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Research Article

Land take and landscape loss: Effect of uncontrolled urbanization in Southern Italy

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ABSTRACT

The present paper describes a research that, based on the evolutionary data of the urban settlement over a period of half a century, shows the changes undergone by the various landscape categories of Southern Italy. The regions involved are four (Campania, Basilicata, Puglia and Calabria) and share renowned urban, economic and social issues such as unauthorised development, low income per capita and organised crime. All this has produced profound transformations on some of the most important and rare Italian landscapes, such as coastal plains and coastal carbonate slabs. Uncontrolled urban sprawl has further provoked an environmental crisis and eco-friendly insularisation of the yet numerous and valuable protected areas of this geographical area, thus leading to a high density of buildings and infrastructures even in national parks, breaking European records in this respect. Through finalised indicators, the characteristics of the evolution occurred have been analytically highlighted, and by using the latest generation satellite data, it is shown how such phenomena have continued to take place with significant energy over the last few years. The result is a picture of environmental threats still very prominent in this southern extremity of the peninsula, above all towards those naturalistic qualities and landscapes that are the main attractions of an intense national and international tourism whose income, however, has not been conveyed in a correct and inclusive way to allow high-level socio-economic conditions of the resident population.

1. Introduction

The phenomena of land take, associated with the urban sprawl standard, has been internationally recognised internationally by the scientific literature and it is now consolidated in terms of characteristics and related consequences on environmental, economic, social and territorial balances (Barrington-Leigh & Millard-Ballb, 2015; European Commission, 2006; Jaeger, Bertiller, Schwick, & Kienast, 2010; The Worldwatch Institute, 2007). A great interest has also been manifested around the topic of rural areas, especially in countries with rapid expansion such as China (Chen, Wang, Ren, & Du, 2016; Ding & Zhao, 2011; Jiang & Zhang, 2016; Li et al., 2016).

The research presented in this paper shows the effects that 50 years of variations in the urban settlement geography occurred in Southern Italy have caused on certain environmental and landscape components. Furthermore, the transformations studied are correlated to social dynamics and to the concentrations of high naturalistic and vulnerability values, such as protected areas and

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coasts. Such an aspect was taken into consideration half a century after the II World War because in this period Italy experienced the most impressive phenomenon of urban transformation in its history. In fact, previously, exception made for the few large cities, the remaining territory lived in an agricultural and rural conditions with very small and localised urbanised areas. The post-war reconstruction and the economic boom of the '60s' and '70s' completely changed the country's landscape and the construction of buildings and roads spread over huge areas far away from the cities even though with extremely low urban and demographic densities. The questions to which the research carried out attempted to answer therefore concern the distribution and geographical impact of this phenomenon on the Southern Italy area, by verifying the different physiognomies piloted by the regions policies and trying to understand if the entity of what happened, in addition to causing disadvantages to the environment and landscape, has at least led to positive economic results, even if local.

A further intent of this work is to demonstrate how the significant urban growth detected in the investigated period is completely unrelated to the observed demographic dynamics, and to provide at the same time policy guidelines and technical means (GIS based) aiming at limiting, monitoring and controlling the effects of the urban conversion of the soils.

The results presented by this paper derive from a research lasted nearly ten years and that has processed information and made a diagnosis of the impact of urbanisation on the entire national territory from the post-war period (1949–1962) to the noughties (2000–2008), then describing in depth certain geographical areas such as the Alps, the Po Valley, Central Italy and the major islands (Fiorini, Zullo, & Romano, 2017; Romano & Zullo, 2014a, 2014b).

Although most of the research works on soil consumption in Italy carried out by the group of Authors of this paper has been published on international journals, the phenomenon has simultaneously been attracting national scientific attention for several years, producing, however, studies almost exclusively in Italian or based on conference proceedings. Among them, special mention goes to those originated from the research performed by the University of Venice Architectural Institute (IUAV) (Gibelli & Salzano, 2006; Salzano, 1992), Milan Polytechnic Institute (Bonifazi & Heins, 2001; Pileri & Maggi, 2010), University of Palermo (Indovina, 2009), and University of Camerino (Sargolini, 2010), in addition to ItUrb by Giovanni Astengo, which was maybe the first research ever conducted in Italy on this topic (Astengo & Nucci, 1990). Concerning the studies published on international journals on the topics discussed in the present article, relevant references have been made consistently, according to the topics of each section. However, it should be highlighted that the main difference between the data at the basis of this research and those just mentioned is to be found in the actual measurement of the extension of the urbanised areas performed on cartography since the '50s', which took almost ten years of processing to obtain a scale of 1:25,000 for the entire Country. All other contributions, either past or contemporary, to this chronological section made use of sampling methods or took into consideration only sample areas (Munafò et al., 2013).

The present paper highlighted, with final indicators, various relations among the several above-mentioned aspects, which are closely connected with the urban dynamics this territory has experienced since the end of the Second World War.

Section 2 is a description of the field of study, by providing a series of information aiming at depicting an overall picture of the specific domain including its multiple contours of quality and difficulty; Section 3 deals with data acquisition methods related to the urban transformation dynamics, which called for a significant and absolute commitment, but that consequently allowed for drawing many previously unpublished results of the research. Section 4, dealing with the results, is divided into two sub-sections: point 4.1., that presents the urbanisation development data, with a specific focus on the most significant phenomena, and point 4.2., that analyses the effects of such development on the landscape and environment by making use of the classifications of these entities as provided by the Italian institution bodies. The Discussion and Conclusions sections, points 5 and 6, summarise the substantial steps of the study, highlighting the unique aspects that emerged, and indicate the most serious problems and difficulties in solving them.

