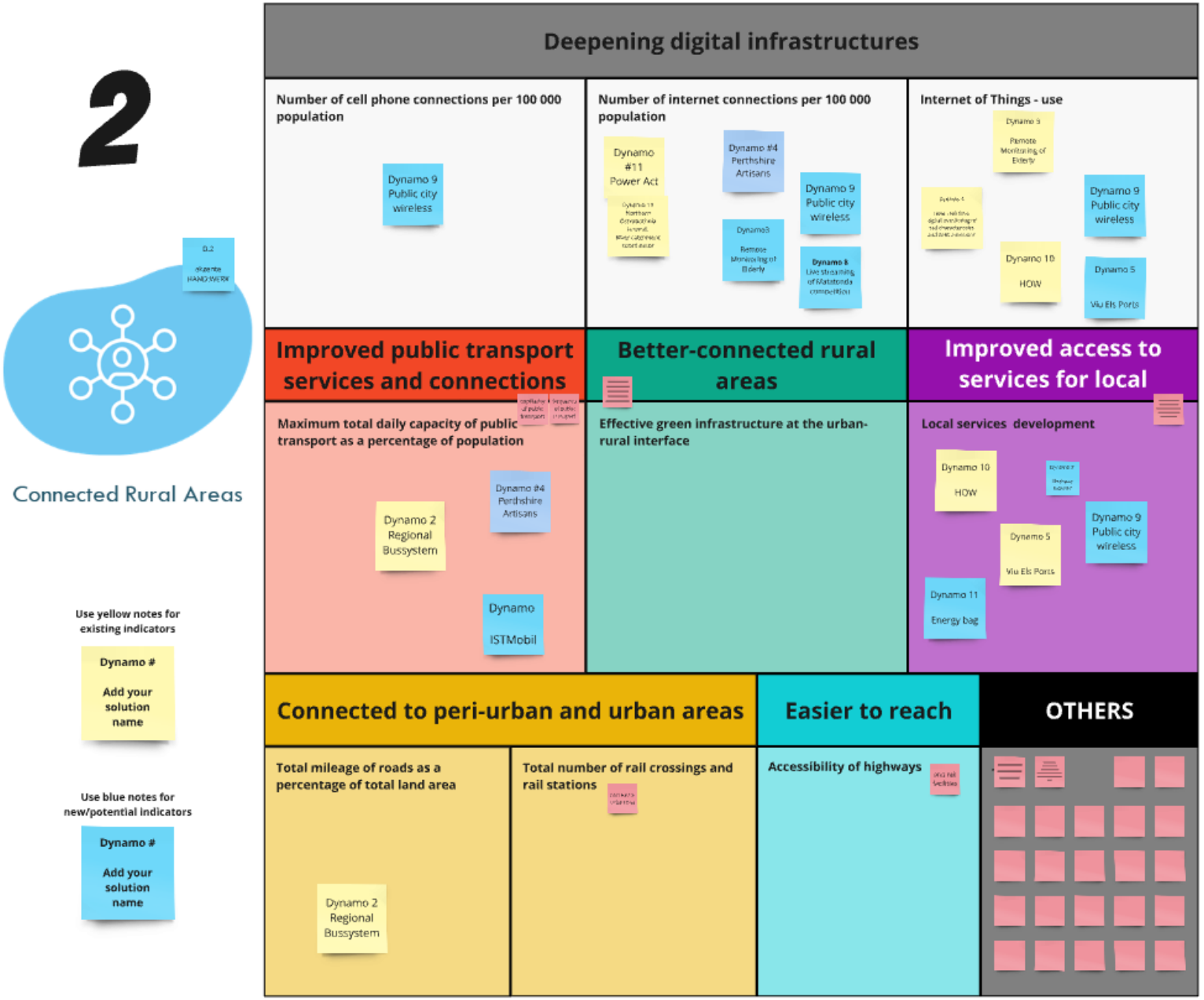
Add your solution name

Use blue notes for new/potential indicators

Dynamo #

Add your solution name




2
Connected Rural Areas
Use yellow notes for existing indicators
Dynamo #
Add your solution name
Use blue notes for new/potential indicators
Dynamo #
Add your solution name
Deepening digital infrastructures
Number of cell phone connections per 100 000 population
Dynamo 9 Public city wireless
Number of internet connections per 100 000 population
Dynamo #11 Power Act
Dynamo #4 Perthshire Artisans
Dynamo 9 Public city wireless
Dynamo 8
Internet of Things - use
Dynamo 9 Public city wireless
Dynamo 10 HOW
Dynamo 5 Viu Els Ports
Improved public transport services and connections
Maximum total daily capacity of public transport as a percentage of population
Dynamo 2 Regional Bussystem
Dynamo #4 Perthshire Artisans
Dynamo ISTMobil
Better-connected rural areas
Effective green infrastructure at the urban-rural interface
Improved access to services for local
Local services development
Dynamo 10 HOW
Dynamo 5 Viu Els Ports
Dynamo 9 Public city wireless
Dynamo 11 Energy bag
Connected to peri-urban and urban areas
Total mileage of roads as a percentage of total land area
Dynamo 2 Regional Bussystem
Total number of rail crossings and rail stations
Easier to reach
Accessibility of highways
OTHERS

3

Resilient Rural Areas

Use yellow notes for existing indicators

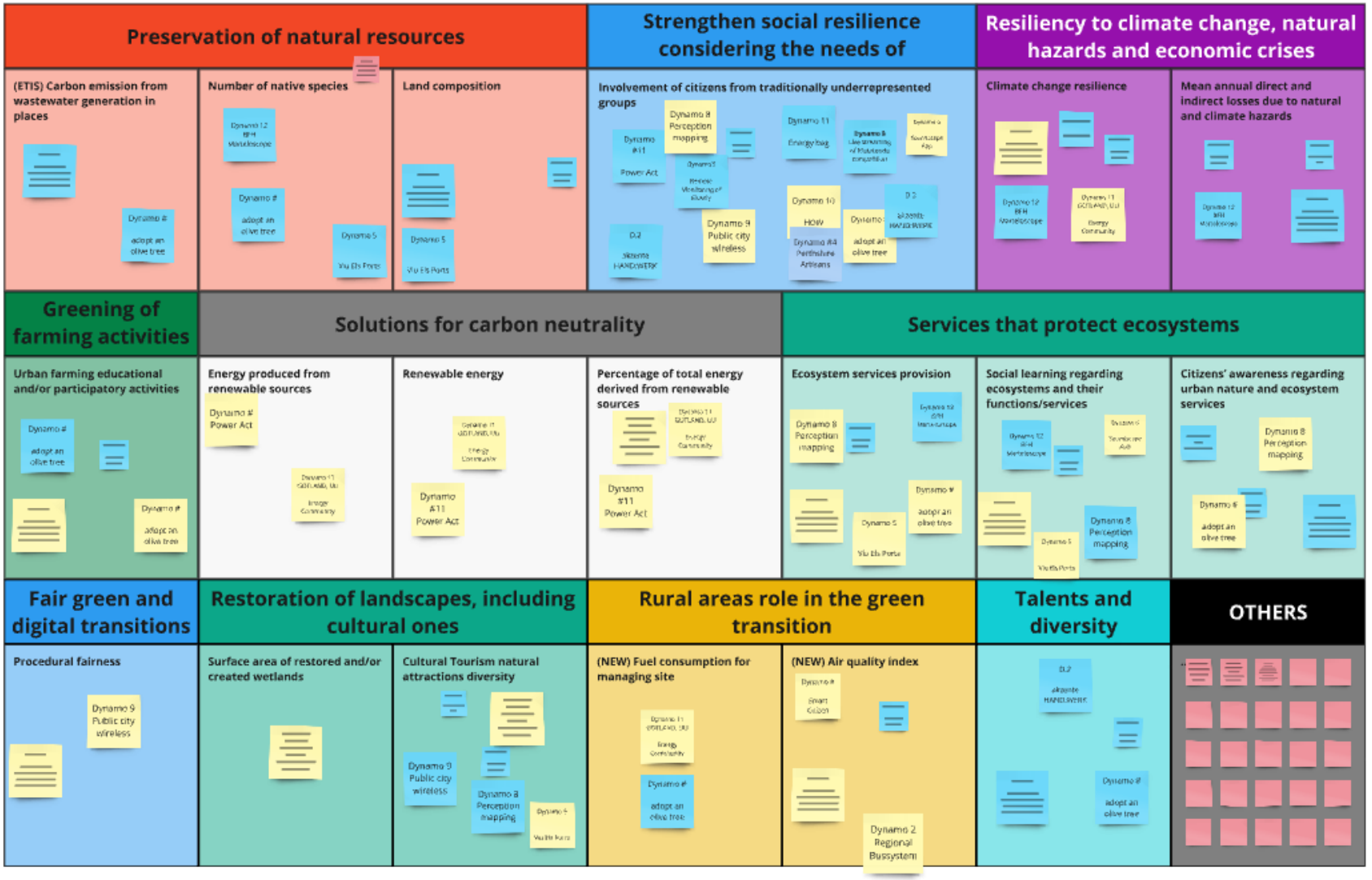
Dynamo #

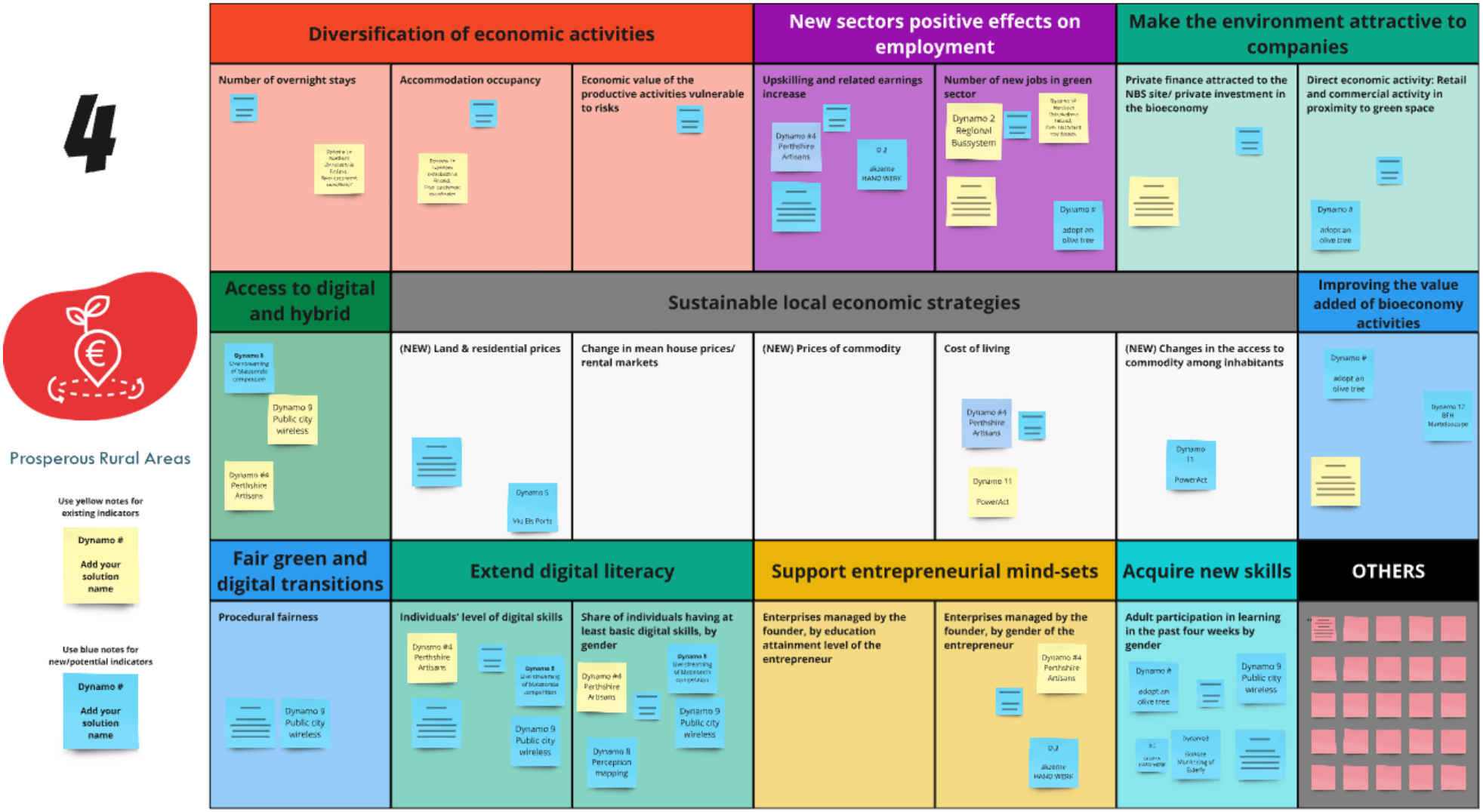
Add your solution name

Use blue notes for new/potential indicators

Dynamo #

Add your solution name




4
Prosperous Rural Areas
Use yellow notes for existing indicators
Dynamo #
Add your solution name
Use blue notes for new/potential indicators
Dynamo #
Add your solution name
Diversification of economic activities
Number of overnight stays
Accommodation occupancy
Economic value of the productive activities vulnerable to risks
New sectors positive effects on employment
Upskilling and related earnings increase
Number of new jobs in green sector
Dynamo 2 Regional Bussystem
Make the environment attractive to companies
Private finance attracted to the NBS site/ private investment in the bioeconomy
Direct economic activity: Retail and commercial activity in proximity to green space
Access to digital and hybrid
Dynamo 9 Public city wireless
Sustainable local economic strategies
(NEW) Land & residential prices
Change in mean house prices/ rental markets
(NEW) Prices of commodity
Cost of living
(NEW) Changes in the access to commodity among inhabitants
Improving the value added of bioeconomy activities
Fair green and digital transitions
Procedural fairness
Extend digital literacy
Individuals' level of digital skills
Share of individuals having at least basic digital skills, by gender
Support entrepreneurial mind-sets
Enterprises managed by the founder, by education attainment level of the entrepreneur
Enterprises managed by the founder, by gender of the entrepreneur
Acquire new skills
Adult participation in learning in the past four weeks by gender
OTHERS

Annex C. Indicators Initial Selection by Dynamo

Ref	Indicator	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
IRD6.3	Total number of rail crossings and rail stations				•	•		•			•		
IRD6.1	Maximum total daily capacity of public transport as a percentage of population	•	•		•	•	•	•	•	•	•	•	•
ISO079	Number of personal automobiles per capita		•		•	•	•	•	•	•	•	•	•
ISO082	Kilometres of bicycle paths and lanes per 100 000 population		•		•	•	•	•	•	•	•	•	•
RO67	Average distance to train stations	•			•	•	•	•	•		•		
ISO024	Greenhouse gas emissions measured in tonnes per capita		•		•	•	•		•	•	•	•	
OTH21	Energy produced from renewable sources		•		•	•	•		•	•	•	•	
ISO018	Percentage of total energy derived from renewable sources, as a share of the Dynamo's total energy consumption		•		•	•	•		•	•	•	•	
ISO019	Total electrical energy use per capita		•		•	•	•		•	•	•	•	•
RO78	Solar photovoltaics production			•	•	•			•	•		•	
RO79	Solar photovoltaics potential	•	•	•		•			•	•		•	
RO80	Suitable area for solar photovoltaics	•	•	•		•			•	•		•	
RO81	Onshore wind production	•		•	•				•	•	•	•	
RO82	Onshore wind potential	•		•					•	•	•	•	
RO83	Suitable land for onshore wind	•		•					•	•	•	•	
RO84	Hydropower production	•			•	•			•	•	•	•	
RO85	Hydropower potential	•		•		•			•	•	•	•	
NBS4.20	Water Exploitation Index	•				•	•	•	•	•	•		•
NBS2.7	Surface area of restored and/or created wetlands/peatlands	•	•		•		•	•		•	•		•
NBS10.3	Shannon Diversity Index of habitats	•	•		•	•	•	•	•	•	•		•
NBS5.3	Mean annual direct and indirect losses due to natural and climate hazards		•			•	•	•		•	•		
NBS1.3	Monthly mean value of daily maximum temperature (TXx)	•	•		•	•	•	•	•	•	•		•
NBS1.4	Monthly mean value of daily minimum temperature (TNn)	•	•		•	•	•	•	•	•	•		•
NBS1.5	Heatwave incidence: Days with temperature >90thpercentile, TX90p	•	•			•	•	•	•	•	•		•
NBS2.6	Total surface area of wetlands/peatlands	•	•		•		•	•	•	•	•		•
NBS2.17	Rate of evapotranspiration	•	•		•	•	•	•	•	•	•		•
NBS6.32	Heatwave incidence		•		•	•	•	•	•	•	•		•
NBS8.1	Ecosystem services provision	•	•		•	•	•	•	•	•	•		•
NBS8.3	Edge density	•	•			•	•	•	•	•	•		•
NBS9.4	Species diversity within a defined area	•	•		•	•	•	•	•	•	•		•
NBS24.18	Number of new jobs in green sector	•	•		•	•	•	•	•	•	•		

NBS24.22	Employment in agriculture: women employed in agriculture	•	•	•	•	•	•	•	•	•	•		•
RO75	Land use (detailed)	•	•		•	•	•	•	•	•	•		•
NBS2.1.3	Total leaf area	•	•	•		•	•	•	•	•	•		
OTH14	(ETIS) Percentage of the destination's events that are focused on traditional/local culture and heritage	•	•		•	•	•		•	•			•
RRTG.BC-10	Number of sites or events accessible by people with disabilities	•	•		•	•	•		•	•	•		
RO68	Average distance to cinemas		•		•		•		•	•	•		
ISO134	Dynamo area (Square kilometres)	•	•	•	•	•	•	•	•	•	•	•	•
ISO102	Population density (per square kilometre)	•	•	•	•	•	•	•	•	•	•	•	•
ISO104	Percentage of population that are children (0-14)	•	•	•	•	•	•	•	•	•	•	•	•
ISO105	Percentage of population that are youth (15-24)	•	•	•	•	•	•	•	•	•	•	•	•
ISO106	Percentage of population that are adult (25-64)	•	•	•	•	•	•	•	•	•	•	•	•
ISO107	Percentage of population that are senior citizens (65+)	•	•	•	•	•	•	•	•	•	•	•	•
IRD8.6	Employment rate of men vs. employment rate of women	•	•	•	•		•	•	•	•	•		•
ISO041	Women as a percentage of total elected to municipality-level office	•	•		•	•	•	•	•	•	•		
ISO108	Male to female ratio (number of males per 100 females)	•	•		•	•	•	•	•	•	•		
NBS18.12	Diversity of stakeholders involved	•	•	•	•	•	•		•	•	•		•
NBS17.3	Adoption of new forms of participatory governance: PPPs activated	•	•		•	•	•		•	•			•
OTH25	#solutions included in the Solutions' Catalogue	•	•	•	•	•	•	•	•	•	•	•	•
OTH26	#users of the RURACTIVE Digital Hub	•	•	•	•	•	•	•	•	•	•	•	•
OTH27	Population dependency ratio (Total age dependency ratio?)	•	•		•	•	•		•	•	•		•
ISO073	Number of internet connections per 100 000 population	•	•		•		•		•	•	•		•
ISO064	Total collected municipal solid waste per capita	•	•		•	•	•		•	•	•		
ISO097	Total domestic water consumption per capita (litres/day)	•	•		•	•	•		•	•	•		•
ISO098	Total water consumption per capita (litres/day)	•	•		•	•	•		•	•	•		•
NBS2.10.2	Number of combined tropical nights and hot days	•	•		•	•	•		•	•	•		
NBS6.1	Potential areas exposed to risks	•	•		•	•	•		•	•	•		•
NBS6.37	Effective Drought Index	•	•		•	•	•		•	•	•		•
NBS7.1	Green space accessibility		•		•	•	•			•	•		
NBS8.31.1	ESTIMAP nature-based recreation		•		•	•	•		•	•	•		
IRD8.1	Life expectancy at birth (years)	•	•		•	•	•		•	•	•		
NBS15.1	Citizen involvement in environmental education activities	•	•		•	•	•		•	•	•		•
NBS24.27	Upskilling and related earnings increase	•	•		•	•	•			•	•		•
ISO005	Youth unemployment rate	•	•		•	•	•		•	•	•		
IRD7.4	Proportion or number of science and technology personnel	•	•		•	•	•			•	•		
OTH01	(NEW) Land & residential prices	•	•		•	•	•		•	•	•		•
OTH02	(NEW) Prices of commodity	•	•		•	•	•			•	•		•
ISO120	Cost of living	•	•		•	•	•		•	•	•		•

ISO121	Income distribution (Gini Coefficient)	•	•	•	•	•	•		•	•	•		•
OTH30	Individuals' level of digital skills (from 2021 onwards)	•	•		•	•	•		•	•	•		
OTH31	Share of individuals having at least basic digital skills, by sex	•	•		•	•	•		•	•	•		
OTH32	Adult participation in learning in the past four weeks by sex	•	•	•	•	•	•			•	•		
OTH38	#people trained in Dynamos	•	•	•	•	•	•	•	•	•	•		•
RO01	Total population (on 1st January)	•	•	•	•	•	•	•	•	•	•	•	•
RO02.1	Total population by age group (0-14)	•	•	•	•	•	•	•	•	•	•	•	•
RO02.2	Total population by age group (15-64)	•	•	•	•	•	•	•	•	•	•	•	•
RO02.3	Total population by age group (65+)	•	•	•	•	•	•	•	•	•	•	•	•
RO03.1	Total population by sex (Female)	•	•	•	•	•	•	•	•	•	•	•	•
RO03.2	Total population by sex (Male)	•	•	•	•	•	•	•	•	•	•	•	•
RO04	Crude rate of natural change	•	•	•	•	•	•	•	•	•	•	•	
RO06	Crude rate of total population change	•	•		•	•	•	•	•	•	•	•	•
RO07	Population density	•	•	•	•	•	•	•	•	•	•	•	•
RO08	Median age	•	•	•	•	•	•	•	•	•	•	•	•
RO09.1	Median age by sex (Female)	•	•	•	•	•	•	•	•	•	•	•	•
RO09.2	Median age by sex (Male)	•	•	•	•	•	•	•	•	•	•	•	•
RO10	Crude rate of net migration	•	•		•	•	•		•	•	•		
RO12	Foreign population over 15 years old (EU27 vs Extra-EU)	•	•		•	•	•		•	•	•		•
RO19	GDP per capita at current prices	•	•		•	•	•	•	•	•	•	•	•
RO28	Employment rate	•	•	•	•	•	•	•	•	•	•	•	•
RO29.1	Employment rate by sex (Female)	•	•	•	•	•	•	•	•	•	•	•	•
RO29.2	Employment rate by sex (Male)	•	•	•	•	•	•	•	•	•	•	•	•
RO30	Total employment (workplace based)	•	•	•	•	•	•	•	•	•	•	•	•
RO31.1	Employment by sex (20-64) (Female)	•	•	•	•	•	•	•	•	•	•	•	•
RO31.2	Employment by sex (20-64) (Male)	•	•	•	•	•	•	•	•	•	•	•	•
RO32	Employment by sector (Agriculture, Forestry and Fishing (A))	•	•		•	•	•	•	•	•	•		•
RO36	Unemployment rate	•	•		•	•	•	•	•	•	•	•	•
RO37.1	Unemployment rate by sex (Female)	•	•		•	•	•	•	•	•	•	•	•
RO37.2	Unemployment rate by sex (Male)	•	•		•	•	•	•	•	•	•	•	•
RO64.1	Broadband speed (Fixed network speed)	•	•	•	•	•	•		•	•	•		
RO64.2	Broadband speed (Mobile network speed)	•	•	•	•	•	•		•	•	•		
RO65	Average distance to primary schools	•	•		•	•	•		•	•	•		•
RO66	Average distance to secondary schools	•	•		•	•	•		•	•	•		•
RO69	Persons at risk of poverty	•	•		•	•	•		•	•	•		
RO70	Persons at risk of poverty or social exclusion	•	•		•	•	•		•	•	•		
RO71	Age dependency ratio	•	•	•	•	•	•		•	•	•		•
RO72.1	Age dependency ratio by age class (old / young) - Young Age (<15)	•	•		•	•	•		•	•	•		

RO72.2	Age dependency ratio by age class (old / young) - Old Age (over 65)	•	•		•	•	•		•	•	•		•
RO73	Female Achievement Index	•	•		•	•	•		•	•	•		
RO74	Female Disadvantage Index	•	•		•	•	•		•	•	•		
RO76	Cooling Degree Days	•	•		•	•	•		•	•	•		
RO77	Heating Degree Days	•	•		•	•	•		•	•	•		
OTH37	#stakeholders involved in the RIEs	•	•	•	•	•	•	•	•	•	•	•	•
RO68.5	Average distance to healthcare facilities	•	•	•	•	•	•		•	•	•	•	•
TExT10.2	Cultural Tourism natural attractions diversity	•	•		•	•	•	•	•	•	•		•
NBS8.31.2	Number of visitors to recreational areas	•	•		•	•	•	•	•	•	•		•
TExT1.2	Accommodation occupancy	•	•		•	•	•	•	•	•	•		•
NBS24.15	Increase in tourism	•	•		•	•	•	•	•	•	•		•
TExT9.1	Visitors from outside the pilot area	•	•		•	•	•	•	•	•	•		•
TExT12.1	Touristic routes development	•	•		•	•	•	•	•	•	•		•
RO48	Nights spent at tourist accommodation establishments	•	•		•	•	•	•	•	•			•
RO49.1	Nights spent at tourist establishments by accommodation typology (Hotels and similar accommodation)	•	•		•	•	•	•	•	•			•
RO49.2	Nights spent at tourist establishments by accommodation typology (Camping grounds and RV parks)	•	•		•	•	•	•	•	•			•
RO49.3	Nights spent at tourist establishments by accommodation typology (Other short-stay accommodation)	•	•		•	•	•	•	•	•			•
RO50	Arrivals at tourist accommodation establishments	•	•		•	•	•		•	•	•		•
RO51.1	Arrivals at tourist establishments by accommodation typology (Hotels and similar accommodation)	•	•		•	•	•		•	•			•
RO51.2	Arrivals at tourist establishments by accommodation typology (Camping grounds and RV parks)	•	•		•	•	•		•	•			•
RO51.3	Arrivals at tourist establishments by accommodation typology (Other short-stay accommodation)	•	•		•	•	•		•	•	•		•
RO52	Nights spent in tourist accommodation establishments per inhabitant	•	•		•	•	•	•	•	•			•
RO53.1	Nights spent at tourist accommodation establishments by country of residence (Domestic tourists)	•	•		•	•	•	•	•	•	•		•
RO53.2	Nights spent at tourist accommodation establishments by country of residence (Foreign tourists)	•	•		•	•	•	•	•	•	•		•
RO54	Tourism capacity	•	•		•	•	•	•	•	•	•		•
RO55	Nights in short-term rentals	•	•		•	•	•		•	•	•		•
OTH40	#climate adaptation initiatives	•	•	•	•	•	•	•	•	•	•	•	•

Annex D. Crosscutting Priorities Data

D1. Northern Ostrobothnia, Finland

Cross-Cutting priorities

Social Justice and Inclusion

RDD

Local services, health and wellbeing

Sustainable multimodal mobility

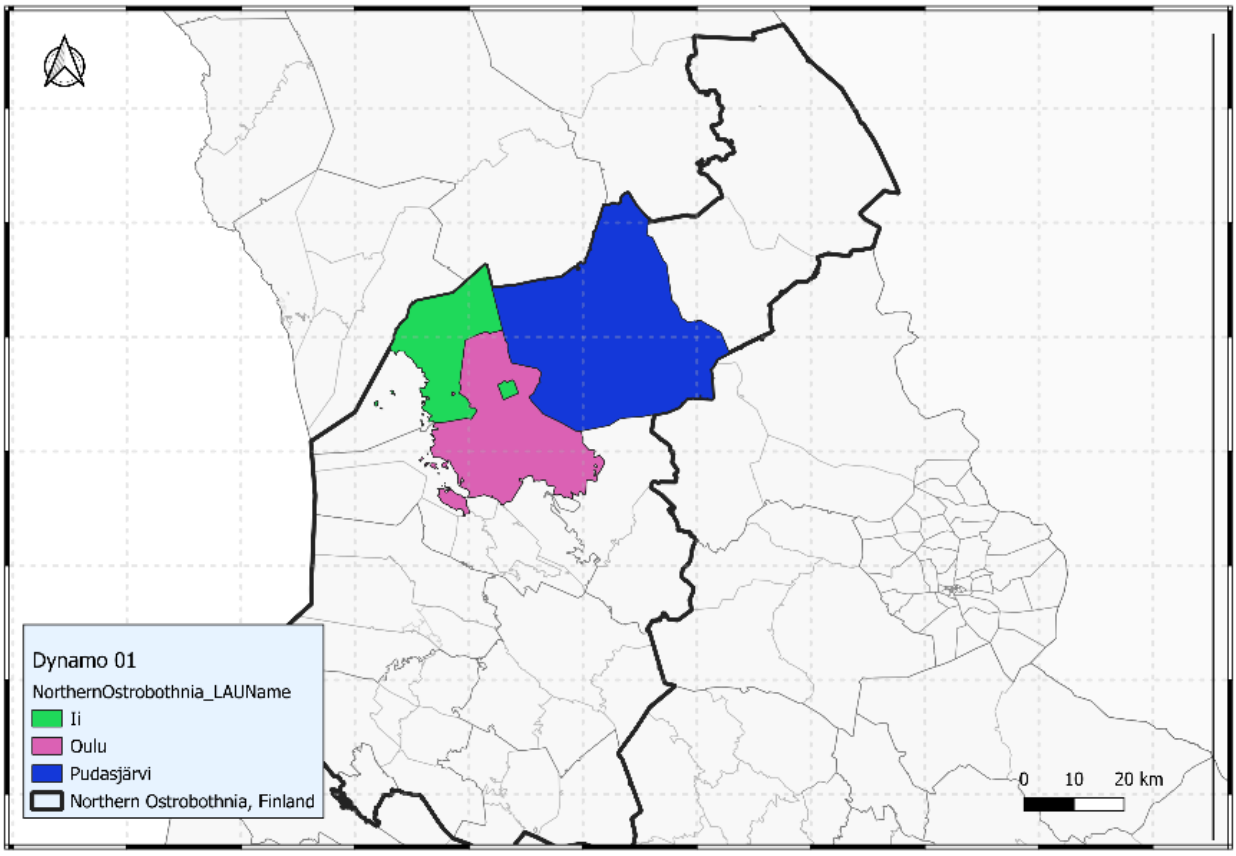


Figure 21. Dynamo 1. Administrative context

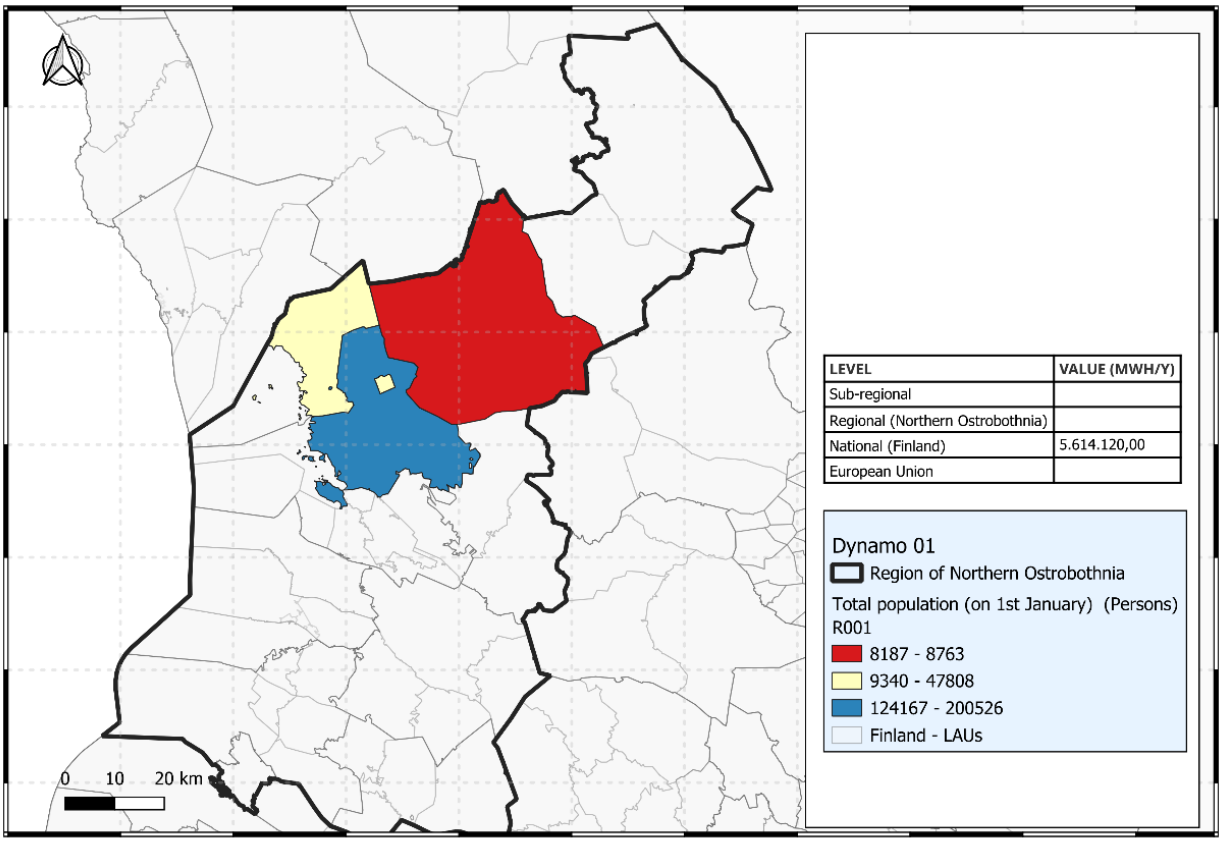
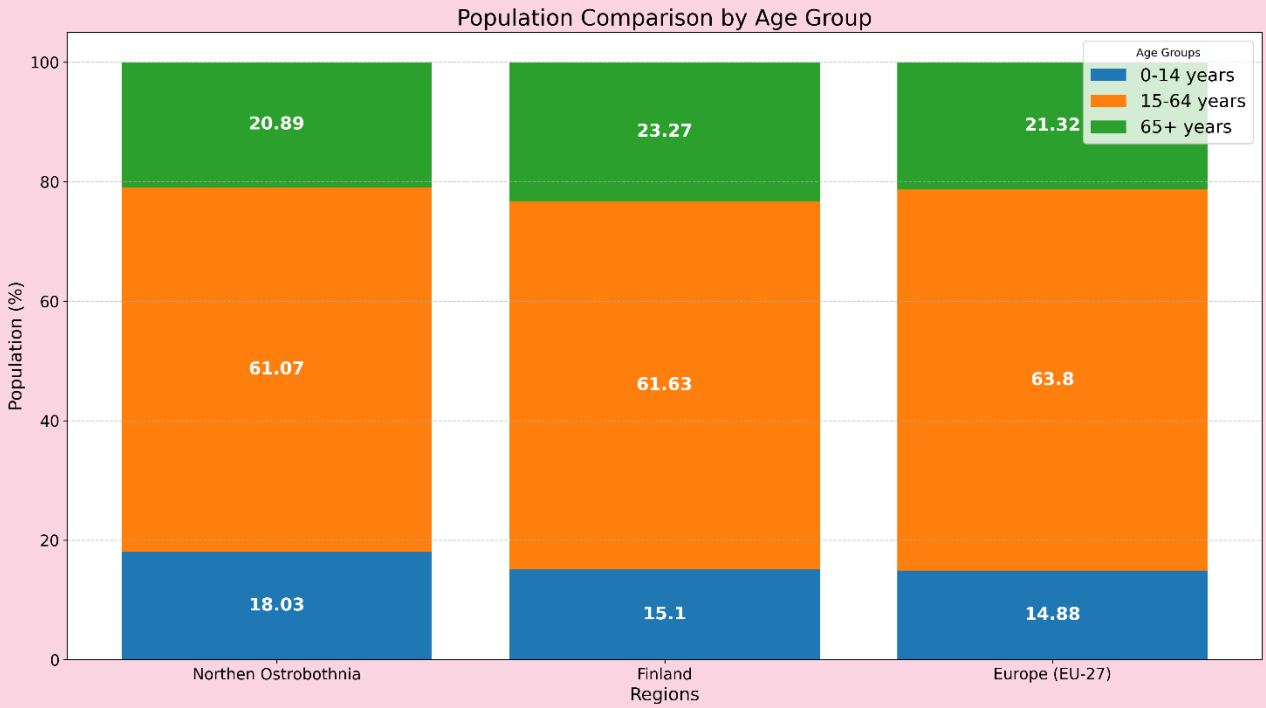


Figure 22. Dynamo 1. Total population



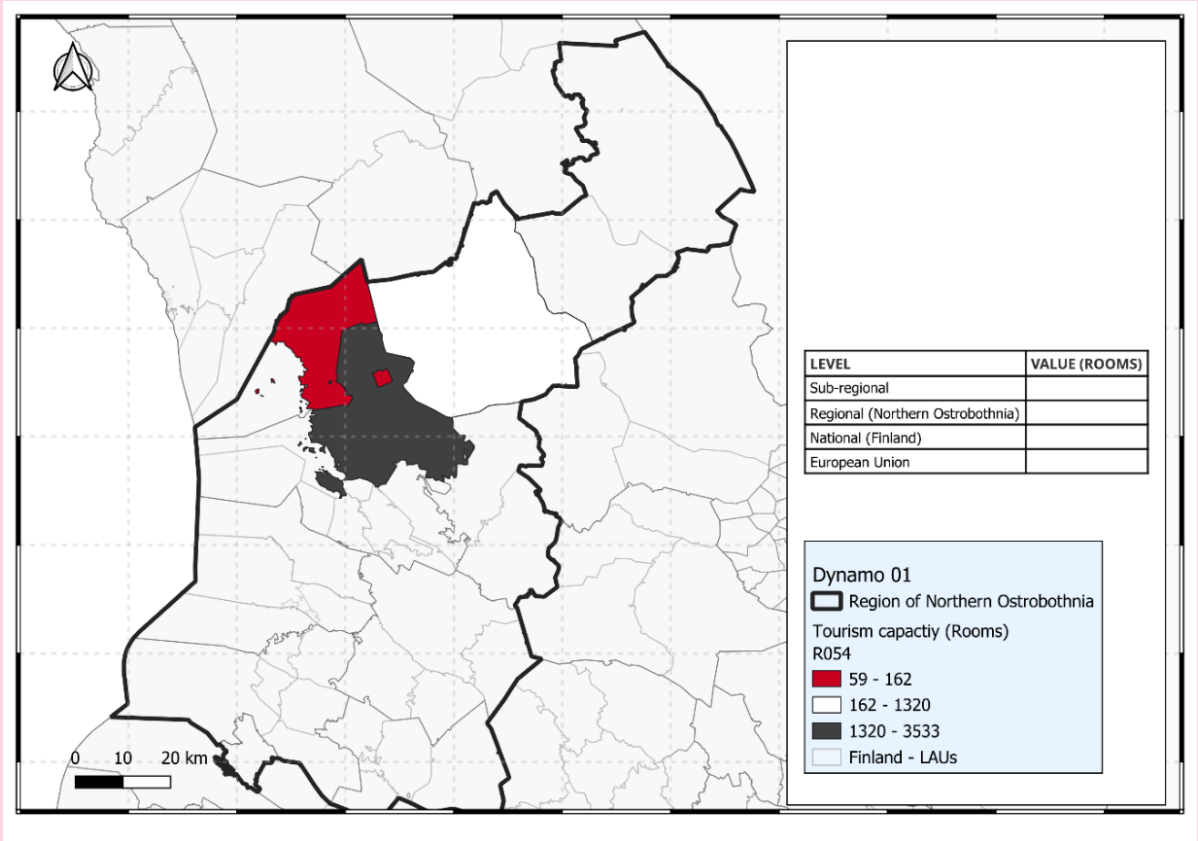


Figure 23. Dynamo 1. Tourism capacity

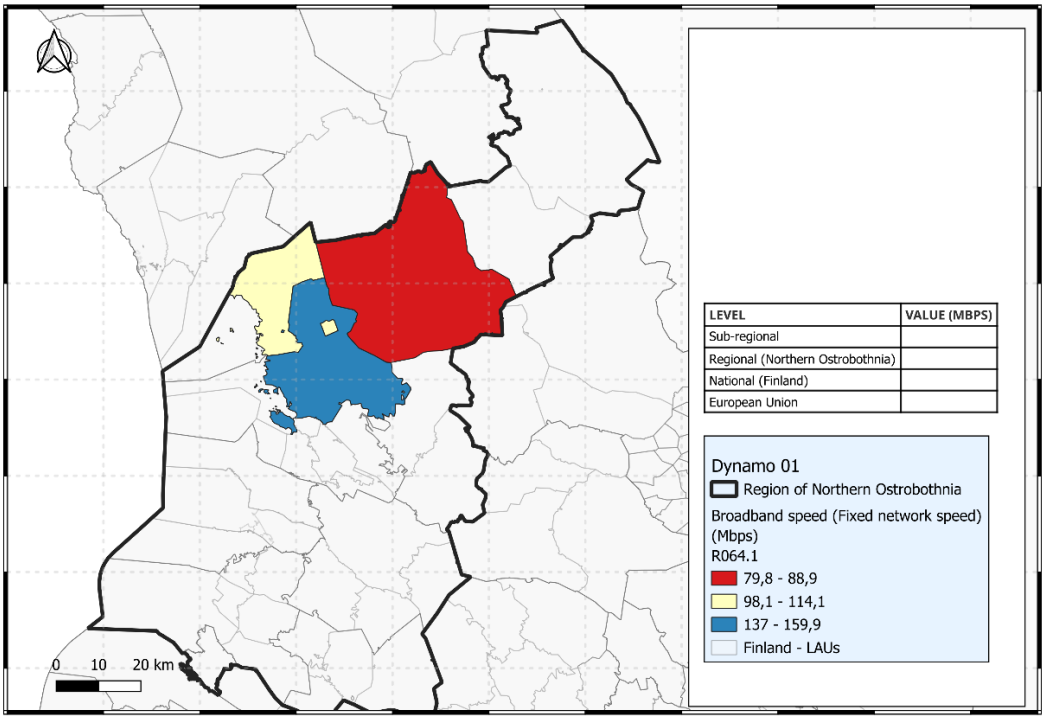


Figure 24. Dynamo 1. Broadband speed (Fixed network speed)

