Evaluation of Spatial Variables Related to the Provision of Essential Services in the Basilicata Region

Valentina Santarsiero[1,2(✉)], Gabriele Nolè[2], Francesco Scorza[1], and Beniamino Murgante[1]

[1] IMAA-CNR C.da Santa Loja, Zona Industriale, Tito Scalo, Italy
{valentina.santarsiero,gabriele.nole}@imaa.cnr.it
[2] School of Engineering, University of Basilicata, Viale dell'Ateneo Lucano 10, 85100 Potenza, Italy
{valentina.santarsiero,francesco.scorza, beniamino.murgante}@unibas.it

Abstract. Basilicata is composed by many small municipalities that offer poor accessibility to essential services. The key theme of this work is the evaluation of the endowment of these services, analyzing, in a GIS environment, their accessibility in terms of temporal distance. This work explores the specific issues and challenges for accessibility to internal areas and reflects on the future development prospects of the 131 Lucanian municipalities. The analysis was conducted on the basis of two types of information layers in relation to the totality of the municipalities: demographic structure of the population and provision of essential services, divided into 3 macro classes: education, health and mobility. Evaluations were thus extracted which provided a comparative-objective analysis of the presence of essential services. The result is a picture that shows serious difficulties linked to the socio-cultural and territorial fabric, the railway and motorway networks are profoundly lacking, showing a clear gap between the municipalities in terms of provision of services.

Keywords: Inland areas · GIS · Remote sensing · Basilicata region · Accessibility

1 Introduction

Urban areas have been identified, both internationally and nationally, as a crucial ladder for the development and advancement of civilization.

Much of the Lucanian territory is characterized by a spatial organization based on smaller centers which, in many cases, are able to guarantee limited accessibility to essential services. The characteristics of these smaller centers consist in a significant distance from the main centers offering essential services (education, health and mobility). These inland areas represent a very varied territory, the result of the dynamics of the various territorial processes and of the phenomena of anthropization that have occurred. The

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2022
O. Gervasi et al. (Eds.): ICCSA 2022, LNCS 13376, pp. 344–353, 2022.
https://doi.org/10.1007/978-3-031-10450-3_29

identification of internal areas is a polycentric interpretation of the regional territory, characterized by different levels of spatial periphery.

From a spatial point of view, the level of periphery of the territories with respect to the network of urban centers, home to a vast plurality of services, profoundly influences the quality of life of citizens and the level of social inclusion. In these, the presence of essential services can act as an attractor capable of generating discrete catchment areas.

The center of the supply of essentials is identified in that municipality capable of supplying at least the whole supply, an essential hospital and a railway station.

In a similar context, giving an adequate definition to a territorial model represents a challenge, since spatial data and information must be able to understand the mechanisms that determine, on a local scale, and supply demand for services [1–4]. It consists of an interpretative approach to the dynamics of settlement, territorial, infrastructural endowments and organizational models that condition, for example, territorial accessibility and that lead citizens to self-determine residence and systematic travel according to criteria for optimizing the methods of use of space and territory.

It is in this perspective that the concept of accessibility is grafted. The concept of accessibility is widely used even if there are many definitions that can be attributed to it and that give it a changeable and indefinite outline.

We can understand it as a right and intrinsic condition of living in cities and in the territory [5–7].

Too often, however, this concept is taken into consideration only in the territory of the planning and design phases, thus not responding to the real needs of those who live the term. This is the result of an objective and not subjective approach, the planning of the territory does not focus on the single individual and his needs-possibilities, but following an equitable live ability.

We have gone from a strictly connected link to the productive and economic sector and then, after the war, to take root in that of services of social interest such as education, health and ambitious recreation. Among the variables that most affect the way of understanding accessibility is the territorial context to which reference is made. The latter can in fact aggravate or bring out, in a marked way, forms of social inequality in terms of equal opportunities or, even more, isolate and marginalize some urban contexts. Recent studies have highlighted the possibility between social exclusion and use of the city by showing combinations of use of the latter monotonous and mono-place [8, 9]. This is the case of the Basilicata Region characterized by a serious delay in development and a secular infrastructural deficit [9, 10] especially for rural and mountain areas. The National Strategy for Internal Areas (SNAI) promotes an approach based on the provision of structural conditions for territorial (including accessibility) and local development [10, 11].