2. Study area

The southern Italian extremity, made of the four regions of Campania, Basilicata, Puglia and Calabria, constitutes, however, as widely known, one of the most problematic areas of the country, both for economic and social reasons and for environmental/urban aspects and therefore it was deemed appropriate to study them separately from other geographical areas.

The area studied represents about one fifth of the entire country, but it is undoubtedly home to the most contradictory phenomena which are possible to detect: on one hand, it boasts some of the most valuable natural, cultural and landscape resources, both at a national and at a European level, an active farming industry of great importance thanks to the climate and geomorphological characteristics, the coasts are among the most attractive in Southern Europe for summer tourism, and, moreover, the area includes an extensive part of the Apennines, which is of considerable environmental value (Efe & Öztürk, 2014). On the other hand, it is one of the national areas with the greatest problems of social stability, organised crime, and deregulation in every sector, unemployment and youth challenges, illegal housing and corruption of businesses, environmental and urban degradation (Pinotti, 2015). Moreover, this area has seen extensive land-use changes that led to a deep soil consumption (Foley et al., 2005; Ramankutty & Coomes, 2016).

The study area extends over 5,800,000 ha on three sides of the Mediterranean and is surrounded by three Italian Seas (Adriatic, Ionian, and Tyrrhenian), with over 2000 km of coastline (Fig. 1 on the left). Four of the 20 Italian regions (namely Campania, Basilicata, Puglia and Calabria)were included in the analysis, together with 1338 municipalities that constitute 17% of the national ones, but that are larger than average (43 sq. km against 36). The current population (National Institute for Statistics' census from 2011) is 20% of the country's total population (12,500,000 inhabitants) and is perfectly proportional to the area of Italian territory covered by the study, which is exactly 20% of the total territory. The largest part of population is situated in Campania and Puglia, with nearly 10 million inhabitants, while Basilicata, with less than 600,000 inhabitants, is one of the least populated regions in Italy, excluding the very small Valle d'Aosta and Molise regions, whose surfaces are less than half that of Basilicata. However, Campania is

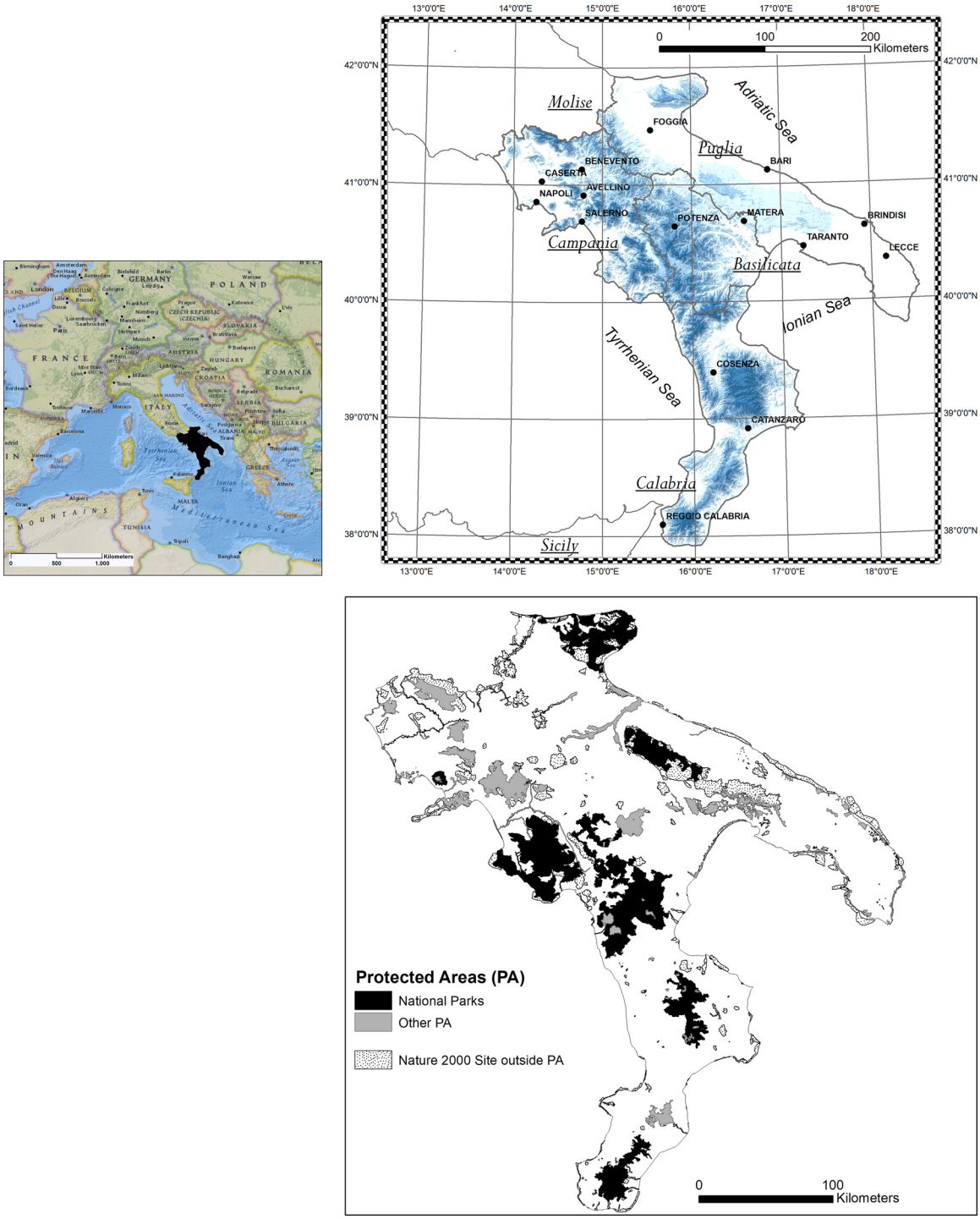


Fig. 1. Study area and geographical distribution of protected areas and Natura 2000 sites.

the Italian region with the highest population density (430 people per sq. km), higher than those of Lazio and Lombardy and more than twice as high as the national average, which is however a constant within the entire study area.