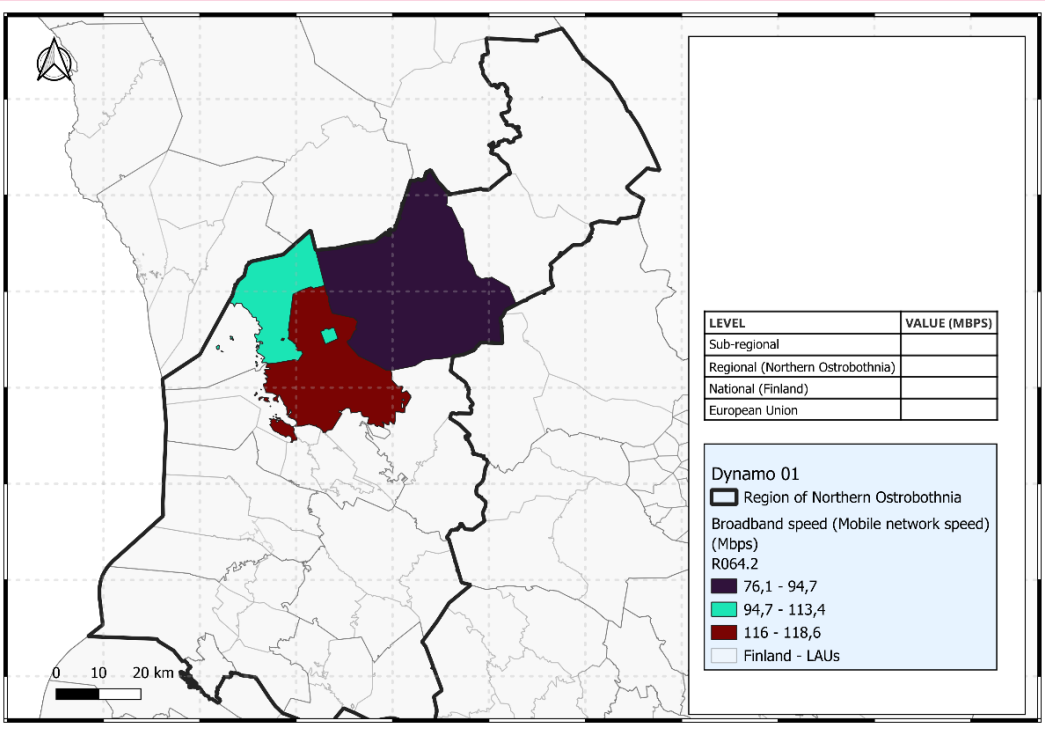
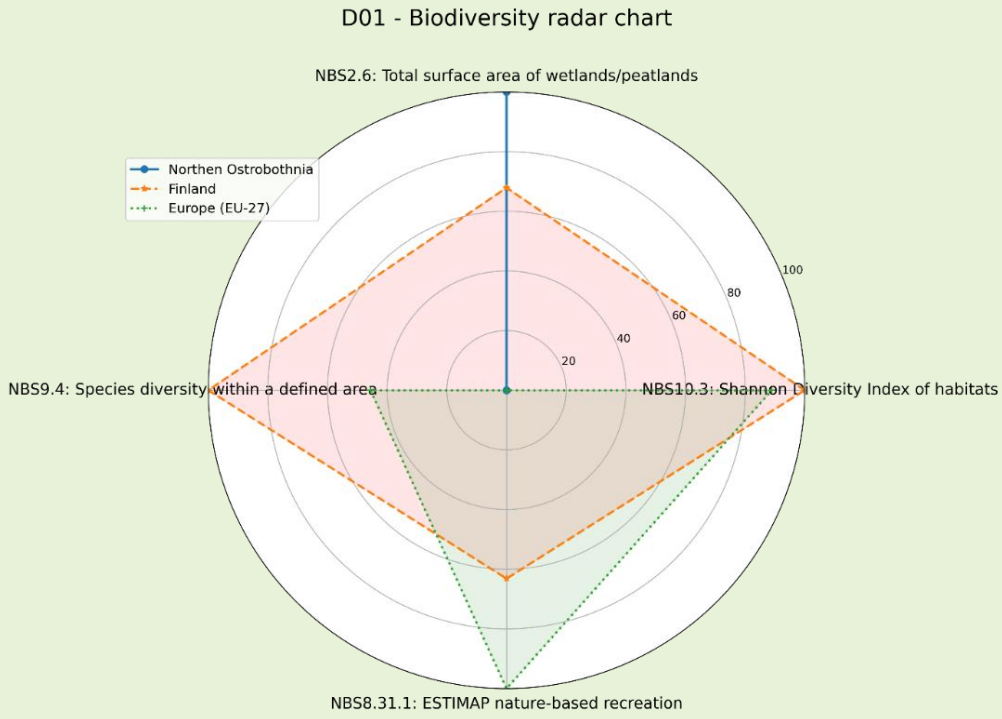


Figure 25. Dynamo 1. Broadband speed (Mobile network speed)

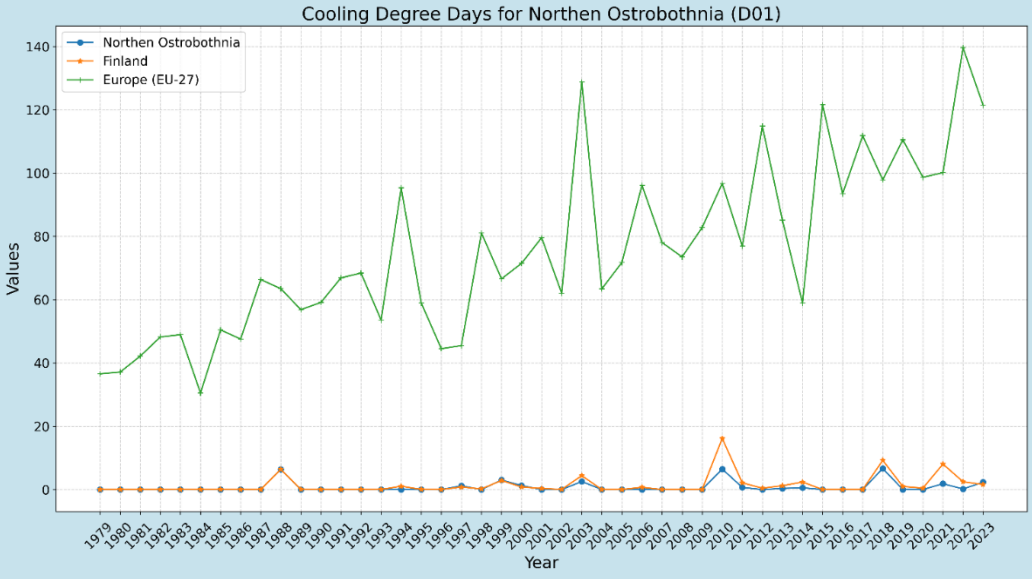
Biodiversity

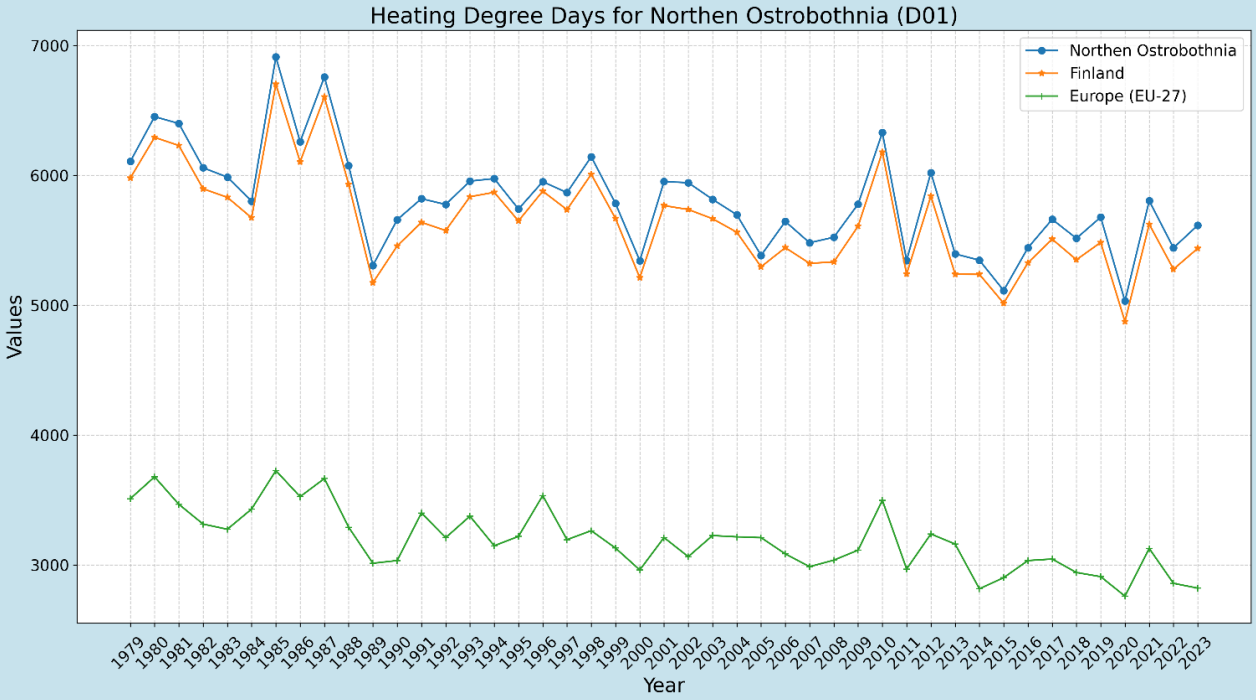
Energy transition and climate neutrality



Climate change mitigation and adaptation

Sustainable multimodal mobility





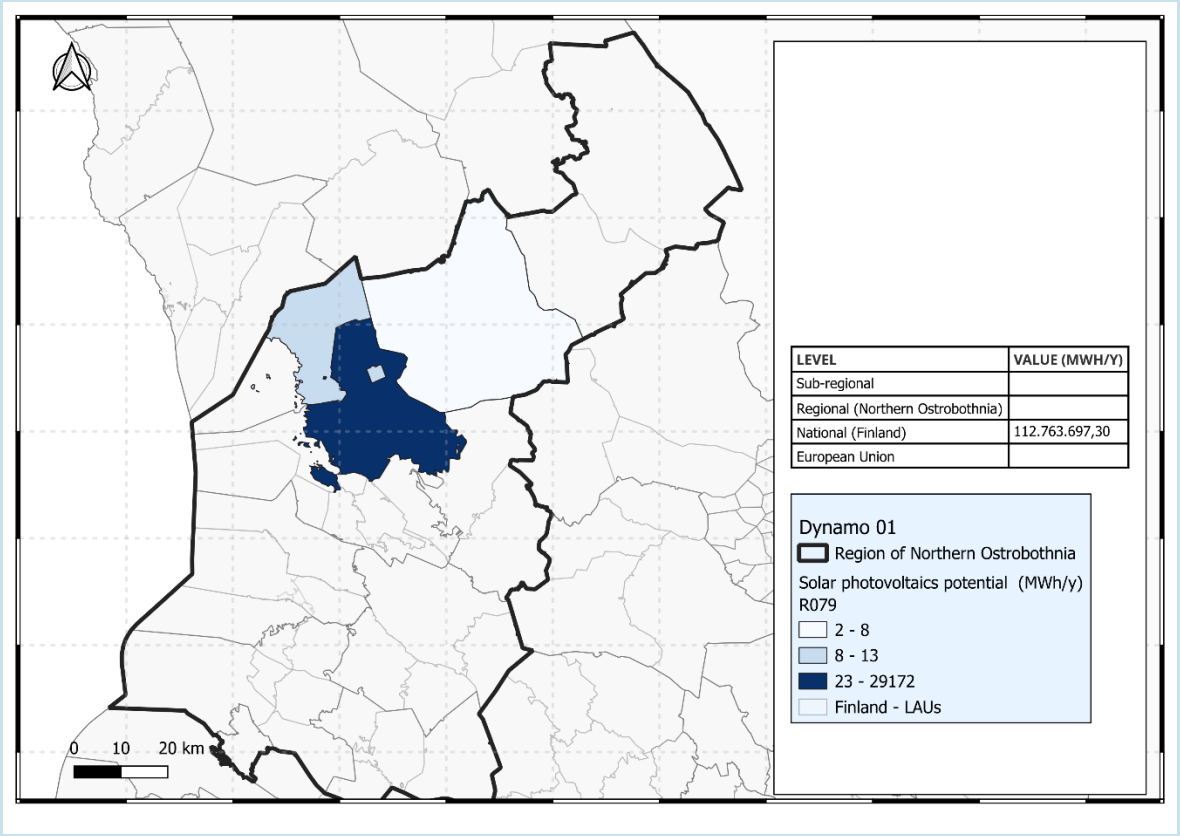


Figure 26. Dynamo 1. Solar photovoltaics potential

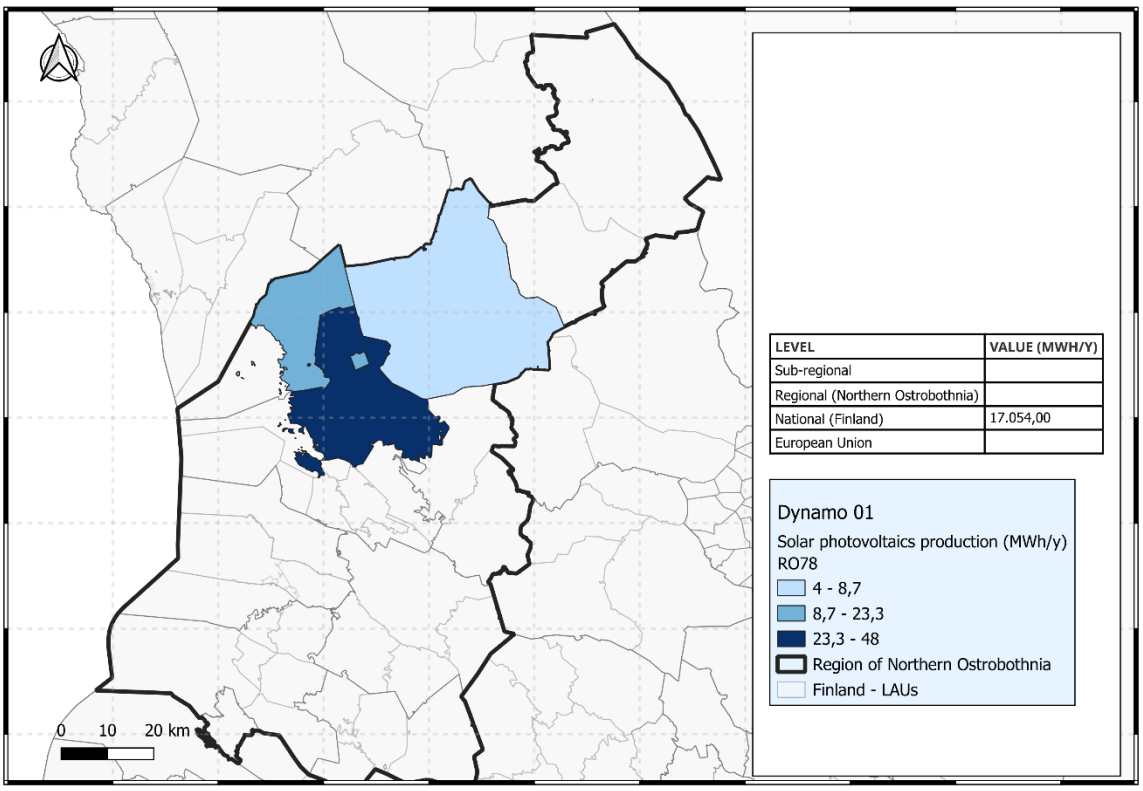


Figure 27. Dynamo 1. Solar photovoltaics production

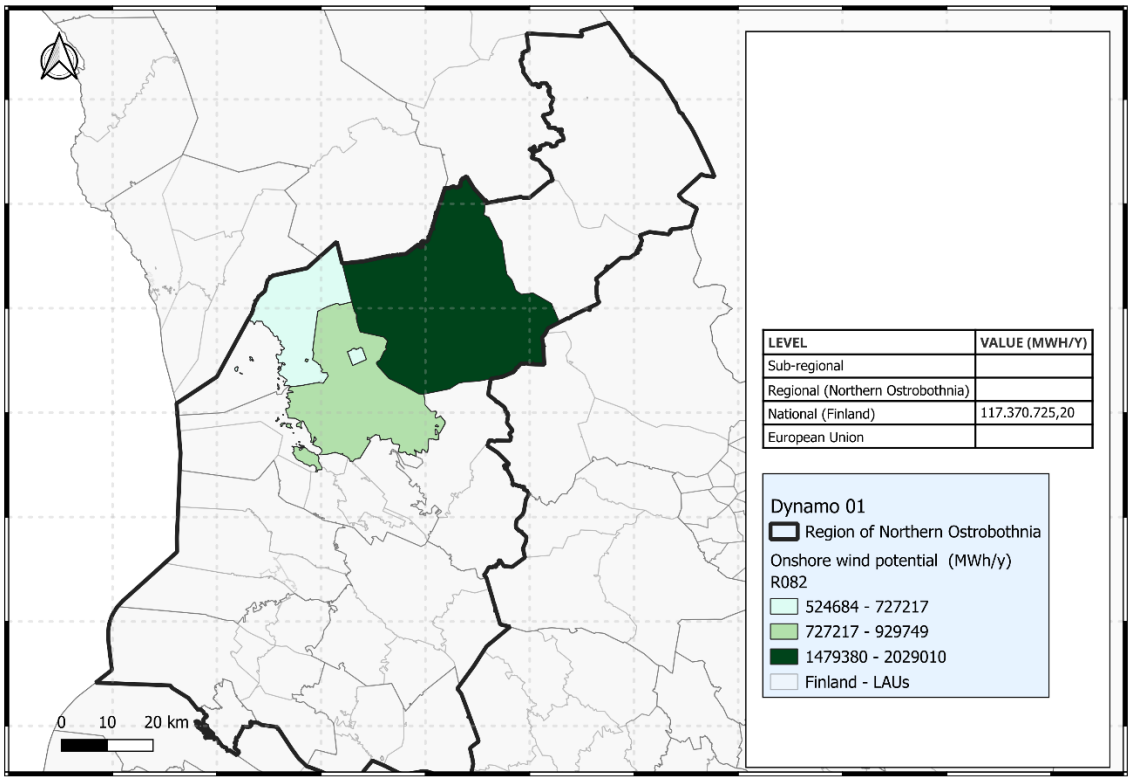


Figure 28. Dynamo 1. Onshore wind potential

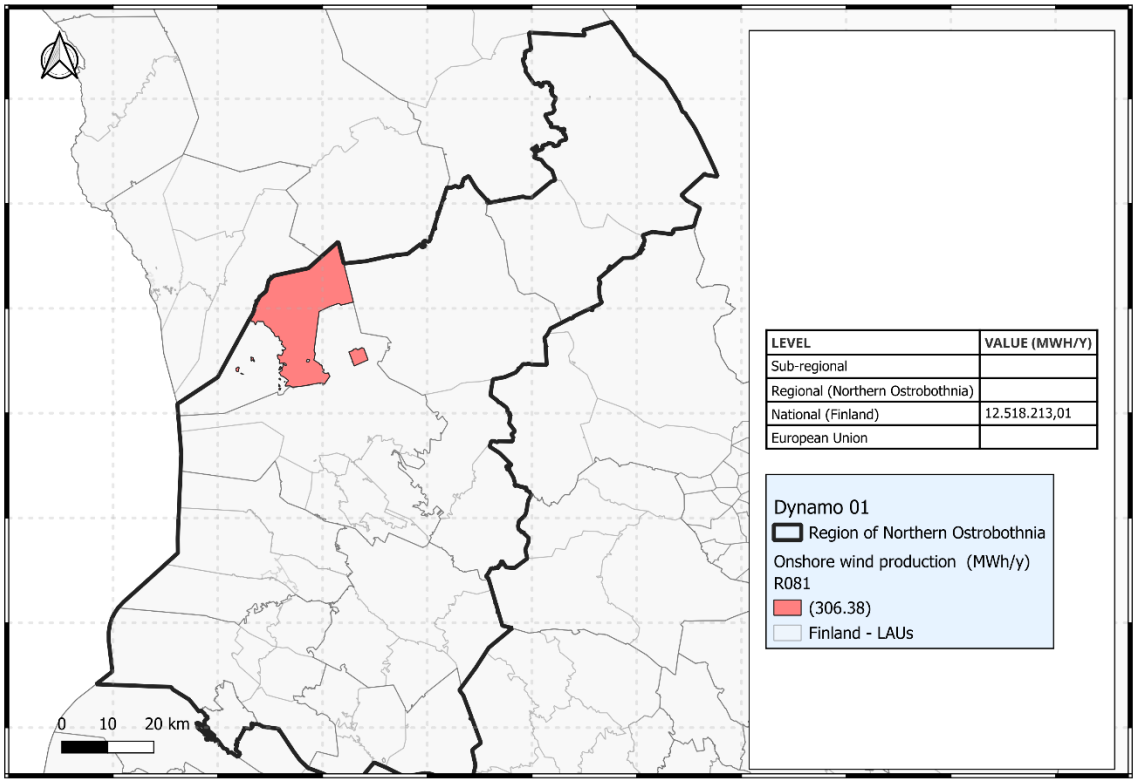


Figure 29. Dynamo 1. Onshore wind production

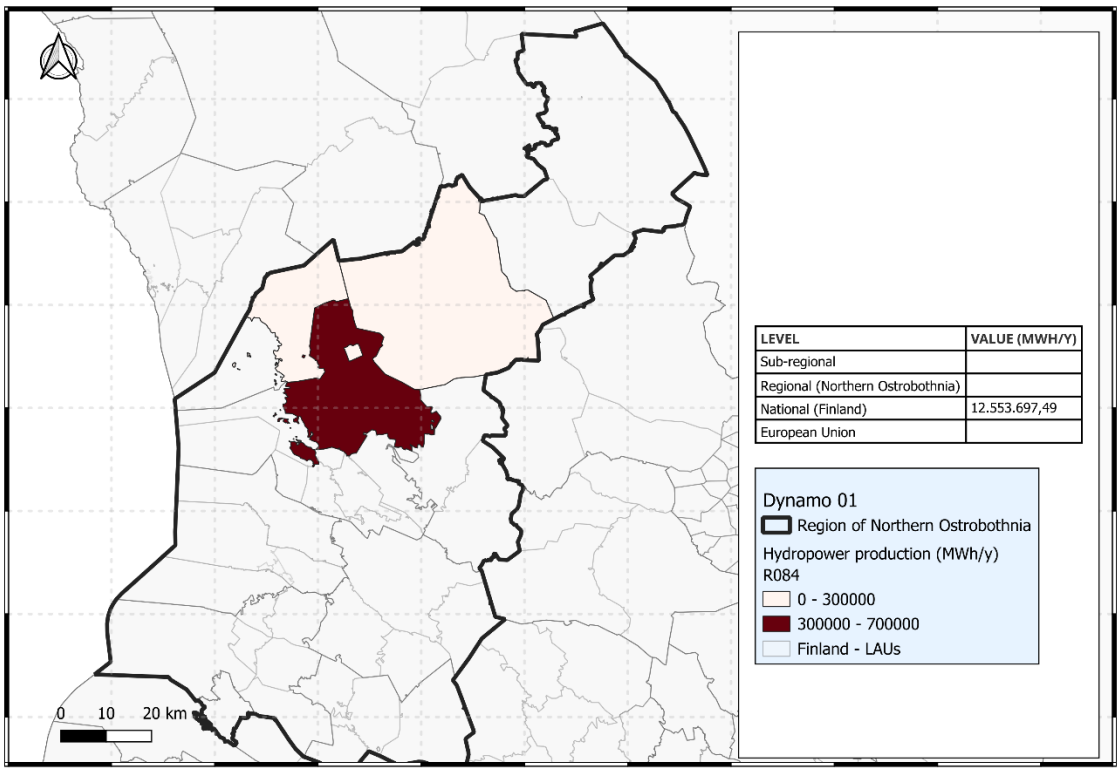


Figure 30. Dynamo 1. Hydropower production

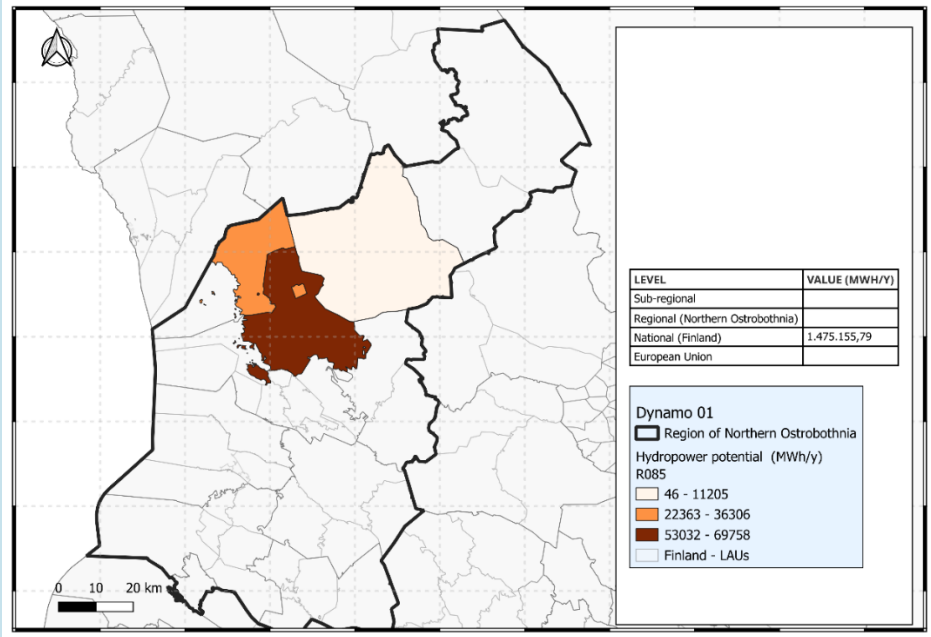


Figure 31. Dynamo 1. Hydropower potential

D2. Südburgenland, Austria

Cross-Cutting priorities

Social Justice and Inclusion

RDD

Local services, health and wellbeing

Culture and cultural innovation

Sustainable multimodal mobility

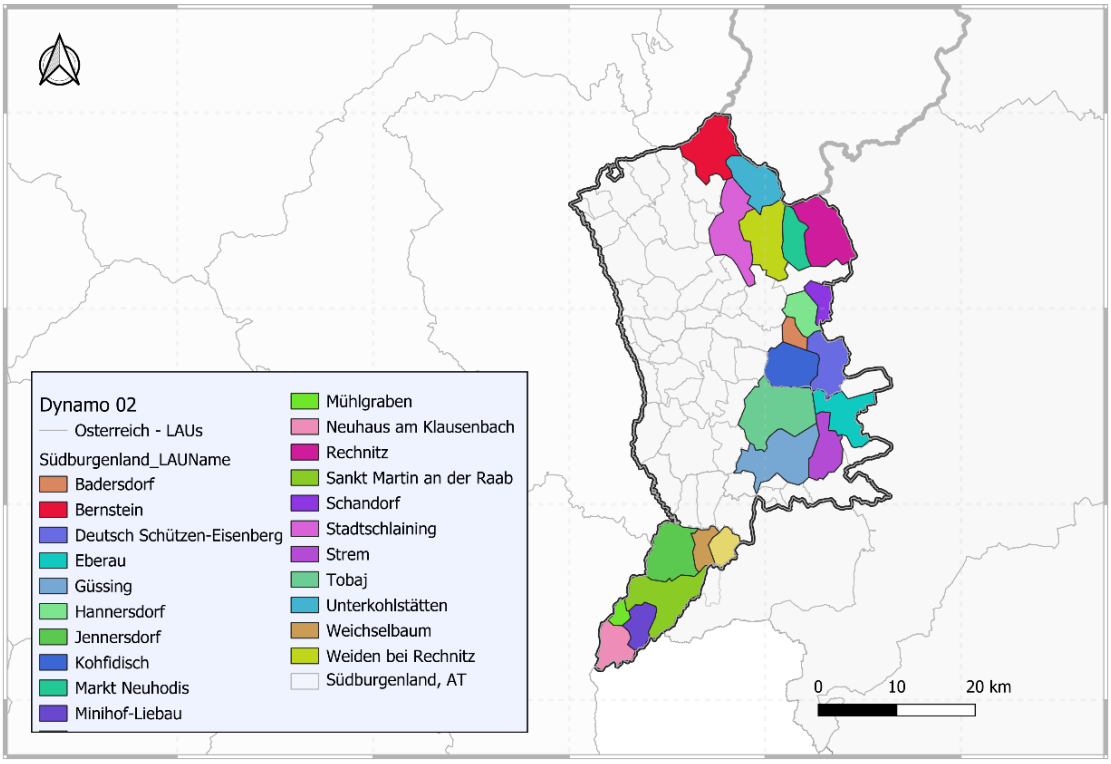
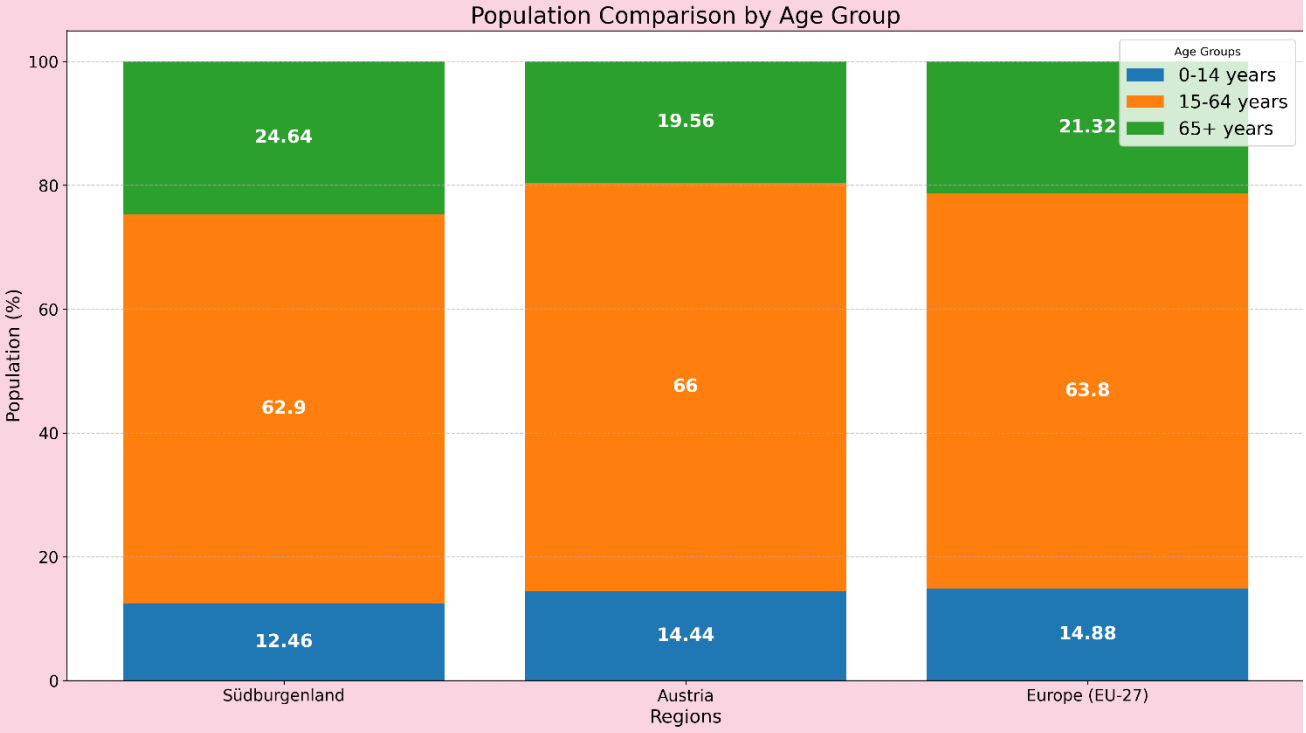


Figure 32. Dynamo 2. Administrative Context



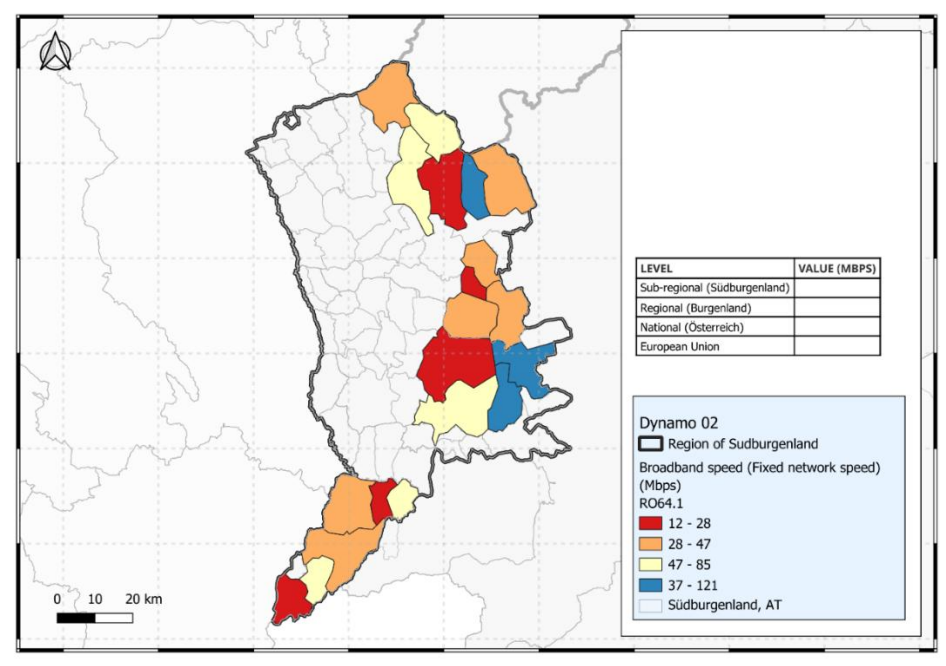


Figure 33. Dynamo 2. Broadband speed (Fixed network speed)

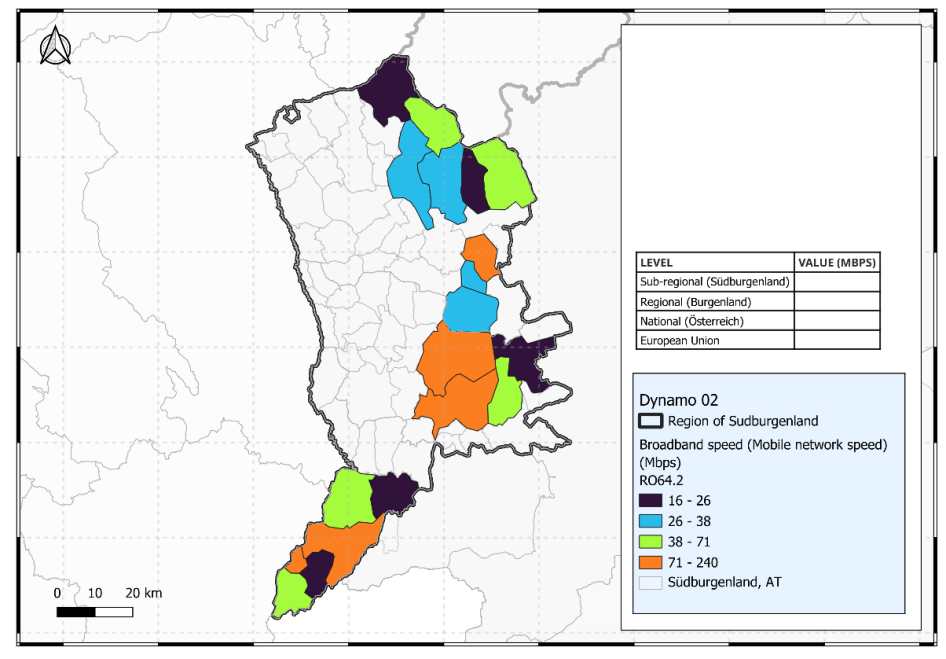


Figure 34. Dynamo 2. Broadband speed (Mobile network speed)

