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GRINS FOUNDATION

DELIVERABLE 3.1

Repository of solutions for monitoring and increasing the local attractiveness and resilience of specific areas

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Executive summary

The present *Repository of solutions for monitoring and increasing the local attractiveness and resilience of specific areas*, constitutes the first Deliverable (D.7.3.1. Repository) od the WP3 Area Specific Planning and is fully within the actions related to the Milestones *M.7.3.1. Selection of Case studies for each territorial typology* (M12) and M.7.3.2. *Completion of local data collection and integration to WP1 data for each case study* (M18).

The main activities are related to Tasks 7.3.1, 7.3.2, 7.3.3 of the WP3, which were conducted in parallel by the research units of UNIBA, POLIMI, UNINA, UNIBO, UNICA, UNICT:

- Task 7.3.1. *Integrate data from WP1 with local level data and analysis to define detailed vulnerability maps for specific case studies*;
- Task 7.3.2. *Identify infrastructures and services digitalization policies to reduce divides between city centers, suburbs, and outskirts*;
- Task 7.3.3. *Analyze the role of infrastructures and related services on urbanization, residential choices, mobility patterns and choices, firms' relocation decisions and urban economic integration of inner and marginal areas, also through lab-in the field experiments and design thinking approach involving local actors*.

The first year of work was dedicated to defining some interpretative frameworks starting from the territorial typologies identified by the research. The activity involved the construction of integrated and dialoguing databases to define the characteristics, dimensions, and dynamics of Italian territories through the categories of: Metropolitan Italy, Inner Italy, Intermediate Italy, to which a fourth transversal category was added, that of the insular Italy. This part of the work held together quantitative and qualitative analysis starting from the spatialisation and cartographic visualisation of data and indicators to be integrated with the sets of indicators elaborated within the framework of WP1 (Human Capital, Social Capital, Physical Capital, Economic Capital).

The document returns the work of defining interpretative frameworks for the sustainability of Italian territories and the specification of a hybrid taxonomy in 13 classes, which allow for a preliminary classification that problematises and complexifies the territorial typologies of metropolitan, inner and intermediate Italy. This taxonomy is intertwined with a macro-regional classification that allows insular Italy to be distinguished from the rest of Italy (North, South, Centre), starting from the recognition of the country's settlement and geomorphological structures. The classification can be read in its extended or reduced dimension, with some elements of overlapping between the three territorial typologies, as for example, in the case of the metropolitan fringes that can participate in the macro-class Italy Metropolitan or Intermediate Italy.

The document provides the methodologies adopted, references and main work themes, research operations and articulation of activities carried out. The final part of the Repository is tripartite into Bibliographic Repository, Dataset, and Indicators. The final part of the Repository is divided into bibliographic Repository, dataset, and indicators.

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1. Spoke 7 Territorial Sustainability

1.1 WP3 Area-specific planning

1.1.1 Deliverable 3.1 Repository of solutions for monitoring and increasing the local attractiveness and resilience of specific areas

The WP3 intends to identify challenges for the transition towards sustainable, attractive, and smart cities and territories with a focus to specific territorial typologies: inner regions, islands, large urban areas and the so-called "Intermediate Italy", i.e. urban areas including mid-size cities and their wider polycentric and low-density urban systems. To this scope, a preliminary structure of the repository of solutions has been developed, which includes a bibliographic repository, a dataset and a list of preliminary indicators for monitoring and increasing the local attractiveness and resilience of each specific areas.

The activities were required to address the following main tasks:

- Integrate data from WP1 with local level data and analysis to define detailed vulnerability maps for specific case studies;
- Identify infrastructures and services digitalization policies to reduce divides between city centers, suburbs, and outskirts;
- Analyze the role of infrastructures and related services on urbanization, residential choices, mobility patterns and choices, firms' relocation decisions and urban economic integration of inner and marginal areas, also through lab-in the field experiments and design thinking approach involving local actors.

The first part of the work was dedicated to the definition of some interpretative frameworks starting from the territorial typologies identified by the research. The activity involved the construction of integrated and dialoguing databases to define the characteristics, dimensions and dynamics of Italian territories through the categories of: Metropolitan Italy, Inner Italy, *Intermediate Italy*, to which a fourth transversal category is added, which looks at the Insular Italy.

1.1.2 The refinement of the territorial typologies: toward selecting case studies from an institutional meta-classification of the Italian municipalities.

1.1.2.1 A hybrid taxonomy in 13 classes

The study proposes a preliminary classification into 13 classes that allow for a problematic definition of metropolitan, interior, and intermediate Italy. This taxonomy is interwoven with a macro-regional classification that allows insular Italy to be distinguished from the rest of Italy (North, South, Centre), starting from the recognition of the country's settlement and geomorphological structures. The classification can be read in its extended or reduced dimension, with some elements of overlap between the three territorial typologies, as for example in the case of the metropolitan fringes that can participate both in the macro-classification metropolitan Italy and intermediate Italy.

Given the complexity and variety of the Italian territory that we are trying to represent, it is essential to relate and make interact the studies that question the hierarchies and development trajectories of some of the main urban realities, those that concern socio-economic gaps and fractures - to orient, above all, cohesion policies - with those that, instead, try to construct geographical representations of settlement forms and systems. The elaboration of the classification underlying this research is in debt to certain conceptualizations, research, and analyses of spatial and territorial dynamics at different scales. To understand its innovation and potential, however, it is necessary to start from the reasons that have generated a multiplicity of classifications, mappings, and studies of our country: the growing territorial polarization of certain systems, the consequent marginalization of other portions of territories and the changes in urban polycentrism.

Territorial polarization - in some contexts referred to as territorial disparity or inequality - refers to the difference in access to resources, economic opportunities, public services, income, and welfare between different territories within a given country or geographical area. This phenomenon indicates that some areas prosper and develop much faster than others, creating significant imbalances in economic and social development. Many studies discuss its causes, effects, and policy implications. While GRINS research aims to promote interventions and policies of equity, inclusion, sustainability, resilience, and cohesion that tend to improve people's quality of life, social stability, and economic competitiveness, it is crucial to question the processes of polarization in territories. Indeed, understanding the geography of territorial disparities underpins the design of targeted policies that address the specific challenges of each area and promote equitable and sustainable development.

Polarization is also a factor contributing to **territorial marginalization** since the concentration of resources and opportunities in certain areas can exclude or marginalize those that do not benefit from them. Marginalization refers, in fact, to the process by which portions of territory or entire regions are excluded or placed on the margins of socio-economic and territorial development. Marginalized areas are often at a structural disadvantage compared to more developed areas, with less accessibility to services, limited employment, and lower quality of life.

In Italy, the processes of marginalization and territorial polarization are structural and have involved several recent public policies at national, regional and local level. For instance, thanks to the European Union's structural and investment funds (e.g. ERDF, EAFRD), development strategies

and projects have been launched to reduce territorial disparities and promote economic and social cohesion. In this context, the National Strategy for Inner Areas (SNAI) aims to promote the sustainable development of those territories facing challenges related to depopulation, geographical isolation, scarcity of services and limited access to economic opportunities.

These processes have stimulated a dense network of research and studies - both academic and non-academic - that focus on the analysis of territorial dynamics and strategic planning to reduce dependence on a few large cities or metropolises. This is how the concept of "***urban polycentrism***" developed, an approach that aims to build a network of complementary centers - of varying size and importance within a region or geographical area - decentralizing economic, social and cultural functions to contribute significantly to the integrated development of the entire territory.

Territorial polarization, marginalization and urban polycentrism have therefore led many to set up national taxonomies, statistical analyses and mapping of our country, analysis tools useful for highlighting possible geographies, identifying recurring dynamics, selecting samples of territory on which to launch intervention or research programs. This has produced a plurality of representations, sometimes unprecedented, others overlapping, often characterized by a specific thematic focus. Although crucial for our research intentions and shareable in the methodological structure, we believe that it is necessary to construct a new classification of Italy that holds together different criteria that, to this day, have characterized specific research paths or analyses. The reason is the need to overcome both the fragmentation and the partiality of some mappings, as well as the urgency of holding together differentiated indicators and criteria that open new scenarios and possible avenues of investigation and research.

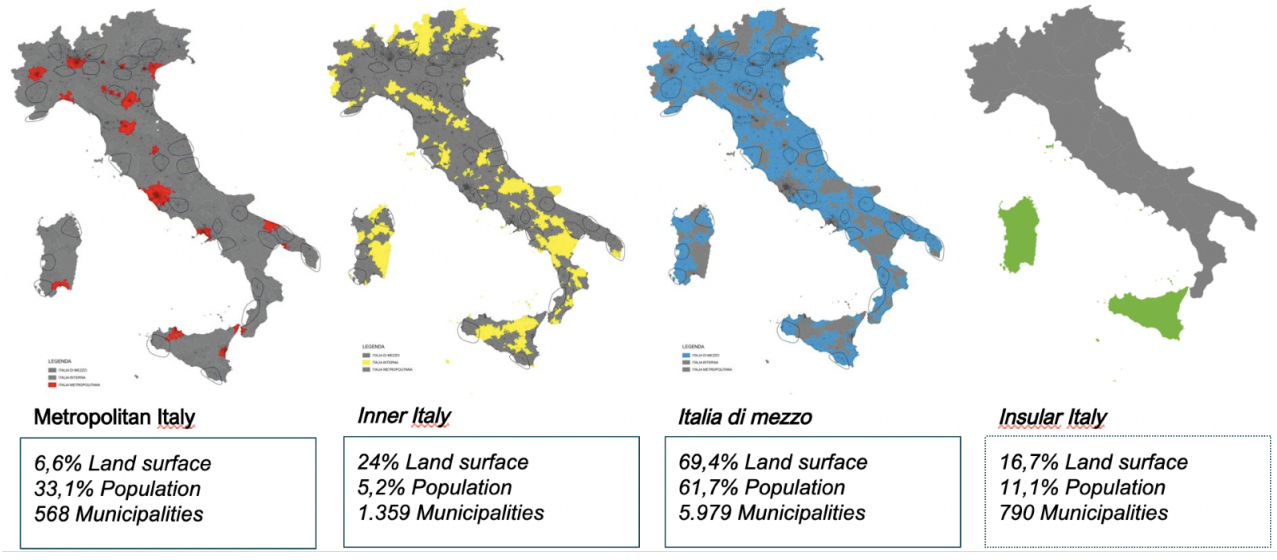


Figure 1: The four territorial typologies (elaboration by DAStU – POLIMI).

1.1.2.2 Classification methodology

The first methodological step was the classification of all Italian municipalities, updated to ISTAT 2021 borders and codes, following four main criteria:

i. the classification underlying the 2014 National Strategy for Inner Areas (SNAI);

ii. the same classification was updated and revised in 2020;

iii. the belonging or not belonging to a Metropolitan City as a territorial body of a vast area;

iv. the belonging or not belonging to one of the Functional Urban Areas (FUA) defined by the OECD in 2022.

SNAI ranked, first in 2014 and then in 2020, all Italian municipalities based on the presence of, or the travel time to reach by car, certain essential services such as education, health and rail. In short, SNAI classifies them as: "Poles" or "Inter-municipal Poles" the municipalities, single or aggregated, able to simultaneously offer all secondary school offerings, a hospital home to a Level I DEA and at least one Silver category railway station; "Belt" the municipalities less than 20′ (2014) or 27′ (2020) by car from Poles; "Intermediate" the municipalities requiring up to 40′ of travel time; "Peripheral" the municipalities within 75′ (2014) or 66′ (2020) minutes from Poles; and, finally, as "Ultraperipheral" the municipalities with travel times greater than 75′ (2014) or 66′ (2020).

Instead, the OECD uses population density to identify central urban nuclei (defined as "City" or "Greater City", depending on whether the cluster of maximum density extends over one or more municipalities), and then the origin of commuter flows to these nuclei to identify the relative "Commuting Zones", to arrive at a classification of the various FUAs on the basis of their overall population: "Large Metropolitan" for FUAs with a population of over 1.5 million; "Metropolitan" if with a population of between 250. 000 to 1.5 million; 'Medium-sized' between 100,000 and 250,000; 'Small' between 50,000 and 100,000.

By cross-referencing the presence or absence of the four criteria described above, and considering in addition the criterion relating to the administrative status of a capital municipality (of a Province or Metropolitan City), it was possible to recognise in the first place the three macro-classes of *Inner Italy*, *Metropolitan Italy* and *Intermediate Italy*.

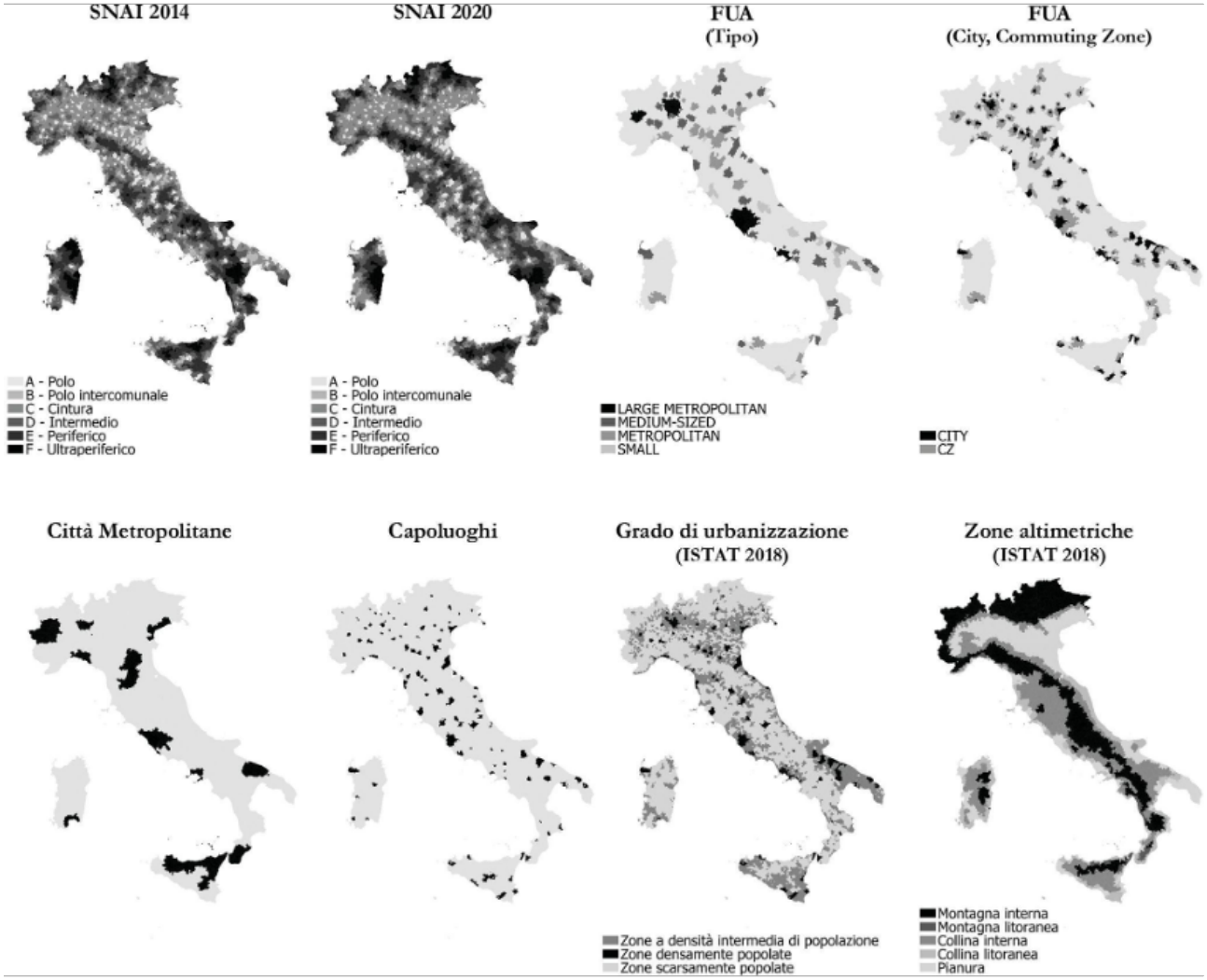


Figure 2: The classifications underlying the criteria for constructing the municipal taxonomy (elaboration by DAStU- Polimi on data from ISTAT, Agenzia per la Coesione Territoriale and OECD).

The inner Italy that emerges from our classification is that portion of the territory that presents characteristics of peripherality or ultra-peripherality that are confirmed by both SNAI classifications (2014, 2020). Although the condition of peripherality dominates, the municipalities belonging to this macro-class can be included in a de jure and/or de facto metropolitan city or area. A first disaggregation of the municipalities of inner Italy was carried out based on the presence or absence of points of contact - i.e. of potential overlap - with metropolitan Italy. Two types of internal municipalities emerged from this first operation: those that we defined as "remote", insofar as they are outside the de jure and de facto metropolitan areas, and those that we defined as "proximate" insofar as, although peripheral or ultra-peripheral according to SNAI, they are located within a metropolitan city or functional urban area (FUA) of metropolitan rank.

Metropolitan Italy, on the other hand, is composed of municipalities that in both SNAI classifications are outside the "peripheral" and "ultra-peripheral" classes and that belong de jure and de facto or only de facto to metropolitan-type contexts. On the basis of belonging to a Metropolitan City (de jure metropolis), to a FUA of metropolitan rank (de facto metropolis) and of

the status of capital (of Province or Metropolitan City), it has been possible to distinguish three subclasses of metropolitan Italy: the metropolitan capitals are the de facto metropolitan municipalities and de jure metropolitan city capitals (Turin, Milan, Venice, Genoa, Bologna, Florence, Rome, Naples, Bari, Cagliari, Palermo, Catania, Messina), with the sole exception made to include in metropolitan Italy the city of Reggio Calabria which, despite its 202. 000 inhabitants, has been considered on a par with a FUA city of metropolitan rank; the de jure and de facto metropolitan areas include all the remaining de facto and de jure metropolitan municipalities; finally, the de facto and non-de facto metropolitan poles are municipalities classified by the OECD as FUA Metropolitan Cities but which are not part of a Metropolitan City (Bergamo, Brescia, Verona, Padua, Modena, Parma, Reggio Emilia, Prato, Perugia, Taranto) to which is added the municipality of Monza as a provincial capital included in a FUA Large Metropolitan City (that of Milan).

If we exclude metropolitan and inner Italy, the geography of intermediate Italy emerges. Due to its large extension and rather heterogeneous demographic and settlement composition, it was necessary to distinguish this macro-class into several subclasses.

Firstly, we can distinguish the Medium Cities or non-metropolitan capitals as that sub-class which includes all municipalities in FUA Small and Medium and all provincial capitals not classified as FUA because they have a population of less than 50,000 inhabitants. Secondly, we can recognise the de jure or de facto Metropolitan Fringes as the subclass of municipalities included in de jure and/or de facto metropolitan areas that have never been classified by SNAI as 'peripheral' or 'ultra-peripheral' or classified as such by only one of the two SNAI classifications (2014, 2020). The remaining municipalities in intermediate Italy have been classified as urban-rural continuum.

A further classificatory step was necessary to account for some differences within the classes of remote Inner Italy, near Inner Italy municipalities and, above all, the very extensive class of the Urban-Rural Continuum, also in order to facilitate a more accurate reading of the interdependencies and overlaps between Inner Italy and metropolitan Italy. Using the classification relative to the degree of urbanisation provided by ISTAT (2018), it was possible to disaggregate the two classes of near and remote inner Italy by making a distinction between sparsely populated municipalities and municipalities with intermediate population density. Using the urbanisation degree and altitude zone classifications - the latter also provided by ISTAT (2018) - it was also possible to disaggregate the Urban-Rural Continuum class by distinguishing between: sparsely populated mountain/inland hilly municipalities, intermediate-populated mountain/inland hilly municipalities, sparsely populated coastal and/or lowland municipalities and intermediate-populated coastal and/or lowland municipalities.

CRITERIO 1		CRITERIO 2		CRITERIO 3		CRITERIO 4		CRITERIO 5		OUTPUT INTERMEDIO	CRITERIO 6		CRITERIO 7		OUTPUT FINALE
Comune periferico o ultraperiferico (SNAI 2014)		Comune periferico o ultraperiferico (SNAI 2020)		Comune facente parte di una Città metropolitana (*de jure*)		Comune incluso in una FUA di rango *Large metropolitan* o *Metropolitan*		City di FUA small o medium o comuni capoluogo al 31/12/2021			fascia altimetrica del comune (ISTAT)		grado di urbanizzazione (ISTAT)		
si	no	si	no	si	no	si	no	si	no		montagna/ collina	pianura/ litoraneo	scarsamente popolato	a media densità di popolazione	
X		X			X		X	*non considerato*		Interno remoto	*non considerato*		X		Interno remoto scarsamente popolato
														X	Interno remoto a media densità di popolazione
X		X			X	X		*non considerato*		Interno prossimo	*non considerato*		X		Interno prossimo scarsamente popolato
X		X		X			X								
X		X		X		X								X	Interno prossimo a media densità di popolazione
X			X		X		X		X	Continuum urbano-rurale	X		X		Continuum urbano-rurale di montagna/collina interna scarsamente popolato
														X	Continuum urbano-rurale di montagna/collina interna a media densità di popolazione
												X	X		Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato
	X		X		X		X		X					X	Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione
								X		Città media o capoluogo non metropolitano	*non considerato*		*non considerato*		Città media o capoluogo non metropolitano
	X	X			X		X	X							
	X		X	X			X	X							
									X	Frangia metropolitana de jure o de facto	*non considerato*		*non considerato*		Frangia metropolitana de jure o de facto
	X	X			X	X		*non considerato*							
	X	X		X			X								
X			X		X	X									
X			X	X			X								
	X		X		X	X									
	X	X		X		X									
X			X	X		X									
	X		X		X	X		*non considerato*		Polo metropolitano de facto e non de jure	*non considerato*		*non considerato*		Polo metropolitano de facto e non de jure
	X		X	X		X			X	Area metropolitana de jure e de facto (extra-capoluogo)	*non considerato*		*non considerato*		Area metropolitana de jure e de facto (extra-capoluogo)
								X		Capoluogo metropolitano	*non considerato*		*non considerato*		Capoluogo metropolitano

Figure 3: Synoptic overview of the criteria and steps taken for the classification of Italian municipalities. Elaboration DAStU - POLIMI