Before the unification of Italy in 1861, the regions taken into consideration here had a marked territorial history, due to their shared belonging to the Kingdom of the Two Sicilies. Historical farming in these regions was based on the landed estate model (Cardoza, 1994), that is large properties owned by noblemen or church aristocracy used for traditional cultivations but more often as pastures managed by farmhands employed by the owners.

This system, that is so typical of the Ancien Régime, was overcome in Western Europe between the XVIII and XIX centuries thanks to the spreading of capitalism in managing farms.

The economic problems of this national district are well translated by a GDP per capita that is on average equal to 65% of the Italian GDP, but, with an average of € 17,500, it is about half that of other regions such as Lombardy, Trentino Alto-Adige or Emilia Romagna. Calabria, in particular, shows the lowest GDP in Italy with € 16,600 (EUROSTAT, 2018).

A particularly important mention is certainly that related to the importance of environmental protection, which is often obscured in public perception by the reputation of a socio-economically problematic area of this extreme southern part of the Peninsula. In the area there are 188 protected areas covering over 1 million hectares. Among these there are 7 of the 24 national Italian parks, with a total of over 760,000 ha, representing overall 50% of all national Italian parks: some of these, being over 175,000 ha (Cilento-Vallo di Diano and Pollino), are some of the largest in Europe. Moreover, 403 Natura 2000 (SCIs) sites are partially integrated in the protected areas and safeguard habitats of European interest, among which the Alta Murgia that, with its 126,000 ha, is the largest Natura 2000 site of Italy. The total of the protected natural areas amounts to 1,608,000 ha, meaning 28% of the study area, which undoubtedly shows the high naturalistic-ecological quality of this Italian extremity, perhaps not known nor enhanced enough. From the geological point of view, 40% of the entire study area is made of terrigenous structures (sandstones, clays and marl), that make it a territory very vulnerable to instability with frequent phenomena such as landslides and collapses (Marzaioli, D'Ascoli, De Pascale, & Rutigliano, 2010). In this respect, the most famous events were the landslide in Sarno in 1998, which caused 160 victims, and the landslide in Sapri in 2010 within a territory with dramatic scenarios of vulnerability well-documented from a scientific point of view (Albanese, Iavazzo, Adamo, Lima, & De Vivo, 2013; Gariano, Rianna, Petrucci, & Guzzetti, 2017). It is, indeed, an area characterised by a high level of hydrological and landslide risk due to the irregular Apennine morphologies (see Fig. 1) that run through it from North to South, affecting essentially all the regions taken into consideration and to a lesser extent the Puglia region, whose geological conformation is mostly flat. Areas at landslide risk cover more than 12,000 km^2, a third of which is characterised by considerable danger. Most of these areas involve the Campania (8200 km^2) and Basilicata (1800 km^2) regions. Hydrogeological risk affects 5% (2600 km^2) of the whole territory studied, with over 1800 km^2 at very high risk, for which a more even distribution of risk can be found among the regions studied, with Basilicata presenting the lowest value (200 km^2). The envelope for both types of danger represents 25% of the investigated area.

In addition to this, it is one of the Italian areas most vulnerable to earthquakes: data from the INGV and relating to OPCM No. 3274 from 2003 denounce that 27% of the area is in the seismic hazard category 1 and another 32% in the next type 2 hazard category. Furthermore, it has a history full of high intensity seismic phenomena with many victims (Cubellis, Carlino, Iannuzzi, Luongo, & Obrizzo, 2004; Jenni, Goes, Giardini, & Kahle, 2006; Nappi, Gaudiosi, Alessio, De Lucia, & Porfido, 2017).

The cultural significance is also considerable, with several cities of art (the most widely known among these are Naples, Caserta, Matera, Bari, Lecce, Reggio Calabria) and 11 Unesco sites mostly distributed among Campania and Puglia that certify the importance of this geographical area in all historical eras. The population is distributed throughout the territory, but only six cities exceed 100,000 inhabitants and Naples alone counts almost one million with its metropolitan area.

As already mentioned, the area is home to extreme contradictions. In contrast with the already highlighted objective environmental and cultural quality, in 2013, CRESME placed Campania, Puglia and Calabria in the top three places in the Italian ranking of unauthorised building with more than 2000 detected violations (De Biase & Losco, 2017; Zanfi, 2013). By adding to these data also those of Sicily and Basilicata, the total amount of unauthorised buildings corresponds to the half of all those ascertained in Italy. The cited data show that in Calabria and in Campania, unauthorised buildings represent 60% of all buildings. To give an idea of the proportions of the phenomenon, Lombardy, Piedmont, Veneto and Emilia-Romagna together do not reach 1000 cases of verified unauthorised development (CRESME, 2018; ISTAT, 2018). The issue has been widely debated for years and more sources support the links with organised crime, which in some of these regions has deep historical roots. In any case, as it can be seen further on, the most common issue is the widespread pressure of unauthorised construction has not had far-reaching consequences on urban sprawl from those registered in other parts of the country. Although it must be said that the cause of soil consumption and landscape degradation is not only due to the high degree of extension of this phenomenon but also to wrong laws that favoured the phenomenon.