Basilicata presents this criticality in the management of the territories, being one of the regions with the lowest settlement density.

This thesis work explores the specific themes and challenges for accessibility in inland areas and reflects on future development prospects. It wants to promote the development of a spatial analysis methodology aimed at analyzing essential services in terms of accessibility and capable of providing a detailed picture of the territory in terms of local development. The work aims to study the spatial relations existing between the 131 municipalities of the Region and to promote the themes of territorial and spatial

planning in order to outline a strategic development framework. It is important to define the urban poles in which the essential services are concentrated to connect them neighboring cases by developing, improving and improving in some cases, trying to eliminate programmatic interiors, trying to eliminate internal imbalances.

2 Material and Method

The Basilicata Region is mainly mountainous and hilly, with a single wider plain in the Metaponto area (Ionian coast) and four valleys that rise from the great rivers from south to north of the region. Urban centers are mainly located in the higher areas of the region for historically defensive reasons, generally surrounded by large uninhabited areas and scattered houses or small civil or industrial aggregates. Thirty percent of the territory is affected by areas subject to environmental constraints; these data further highlight the need for prudence and more sustainable use of natural soil.

Most of the small Italian urban centers, despite having development potential linked to cultural tourism, suffer from serious economic and above all social hardships, mainly due to depopulation processes. Basilicata is one of the Italian regions with a high rate of depopulation as a result of migratory processes [12] and adverse territorial conditions; according to Istat sources [12], the resident population in the region increased from about 600,000 in 2000 to about 547,000 inhabitants in 2022. Most urban centers have a population that on average does not exceed 5,000 inhabitants, exceptions are the two capital cities and some industrial centers with a strong tourist and agricultural vocation. The SNAI (National Strategy of Internal Areas) [13] divides the Lucanian territory into four internal zones: Alto Bradano; Platano marble; Mercure - Sinni, Sarmento Valley and Matera Montain.

This classification is based on accessibility indicators in terms of minutes of travel, and is intended to show the remoteness of these areas from essential services.

2.1 Methodology

In this work, two main types of information layers were considered to analyze the framework of the territorial accessibility of the 131 Lucanian municipalities: the demographic structure of the resident population and the provision of essential services, which then made it possible to carry out an accessibility analysis. The classification of the demographic structure refers to Istat data, while the essential services are obtained from a detailed survey and mapping of the offer of public services, which together determine the different types of territorial endowments.

The first methodological approach was to reconstruct the stock of essential services (education, health and mobility) with the use of open data [14, 15] in a GIS environment. The provision of services is a fundamental parameter against which to evaluate the quality of life in a specific area. It can also be understood as an assessment of deficits, or the absence of minimum requirements for the supply of essential services with reference to the urban functions exercised by each territorial unit.

In order to frame a first summary view of the main socio-economic variables of the territory, read with respect to the trends that emerge from the Istat census data,

the demographic trend was analyzed. A significant elaboration to describe the severity of the aging process of the population is the construction of indicators that frame the resident population in percentage terms, divided into three classes: Youth population (aged between 14 and 35 years), Adult population (over 55 years) and Elderly population (over 80 years). This information base describes the socio-demographic structure to which we refer for the proposal of territorial organizational models aimed at balancing the demand for services. The variables related to the presence of the latter, organized on two levels of very detailed classification, describe the supply side of these and therefore the territorial endowment.

3 Results

All the municipalities of the Region were evaluated taking into consideration variables linked to information relating to the structure of the population and the provision of essential services. These were divided into three macro classes: education, health and mobility.

The spatial analysis on education initially focused on a survey of the regional school supply through the use of public datasets [14] and subsequently an analysis of the spatial distribution of secondary schools was carried out (Fig. 1).

It can be seen from the map in Fig. 1, a fairly varied trend in inland areas with maximum distances of 44 min for some urban centers located on the border with Calabria and for some inland areas.