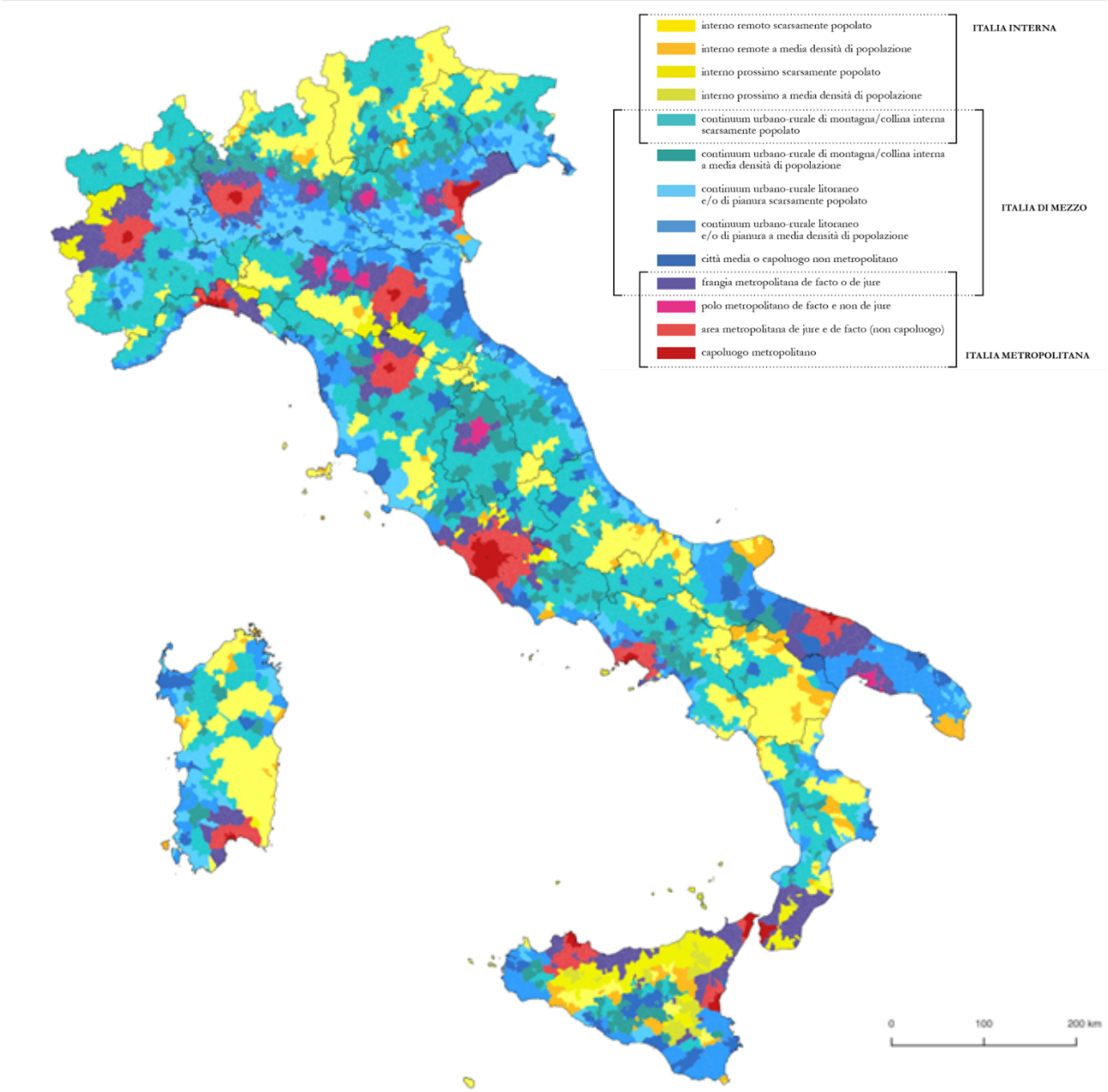


Figure 4: Overview map of the 13 subclasses resulting from the classification of Italian municipalities. Elaboration by DAStU - POLIMI.

	mappe	regioni	territori interessati	comuni	% pop.	% sup.
Interno remoto scarsamente popolato		tutte	Alta Valtellina, Alpi Orobie, Val Camonica, Abruzzo interno, Appennino Emiliano, Appennino tra Toscana Marche e Umbria, territori tra Abruzzo e Molise, Monti Sibillini, Pollino, Basilicata, Ogliastra.	1024	2,6	17,6
Interno remoto a media densità di popolazione		tutte tranne Valle d'Aosta, Liguria, Friuli-Venezia Giulia, Marche, Umbria.	Gargano, basso Salento.	127	1,6	2,7
Interno prossimo scarsamente popolato		Piemonte, Liguria, Emilia-Romagna, Toscana, Lazio, Puglia, Calabria, Sicilia, Sardegna.	Aree interne dentro le città metropolitane di Torino, Firenze, Messina, Catania, Palermo e Reggio Calabria.	177	0,5	3,0
Interno prossimo a media densità di popolazione		Lazio, Campania, Calabria, Sicilia.	Aree interne dentro le città metropolitane siciliane.	31	0,5	0,7
Continuum urbano-rurale di montagna/collina interna scarsamente popolato		tutte.	Valle d'Aosta, Montagne della provincia di Imperia e di Cuneo, Val d'Ossola, provincia di Bolzano, alte Langhe, Monferrato, montagne delle cinque terre, dorsale appenninica, Cilento, Presila cosentina.	2311	7,0	26,2
Continuum urbano-rurale di montagna/collina interna a media densità di popolazione		tutte.	Pedemonte alpino, Conche interne tra Umbria, Lazio, Marche e Campania.	841	9,9	8,6
Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato		tutte tranne Valle d'Aosta, Trentino Alto Adige, Umbria.	Asse del Po, Collina costiera adriatica, Maremma, Sulcis, Olbia, Trapani, Ragusa.	979	4,4	8,8
Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione		tutte tranne Valle d'Aosta, Trentino Alto Adige, Umbria.	Costa adriatica, Salento, Sicilia meridionale.	788	16,4	11,5
Città media o capoluogo non metropolitano		tutte.	*VC, NO, CN, AT, AL, AO, IM, SV, SP, VA, CO, SO, PV, CR, MN, BZ, TN, VI, BL, TV, RO, UD, GO, TS, PC, Carpi, Sassuolo, FE, RA, FC, PS, AN, MC, AP, FM, MS, LU, PT, LV, PI, AR, SI, GR, TR, VT, RI, LT, FR, CE, BN, AV, Battipaglia, SA, AQ, TE, PE, CHi, CB, Cerignola, FG, Altamura, Andria, Barletta, Bisceglie, Trani, BR, LE, PZ, MT, CS, CZ, TP, AG, CL, Gela, EN, Acireale, RG, SR, SS, NU, Carbonia, PN, IS, OR, BI, LC, RN, KR, VV, VB.	91	11,4	5,2
Frangia metropolitana de jure o de facto		tutte tranne Valle d'Aosta, Trentino Alto Adige, Friuli-Venezia Giulia, Marche, Molise, Basilicata.	Frange metropolitane delle città di Torino, Milano, Venezia. Genova, Bologna, Firenze, Roma, Napoli, Bari, Cagliari, Palermo, Catania, Messina e Reggio Calabria.	967	12,6	9
Polo metropolitano de facto e non de jure		Lombardia, Veneto, Emilia-Romagna, Toscana, Umbria, Puglia.	Monza, Bergamo, Brescia, Verona, Padova, Modena, Parma, Reggio Emilia, Prato, Perugia, Taranto.	11	3,4	0,6
Area metropolitana de jure e de facto (extra-capoluogo)		Piemonte, Lombardia, Veneto, Liguria, Emilia-Romagna, Toscana, Lazio, Campania, Puglia, Sicilia, Sardegna.	Aree metropolitane delle città di Torino, Milano, Venezia. Genova, Bologna, Firenze, Roma, Napoli, Bari, Cagliari, Palermo, Catania e Messina.	543	14,0	4,7
Capoluogo metropolitano		Piemonte, Lombardia, Veneto, Liguria, Emilia-Romagna, Toscana, Lazio, Campania, Calabria, Puglia, Sicilia, Sardegna.	Torino, Milano, Venezia, Genova, Bologna, Firenze, Roma, Napoli, Bari, Cagliari, Palermo, Catania, Messina e Reggio Calabria.	14	15,6	1,2

Figure 5: Analytical table of the subclasses of Intermediate Italy. Elaboration by DAStU - POLIMI

1.1.3 Thematic framework: Four territorial typologies

This part of the work used a set of data and indicators spatialised and visualised at the national scale, in which elements of structure and ongoing dynamics are articulated in the 3 + 1 territorial typologies of metropolitan, inner, intermediate and insular Italy. Starting from the 4 thematic macro-areas of data and indicators identified within WP1 (Economic, Social, Human, and Physical Capital), WP3 articulates some background themes within the territorial typologies.

1.1.3.1 Profiles of Metropolitan Italy

Metropolitan Italy presents a complex picture. Belonging to a Metropolitan City (de jure metropolis), to a FUA of metropolitan rank (de facto metropolis) and to the status of capital (of Province or Metropolitan City), it has been possible to distinguish three subclasses of metropolitan Italy metropolitan capitals are the de facto metropolitan municipalities and de jure metropolitan city capitals (Turin, Milan, Venice, Genoa, Bologna, Florence, Rome, Naples, Bari, Cagliari, Palermo, Catania, Messina), with the sole exception made to include in metropolitan Italy the city of Reggio Calabria which, despite its 202.000 inhabitants, has been considered on a par with a FUA city of metropolitan rank; the de jure and de facto metropolitan areas include all the remaining de facto and de jure metropolitan municipalities; finally, the de facto and non-de facto metropolitan poles are municipalities classified by the OECD as FUA Metropolitan Cities but which are not part of a Metropolitan City (Bergamo, Brescia, Verona, Padua, Modena, Parma, Reggio Emilia, Prato, Perugia, Taranto) to which is added the municipality of Monza as a provincial capital included in a FUA Large Metropolitan City (that of Milan). In metropolitan Italy there also emerges the "boundary class" of metropolitan fringes that can participate in the extended description of both metropolitan Italy and intermediate Italy.

Metropolitan Italy is the only territorial division that has experienced demographic growth in the last decade against the backdrop of a country that has begun to contract. Metropolitan and de facto poles and metropolitan capitals in particular are growing, with, however, the significant counter-trend performances of Genoa, Taranto, Reggio Calabria and Messina. Growth when present is due to a positive migration rate concentrated in the poles and capitals. Conversely, birth rates are higher in the metropolitan crowns (according to a well-established geographical differentiation between cores marked by the presence of singles and outer areas of families).

Figure 6: Percentage change in population 2011-2022 in metropolitan cities. (Elaboration by DATsU – POLIMI from https://inumeridibolognametropolitana.it/)

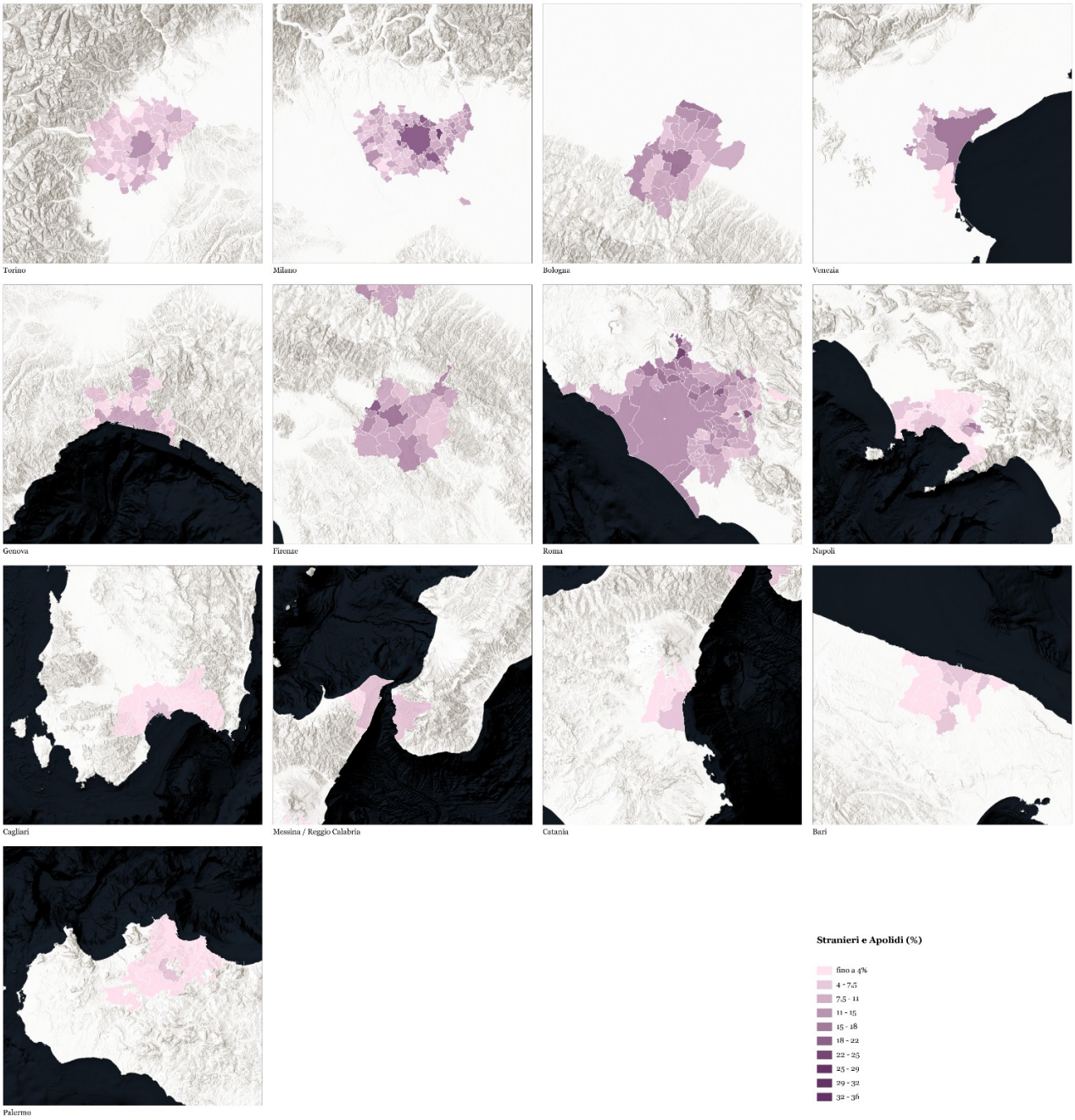


Figure 7: Presence of foreigners and stateless people in % in metropolitan cities. (Elaboration by DATsU – POLIMI from https://inumeridibolognametropolitana.it/)

Metropolitan Italy added value per capita has grown over the last ten years by approximately 12% with an almost constant trend until 2019. The northern metropolitan cities all positioning themselves above the national average, which is equal to € 26,978 (Milan shows a per capita added value of €49,978), while the southern cities are all below this threshold.

In 2020, due to the pandemic, there was a strong setback in Metropolitan Italy as in the rest of the country, with very differentiated reductions in added value per capita, which however do not substantially change the overall situation between north and south.

Metropolitan Italy features a dynamic real estate market, with annual growth rates in home transactions higher than the other regions and well above the national level. However, counterbalancing this dynamism are conditions of accessibility much lower than the national average due to higher average prices. Alongside this vulnerability, there are processes of exclusion and exclusivity in certain areas compared to others, ongoing gentrification processes, and expulsive dynamics affecting certain segments of the resident or active population. Speculation can also pose a problem, with properties being kept vacant in a market where many are in search of a residence.

Metropolitan Italy has the highest levels of urbanised land use with a prevalence of dense urban cores and to a lesser extent peri-urban and suburban space as well as a marked lowland connotation. Less obvious is the fact that in recent years it has also been the most densely urbanised, while per capita soil consumption is lower. The high levels of pollution due to pm10 are quite intuitive, while the highest levels of presence of RIR plants and SIN areas (more present in intermediate Italy.

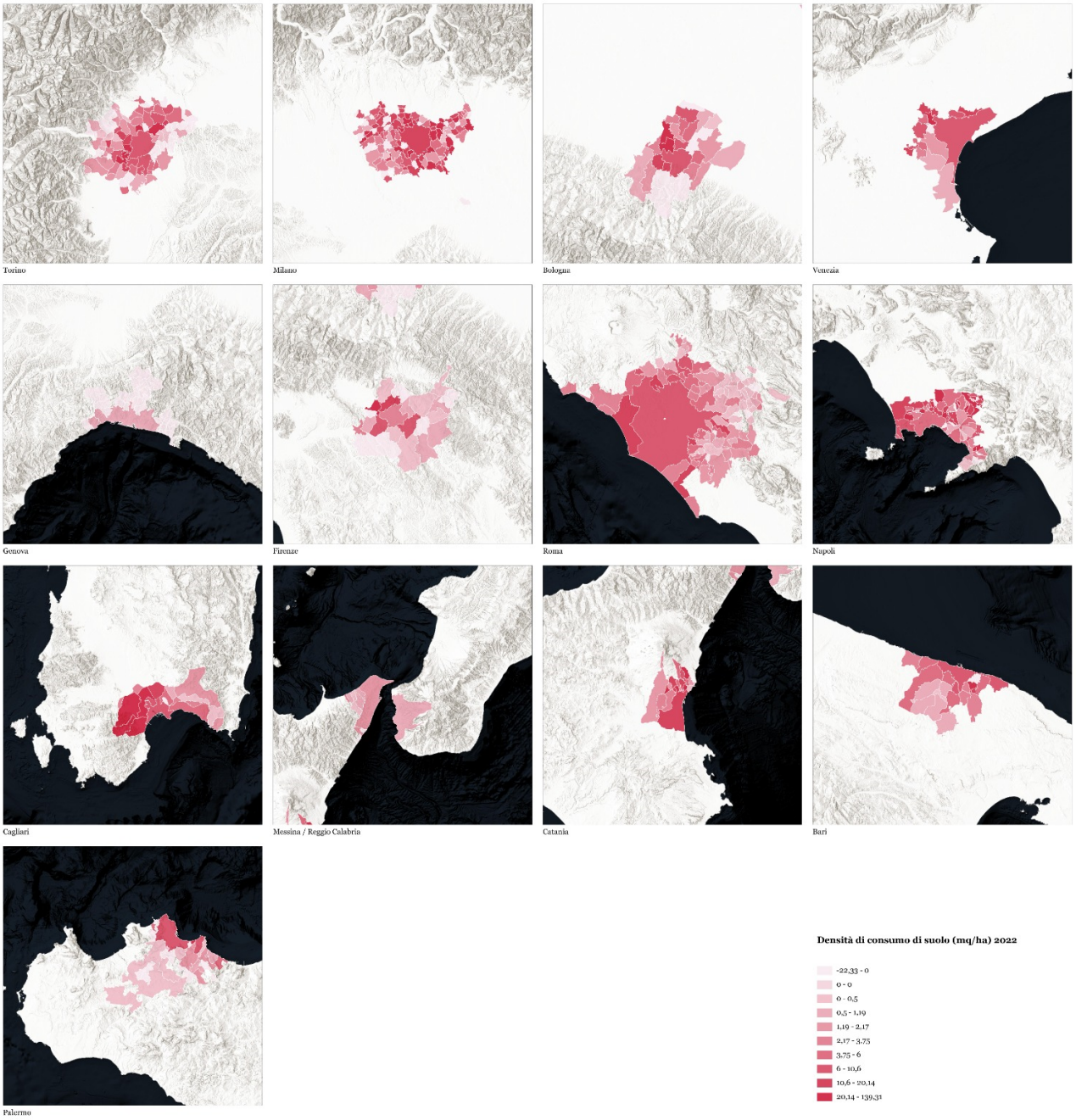


Figure 8: Land use density in metropolitan cities (m2/ha, 2022)

The metropolitan areas, especially in the north of the country, are characterised by positive demographic indicators, which highlight population growth, a higher birth rate and a greater presence of foreigners. All this leads to a larger school population, which is fully served by the provision of primary and lower secondary schools. The already significant number of schools in metropolitan areas increases when fringe areas are considered. In terms of upper secondary education, metropolitan areas have a large and variegated provision, concentrated mainly in the capital cities and in the first belt.

Metropolitan Italy has been, in thirty years, the main interest of rail transport policies. With few exceptions, HS is reaching (or will reach by 2026) all urban cores of metropolitan Italy except

Taranto, Reggio Calabria and Sicilian and Sardinian cities. However, some cities of Metropolitan Italy, despite along HS lines (Parma, Modena, Perugia), are out of the HS network of services for understandable design choices. However, they are also barely connected through mixed services. Also for regional transport, metropolitan cities – some of them, actually – were at the centre of policies. Starting form 1998 the concept of suburban service has reached Milan and its metropolitan area and is now a way to design services in most of other main metropolitan areas from north to south (interesting the recent systems under implementation of Palermo, Bari and Catania).

1.1.3.2 Profiles of Intermediate Italy

The geography of intermediate Italy emerges if we exclude metropolitan and inner Italy. Due to its large extension and rather heterogeneous demographic and settlement composition, it was necessary to distinguish this macro-class into several subclasses. Firstly, we can distinguish the Medium or Non-Metropolitan Capital Cities as that sub-class which includes all municipalities in FUA Small and Medium and all provincial capitals not classified as FUA because they have a population of less than 50,000. Secondly, we can recognise the de jure or de facto Metropolitan Fringes as the subclass of municipalities included in de jure and/or de facto metropolitan areas that have never been classified by SNAI as 'peripheral' or 'ultra-peripheral' or classified as such by only one of the two SNAI classifications (2014, 2020). The remaining municipalities in intermediate Italy were classified as urban-rural continuum. A further classificatory step was necessary to account for some differences within the classes of remote Inner Italy municipalities, near Inner Italy municipalities and, above all, the very extensive class of the urban-rural Continuum, also in order to facilitate a more accurate reading of the interdependencies and overlaps between Inner Italy and metropolitan Italy. Using the classification relative to the degree of urbanisation provided by ISTAT (2018), it was possible to disaggregate the two classes of near and remote inner Italy by making a distinction between sparsely populated municipalities and municipalities with intermediate population density. Using the classifications of the degree of urbanisation and altitude zones - the latter also provided by ISTAT (2018) - it was also possible to disaggregate the class of the urban-rural Continuum by distinguishing between: sparsely populated mountain/inland hilly municipalities, intermediate-populated mountain/inland hilly municipalities, sparsely populated coastal and/or lowland municipalities and intermediate-populated coastal and/or lowland municipalities. Two "boundary classes" emerge in intermediate Italy: that of the Metropolitan Fringes that can participate in the extended description of both Metropolitan Italy and that of the sparsely populated urban-rural mountain/hinterland Continuum that can participate in the extended description of Inner Italy.

The population trend in intermediate Italy is marked by a weak contraction. However, there are significant differences within it. First of all, the contraction is more significant in the less dense and hilly municipalities in the hinterland. In addition, the municipalities - especially the denser ones and the medium-sized cities - experience weak growth in Lombardy, Veneto and Emilia Romagna, along the Adriatic coast as far as Tremoli, in the non-metropolitan portion of central Tuscany (in the lowland territories of the provinces of Pistoia, Pisa, Lucca) and in some areas outside metropolitan Italy in Latium and Campania (towards Latina and Frosinone, towards Caserta,

Salerno Avellino) and in some areas in the south (portions of Puglia, Olbia, Scicli-Ragusa-Gela). More generally, migration balances are positive in these areas (and more generally in the centre-north), negative in other cases. A similar geography is found in the presence of foreigners, while the geography of birth rates presents a different articulation with high values in the Cuneo area, in Alto Adige and in significant portions of Campania and Sicily.

In intermediate Italy, the real estate market displays considerable diversity. This variability is not only among the different identified territorial types but is also observed within the same category. In medium-sized cities and metropolitan fringes, the number of property transactions is high, and so are the average prices. There isn't a clear north-center-south differentiation; rather, the distinction lies in the location and status of the medium-sized city, with the attractiveness of an area playing a significant role in settlement dynamics. A different scenario unfolds in the urban-rural continuum across its four classifications. As one moves away from more densely populated areas, the market experiences a sudden slowdown, and property prices tend to decrease. However, within these categories, certain areas record very high real estate prices, attributed to their value or tourist-recreational appeal.

Three traits characterise the environment of intermediate Italy: a) the low gradient and low hill and lowland as well as coastal location; b) the strong presence of intensively cultivated and arboreal areas (it is the Italy of industrialised agriculture); c) an intermediate level of soil urbanisation with a prevalence of suburban and periurban forms of medium density and the strong presence of urbanised soils for manufacturing, logistics, infrastructural and commercial use. The dynamics of soil consumption is intermediate in terms of density of soil consumed and per capita consumption, but still has a rather high value in absolute terms, linked in particular to non-residential uses, Significant environmental criticalities due not only to soil consumption but above all to the fragmentation of open spaces and the degradation of non-urbanised land, to the presence of many RIR plants and SIN sites, to particularly high levels of PM10 in the atmosphere of the Po Valley, the inland peninsular basins and valley floors, to the presence of many ground-mounted solar plants, and finally to the high hydraulic risk.