3. Data and methods

The main issue in this study was that of finding a historical dataset updated to the post-World War II period that was as homogenous as possible within the entire country. As we lacked digital data with these features, our choice fell on the only existing maps (raster format) that helped us to extract urbanised areas almost semi-automatically using GIS techniques, through a methodology already described in various articles and to which this work is linked (Romano and Zullo, 2014a, 2014b, 2015; Romano, Zullo, Fiorini, Ciabò et al., 2017; Romano, Zullo, Fiorini, Marucci et al., 2017).

Therefore, we obtained the historical urbanised areas from the maps produced by the Italian Military Geographical Institute (IGMI) on a scale of 1:25,000 (Table 1); considering also for this work the definition of "urbanised areas" introduced by Romano and Zullo (2013).

The classification used in this study included all the territorial spaces, both physical and artificial, which however had only been subjected to the impact of "urban" anthropological activities. They were therefore considered "urbanised land": built-up land and land used for ancillary settlement functions, such as public and private gardens, sports facilities, unpaved roads and other service areas, either permeable or impermeable to water. Land with rural houses and outbuildings used to support farming and animal husbandry is also classified as an "urbanised area", even though its features cannot be defined as strictly "urban". The phenomenon of land take is caused precisely by the proliferation of such "urbanised areas" that replace the natural and semi-natural soil sectors with

Table 1
List of regional map datasets used for our study and dates of update.

Region	Map dataset used			
	1950s		Noughties	
	Type of map	Scale	Type of map	Scale
Puglia (1949–2006)	**25V Series - published by IGMI***	1:25.000	Land use map	1:5.000
Campania (1956–2009)			Agricultural land use map	1:25000
Basilicata (1956–2010)			ISTAT Map	1:10.000
Calabria (1956–2010)			ISTAT Map	1:10.000

* IGMI = Italian Military Geographical Institute.

artificial materials, such as concrete, aggregates and asphalt, creating non-reversible conditions for removing the surface layer of non-renewable "soil" resource.

The historical data was compared to the current urbanised data already available in vector format (Table 1). In particular, different maps were used for the regions considered:

– Land Use Map (2006) on a scale of 1:5,000 for Puglia (http://webapps.sit.puglia.it/freewebapps/UDS2006/index.html);
– Agricultural Land Use Map (2009) on a scale of 1:25,000 for Campania (https://sit2.regione.campania.it/content/carta-utilizzazione-agricola-dei-suoli);
– ISTAT Map (2010) on a scale of 1:10,000 for Calabria and Basilicata (https://www.istat.it/it/archivio/104317).

From these data we evaluated the phenomena of urban transformation in the study area occurred between the 1950s and 2000 using demo-urban indicators and appropriate GIS techniques (Fig. 2). The results obtained from historical maps on a scale of 1:25,000 were then compared with those of urbanised areas available in vector format from the regional Land Use Maps (LUM) generally derived from photo interpretation on a nominal scale of 1:10,000 or 1:5000, updated between 2002 and 2007. Considering the time difference in the updating of the primary data, a 5% tolerance should be allowed for future assessments.

It is important to point out that interpreting these phenomena on a municipal scale is particularly useful for the purposes of land use policy, since in Italy municipalities are the territorial authorities that make concrete urban-planning decisions. The Regions, instead, generally produce laws and framework plans on territorial transformation that however have limited impact on the activities of municipalities and merely provide guidance.

Some national bodies have produced even more detailed data on the entire country but using "sampling-based" and not "measurement-based" techniques. In the case of Italy, the highly varied geographical standards of settlements make it very difficult to