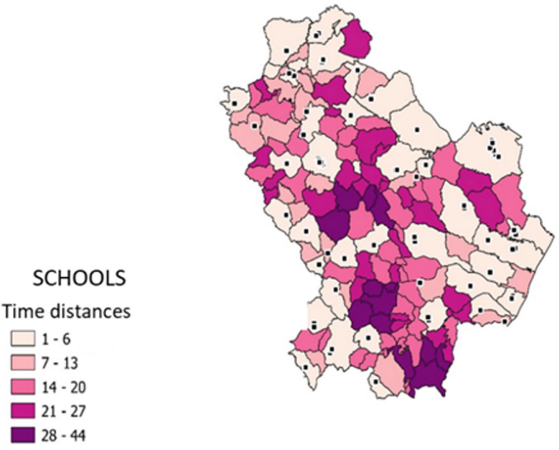


Fig. 1. Time distance, expressed in minutes, of each municipality to the nearest upper secondary school.

The analysis of essential services concerning the health aspect focused on spatial analyzes that related the availability of these services and their spatial and temporal distribution on the analyzed territory. An initial analysis concerned the recognition of all public health facilities, emergency rooms present in the Region through the use of

open datasets [15] and subsequently maps of the distribution of hospital facilities were drawn up (Fig. 2) and the Emergency room (Fig. 3).

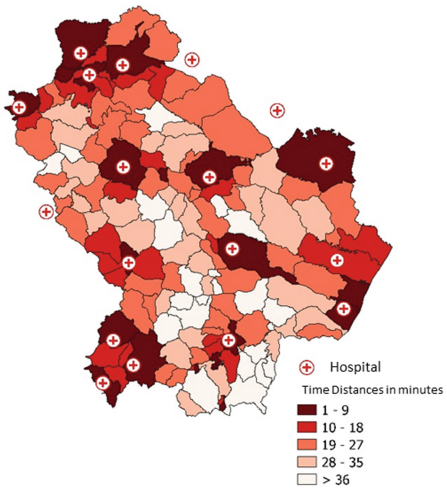


Fig. 2. Time distance, expressed in minutes, of each municipality to the nearest Hospital.

A highly fragmented and varied picture emerges in the three areas analyzed. From the analyzes concerning the distance from hospitals it emerges, in some cases, that the closest hospital is located in the neighboring regions of Campania and Puglia. Travel times vary widely. Also in this case, the most internal and isolated areas of the territory are characterized by a poor road infrastructure network; they are therefore the most penalized, with travel times of up to 55 min. A similar picture emerges from the analysis carried out for Emergency Room. In this case as well, the penalized urban centers are those falling within the innermost band of the Region (Fig. 3).

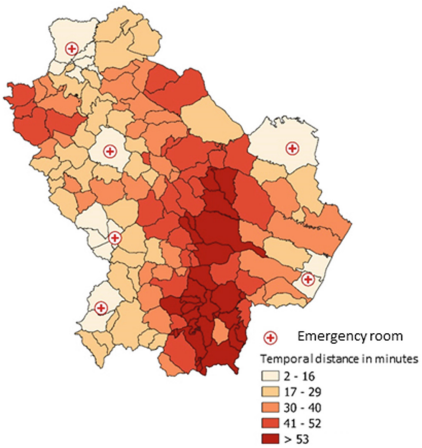


Fig. 3. Time distance, expressed in minutes, of each municipality to the nearest Emergency Room.

The following tables (Figs. 4 and 5) represent the temporal distances from the main mobility services such as airports and Highway Tollbooths. Figure refers to the temporal accessibility in minutes of the urban centers of Basilicata from the two nearest airports of Bari and Naples, located in Campania and Apulia Region. It can be seen that the nearest airport is at a distance of no less than 59 min, while the one furthest away shows temporal distances greater than 150 min.