Distribution, accessibility and functioning of services and facilities in intermediate Italy presents an intermediate situation compared to the other two contexts (metropolitan Italy and inner Italy) with significant elements of territorial variety and specificity. As far as schools are concerned, it is often first and second grade secondary education that shows some polarisation processes, with higher concentrations in more densely populated and more easily accessible territories. The capillary presence of first-cycle school service delivery points coexists with a scarce variety and diversification of the educational offer in the territories, which raises questions of rationalisation of educational governance, through a spatialised strategy of organisation of the school network. Intermediate Italy's rail service is characterised by a good first-mile accessibility, but by an often inadequate service. In a context of low road congestion, a slow and infrequent train service is typically not an option for most of users. At the same time, the potentialities of existing networks tend to be unexploited because too linked to the idea of rail as universal service rather than as a competitor of private car.

1.1.3.3 Profiles of Inner Italy

Inner Italy is that portion of the territory that presents characteristics of peripherality or ultra-peripherality confirmed by both SNAI (2014, 2020) classifications. Although the condition of peripherality dominates, the municipalities belonging to this macro-class may be included in a de jure and/or de facto metropolitan city or area. A first disaggregation of the municipalities of inner Italy was carried out on the basis of the presence or absence of points of contact - i.e. of potential overlap - with metropolitan Italy. Two types of inner municipalities emerged from this first operation: those that we defined as "remote", in that they are outside the de jure and de facto metropolitan areas, and those that we defined as "proximate" in that, although peripheral or ultra-peripheral according to SNAI, they are located within a metropolitan city or functional urban area (FUA) of metropolitan rank. In inner Italy there also emerges the 'border class' of the sparsely populated urban-rural continuum of mountainous/inland hills that can participate in the extended description of inner and intermediate Italy.

In the last census interval, there are no significant indications of a counter-trend to the population contraction that characterises Inner Italy in the long term, the only exceptions being Trentino-Alto Adige Interno (where the relatively high birth rate is particularly noteworthy) and a few small and discontinuous areas in Lombardy and Valle d'Aosta. In the other regions anomalous trends are limited to single municipalities.

Although internal areas suffer from conditions of marked peripherality and marginality, they are contexts in which the cultural and natural heritage is relevant and can constitute an important resource for resident populations, both with a view to strengthening local identity and in a perspective of promotion and valorisation of the local area also for tourism purposes.

Also in terms of cultural ecosystem services, which highlight the presence and use of the natural resources of the territory, rural areas have on average higher provision than more urban territories.

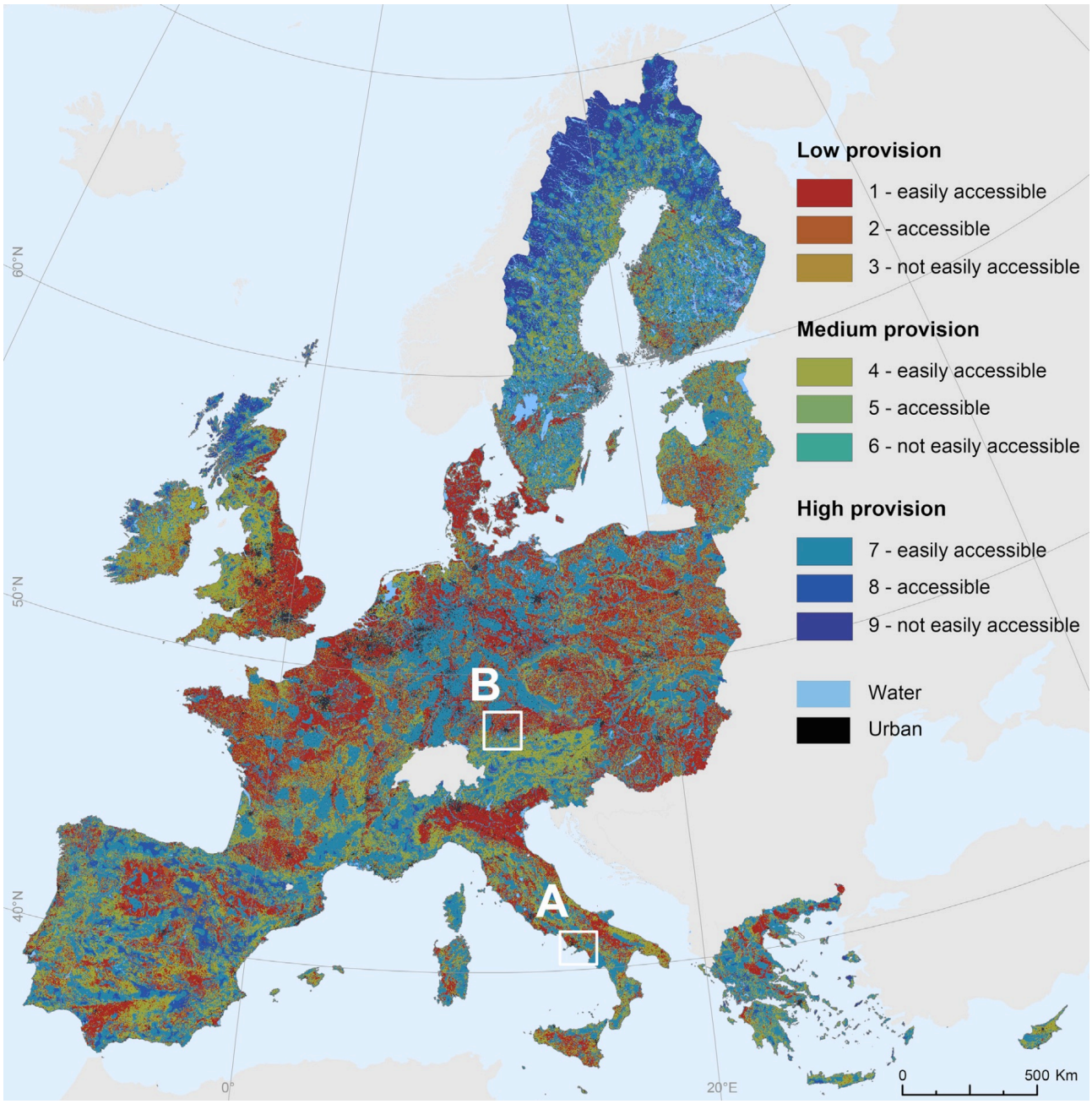


Figure 9: The Recreation Opportunity Spectrum (ROS) for Europe, where ROS framework categorises the potential ecosystem service in terms of quality and accessibility. (source: M. L. Paracchini, G. Zulian, L. Kopperoinen, J. Maes, J.P. Schägnera, M. Termansen, M. Zandersen, M. Perez-Soba, P. A. Scholefield, G: Bidoglio. (2014). Mapping cultural ecosystem services: A framework to assess the potential for outdoor recreation across the EU, Ecological Indicators 45 (2014) 371–385)

In inner Italy, real estate dynamics are limited and, generally, characterized by a very low number of property exchanges, a high rate of underutilization, and low property prices. However, it is important to emphasize that these dynamics are significantly influenced by the tourist attractiveness of the area and, in some circumstances, by the particular value of the building heritage. In these latter cases, where property transactions are low, there is a contrasting very high real estate value, indicating that these territories are particularly oriented towards tourism and second homes. Among the main processes that emerge are, on the one hand, the peripheralization and abandonment of real estate assets - with significant costs in terms of

territory care and management, and on the other hand, processes of touristification that impact the sustainability and quality of services and landscape.

Inner Italy is characterised, as is well known, by the prevalence of mountainous terrain, high forest cover, a low level of urbanised land, but a high level of per capita consumption (due to the presence of both abandoned assets and second homes). From a dynamic point of view, the -unguided- growth of the forest on abandoned cultivated land and pastures is the central aspect (a dynamic that in this case entails a reduction and not an increase in biodiversity as would be the case with lowland forestation). The danger associated with landslides is particularly high but given the structure this reverberates into a high risk for the built heritage more than for the contained population.

There are fewer schools in inner Italy than in the metropolitan and intermediate ones, due to the phenomena of permanent and constant demographic decline, low birth rates and reduced immigration. The context with fewer schools is the one defined as "inland close to medium population density", while the "remote sparsely populated inland" is the one that suffers from the greatest number of absences from services, including primary ones (3.3% of the population). The percentage of the population without services rises to 10.1% in the case of lower secondary schools. Secondary schools are rare in these areas; sometimes there is a residual and long-term offer or one that is still strongly linked to the local economic vocation.

1.1.3.4 Profiles of Insular Italy

With respect to the three previous territorial typologies, insular Italy represents a “transversal section” whose objective is to investigate the specificity of the two island regions (Sardinia and Sicily) with respect to the other macro-regional divisions; North-Western Italy, North-Eastern Italy, Central Italy, Southern Italy. Overall, interweaving this breakdown with the three previous ones reveals a particularly high demographic and territorial weight of inner Italy if it is defined in 'restricted' form.

Insular Italy as a whole is losing population (with a contraction that in percentage terms is the same as that of intermediate Italy) and is characterised by negative migration rates and low percentages of foreigners. Slightly positive trends or at least relative stability can be found in the metropolitan cities of Palermo, Cagliari, Catania, but not Messina, the Olbia area and the Ragusa Scicli and Avola area of Insular intermediate Italy).

Insularity and marginality are different concepts that may or may not coexist on an economic level and their definition is a function of geographical aspects or aspects of strategic distance from the main centroids of economic development. As argued by Behrens et al. 2006, in presence of asymmetric transport costs, disadvantaged regions do not necessarily always coincide with island areas; there are regions which, due to the lack of direct access by sea, must necessarily use the road or railway network before accessing the maritime network with additional costs.

Insularity has geographical limitations that impact the economic productivity prospects of the territory (Deidda M., 2015, pp. 112-114), including remoteness (Meloni I., Loi S., Sanjust di Teulada B.,

2014), the globalization of investments (Musolino, 2014; Adair, A., Berry, J.; McGreal, S.; Syacutekora, L.; Ghanbari Parsa, A., and Redding, B. 1999).

Several authors have focused on the advantages of the condition of isolation, but never in relation to aspects of marginality (Husmann C., 2015) from economically competitive contexts (Amenta C., Stagnaro C., Vitale L., 2020, 8). Some underline the social and cohesive homogeneity of island contexts (Deidda M., 2015, 114) or the richness of the environmental and cultural heritage protected by natural ecosystems (Amenta C., Stagnaro C., Vitale L., 2020, 8).

The negative effects of insularity, from an empirical point of view, rather than generalized, appear to be case-specific also with reference to the Italian national context itself. For Cocco Deidda Marchesi and Pigliaru (2018) the importance of doing business in territories connected with a network on the mainland is highlighted by exploiting the proximity of its customers or distribution centers and it also demonstrates how insularity is, in some cases, a condition of peripherality and remoteness which stifles the development of the production system and negatively affects the well-being of consumers.

The analysis of the Italian real estate market highlights how the highest growth rate, in terms of exchanged residential area, is observed in the two major islands, which, compared to 2021, show an increase of 8.4%. However, the analysis of NTN (the number of homes bought and sold) reveals that this dynamism is particularly concentrated in cities: Messina, Palermo, Catanzaro with over 2000 transactions; Siracusa, Sassari, Cagliari, Olbia between 1000 and 2000. The remaining portion of the territory, partly in intermediate Italy, partly in inner Italy, has low values, with some Sardinian municipalities recording no sales. Real estate values are diverse and significantly influenced by tourist attractiveness or the presence of an urban or metropolitan center. Processes that emerge from this analysis include: polarization towards major cities and the consequent peripheralization of significant portions of the territory; obsolescence and abandonment of underutilized building capital; touristification of the coasts; urbanization without a real increase in population; declining or collapsing real estate values in some areas.

Insular Italy does not have strong environmental features beyond the strong coastal development linked to insularity. As far as forest cover is concerned, it reaches relatively low levels (although slightly higher than in Apulia and definitely higher than in the Po Valley). Soil consumption is much higher in Sicily than in Sardinia. However, if we move on to consider the density of changes in recent years, the situation rebalances with high levels of consumption density in northern Sardinia as well. Landslides are higher in Sardinia, but with a risk due to the low population density of the areas affected by the hazard. In both regions the hydraulic hazard is concentrated in border areas close to the metropolitan areas of Cagliari and Catania

The insular Italy shows a situation of good educational infrastructure, even in the most remote areas, where only 2.2% of the population do not have a primary school and 3.1% do not have a secondary school. Values of presence and coverage of the educational service are generally higher than other Italian macro-regions, for every territorial typology.

1.1.4 First comparisons between territorial typologies

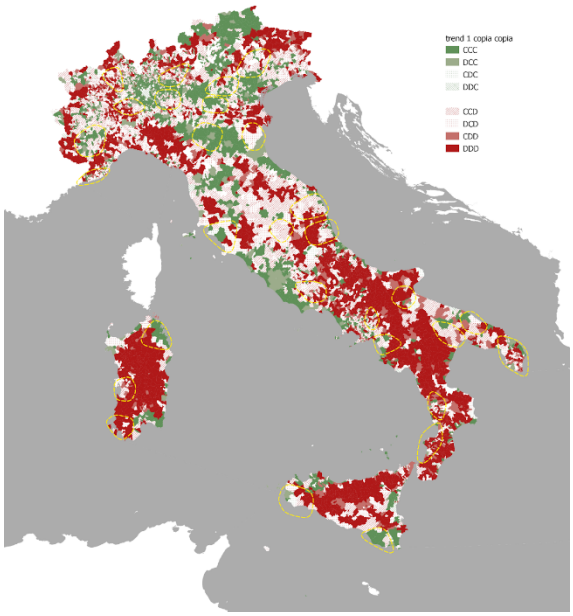
The aim of this section is providing a comparative analysis, through the drawing of interpretative thematic focuses. These focuses let us select some territorial contexts to be deepened later during case studies phase. Each of these thematical axes can be integrated by further data and interpretations, proposed by each component of the working group.

1.1.4.1 Demography

Through the reading of census and registry data and of some summary indicators referring to the Italian population (concerning: general trend, age, citizenship, family composition, natural and migratory trends), the study reconstructs the structure and characteristics of the people residing in the different territorial typologies, identifying prevailing demographic processes and trends. The set of indicators examined is part of the broader catalogue of data relating to the macro-categories of Social Capital and Human Capital defined in WP1.

	Popolazione legale al 31/12/2021	Superficie territoriale (kmq) al 31/12/2021	% pop	% sup
1 ITALIA INTERNA	**3.094.837**	**72.548**	**5,2**	**24,0**
1.1.1 - Interno remoto scarsamente popolato	1.545.013	53.205	2,6	17,6
1.1.2 - Interno remoto a media densità di popolazione	943.711	8.158	1,6	2,7
1.2.1 - Interno prossimo scarsamente popolato	298.941	8.942	0,5	3,0
1.2.2 - Interno prossimo a media densità di popolazione	307.172	2.243	0,5	0,7
2 ITALIA DI MEZZO	**36.424.674**	**209.751**	**61,7**	**69,4**
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	4.147.718	79.276	7,0	26,2
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	5.851.551	26.045	9,9	8,6
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	2.573.509	26.748	4,4	8,9
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	9.680.609	34.970	16,4	11,6
2.2 - Città media o capoluogo non FUA	6.720.878	15.595	11,4	5,2
2.3 - Frangia metropolitana de facto o de jure	7.450.409	27.117	12,6	9,0
3 ITALIA METROPOLITANA	**19.510.622**	**19.862**	**33,1**	**6,6**
3.1 - Polo metropolitano de facto	1.997.353	1.927	3,4	0,6
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	8.286.502	14.320	14,0	4,7
3.2.2 - Capoluogo metropolitano	9.226.767	3.615	15,6	1,2
TOT	**59.030.133**	**302.161**	**100**	**100**

Table 1: Resident population and land area of the 3 macroclasses and 13 subclasses, with relative percentage weights (Elaboration by DAStU - POLIMI on ISTAT data).



		Variazione % pop 2011-2021
	ITALIA INTERNA	-6,6%
	ITALIA DI MEZZO	-1,3%
	ITALIA METROPOLITANA	1,6%

Classe	Sottoclasse	Variazione % pop 2011-2021
interna	1.1.1 - Interno remoto scarsamente popolato	-8,1%
	1.1.2 - Interno remoto a media densità di popolazione	-3,8%
	1.2.1 - Interno prossimo scarsamente popolato	-10,0%
	1.2.2 - Interno prossimo a media densità di popolazione	-3,5%
di mezzo	2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	-5,9%
	2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	-1,4%
	2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	-3,7%
	2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	-0,6%
	2.2 - Città media o capoluogo non FUA	-0,6%
	2.3 - Frangia metropolitana de facto o de jure	0,8%
metropolitana	3.1 - Polo metropolitano de facto	2,5%
	3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	1,7%
	3.2.2 - Capoluogo metropolitano	1,3%
	NOTA: solo comuni con dato presente sia al 2011 che 2021, per un totale di 7794 su 7905 comuni	

Figure 10: In the map: resident population trends in the intervals 1991-2001, 2001-2011, 2011-2021 (C = growth, D = decrease). In the table: percentage change in resident population between 2011 and 2021. Elaborated by DAStU - POLIMI.

	Tasso di natalità medio (2014-2019)	Tasso di mortalità medio (2014-2019)	Tasso migratorio medio (2014-2019)
1 ITALIA INTERNA	**6,2**	**14,6**	**-2,7**
1.1.1 - Interno remoto scarsamente popolato	6,1	15,0	-2,7
1.1.2 - Interno remoto a media densità di popolazione	7,4	10,7	-1,5
1.2.1 - Interno prossimo scarsamente popolato	6,0	15,5	-3,9
1.2.2 - Interno prossimo a media densità di popolazione	7,9	10,6	-2,7
2 ITALIA DI MEZZO	**7,0**	**12,1**	**-0,8**
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	6,4	13,9	-1,5
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	7,7	10,1	0,0
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	6,9	12,3	-1,4
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	7,7	10,0	0,1
2.2 - Città media o capoluogo non FUA	7,2	11,0	2,2
2.3 - Frangia metropolitana de facto o de jure	7,6	10,8	-0,1
3 ITALIA METROPOLITANA	**7,8**	**9,7**	**0,7**
3.1 - Polo metropolitano de facto	7,8	10,6	5,9
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	7,8	9,6	0,6
3.2.2 - Capoluogo metropolitano	7,6	11,3	2,2

Table 2: Birth, death and migration rates. Average years 2014-2019 (Elaboration DAStU – POLIMI).

Media dei valori comunali 2020 >	pop. fino a 4 anni (% sul totale)	pop. di 75 anni e più (% sul totale)	pop. di 85 anni e più (% sul totale)
ITALIA INTERNA	**3,0**	**15,2**	**5,5**
1.1.1 - Interno remoto scarsamente popolato	2,9	15,7	5,7
1.1.2 - Interno remoto a media densità di popolazione	3,6	11,8	3,7
1.2.1 - Interno prossimo scarsamente popolato	2,9	15,6	5,7
1.2.2 - Interno prossimo a media densità di popolazione	3,9	11,1	3,6
ITALIA DI MEZZO	**3,4**	**12,9**	**4,2**
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	3,1	14,4	5,0
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	3,7	11,5	3,5
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	3,4	12,8	4,2
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	3,8	11,4	3,5
2.2 - Città media o capoluogo non FUA	3,5	12,7	4,1
2.3 - Frangia metropolitana	3,7	11,8	3,7
ITALIA METROPOLITANA	**3,8**	**10,8**	**3,1**
3.1 - Polo metropolitano de facto	3,7	12,8	4,2
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	3,8	10,7	3,1
3.2.2 - Capoluogo metropolitano	3,7	12,8	4,1

Table 3: Percentage of population in age groups 0-4, ≥75, ≥85 (Elaboration DAStU - POLIMI on ISTAT data).

Italy, after a long season of population growth, has for some years now begun to decline as a result of a strongly negative natural balance and a migratory dynamic that sees a growing flow of emigration towards foreign countries flanking the well-known process of immigration (which has stabilised in recent years). The halt in demographic growth (and even a contained contraction) in itself should not necessarily be understood as an element of crisis, but should be thought of as a new reference horizon, which in some respects is also positive (for a country with a high population density like Italy).

What is problematic is on the one hand the youthful connotation of emigration that makes the ageing of the Italian population even more radical, and on the other hand the presence of significantly differentiated trends at territorial level. The particularly significant contraction in some contexts signals three orders of problems: (a) the also highly differentiated trend of the different regional and local economies that is configured as one of the forms of socio-economic inequality emerging today; (b) concentration phenomena that lead to the underutilisation of social fixed capital deposited in the territory over the long term and demands for new infrastructure in a few areas that have a heavy ecological footprint c) weakening of not a few of the historical and differentiated Italian socio-territorial formations (in particular of intermediate Italy) that in their plurality have been an element of resilience and plasticity of the nation in the face of different global and systemic dynamics.

That being said, the trend over the last decade confirms the new dynamism of metropolitan Italy, which is also manifested in the border class with intermediate Italy "metropolitan fringe", the persistent significant contraction in inner Italy and the start of a slight contraction in intermediate Italy (slightly higher than the national figure), which becomes more marked in the border class with sparsely populated mountain and hillside rural urban continuum. In metropolitan Italy the most dynamic class is that of the de facto metropolitan poles, in intermediate Italy, in addition to the anomalous positive trend of the boundary class metropolitan fringes, the classes with the least contraction are those of the intermediate city and the densest continuum, in the internal areas significant collapses are recorded in the least populated municipalities even those not too far from the metropolitan cities.

Obviously within the classes there are some anomalous trends, which we can see in figure 10 four areas of metropolitan Italy experience a contraction in contrast to the general figure. The areas of Genoa, Taranto, Reggio Calabria and Messina have entered or confirmed (in the case of Genoa) a contraction in the last decade. For intermediate Italy, there are anomalous growth dynamics in Lombardy, Veneto and Emilia (particularly in the large foothills), in a good part of the Adriatic coastal municipalities (in an almost continuous form up to Termoli), in the plain between Pisa and Lucca, in large segments of the Tyrrhenian coast of Tuscany, Latium and Campania, and in more circumscribed areas in the south and on the islands (the new urban reality being formed in Olbia, the Gela-Ragusa-Scicli-Avola area, the coastal Salento, etc.). It can be said that population dynamics are more positive in central-northern Italy than in the south. However, strong and consolidated contractions are to be noted in the area on the border between Piedmont and Lombardy between Vercelli, Alessandria and Pavia, along the entire Po River and in much of Friuli. in Umbria and the hilly Marche. Finally, with regard to inner Italy, anomalies of growth - against a widespread background of strong contraction - are found essentially in Trentino-Alto Adige and more discontinuously in Lombardy and Valle d'Aosta.

A reading of the migration and birth and death rates and the percentage of the foreign population and the percentage of the population over 75 and under 4 years old helps to better define the different territorial typologies and their intertwining with the major macro-regional breakdowns and with the island breakdown.

The migration rate is positive in all metropolitan classes and in the intermediate Italian cities. Again in intermediate Italy, it is around zero in classes with medium population density and slightly negative in low-density municipalities. These dynamics as a whole indicate processes of concentration in the most urban situations. The distribution between macro-regions in figure 10 also signals the clear and well-known division between central-northern Italy, with a positive migration rate even in intermediate Italy as well as in metropolitan Italy (with the anomalous trend of the non-coastal Marche and Umbria) and southern Italy, where instead intermediate Italy seems to know more similarities with the internal areas than with metropolitan Italy (which on the other hand sees anomalous negative values in Reggio Calabria and Messina). In turn, Insular Italy presents more markedly negative rates in Sicily than in Sardinia (which in many ways presents similar traits to Central Italy). The territorial differentiation of the percentage share of foreigners is even more strongly linked to the distinction between the central north and south of the country. Significantly higher values are found in metropolitan Italy and intermediate Italy in the centre-north (with slightly higher values in metropolitan Italy), while in the south they are particularly low in metropolitan Italy as well as in the other typologies (note how slightly higher values are found here in intermediate Italy in the south and islands than in metropolitan Italy in the south and islands, being in both cases lower than in all the typologies of areas in the centre-north).