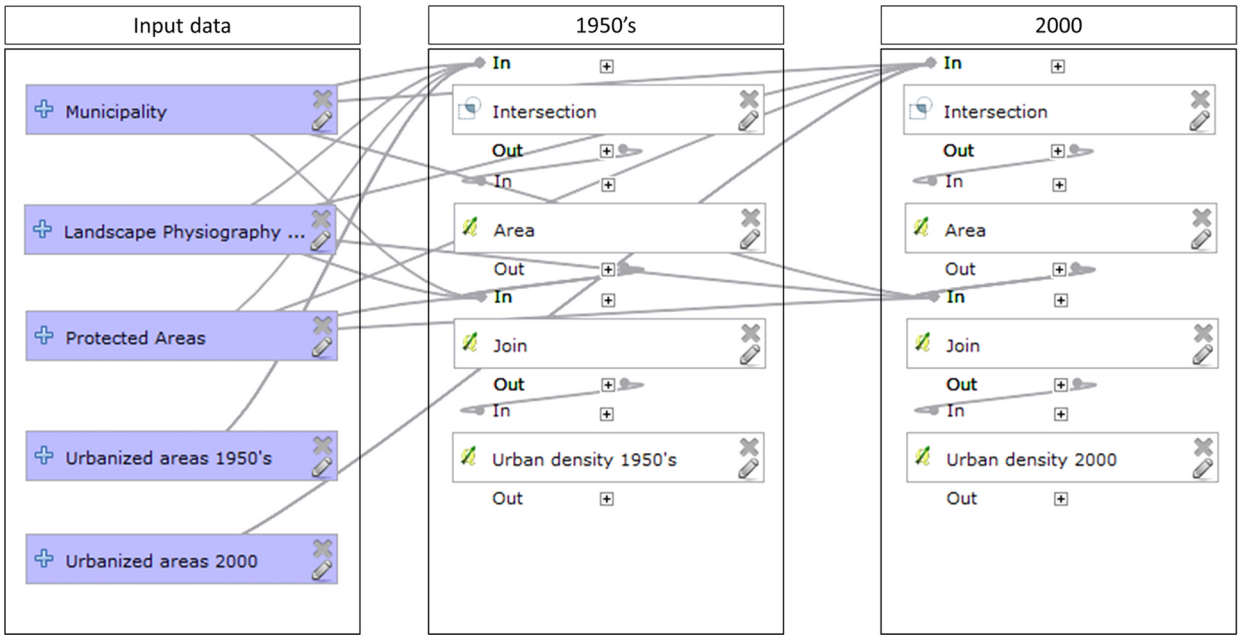


Fig. 2. Input data and methodology used.

select significant samples [39]. For this reason, we used Copernicus data to provide a consideration on the dynamics of the phenomenon over the latest years. These data, processed by the ISPRA (The Italian Institute for Environmental Protection and Research), are based on a satellite survey performed by Copernicus (ISPRA, 2018) by considering that the method adopted is based on a detailed grid of 10 × 10 m where the individual cells are added to the urban category if at least 30% of them show such coverage. This survey method clearly entails the impossibility to compare the data reported for the post-2000 time period in this paper and which taken from the regional LUM; in fact, since 2012 it has been possible to estimate the variation rates only on the basis of the Copernicus data.

Finally, we evaluated the effects of urbanisation on the landscape using the Italian Landscape Units identified by the ISPRA (2004). This map, on a scale of 1:250,000, is based on the 37 types of Landscape Physiography Units (Fig. 7 on the left) defined as portions of territory presenting typical physiographic arrangement, land cover patterns and litho-geo-morphological characteristics.

4. Results

4.1. A comparison between the 1950s and 2000

The regions analysed showed significant urbanisation differences between the 1950s and the post-2000 years for reasons clearly linked to the aforementioned historically dominant territorial policies, as well as the climatic, geographical, morphological and productive characteristics. However, the variations are quantitatively significant (Fig. 3 and Table 2), with minimum increase rates by 200% in the case of Campania, approximately 500% in Puglia and Calabria and a peak exceeding 700% in Basilicata. The land of this latter region, which is the smallest among the four examined, has been urbanised at the average speed of 8000 m^2 per day, whereas significantly higher speed values have been recorded in Calabria and Campania with 3.5 ha per day, and also in Puglia, with more than 5 ha per day.

In the regions subjected to the study, the urban area expanded on average by more than 4.5 times with an increase of 256,000 ha over a period of approximately 50 years (an increase slightly lower than the entire urban surface of Paris). The daily land take is referred to variable survey periods, but the average value settled at around 13 ha/day, thus providing a contribution of 16% to the national total calculated at 82 ha/day (Romano et al., 2017a, 2017b). The urban dynamics of the last 50 years show how they have insufficiently taken into consideration hydrogeological and landslide risks, since these areas, covering, as already said, approximately 25% of the study area, have experienced 15% of the urban transformations (360 km^2).

Moreover, as already described in the study area section, these regions were mainly characterised by the landed estate model in which no particular attention was paid to innovation and the owner would only focus on getting good earnings, ignoring agricultural details and the living conditions of farmhands. For this reason, agriculture in land estates was often quite underdeveloped. The land estate model did not have the need for a dense settlement system on the territory. Therefore, built-up areas are historically more aggregated with respect to Central and Northern Italy, managed through the prevailing sharecropping model (Reid & Joseph, 1975; Shaban, 1987).

The regions considered are composed of 1338 municipal districts, of which 797 (almost 60%) recorded a demographic drop in the time period 1956–2000, mostly occurring in Basilicata, Campania and Calabria. The average size of the municipal districts, as already previously mentioned, is approximately 43 km^2 versus the overall 36 km^2 for Italy in general; however, there are 67 municipal districts with a surface that is less than 5 km^2 and 220 with a surface that is less than 10 km^2 (corresponding to a square of 3.5 km per side). There is no doubt that such small municipal districts would have difficulties in terms of urban planning when it comes to making independent decisions on the development of new areas to be urbanised.

Within the entire territory analysed, in the 1950s only 32 municipal districts presented an urbanisation rate over 20%, while 756 did not even reach 1%. After 2000, the number of urbanised municipal districts with the threshold of over 20% increased to 149, while 30 exceeded the 50% threshold and only 171 remained below the 1% level (Fig. 3c) and d).

Table 2 provides a very effective dynamic image regarding the actual size of the process analysed. The regions studied, over the years after WWII, showed very limited urbanisation density rates: Basilicata, with a marginal 2‰, could be deemed effectively lacking urbanisation while Calabria and Puglia presented a marginal 1% versus a rate just over 2% showed by Campania. All the values have substantially changed over the 50 years reviewed: the three largest regions settled between 5% and 7%, close to the national average, while Basilicata reached almost 2%. The per capita data variation, a typical human settlement trend index, sees a three-fold increase in the average value in the area of study with a maximum of more than 400 m^2/inhabit. in Calabria and a relatively low value in Campania quantified as 170 m^2/inhabit. In the Puglia and Calabria regions, the per capita rate is clearly influenced by coastal urbanisation.