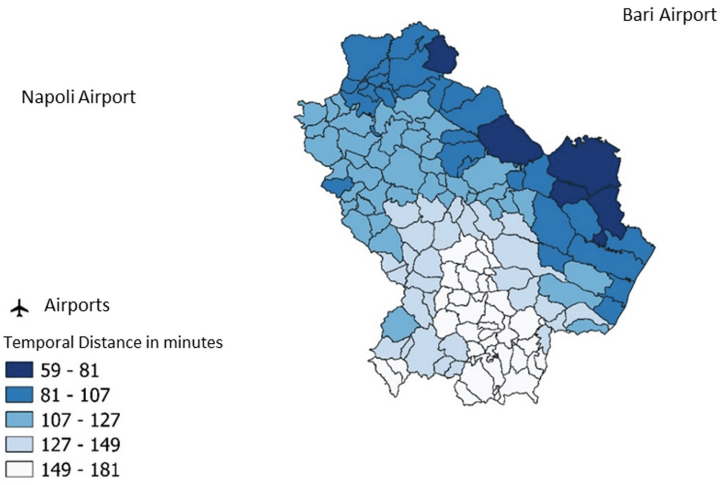


Fig. 4. Time distance, expressed in minutes, of each municipality to the nearest Airports.

The Basilicata Region does not have highways. The nearest freeway exits are those of Mercato San Severino, Candela, Barriera Taranto Nord and Bari. Figure 5 shows the temporal distance of the urban centers from the above-mentioned freeway tollbooths; it can be seen that the minimum distance is slightly more than 20 min and the maximum is more than 99 min.

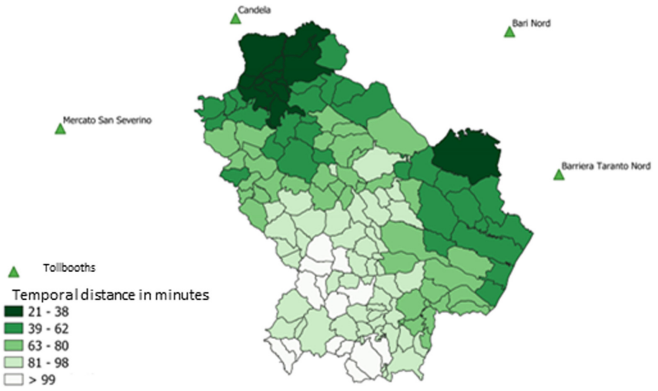


Fig. 5. Time distance, expressed in minutes, of each municipality to the nearest Highway Tollbooths.

The Basilicata region has a resident population of about 545000 inhabitants, a figure that is declining in view of the negative trend accompanied by an aging population and a decrease in the number of young people [20]. The demographic analysis (Fig. 6) shows us a region characterized by a strong centralization in a few urban centers, with consequent depopulation of inland areas and intensification of regional disparities [11]. We identify urban aggregates with high rates of resident population, where over the years there is a weak increase in population. These areas coincide with the two provincial capitals and the hinterland of the industrial pole of Melfi and the tourist poles of Metapontino.

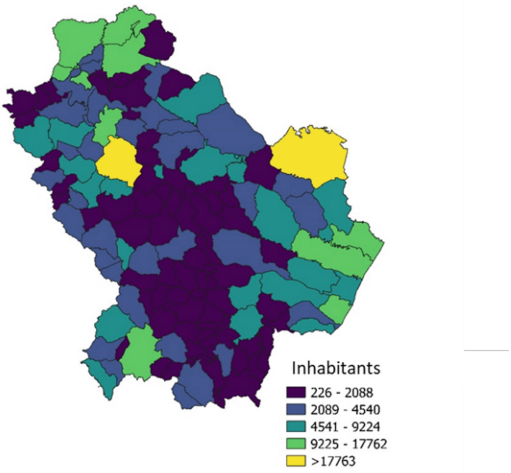


Fig. 6. Distribution of resident population as of 2021.

The results of calculating the indicators by age group for the year 2021 are very significant (Fig. 7). The indicators measure, as a percentage of age, the population in the three age groups considered (young (14–34 years), over 55 and over 80) out of the total resident population. These values were compared to the national average values. The indicators have been constructed and classified into 5 value classes, with reference to the national average for southern Italy. With regard to the indicator relative to the percentage of the resident population in the 14–34 age bracket, the class with value 5 represents a rate of resident youth population greater than 27% until decreasing to value 1, which represents the percentage of resident youth population less than 18%. What emerges from this initial analysis is that the resident population for this age group in the areas considered is of the order of 21%–18% of classes 3 and 2. With regard to the adult population over 55, the indicator measures, once again, the resident population in percentage terms compared with the average for southern Italy. Class 5 is attributed a percentage of the population over 55 years of age of less than 30%, while class 1 represents a resident population over 55 years of age of over 40%. Analysis shows that the resident population in the test area, in the over 55 age group, is over 40%. A similar argument was made for the resident population in the over 80 age group, where in class 5 a resident population of less than 3% is represented while in class 1 a value of the

resident elderly population greater than 10% is represented. In this case it emerges that the percentage of the resident population in this age group in the area is between 7% and 10%.