On the other hand, birth and death rates and the share of population under 4 and over 75 years of age show trends that are less related to trends in regional and local economies but are also affected by specific urban and cultural data. In fact, high birth rates and percentages of the population under 4 years of age are recorded more in metropolitan areas and de facto metropolitan poles than in de jure metropolitan capitals and in all the medium-density lowland

and coastal or hillside classes of intermediate Italy (and also in the small class of inner Italy close to medium population density). On the other hand, concerning the regional macro-divisions, the birth rate registers higher values in the Cuneo area, in the Alto Adige-South Tyrol, in the upper Lombardy-Veneto plain, in the coastal and lowland areas of Campania (straddling the provinces of Naples, Caserta and Salerno) and in significant shares of the metropolitan and intermediate areas of Calabria, Apulia and Sicily, with Sardinia having trends more similar to Central Italy.

1.1.4.2 Economy, society, real estate

Through the analysis of a variety of economic data and complex indicators (e.g., Gini index, per capita income, number of employees, employment rate, NEET [Not in Education, Employment, or Training], location quotient, spatial distribution of businesses), the research reconstructs the structure, dynamics, and composition of the prevailing economy, labour market, and economic-employment impacts in different territorial types. This set of indicators is part of the broader catalogue of data related to the macro-categories of Economic and Social Capital defined within the scope of WP1 (Work Package 1).

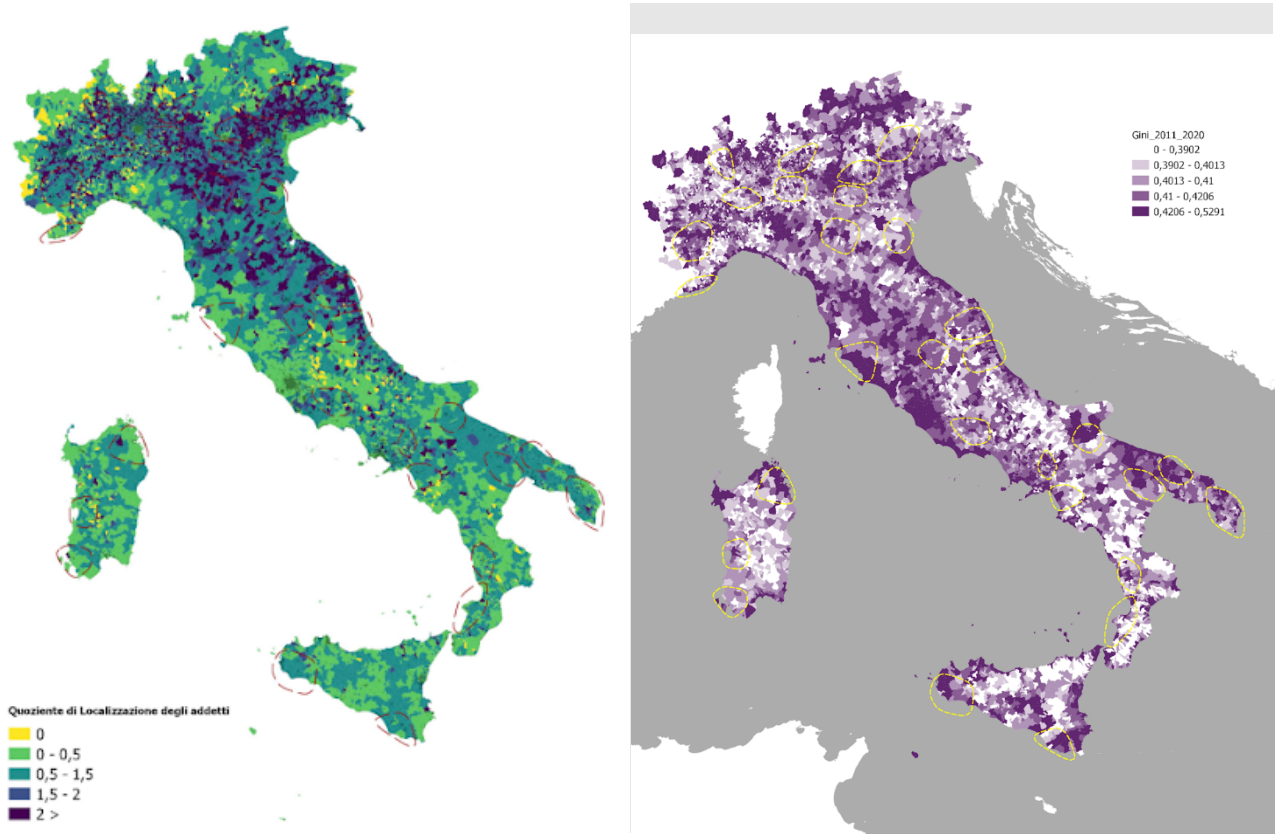


Figure 11-12: Localization quotient of employees (year 2019) and GINI Index (year 2019). Elaboration by DAStU – POLIMI.

QL degli addetti 2019 (media comuni) >	Attività agricole manifatturiere	Industria estrattiva	Industria manifatturiera	Costruzioni	Servizi alle imprese	Servizi al consumatore	Servizi sociali	Servizi tradizionali
1.1.1 - Interno remoto scarsamente popolato	2,2	2,2	0,7	2,3	0,5	1,6	0,9	1,0
1.1.2 - Interno remoto a media densità di popolazione	1,2	1,4	0,9	1,7	0,6	1,4	1,1	1,1
1.2.1 - Interno prossimo scarsamente popolato	3,0	1,8	0,6	2,2	0,5	1,5	1,1	1,2
1.2.2 - Interno prossimo a media densità di popolazione	1,5	1,1	0,5	1,4	0,6	1,5	1,1	1,4
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna sc	2,1	2,8	1,0	2,1	0,6	1,3	0,9	0,9
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a	2,1	1,3	1,4	1,5	0,6	1,0	0,9	0,9
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsa	2,2	2,0	1,5	1,6	0,6	1,0	0,7	0,8
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a med	1,3	1,4	1,3	1,3	0,7	1,0	0,8	1,0
2.2 - Città media o capoluogo non FUA	0,9	1,0	0,6	0,9	1,1	1,0	1,3	1,1
2.3 - Frangia metropolitana de facto o de jure	1,7	1,9	1,2	1,7	0,7	1,0	0,9	1,0
3.1 - Polo metropolitano de facto	0,8	0,2	0,8	0,7	1,3	0,9	1,2	0,9
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	1,8	0,9	1,1	1,5	0,8	0,9	1,1	1,0
3.2.2 - Capoluogo metropolitano	1,1	0,2	0,4	0,7	1,3	1,1	1,4	1,2

Table 4: Localization quotients of employees by macro-sectors (2019). Elaboration by DAStU – POLIMI based on ISTAT data

Classe	Sottoclasse	Reddito pro capite* 2019	Indice di Gini** 2019
interna	1.1.1 - Interno remoto scarsamente popolato	15.436	0,40
	1.1.2 - Interno remoto a media densità di popolazione	15.451	0,41
	1.2.1 - Interno prossimo scarsamente popolato	14.527	0,39
	1.2.2 - Interno prossimo a media densità di popolazione	14.379	0,42
di mezzo	2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	17.121	0,40
	2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	19.205	0,42
	2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	17.762	0,40
	2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	18.120	0,41
	2.2 - Città media o capoluogo non FUA	20.648	0,43
	2.3 - Frangia metropolitana de facto o de jure	19.405	0,41
metropo	3.1 - Polo metropolitano de facto	23.527	0,44
	3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	19.866	0,41
	3.2.2 - Capoluogo metropolitano	24.202	0,45
(*)	Reddito imponibile diviso numero di contribuenti (Dichiarazione IRPEF 2020)		
(**)	Riguarda solo la componente 'tra gruppi', essendo costruita sull'ipotesi che dentro ciascun gruppo non ci siano differenze.		

Table 5: Per capita income (2019) and GINI Index (2019). Elaboration by DAStU – POLIMI based on MEF data.

Through the reading and mapping of geographic data and complex indicators (e.g., Number of Normalized Transactions, Real Estate Market Intensity, number of occupied/vacant houses, average real estate values, age of housing stock, Affordability Index), the study reconstructs the evolution and dynamics of real estate assets and the market in different territorial types, identifying critical issues in housing geography. This set of indicators is part of the broader catalogue of data related to the macro-categories of Physical and Human Capital defined within the scope of WP1 (Work Package 1).

In 2022, the economy of Italy, as captured by ISTAT in March 2023, shows an increase compared to the previous year, with a 3.7% rise in GDP in volume and internal demand (+9.4% in volume for gross fixed capital formation and +3.5% for final national consumption). Employment and gross wages have increased by 3.5% and 3.7%, respectively, with a generalized increase in almost all macro-sectors, with the construction sector standing out at +7.6% and +5.2%, respectively. It's a robust growth, but it weakened over the year, particularly in the last quarter of 2022, where household spending slowed in a context of high inflation, and interest rates continued to rise. A similar trend is observed in the dynamics of transactions in the residential sector. After the strong rebound in 2021 compared to 2020 (+34%), 2022 closed with a growth in home transactions, marking a +4.7% and reaching a transaction volume not seen in over fifteen years. In 2022, the residential market exceeded 780 thousand homes sold (in terms of NTN), over 30 thousand more units than in 2021.

On the price side, the dynamics of the residential market in recent years have not followed that of transactions. Unlike the average of European countries, average home prices remained essentially stable between 2008 and 2011 when transaction volumes were sharply declining. The price decline began in 2012, the year with the sharpest decline in transactions, and continued until 2019, although the recovery in transaction volumes began in 2014. In 2020, while the real estate market was experiencing the effects of the economic shock due to the pandemic crisis, home prices – which had shown some signs of recovery at the end of 2019 – began to grow, strengthening in 2021 and 2022 parallel to the recovery in transactions.

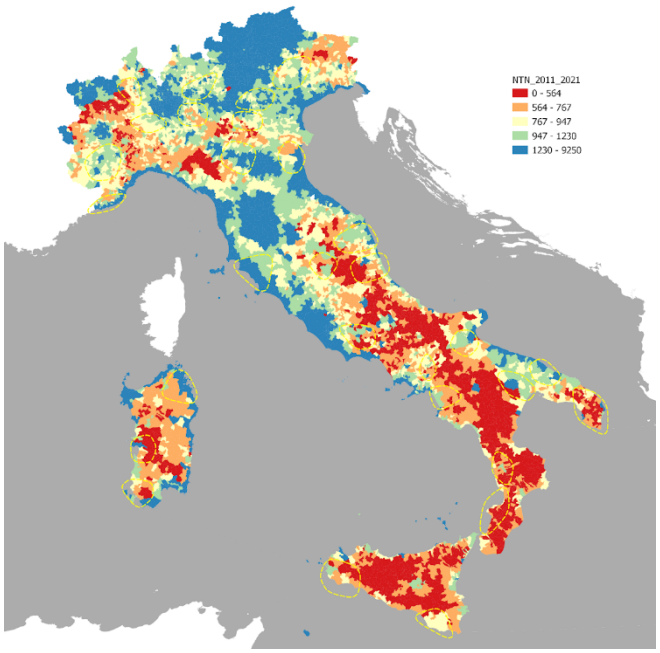


Figure 13: NTN variation 2011-2021 (II semester). Elaboration by DAStU – POLIMI on OMI data.

Analyzing the data, maps, and elaborations developed in the GRINS research, in 2022, the total number of homes sold in Italy (in terms of NTN) amounts to 784,486, excluding municipalities where the cadastral system applies (e.g., Trento, Bolzano), representing a 4.7% increase compared to 2021. This continues the positive trend observed since 2014, only interrupted by the significant drop in 2020 (-7.7%) induced by the pandemic crisis. The annual rate of change is in line with the average recorded in the years before the pandemic, confirming a renewed positive outlook for the housing market.

Compared to 2021, the increase in transaction volumes is more pronounced in the Southern areas, rising by 7%, and in the Islands, where the increase is around 9%. In the capital cities overall, the growth from 2021 is more robust at +5.5%, compared to non-capital cities where the increase is 4.3%. The map of municipal distribution of NTN in 2022 shows that the increase in volumes has affected the entire national territory. Specifically, there are 4,842 municipalities where fewer than 50 homes were sold, including only 62 municipalities with no transactions in 2022 (compared to 88 in 2021, 157 in 2020). Finally, there are 215 municipalities where more than 500 homes were sold.

Analyzing the data in terms of territorial types, metropolitan Italy has the most pronounced distribution of NTN, with metropolitan capitals (e.g., Milan, Rome, Palermo) and de facto metropolitan poles (e.g., Bergamo, Reggio Emilia, Taranto) exceeding 2000 homes sold. The real estate market is also very active in de jure and de facto metropolitan areas, as well as in the metropolitan fringe de jure or de facto, where homes sold range from 1000 to 2000 units.

In intermediate Italy, the situation is more varied, with situations where between 1000 and 2000 homes were sold, especially in major medium-sized cities (e.g., Lecce, Olbia, Alessandria, Ancona, to name a few). However, the situation is quite different in the coastal and/or low-density urban-rural continuum where, although population density might generate home exchanges, NTN figures range between 50 and 200 units. The further away from moderately populated territories and into sparsely populated ones, the lower the number of transactions, with some situations where fewer than 50 homes were sold (e.g., Lomellina in Pavia).

Inner areas, based on morphology, demographics, and available assets, record a very low number of NTN, with some municipalities (51 in total) not having any homes sold in 2022.

Classe	Sottoclasse	Prezzo medio di compravendita delle abitazioni* 2021	Media dei valori minimi	Media dei valori massimi	Minimo dei valori minimi	Massimo dei valori massimi
interna	1.1.1 - Interno remoto scarsamente popolato	966	581	1.351	90	13.800
	1.1.2 - Interno remoto a media densità di popolazione	1.060	573	1.547	175	5.900
	1.2.1 - Interno prossimo scarsamente popolato	719	442	997	200	4.600
	1.2.2 - Interno prossimo a media densità di popolazione	1.495	700	2.290	200	11.500
di mezzo	2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente	870	527	1.213	100	12.100
	2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media dens	1.181	712	1.649	175	11.400
	2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente pop	908	573	1.243	175	8.200
	2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità c	1.277	691	1.863	150	14.500
	2.2 - Città media o capoluogo non FUA	1.649	613	2.685	175	7.500
	2.3 - Frangia metropolitana de facto o de jure	1.062	625	1.498	190	22.900
metropolita	3.1 - Polo metropolitano de facto	2.386	731	4.041	200	5.600
	3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	1.382	794	1.970	210	10.300
	3.2.2 - Capoluogo metropolitano	3.271	735	5.807	350	15.000
(*)	euro al metro quadrato, secondo semestre del 2021					
(**)	sono stati esclusi dal dataset i comuni con valore minimo pari a zero					

Table 6: Housing prices 2021 (II semester). Elaboration by DAStU – POLIMI on OMI data

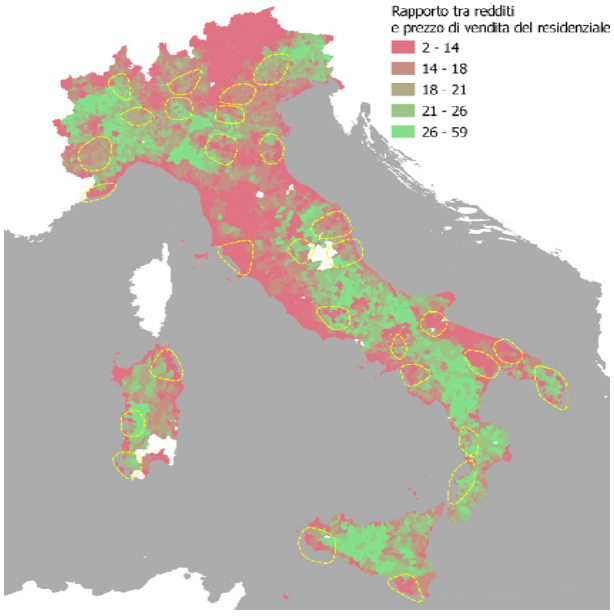


Figure 14: Housing affordability. Elaboration by DAStU – POLIMI

Monitoring the economic and financial conditions of families, particularly their vulnerability, has gained increasing importance in recent years. While the financial profile of this issue was a central focus for Anglo-Saxon economies with the outbreak of the Great Recession, in Italy, the situation of families has become especially relevant in light of the prolonged crisis affecting our economy for over a decade. In such a context, a privileged field of analysis has been residential investment, representing the primary and often the only form of indebtedness for families.

To analyze the families' ability to access home purchases, let's begin by describing the relationship between housing prices (unit price per square meter multiplied by the average size of homes bought and sold) and the per capita income of Italian families. Overall, throughout 2022, there has been a continued nominal recovery in both housing prices and the disposable income of families. While per capita disposable income, in line with economic recovery and price growth, increased by 6.3% (from €44,482 in 2021 to €47,263 in 2022), housing prices showed a lower growth rate of +3.4%, with a slowing trend in the second half of the year. Thus, the growth in property prices is less dynamic than that of income. In 2022, the average annual cost of purchasing a medium-sized house was just over €152,000, an increase of 3.4 percentage points compared to the previous year but almost 11 percentage points less than the peak reached in 2011.

However, in major cities (i.e., Rome, Milan, Turin, Genoa, Naples, Bologna, Florence, and Palermo), house prices are 141% higher than the national average. For example, in 2022, the price of a residence in major urban centers was €3,612 per square meter, compared to the national average of €1,467 per square meter. It's important to note that the size of homes sold in major cities is on average 6% smaller than the national average.

At the regional level, the two main regions of Central Italy (Lazio and Tuscany) rank among the top five in terms of housing costs. Campania and Sardinia are the two most expensive regions in the South, with prices slightly lower than the national average. Overall, real estate prices, both at the local and regional levels, are significantly influenced by the presence of large urban centers (especially in Lazio, Campania, and partly Lombardy), the tourist attractiveness of the region (notably in Trentino-Alto Adige, Liguria, Tuscany, Valle d'Aosta, and Sardinia), and the distinctive value of the architectural heritage (in Lazio and Tuscany).

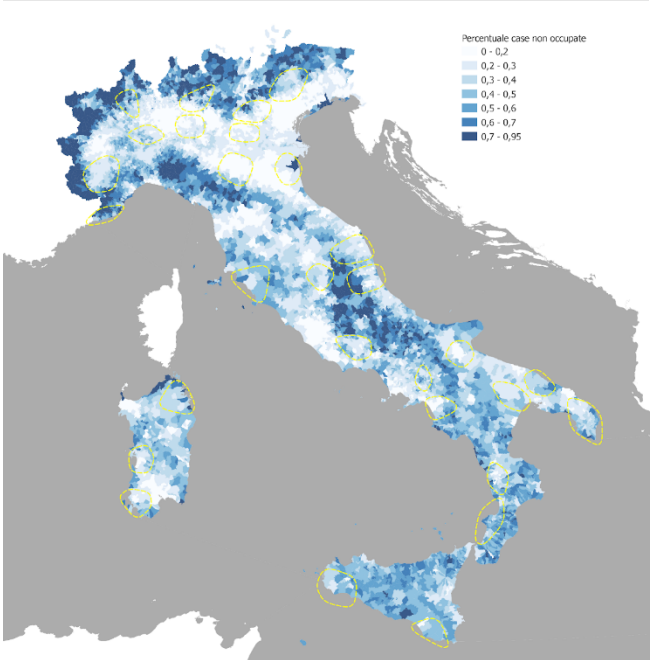


Figure 15: Housing emptiness. Elaboration by DAStU – POLIMI.

Etichette di riga	Percentuale di Abitazioni non occupate	Abitazioni non occupate pro capite
1 ITALIA INTERNA	**55%**	**0,54**
1.1.1 - Interno remoto scarsamente popolato	60%	0,68
1.1.2 - Interno remoto a media densità di popolazione	45%	0,34
1.2.1 - Interno prossimo scarsamente popolato	60%	0,69
1.2.2 - Interno prossimo a media densità di popolazione	40%	0,28
2 ITALIA DI MEZZO	**32%**	**0,20**
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	47%	0,39
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	30%	0,18
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	35%	0,22
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	31%	0,19
2.2 - Città media o capoluogo non FUA	23%	0,13
2.3 - Frangia metropolitana de facto o de jure	29%	0,17
3 ITALIA METROPOLITANA	**18%**	**0,09**
3.1 - Polo metropolitano de facto	16%	0,08
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	20%	0,10
3.2.2 - Capoluogo metropolitano	16%	0,09
Totale complessivo	**30%**	**0,18**

Table 7: Housing emptiness. Elaboration by DAStU – POLIMI on ISTAT data

Finally, it is useful to examine the processes of housing emptiness (chronic disuse, underutilization, intermittent use, abandonment, and deterioration of real estate assets) affecting the territory. This serves both to detect emerging issues of polarization, suburbanization, speculation, or touristification in significant portions of the country and to highlight differentiated forms of land use. Quantitative analysis shows that in inner Italy, one in two residences is unused, with some municipalities even reaching 94% of continuously unused residences (e.g., Foppolo, Madesimo). The situation is different and much more varied in intermediate Italy, where sparsely populated areas record a higher rate of real estate underutilization. However, it is important to emphasize that this data should be analyzed qualitatively as well because housing emptiness is significantly influenced by the presence of nearby large urban centers, the tourist attractiveness of the area (greater presence of second homes or vacation homes), or specific depopulation processes in the area (vacant homes not available on the sales or rental market due to obsolescence). It becomes apparent that various processes can both influence the number and persistence of

vacant homes and be a consequence of them, impacting not only the real estate market in terms of intensity and possibilities of buying and selling but also the quality of living in these areas.

In summary, several issues arise from this analysis. In metropolitan Italy, the challenging accessibility to housing can lead to significant crises, particularly affecting vulnerable population segments, while maintaining a vigorous real estate market. In intermediate Italy, due to its typological variety, the main emerging issues are differentiated and geographically characterized. In some areas, the market is in crisis with constantly decreasing property values and a very low number of homes bought and sold; in others, tourist attractiveness or the value of the building heritage keeps the market stable or even generates processes of exclusion and exclusivity impacting the forms of using the heritage itself and living. Alongside these processes of real estate market growth/contraction, there are also territories with characteristics – in terms of demographics, employment, and economics – that generate processes of polarization and marginalization impacting the quality and dynamics of real estate assets. Finally, in inner areas, the disuse of heritage, as well as its obsolescence or abandonment, affects the quality and forms of living.

1.1.4.3 Environment, soil, energy

Through the reading of complex data, indices and indicators on soil and energy (e.g., open space fragmentation, land degradation, land consumption, pollution, risks, location of bioenergy, geothermal, photovoltaic, wind, water), the research reconstructs processes and trends taking place in the spatial typologies, identifying criticalities, negative impacts, and geographies of energy production from renewable sources. This set of indicators is part of the broader catalogue of data related to the Physical Capital macro categories defined in WP1.

From the analysis of geographical land use data (obtained from the Corine Land Cover project) and the calculation of the extension of the main land uses within the 13 classes into which Italy has been subdivided, the following emerges. Considering the absolute values expressed in square kilometres, it emerges that: most of the agricultural land is located in intermediate Italy; significant portions of agriculture are also present in the remote sparsely populated interior and in the metropolitan areas that are not capitals; woods and pastures are partly present in the interior areas, but above all in the sparsely populated urban-rural Continuum of mountain/interior hills with a considerable reduction Mountain/interior hills medium density and in the metropolitan fringes. If we look instead at the weight, expressed in percentage values, that each land use has within the extension of each class, we can identify a curve for arable land, which has its lowest points at the extremes and its apex at 2.1.2.1 Sparsely populated urban-rural coastal and/or lowland continuum. At the same time, forests show a two-level trend: a high level for inner areas and a low level for intermediate Italy and metropolitan areas. Aggregating these data into three groups Inner Italy, intermediate Italy, Metropolitan Italy, we find the confirmation of an empirical evidence, i.e. that inner areas are also an ecological resource given the predominance of forest areas, while in intermediate Italy agricultural soils prevail. However, considering that in intermediate Italy, more than 50,000 square kilometres are occupied by wooded areas, we can see that among the three Italies, intermediate Italy is perhaps the most important for an

ecological and environmental programme aimed in the near future at reducing anthropic pressure and reinvigorating the natural capital.