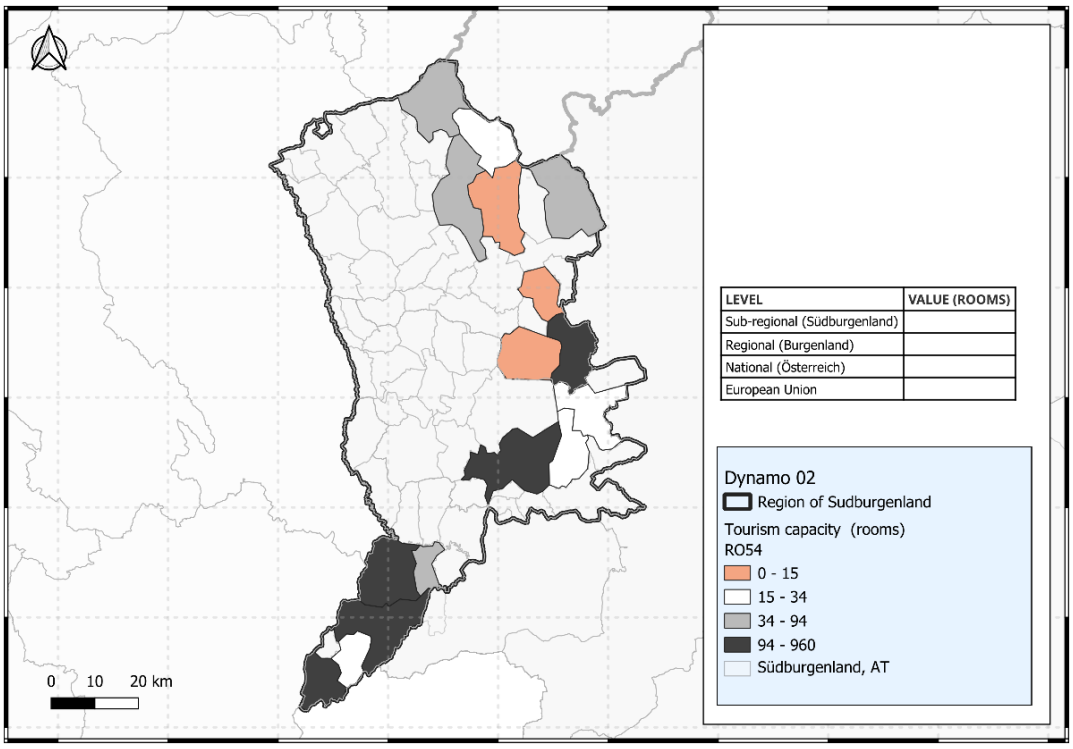


Figure 35. Dynamo 2. Tourism capacity

Local services, health and wellbeing

Culture and cultural innovation

Sustainable multimodal mobility

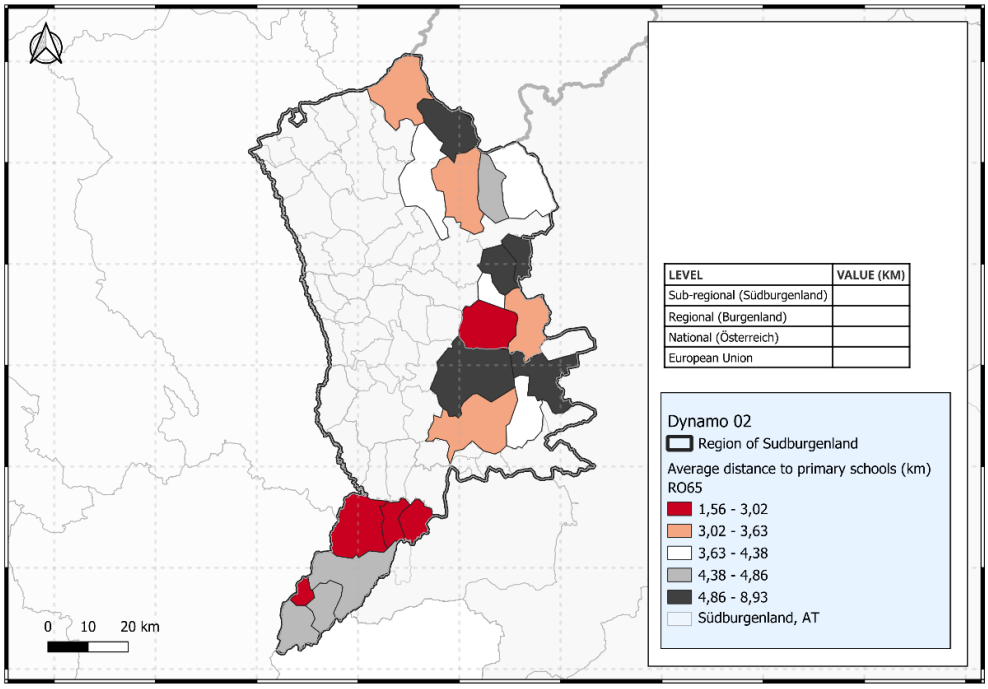


Figure 36. Dynamo 2. Average distance to primary schools

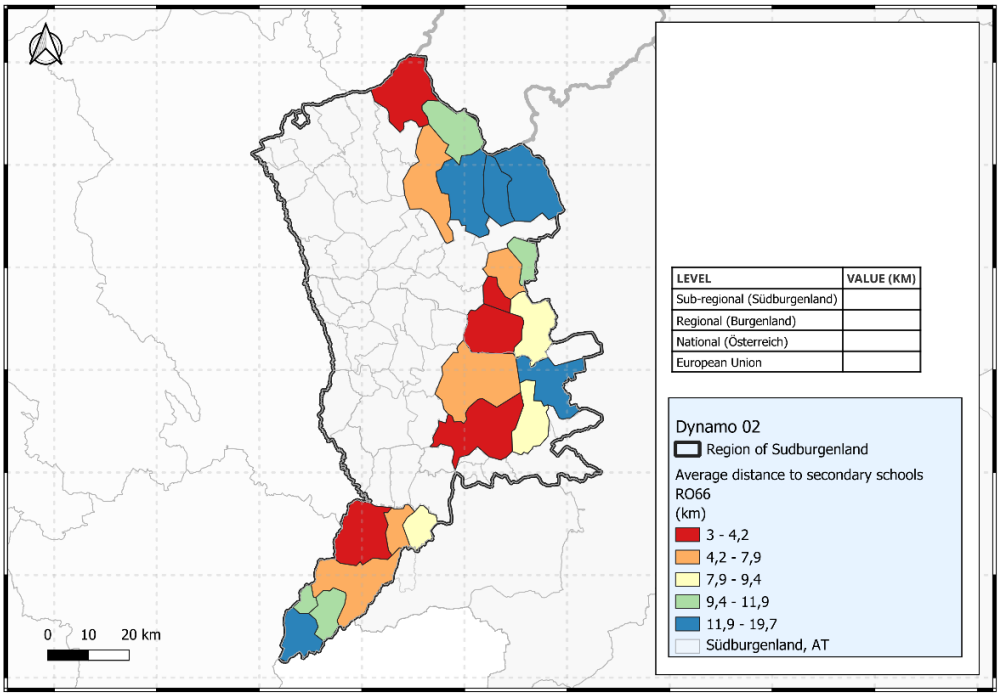


Figure 37. Dynamo 2. Average distance to secondary schools

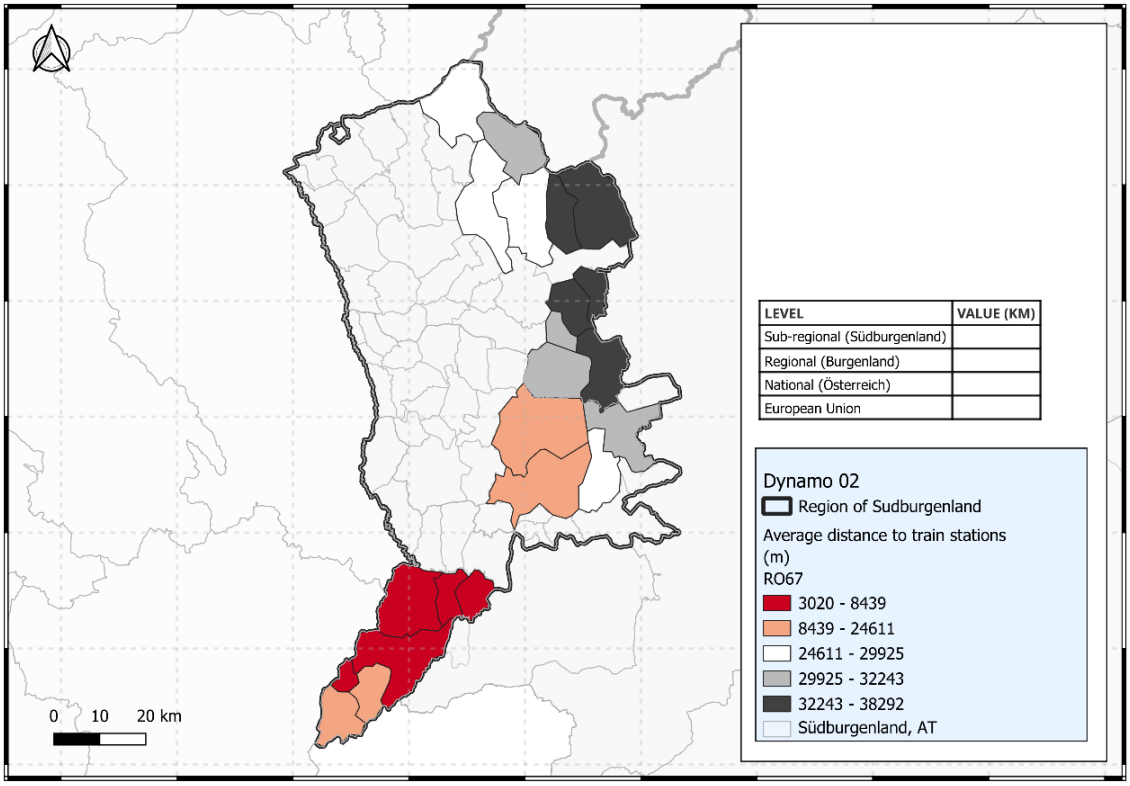


Figure 38. Dynamo 2. Average distance to train stations

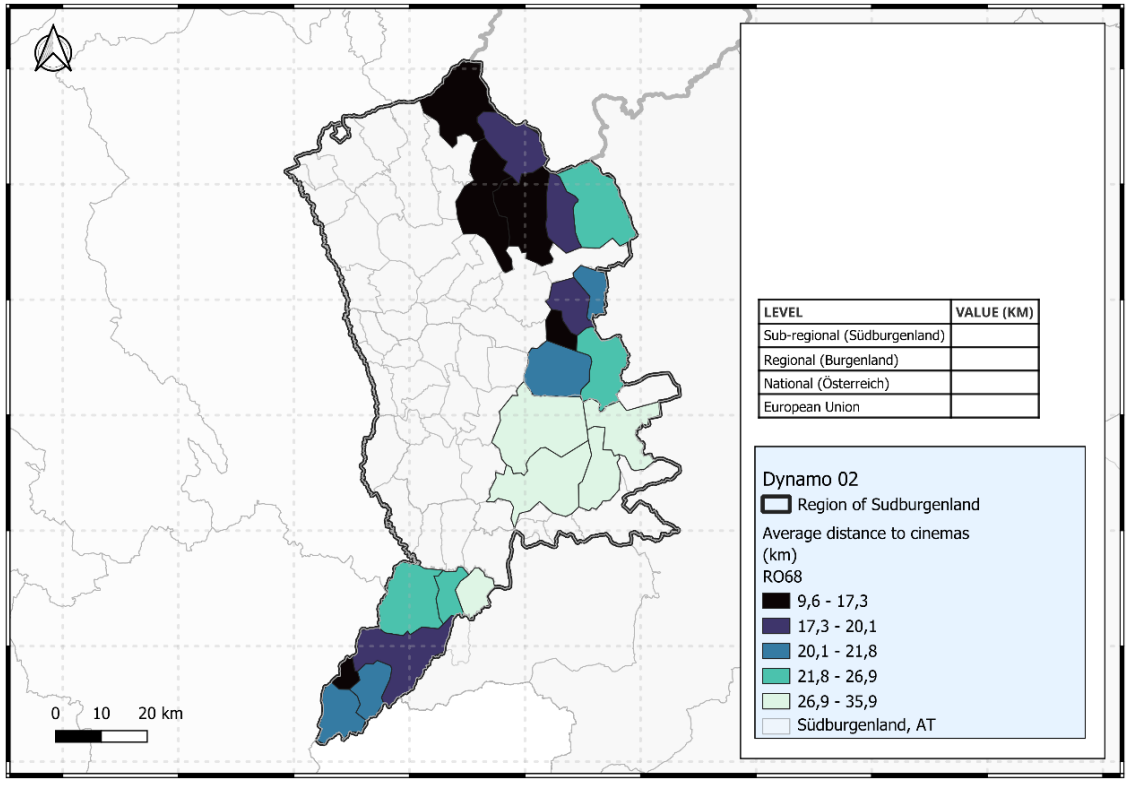


Figure 39. Dynamo 2. Average distance to cinemas

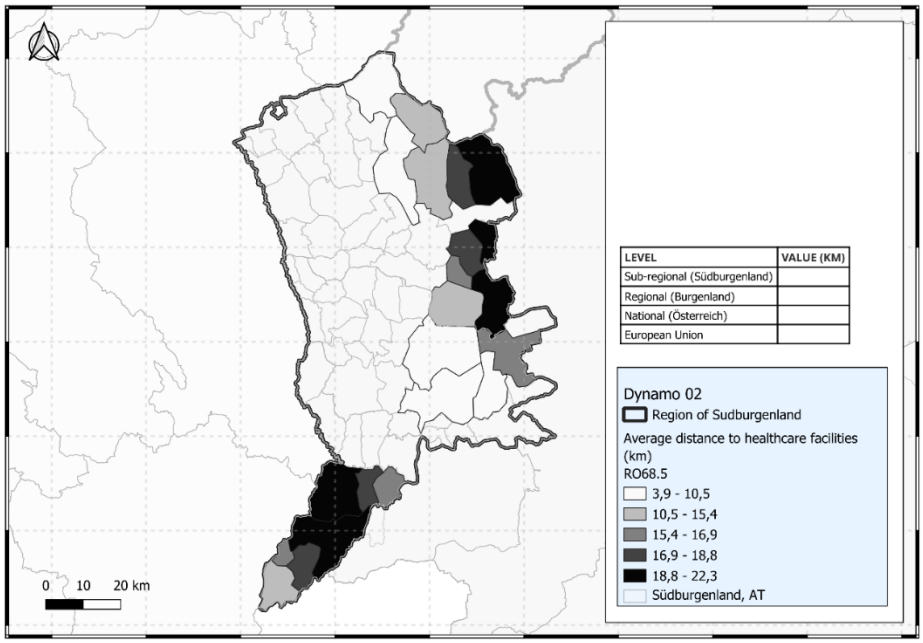


Figure 40. Dynamo 2. Average distance to healthcare facilities

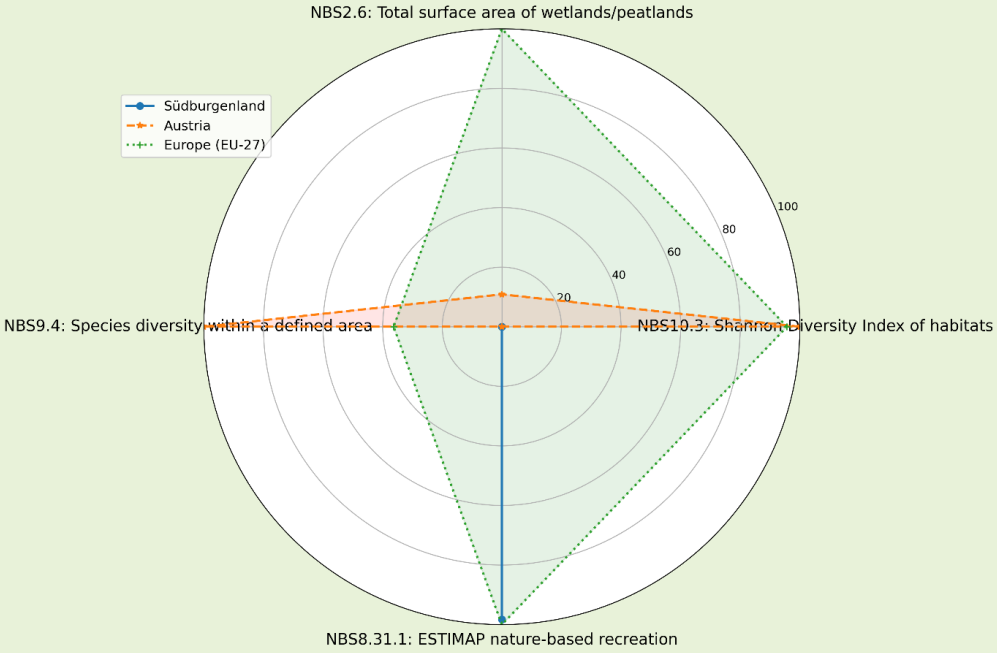
Biodiversity

Energy transition and climate neutrality

Sustainable multimodal mobility

Nature-based and cultural Tourism

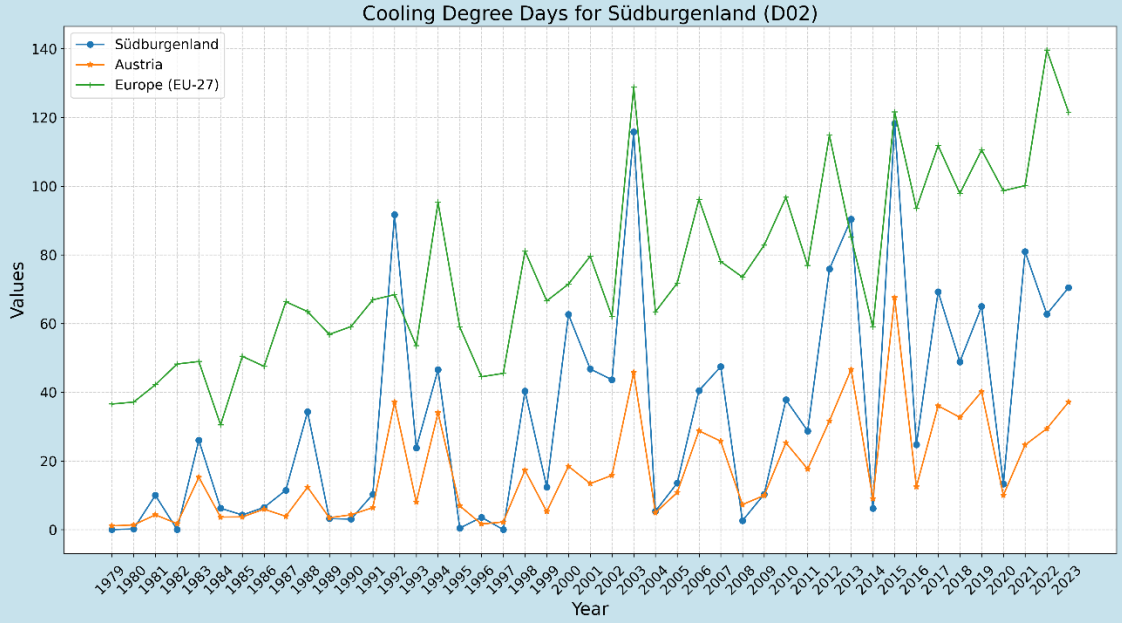
D02 - Biodiversity radar chart

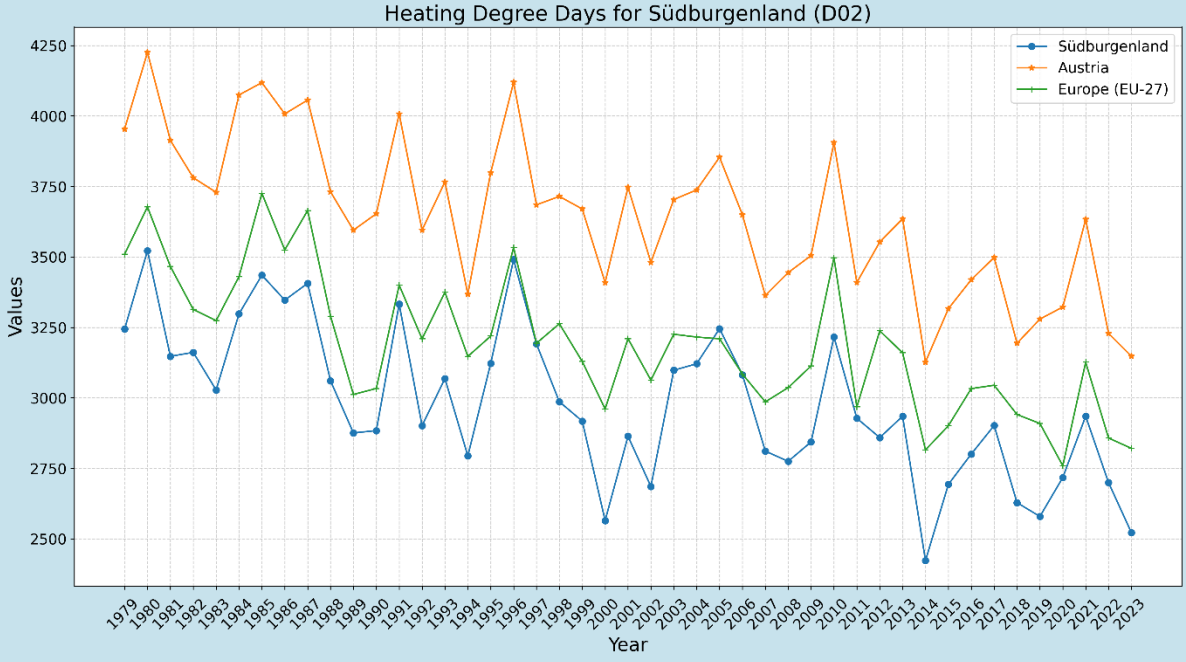


Climate change mitigation and adaptation

Sustainable agrifood systems and ecosystem management

Sustainable multimodal mobility





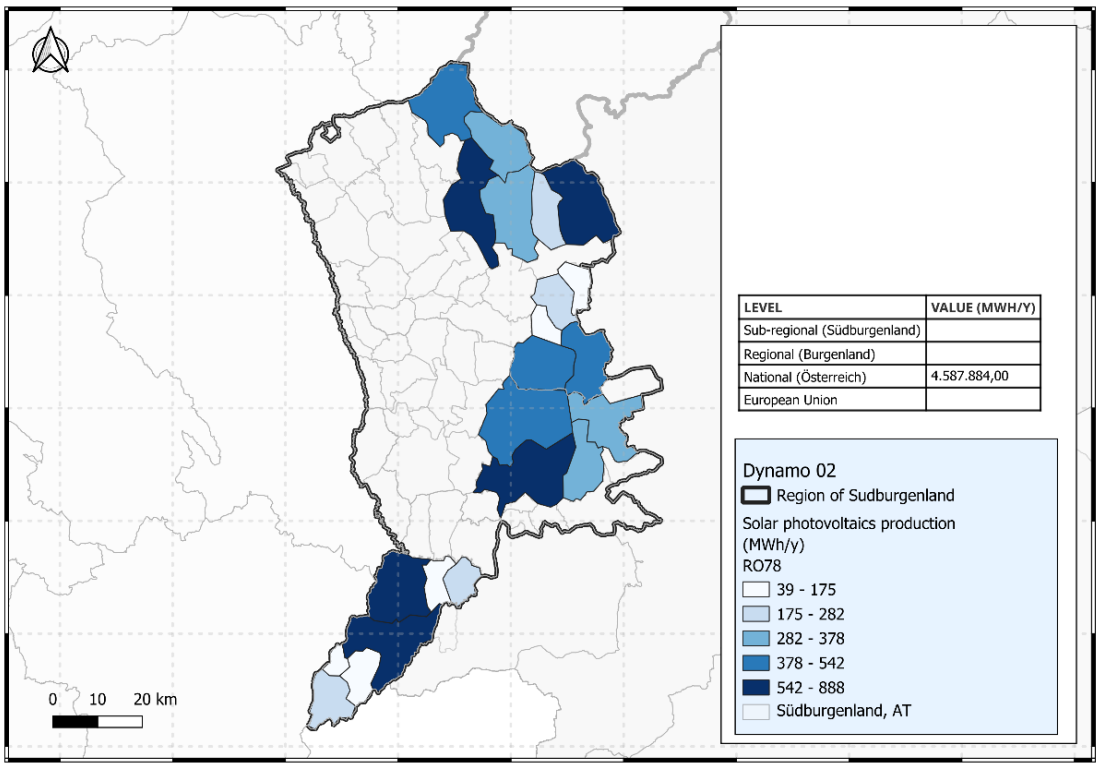


Figure 41. Dynamo 2. Solar photovoltaics production

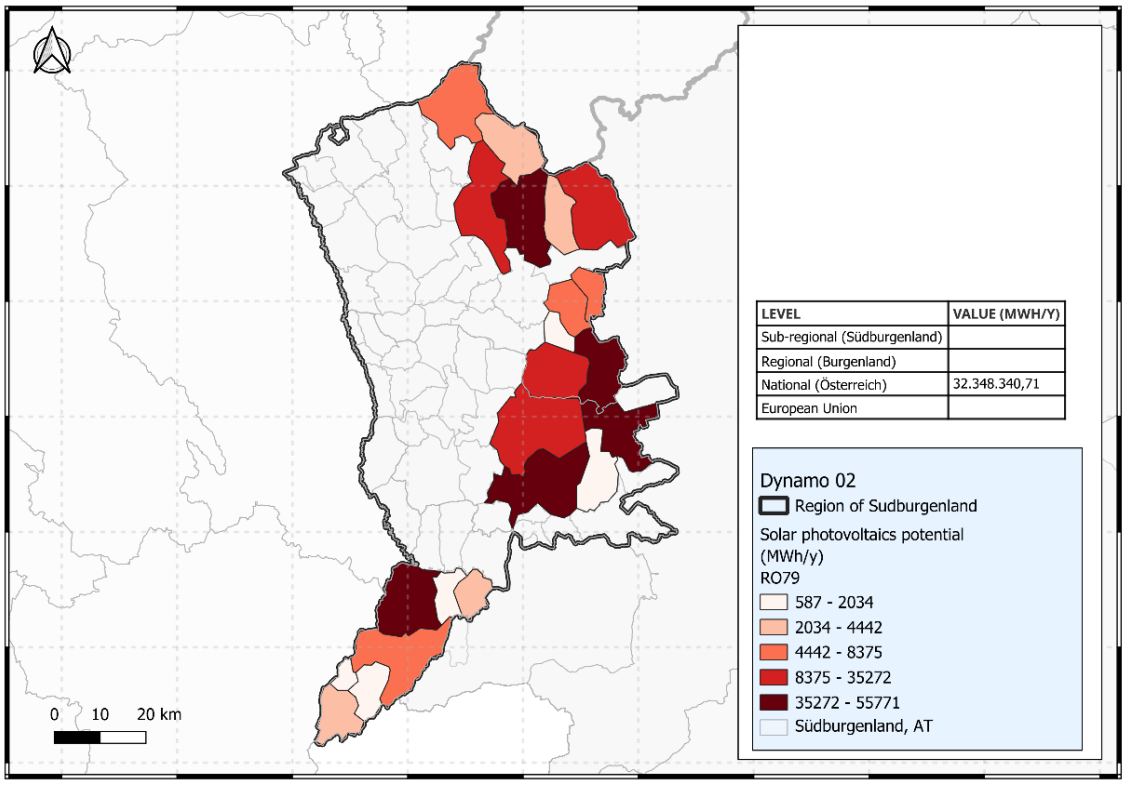


Figure 42. Dynamo 2. Solar photovoltaics potential

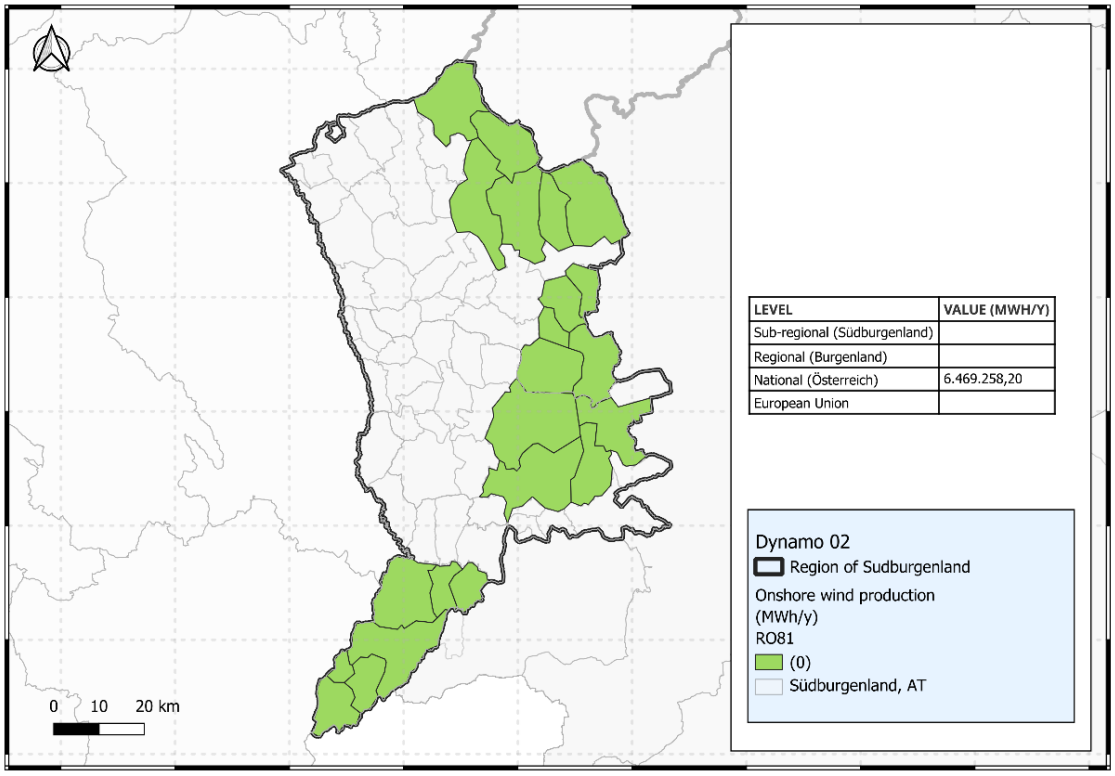


Figure 43. Dynamo 2. Onshore wind production

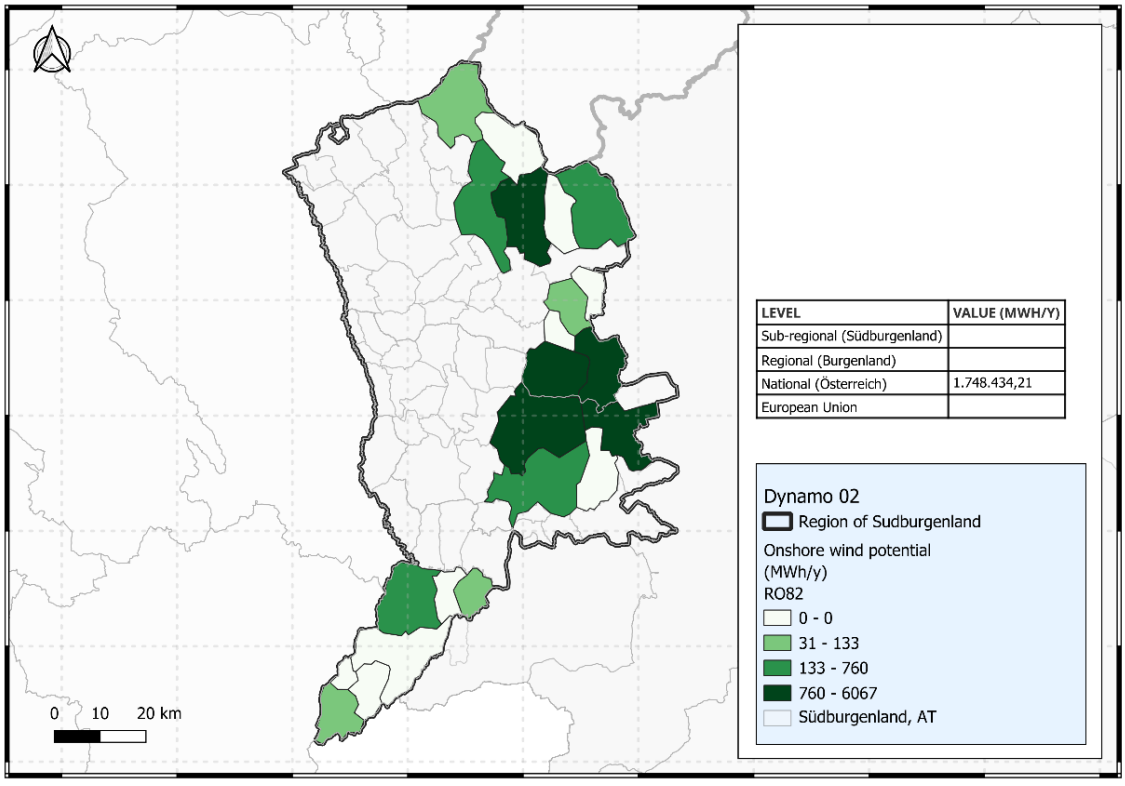


Figure 44. Dynamo 2. Onshore wind potential

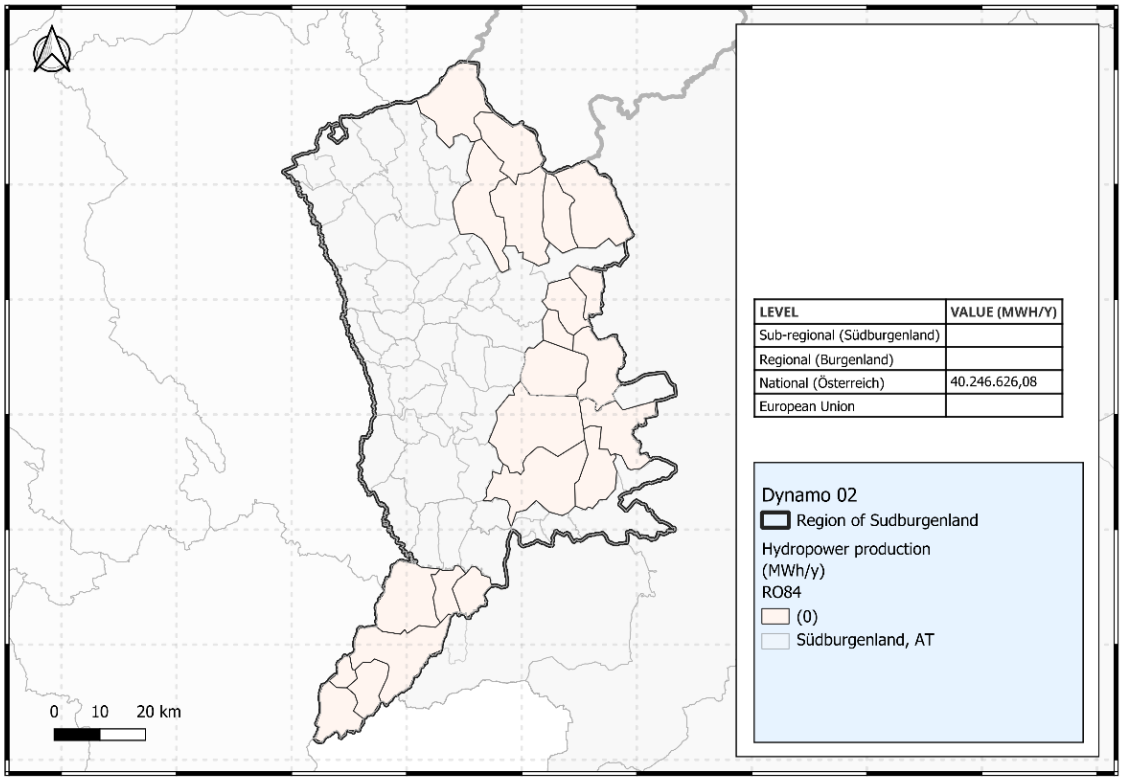


Figure 45. Dynamo 2. Hydropower production

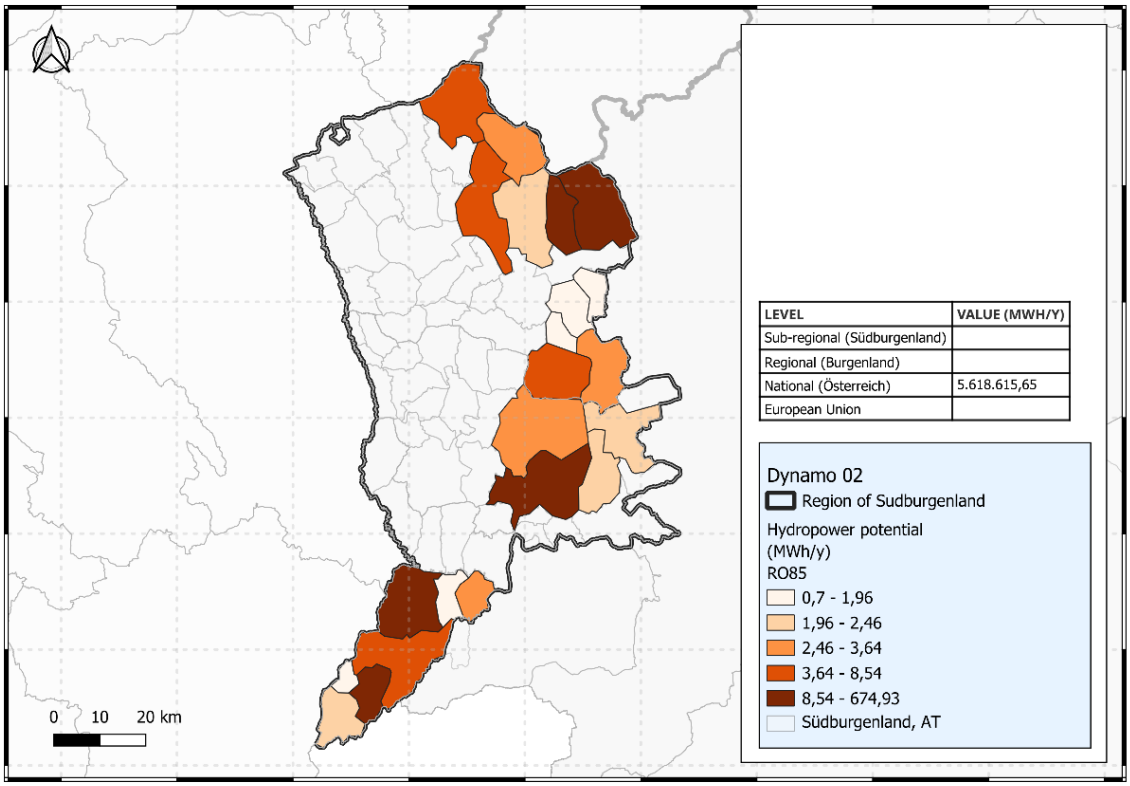


Figure 46. Dynamo 2. Hydropower potential

D3. Zamora, Spain

Cross-Cutting priorities

Social Justice and Inclusion

Local services, health and wellbeing

Culture and cultural innovation

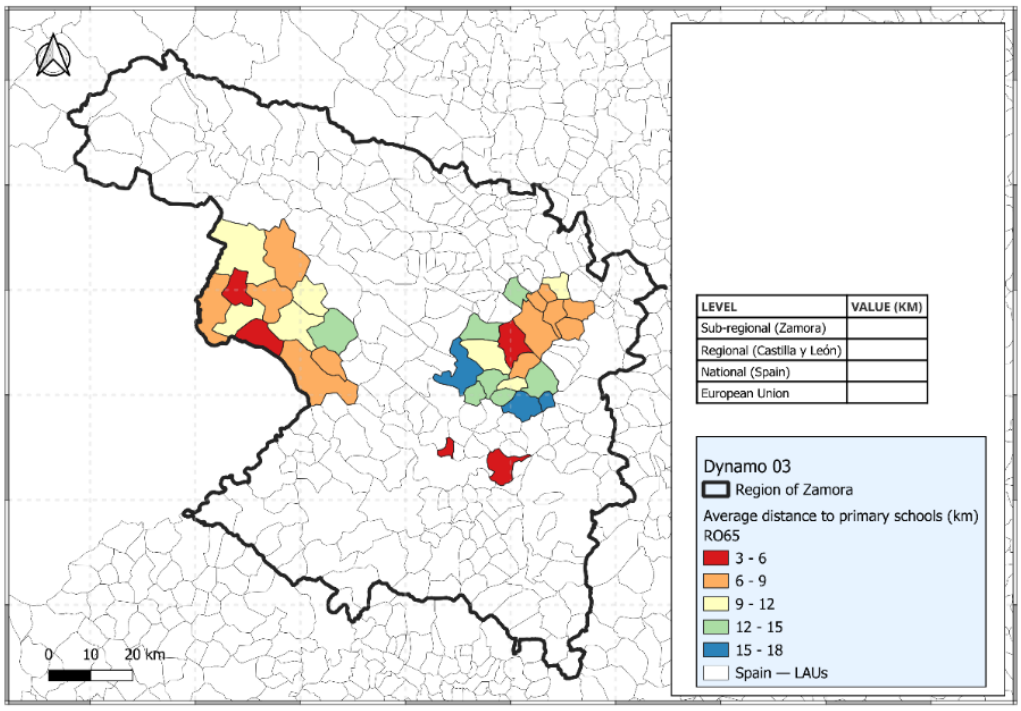


Figure 47. Dynamo 3. Average distance to primary schools