It is rather counter-intuitive to note that Campania had the lowest per capita urbanisation value while having the highest regional rate (7.5%); however, as stated before, this is an extremely high demographic area, with a rate that is twice as high as the national rate and that includes almost 1,800,000 more inhabitants with respect to the bordering Puglia region, which presents greater extension. The low rate of Campania reduced significantly the overall value per capita with respect to the national rate and the Western Europe rate (350 m^2/inhabit.), which, however, was confirmed in the other three regions.

Using a min-max standardisation criterion, density curves on a municipal district basis have been developed for the four regions examined. The z_i sets of values represented by the municipal districts in the two chronological sections of the 1950s and post-2000 years have been arranged in decreasing order and then interpolated with a polynomial degree of 3 (Fig. 4).

$$z_i = \frac{x_i - \min(x)}{\max(x) - \min(x)}$$

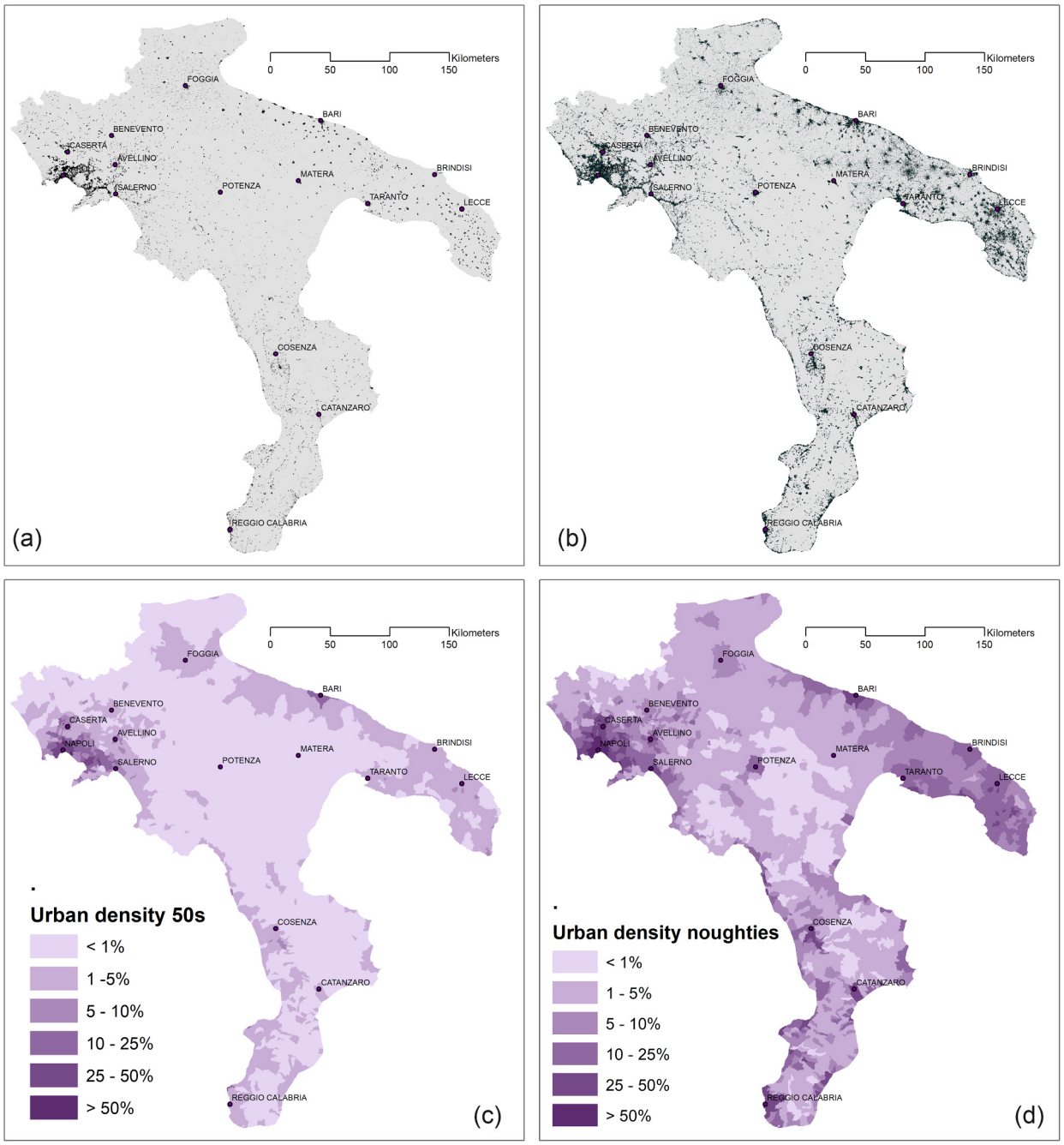


Fig. 3. Urbanised areas in the 1950s (a) and after the year 2000 (b). The urban density at the municipal district level in the 1950s (c) and post-2000 time period(d).

The curves show similar development scenarios for Puglia and Campania, but significant differences for Basilicata and Calabria. First of all, it is clear that all the regions have a distribution with a few municipal districts with high density and the large majority showing medium to low density. Between the first and the second time frames, however, Puglia and Campania experienced a significant increase in the number of more urbanised municipal districts (more than 40%), while the situation remained unchanged in Calabria with the urbanisation balance substantially identical in the two periods analysed. Basilicata, instead, presented a different scenario, where, after 2000, the curve shows a downward path to confirm greater evenness among the municipal districts towards the minimum values of the series, with a greater balancing of the urban density weights.

In the half a century examined, there was also a substantial regional demographic stability (Table 2) for Basilicata and Calabria, even if with a slightly negative trend, but with the majority of the municipal districts losing population, while Campania and Puglia

Table 2
Data on the demographic and urban dynamics of the study area compared to the national scale corresponding values.