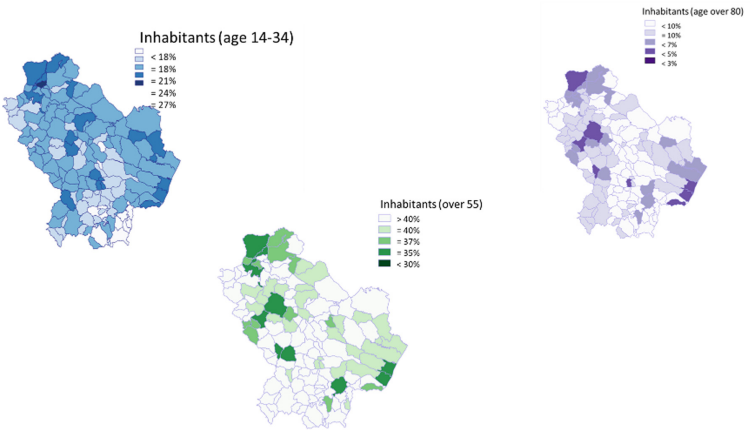


Fig. 7. Distribution of resident population by age group.

4 Discussion

This study proposed the use of a basic analytical methodology capable of evaluating the potential for local development of an area and highlighting its critical points. Numerical evaluations and maps have been extracted to allow an objective and quantifiable comparative analysis of the endowment of essential services.

The picture that emerges shows serious difficulties deriving from socio-cultural issues, but also territorial ones.

Analyzing the network of infrastructures and services that can be used in the regional territory, what is an indispensable and fundamental component for full and active participation in social life [8], significant shortcomings are revealed that specifically concern the rail and freeway networks. The regional rail network runs on a discontinuous line of 365 km that divides the region into two sectors. The entire territory, moreover, is devoid of freeway network and its tollbooths, the only points of entry to a fast road are present in the municipalities of Lagonegro and Lauria crossed by the Salerno-Reggio Calabria.

The low settlement density of Lucanian urban centers, confirmed by demographic analysis, and the characteristics of fragility and geological and geomorphological instability, are associated with considerable distances from essential services and also from the consequent opportunities for social development.

The population as a whole is aging and aging more rapidly in areas where there is more emigration of young people, aggravating the economic difficulties and social discomfort, in a spiral that seems unstoppable.

From the preliminary study carried out in this thesis emerges a region characterized by deep structural gaps between the 131 municipalities, those located inland, equipped

with essential services, are in a favorable position compared to other centers located in inland areas difficult to connect and lacking basic services.

This preliminary research provides a methodology for the application of spatial analysis to map the endowment of basic services in inland areas and the existing gap in accessibility, and can be a useful tool in future development planning for these marginal areas.

5 Conclusion

This work represents the main elements of a first experimentation, at the municipal level, of the methodology in the previous chapters.

The objective has been to create a spatial framework that can be used in future spatial elaborations, with the aim of integrating traditional methodologies and geostatistical approaches in the definition of the regional socio-economic framework.

The work carried out has thus made it possible to bring out the existing gap between municipalities in the same region in terms of accessibility and provision of essential services, showing how this is one of the parameters that affects regional development. Improving the accessibility of these territories means bringing, for example, essential services back to the most isolated areas, strengthening the mobility offer and acting on the local territorial capital.

Although an improvement in infrastructure endowment is not a very feasible prospect, forms of territorial cooperation oriented towards the efficient organization of the supply of the main public services should be undertaken on the basis of a strongly contextualized model of territorial organization [16, 17]. This work, on a preliminary basis, offers a synthetic representation useful for comparing localization choices of local policies with the current levels of supply of basic services on a regional scale.