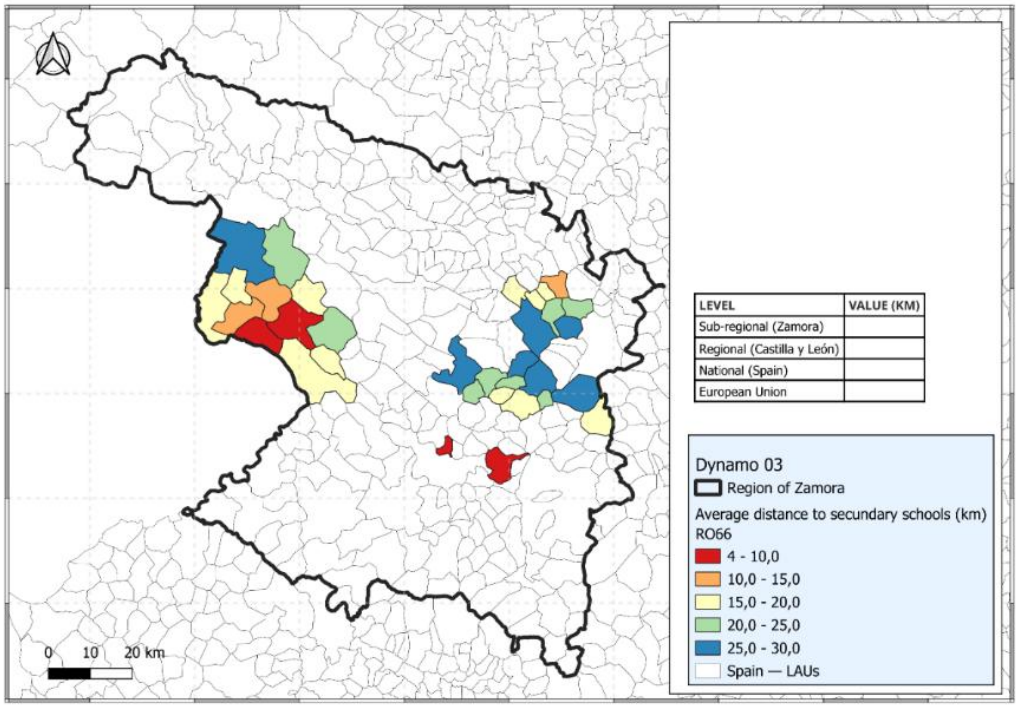


Figure 48. Dynamo 3. Average distance to secondary schools

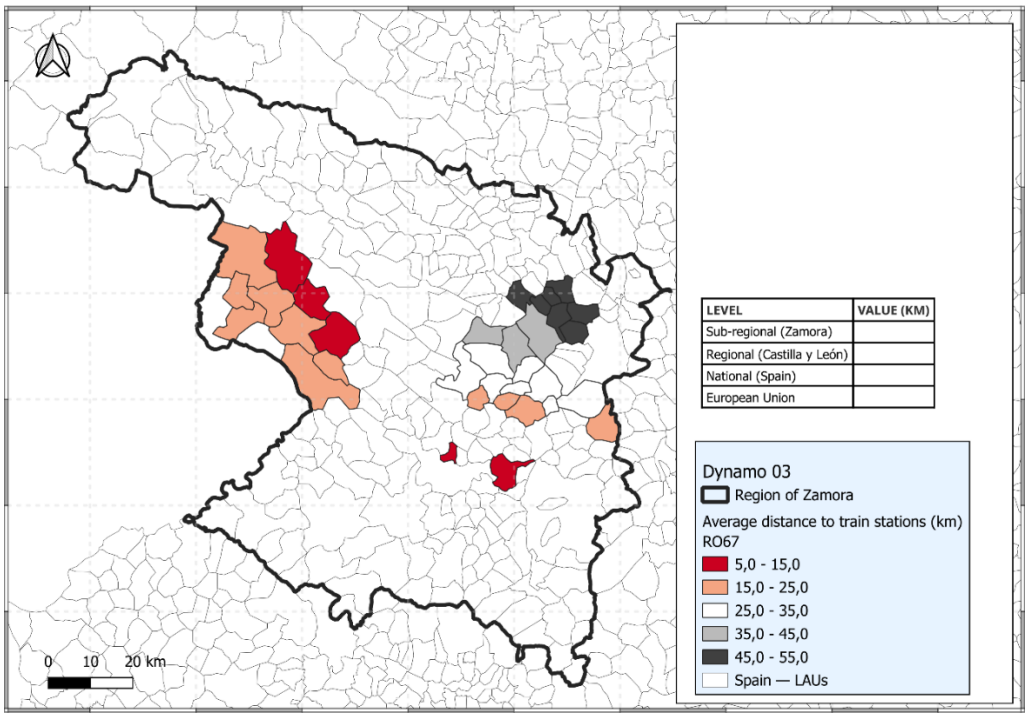


Figure 49. Dynamo 3. Average distance to train stations

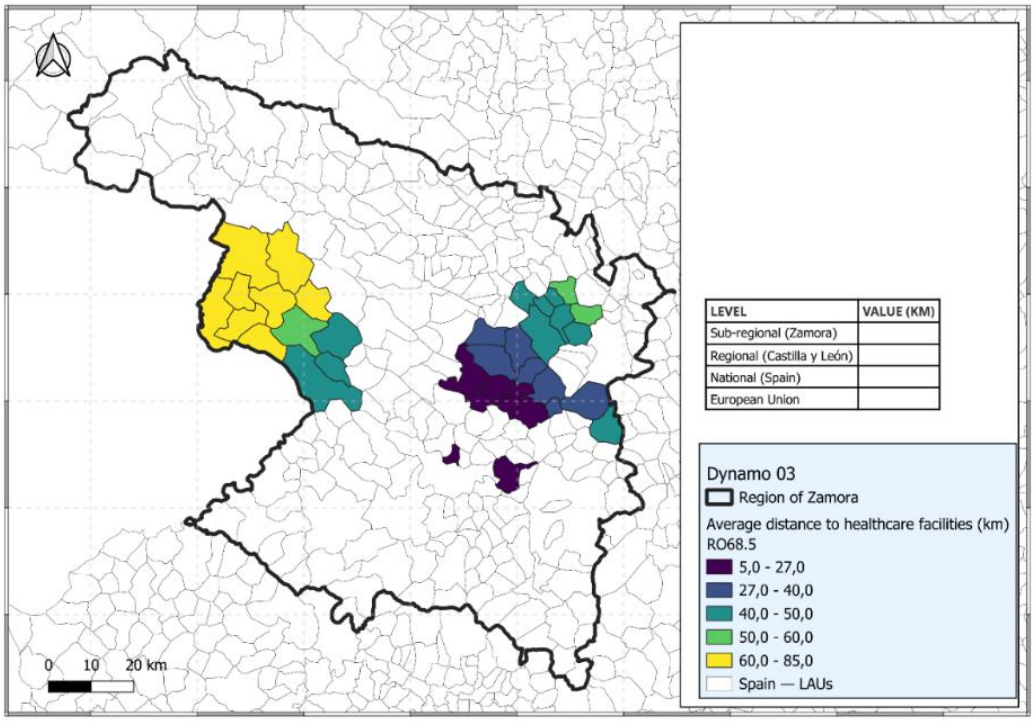


Figure 50. Dynamo 3. Average distance to healthcare facilities

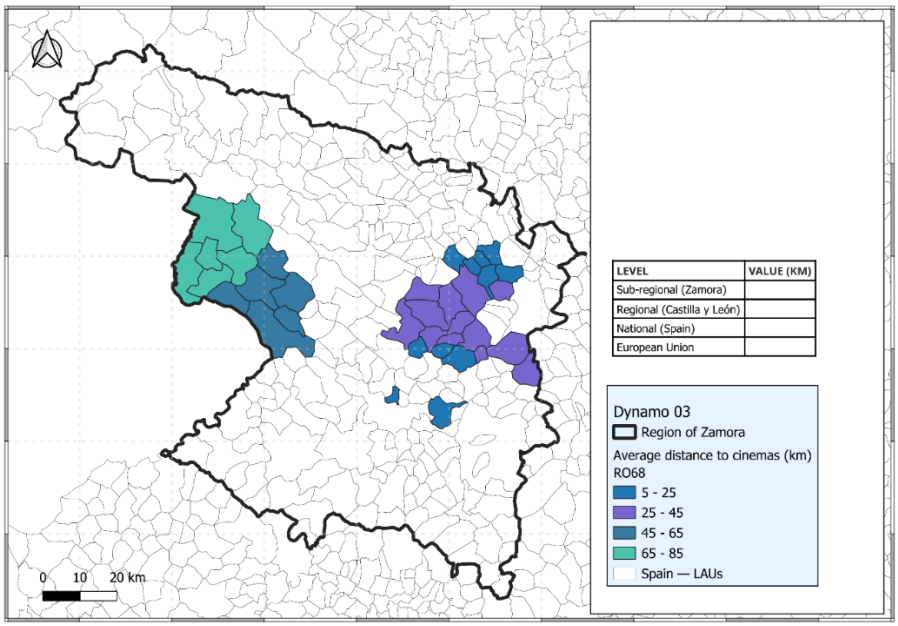


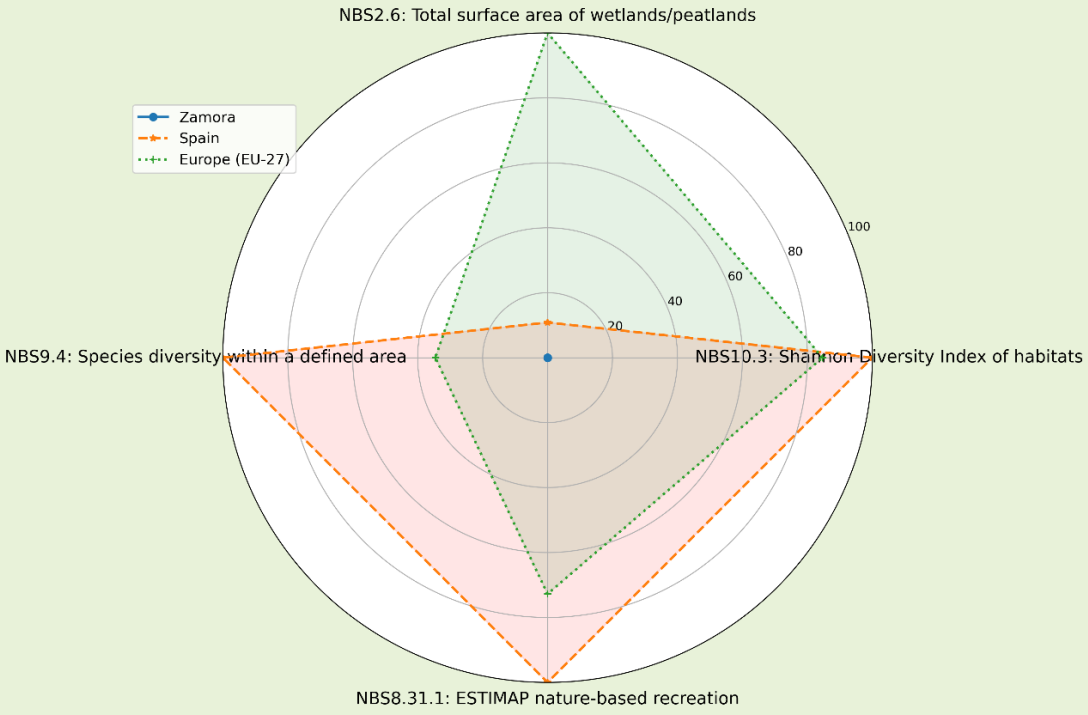
Figure 51. Dynamo 3. Average distance to cinemas

Biodiversity

Local services, health and wellbeing

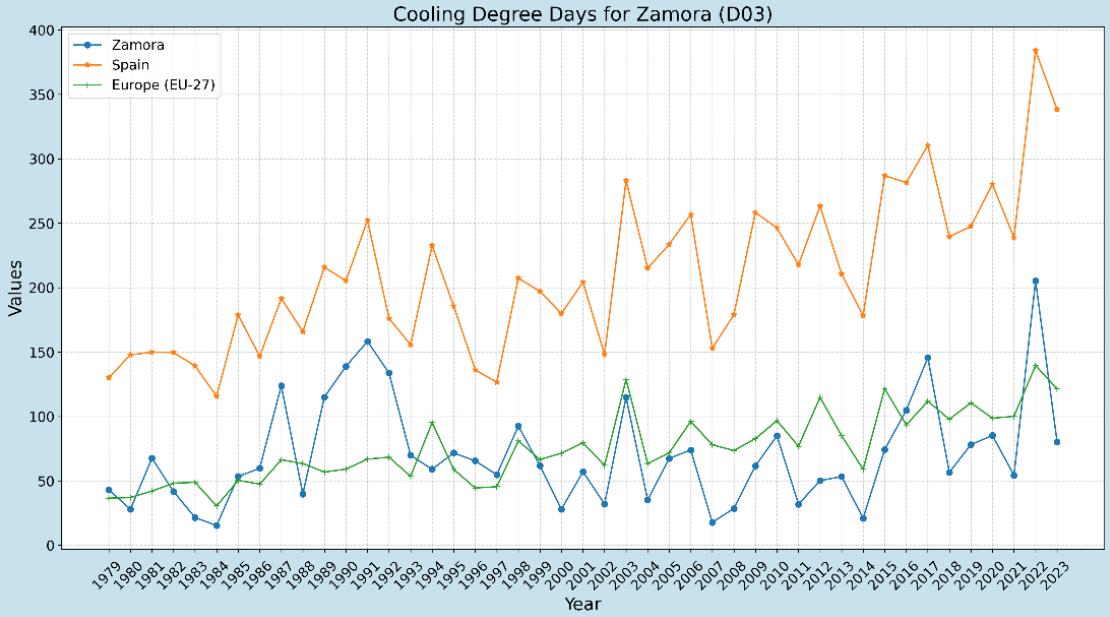
Sustainable agrifood systems and ecosystem management

D03 - Biodiversity radar chart

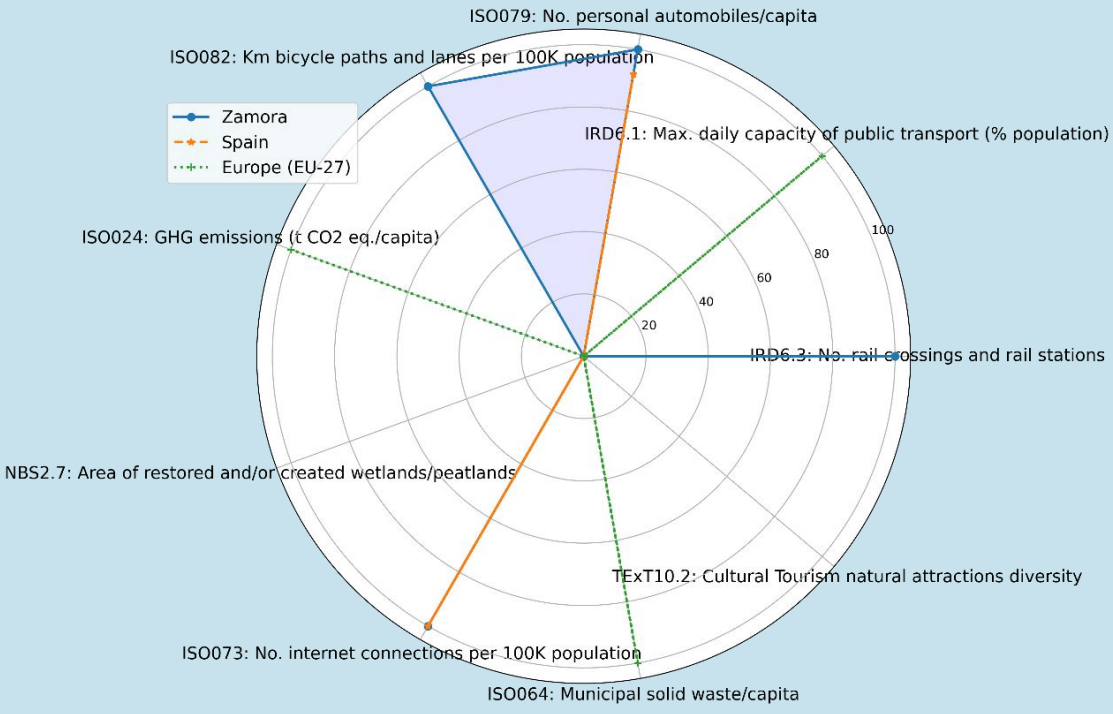


Climate change mitigation and adaptation

Sustainable agrifood systems and ecosystem management



D03 - Climate Change Mitigation radar chart



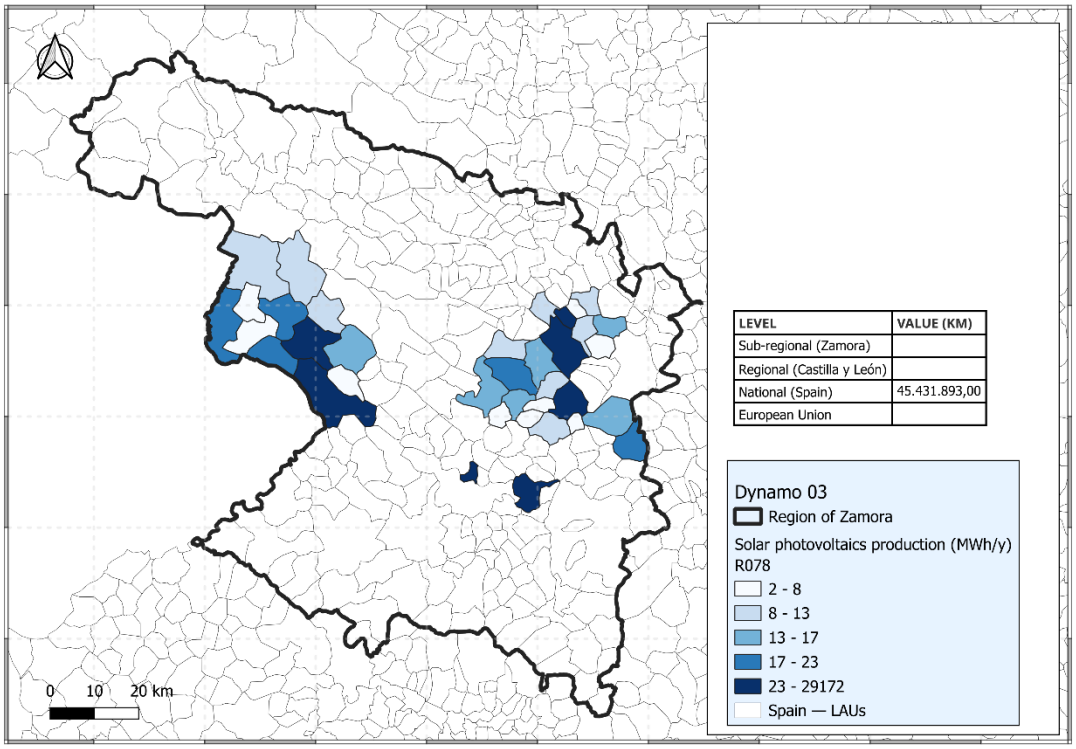


Figure 52. Dynamo 3. Solar photovoltaics production

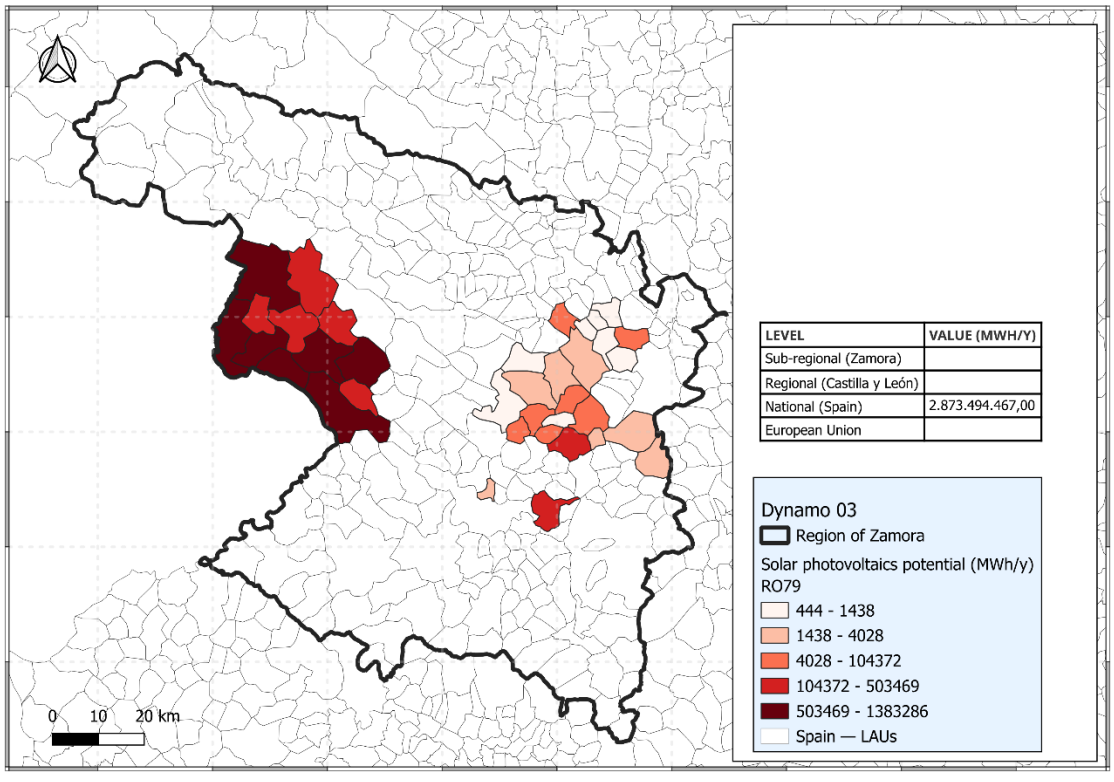


Figure 53. Dynamo 3. Solar photovoltaics potential

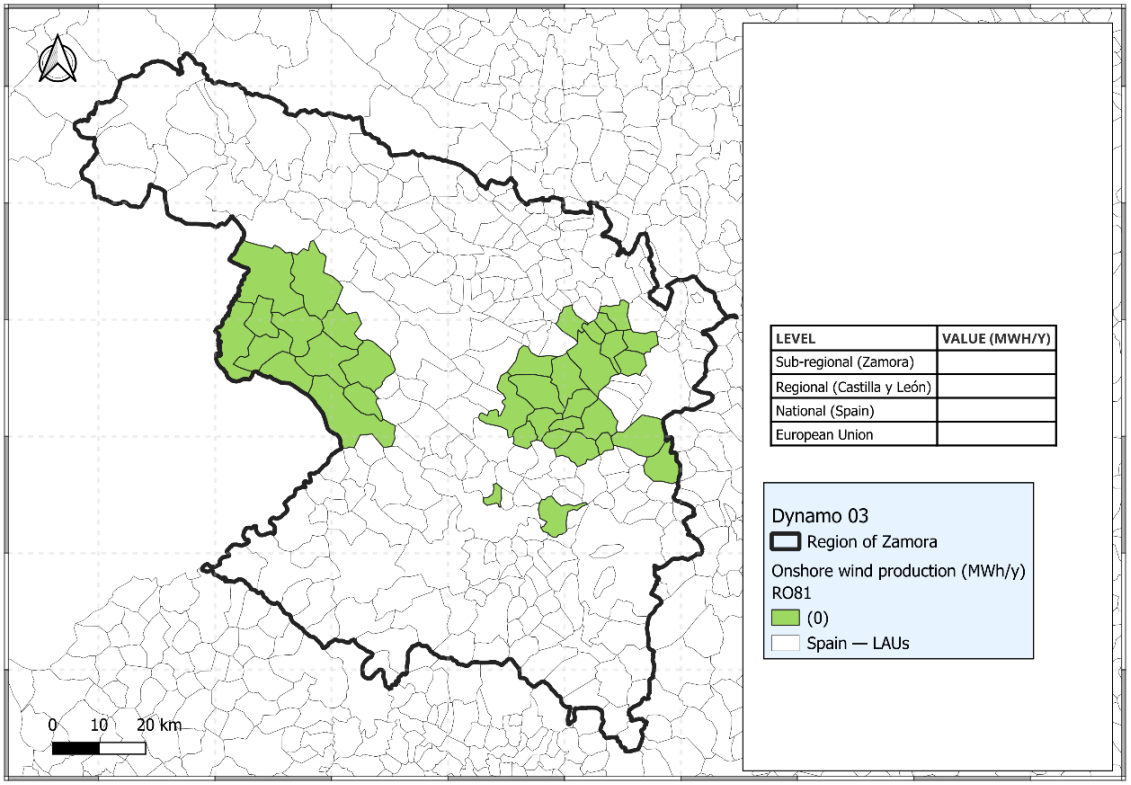


Figure 54. Dynamo 3. Onshore wind production

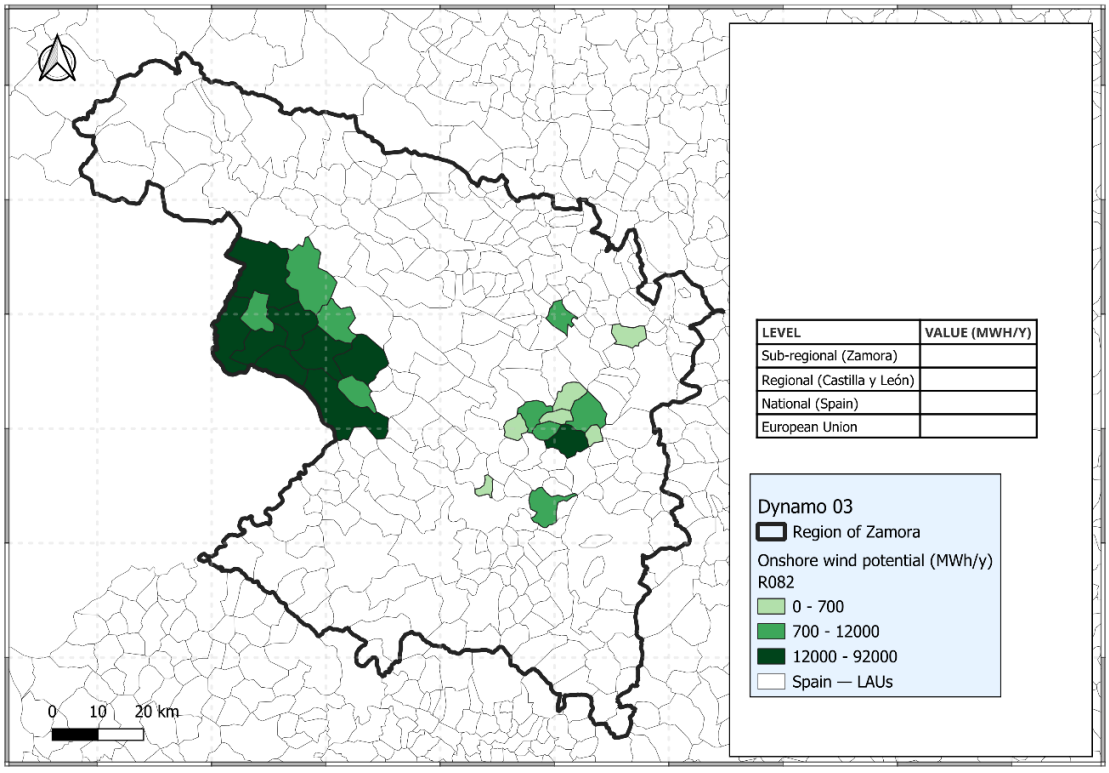


Figure 55. Dynamo 3. Onshore wind potential

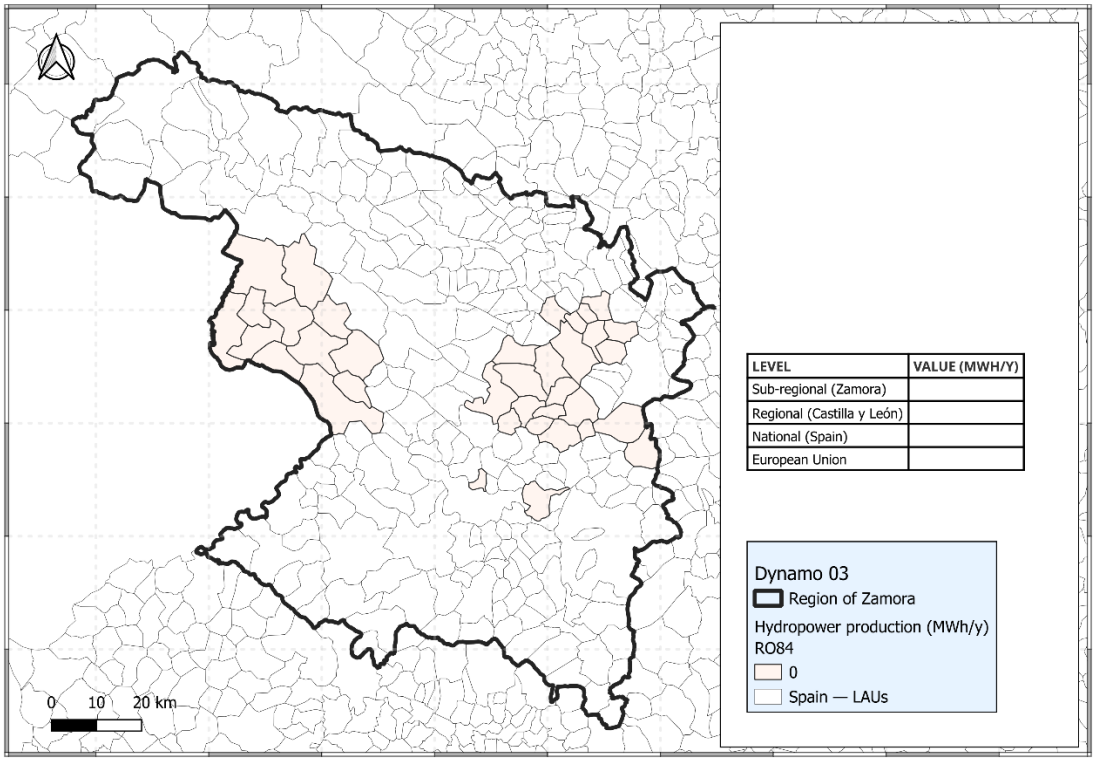


Figure 56. Dynamo 3. Hydropower production

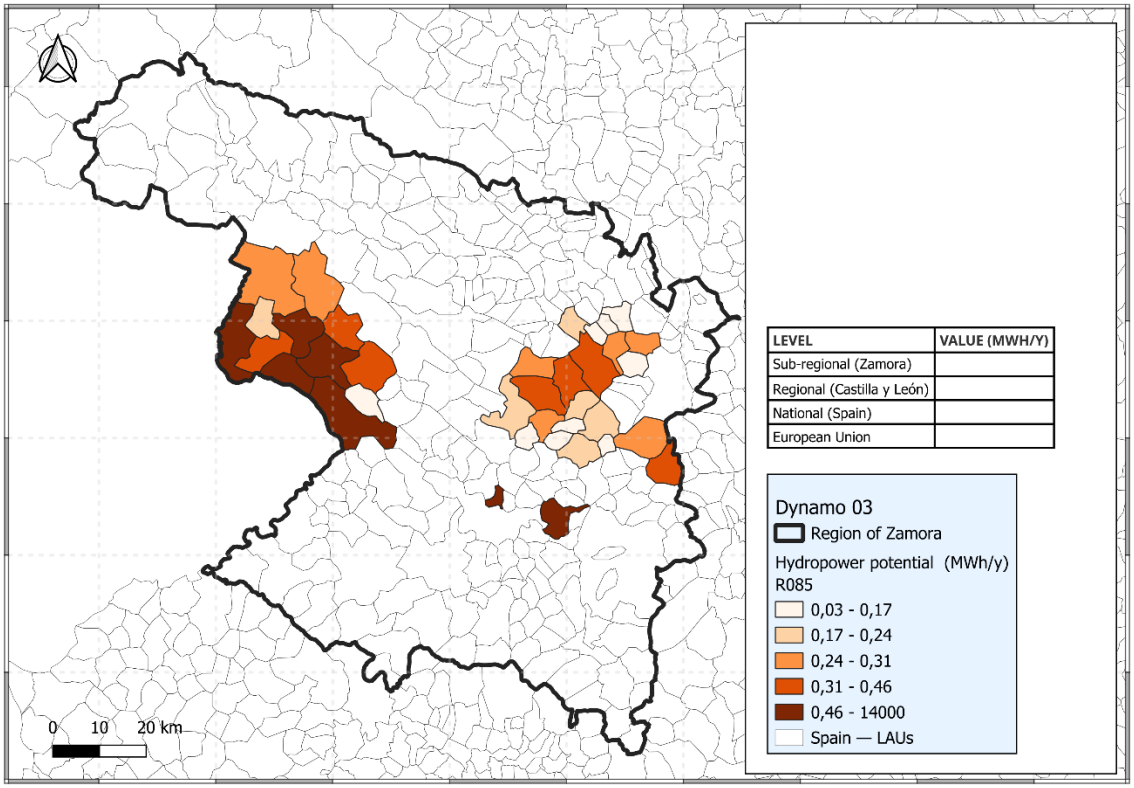


Figure 57. Dynamo 3. Hydropower potential

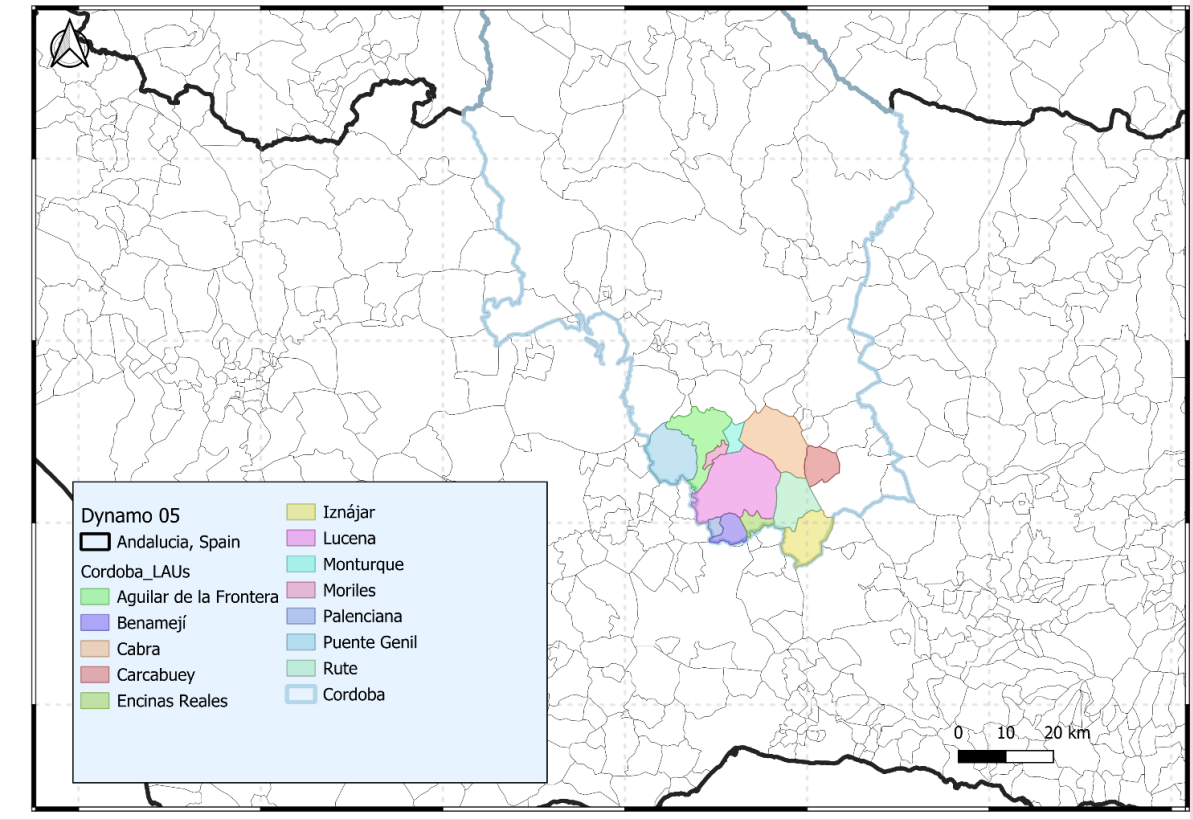
D5. Andalucía, Spain

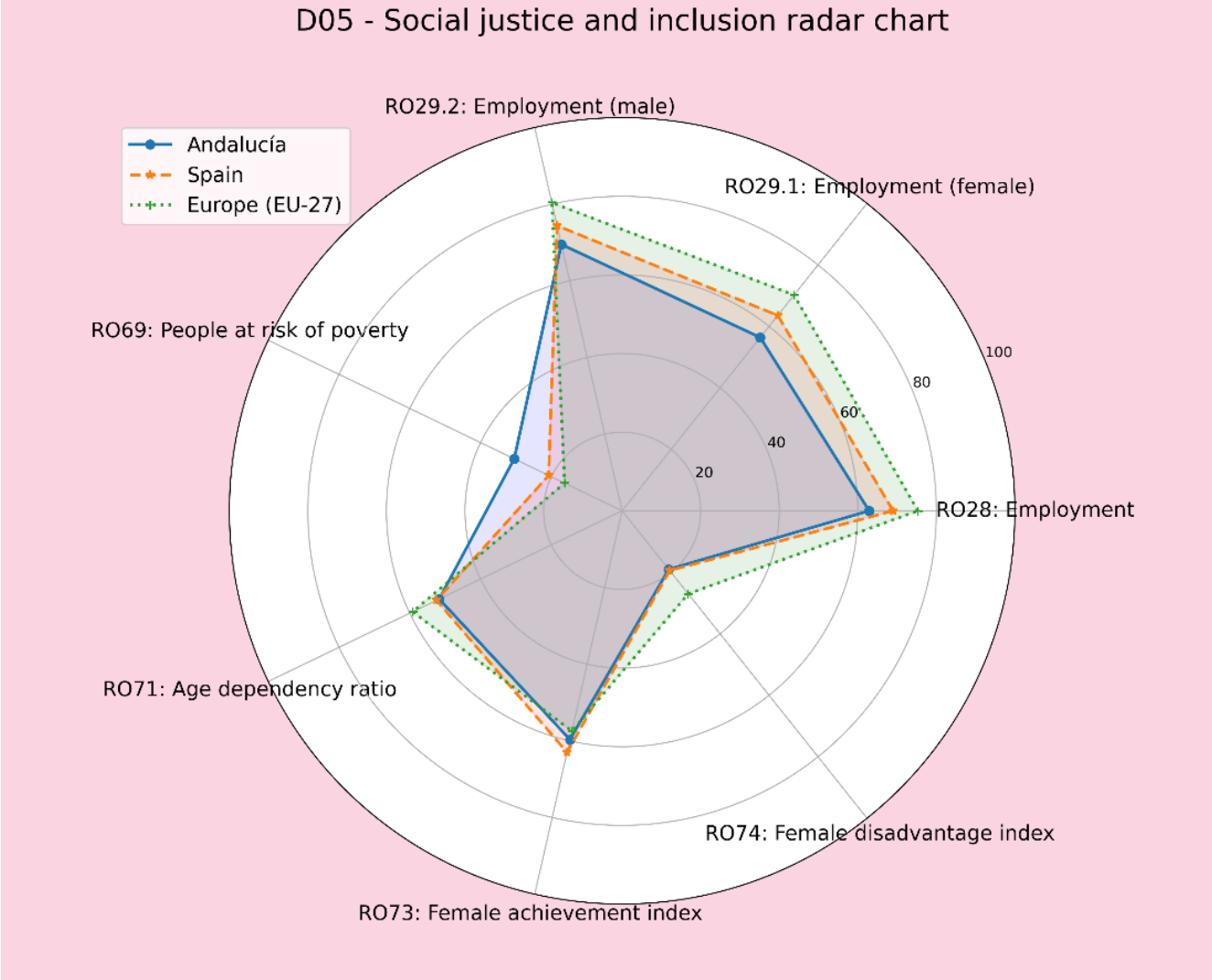
Cross-Cutting priorities

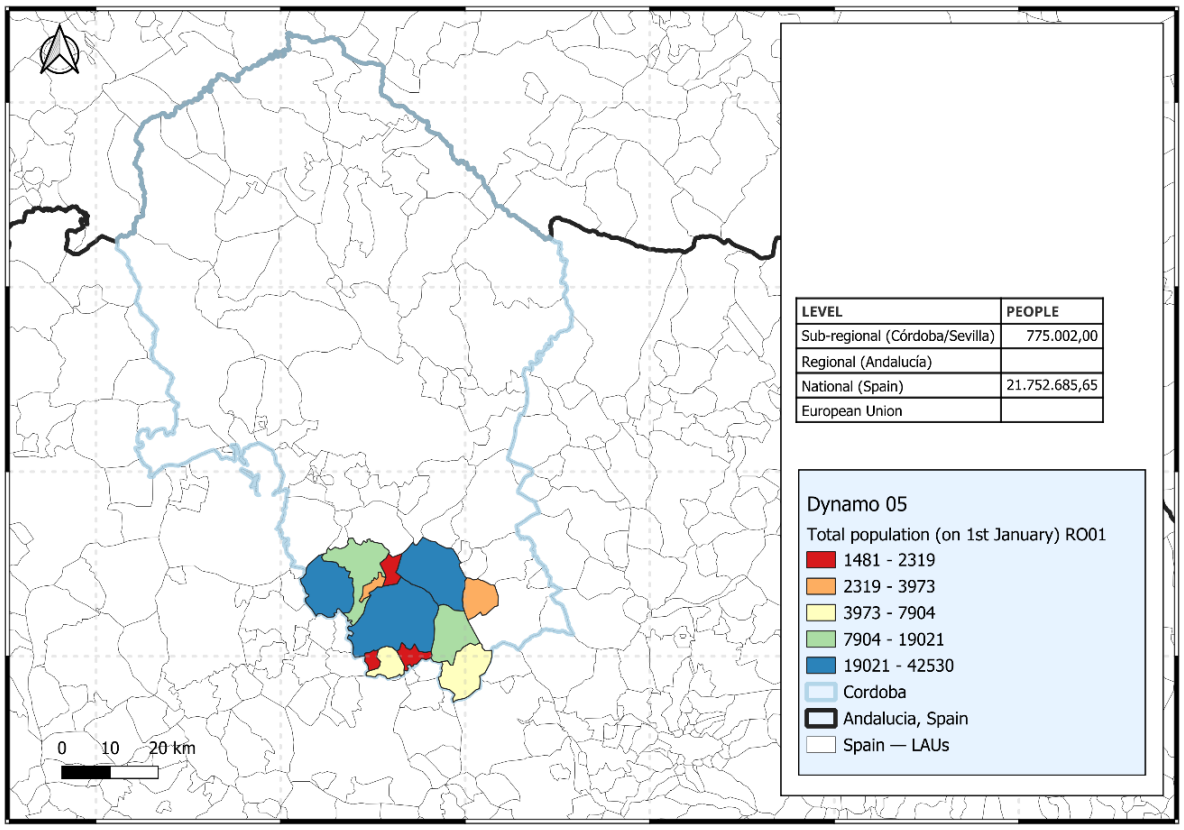
Social Justice and Inclusion

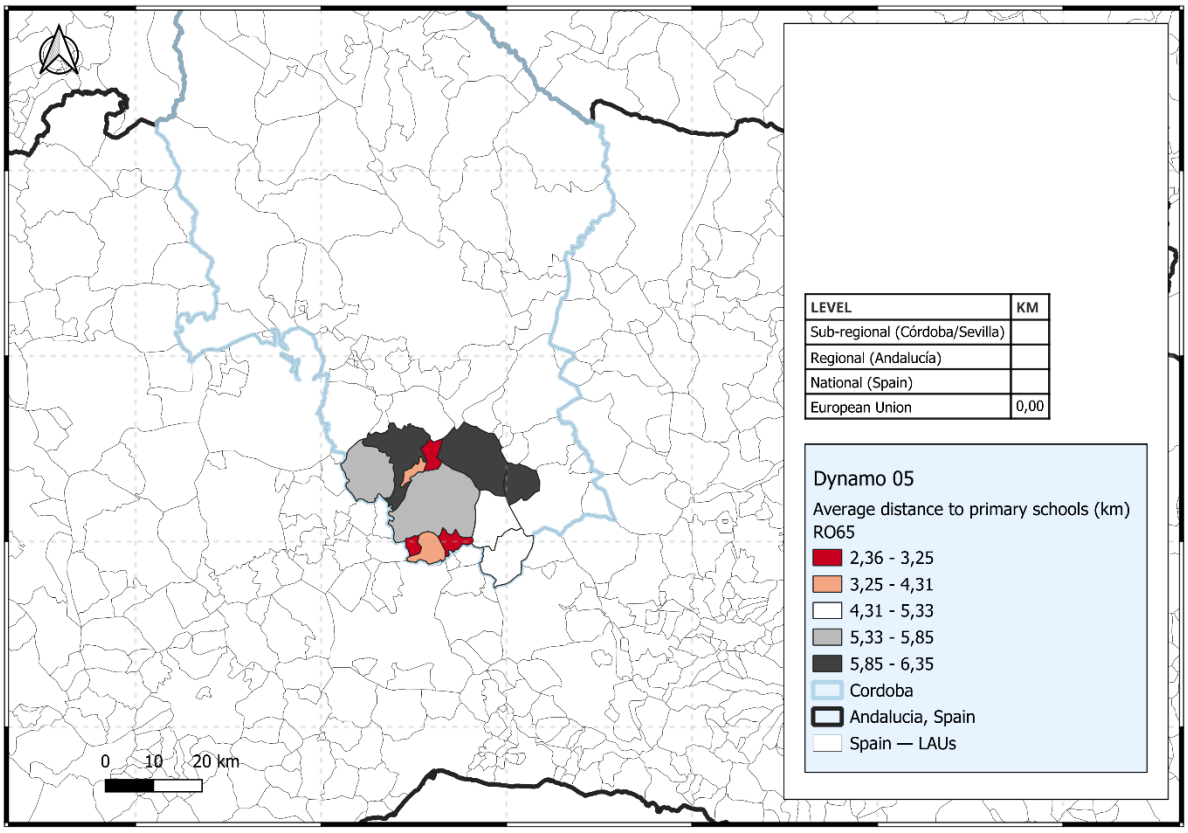
RDD

Local services, health and wellbeing




D05 - Social justice and inclusion radar chart
Andalucía
Spain
Europe (EU-27)
RO29.2: Employment (male)
RO29.1: Employment (female)
RO28: Employment
RO74: Female disadvantage index
RO73: Female achievement index
RO71: Age dependency ratio
RO69: People at risk of poverty
20
40
60
80
100