Region	Regional area (kmq)	Resident inhabitants			Urbanized area (ha)				Urbanization density (%)		Urbanization per capita (m^2/inhabitant)		Land uptake speed (ha per day)
		50s	Noughties	Difference rate (%)	50s	Noughties	Difference	Increasing rate (%)	50s	Noughties	50s	Noughties	
Puglia	19533.85	3220238	4020707	0.25	22298.60	128190.03	105891.43	4.75	0.011	0.066	69.25	318.82	5.089
Campania	13670.59	4346264	5766810	0.33	33133.18	101163.93	68030.75	2.05	0.024	0.074	76.23	175.42	3.517
Basilicata	9986.27	627586	578036	-0.08	2165.96	17764.66	15598.7	7.20	0.002	0.018	34.51	307.33	0.800
Calabria	15221.61	2044287	1959050	-0.04	13044.77	79779.47	66734.7	5.12	0.009	0.052	63.81	407.24	3.400
Sum and mean	**58412.32**	**10238375**	**12324603**	**0.20**	**70642.51**	**326898.09**	**256255.58**	**4.63**	**0.012**	**0.056**	**68.998**	**265.240**	**12.81**
National data	*301918.79*	*48043356*	*58366934*	**0.21**	*551151.33*	*2044834.08*	*1493682.75*	*3.71*	*0.018*	*0.068*	*114.72*	*350.34*	*81.85*

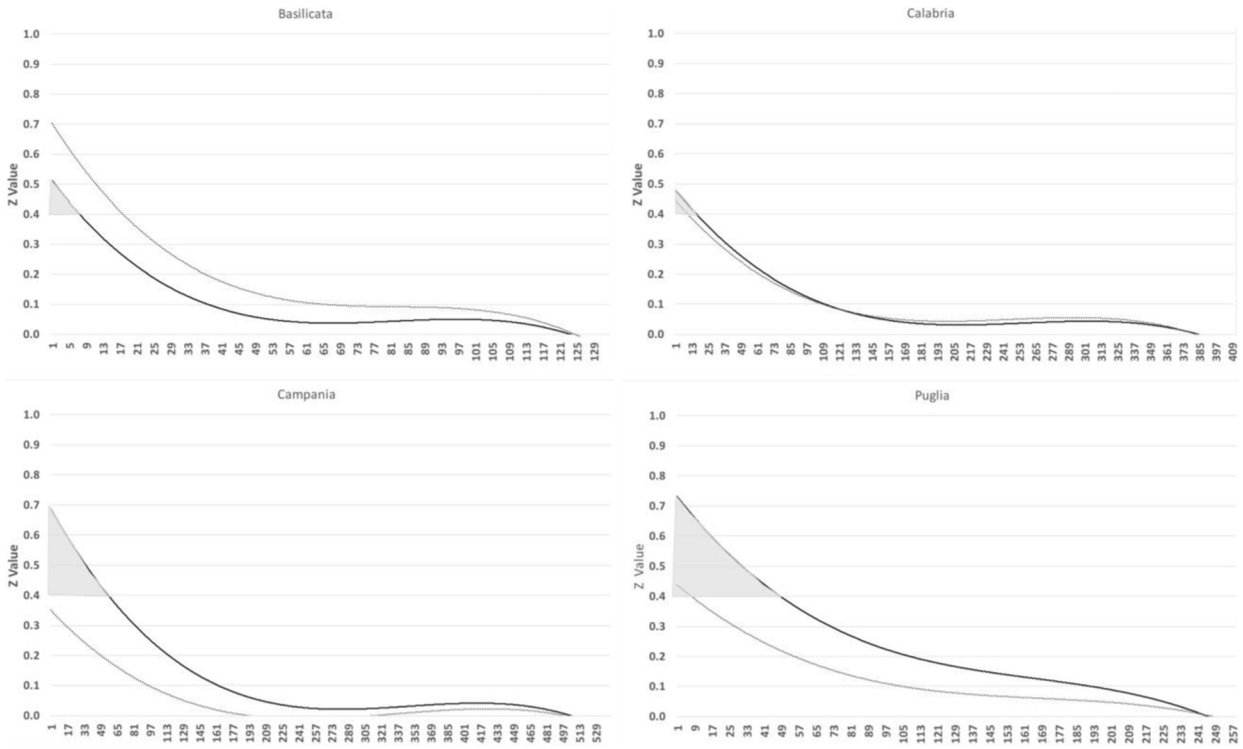


Fig. 4. Urban density variation curves on a municipal district basis with min-max standardisation (dotted line: the 1950s, solid line post-2000 period).

registered significant increase up to 33%. In the case of the first two regions, the analysis of the correlation carried out at a municipal district level between the variation rates of urbanisation and population in the 50 years considered (Fig. 5) showed a corresponding degree that went from high to significant (with R^2 respectively at 0.62 and 0.35), while the independence of the two phenomena appeared clear in the case of the two largest regions to confirm a fact already known in international demographic and urban