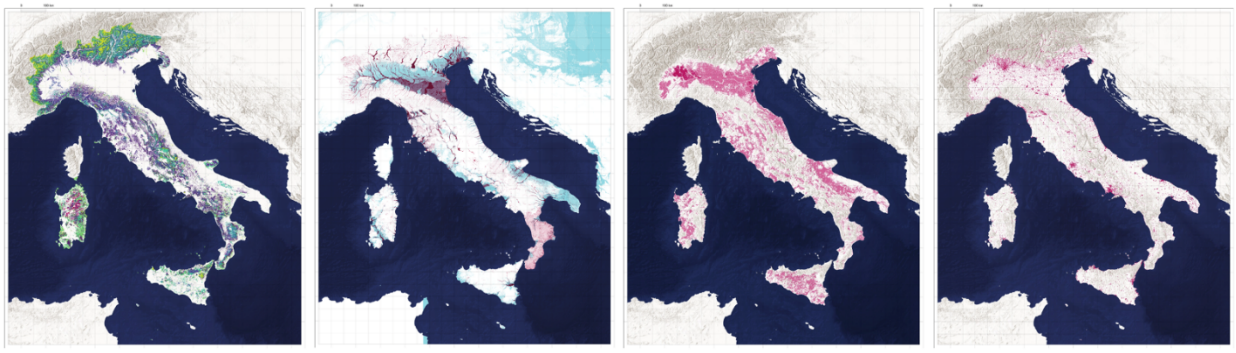


Fig. 16 – Vegetation cover, hydrography, intensive agriculture, and urbanisation. Elaboration by DAStU POLIMI.

classi	seminativi	colt da frutto	colt miste	boschi	pascoli	SUP. TOT
1.1.1 - Interno remoto scarsamente popolato	7.290,51	1.308,72	6.630,69	20.374,44	11.209,09	53.087,52
1.1.2 - Interno remoto a media densita di popolazione	2.465,74	932,65	1.160,47	1.853,10	1.002,13	8.113,80
1.2.1 - Interno prossimo scarsamente popolato	1.619,19	619,49	1.054,61	2.929,29	2.013,24	8.914,24
1.2.2 - Interno prossimo a media densita di popolazione	830,93	307,27	319,01	275,58	332,89	2.231,31
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	13.598,73	3.480,22	13.249,57	31.470,11	10.440,93	79.152,13
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densita di popolazione	6.282,26	2.214,82	4.820,51	7.590,14	1.911,05	26.001,70
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	15.415,12	1.589,50	3.611,15	2.038,30	1.625,82	26.716,24
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densita di popolazione	15.407,15	4.786,14	5.827,75	2.202,16	2.188,78	34.851,76
2.2 - Citta media o capoluogo non FUA	6.367,18	1.446,89	2.716,43	1.788,50	950,94	15.451,82
2.3 - Frangia metropolitana de facto o de jure	8.082,92	2.967,00	4.707,59	5.507,23	2.613,15	27.049,16
3.1 - Polo metropolitano de facto	844,42	104,03	272,50	132,27	32,24	1.923,86
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	4.185,15	1.862,79	2.565,21	2.484,81	853,13	14.298,89
3.2.2 - Capoluogo metropolitano	773,09	165,54	437,09	290,36	236,39	3.607,39

Table 8: – Extension of land uses (Km2). Elaboration by DAStU – Polimi on Corine Land Cover data.

classi	seminativi	colt da frutto	colt miste	boschi	pascoli	SUP. TOT
1.1.1 - Interno remoto scarsamente popolato	13,73%	2,47%	12,49%	38,38%	21,11%	100,00%
1.1.2 - Interno remoto a media densita di popolazione	30,39%	11,49%	14,30%	22,84%	12,35%	100,00%
1.2.1 - Interno prossimo scarsamente popolato	18,16%	6,95%	11,83%	32,86%	22,58%	100,00%
1.2.2 - Interno prossimo a media densita di popolazione	37,24%	13,77%	14,30%	12,35%	14,92%	100,00%
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	17,18%	4,40%	16,74%	39,76%	13,19%	100,00%
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densita di popolazione	24,16%	8,52%	18,54%	29,19%	7,35%	100,00%
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	57,70%	5,95%	13,52%	7,63%	6,09%	100,00%
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densita di popolazione	44,21%	13,73%	16,72%	6,32%	6,28%	100,00%
2.2 - Citta media o capoluogo non FUA	41,21%	9,36%	17,58%	11,57%	6,15%	100,00%
2.3 - Frangia metropolitana de facto o de jure	29,88%	10,97%	17,40%	20,36%	9,66%	100,00%
3.1 - Polo metropolitano de facto	43,89%	5,41%	14,16%	6,88%	1,68%	100,00%
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	29,27%	13,03%	17,94%	17,38%	5,97%	100,00%
3.2.2 - Capoluogo metropolitano	21,43%	4,59%	12,12%	8,05%	6,55%	100,00%

Tab. 9 – Extension of land uses (%). Elaboration by DAStU – Polimi on Corine Land Cover data.

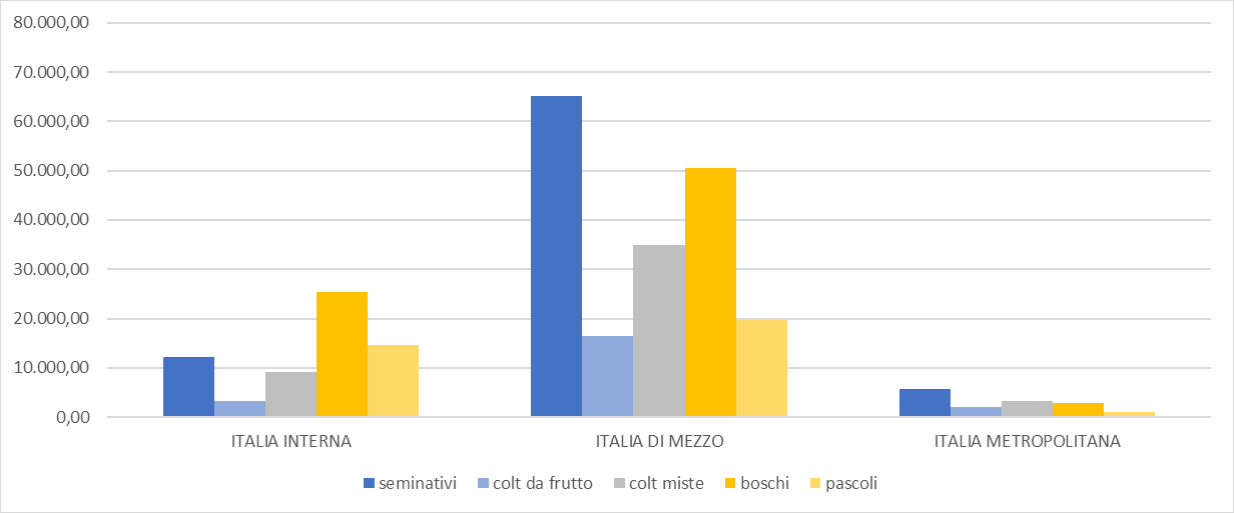


Figure 17: Chart of Extension of land uses (Km2). Elaboration by DAStU – POLIMI on Corine Land Cover data.

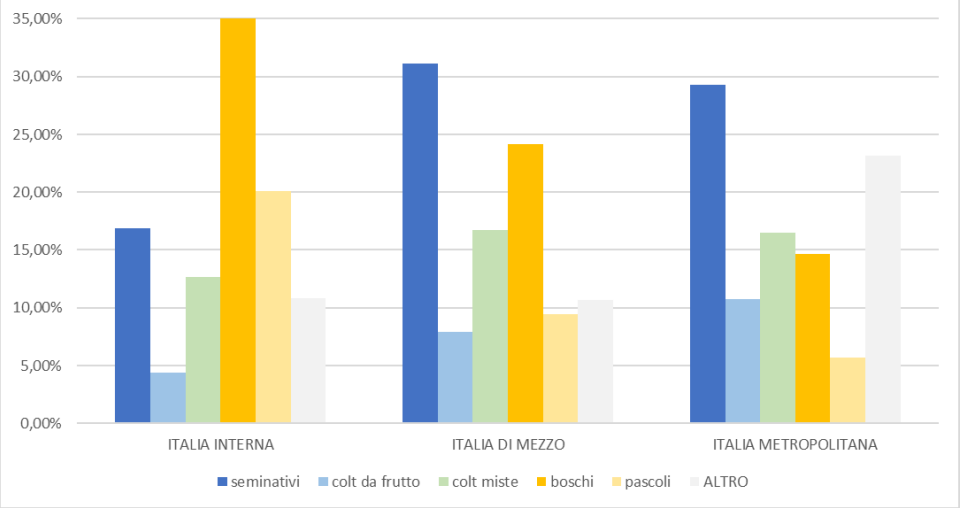


Figure 18: Chart of Extension of land uses (%). Elaboration by DAStU – POLIMI on Corine Land Cover data.

For a thorough understanding of the national context, it is essential to analyze statistical aspects in conjunction with the physical configurations of the territory. The latter play a crucial role in influencing socio-economic dynamics, despite being constants rather than variables over time. At first glance, it is possible to distinguish the three Italies quite clearly based on orographic elements and vegetation cover. Inner Italy has a clear mountain and high hill connotation, extensive forest cover (expanding) with some insertion of pastures (shrinking) and specialised tree crops. In Italia di Mezzo which is predominantly flat (with some presence of lower hills), and in coastal peninsular Italy, intensive arable crops of a cereal character (rice, wheat, maize) prevail, sometimes accompanied by significant inserts of specialised tree crops. The presence of greenhouse crops is also significant, while forest cover (which has not recovered significantly here) is much sparser and more focused in a few limited areas (especially river and hillside). The predominantly lowland and coastal metropolitan Italy, for its part, sees a significant reduction in cultivated areas, while there are still limited signs of some new urban forestation.

The acclivity, or slope of a topographical surface, serves as the initial and simplest tool for observing the national context. A map highlighting the flattest surfaces (with a maximum slope of 5%) reveals key topological features, such as the ramification of Alpine valleys, an Adriatic macro figure connecting the Po basin, central Italy's coastal areas, and the Apulian and Lucanian plains. Additionally, there are signs parallel to the coastline from Lunigiana to the Gioia Tauro plain, Sicilian plains (Catania, Vittoria, Gela, and Trapani), the Sardinian context featuring the Campidano, and the axis from Oristano to Olbia. Overlaying this acclivity map with altitude belts provides insights into a phenomenology of flat contexts. Across all scales, one can appreciate the correspondence between soil gradient and the shape of the hydrographic network. Here, we encounter the Alpine ramification of springs and initial tributaries, the Po River, as well as the short and frequent watercourses of the Marche, such as the Esino, Tronto, or Chienti. On the Tyrrhenian side of the Apennines, there is a more dispersed network of watercourses, encompassing rivers like the Arno or the Tiber. Notably, the predominant direction shifts from perpendicular to parallel to the coastline for bodies of water near the central Apennine massifs, like the Calore Irpino or the Sabato, which flow through Benevento. Considering the interplay between soil slope and hydrographic network leads to reflections on hydraulic hazard—namely, the probability of flood events. Cartographic data provided by ISPRA categorize hydraulic hazard areas into three probability classes: high, medium, and low. High flood hazard areas encompass regions near the main Italian rivers, Eraclea, and Latisana. They also include the plains between Prato and Pistoia, as well as the area between Viareggio, Pisa, and Livorno. Other high-risk zones are in Apulia, close to the Candelaro and Ofanto torrents, the Dittaino river valley near Catania, and specific areas along the Leni Torrent and the Flumini Mannu between Cagliari and Oristano. Medium flood hazard areas cover a significant portion of the territory between the right bank of the Po and the Apennines, a substantial part of the Friuli plain, and the Caserta area. Low flood hazard areas comprise the territory on the left bank of the Po, including the Mantuan Oltrepo, regions west of the Venice lagoon, areas at the mouth of the Tuscan-Lazio torrents, and the entire Calabria region.

National data confirm a continuous increase in wooded areas. Deforestation, which occurred between the 18th and 19th centuries to make way for agriculture and grazing, no longer serves the same purpose due to industrialization. The expansion of forests becomes evident when comparing soil conditions in 1990 and 2018. Generally, the growth of forestry is observed in inner Italy, particularly in mountainous and hilly regions. In some cases, especially in the center-north, this growth contributes more to the reduction of biodiversity (resulting from the disappearance of pastures and patches of arable land) than to actual expansion. Notably, we can identify both reforestation efforts undertaken by forestry bodies (especially in the South) and the natural resurgence of woodlands as cultivated lands and forests are abandoned (seen in the central and southern Apennines, the Alps, and numerous hilly areas in central and northern Italy).

The re-emergence of forests, on the other hand, is less evident in Italia di Mezzo (except for its hilly or higher hilly regions) and metropolitan areas. Here, it could potentially offset the significant decline in biodiversity and landscape quality caused by the near-total disappearance of mixed crops, reduced cultivation, and the extensive expansion of the land and farm network due to mechanization (resulting in the loss of hedges and rows along field edges). While lowland contexts have become increasingly depleted, a few surviving examples of lowland forests still

exist. In the Po Valley, notable forested areas include the river parks, especially the Ticino, along with the Bosco della Partecipanza in Trino and Bosco Fontana in Mantua. Among the coastal forests or those in proximity, the Adriatic pinewoods of Ravenna and Lignano stand out, along with the Tyrrhenian sites such as the San Rossore Park, the Bibbona pinewood, Marina di Grosseto, the Tuscan-Lazio coasts, the Castelporziano estate, the Foglino forest, and the Circeo. With the exception of these cases, lowland forests have nearly vanished, and human activities have extended to alter floodplain areas, particularly along the Po. Here, spontaneous vegetation has given way to dense poplar groves, leading to a decline in biodiversity. Nevertheless, a few instances straddling inner and central Italy persist, where a harmonious blend of spontaneous vegetation and spaces used for productive purposes has been maintained. Apart from Sardinia, where agroforestry occupies extensive areas in the Nuorese and Sassarese regions, traces of these hybrid spaces can also be found in the Gargano, in Campania near Battipaglia, and in Basilicata.

Overall, cultivated land has decreased, influenced by both the return of forests to marginal areas and the expansion of urbanized areas. However, the most significant changes pertain to the ecological and landscape characteristics of cultivated spaces. In the latter half of the 20th century, advancements in chemistry, genetics, and mechanization, along with shifts in the organization of agricultural product markets, led to increased productivity of many soils. Simultaneously, this resulted in their simplification and a profound transformation of both the agricultural structure and landscape. In particular, it's noteworthy how the rationalization of land through the amalgamation of plots and the increase in the average size of agricultural enterprises has significantly altered the structure of land parcels. This transformation has led to larger and more homogeneous plots, reducing the diversification of crops within farming systems, eliminating mixed cultivation, and diminishing the variety of crops in fields. Consequently, this has resulted in a reduction of agroforestry, row systems, hedges, linear woods, and lowland forest areas, which were once integral to farm conditions. The process has also simplified the irrigation network, marked by the widespread abandonment of tertiary canals and drains, while simultaneously increasing water demand for specialized and demanding crops. Overall, these transformations, driven by the growth of intensive agriculture, not only decrease biodiversity but also contribute to significant soil pollution (excessive metals and organic load), water pollution (groundwater and watercourses), and air pollution (fine dust and pesticides). These impacts, at times, extend to substantial portions of other regions in Italy. In regions characterized by intensive agriculture, crops are concentrated in the most accessible and convenient areas. Conversely, there is a resurgence of forests and other forms of spontaneous vegetation in poorer, fragmented areas (along rivers, near urbanized zones, and abandoned areas). The biodiversity that once defined traditional agricultural landscapes is only partially compensated for by the biodiversity emerging in marginal and abandoned areas. Generally, these phenomena are characteristic of intensive agriculture dominated by straightforward arable land, primarily situated in plains but also extending into substantial portions of moderately sloped terrain: the Garda moraines, Asti hills, northern foothills of the Apennines, the hills of Tuscany, Umbria, and Marche, the Murgia plateau between Termoli and Matera, the Sicilian hinterland, and Marmilla and Trexenta in Sardinia. Similar dynamics of biodiversity reduction and ecomosaic simplification, however, also

impact lowland and hillside territories used for specialized tree cultivation and partially for extensive cultivation — farming over vast areas with limited resources.

This series of transformations, marked by diverse economic and ecological consequences (increased agricultural productivity coupled with a decline in biodiversity and a rise in soil, water, and air pollution), is most pronounced in Central Italy. Inner Italy witnessed less-than-virtuous alterations in vegetation cover due to abandonment and neglect. In contrast, in Central Italy, particularly in the plains and hills, problematic transformations from ecological, environmental, and landscape perspectives are attributed to the success of industrialized agriculture and substantial private investments and public financing that contributed to its growth. Here, more than elsewhere, we observe a phenomenon akin to 'modernization without development' or 'unregulated growth,' which has profound effects on the environment and ecological balance.

1.1.4.4 *Intensity and forms of urbanisation, land consumption, risks and pollution*

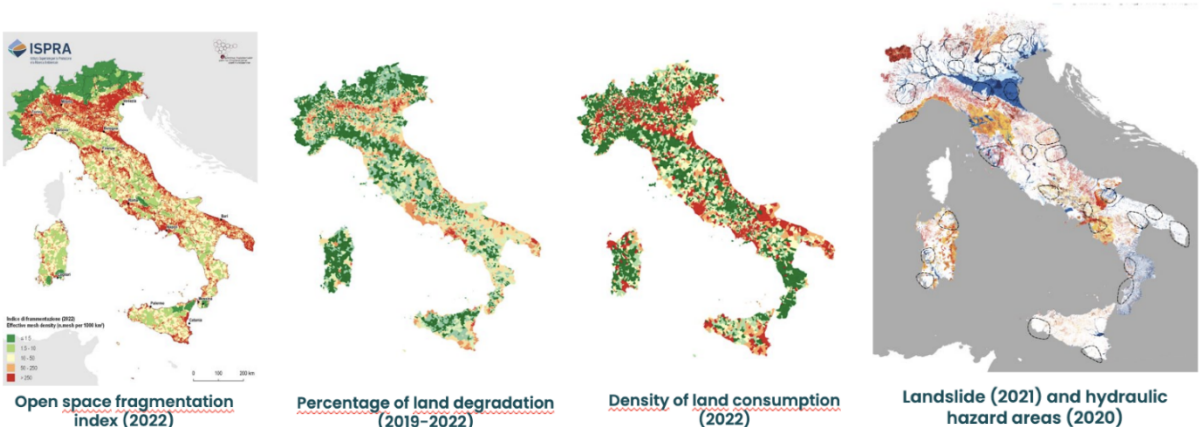


Figure 19: Indicators on soil consumption and hydro-geomorphological hazard. Elaboration by DAStU – POLIMI on ISPRA data.

	Somma di Suolo consumato [ha] 2022	Somma di Suolo non consumato [ha] 2022	% suolo consumato 2022 (per classe)	Somma di Incremento 2021-2022 [ha]	Densità suolo consumato (mq/ha) 2021-2022	Somma di Area con degrado in aumento totale (ha) 2019-2022	% Area con degrado in aumento 2019-2022 (per classe)	% suolo consumato 2022 (quota parte sul totale nazionale)	% Area con degrado in aumento 2019-2022 (quota parte sul totale nazionale)
1 ITALIA INTERNA	**205.272,6**	**7.025.782,4**	**2,8%**	**650,8**	**0,9**	**82.429,7**	**1,1%**	**9,5%**	**6,7%**
1.1.1 - Interno remoto scarsamente popolato	126.234,2	5.178.871,5	2,4%	390,5	0,7	44.740,9	0,8%	5,9%	3,6%
1.1.2 - Interno remoto a media densità di popolazione	46.057,7	765.337,9	5,7%	184,1	2,3	28.194,9	3,5%	2,1%	2,3%
1.2.1 - Interno prossimo scarsamente popolato	21.913,2	869.510,2	2,5%	37,5	0,4	7.553,4	0,8%	1,0%	0,6%
1.2.2 - Interno prossimo a media densità di popolazione	11.067,4	212.062,7	5,0%	38,6	1,7	1.940,5	0,9%	0,5%	0,2%
2 ITALIA DI MEZZO	**1.593.528,9**	**19.325.652,7**	**7,6%**	**5.161,3**	**2,5**	**894.016,5**	**4,3%**	**74,1%**	**72,4%**
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	304.658,9	7.608.860,6	3,8%	903,3	1,1	88.014,5	1,1%	14,2%	7,1%
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	226.048,9	2.373.557,4	8,7%	604,1	2,3	104.502,9	4,0%	10,5%	8,5%
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	194.896,5	2.474.617,5	7,3%	557,8	2,1	74.410,9	2,8%	9,1%	6,0%
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	409.453,2	3.075.726,7	11,7%	1.548,0	4,4	314.230,2	9,0%	19,0%	25,5%
2.2 - Città media o capoluogo non FUA	188.347,6	1.356.829,2	12,2%	705,2	4,6	129.504,5	8,4%	8,8%	10,5%
2.3 - Frangia metropolitana de facto o de jure	270.123,9	2.436.061,3	10,0%	842,9	3,1	183.353,6	6,8%	12,6%	14,9%
3 ITALIA METROPOLITANA	**352.333,4**	**1.630.652,8**	**17,8%**	**1.263,3**	**6,4**	**257.575,0**	**13,0%**	**16,4%**	**20,9%**
3.1 - Polo metropolitano de facto	46.506,9	145.852,7	24,2%	174,2	9,1	38.079,6	19,8%	2,2%	3,1%
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	201.076,1	1.228.811,8	14,1%	802,1	5,6	158.424,1	11,1%	9,3%	12,8%
3.2.2 - Capoluogo metropolitano	104.750,4	255.988,3	29,0%	287,0	8,0	61.071,3	16,9%	4,9%	4,9%

Table 10: Indicators on soil consumption. Elaboration by DAStU – POLIMI on ISPRA data