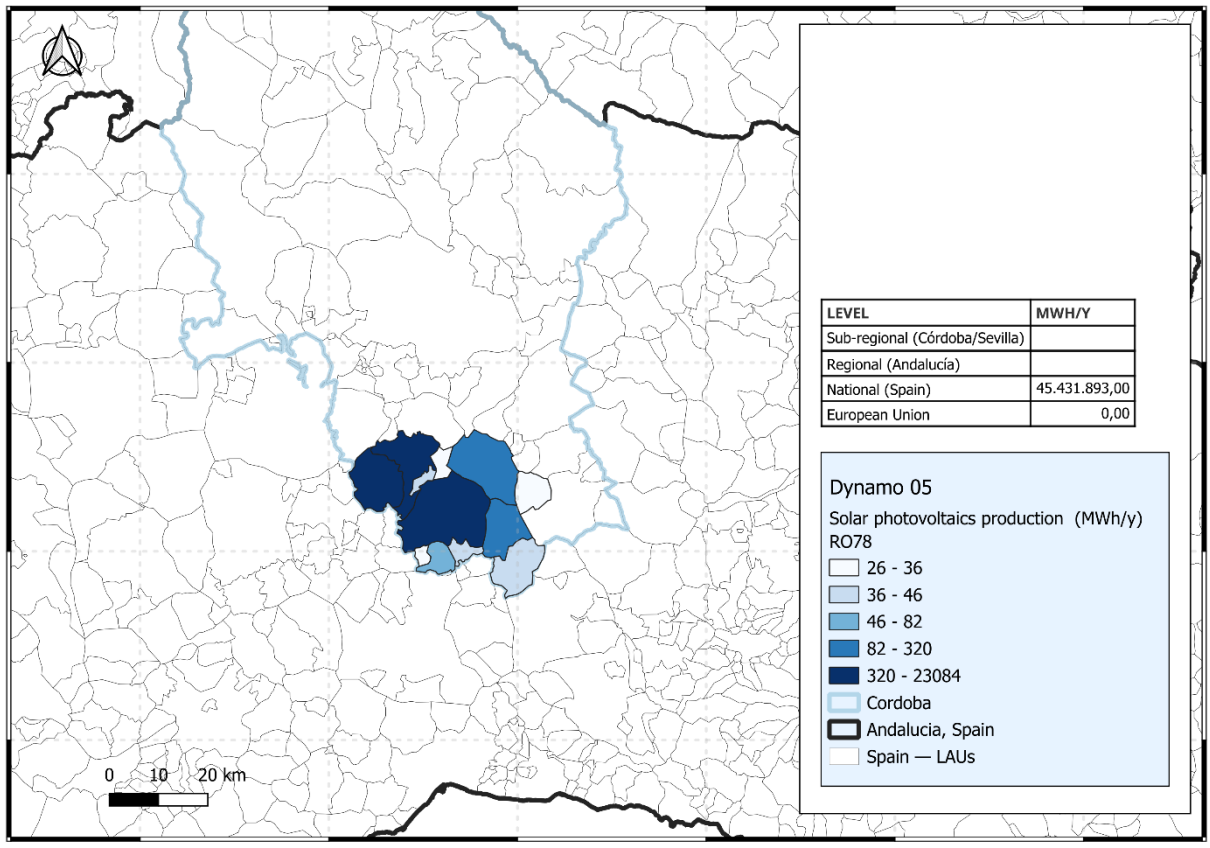

LEVEL
PEOPLE
Sub-regional (Córdoba/Sevilla)
775.002,00
Regional (Andalucía)
National (Spain)
21.752.685,65
European Union
Dynamo 05
Total population (on 1st January) RO01
1481 - 2319
2319 - 3973
3973 - 7904
7904 - 19021
19021 - 42530
Cordoba
Andalucia, Spain
Spain — LAUs
0 10 20 km

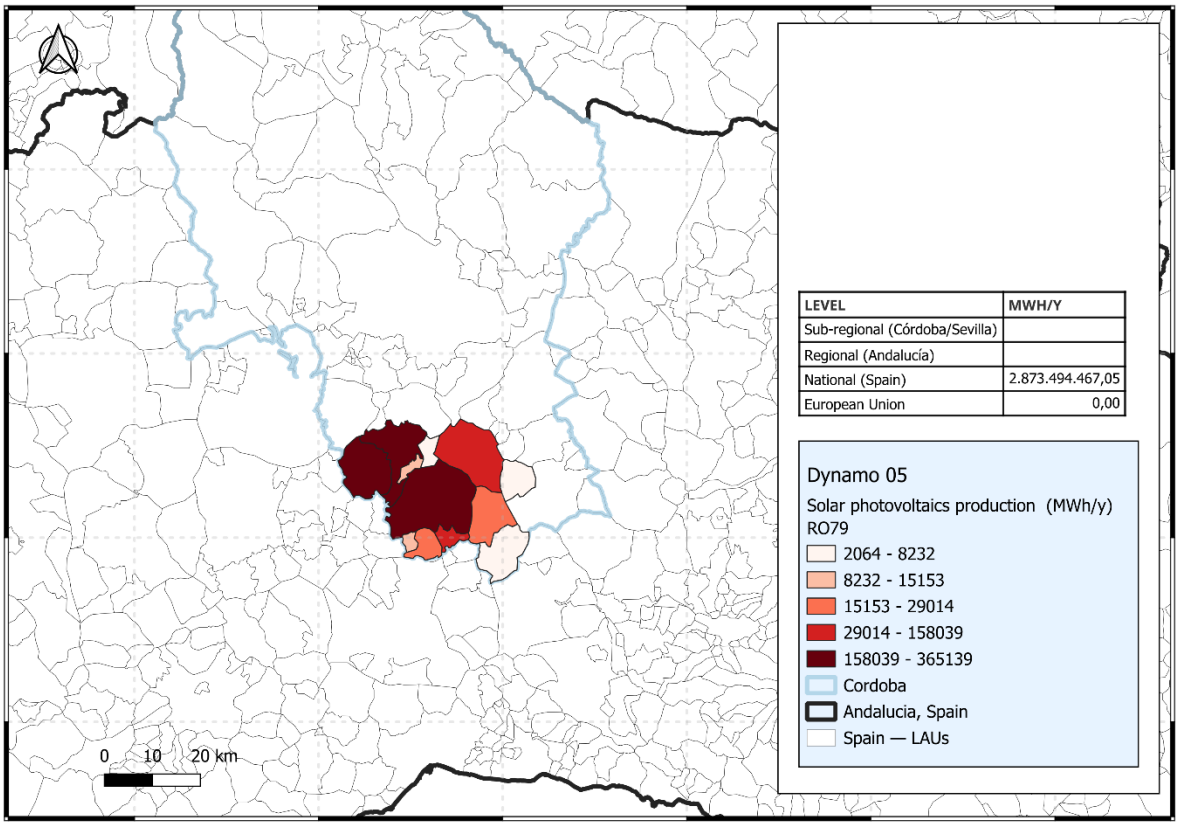

LEVEL
KM
Sub-regional (Córdoba/Sevilla)
Regional (Andalucía)
National (Spain)
European Union
0,00
Dynamo 05
Average distance to primary schools (km) RO65
2,36 - 3,25
3,25 - 4,31
4,31 - 5,33
5,33 - 5,85
5,85 - 6,35
Cordoba
Andalucia, Spain
Spain — LAUs
0 10 20 km

Climate change mitigation and adaptation

Sustainable agrifood systems and ecosystem management

Energy transition and climate neutrality





D6. Zagori, Greece

Cross-Cutting priorities

Social Justice and Inclusion

RDD

Local services, health and wellbeing

Culture and cultural innovation

Sustainable multimodal mobility

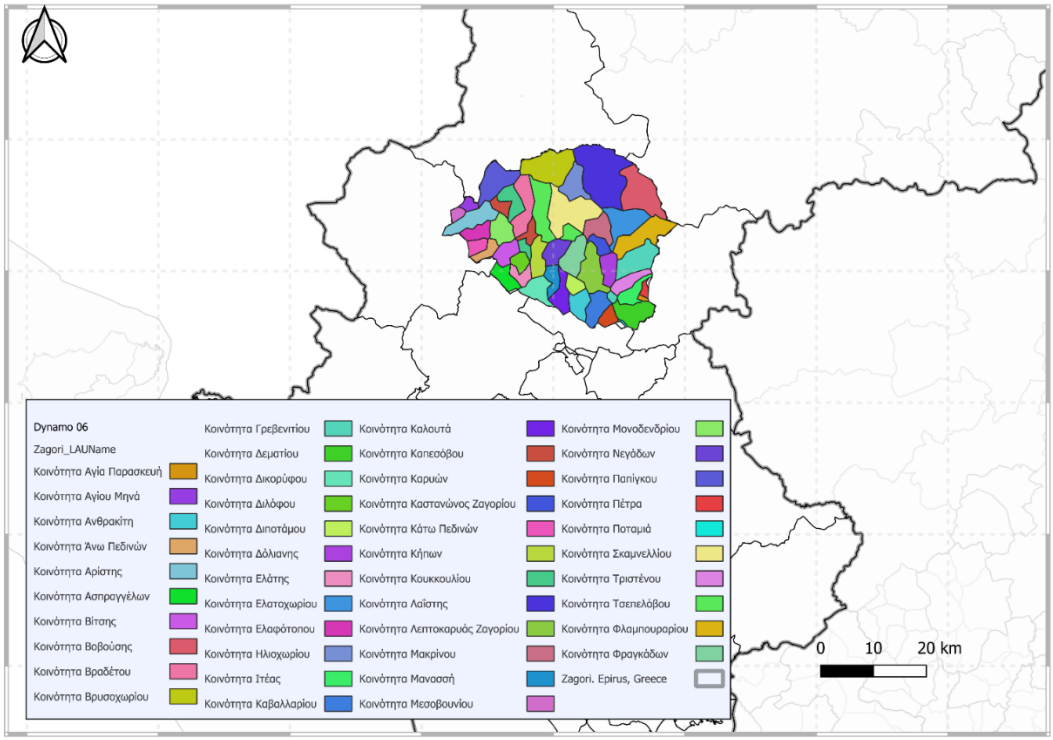


Figure 58. Dynamo 6. Administrative Context

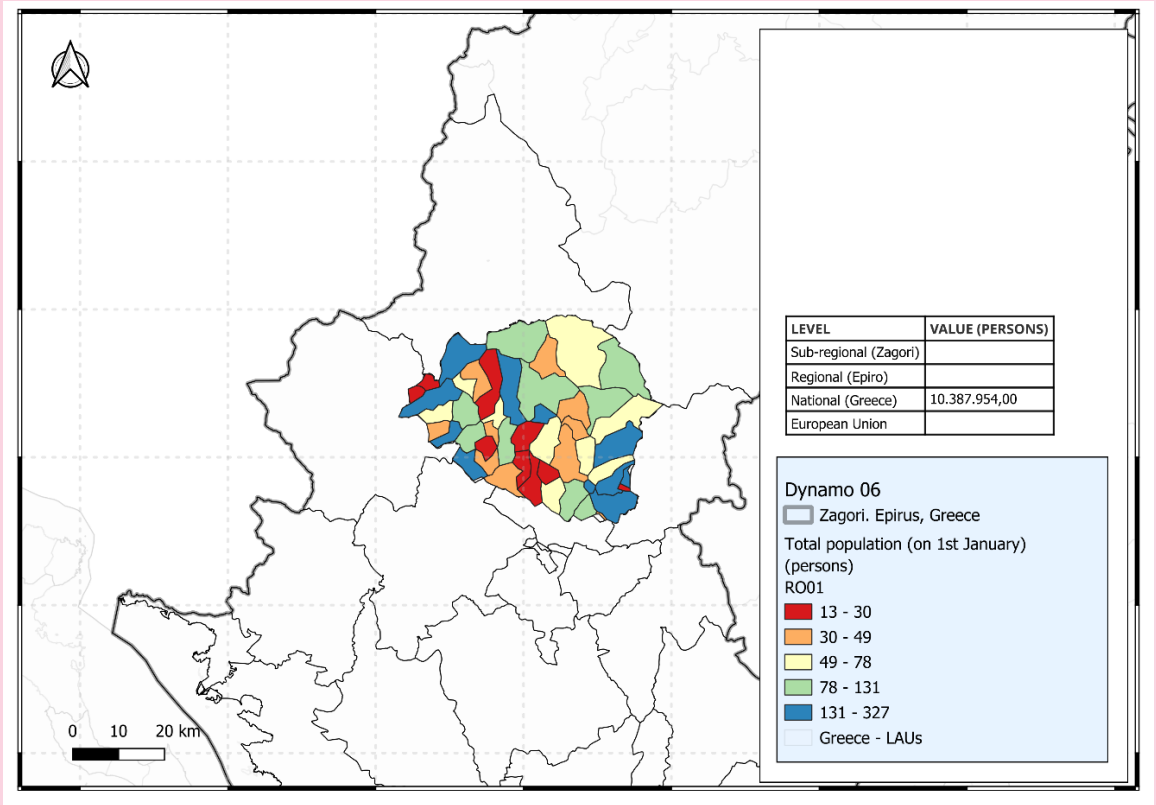
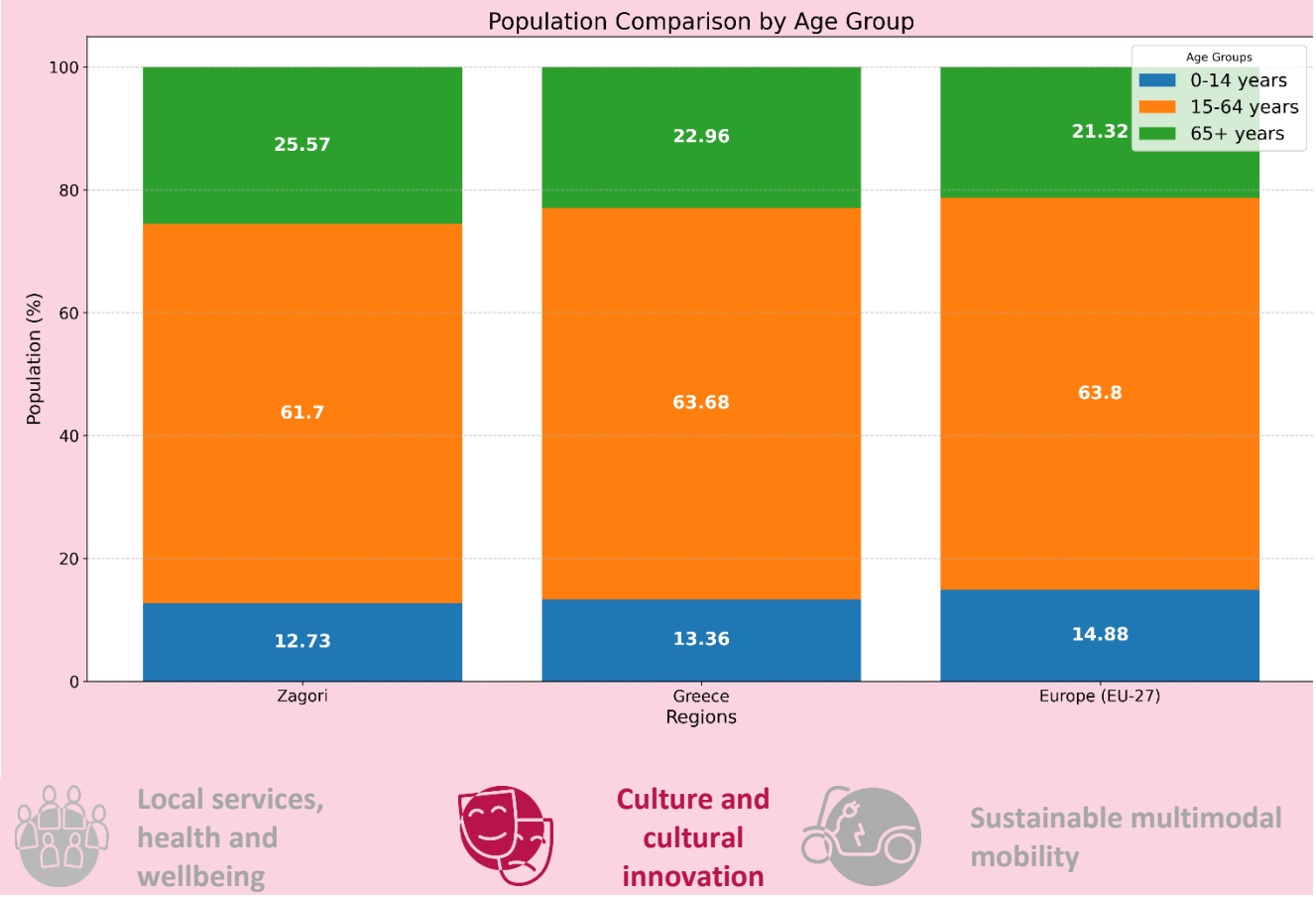


Figure 59. Dynamo 6. Population density


Population Comparison by Age Group
Age Groups
0-14 years
15-64 years
65+ years
Population (%)
100
80
60
40
20
0
25.57
22.96
21.32
61.7
63.68
63.8
12.73
13.36
14.88
Zagori
Greece
Europe (EU-27)
Regions
Local services, health and wellbeing
Culture and cultural innovation
Sustainable multimodal mobility

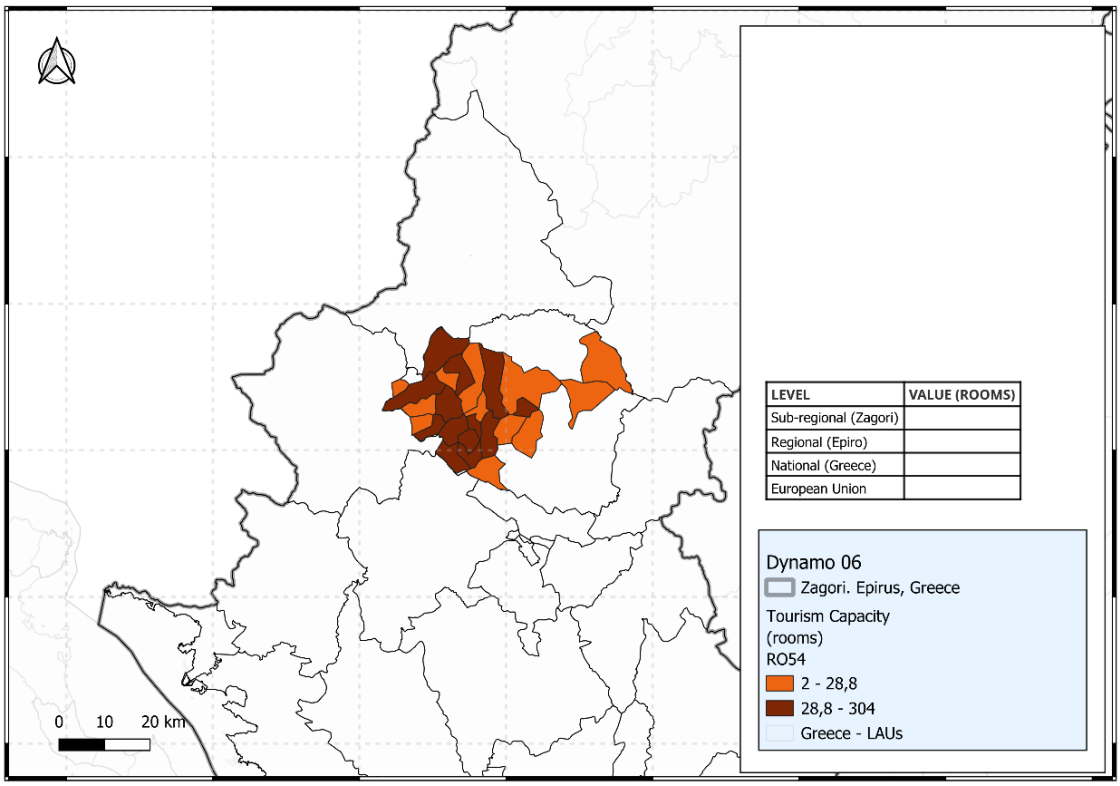


Figure 60. Dynamo 6. Tourism capacity

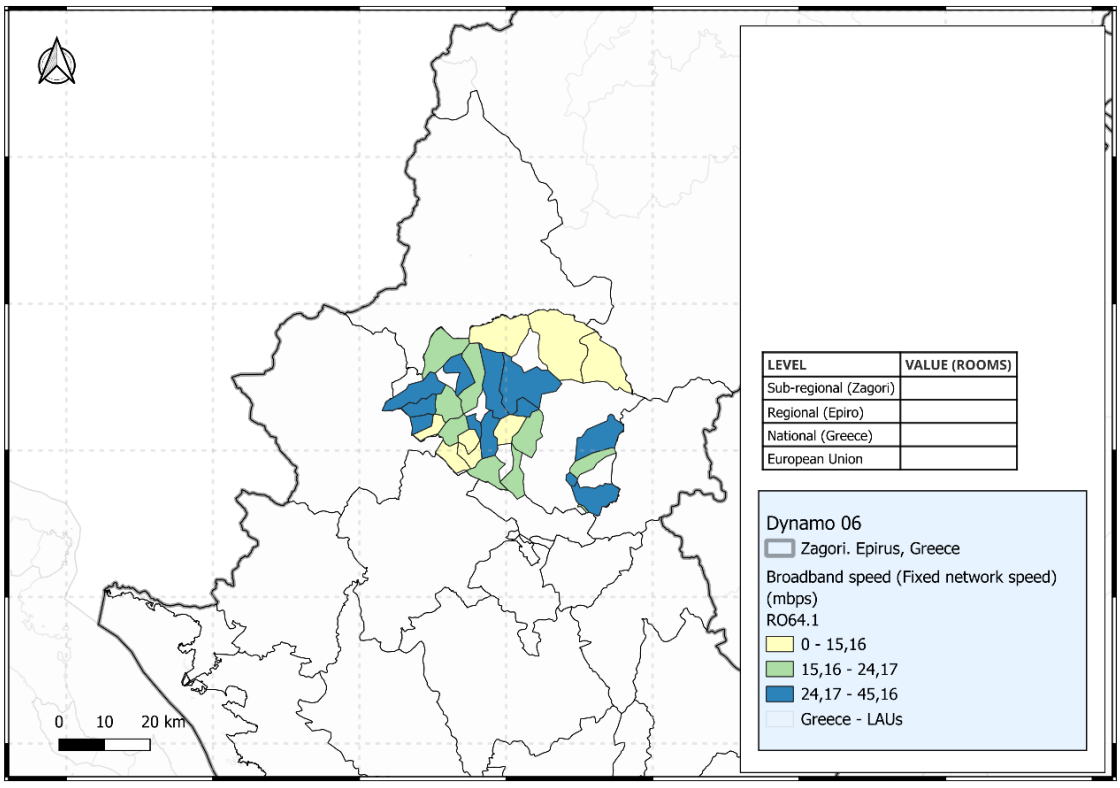


Figure 61. Dynamo 6. Broadband speed (Fixed network speed)

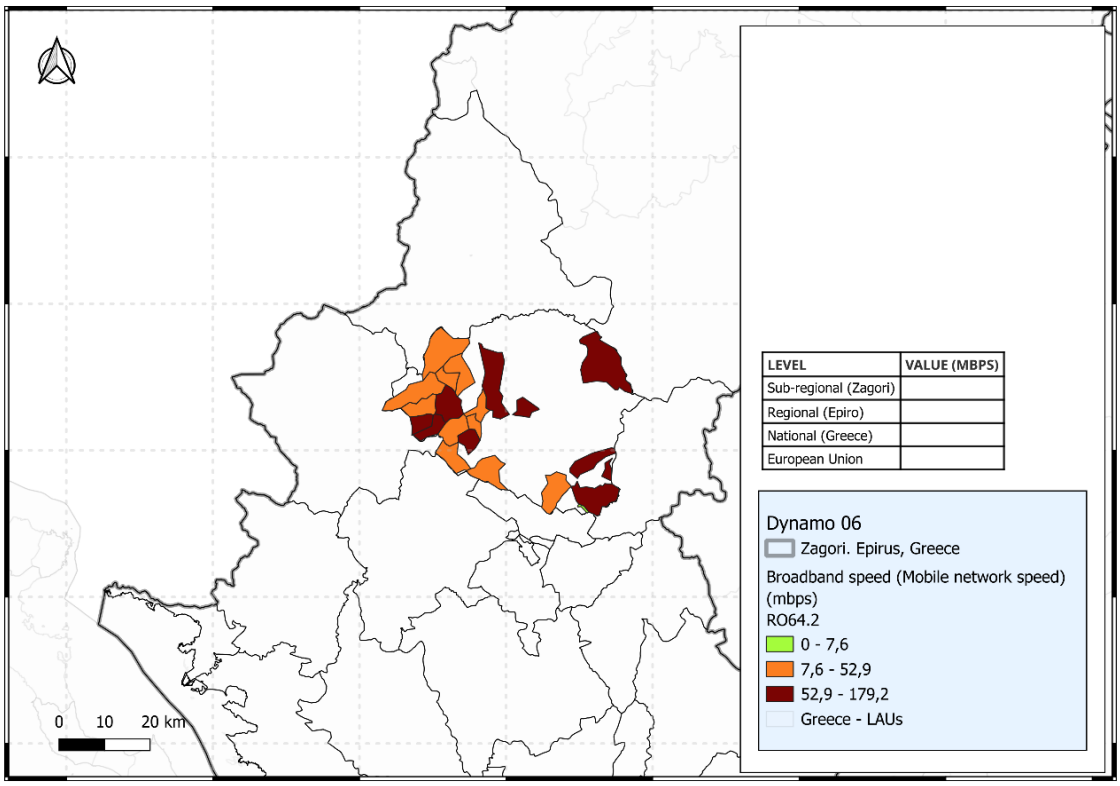


Figure 62. Dynamo 6. Broadband speed (Mobile network speed)

Local services, health and wellbeing

Culture and cultural innovation

Sustainable multimodal mobility

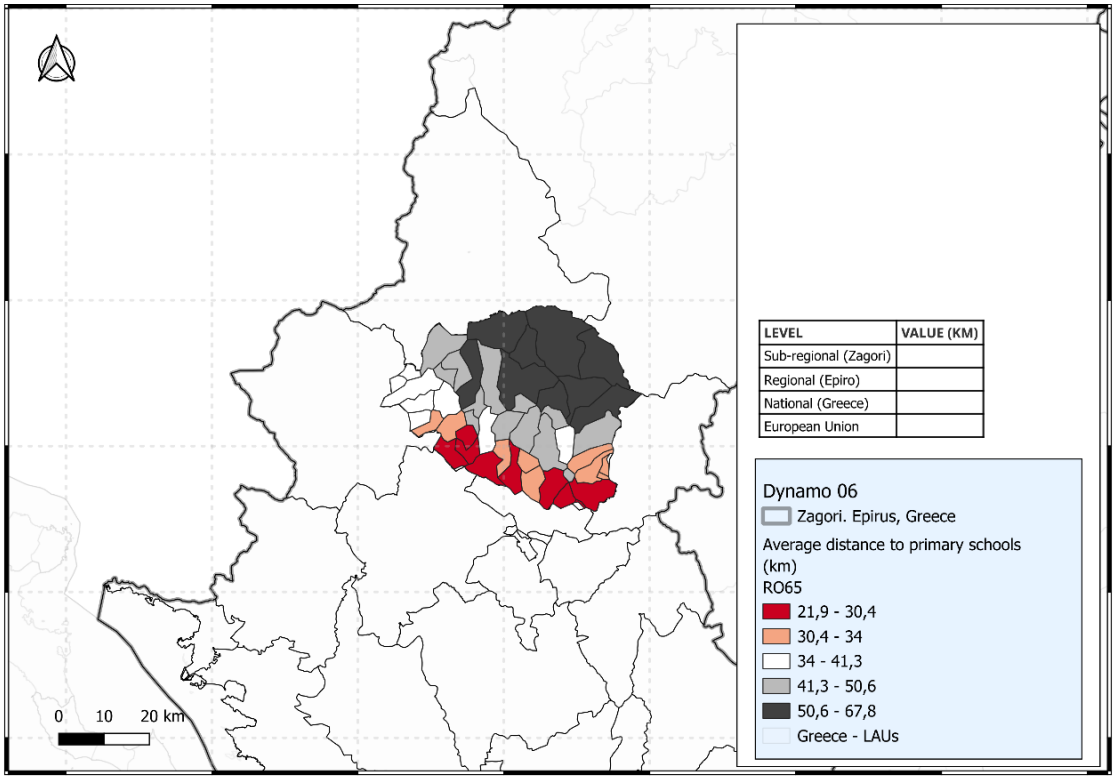


Figure 63. Dynamo 6. Average distance to primary schools

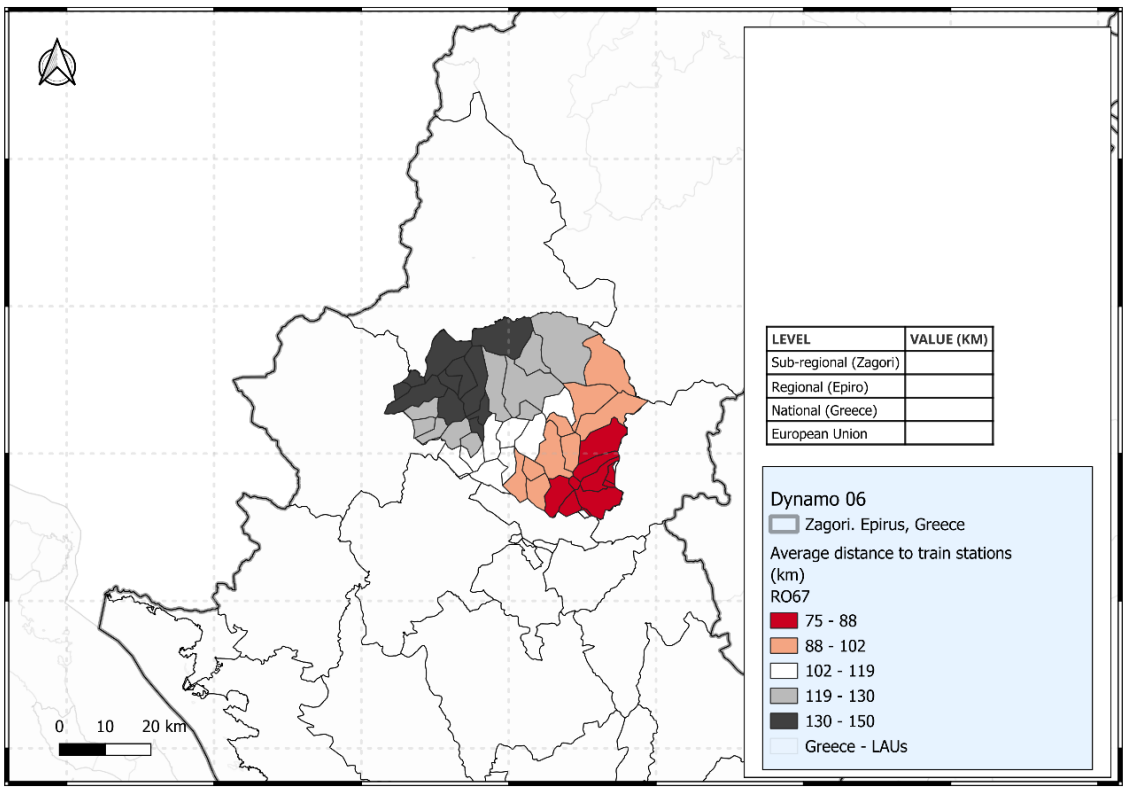


Figure 64. Dynamo 6. Average distance to train stations

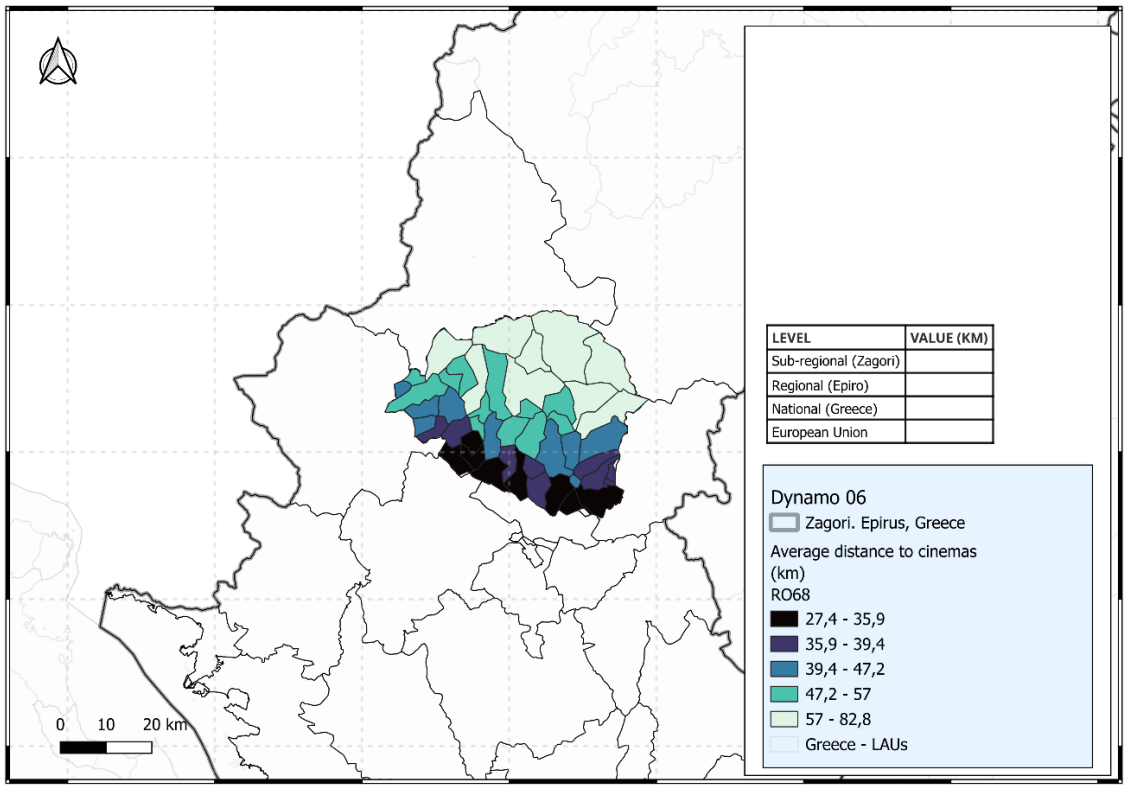


Figure 65. Dynamo 6. Average distance to cinemas

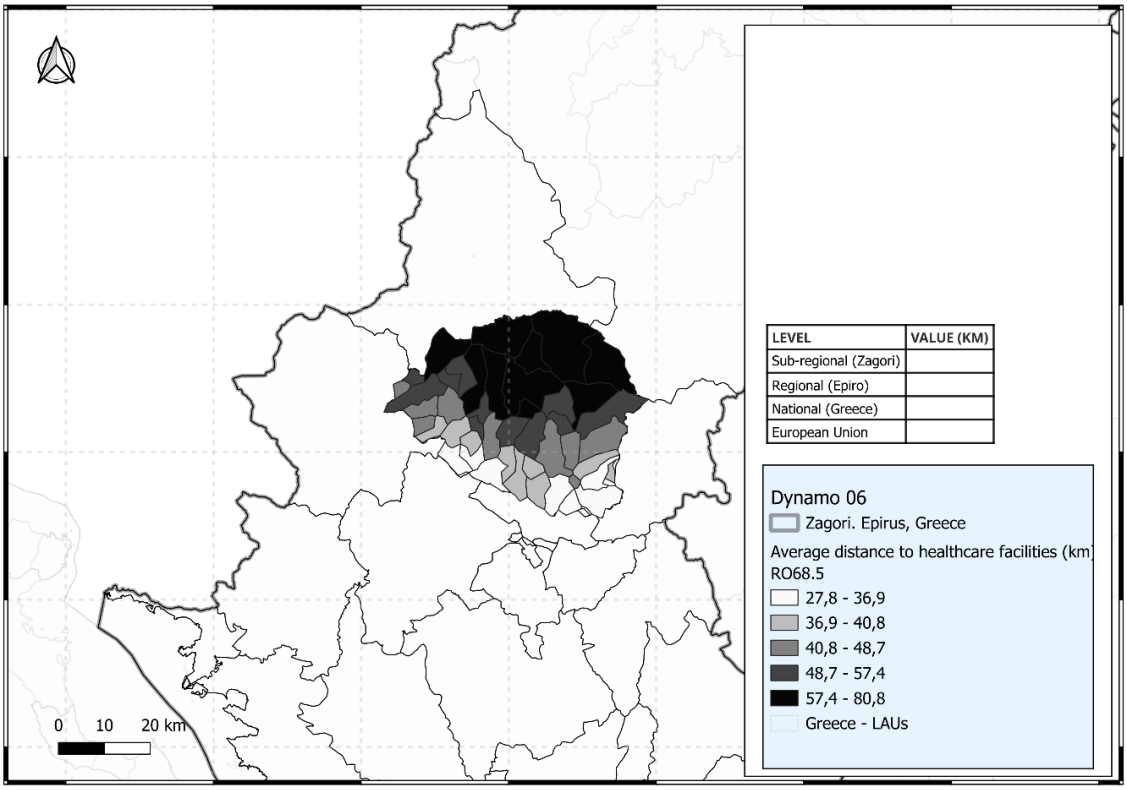


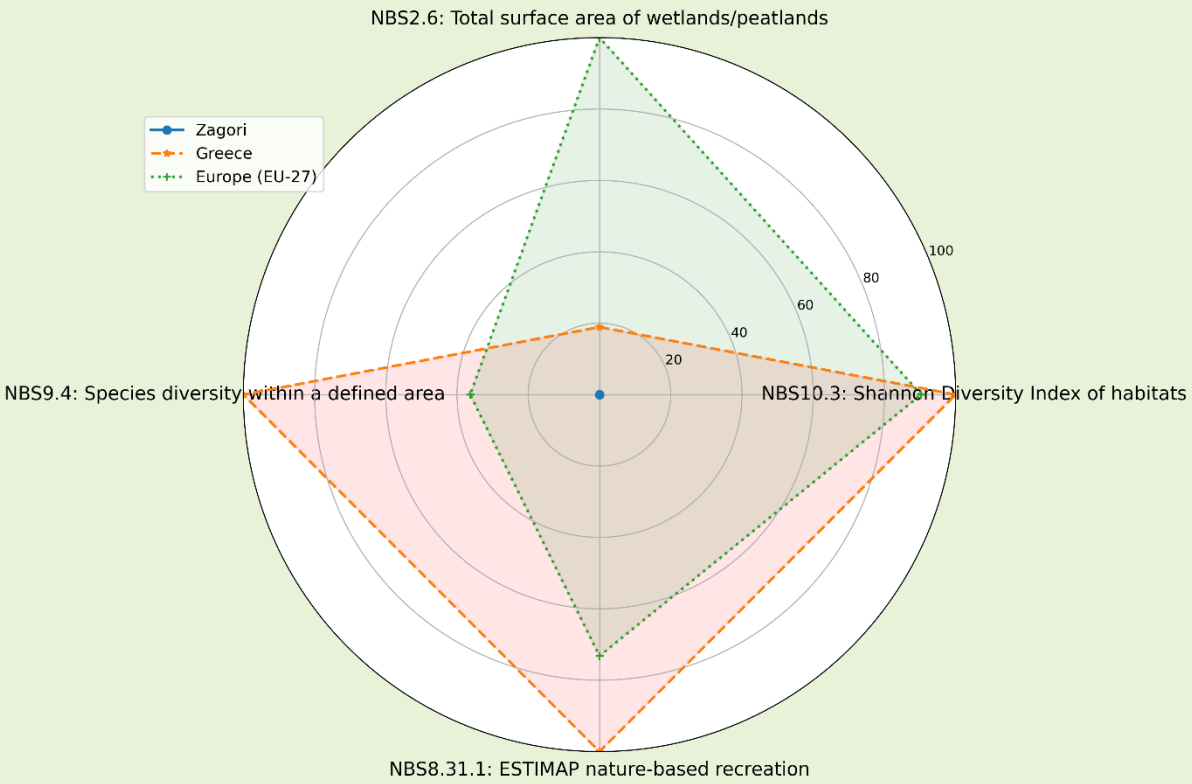
Figure 66. Dynamo 6. Average distance to healthcare facilities