References

1. Danese, M., Nolè, G., Murgante, B.: Visual impact assessment in urban planning. Stud. Comput. Intell. **176**, 133–146 (2009). https://doi.org/10.1007/978-3-540-89930-3_8
2. Fortunato, G., Scorza, F., Murgante, B.: Hybrid oriented sustainable urban development: a pattern of low-carbon access to schools in the City of Potenza. In: Gervasi, O., et al. (eds.) ICCSA 2020. LNCS, vol. 12255, pp. 193–205. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-58820-5_15
3. Murgante, B., Borruso, G., Lapucci, A.: Geocomputation and urban planning. Stud. Comput. Intell. **176**, 1–17 (2009). https://doi.org/10.1007/978-3-540-89930-3_1
4. Pontrandolfi, P., Dastoli, P.S.: Comparing impact evaluation evidence of EU and local development policies with new urban agenda themes: The Agri Valley Case in Basilicata (Italy). Sustainability **13**, 9376 (2021). https://doi.org/10.3390/SU13169376
5. Bacci, E., Cotella, G., Vitale Brovarone, E.: La sfida dell'accessibilità nelle aree interne: riflessioni a partire dalla Valle Arroscia. Territorio. 77–85 (2021). https://doi.org/10.3280/TR2021-096007
6. Calvaresi, C.: A national strategy for internal areas: Rights of citizenship and local development. Territorio. 78–79 (2015). https://doi.org/10.3280/TR2015-074013

7. Scorza, F., Saganeiti, L., Pilogallo, A., Murgante, B.: Ghost Planning: The Inefficiency of Energy Sector Policies in Low Population Density Region, pp. 34–55 (2020). https://doi.org/10.3280/ASUR2020-127-S1003
8. Borlini, B., Memo, F.: Ripensare l'accessibilità urbana. (2009)
9. Bonaiuto, M., Fornara, F., Bonnes, M.: Indexes of perceived residential environment quality and neighbourhood attachment in urban environments: a confirmation study on the city of Rome. Landsc. Urban Plan. **65**, 41–52 (2003). https://doi.org/10.1016/S0169-2046(02)00236-0
10. Dastoli, P.S., Scorza, F., Murgante, B.: Impact evaluation: an experiment on development policies in Agri Valley (Basilicata, Italy) compared with new urban agenda themes. In: Gervasi, O., et al. (eds.) ICCSA 2021. LNCS, vol. 12957, pp. 621–633. Springer, Cham (2021). https://doi.org/10.1007/978-3-030-87013-3_48
11. Curatella, L., Scorza, F.: Polycentrism and insularity metrics for In-land areas. In: Gervasi, O., et al. (eds.) ICCSA 2020. LNCS, vol. 12255, pp. 253–261. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-58820-5_20
12. Popolazione residente al 1° gennaio : Basilicata. http://dati.istat.it/Index.aspx?QueryId=18564. Accessed 23 Nov 2021
13. Ministro per il Sud e la Coesione territoriale - Strategia Nazionale Aree Interne. https://www.ministroperilsud.gov.it/it/approfondimenti/aree-interne/strategia-nazionale-aree-interne/. Accessed 2 Mar 2021
14. Portale Unico dei Dati della Scuola|MIUR: https://dati.istruzione.it/opendata/. Accessed 2 Mar 2022
15. Open Data - Dati - Posti letto per struttura ospedaliera. https://www.dati.salute.gov.it/dati/dettaglioDataset.jsp?menu=dati&idPag=18. Accessed 2 Mar 2022
16. Saganeiti, L., Favale, A., Pilogallo, A., Scorza, F., Murgante, B.: Assessing urban fragmentation at regional scale using sprinkling indexes. Sustainability **10**, 3274 (2018). https://doi.org/10.3390/su10093274
17. Nolè, G., Murgante, B., Calamita, G., Lanorte, A., Lasaponara, R.: Evaluation of urban sprawl from space using open source technologies. Ecol. Inform. **26**, 151–161 (2015). https://doi.org/10.1016/J.ECOINF.2014.05.005