	Quota parte (%) Superficie delle aree a pericolosità idraulica elevata (kmq)	Quota parte (%) Popolazione a rischio in aree a pericolosità idraulica elevata (n. ab.)	Quota parte (%) Edifici a rischio in aree a pericolosità idraulica elevata (n.)	Quota parte (%) Unità locali d'impresa a rischio in aree a pericolosità idraulica elevata (n.)	Quota parte (%) Beni culturali a rischio in aree a pericolosità idraulica elevata (n.)	Quota parte (%) Popolazione a rischio in aree a pericolosità da frana molto elevata e molto elevata (P4 + P3) (n. ab.)	Quota parte (%) Edifici a rischio in aree a pericolosità da frana molto elevata e molto elevata (P4 + P3) (n.)	Quota parte (%) Beni culturali a rischio in aree a pericolosità da frana molto elevata e molto elevata (P4 + P3) (n.)	Quota parte (%) Superficie delle aree a pericolosità idraulica media (kmq)	Quota parte (%) Popolazione a rischio in aree a pericolosità idraulica media (n. ab.)	Quota parte (%) Edifici a rischio in aree a pericolosità idraulica media (n.)	Quota parte (%) Unità locali d'impresa a rischio in aree a pericolosità idraulica media (n.)	Quota parte (%) Beni culturali a rischio in aree a pericolosità idraulica media (n.)
1 ITALIA INTERNA	**12,9%**	**4,6%**	**8,5%**	**4,2%**	**5,7%**	**17,6%**	**27,2%**	**20,0%**	**9,1%**	**2,8%**	**5,5%**	**2,9%**	**3,8%**
1.1.1 - Interno remoto scarsamente popolato	9,0%	2,1%	4,3%	2,1%	3,4%	11,2%	18,9%	14,5%	6,6%	1,5%	3,1%	1,6%	2,3%
1.1.2 - Interno remoto a media densità di popolazione	2,0%	1,6%	2,2%	1,5%	1,4%	2,6%	2,6%	2,1%	1,4%	0,9%	1,3%	0,9%	0,8%
1.2.1 - Interno prossimo scarsamente popolato	1,5%	0,6%	1,5%	0,4%	0,7%	2,2%	4,3%	2,6%	0,9%	0,3%	0,8%	0,2%	0,5%
1.2.2 - Interno prossimo a media densità di popolazione	0,4%	0,3%	0,5%	0,3%	0,1%	1,6%	1,4%	0,7%	0,3%	0,1%	0,2%	0,1%	0,1%
2 ITALIA DI MEZZO	**79,0%**	**68,9%**	**74,0%**	**68,4%**	**57,7%**	**65,6%**	**64,5%**	**69,4%**	**81,1%**	**70,1%**	**77,7%**	**68,7%**	**68,5%**
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	15,4%	4,1%	7,4%	3,6%	7,3%	23,0%	29,4%	30,2%	12,2%	3,3%	6,0%	3,0%	6,2%
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	8,3%	6,8%	7,0%	6,8%	6,2%	14,0%	10,8%	12,0%	6,6%	6,9%	6,9%	6,7%	5,1%
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	17,1%	5,8%	7,9%	4,6%	5,7%	3,8%	4,1%	5,7%	19,2%	6,8%	10,0%	5,3%	9,8%
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	17,4%	19,5%	21,1%	19,6%	14,7%	9,9%	7,6%	8,7%	20,5%	20,1%	23,7%	19,9%	17,8%
2.2 - Città media o capoluogo non FUA	8,5%	15,7%	12,9%	17,8%	13,1%	6,7%	4,1%	5,5%	9,5%	17,6%	15,2%	19,7%	18,6%
2.3 - Frangia metropolitana de facto o de jure	12,3%	16,9%	17,7%	16,1%	10,7%	8,2%	8,7%	7,3%	13,1%	15,4%	15,8%	14,0%	10,9%
3 ITALIA METROPOLITANA	**8,1%**	**26,5%**	**17,5%**	**27,3%**	**36,6%**	**16,8%**	**8,2%**	**10,6%**	**9,8%**	**27,1%**	**16,9%**	**28,5%**	**27,8%**
3.1 - Polo metropolitano de facto	1,0%	4,1%	2,9%	4,2%	3,0%	0,3%	0,2%	0,4%	1,8%	5,5%	3,8%	6,2%	3,9%
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	5,3%	10,6%	8,0%	8,5%	6,4%	9,6%	6,3%	4,8%	6,4%	10,6%	7,6%	9,6%	5,6%
3.2.2 - Capoluogo metropolitano	1,9%	11,7%	6,6%	14,6%	27,2%	7,0%	1,8%	5,5%	1,6%	11,0%	5,4%	12,7%	18,3%
ITALIA	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

Table 11: Hydraulic and landslide hazard indicators. Elaboration by DAStU – POLIMI on ISPRA data

The map of the percentage of consumed soil fits well with the distinction between the three Italies. Metropolitan Italy has a share of urbanised soil between 12 and 24% (with a maximum value in the North-West), intermediate Italy between 6 and 9.4 % (with a maximum level in the North-East), and inner Italy between 2 and 5% (with a maximum in the South). Even if we consider the classes of urbanised land we find a clear distinction. In metropolitan Italy the densest urban cores prevail, which are flanked to a lesser extent by suburban-periurban space; in intermediate Italy, alongside some dense urban cores, semi-dense and suburban-periurban forms of urbanisation clearly prevail; in inner Italy rural cores and rural territory are only occasionally interspersed with a node or a small alignment fi semi-dense urban forms. On the other hand, the presence of land used for industry, commerce and service facilities and the index of open space fragmentation are clear markers both of metropolitan areas (but not of poles) and, above all, of intermediate Italy (and especially of medium-density situations).

Now let us consider the map of urbanised textiles, i.e. the portions predominantly occupied by housing, services and facilities, introducing a colour difference between urbanised textiles with a degree of soil sealing of more than 80% - as is the case for most building textiles built before the 20th century - and urbanised textiles with sealing between 30% and 80%. The image is one of a non-isotropic dust. In the Po Valley the distinction between metropolitan Italy and large sectors of intermediate Italy is effectively impossible. To the east, one recognises the sequence of Udine, Pordenone, Treviso and Padua, four polarities that stand out against a densely populated territory. The frequency of towns and small villages decreases if one moves from Padua towards Rovigo and Emilia, while it thins out but remains almost unchanged if one continues along the line of the foothills, touching the southern shore of Lake Garda and reaching as far as Bergamo. From the city of Orobica to Lake Maggiore, an urbanised region opens up like a fan, with Milan at its centre. The borders of this region are closed by Turin with its branches in the Alpine arc and the linear sequence of cities along the Via Emilia. Continuing southwards, in addition to the linear Adriatic conurbation typical of intermediate Italy, the three Tyrrhenian constellations that have their focus in the metropolitan areas but overflow extensively into intermediate Italy stand out above all: the Tuscan constellation that has Florence-Prato-Pistoia as its fulcrum and extends towards the sea

as far as Viareggio; the Capitoline constellation that has its seafront in Ostia; the Neapolitan constellation that embraces the entire Gulf and extends as far as Caserta. Similar polarities albeit of more modest dimensions (and largely within the limits of metropolitan Italy) can be found in Sicily along the coast (Catania, Messina, Palermo and Trapani) and in Sardinia (Cagliari and Oristano), while in Apulia we find dispersion phenomena comparable to those of the Po Valley without a clear distinction between intermediate Italy and metropolitan Italy. Generally speaking, considering both types of urbanised areas in metropolitan Italy relatively compact patterns prevail, while in intermediate Italy reticular patterns prevail (especially in northern Italy, but also in Apulia and Campania) comb patterns (especially on the Adriatic coast and in the Alpine foothills) and linear patterns (especially on the Ligurian coast and to a lesser extent in Sicily and Calabria). A punctual pattern with some rare linear patterns in inner Italy.

This map is counterbalanced by the map of industrial and commercial areas, which reveals a particular territorial shape that, starting from the urban centres, branches off along the main infrastructure axes. Turin emerges the shaft of the Scrivia river that continues towards Genoa, the Lombardy-Veneto piedmont, the Emilia-Romagna axis, the Adriatic coast. It is a sufficiently marked figure to make the territory as far as Termoli intelligible. Beyond that, the signs dilate and their interpretation must be entrusted to representations at a closer scale. Observing the position of the historic centres, one can understand how the forms of dispersion in Italy are rooted in a long time in history and territory. This is the matrix of the polycentric conformations and of the main continuous conurbations characterised by the most evident environmental criticalities linked to soil sealing and the cancellation of the agro-environmental matrix that in the past approached the historic centres and isolated nuclei in a complementary form. The same matrix has instead become a support and measure for new forms of urbanisation. It is enough to look at the chromatic intensity of North Milan, the Florentine axis, Rome-Ostia or Naples to realise how relevant the problem of sealing permeable open spaces is for these realities, the dimension of soil consumption processes, the interruption of hydrographic systems.

The map on soil consumption in the period 2006-2022 shows on the one hand the belts of the metropolitan areas with the partial exception of those of Genoa, Reggio Calabria and Messina, and on the other hand a large part of intermediate Italy. In particular, in the intermediate Italy, the highest consumption is reported in the Cuneo area, in the Piedmontese 'back harbour' of the port of Genoa, along the piedmont axis from Novara to Pordenone with larger areas north of the metropolitan city of Milan, in the Veronese and Vicentino areas and in central Veneto, in the Via Emilia axis from Milan to Rimini, in the coastal and valley combs from Rimini to Termoli, in a large part of flat southern Latium (in the two directions towards Frosinone and Latina and in flat Campania (north of Naples towards Formia, in the Casertano area, in the Avellinese area, in the Sele plain) in Apulia in a very widespread manner with the sole exception of the Gargano and the Murgia, as well as in four of the main areas of intermediate insular Italy Gela-Ragusa-Scicli, Agrigento, Marsala-Trapani, the Olbia region. Overall, these dynamics do not show great distinctions at macro-regional level but rather at regional level, with the percentages of soil most consumed in Lombardy, Veneto, Campania, Emilia-Romagna, Apulia and Lazio.

The map of the density of soil consumed per municipality in the last year surveyed (2022) reproduced here, apart from some anomalies related to the short time span, largely confirms these indications. In metropolitan Italy, high soil consumption is confirmed with the novelty that it is now more relevant in metropolitan capital cities and de facto metropolitan poles. Exceptions to this are in the pole and in the area Genoa, Taranto, Regio Calabria and Messina (to which Perugia is now added). Consumption in intermediate Italy is still very relevant (with lower percentage levels than in metropolitan Italy, but with a contribution in absolute terms of three quarters). The directions of higher consumption in intermediate Italy are those already highlighted for the transformations of longer duration. However, higher consumption is now also creeping into the heart of the Po Valley and more widely in the two islands.

Finally, the per capita net land consumption in 2022 slightly reshuffles the geography of the phenomenon. On the one hand, intermediate Italy becomes a greater consumer than metropolitan Italy (partly along the lines already indicated elsewhere). On the other hand, the high figure associates intermediate Italy with significant portions of inner Italy. In fact, it reaches high levels in sparsely populated Inner Italy (probably due to the building of second homes) and from a regional point of view in the Valle d'Aosta, Trentino-Alto Adige, Veneto, Campania, Basilicata, Sicily and Sardinia. At the regional level, Lombardy's land consumption is reduced, and Sardinia, Sicily, Basilicata and Trentino-Alto Adige's land consumption becomes considerable.

It remains to emphasise and better analyse the determinants of land consumption, which in a large part of intermediate Italy seem to be linked not only and not so much to the growth of residential areas (with lower density) but above all to the strong consumption in mobility infrastructures, manufacturing and above all logistics activities (especially in central and northern Italy) and energy plants (especially solar energy in the south and islands and in the lower Po Valley). Therefore, not only to an endogenous development of manufacturing (and to a lesser extent residential) but of quite a few infrastructures and activities serving metropolitan Italy.

The information on soil degradation gathered by Ispra needs to be more complete and extensive. They take into account soil urbanisation (sealing), the reduction of particular habitats, soil productivity and organic carbon content as well as erosion and fires. However, there is no specific focus in the Ispra report on the many forms of degradation related to intensive agricultural practices that are reported by other agro-ecological studies: soil (and water) contamination by excessive pesticides and chemical fertilisers, soil compaction, soil salinisation, etc. All in all, we see a degradation that is not limited to metropolitan Italy, but also extends to large areas of diffuse linear and peri-urban urbanisation in intermediate Italy. Small local surveys extend the phenomena of soil degradation to much of the agricultural territory subjected to industrial agriculture, leading to the hypothesis that the combined combination of land consumption and soil degradation is a particularly characteristic feature of intermediate Italy.

Moreover, because of its historical manufacturing connotation, intermediate Italy has a marked presence of RIR establishments (establishments at risk of major accidents) and of areas occupied by SINs (sites of national interest, for the purposes of reclamation, which can be identified in relation to the characteristics of the site, the quantity and hazardousness of the pollutants

present, the importance of the impact on the surrounding environment in terms of health and ecological risk, as well as damage to cultural and environmental heritage).

On the other hand, even atmospheric pollution, often associated with metropolitan Italy alone, presents, with regard to PM10 in particular, a rather extensive and problematic geography also in many non-metropolitan territories, reaching average levels that are slightly lower in intermediate Italy (with the exception of the urban-rural continuum of mountains or low-density inland hills), with areas in the Po Valley, but also in Puglia and Sicily, that reach levels higher than those of the respective capitals and metropolitan poles.

Lastly, if we look at the data on hydraulic and landslide hazard, we note that, for obvious geo-morphological reasons, if inner Italy is the territorial partition most characterised by landslide conditions, particularly with regard to the exposed building heritage, intermediate Italy is the territorial typology with the most extensive situations of hazard and hydraulic risk. In relative terms, however, if one takes into account the territorial surface differential that exists between intermediate Italy and metropolitan Italy, it is possible to appreciate the high density of cultural assets and enterprises insisting in areas of high hydraulic hazard in metropolitan Italy. In the large regional islands, Sardinia has the highest landslide risk, however with a lower risk than Sicily due to the lower exposure of population living in high hazard areas. In both regions the hydraulic hazard is concentrated in a fairly circumscribed manner in some urban and metropolitan areas, particularly in the Simeto valley in Sicily and in the Campidano hydrographic reticulum between Oristano and Cagliari. In this too, the greater exposure of the population living in the Sicilian region compared to that of Sardinia should be noted.

1.1.4.5 Geographies of renewable energy production

According to statistical data on electricity in Italy in 2021 published by Terna, gross domestic consumption of electricity was 329,769 GWh (51.7% from traditional sources, 35.3% from renewable sources, 13% from foreign balance) of which 289,069.5 GWh produced in Italy. Gross efficient capacity of electric generating facilities was 119,780.8 MW (51.7% thermoelectric, 19.3% hydro, 18.9% photovoltaic, 9.4% wind, 0.7% geothermal) of which 57,943.2 MW (48.37% as of 2021) were produced from renewable sources (39.0% photovoltaic, 33.1% hydro, 19.4% wind, 7.1% bioenergy, 1.4% geothermal). The top three regions in terms of efficient installed capacity, both considering electricity production also from traditional sources and considering only that produced from renewable sources, are Lombardy, Apulia, and Piedmont.

A first reading of the energy geographies in Italy is inferred by associating the nominal power that each municipality can produce per renewable source (data provided by GSE) with its administrative boundaries (data provided by ISTAT). This results in five maps: that of hydro, wind, biogas, geothermal and photovoltaic.

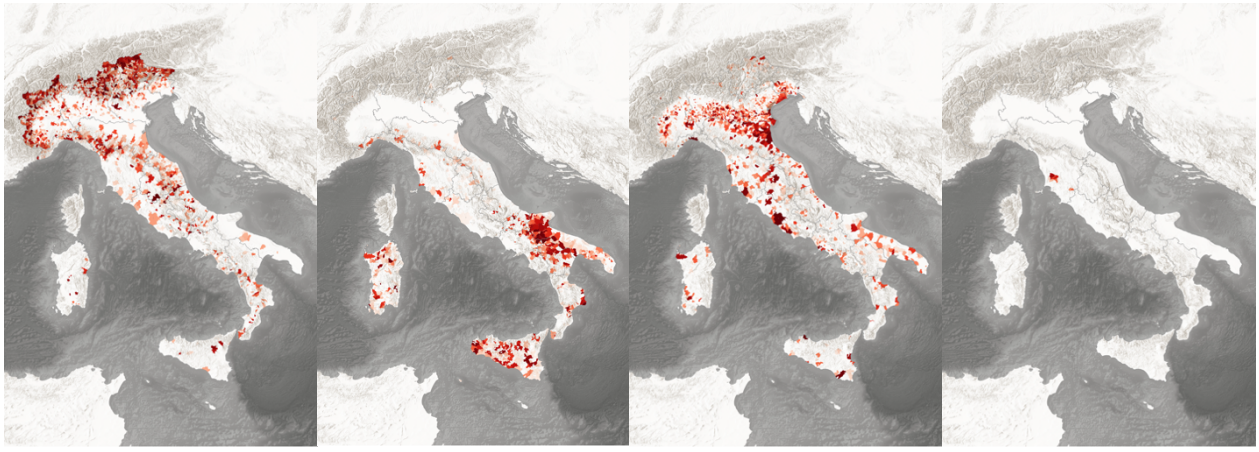


Figure 20: Installed capacity of photovoltaic, hydroelectric, wind, geothermal energy per municipality (GSE data processing 2021)

Very clear is the distribution of the hydropower infrastructure (19,172.3 MW of efficient installed capacity), which has municipalities lit up along the natural Alpine borders of Piedmont, Aosta Valley, Lombardy, Veneto, Trentino-Alto Adige and Friuli-Venezia Giulia and, with less intensity, those along the Apennine ridge of central Italy between Emilia-Romagna, Marche, Umbria and Abruzzo. Also immediate is the case of wind power (11,253.7 MW), which has a very high concentration between Apulia and Basilicata, an almost total absence in the remaining regions of the peninsula, and a medium presence on the major islands. Evident is the strong presence of biogas in all municipalities of the Po Valley, a fact that denotes its close correlation with agriculture, while less indicative is its presence in the remaining portions of Italy. Finally, uniquely Tuscan is geothermal energy production (817.1 MW), a surprising figure at first glance, but one that is easily explained if one puts it side by side with the maps of underground temperatures provided by the Ministry of Environment and Energy Security, where the municipalities hosting geothermal power plants coincide with the area in Italy with the highest temperatures (up to about 350°C at a depth of 3000m).

The case with photovoltaics (Fig. 21) is less straightforward, which, like a mosaic of varying intensities, cover the entire country. In a dark red, the major metropolitan cities such as Rome, Milan and Venice and the conurbation along the Via Emilia appear conspicuous. These are joined by clusters concentrated along all of Apulia, in the southwest side of Sicily, in the Cuneo area, along the entire Adriatic ridge, in Umbria, and in the Po Valley. Two types of PV geographies are evident from this distribution: that of cities and that of the countryside, made explicit by overlaying maps of intensive cultures and urbanized areas produced on data provided by the Corine Land Cover inventory of Copernicus. The sectors of activity in which PV is present are residential, tertiary, industrial (manufacturing facilities, from manufacturing to energy production) and agricultural. At the end of 2021, according to GSE data, about 80% of the total 1,016,083 systems in operation in Italy are concentrated in the residential sector with an installed capacity equal to 17% of the total installed capacity, which is 22,594.3 MW, while the largest share of the total installed capacity (48%) is found in the industrial sector, which, however, has only 5% of the number of systems. To spatialize this 5%, a second photovoltaic map (Fig. 22), obtained by putting in proportion the nominal power that each municipality can produce, with its surface area (ISTAT data), shows the density of photovoltaic.

The three municipalities that appear in the top twenty according to both this formula and the first PV map turn out to be the municipalities of San Bellino and Canaro, both in the province of Rovigo, and that of Cellino San Marco in the province of Brindisi. In fact, in the first municipality there is a photovoltaic park (Emmezeta Solar Park) with an installed capacity of 70 MW on 85 ha of land that at its completion in 2010 was the most powerful photovoltaic power plant in Europe. According to the Global Energy Monitor, the owners of the plant are the American private equity firm First Reserve Corporation and the investment fund Vortex Energy, while the operator is SunEdison INC, an American renewable energy company. In the municipality of Canaro, on the other hand, there is a photovoltaic park (Serenissima solar farm) that has an installed capacity of 48 MW on 150 ha of land, managed by the Spanish company BNZ present in the portfolio of Nuveen, American global investment manager and owner of the park. In the third municipality, that of Cellino San Marco in the province of Brindisi, there is a park with an installed capacity of 43 MW on 101 ha of land. Owners are the American power generation company AES Corporation, and Riverstone Holdings LLC, an American leading private markets asset management firm, while its management is entrusted to BFP Group, an Apulian engineering and consulting firm.

These are three cases, all located in very small municipalities of intermediate Italy. In fact, as deduced from Table 1, 80.8% of installed photovoltaic capacity is in intermediate Italy, followed by 12.5% in metropolitan Italy and 6.7% in inner Italy. The majority (24.4%) is concentrated in territories defined as coastal and/or lowland urban-rural continuum with medium population density. However, if we look at the density data, the *de facto* metropolitan poles come first.

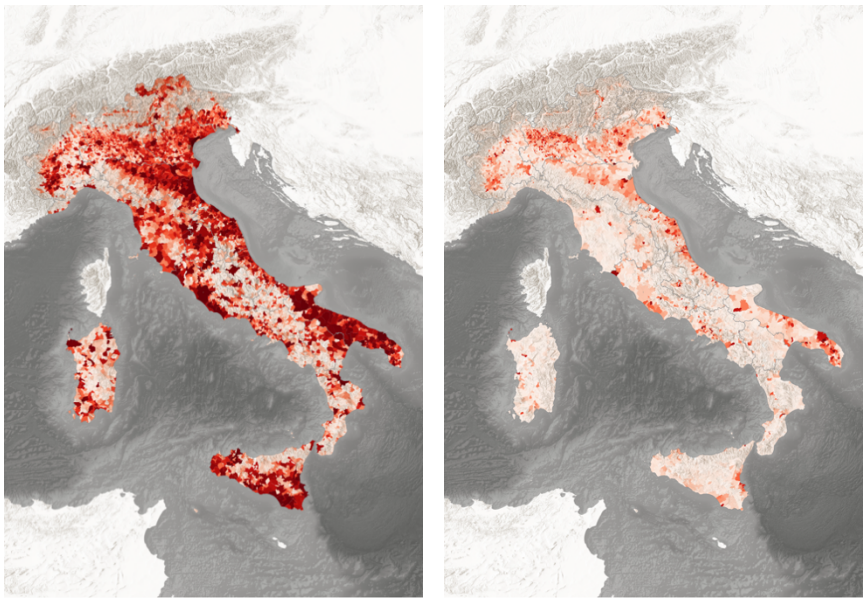


Figure 21: Installed capacity of PV power per municipality (GSE data processing 2021)

Figure 22: Density of installed PV power per municipality (GSE data processing 2021)

	GSE - Somma di Pot. nom. (kW)	densità della capacità installata (kW/Kmq)
1 ITALIA INTERNA	**6,7%**	**18,1**
1.1.1 - Interno remoto scarsamente popolato	3,6%	13,4
1.1.2 - Interno remoto a media densità di popolazione	2,3%	55,3
1.2.1 - Interno prossimo scarsamente popolato	0,4%	9,9
1.2.2 - Interno prossimo a media densità di popolazione	0,3%	27,3
2 ITALIA DI MEZZO	**80,8%**	**75,7**
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	11,5%	28,6
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	10,4%	78,2
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	13,0%	95,9
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	24,4%	137,2
2.2 - Città media o capoluogo non FUA	9,9%	124,9
2.3 - Frangia metropolitana de facto o de jure	11,6%	83,9
3 ITALIA METROPOLITANA	**12,5%**	**124,2**
3.1 - Polo metropolitano de facto	2,2%	225,3
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	8,1%	110,7
3.2.2 - Capoluogo metropolitano	2,3%	123,6
Totale complessivo	100,0%	65,1

Table 12: Indicators on the Distribution of Installed Power from Photovoltaics

1.1.4.6 Infrastructures of everyday life

Through the reading of data, indexes, and composite indicators (e.g., number of schools by grade, number of schools by level and grade, presence/absence of school infrastructure, proximity to stations for cyclists and pedestrians, main direction of travel - OD matrix, travel concentration index), the study reconstructs the infrastructures of everyday life in different territorial contexts. The term "infrastructure of everyday life" refers to the "material basis of well-being and social cohesion. It is what we should be able to take for granted every day: safe drinking water, non-rationed electricity, advanced and accessible health services, free higher education, efficient public transport and infrastructure, care services for children and the elderly, food markets oriented towards the well-being of consumers and food producers" (Collective for the Foundational Economy 2019).

In particular, in the framework of this research work, we deepen two aspects of such “infrastructure” of everyday life, pointing out their complexity: the educational landscape and the landscape of rail networks. This set of indicators is part of a broader catalog entailing the macro categories of Physical and Human Capital defined during WP1.

The thematic focus on the infrastructures of everyday life allows us to interpret territorial phenomena through the distribution and localisation in different contexts of the school infrastructure. Thus, the research work highlights the territorial gaps in terms of educational landscapes, in relation to places and spaces (educational facilities, local cultural and collective services, agro-environmental infrastructures), to ongoing demographic and social dynamics (processes of demographic contraction and birth rate decline, conditions of progressive social differentiation), to institutional organisation and governance settings (school institutions and instruments for the territorial dimensioning of services, local and supra-local territorial governance structures), to general and sectoral policies at different scales (national and regional funding programmes and the associated selection of target areas, forms of integration between policies and funding lines). It is a question of building reference frameworks capable of dealing with a plurality of situations that need to be observed with an integrated and territorialised

approach, while working at the same time on synthesis frameworks capable of informing choices at the national level and zoom-ins capable of capturing local specificities.