Biodiversity

Energy transition and climate neutrality

Nature-based and cultural Tourism

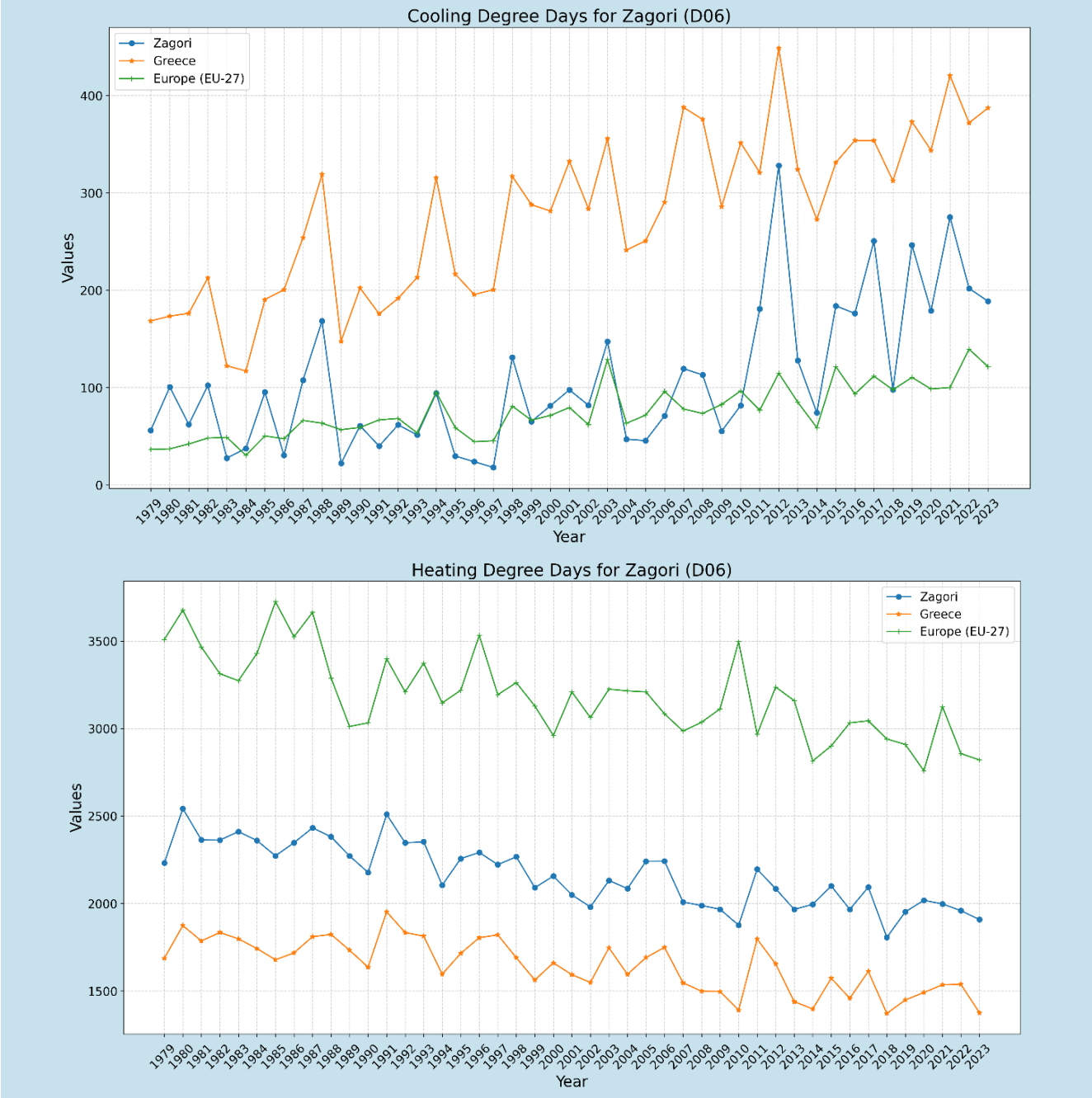
D06 - Biodiversity radar chart



Climate change mitigation and adaptation

Energy transition and climate neutrality

Sustainable multimodal mobility


Cooling Degree Days for Zagori (D06)
Zagori
Greece
Europe (EU-27)
Values
Year
Heating Degree Days for Zagori (D06)
Zagori
Greece
Europe (EU-27)
Values
Year

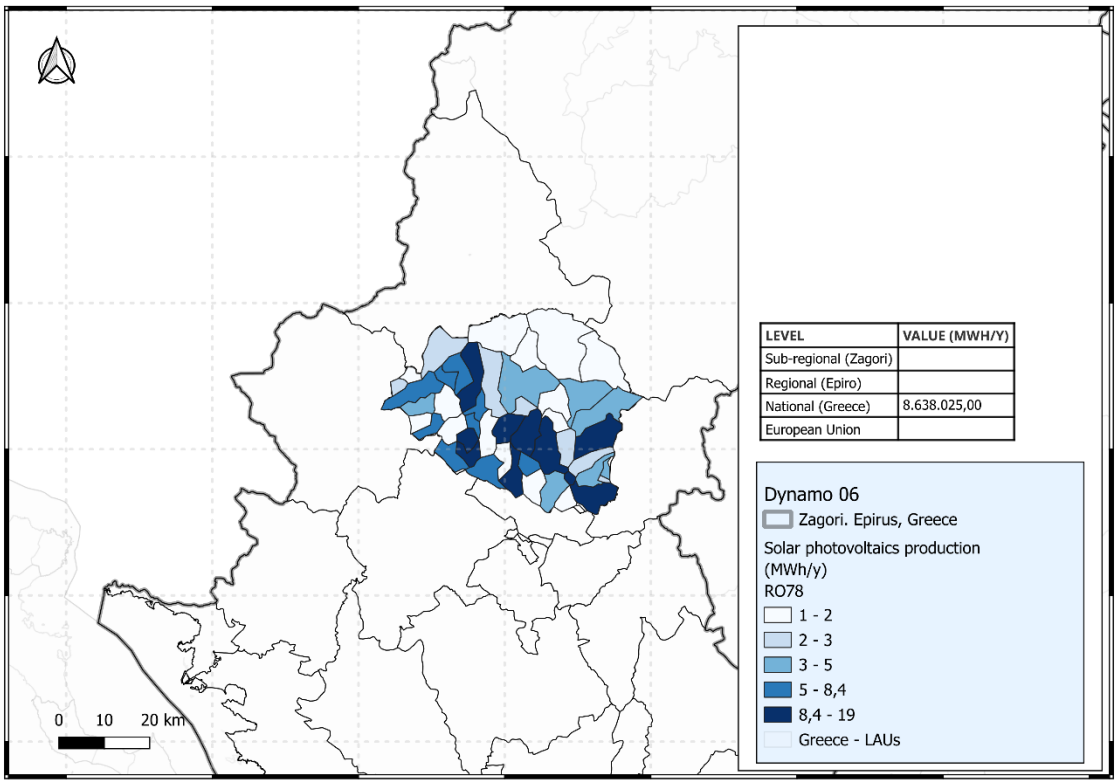


Figure 67. Dynamo 6. Solar photovoltaics production

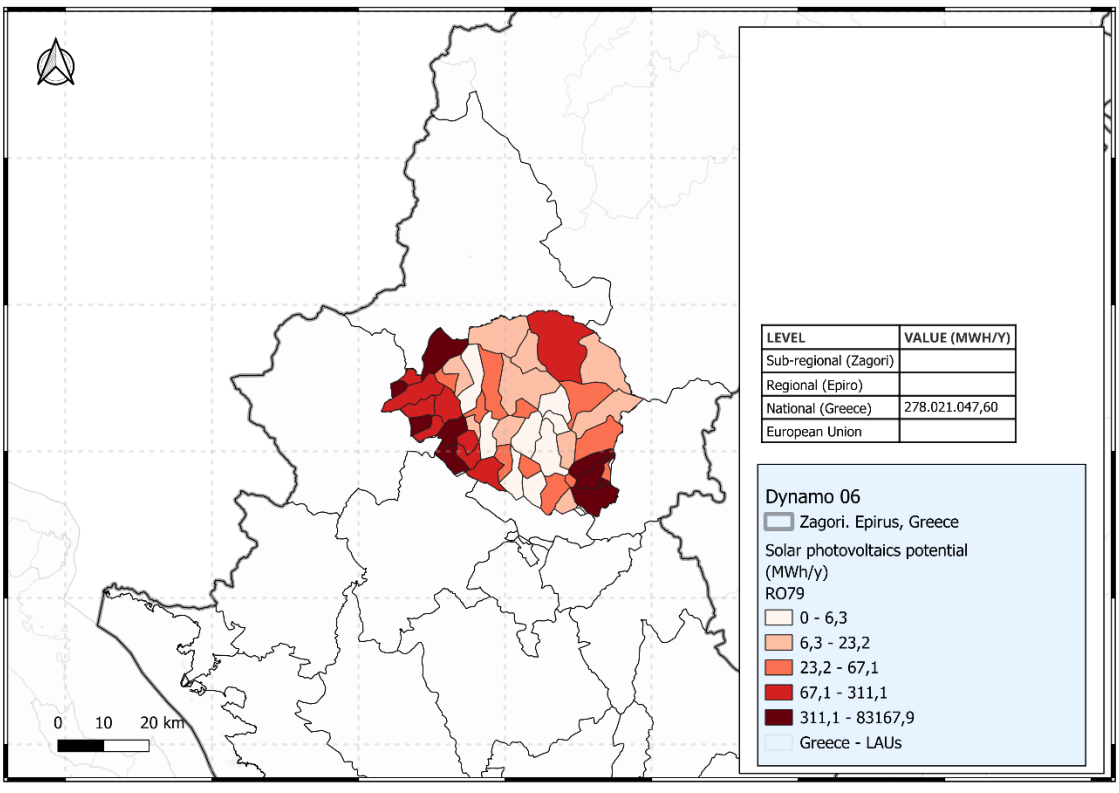


Figure 68. Dynamo 6. Solar photovoltaics potential

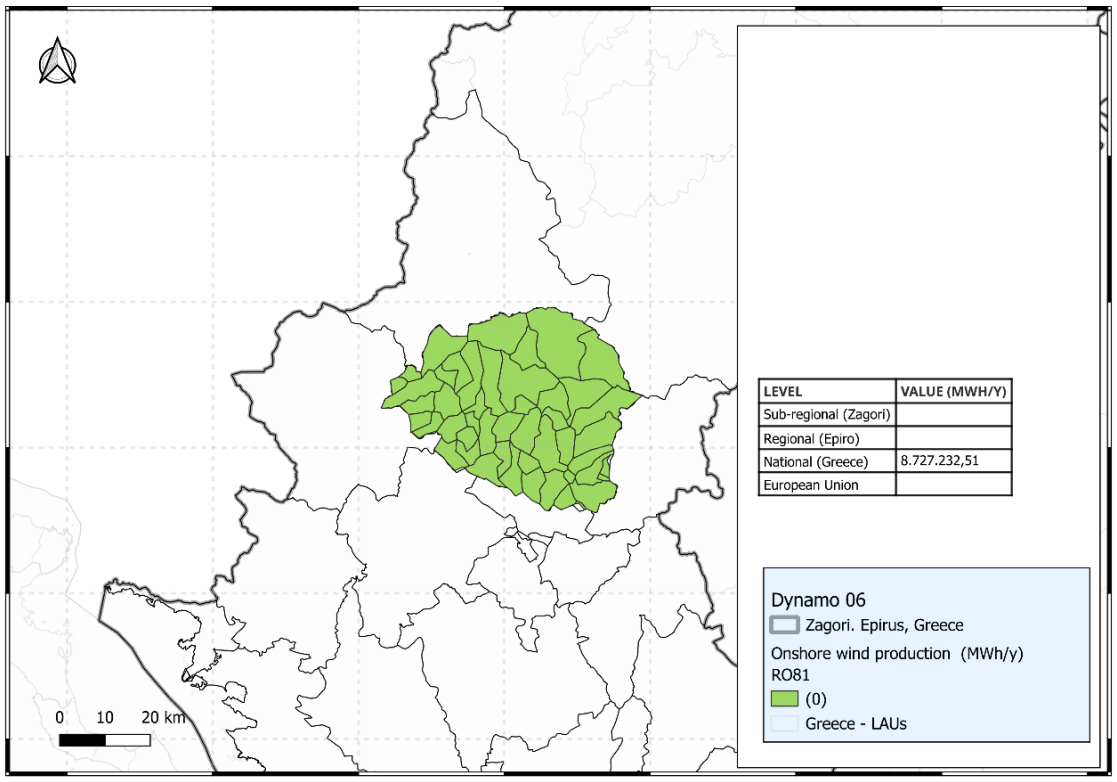


Figure 69. Dynamo 6. Onshore wind production

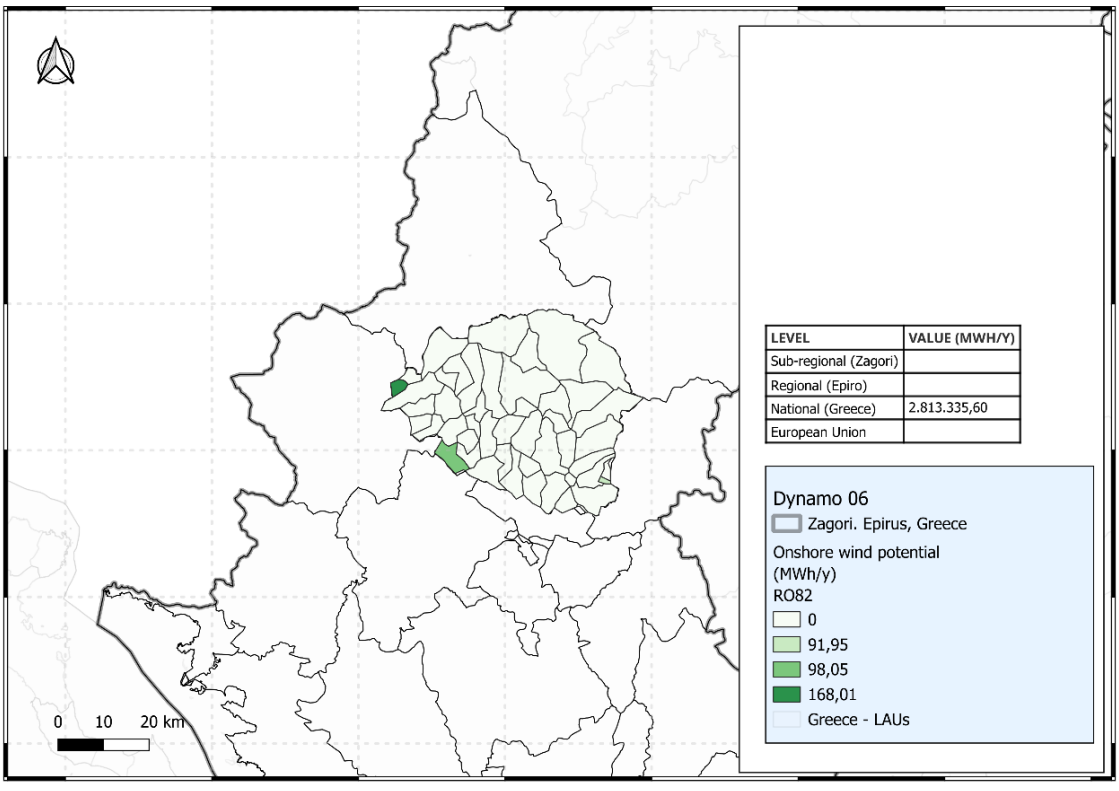


Figure 70. Dynamo 6. Onshore wind potential

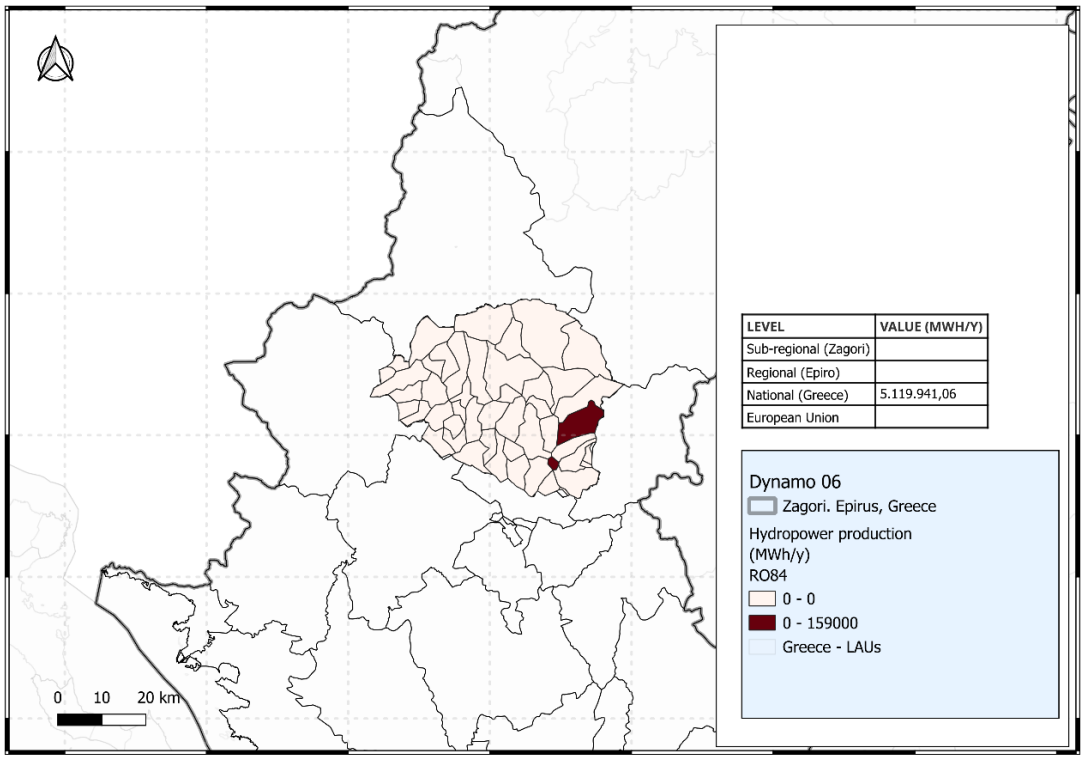


Figure 71. Dynamo 6. Hydropower production

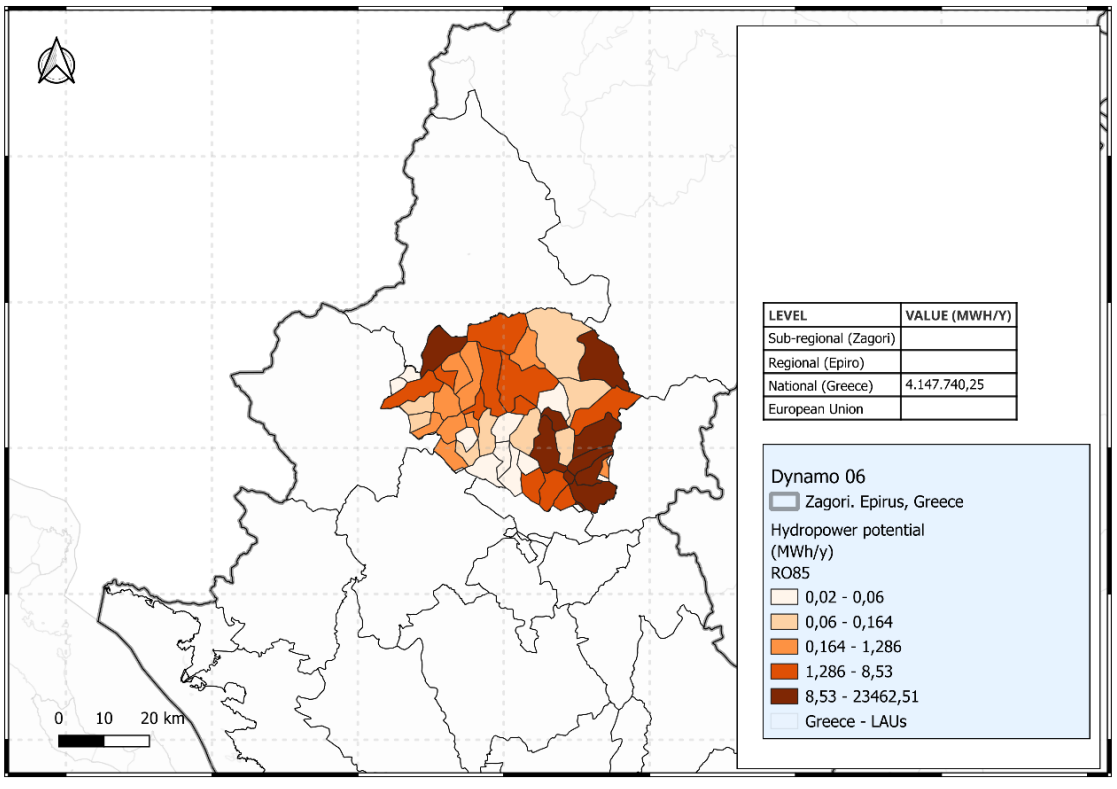


Figure 72. Dynamo 6. Hydropower potential

D8. Fiastra Valley, Italy

Cross-Cutting priorities

Social Justice and Inclusion

RDD

Local services, health and wellbeing

Culture and cultural innovation

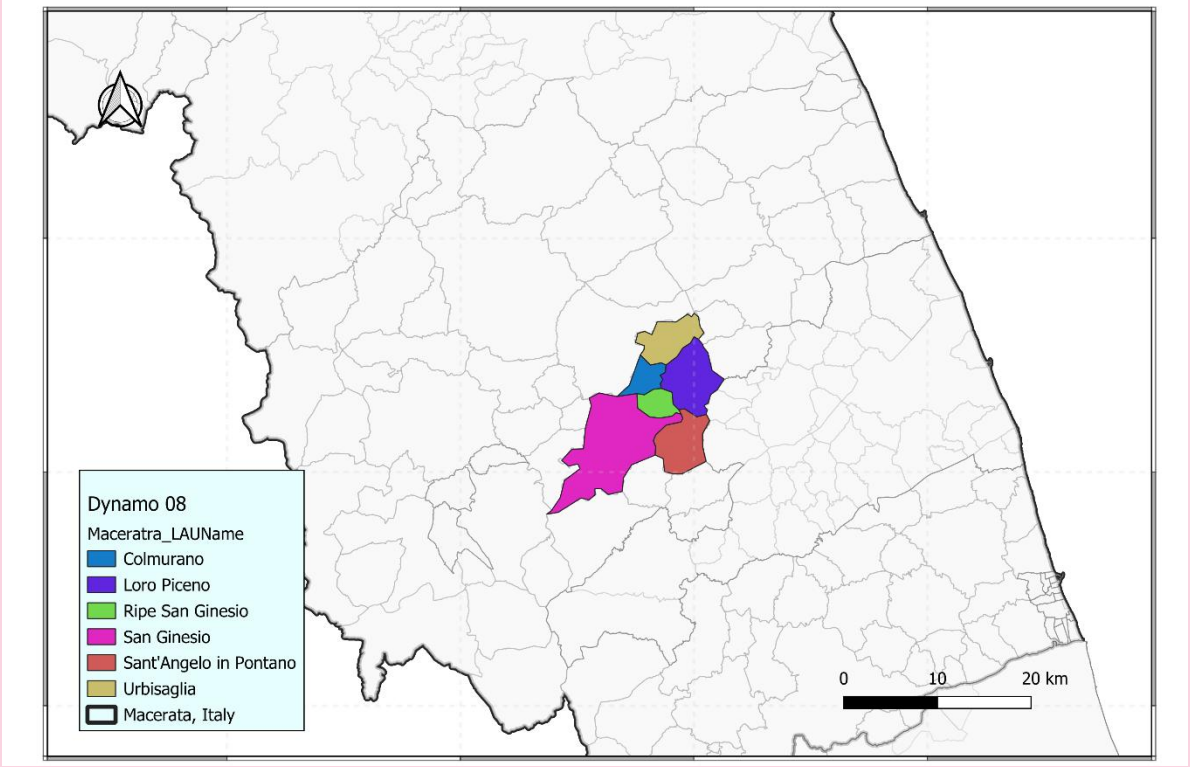


Figure 73. Dynamo 8. Administrative Context

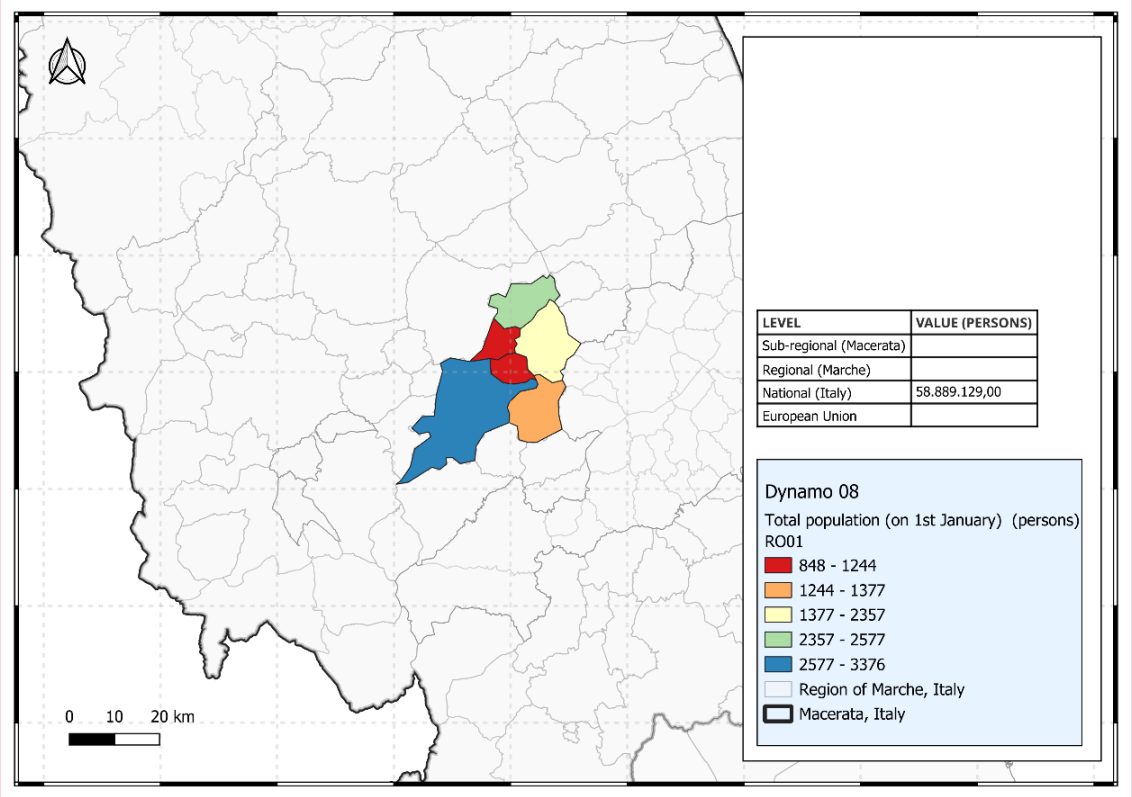
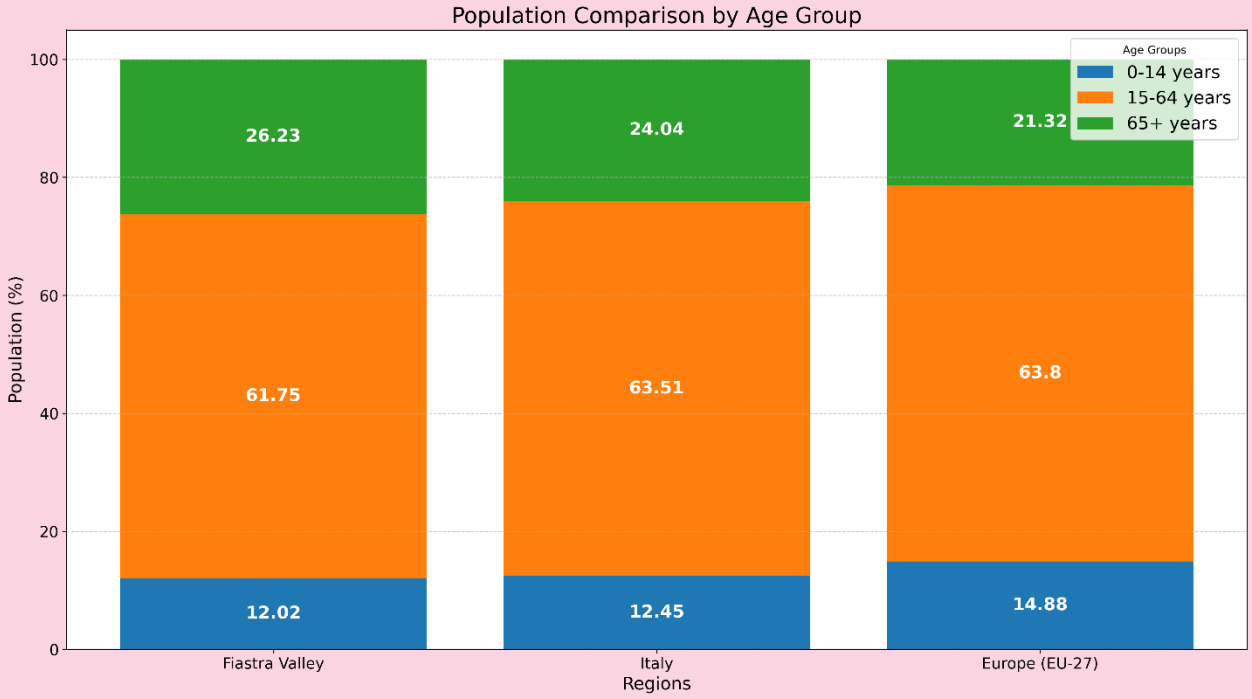


Figure 74. Dynamo 8. Population density



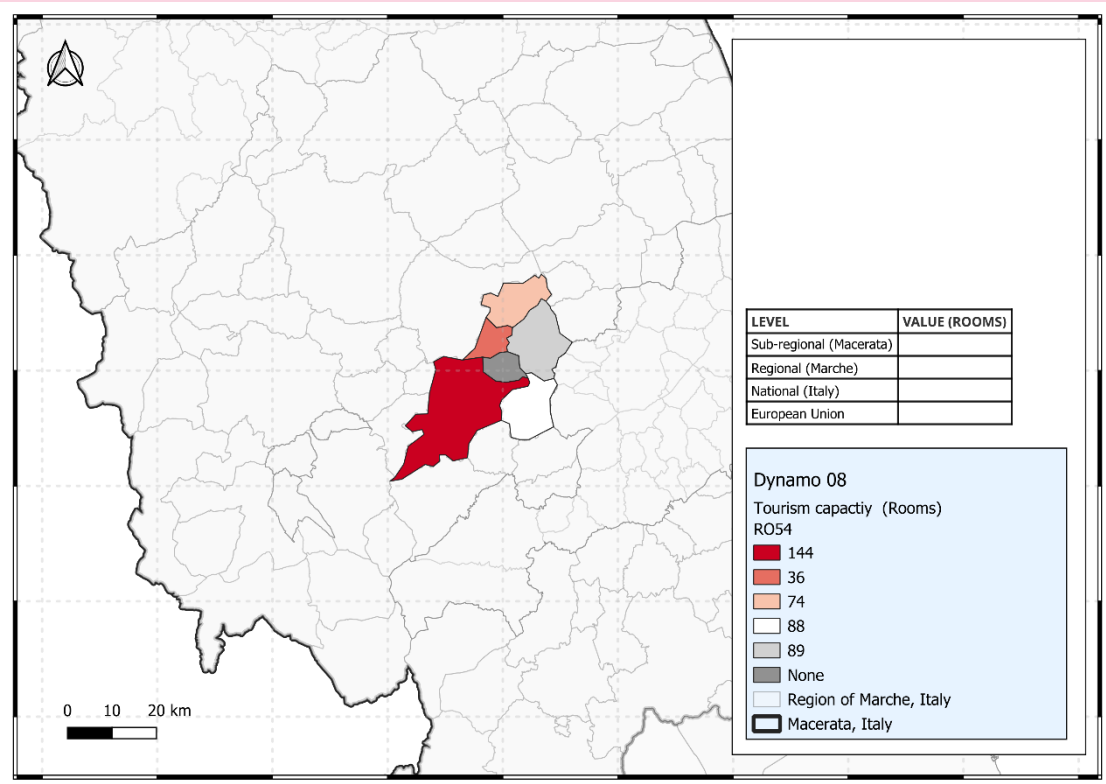


Figure 75. Dynamo 8. Tourism capacity

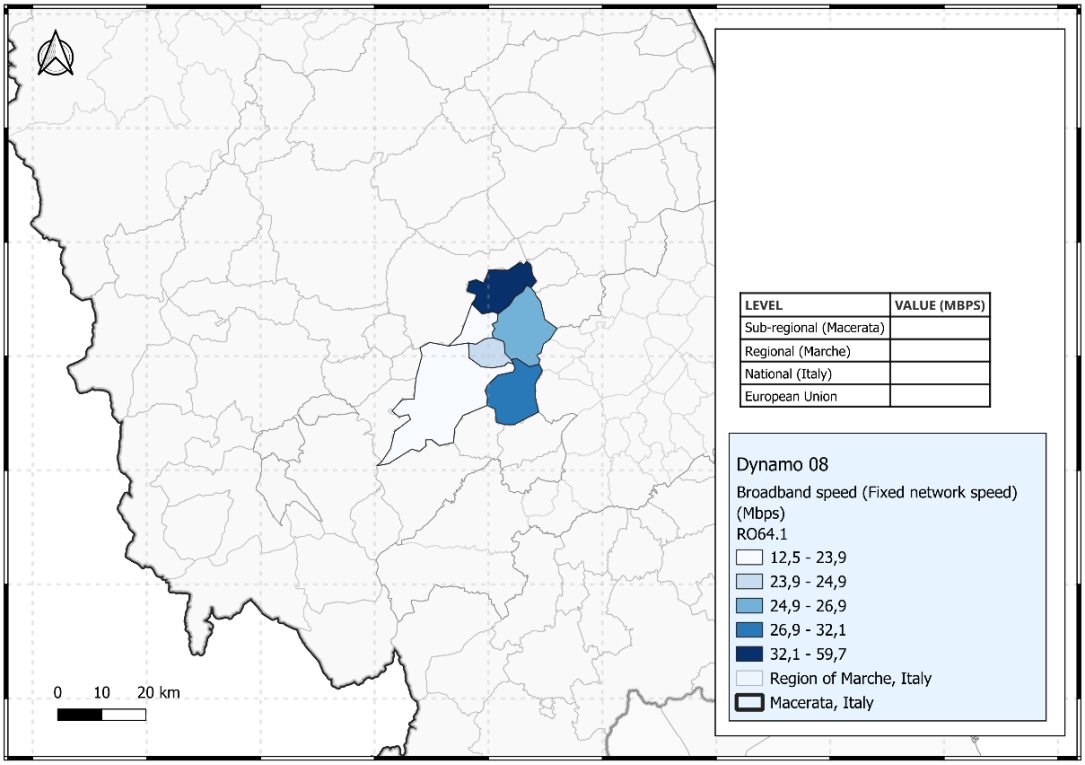


Figure 76. Dynamo 8. Broadband speed (Fixed network speed)

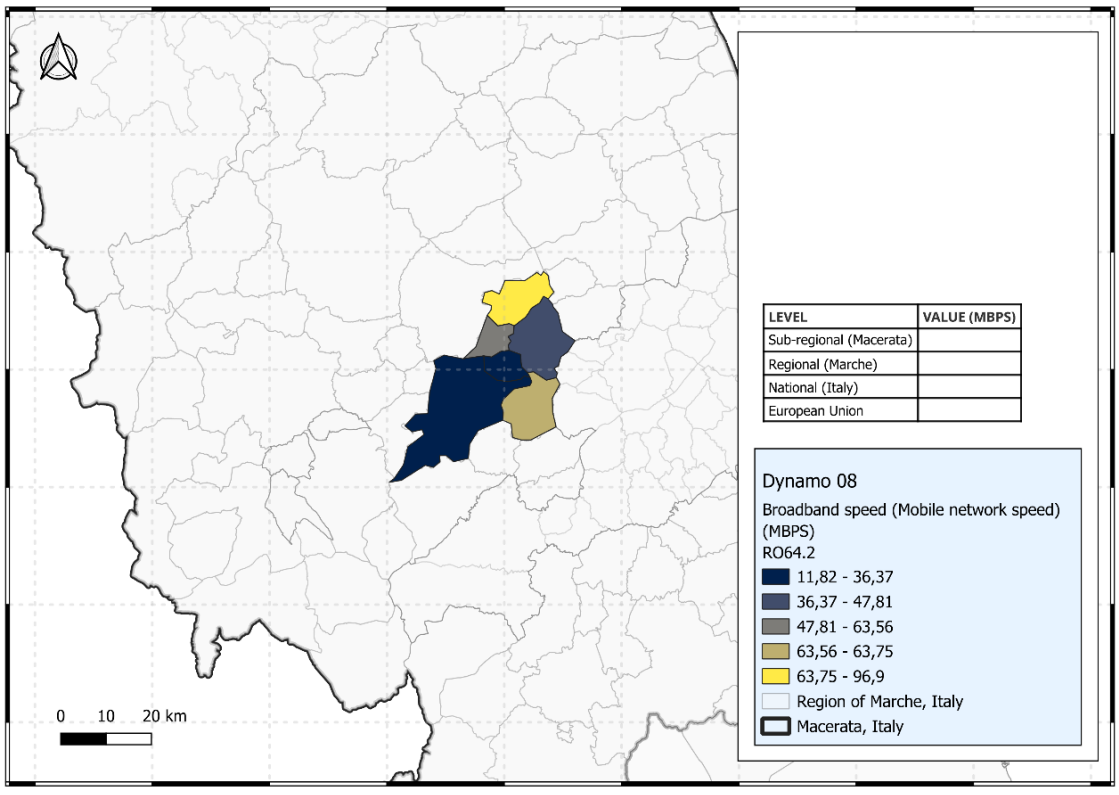


Figure 77. Dynamo 8. Broadband speed (Mobile network speed)

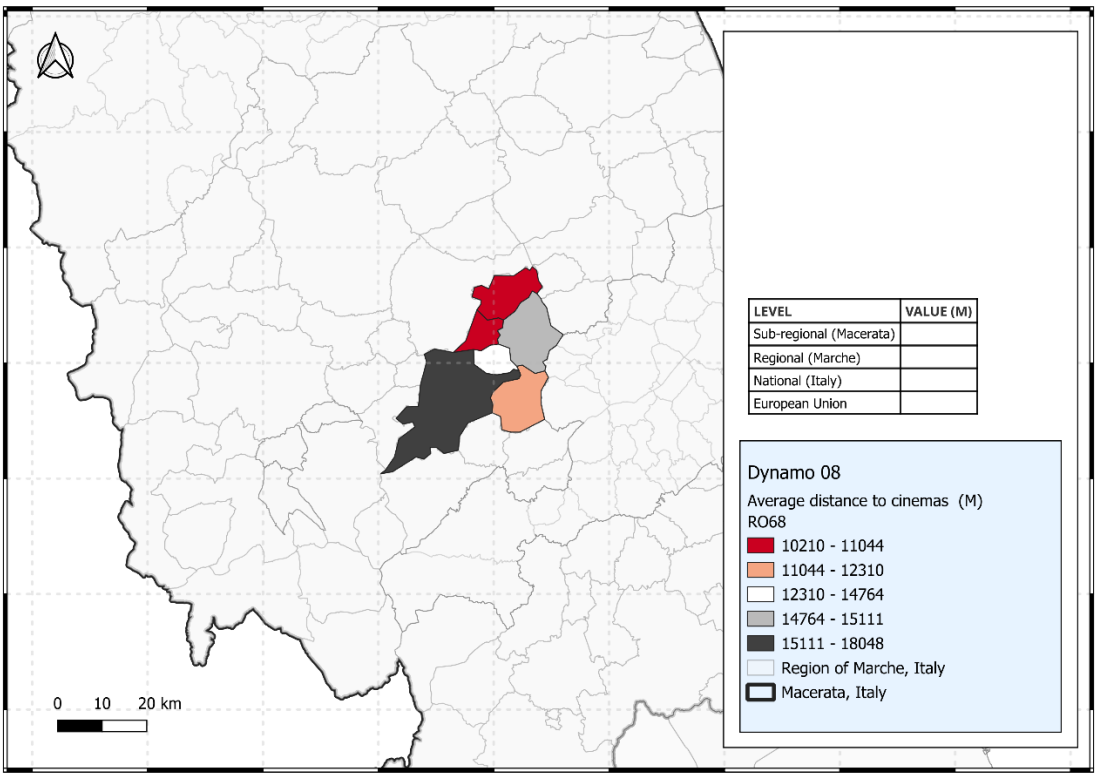
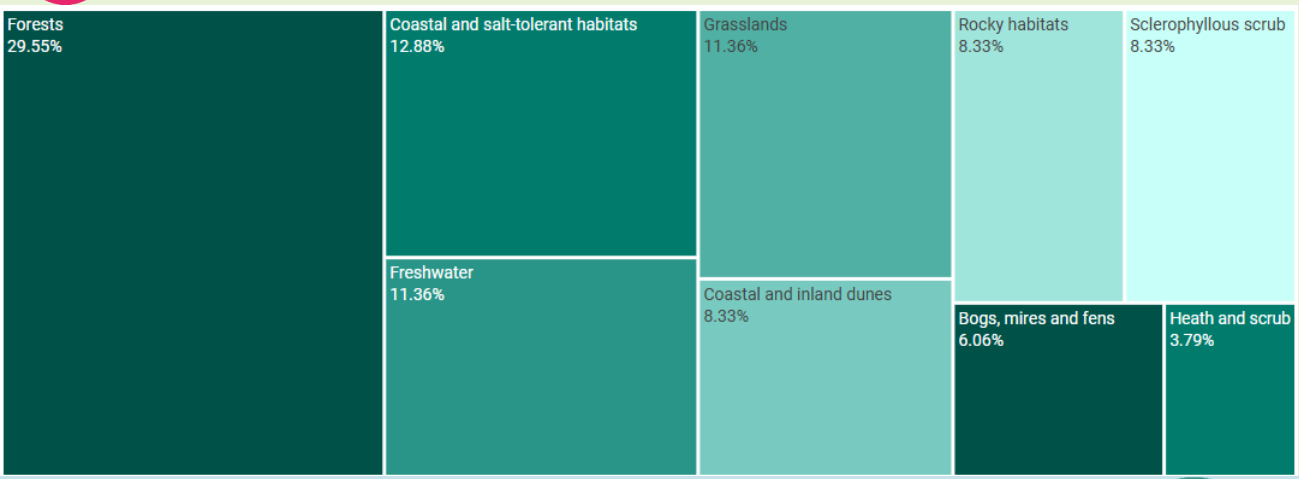


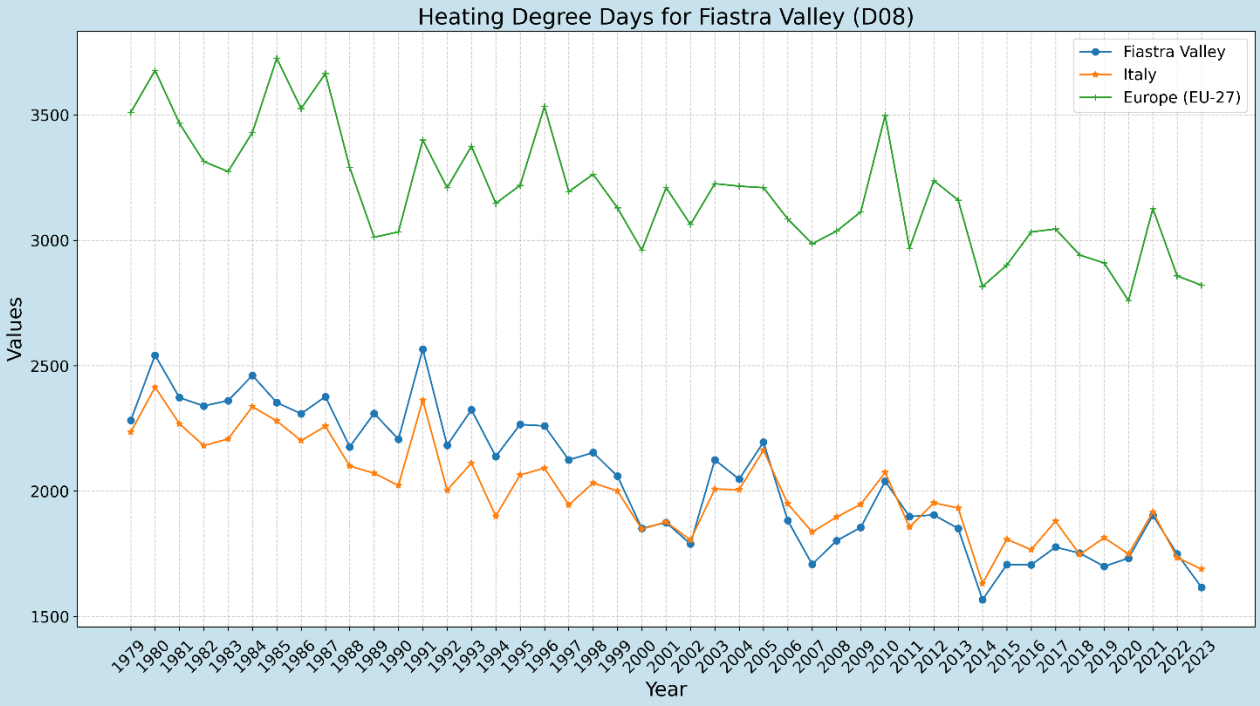
Figure 78. Dynamo 8. Average distance to cinemas

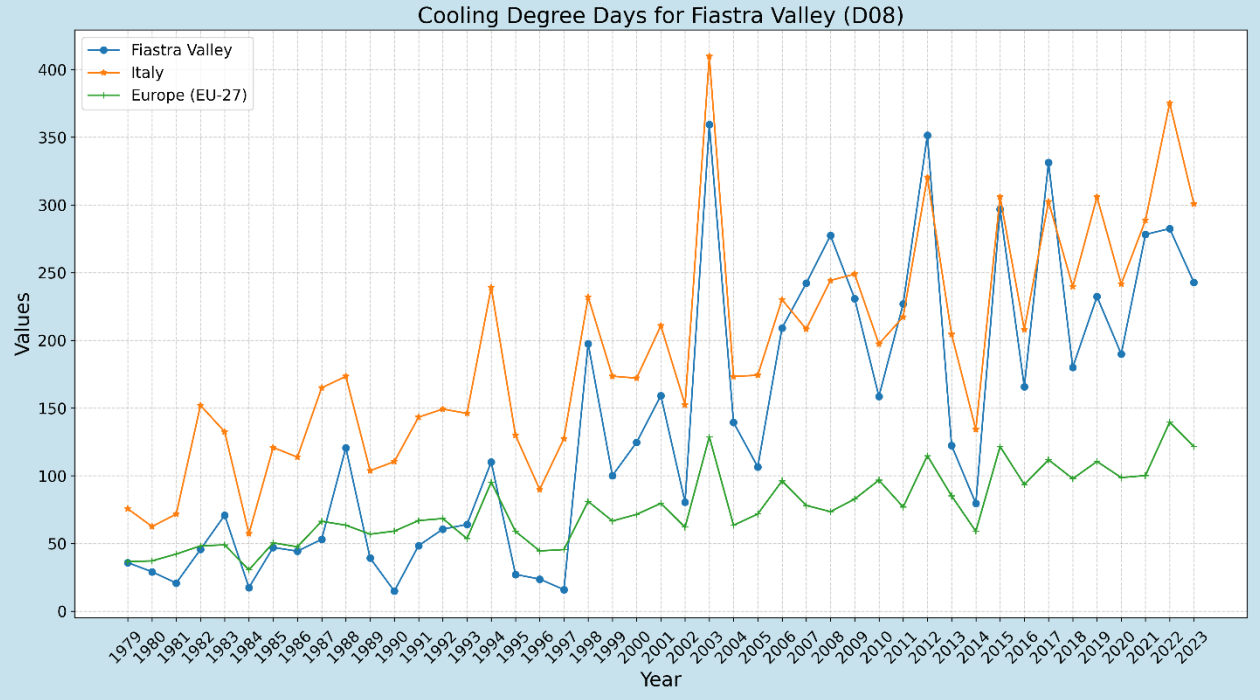
Biodiversity

Nature-based and cultural Tourism



Climate change mitigation and adaptation


Heating Degree Days for Fiastra Valley (D08)
Fiastra Valley
Italy
Europe (EU-27)
Values
Year


Cooling Degree Days for Fiastra Valley (D08)
Fiastra Valley
Italy
Europe (EU-27)
Values
Year

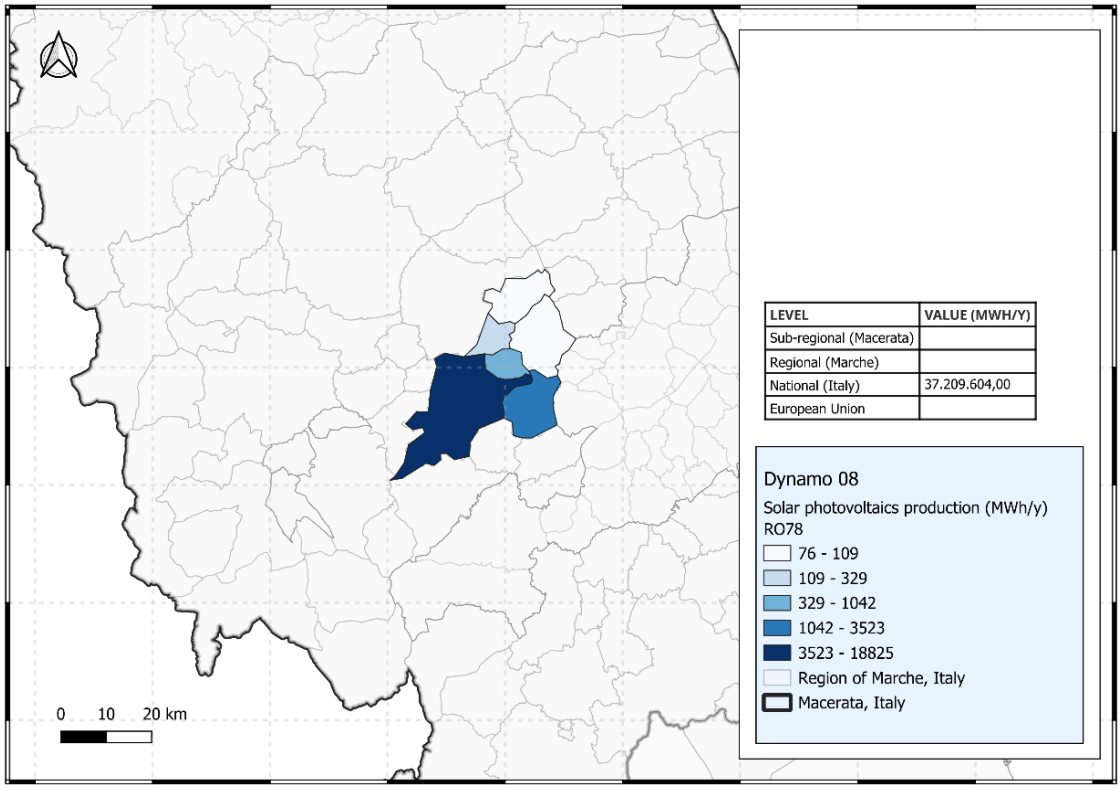


Figure 79. Dynamo 8. Solar photovoltaics production

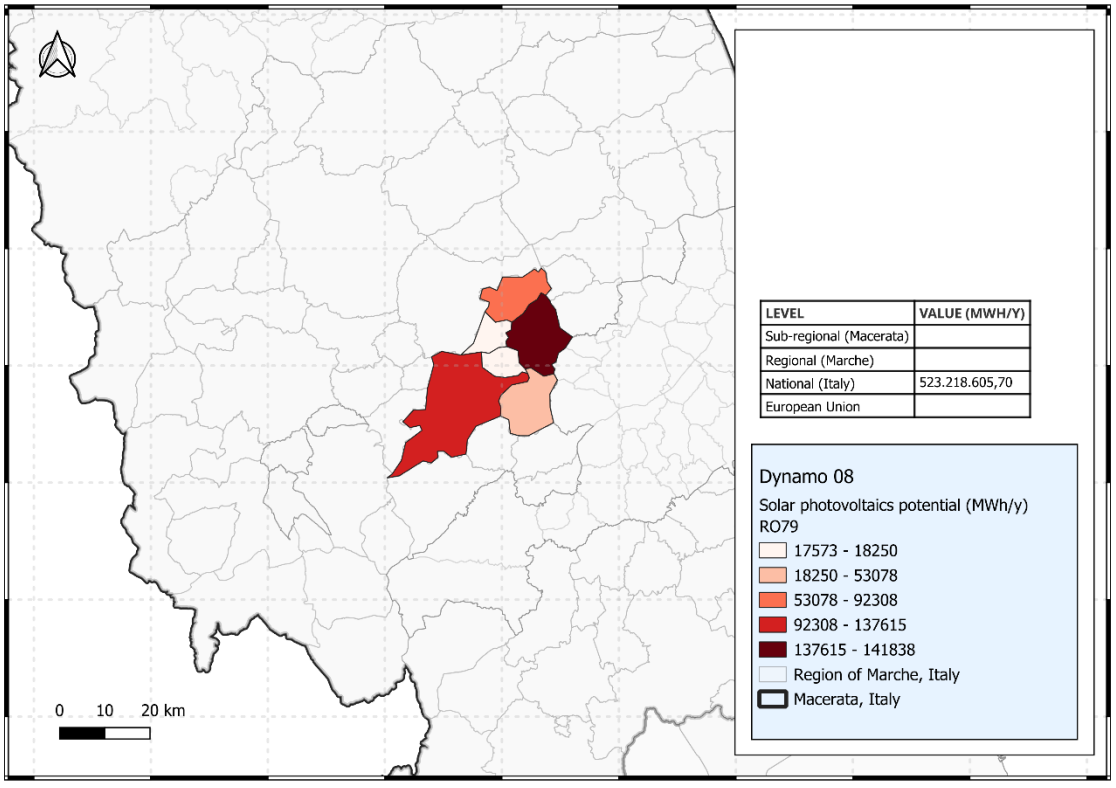


Figure 80. Dynamo 8. Solar photovoltaics potential

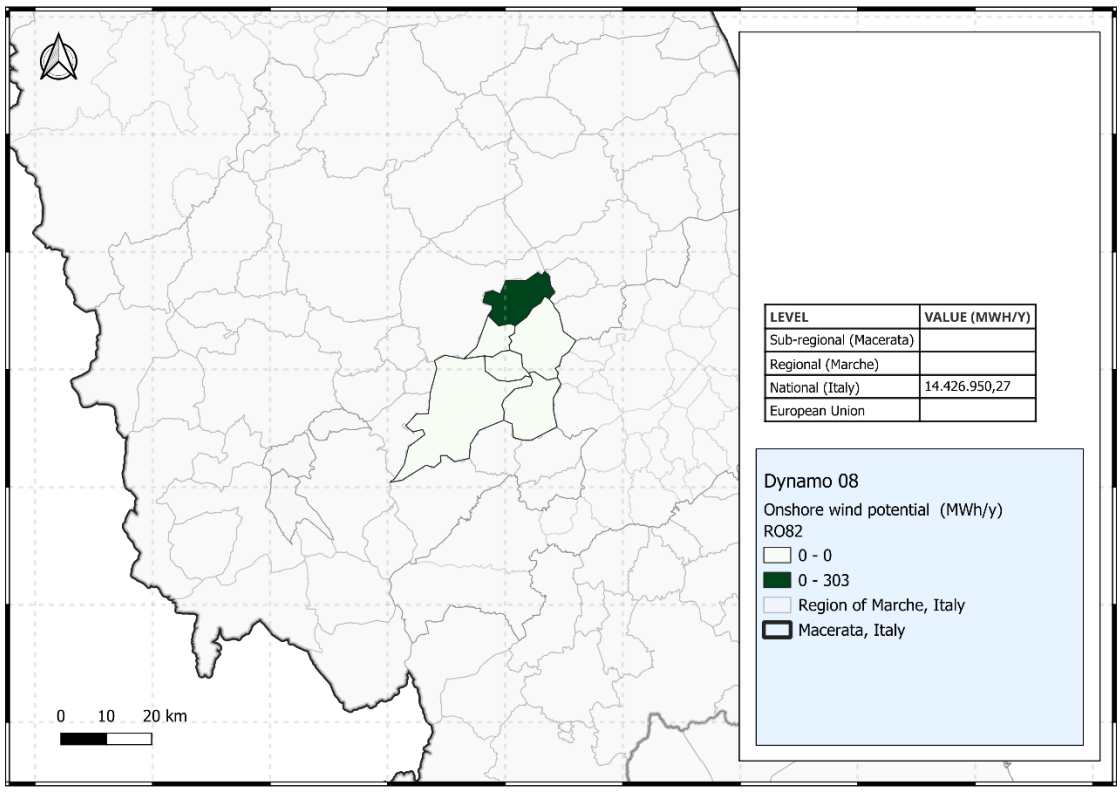


Figure 81. Dynamo 8. Onshore wind potential

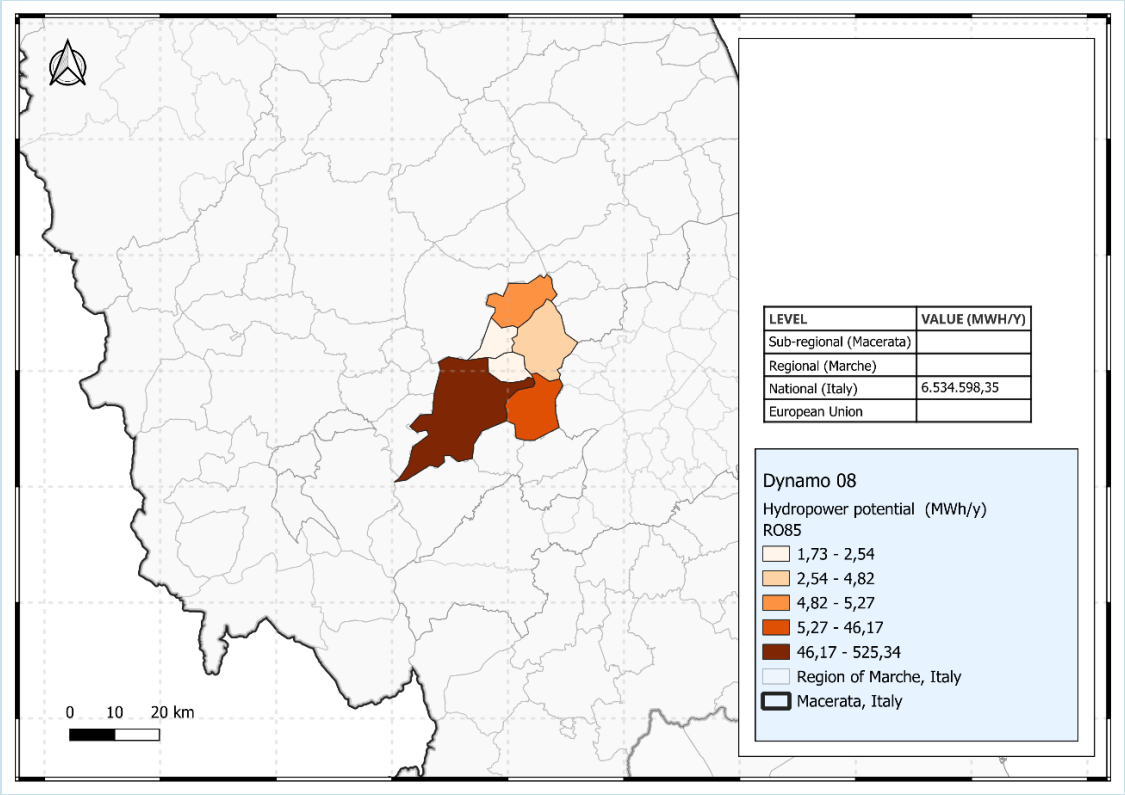


Figure 82. Dynamo 8. Hydropower potential

D9. Zadar, Croatia

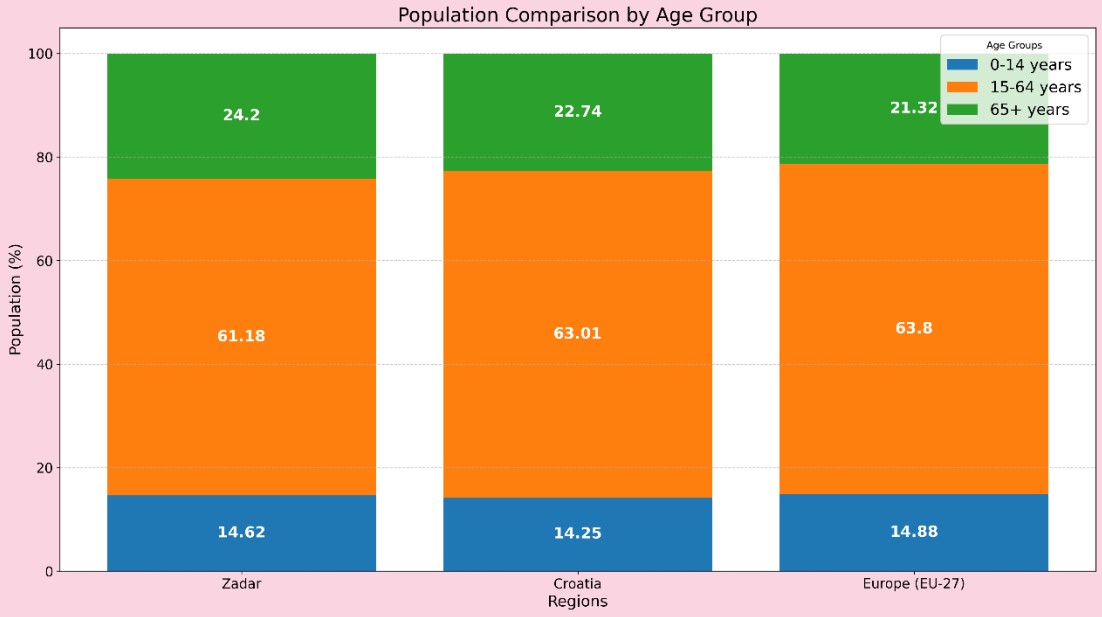
Cross-Cutting priorities

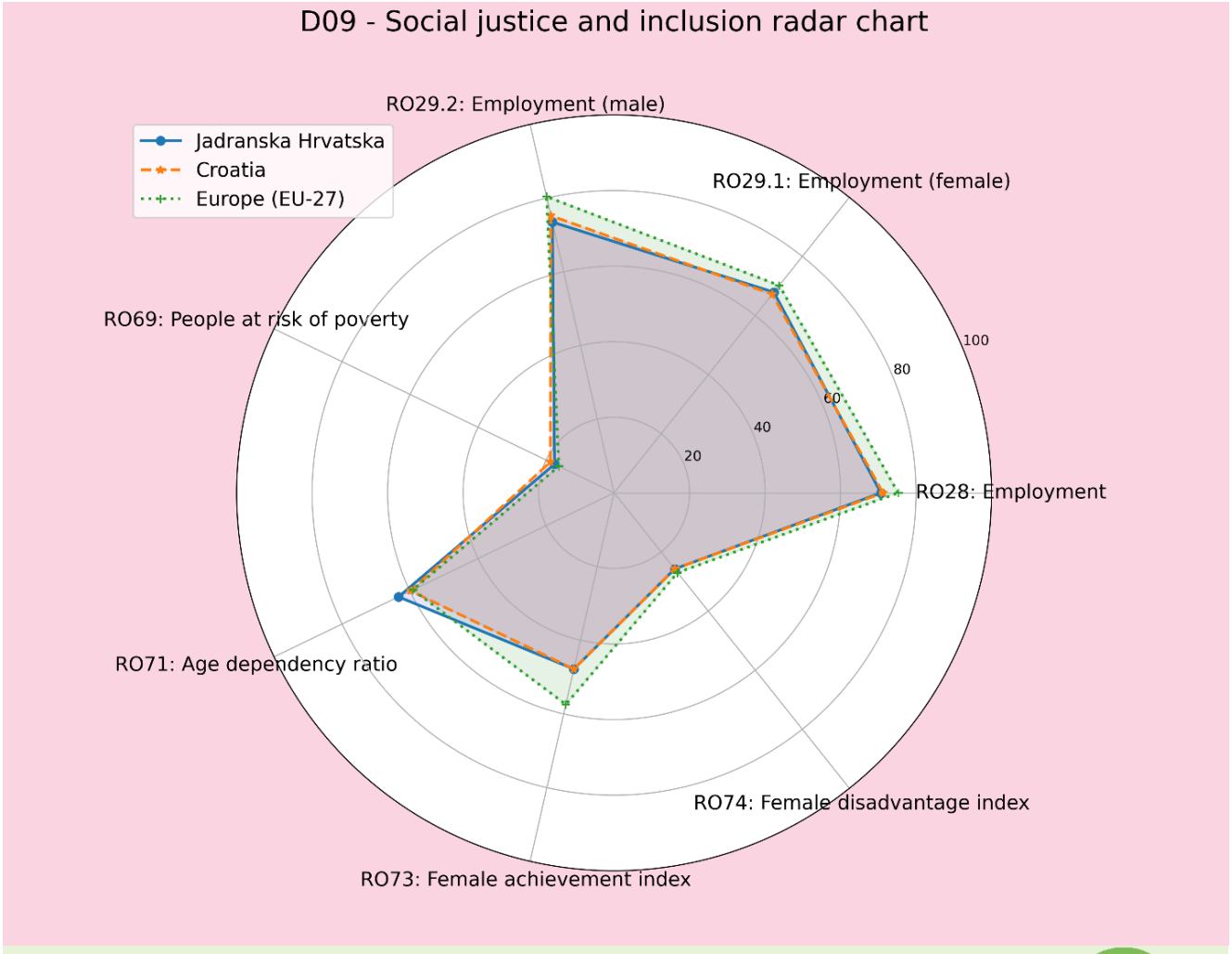
Social Justice and Inclusion

RDD

Local services, health and wellbeing

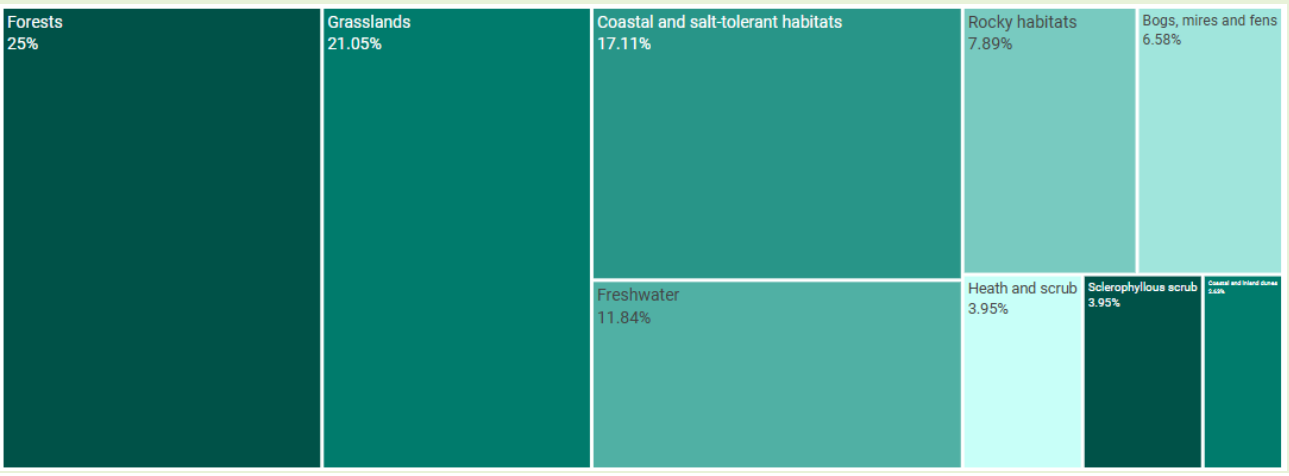
Sustainable multimodal mobility





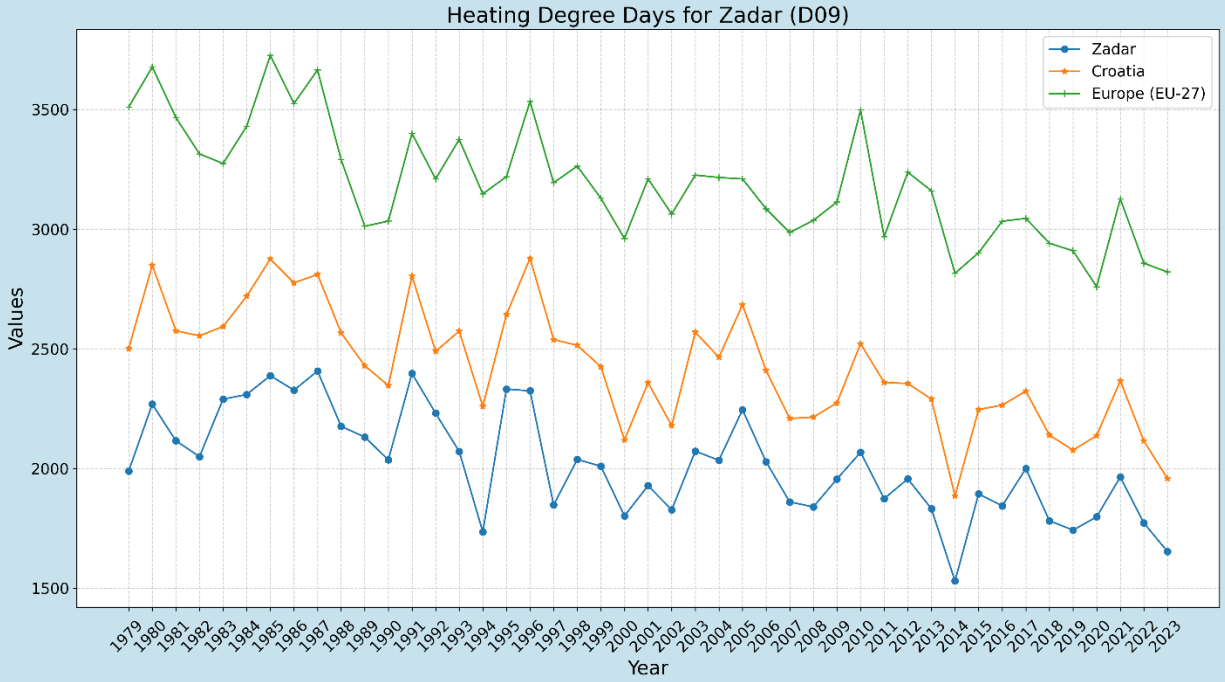
Biodiversity

Energy transition and climate neutrality

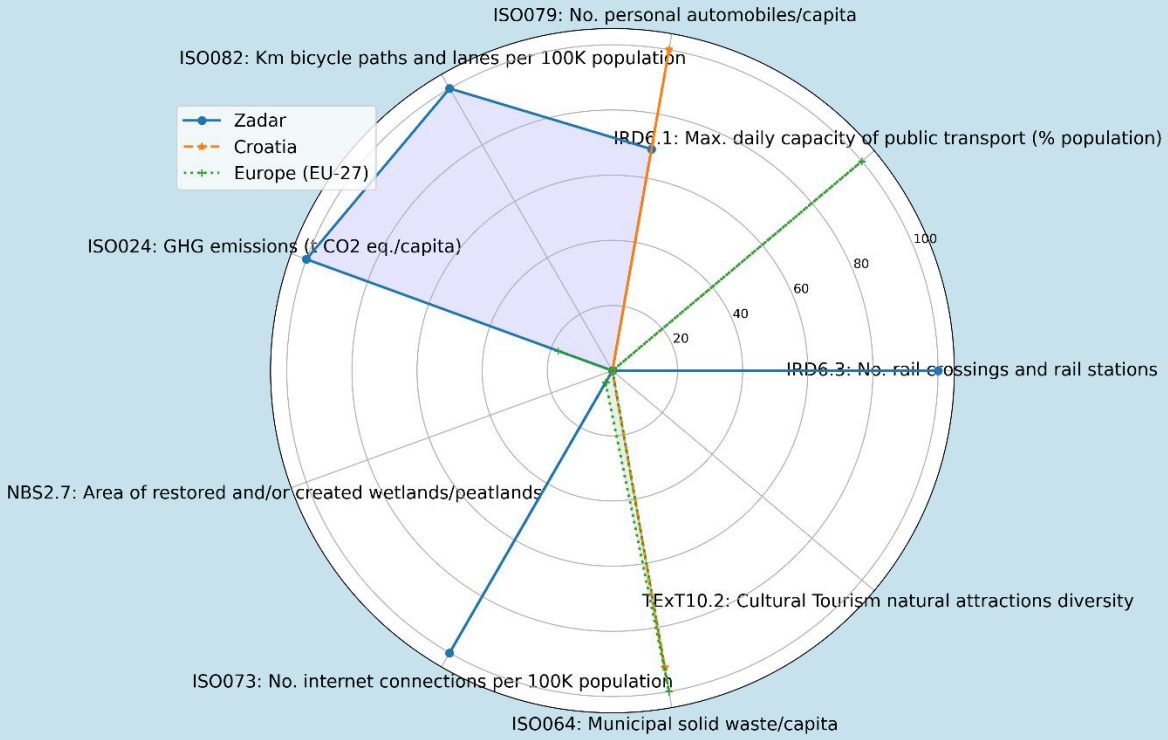


Climate change mitigation and adaptation

Energy transition and climate neutrality



D09 - Climate Change Mitigation radar chart



D10. Abruzzo, Italy

Cross-Cutting priorities

Social Justice and Inclusion

RDD

Local services, health and wellbeing

Sustainable multimodal mobility

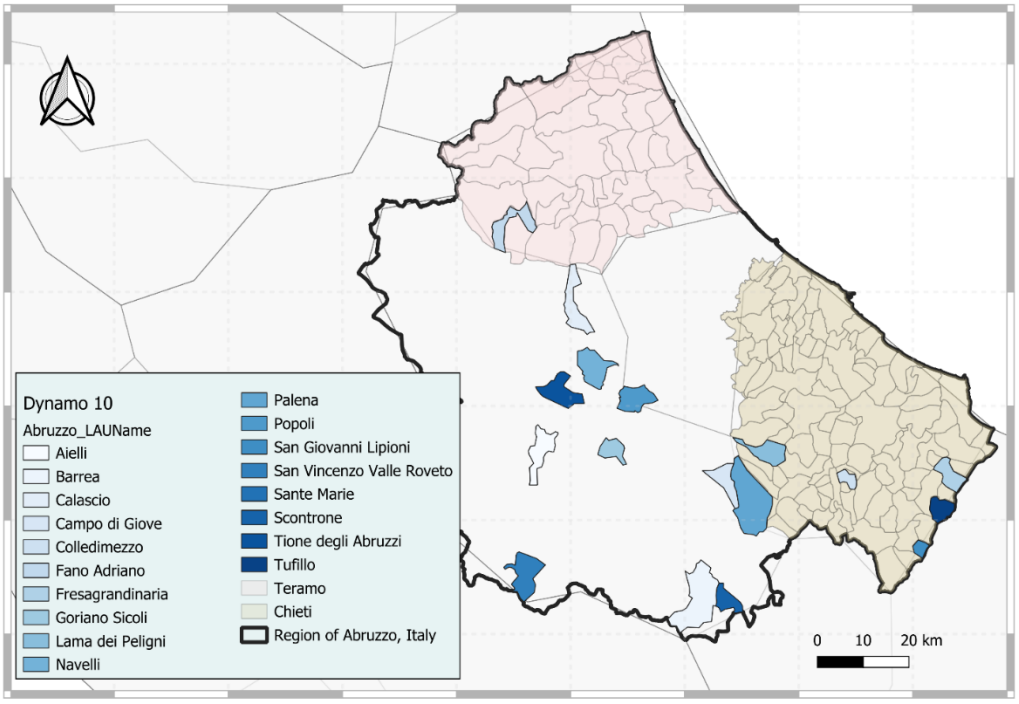
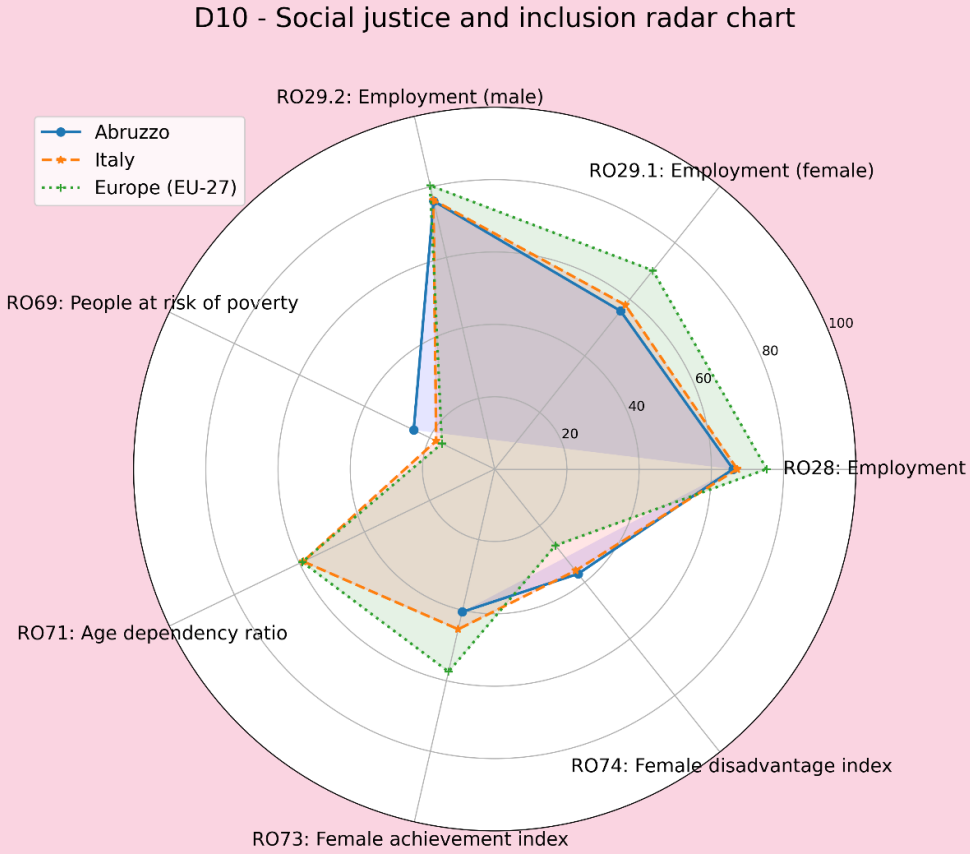


Figure 83. Dynamo 10. Administrative Context



Climate change mitigation and adaptation

Sustainable multimodal mobility

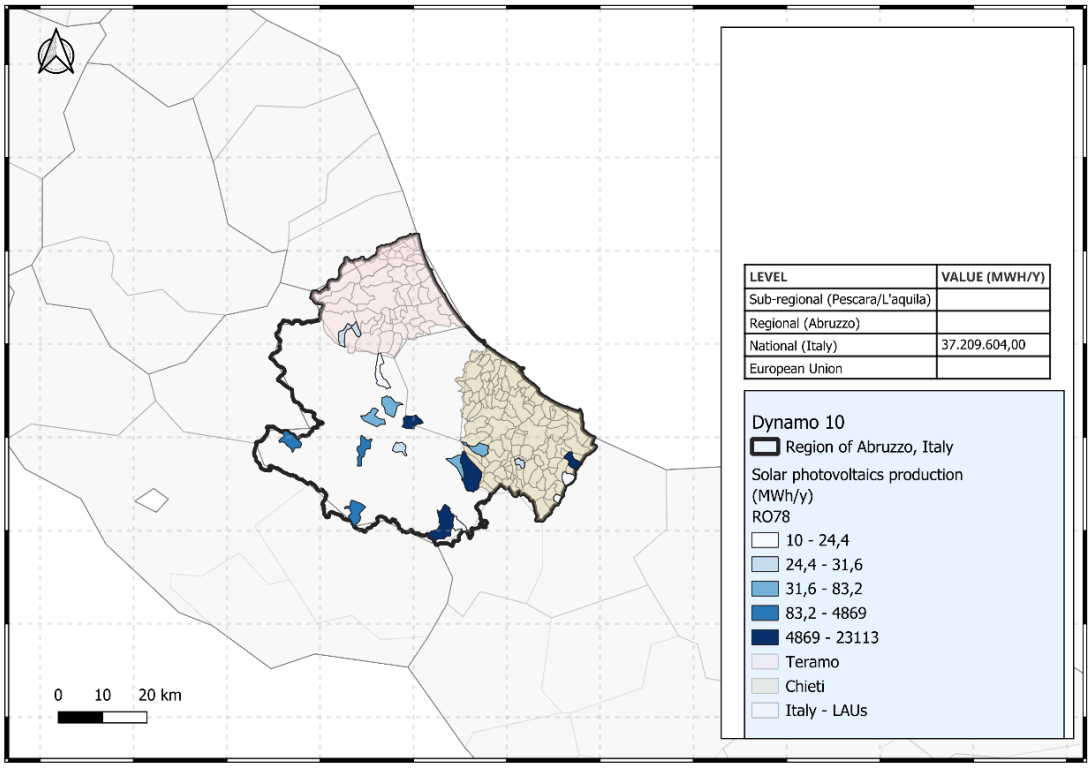


Figure 84. Dynamo 10. SolarClimate Change MitigationSolar photovoltaics production