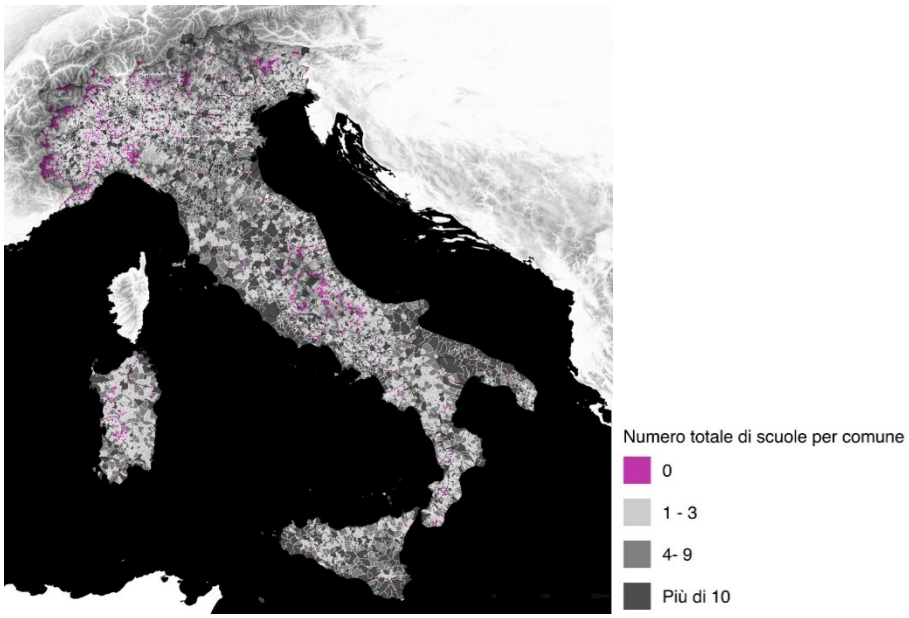


Figure 23 - The total number of schools on a municipal basis and the distribution of the absence of educational services. Elaboration by DAStU – POLIMI on MIM data (2021-22).

Schools represent a widespread infrastructure that covers the Italian territory in an omnipresent way, with a variety of spatial conditions and local specificities. According to the annual report of the Statistics Office of the Ministry of Education and Merit (Ministry of Education and Merit 2023), in September 2023 in Italy there were 8,089 active educational institutions - including comprehensive schools (4,865), teaching departments (313), first cycle main institutes (121), Provincial Centres for Adult Education (129) and second cycle institutions (2,661) - distributed in 40,321 complexes.

Etichette di riga	Somma di Numero scuole totali	Somma di Abitanti privi di primaria	Somma di abitanti privi di I grado	Somma di abitanti privi di scuola di qualunque grado e ordine	Percentuale di Abitanti privi di primaria	Percentuale di abitanti privi di I grado	Percentuale di abitanti privi di scuola di qualunque grado e ordine	Numero di scuole ogni mille abitanti
1 ITALIA INTERNA	**4716**	**103493**	**313304**	**64875**	**3,3%**	**10,1%**	**2,1%**	**1,5**
1.1.1 - Interno remoto scarsamente popolato	2719	87532	250717	55908	5,7%	16,2%	3,6%	1,8
1.1.2 - Interno remoto a media densità di popolazione	1077	6124	32393	2164	0,6%	3,4%	0,2%	1,1
1.2.1 - Interno prossimo scarsamente popolato	535	9837	27150	6803	3,3%	9,1%	2,3%	1,8
1.2.2 - Interno prossimo a media densità di popolazione	385	0	3044	0	0,0%	1,0%	0,0%	1,3
2 ITALIA DI MEZZO	**31586**	**421381**	**2197520**	**265345**	**1,2%**	**6,0%**	**0,7%**	**0,9**
2.1.1.1 - Continuum urbano-rurale di montagna/collina interna scarsamente popolato	5780	229397	879283	156052	5,5%	21,2%	3,8%	1,4
2.1.1.2 - Continuum urbano-rurale di montagna/collina interna a media densità di popolazione	5019	26721	430952	19456	0,5%	7,4%	0,3%	0,9
2.1.2.1 - Continuum urbano-rurale litoraneo e/o di pianura scarsamente popolato	2571	113567	434991	61589	4,4%	16,9%	2,4%	1,0
2.1.2.2 - Continuum urbano-rurale litoraneo e/o di pianura a media densità di popolazione	7335	8676	113886	1944	0,1%	1,2%	0,0%	0,8
2.2 - Città media o capoluogo non FUA	5544	0	0	0	0,0%	0,0%	0,0%	0,8
2.3 - Frangia metropolitana de facto o de jure	5337	43020	338408	26304	0,6%	4,5%	0,4%	0,7
3 ITALIA METROPOLITANA	**11016**	**10473**	**108773**	**3543**	**0,1%**	**0,6%**	**0,0%**	**0,6**
3.1 - Polo metropolitano de facto	1161	0	0	0	0,0%	0,0%	0,0%	0,6
3.2.1 - Area metropolitana de jure e de facto (non capoluogo)	5193	10473	108773	3543	0,1%	1,3%	0,0%	0,6
3.2.2 - Capoluogo metropolitano	4662	0	0	0	0,0%	0,0%	0,0%	0,5
Totale complessivo	**47318**	**535347**	**2619597**	**333763**	**0,9%**	**4,4%**	**0,6%**	**0,8**

INSULAR ITALY				
	INNER ITALY	**INTERMEDIATE ITALY**	**METROPOLITAN ITALY**	**TOTAL**
Number of schools every 1000 inhabitants	**1.6**	**1.1**	**0.8**	**1.0**
Population with no primary schools	**2.2%**	**0.8%**	**0,0%**	**0.7%**
Population with no lower secondary schools	**3.1%**	**1.2%**	**0.1%**	**1.1%**
Population with no schools	**0.9%**	**0.3%**	**0.0%**	**0.3%**

Table 13: Indicators of the territorial distribution of educational infrastructure in the different territorial typologies.

Where are Italian schools located and in what contexts do they operate? The geo-referenced analysis of public schools' first (3-13 years old) and second (14-18 years old) cycle reveals some specificities closely linked to the territorial typologies observed. Depending on its location in metropolitan, intermediate, and inner Italy, the Italian educational infrastructure poses different questions to national policies and local agendas.

In the **insular Italy**, the number of schools per municipality allows for a more comprehensive provision than the national average. Still, it is useful to note some differences compared to other geographical situations. Even in the most remote areas, only 2.2% of the population do not have a primary school and 3.1% do not have a secondary school. Although lower than the national average, the population without primary education is higher than in the south, centre and north-east, while the coverage of lower secondary education is significantly higher than in the other geographical areas considered individually. When observed in a disaggregated way by territorial typology, these values allow some reflections.

The number of schools in **metropolitan Italy** is high but lower than in the intermediate contexts. This depends on the size and capacity of the schools, which are on average larger in the central areas (Fondazione Agnelli, 2019), where the school population is higher. Regarding upper secondary education, metropolitan areas have a large and varied supply, concentrated mainly in the capital cities and the first belt. The supply is, therefore, sufficient to fully serve the resident population, albeit with different degrees of accessibility depending on the territory conditions and the different types and levels of schooling. As far as the organization of school autonomy is concerned, short networks are emphasized, mostly corresponding to sub-municipal contexts.

Some relevant issues for addressing school infrastructure in metropolitan contexts are school segregation, especially in the most peripheral, disadvantaged or ethnically characterized areas (Ranci and Pacchi, 2017); the presence of schools in degraded contexts (see the Openpolis reports) and the strong territorial gaps between the different macro-regions of the country; schools intended as urban centers within the concept of the "15-minute city", as well as socio-environmental hubs that can provide services to increase social inclusion and open spaces for environmental mitigation, as experienced in some European capitals (Paris, Barcelona) and Italian cities (Milan, Turin, Florence, Naples).

There are fewer schools in **inner Italy**. The most critical context is defined as ‘inner area with a medium population density’; however, it is served by the close intermediate areas in terms of lower secondary education, which is more polarised. 3.3% of the population lacks a primary school, and it rises to 10% in the case of lower secondary education, with values of 25-30% in the north of Italy. The 'sparsely populated remote inner area’ suffers from the greatest number of absences, including primary schools (5.7% of the population), which rises to 16.2% in the case of lower secondary schools. Upper secondary schools are rare in these areas; sometimes, there is still a residual and long-term offer or one strongly linked to the local economic vocation. As far as the organisation of school autonomy is concerned, long networks are highlighted, sometimes covering entire valleys.

The problems emerging in inner Italy about education concern, first of all, the scarcity of schooling and the existence of small schools and schools with mixed-age classes (see the detailed work of Indire), as well as the need to reduce the current supply of services due to the continuous demographic decline. This can result in a low quality of service, aggravated by the high turnover of teaching staff, in severe shortage (Openpolis), and, consequently, a lower level of knowledge and skills acquired than in other contexts (Invalsi). Regarding the building stock, there are numerous situations of abandonment, but also a good distribution of energy efficiency interventions, favoured by the abundance of dedicated funds. The main issue, however, concerns the maintenance of a civic and social presence, even before the educational one, which can retain and possibly attract population, especially young people and families, and which can act as a 'community centre' (learning hub). From this point of view, the school can also provide other services – for example, it can be an important contact point for the prevention of hydrogeological risks – or it can be integrated with other socio-health and recreational-cultural facilities. Finally, another key issue is the public accessibility of schools, especially upper secondary schools (which should be reachable within 40 minutes by bus).

The **intermediate Italy** presents an in-between situation, less polarised than the other two contexts discussed before, but also more internally diverse. 1.2% of the population has no primary education and 6% has no secondary education. Medium-sized cities have sufficient supply to satisfy all demand, while the areas of the 'sparsely populated urban-rural hill/mountain continuum' are the most critical, with 5.5% of the population without primary education and as much as 21.2% without lower secondary education (a higher percentage than in the more remote areas). The 'sparsely populated coastal and/or lowland urban-rural continuum' presents a similar situation, with 4.4% of the population without primary education and 17% with lower secondary education. In these contexts, it is often lower upper secondary education, and it shows strong polarisation processes, with concentrations in more densely populated and more easily accessible areas. Finally, it is worth mentioning the situation of the urban fringe (borderline class), which is not always well served by school infrastructure (4.5% of the population has no lower secondary education) but is well connected to better-equipped areas (metropolitan areas, medium-sized cities or widespread urbanisations).

There is therefore an overlap between the two previous situations, albeit with less social segregation than in metropolitan areas. The widespread presence of first-cycle schooling services coexists with a lack of variety and diversification of educational provision in the territories. In the face of an ongoing process of clustering of school autonomies and rationalisation of educational governance, the need for a spatialised strategy for organising the school network emerges, particularly in these contexts. Indeed, here the necessarily supra-municipal and inter-municipal scale requires also inter-institutional alliances and cooperation. An assessment of the conditions of proximity and sustainable accessibility is therefore essential to foster a complementary specialisation of educational offer between municipalities (distribution of different levels and types of school, school diversification, etc.). Furthermore, for combating social fragility and educational poverty, schools must be intended as crucial nodes of a territorial, cultural welfare network.

Infrastructure networks, and rail ones in particular, are naturally non-homogeneous: parts of the territory are served directly, bur large parts need time and effort to get access to them. While some networks such as the road and the telecommunication ones are now generally available – although with different performance levels – rail and public transport in general are intrinsically less spread and characterised by punctual access point, the stations/stops. The study of the territory and of the level of this fundamental service requires to look at least two dimensions:

i. the distance, or the effort, needed to reach the access points.
ii. the level of service of the system (e.g. frequency, speed and quality of transport services).

One dimension, alone, is not entirely describing the phenomenon and in particular the proximity to a point of access, alone, is not exhaustive of the level of accessibility of that place.

The scarce accessibility of a place may have consequences in the field of housing and quality of urban space. The diffused and scarce quality of housing is typically associated to low levels of transport accessibility. Road, rail, stations and their surroundings – all belonging to the "infrastructure of the everyday" – represent a crucial system of spaces to build policies and strategies for social and ecologic transition across different territorial types.

The conditions of degradation and inefficiency of the networks are particularly accentuated in those parts of the territory that present conditions of environmental, social and economic fragility: urban peripheries, marginal or remote areas. These phenomena are declined in different ways in the different contexts of the country, but they always have at their centre the complex space of the mobility networks: carriageways, stations, car parks, pavements, cycle and pedestrian paths, open spaces, marginal and resultant areas. On the one hand, there is the lack of open spaces of proximity, not infrequently reduced to mere parking spaces for cars, often overabundant and lacking in overall design and quality, as well as the lack of care and ordinary maintenance of the same; on the other hand, the lack of certain collective services for integrated mobility and sometimes inaccessibility.

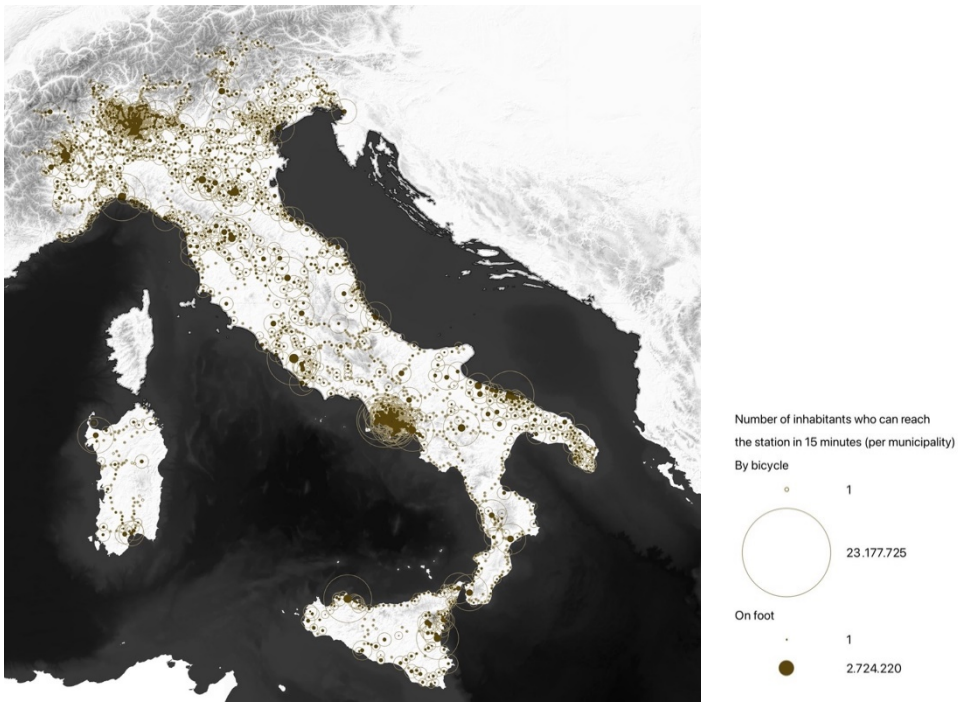


Figure 24: Number of inhabitants who can reach the station in 15 minutes (per municipality).

It is primarily a question of investigating integrated and sustainable forms of mobility, capable of responding to the objective of greater accessibility and widespread urban quality, by declining them in the different territorial typologies. For this reason, initial reflections have focused on the rail transport network, with the belief that its improvement can also have a significant impact on the road network by reducing car use and related emissions.

The railway network in Italy is the outcome of a historical process of infrastructural development, the main phase of which took place in the first half of the 20th century. It is therefore a network created to serve an Italy that is profoundly different from today, not only in terms of fine-grained settlement characteristics but also in terms of relative importance between peripheral areas and poles. For example, Piemonte region has one of the densest and most structured sub-networks, but this is to a large extent the legacy of a historical phase in which it was one of the 'centres' of the country's economy, something that is now partly outdated. Of course, the railway network has changed over more than a century, with new lines (a few), closures (many, at different times in history), but above all a general updating of a technological nature (electrification, signalling systems, rectification and speeding up). The network we inherit today, which can be used as a basis for offering services, is therefore only partially coherent with the needs of today's settlement structures, both in terms of form, quantity and quality.

Looking at access and proximity to rail service allows us to observe the different locational opportunities of the population in relation to their ability to move easily even over long distances by public transport.

In consideration of the recent concept of *15 minutes city*, but also observing that the actual catchment area of smaller stations is basically matching with walking distance, we can build a simple indicator of *accessibility to rail network* that depends on the number of inhabitants that

can reach it in a 15 minutes' walk or bike ride. The indicator depends both on the relative position of the station in the built context, but also the density of it.

	Population walking distance (1,200 m)	Population biking distance (3,750m)
Mainland Italy		
1 INNER ITALY	9%	19%
2 INTERMEDIATE ITALY	26%	60%
3 METROPOLITAN ITALY	34%	77%
Insular Italy		
1 INNER ITALY	7%	14%
2 INTERMEDIATE ITALY	23%	56%
3 METROPOLITAN ITALY	23%	62%

Table 14: Percentage of inhabitants that can reach rail network in a 15 minutes' walk or bike ride.

In the **Metropolitan Italy** we observe the highest concentration of rail services both long-distance and local. As much as 34% of population is at walking distance from a station, but the number is considerably larger if we consider in the walking accessibility also the mass transit networks people can use to reach a station without a private vehicle. The share of bike access is *apparently* much higher (77%), but the quality of such access is often poor making this figure just potential.

At the opposite side, **Inner Italy** is characterised by low-populated areas and sparse settlements, often in orographically complex contexts. Rail access is, not surprisingly, very rare, not to mention its low level of service. Just 8% of population lives at walking distance from a station. The share of bike is slightly higher, 17%, but as mentioned this share is sometimes theoretical due to orography. Given these conditions, these territories cannot rely on rail transport and where available – because of random historical reasons – it is simply not competitive against private transport.

The intermediate class of **Intermediate Italy** is, interestingly, more similar to metropolitan Italy than inner Italy: 26% (vs. 33%) has a station at walking distance and as much as 59% at biking distance. The biking accessibility is, in many contexts, more feasible (and thus more realistic) than elsewhere: mid-sized cities, low density areas, urban fringes, agricultural plains are potentially, and often actually, more bike friendly than other contexts. So, while the "problem" of access to rail in Intermediate Italy is not crucial, the level of service – which ultimately set the competitiveness of rail for everyday mobility – tends to be the weak point. Accessible but underserved stations, or served by low performance trains (infrequent, slow and not targeted services) to small poles, may be enough as a social service, but not competitive with private transport for large slices of resident population. We will detail more the different land-use contexts later in the report.

In **Insular Italy** the situation is just slightly worse than in the peninsular part of the country. For example, the accessibility in the Intermediate Italy is basically the same in Italy and in its islands: 23% vs. 26% (walk) and 56% vs. 60% (bike). The category where the largest differences is found is Metropolitan Italy, that in islands is, in terms of accessibility (but also level of service), the same of Intermediate Italy. In other words, the rail network in main insular cities is comparable to the one of Intermediate Italy differently from what happens in the mainland.

A last mention concerns the rail policies. It is undoubtful that, in the two or three last decades (since the Objective Law of 2001, but even earlier back to the start of the HS network in the Nineties) rail investments and development focused on Metropolitan Italy. This has guaranteed some interesting successes, in particular the HS and the redefinition of suburban services in some regions (Lombardy, Lazio, Emilia-Romagna, Trentino-Alto Adige in particular). But investments and especially the design of services has explicitly left behind the Intermediate Italy: interregional trains have largely disappeared; regional services, where not shrank, focused on large poles; HS trains simply skipped mid-sized city who rely on intercity services, constant in quantity but worsening in commercial speed.

The only season that explicitly tried to "bring back Intermediate Italy on the map" has been that of the so-called *Alta Velocità di Rete*, a sort of redesign of long-distance services towards a more and more extensive mixed use of HS and conventional network. The AVR appeared in 2017 and disappeared from any official document between 2017 and 2020 (Beria and Debernardi, 2021; Chitti and Beria, 2023), leaving the Intermediate Italy without any targeted rail policy.

1.2 Repository of data and references

The construction of the Repository of Proposals for Monitoring and Increasing Local Attractiveness and Resilience was developed along three directions: 1) the construction of a repertoire of bibliographic references defining the thematic fields within which we are working, 2) the identification of a series of datasets useful for monitoring and 3) the definition of some relevant indicators for the identification of inequalities and gaps.

Through the datasets and indicators, it was possible to construct some initial cartographic representations at the Italian scale and at the scale of the case studies that will be developed in the subsequent phases of the research.

1.2.1 Bibliography

Some studies and publications are necessary to build the interpretative framework in which the contribution of the DAStU fits into the research. For this reason, a reference bibliography has been developed on the one hand to specify the knowledge on territories and contexts and issues underlying the interpretations of territorial typologies, and on the other to build the reference frame in which we are operating on each individual theme.

1.2.1.1 Metropolitan Italy

Texts that help define metropolitan Italy:

- Alessandro Balducci, Valeria Fedeli, Francesco Curci (2017). Post-Metropolitan Territories. Looking for a New Urbanity, Routledge, New York.
  Most relevant research in Italy dealing with big urban areas this is an essential baseline to consider for future research for understanding the diversities in the Italian territory. (souce: https://www.anci.it/wp-content/uploads/Dossier_CM_15092023.pdf)

Texts reflecting on economic and real estate processes:

- ANCI (2023). Metropoli strategiche. Aree metropolitane. Dossier 2023.
  The report provides a series of data and information about the Italian metropolitan areas with a special focus on National financing policies dedicated to the MCs that have been obtained.

Texts useful for understanding the agro-energy landscape:

- SNPA, 2022. Città in transizione: i capoluoghi italiani verso la sostenibilità ambientale. Documento di Valutazione Integrata della Qualità dell'ambiente urbano. Report SNPA 30/2022.
  This report analyzes the main capital cities in Italy under three main perspectives: livability, circularity and resilience. Through key indicators developed by ISPRA the report provides information on the performance of the selected cities in terms of the 3 main domains. In the report there is also the indication of the urban form of the selected cities,

which is an indication of the level of resilience and sustainability of a specific urban form. The classification of the 4 different categories is described in the following reference:

- ISPRA, 2016. Qualità dell'ambiente urbano – XII Rapporto ISPRA Stato dell'Ambiente 67/16 ISBN 978-88-448-0793-1

Texts that develop a reflection on the educational infrastructure:

- MiBACT (2017). Demix. Atlante delle periferie funzionali metropolitane, Pacini ed., Ospedaletto (Pisa)
  Study carried out by K-City in collaboration with MiBACT, which mapped the city-effect of Metropolitan Cities by considering 4 main attractors: culture, retail and tourism, society and sport, territorial development through a proximity perspective. The research - which was responsible for investigating and mapping the distribution of activities and services available to citizens within the perimeter of nine Italian metropolitan cities– is responsible for proposing an original interpretation of the concept of periphery, associated with the condition of monofunctionality and lack of the functional mix (demix) that characterizes some parts of the territory compared to the areas perceived as central. (http://www.kcity.it/kcity/wp-content/uploads/2016/12/Demix.pdf)

1.2.1.2 Intermediate Italy

Texts that help define intermediate Italy:

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- Balducci A., Fedeli V., Curci F. (a cura di, 2017) *Post-Metropolitan Territories. Looking for a New Urbanity,* Routledge, London.
- Balducci A., Fedeli V., Curci F. (a cura di, 2017), *Ripensare la questione urbana. Regionalizzazione dell'urbano in Italia e scenari di innovazione,* Guerini e Associati, Milano.
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- Muscarà, C., Scaramellini, G., Talia, I. (2011), *Tante Italie una Italia. Dinamiche territoriali e identitarie*, Franco Angeli, Milano.