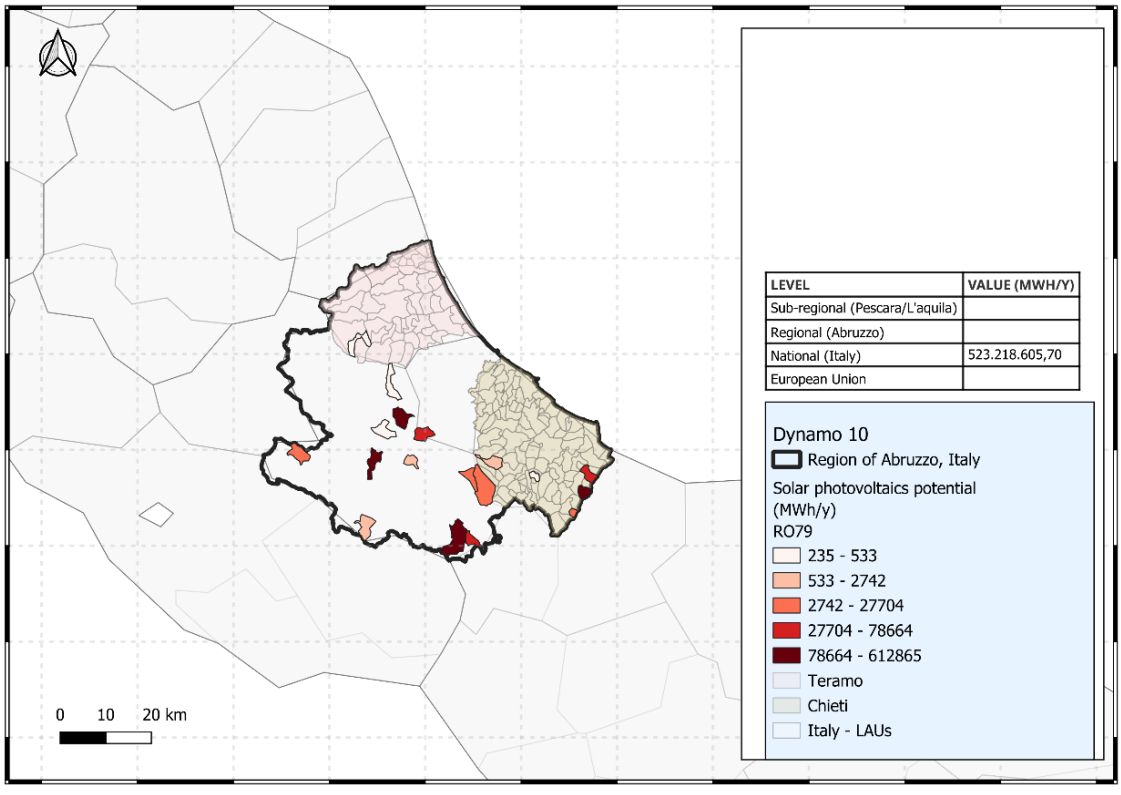


Figure 85. Dynamo 10. Solar photovoltaics potential

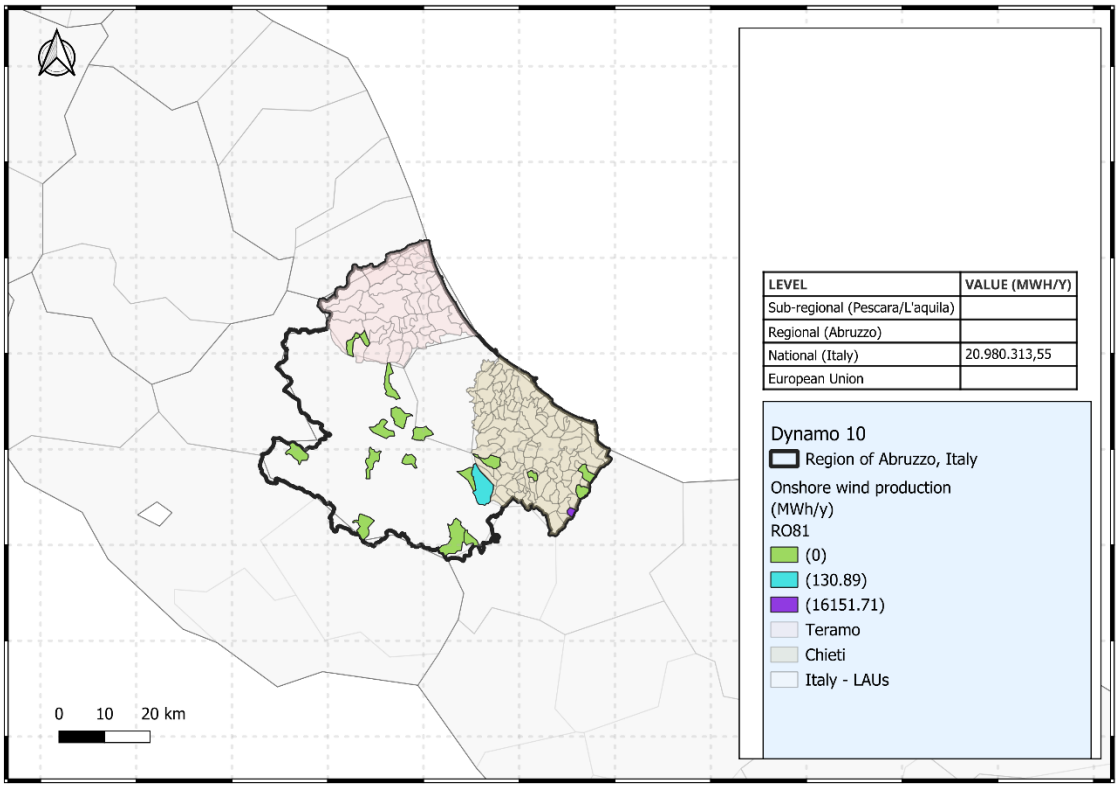


Figure 86. Dynamo 10. Onshore wind production

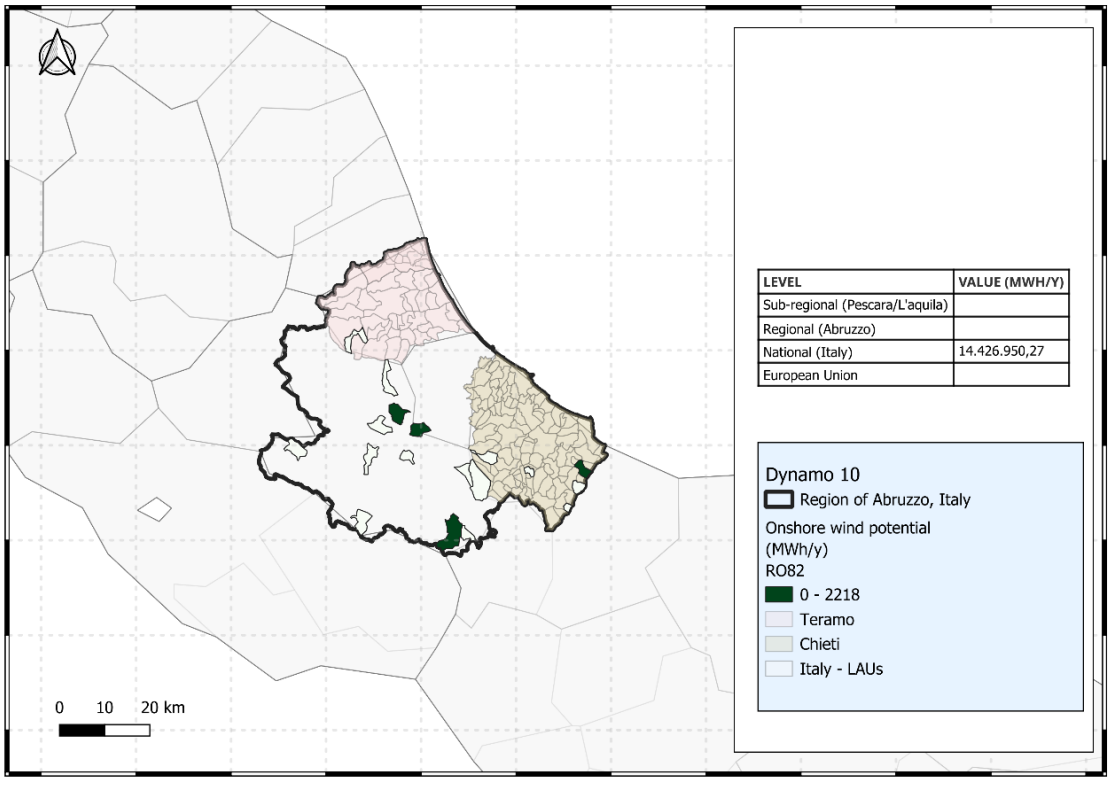


Figure 87. Dynamo 10. Onshore wind potential

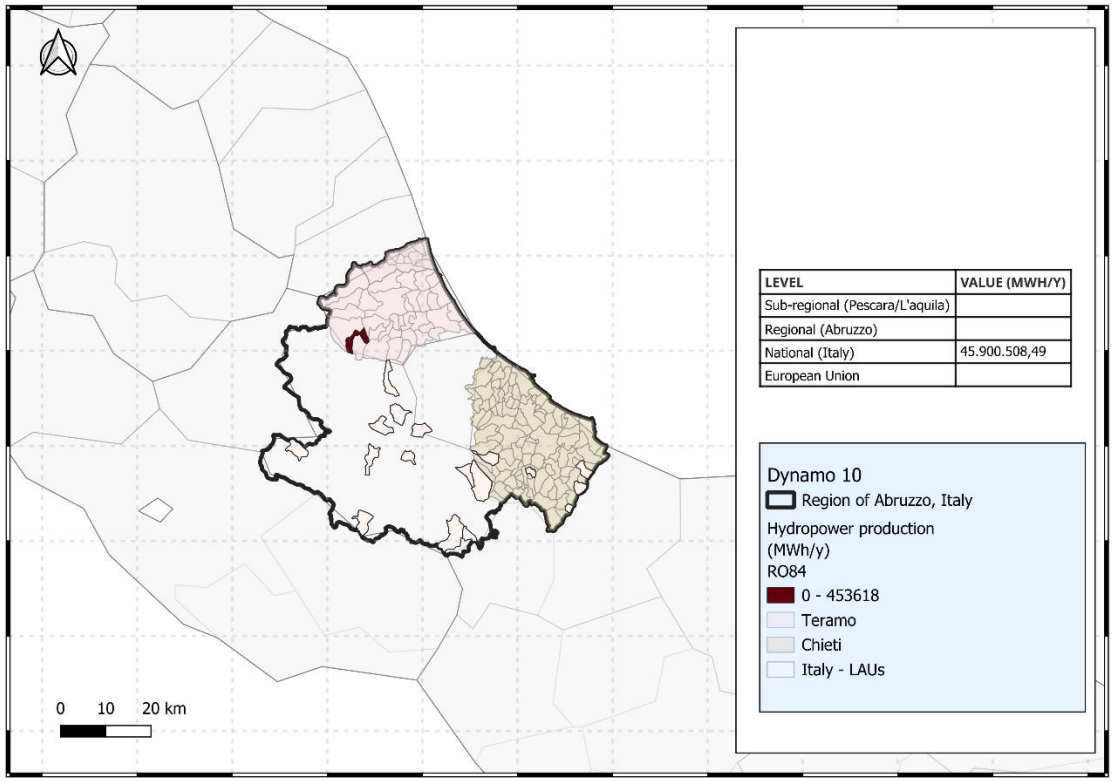


Figure 88. Dynamo 10. Hydropower production

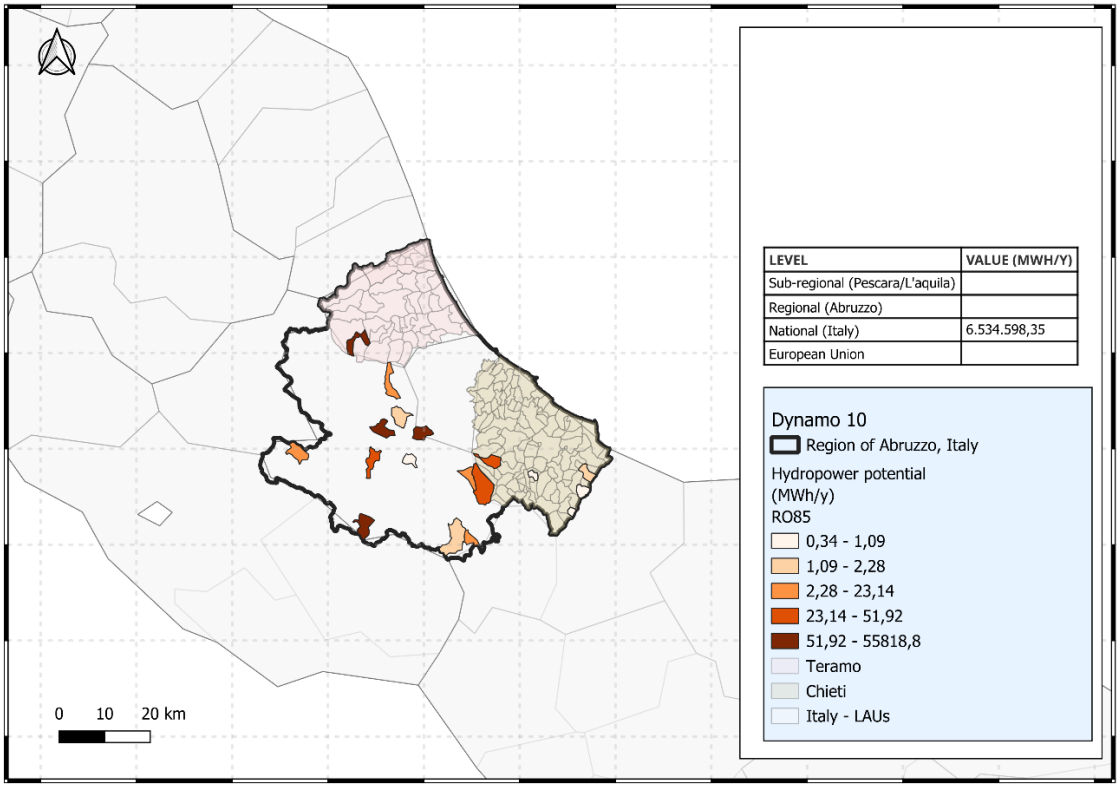


Figure 89. Dynamo 10. Hydropower potential

D11. Gotland, Sweden

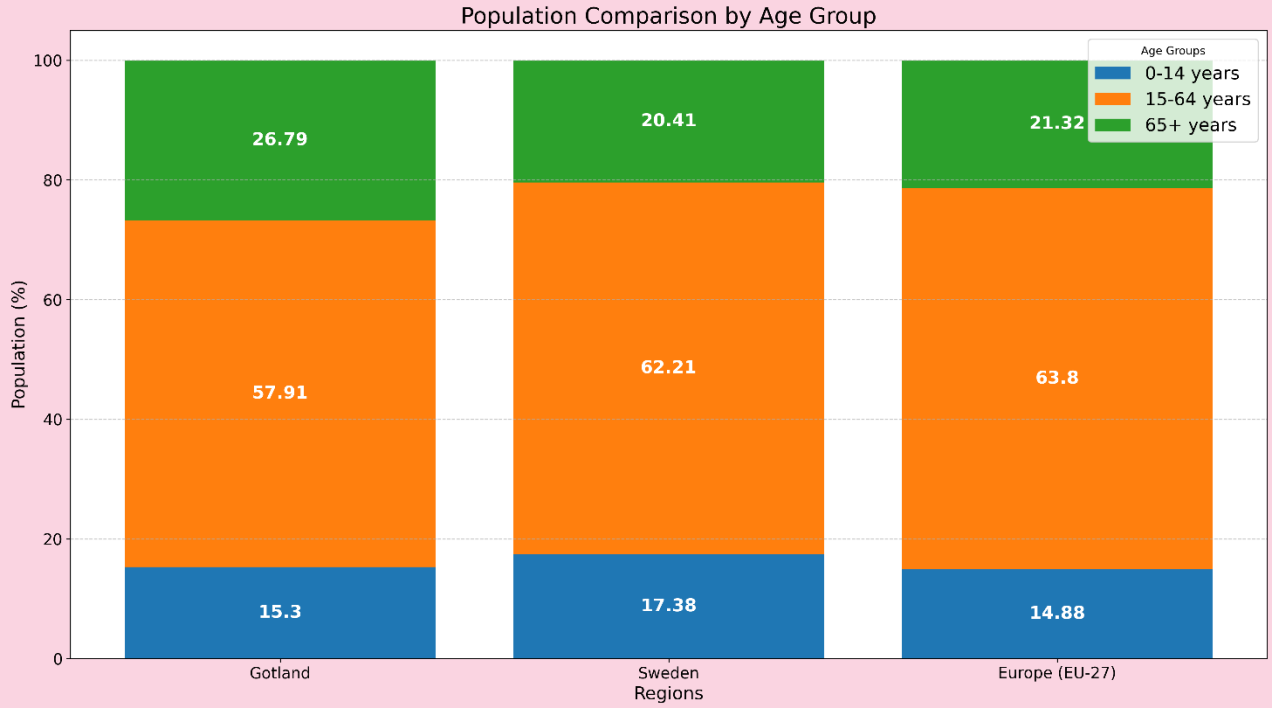
Cross-Cutting priorities

Social Justice and Inclusion

RDD

Local services, health and wellbeing

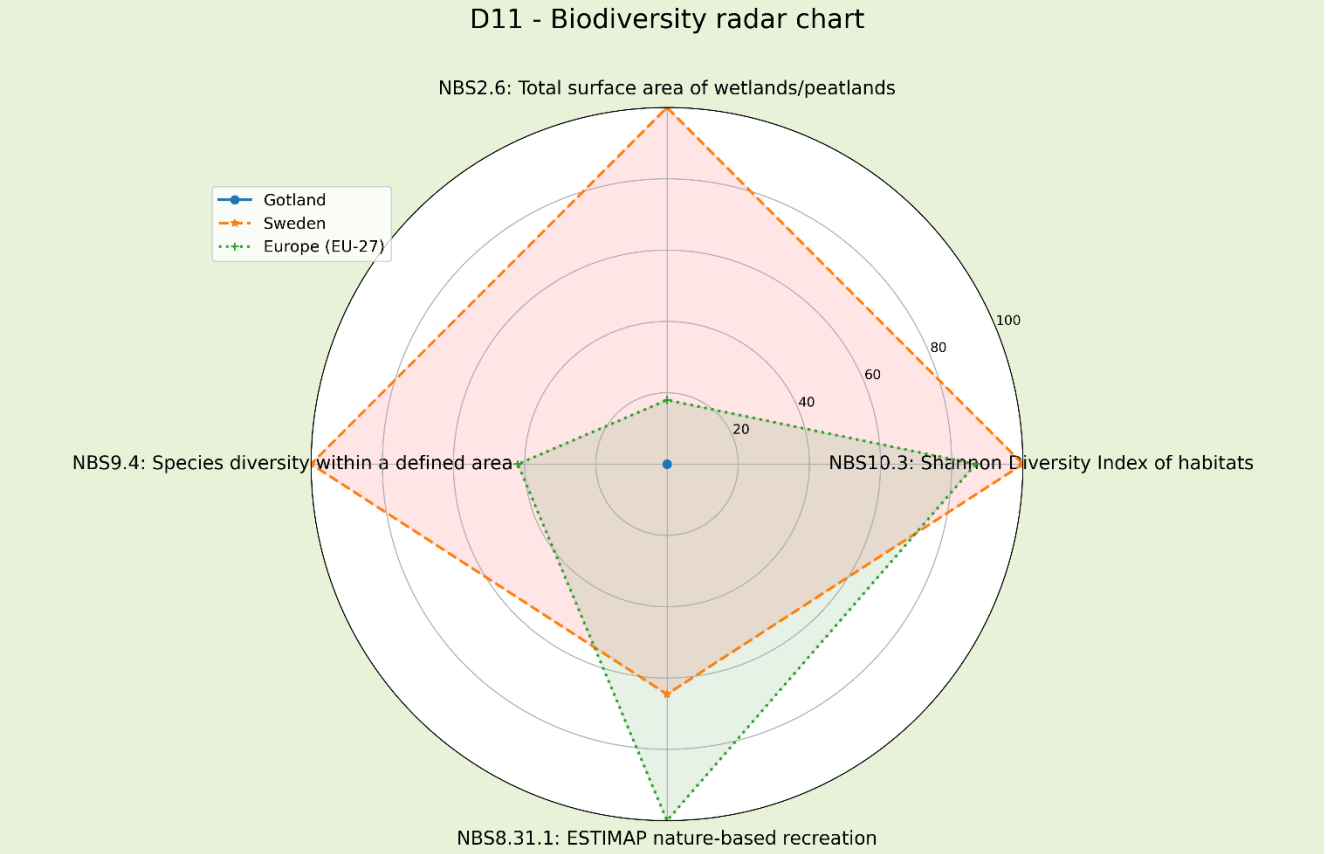
Sustainable multimodal mobility



Biodiversity

Sustainable multimodal mobility

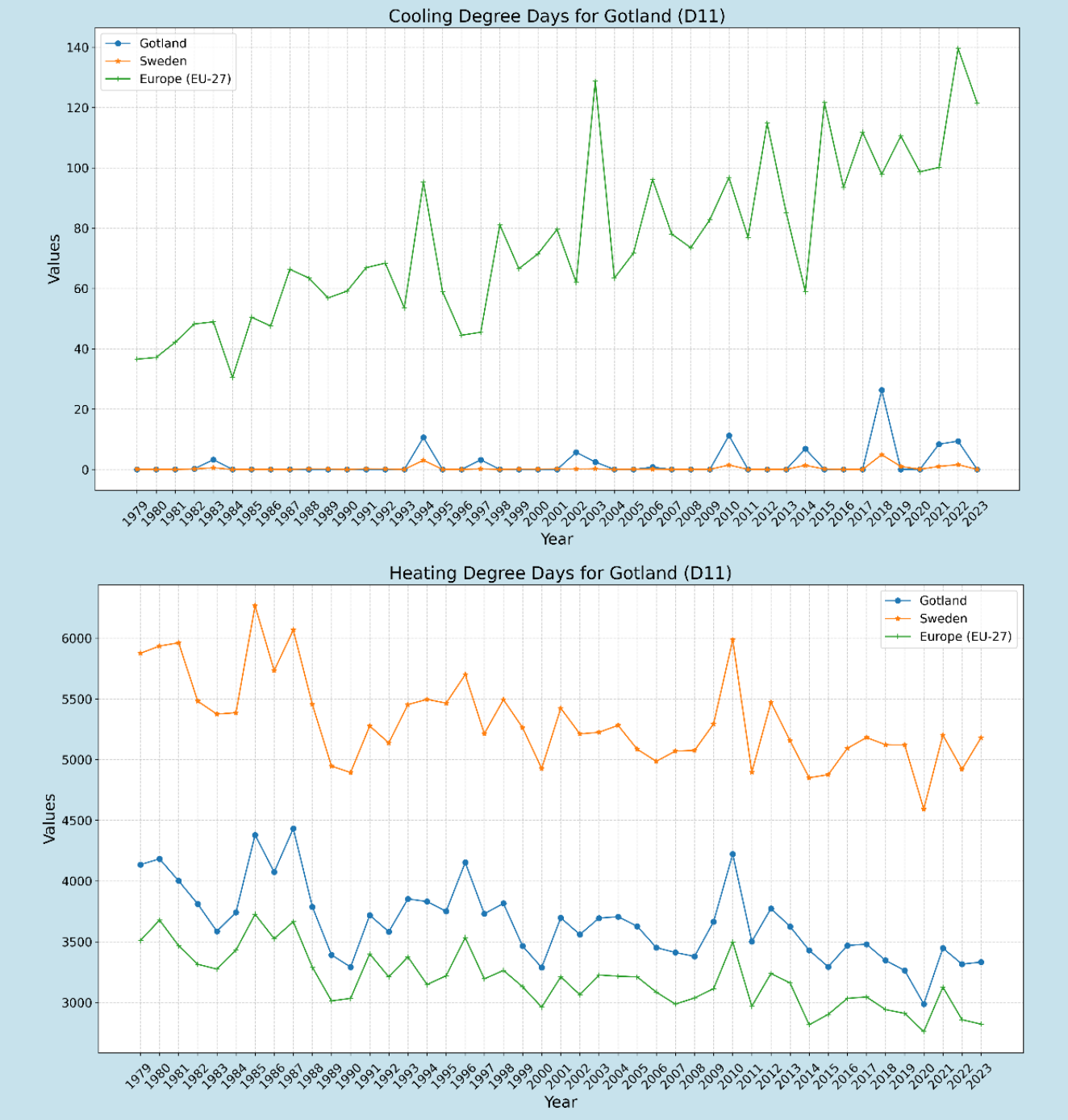
Energy transition and climate neutrality



Climate change mitigation and adaptation

Sustainable multimodal mobility

Energy transition and climate neutrality


Cooling Degree Days for Gotland (D11)
Gotland
Sweden
Europe (EU-27)
Values
Year
Heating Degree Days for Gotland (D11)
Gotland
Sweden
Europe (EU-27)
Values
Year

Annex E. KREI – Key Rural Empowerment Indicators Dataset

Attached to this document you can find the 'KREI – Key Rural Empowerment Indicators.xlsx' workbook containing the indicators' dataset and all the complementary information needed to build it. Due to its size, it is not included here for the impossibility of printing the datasheets properly. The Excel file is submitted as a complement to the present deliverable, for your convenience. It is one of those that make up the D5.1 compressed file that is uploaded to the Funding and Tenders Portal of the EC.

Annex F. AMT Requirement Analysis

When designing the AMT programme, including its architecture, the system should be modelled to support the requirements, even the non-functional ones, and other restrictions that should be considered. The full list of requirements is shown in Table 6, according to the following codification:

- R.TY.nn
  where
  - R is for Requirement
  - TY is the type of requirement (TE - Technological, MN - Management, FN - Functional)
  - nn is the requirement number

Some requirements in Table 6, e.g. R.FN.01 & 02, are included in the list for clarity, but they are grey shadowed because it is assumed that some functionalities related to Dynamo management, such as creating or editing Dynamo's data are out of scope of the AMT.

Table 6: AMT requirements list.

Id	Type	Requirement	Description
R.FN.01	Functional	Create a Dynamo	The Admin user can create a new Dynamo, providing all the mandatory information
R.FN.02	Functional	Edit a Dynamo	The Admin can modify any field in Dynamo profile. Admin is responsible for consistency checking and avoiding duplications
R.FN.03	Functional	Enable/Disable a Dynamo	The Admin can enable or disable a Dynamo for accessing the platform, but without deleting the data from the database. If a Dynamo is disabled, data can be seen but no editing is possible
R.FN.04	Functional	KREI selection	A Dynamo user can select which indicators should be considered
R.FN.05	Functional	Target selection	A Dynamo user must provide Targets values for selected indicators
R.FN.06	Functional	Edit an Action Plan	A Dynamo user can edit an Action Plan by modifying its data, e.g. General Info, Baseline, Actions or Activities within an Action
R.FN.07	Functional	Baseline open	A Data Reviewer can open the Baseline for editing
R.FN.08	Functional	Baseline submit	A Dynamo user can submit a Baseline whenever it is completed
R.FN.09	Functional	Baseline close	A Data Reviewer can review a Baseline submitted by a Dynamo user and close it if everything is correct
R.FN.10	Functional	Add Activity	A Dynamo user can create new Activities within an Action. Baseline should be open for editing
R.FN.11	Functional	Edit Activity	A Dynamo user can modify Activities within an Action. Baseline should be open for editing

R.FN.12	Functional	Delete Activity	A Dynamo user can remove Activities within an Action. Baseline should be open for editing
R.FN.13	Functional	KREI: Key Rural Empowerment Indicators	The Monitoring platform should show a global value that summarises the values of all the indicators, called KREI for Key Rural Empowerment Indicators
R.FN.14	Functional	KREI calculation	KREI values are obtained by the combination of all the relevant indicators considering their relative weight
R.FN.15	Functional	KREI weights	Every indicator has its own weight, independently of other Dynamos, i.e. the same indicator can have different weights in different Dynamos. However, all indicators belonging to the same category (KREI) within the same pilot must be equal to 100%
R.FN.16	Functional	KREI weights assignment	The Dynamo user can assign/modify the weights of the indicators within its own pilot
R.FN.17	Functional	KREI values	The Dynamo user can assign/modify the values of any selected indicator. Monitoring over time is possible by assigning values on different dates.
R.FN.18	Functional	Usability	The user interface must be as simple as possible making easy the interaction with the AMT
R.FN.19	Functional	SSO	User must be logged in to access to data. Accessible data depends on user profile. Single Sing On: once logged in, the user can switch from one tool to the other without further authentication.
R.FN.20	Functional	Save values	The user can click on "Save" button as many times as needed, leaving the application and returning later without losing any data
R.FN.21	Functional	Close Monitoring Campaign	A Data Reviewer can review a monitoring campaign submitted by a user and close it if everything is correct
R.FN.22	Functional	Open Monitoring Campaign	A Data Reviewer can open a monitoring campaign for editing
R.FN.23	Functional	Data frequency	Every indicator has its own update frequency, based on data availability
R.FN.24	Functional	New indicator	A Dynamo can use any indicator available in the AMT system or even create a new one, adapted to its specific situation, solutions, etc., whenever all necessary information for a proper definition is provided
R.MN.01	Management	Administrator	The user with the Admin profile has full access to all the data and functionalities
R.MN.02	Management	Data Reviewer	The user in charge of the data review has access to the data provided by the Dynamos under its supervision. The Admin user assigns the reviewers to the Dynamos
R.MN.03	Management	Dynamo	The Dynamo user (Dynamo) has access to the data and functionalities related to its pilot only. The Admin user assigns the user to the Dynamo
R.MN.04	Management	Visitor	Visiting users (not logged in) can access to the public part of the AMT
R.MN.05	Management	AMT Open Source	The Monitoring Platform must be implemented on top of existing Open Source software, whenever possible

R.MN.06	Management	Open Data	All the data in AMT, either provided by Dynamos or collected in an automated way, will be open and adhered to the FAIR principles
R.TE.01	Technological	Interoperability	AMT must provide an Open API to serve data upon request
R.TE.02	Technological	Data loading	Some data, those that are less suitable to be changed, will be pre-loaded off-line into the platform, while the rest of the data will be provided by the users through the corresponding forms

Considering this list of requirements and the Use Case diagram is an effective way in defining and representing the scope of the software system, and the scenarios in which the system interacts with people, organisations, or external systems. According to these inputs, a detailed explanation of every use case is included in the form of tables (from Table 7 to Table 16).

Table 7: Authentication use case definition.

Name	**Authentication**
Repetition	Every time a user connects to the platform
Actors	Admin, Data Reviewer, Dynamo
User Interfaces	Web browser, login page
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	The actor has been validated by the Admin user and granted access to services according to the actor's profile
Impulse	The actor requests access to the platform
Description	The actor connects to the server with a web browser and selects Login (R.FN.19) - Actor introduces the username and password
Exceptions	The actor has a valid open session in the platform already
End Situation from the User's Point of View	- Login successful: Grant access to the actor according to its profile - Login Error: Error message and Login dialogue again
End Situation from the System's Point of View	- Login successful: set the session id and token while the session is open - Login Error: Notify the error to the user and show Login dialogue again

Table 8: Dynamo Management use case definition.

Name	**Dynamo Management**
Repetition	Every time the Admin pushes the "Edit Dynamo" button
Actors	Admin
User Interfaces	Web browser, Edit Dynamo page
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	The Dynamo has been created already
Impulse	The Admin pushes the "Edit Dynamo" button
Description	The Admin user can enable or disable a Dynamo, in order to be shown in the platform (R.FN.03). It is assumed that other functionalities related to Dynamos management, such as creating or editing Dynamo's data are out of scope of the AMT
Exceptions	If a Dynamo is disabled, data can be seen but no editing is possible (R.FN.03)

End Situation from the User's Point of View	- On "Save": New value for Dynamo Enabled is set - On "Cancel": No modification is made
End Situation from the System's Point of View	- On "Save": save the Enabled value to the database and return to the previous page - On "Cancel": No changes, return to the previous page

Table 9: Monitoring Data use case definition.

Name	**Monitoring Data**
Repetition	When the Action Plan is aproved by the Data Reviewer and set to Close, The Dynamo user can start introducing the monitoring data
Actors	Dynamo
User Interfaces	Web browser, Monitoring Data form
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	A Dynamo is Enabled and Baseline is closed
Impulse	The Dynamo user clicks on "Add Monitoring Data" button
Description	A new Monitoring Campaign is composed by a set of monitoring data values - The Dynamo user creates a new Monitoring Campaign - The user introduces the updated target values (and UC Target Data is executed) - The user introduces the updated KREI values (R.FN.17) (and UC KREI Data is executed) - The user clicks on "Save" button when needed (R.FN.20) - The user clicks on "Submit" button (R.FN.08) and the Monitoring Campaign is set to "Under Review"
Exceptions	For introducing the Monitoring data, the Dynamo must be Enabled and the Baseline has to be Closed (R.FN.07)
End Situation from the User's Point of View	- On "Save": New values for monitoring are set, but in draft mode - On "Submit": The monitoring campaign is closed for editing and set in review mode for the Data Reviewer - On "Cancel": No modifications are made
End Situation from the System's Point of View	- On "Save": save the new/modified monitoring data values to the database in draft mode and return to the previous page - On "Submit": save the final monitoring data values to the database and return to the previous page - On "Cancel": No changes, return to the previous page

Table 10: Data Validation use case definition.

Name	**Data Validation**
Repetition	When the Monitoring Campaign data are submitted by Dynamo user the Data Reviewer has to revise the data
Actors	Data Reviewer (DR)
User Interfaces	Web browser, Monitoring Data form
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	A new Monitoring Campaign has been submitted
Impulse	The DR clicks on "Review Monitoring Data" button

Description	A new Monitoring Campaign is submitted for data review - The DR revises the target data provided by the user and changes/amends data, if needed - The DR revises the KREI data provided by the user and changes/amends data, if needed - The DR clicks on "Save" button when needed (R.FN.20) - The DR clicks on "Close" button and the Monitoring Campaign is set to "Closed" (R.FN.21) - The DR clicks on "Open" button and the monitoring Campaign is set to "Open" for editing again (R.FN.22)
Exceptions	For reviewing the Monitoring data, the Dynamo must be Enabled and the Monitoring Campaign must be submitted
End Situation from the User's Point of View	- On "Save": New values for monitoring are set, but in draft mode - On "Close": The monitoring campaign is closed for editing and data are available for visualisation into the platform - On "Open": The monitoring campaign is open for editing by the Dynamo user - On "Cancel": No modifications are made
End Situation from the System's Point of View	- On "Save": save the new/modified monitoring data values to the database in draft mode and return to the previous page - On "Close": save the final monitoring data values to the database and return to the previous page - On "Open": save the new/modified monitoring data values to the database in draft mode, change the status of the monitoring campaign to open for editing, and return to the previous page - On "Cancel": No changes, return to the previous page

Table 11: Data Visualisation use case definition.

Name	**Data Visualisation**
Repetition	Every time an actor access to the platform
Actors	Visitor, Dynamo user, Data Reviewer (DR)
User Interfaces	Web browser, Data Visualisation dashboard
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	The actor can be logged in (Dynamo, DR) or not (Visitor)
Impulse	The actor clicks on the "Monitoring Dashboard" button
Description	Data Visualisation shows the KREI value (and UC KREI Calculation is executed) The Data Visualisation dashboard shows monitoring data according to the profile of the actor: - For a Visitor: The platform shows a list of Dynamo that are enabled and a dashboard with the public data of the Pilot - For a Dynamo user: The platform shows all the data of the pilot assigned to the user. Filters are available for selecting among the information to be shown - For a DR: The platform shows all the data of the Dynamos assigned to the DR. Filters are available for selecting among the information to be shown
Exceptions	For displaying the Monitoring data, the Dynamo must be Enabled (except for Admin users, R.MN.01)
End Situation from the User's Point of View	The actor clicks on any other button or menu option and jumps to the new location
End Situation from the System's Point of View	The actor leaves the page

Table 12: KREI Selection use case definition.

Name	KREI Selection
Repetition	When the Dynamo user is defining the KREIs for the Dynamo in the Action Plan
Actors	Dynamo user
User Interfaces	Web browser, KREI selection form
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	A Dynamo is Enabled, the Baseline is open and the Action Plan is being created/edited
Impulse	The Dynamo user clicks on the "Add KREI" button
Description	A new KREI Selection is composed by the baseline, target and weight values. - The Dynamo user selects from the list of available KREIs and indicators - For the selected KREI, the user assigns: * Baseline: the initial value for the indicators needed to calculate the value of the KREI in the current action before the beginning of the Action Plan * Target: the expected value for the indicators needed to calculate the value of the KREI in the current action after the deployment of the Action Plan
Exceptions	New indicators can be introduced into the platform, whenever all required information for its definition is provided
End Situation from the User's Point of View	- On "Save": New values for indicators, targets and weights are set - On "Cancel": No modifications are made
End Situation from the System's Point of View	- On "Save": save the modified KREI data values to the database - On "Cancel": No changes, return to the previous page

Table 13: KREI Weighting use case definition.

Name	KREI Weighting
Repetition	Once the Dynamo user has defined the KREIs for the Dynamo in the Action Plan
Actors	Dynamo user
User Interfaces	Web browser, KPI weighting form
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	A Dynamo is Enabled, the Baseline is open and the Action Plan is being created/edited
Impulse	The Dynamo user clicks on the "KREI Weights" button
Description	The KREI Weighting consists of a list of the previously selected indicators and their assigned weights. Weights are unique for every Dynamo, so changes in one Dynamo does not affect other Dynamos - The Dynamo user assigns the weight, a value between 1 and 99, to every indicator in the list - The sum of all the weights within a KREI category must be 100
Exceptions	The system assigns the same weight to every active indicator by default; only user intervention can modify these default values
End Situation from the User's Point of View	- On "Save": Check if the sum of new values for indicator weights equals 100 * Check successful: New values for indicator weights are set * Check Error: Error message and show form again - On "Cancel": No modifications are made

End Situation from the System's Point of View	- On "Save": * Check successful: save the modified indicator weights values to the database and return to the previous page * Check Error: notify the error to the user and show the form again - On "Cancel": No changes, return to the previous page

Table 14: Target Data use case definition.

Name	**Target Data**
Repetition	When the Dynamo user introduces new/updated target values for the Baseline
Actors	Dynamo user
User Interfaces	Web browser, Target Data form
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	A Dynamo is Enabled and Baseline is open
Impulse	The Dynamo user clicks on "Add Target Data" button
Description	The Target Data form consists of the list of previously selected indicators. - For every item in the list, the Dynamo user introduces an updated target value, if any
Exceptions	For introducing the Target data, the Dynamo must be Enabled and the Baseline must be Open (R.FN.07)
End Situation from the User's Point of View	- On "Save": New values for target data are set, but in draft mode - On "Cancel": No modifications are made
End Situation from the System's Point of View	- On "Save": save the new/modified target data values to the database in draft mode and return to the previous page - On "Cancel": No changes, return to the previous page

Table 15: KREI Data use case definition.

Name	**KREI Data**
Repetition	When the Dynamo user introduces new/updated KREI values for the current Monitoring Campaign
Actors	Dynamo user
User Interfaces	Web browser, KREI Data form
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	A Dynamo is Enabled, Baseline is closed and a Monitoring Campaign is open
Impulse	The Dynamo user clicks on "Add KREI Data" button
Description	The KREI Data form consists of the list of previously selected KREIs. - For every item in the list, the Dynamo user introduces an updated value of the affected indicators, if any
Exceptions	For introducing the indicators data, the Dynamo must be Enabled and the Baseline must be Closed (R.FN.07)
End Situation from the User's Point of View	- On "Save": New values for KREIs and indicators are set, but in draft mode - On "Cancel": No modifications are made
End Situation from the System's Point of View	- On "Save": save the new/modified indicators and KREIs data values to the database in draft mode and return to the previous page - On "Cancel": No changes, return to the previous page

Table 16: KREI Calculation use case definition.

Name	KREI Calculation
Repetition	Every time an actor access to the Data Visualisation dashboard
Actors	Dynamo user, Data Reviewer (DR)
User Interfaces	Web browser, Data Visualisation dashboard
Resources and Tools	Desktop PC and/or mobile phone with data connectivity
Initial Situation	The actor is logged in
Impulse	The actor clicks on the "Monitoring Dashboard" button
Description	Data Visualisation shows the KREI values (and UC KREI Calculation is executed) The Data Visualisation dashboard shows monitoring data according to the profile of the actor: - For a Visitor: The platform shows a list of Dynamos that are enabled and a dashboard with the public data of the Dynamo - For a Dynamo user: The platform shows all the data of the Dynamo assigned to the user. Filters are available for selecting among the information to be shown - For a DR: The platform shows all the data of the Dynamos assigned to the DR. Filters are available for selecting among the information to be shown
Exceptions	For displaying the Monitoring data, including the KREI values, the Dynamo must be Enabled (except for Admin users, R.MN.01)
End Situation from the User's Point of View	The actor clicks on any other button or menu option and jumps to the new location
End Situation from the System's Point of View	The actor leaves the page