Texts reflecting on real estate processes:

- Audirac, I., Cunningham-Sabot, C., Fol, S., & Torres Moraes, S. (2012). "Declining suburbs in Europe and Latin America". *International Journal of Urban and Regional Research*, 36(2), 226-244.
- Bartels, B., Ermel, U., Sandborn, P., & Pecht, M. G. (2012). *Strategies to the prediction, mitigation and management of product obsolescence*. Hoboken, New Jersey: John Wiley & Sons.
- Buitelaar, E., Moroni, S., & De Franco, A. (2021). "Building obsolescence in the evolving city. Reframing property vacancy and abandonment in the light of urban dynamics and complexity". *Cities*, 108, 102964.
- Caramaschi, S. (2021). "Il verbo abitare non è all'infinito. Sull'inutilizzo del patrimonio abitativo nella città contemporanea". *CRIOS*, 22, 6–15.
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- Lang, T. (2015). "Socio-Economic and Political Responses to Regional Polarisation and Socio-Spatial Peripheralisation in Central and Eastern Europe: A Research Agenda", *Hungarian Geographical Bulletin*, 64 (3), 171–815.
- Lanzani, A. & Curci, F. (2018). "Le Italie in contrazione, tra crisi e opportunità". In A. De Rossi, *Riabitare l'Italia. Le aree interne tra abbandoni e riconquiste*. (p. 79-107). Roma: Donzelli.
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- Urban@it (2021), *Sesto Rapporto sulle città. Le città protagoniste dello sviluppo sostenibile*, Il Mulino, Milan.

Texts useful for understanding the agro-energy landscape:

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- Frolova M. (a cura di, 2015), *Renewable energies and European landscapes: lessons from Southern European cases*, Springer, Dordrecht Heidelberg.
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- Gliessman S.R. (2015), *Agroecology: the ecology of sustainable food systems,* FL: CRC Press/Taylor & Francis Group, Boca Raton.
- Gritti A. (2022), "Mappe iconografiche dei territori abbandonati", in Gritti A., Oldani A., Valente I. (a cura di), *L'architetture come risorse. Strategie progettuali per i territori produttivi abbandonati*, Aracne Editrice, Roma, pp. 19-41.
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- Freytag, T., Lauen, D., Robertson, S. (eds.) (2022), *Space, Place and Educational Settings,* Springer, Cham.
- Gabrielli G., Montino D., a cura di (2009), *La scuola fascista. Istituzioni, parole d'ordine e luoghi dell'immaginario*, Ombre corte, Verona.
- Galfrè M. (2017), *Tutti a scuola! L'istruzione nell'Italia del Novecento*, Carocci, Roma.
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Texts reflecting on transport networks and infrastructure:

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- Beria, P., & Debernardi, A. (2021). *L'offerta di servizi di trasporto pubblico a lunga percorrenza: Connettere i territori intermedi e non dimenticare i margini.* In *Ricomporre i divari. Politiche e progetti territoriali contro le disuguaglianze e per la transizione ecologica*. (pp. 355-364). il Mulino.
- Chitti M., Beria P., (2023). *A planning history of high-speed rail in Italy. World Conference on Transport Research* - WCTR 2023 Montreal 17-21 July 2023
- Donadoni E., 2021 "The Image Of Networks." in *Territorio*, n° 98, Franco Angeli, pp. 149-170
- Lanzani A., 2010, Ferrovie nel paesaggio e nel territorio, in Lombardia (Railways in the landscape and in the community in Lombardy), in *Territorio* n° 52-010
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- Moreno, et al., 2021, "Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities" in *Smart Cities,* 4, pp. 93-111.

1.2.1.3 Inner Italy

Texts that help define inner Italy:

- Long-term vision for the EU's rural areas. It is a European Commission initiative to develop a common European vision for 2040.
  It recognises the diversity of rural territories across Europe while identifying common challenges and opportunities. In shaping this long-term vision, the Commission gathered the views of rural communities and businesses via public consultations and stakeholder-led events. Through this collaborative process, the Commission created a wide-ranging

vision and a comprehensive rural action plan to help rural communities and businesses reach their full potential in the coming decades. Ten shared goals, summarised by four complementary areas of action emerged, embodying a long-term vision from, by and for stronger, connected, resilient and prosperous rural areas by 2040. (source: https://rural-vision.europa.eu/rural-vision_en#a-vision-for-rural-areas-towards-2040)

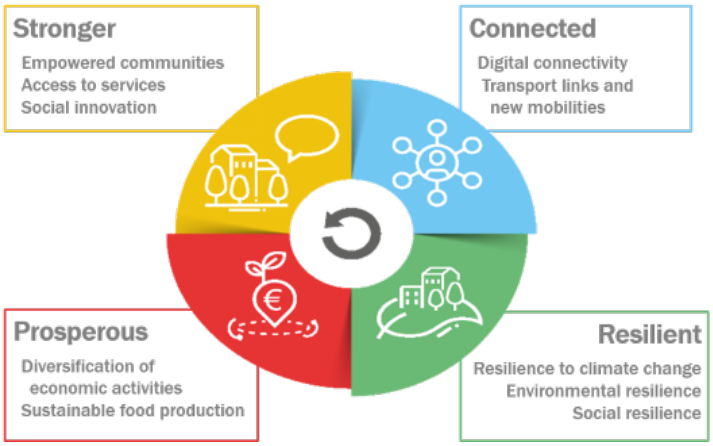

Figure 25: four areas of action of the long term vision for rural areas

- Urban-rural typology statistics. It is the European classification of regions that distinguish among three main types of regions: 'Predominantly rural', 'Intermediate', 'Predominantly urban'. This typology uses a three-step approach to classify the NUTS level 3 regions based on the density and distribution of population. It is a relevant reference that can give additional information on the rural territories in Italy. (souce: https://ec.europa.eu/eurostat/web/rural-development/methodology https://ec.europa.eu/eurostat/web/rural-development/publications)

Texts reflecting on economic and real estate processes:

- ESPON ESCAPE European Shrinking Rural Areas: Challenges, Actions and Perspectives for Territorial Governance. Research commissioned by the European Commission investigating rural shrinking in Europe in terms of Drivers and possible recovering strategies to adopt in order to reverse the trend (source: https://www.espon.eu/escape)

Texts that develop a reflection on the educational infrastructure:

- M. L. Paracchini, G. Zulian, L. Kopperoinen, J. Maes, J.P. Schägnera, M. Termansen, M. Zandersen, M. Perez-Soba, P. A. Scholefield, G: Bidoglio. (2014). Mapping cultural ecosystem services: A framework to assess thepotential for outdoor recreation across the EU, Ecological Indicators 45 (2014) 371–385.
  This research applies a method identified to address recreation mapping and provision of the ecosystem service benefit at EU scale. It is based on the Recreation Opportunity Spectrum (ROS) model and is used as an assessment tool of the current situation of (potential) recreation provision in Europe. The analysis focuses on the whole range of possibilities for recreation provided by ecosystems. This method and indicator is relevant

for highlighting the role of some areas (especially rural) in providing high level of recreation provision, by merging recreation potential and proximity.

Texts reflecting on transport networks and infrastructure:

- E. Vitale Brovarone (2022) Mobilità e accessibilità nelle aree interne: un'analisi della strategia SNAI in atto. Atti XXIII Conferenza Nazionale SIU, Vol. 8, Planum. The Journal of Urbanism.
  Starting from a qualitative-quantitative analysis of the 50 approved area strategies, the contribution proposes a reflection on the initiatives implemented by the territories for the axis dedicated to mobility. In particular, the existing critical issues, the objectives and targets, the actors involved, the integration with other axes and initiatives, the planned actions and the respective resources are investigated. The results of the analysis on the one hand highlight recurring challenges and proposals for intervention, thus being able to define a reference and comparison area for similar areas, and on the other hand propose topics for reflection regarding the actual ability of the SNAI to go beyond to an idea of accessibility still too hinged on prototypical, sectoral solutions and distant from the complexity of these areas.

1.2.1.4 Insular Italy

Texts that help define the costs of insularity and the effecs on foreign trade and attractiveness of insular regions:

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1.2.2 Datasets

Datasets that made it possible to construct the first spatial representations and formulate the first indicators:

1.2.2.1 Metropolitan Italy

- Atlante dei territori postmetropolitani.
  Important research result developed by POLIMI in the framework of a PRIN project funded by the Italian Ministry for Education, Universities and Research (MIUR). It constitutes a thorough overview of Italy, a country that is one of Europe's most diverse in terms of regional development and performance. The atlas contains several indicators and maps where to extract data describing important features of the territories, especially those related to the biggest urban areas. (source:https://www.postmetropoli.it/)
- SNPA, 2022. Città in transizione: i capoluoghi italiani verso la sostenibilità ambientale. *Documento di Valutazione Integrata della Qualità dell'ambiente urbano. Report SNPA 30/2022. This report analyzes the main capital cities in Italy under three main perspectives: livability, circularity and resilience. Through key indicators developed by ISPRA the report provides information on the performance of the selected cities in terms of the 3 main domains.*

1.2.2.2 Intermediate Italy

- State school master data information
- Registry information for state schools
- Information on schools in the autonomous provinces of Aosta, Trento and Bolzano assimilated to state schools
- Information on schools in the autonomous provinces of Aosta, Trento and Bolzano assimilated to state schools
- Information on parish schools
- Information on parish schools
- Information on parish schools in the autonomous provinces of Aosta, Trento and Bolzano
- Information on parish schools in the autonomous provinces of Aosta, Trento and Bolzano
- Underutilisation index of dwellings
- Underutilisation rate of dwellings in built-up areas
- Index of building expansion in built-up areas and centres
- Index of concentration of building use types
- Incidence of residential buildings in a poor state of conservation
- Index of fragmentation of the urban landscape
- Rate of non-use of buildings
- Occupied and unoccupied dwellings
- Buildings Residential buildings by number of storeys
- Dwellings historical series
- Dwellings by age of construction

- Incidence of buildings in poor condition
- Incidence of owner-occupied dwellings
- Average age of recent housing stock
- Index of underutilisation of dwellings
- Empty houses
- Residential sales data
- Tourism classifications
- Soil erosion indicators for Italy from 1981 to 2080
- OMI - Property values
- OMI - Number of sales/purchases NTN MEF - Average income
- OSM - Rail/road network ISTAT - Population and housing census
- GSE - Nominal installed power (kW) per municipality

1.2.2.3 Inner Italy

- Mappa aree interne (2020).
  Result of the mapping of the internal or remote areas in Italy with identification of different level of remoteness of the areas analysed. (Source:https://politichecoesione.governo.it/it/strategie-tematiche-e-territoriali/strategie-territoriali/strategia-nazionale-aree-interne-snai/le-aree-interne-2021-2027/mappa-aree-interne-2020/)
- ISTAT (2020) LA GEOGRAFIA DELLE AREE INTERNE NEL 2020: VASTI TERRITORI TRA POTENZIALITÀ E DEBOLEZZE.
  Analytical description of challenges and opportunities shown by the internal areas, where relevant capitals are highlighted especially in terms of cultural and natural heritage (source:https://www.istat.it/it/files//2022/07/FOCUS-AREE-INTERNE-2021.pdf)

1.2.2.4 Insular Italy

- ISTAT - Coeweb
- ISTAT - EUROSTAT
- CEPII Dataset
- www.distancefromto.net/
- ISTAT - Territorial Indicator
- ISTAT- Territorial Indicator
- ISTAT – ASTI
- https://doi.org/10.1016/j.tranpol.2020.04.006
- EUROSTAT
- Time Distance Matrix (Openroute Service)
- Dataset of 242 regions (NUTS2 EU classification) related to the following topics:
  Health of an area's economy (Gompers and Lerner, 1998);
  Capital market (Gompers and Lerner, 2000, Schertler, 2003, Da Rin et al. 2005);
  Health and quality of governments for economic stability (Armour and Cumming, 2006);

Investor protection and corporate governance the importance of common law (Glaeser et al. 2001, and Djankov et al. 2003, 2005);
Protection of property rights (Knack and Keefer, 1995), and Svensson (1998);
Legality in public administrations;
Taxation and contribution to GDP (Gompers and Lerner, 1998; Bruce and Gurley, 2005; Djankov et al. 2008);
Labor market policies and barriers related to corruption, crime and bureaucratic delay (Djankov et al., 2002);
Importance of schooling, culture and R&D (Megginson, 2004, Schertler, 2003).

1.2.3 Indicators

For each theme addressed by the WP3 research group, a set of indicators were identified to be considered for monitoring and increasing attractiveness and resilience from the datasets available or to be integrated.

1.2.3.1 Metropolitan Italy

- Synthetic fragility index
  Developed in the context of the metropolitan area of Bologna, with the aim of providing analytical elements to develop policies which take into account the territorial differences within the metropolitan area and the different impact that the interventions they can have on the territories and on the people who live there. The index consists of three synthetic indicators that measure the potential demographic, social and economic fragility of the 55 municipalities of the metropolitan area broken down into 17 indicators. This methodology can be applied to other Italian contexts (source: Demographic, social and economic fragility in the statistical areas of the municipality of Bologna - 2022 Edition https://inumeridibolognametropolitana.it/sites/inumeridibolognametropolitana.it/files/altri_temi/la_fragilita_demografica_sociale_ed_economica_nelle_aree_statistiche_del_comune_di_bologna2022.pdf)

- Potential mobility index:
  PMI is defined as the quotient of the aerial or Euclidean distance ('as the crow flies') and the travel time on the transport network between that origin and that destination. A PMI score can be calculated for each origin i by taking the average of the PMI values for all relevant destinations for that origin.
  Provided data is available, the measure can be applied to zones of any spatial scale, ranging from neighborhoods to transport activity zones and from census tracts to individual buildings. The main advantage of the PMI measure is that it captures the impact of both the structure of the transport network and the speed on the links of the network. The measure has significant advantages over the widely used level-of-service criterion.
  The PMI measure offers a more appropriate assessment of the quality of the transport network provided to such an area, as it links travel time to the lowest possible distance between two points in space (i.e. the straight line, aerial or Euclidean distance). Network inefficiencies are thus revealed by the PMI measure. This makes the measure particularly suited to determining the contribution of the transportation system to accessibility.
  (source: Karel Martens (2016), Transport justice: designing fair transportation systems, New York, Routledge, ISBN 9780415638319 (hardback) ISBN 9781315746852 (ebook))

1.2.3.2 Intermediate Italy

Demographic, economic and asset backgrounds:

- Population change 2011-2021
- Population change 2019-2021
- Growth trend decrease 91-01-11-21

- Migration rate 2014-2019
- Birth rate 2014-2019
- Death rate 2014-2019
- Population peak year by municipality
- Age of construction of residential buildings (3rd quartile)
- Percentage of dwellings not continuously occupied
- NTN, dwellings bought and sold in Italy
- NTN trend, dwellings bought and sold in Italy
- IMI, intensity of the housing market, ratio of purchase and sale volumes to housing stock
- Price per square metre of housing units
- Affordability Index
- Average income per capita
- GINI index (economic inequality)
- Ratio of income to average price of housing stock

Environments:

- Acclivity and altimetry
- Prevalent land use by municipality
- Prevalent crops
- Tracks and land subdivisions
- Density and shape of water network
- Nominal installed power per municipality per renewable source - 2021
- Nominal installed power per municipality by renewable source on municipal area - 2021
- Nominal installed power per municipality per renewable source on resident population – 2021

Everyday-life Infrastructure:

- Total number of schools per municipality
- Number of pre-schools per municipality
- Number of primary schools per municipality
- Number of secondary schools per municipality
- Number of secondary schools per municipality
- Diversification of secondary school addresses
- Number of schools per homogeneous territorial unit (educational infrastructure density)
- School drop-out rate
- Travel distance for study
- Distance of work trips
- Share of trips over medium to long distances
- Share of the first three mobility attractors per municipality
- Network rank of the first three mobility attractors per municipality
- Number of destinations constituting the prevailing number of trips. For example: 50%
- Prevalent direction vector of trips
- Number of inhabitants at a walking distance of 15 minutes from the station

- Number of inhabitants at a cycling distance of 15 minutes from the station
- Density of bicycle lanes (Km/Km2)

1.2.3.3 Inner Italy

- Ridurre l'ineguaglianza. Un criterio per selezionare indicatori per l'Italia nell'Agenda Onu 2030
  The article propose a selection of indicator to highlight differences and inequalities coming from the Italian constitution, putting them in connection with the 10th SDG "reduce inequality". (Source: https://asvis.it/approfondimenti/22-870/ridurre-lineguaglianza-un-criterio-per-selezionare-indicatori-per-litalia-nellagenda-onu-2030)

- Everyday-life Infrastructure
  Classification of the internal areas in the SNAI is the basis for the identification of internal areas, that present a significant distance from the centers offering essential services. A relevant set of indicators have been used for clustering the Italian territories into the 5 main categories of areas depending on their remoteness (source: https://www.agenziacoesione.gov.it/wp-content/uploads/2021/01/Guida_allxinterpretazione_degli_Indicatori_per_la_DIAGNOSI_APERTA.pdf)

1.2.3.4 Insular Italy

Inequality and gaps:

- Total exports of manufacturing sectors - ATECO Section "C" in current Euros
- Gross Domestic Product per capita of the Italian regions in current Euros
- Gross Domestic Product per capita of importing countries US Current dollars
- Distances in km between Italian regions and capitals of partner countries
- Regional motorway supply in km of regional network per km2 of regional surface
- Regional supply of electrified railways in km of regional network on the total railway network
- Regional supply of port quays in km per km2 of regional surface area

Infrastructural deficit:

- Average geodesic distance between the centroids in the regions
- Average distance by road
- Average time by road, by truck
- Total estimated average cost of driving a representative 40t articulated truck between the centroids in the regions
- Only the time-related costs (part of total_cost)
- Total wage of the driver for the trip (the hourly wage is an average between origin and destination) (part of all_timecosts)
- Miscellaneous costs assumed proportional to travel time (part of all_timecosts).
- Only the distance-related costs (part of total_cost)
- Total fuel consumption for the trip (part of all_distancecosts)

- Km-based tolls (part of all_distancecosts)
- Miscellaneous costs assumed proportional to distance traveled (part of all_distancecosts).
- Yearly taxes in the region of origin divided by an estimate of the number of yearly trips. not included in all_timecosts or all_distancecosts
- Costs of vignettes (considers the cost of vignettes needed in countries traversed, and divides by the number of estimated yearly trips). not included in all_timecosts or all_distancecosts
- Origin regional gross value added
- Destination regional gross value added
- quota di popolazione con elevate qualifiche di istruzione
- a percentuale di adulti impegnata in programmi di istruzione e training
- Gross Domestic Product
- Dataset NUTS 2 regions
- Regional Competitiveness Index
- Dummy variable (1 = island; 0 = not island)
- Road travel times

Insularity (MIN):

Indicators of the real economy

- Average rate of variation of the population (MAX)
- Gross domestic product at current market prices (MAX)
- Income of households (MAX)
- Persons at risk of poverty or social exclusion (MIN)
- At-risk-of-poverty rate (MIN)
- Gross fixed capital (MAX)

Institutions – regional

- Corruption (MIN)
- Quality and accountability (MAX)
- Impartiality (MAX)
- Individuals who used the internet for interaction with public authorities (MAX)

Institutions – national

- Presence of corruption in the national public institutions in the country (MIN)
- Presence of corruption in the local or regional public institutions in the country (MIN)
- Ease of doing business (MAX)
- Property rights (MAX)
- Intellectual property protection (MAX)
- Efficiency of legal framework in settling disputes (MAX)
- Efficiency of legal framework in challenging regulations (MAX)
- Organised crime (MIN)
- Reliability of police services (MAX)

- ☐ Judicial independence (MAX)

Macroeconomic stability

- ☐ General government deficit/surplus (MIN)
- ☐ National savings (MAX)
- ☐ Government bond yields (MAX)
- ☐ Government debt (MIN)
- ☐ Net international investment position (MAX)

Infrastructure

- ☐ Road transport performance (MAX)
- ☐ Rail transport performance (MAX)
- ☐ Accessibility to passenger flights (MAX)

Health

- ☐ Road fatalities (MIN)
- ☐ Healthy life expectancy (MAX)
- ☐ Child mortality (MIN)
- ☐ Cancer disease death rate (x1000) (MIN)
- ☐ Heart disease death rate (x1000) (MIN)
- ☐ Suicide death rate (MIN)

Basic education

- ☐ Low achievement in reading (15-year-olds) (MIN)
- ☐ Low achievement in maths (15-year-olds) (MIN)
- ☐ Low achievement in science (15-year-olds) (MIN)
- ☐ Population by educational attainment level (MAX)
- ☐ Population by educational attainment level (MAX)

Higher education and lifelong learning

- ☐ Higher educational attainment (MAX)
- ☐ Lifelong learning (MIN)
- ☐ Early school leavers (MIN)
- ☐ University accessibility (MAX)
- ☐ Lower-secondary completion only (MIN)
- ☐ Population by educational attainment level (MAX)

Labour market efficiency

- ☐ Unemployment, from 15 to 29 years (thousand persons) (MIN)
- ☐ Unemployment, from 20 to 64 years (thousand persons) (MIN)
- ☐ Employment (MAX)
- ☐ Average number of usual weekly hours of work in main job (MIN)
- ☐ Young people neither in employment nor in education and training (MIN)
- ☐ Employment rates of young people not in education and training (MIN)
- ☐ Employment rate (excluding agriculture) (MAX)

- ☐ Long-term unemployment (MIN)
- ☐ Unemployment rate (MIN)
- ☐ Labour productivity (MAX)
- ☐ Gender balance unemployment (MIN)
- ☐ Gender balance employment (MIN)
- ☐ NEET rate (MIN)
- ☐ Labour market slack (MIN)
- ☐ Temporary employment (MIN)

Market size

- ☐ Disposable income per capita (MAX)
- ☐ Potential market size expressed in GDP (MAX)
- ☐ Potential market size expressed in population (MAX)

Technological readiness – regional

- ☐ Households with broadband access (%) (MAX)
- ☐ Individuals buying over internet the last year (MAX)
- ☐ Enterprises having received orders online (at least 1 %) (MAX)
- ☐ Enterprises with fixed broadband access. (MAX)
- ☐ Access to high-speed broadband (MAX)
- ☐ Individuals with above-basic overall digital skills (MAX)

Business sophistication

- ☐ Employment (K-N sectors) (MAX)
- ☐ Gross value added (GVA) (K-N sectors) (MAX)
- ☐ Innovative SMEs collaborating with others (MAX)
- ☐ Marketing or organisational innovators (MAX)

Innovation and research

- ☐ Total patent applications (MAX)
- ☐ Core creative class employment (MAX)
- ☐ Knowledge workers (MAX)
- ☐ Scientific publications (MAX)
- ☐ Total intramural research and development expenditure (MAX)
- ☐ Human Resources in Science and Technology (MAX)
- ☐ Employment in technology and knowledge-intensive sectors (MAX)
- ☐ Trademark applications (MAX)
- ☐ Design applications (MAX)
- ☐ Sales of new-to-market and new-to-firms innovation (MAX)
- ☐ Researchers (MAX)
- ☐ GERD (MAX)
- ☐ HRST (MAX)

Data on Taxation Trends in the regions EU ns estimate

- Corporate Tax Rates in Europe (MIN)
- VAT reduced rates in EU % (MIN)
- Indirect taxes as % of GDP (MIN)
- VAT as % of GDP (MIN)
- Taxes and duties on imports excluding VAT as % of GDP (MIN)
- Taxes on products, except VAT and import duties as % of GDP (MIN)
- Other taxes on production as % of GDP (MIN)
- Direct taxes as % of GDP (MIN)
- Personal income taxes as % of GDP (MIN)
- Corporate income taxes as % of GDP (MIN)
- Social contributions as % of GDP (MIN)
- Other as % of GDP MIN)
- Employers' as % of GDP (MIN)
- Households' as % of GDP (MIN)
- Total tax as % of GDP (MIN)