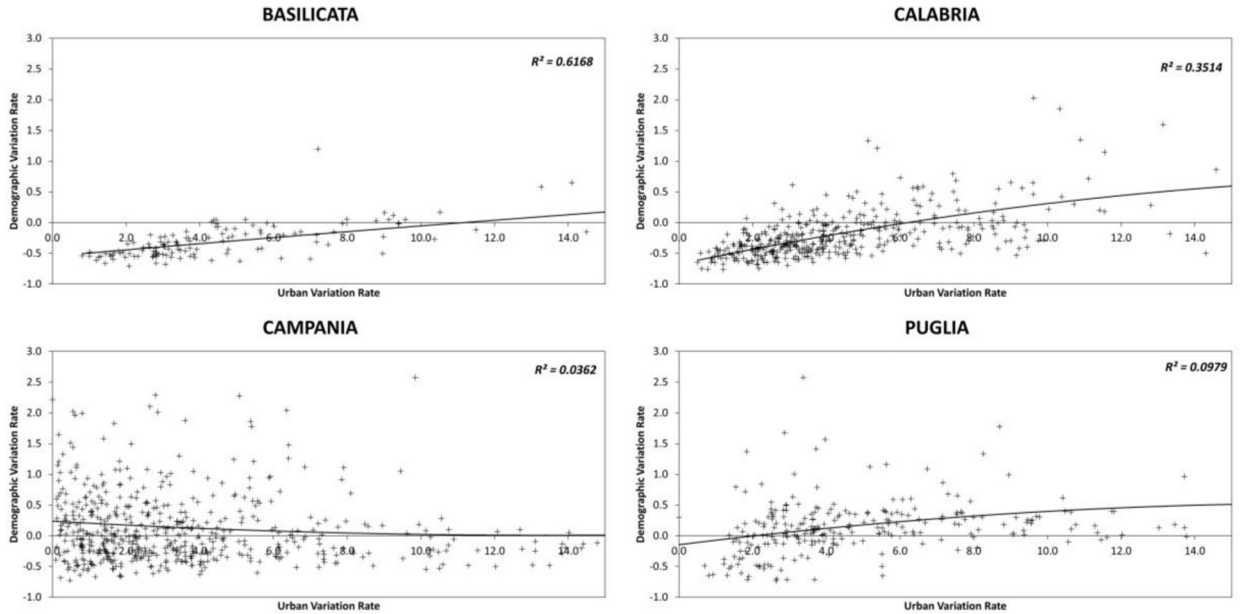


Fig. 5. The correlation between demographic dynamics and urban development. Comparative analysis between the % increase of the urbanised surfaces between the 1950s and the post-2000 years and the corresponding demographic variation index on a regional basis.

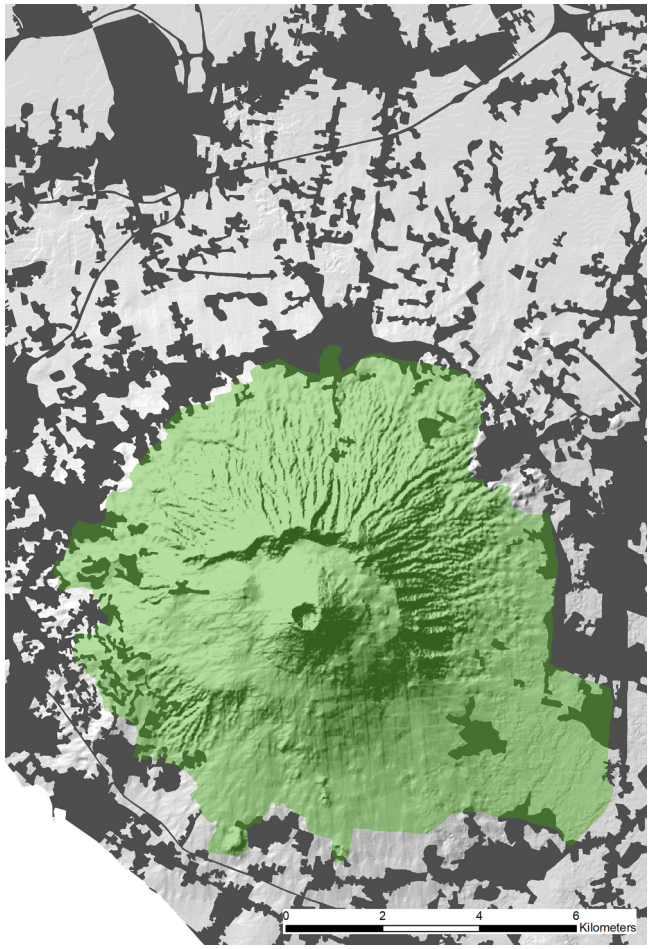


Fig. 6. The degree of urbanisation inside and adjacent to the Vesuvius National Park.

statistics and substantially verifiable in the territories with more marked industrial and service sectors. Basilicata and Calabria showed the highest urban development rates corresponding to the demographic variations that were negative or nil, even if exceeding 600%, with similar curve slopes. The most balanced phenomenon took place in Puglia, which was also the region with the lowest municipal district depopulation rate.

4.2. Effects on the landscape and on protected areas

The remarkable energy of the territory's transformation that emerges from the data suggests very significant impacts on the landscape structures and indeed reality proves this intuition.

First of all, it has been noted that in the protected natural areas themselves, this part of Italy underwent much more intense phenomena than the rest of the country: urbanisation in parks and protected areas have experienced a ten-fold increase in 50 years (from 3688 ha to 37,074 ha) and currently urban density is 4%, which is a much higher value than the national value of about 1%. National parks present an urbanisation of 1.4% and regional parks of 2%, with emblematic cases such as the Regional Park of Campi Flegrei with an urbanisation rate of 22% or the Vesuvius National Park of 8%: the latter is undoubtedly a world record (Fig. 6).

Further analysis of the landscape effects of urban sprawl, based on the Landscape Physiography Units already described in the "Data and methods" section and reported in Fig. 7, proved that:

- in the years after the Second World War, an urbanisation rate of more than 12% was present in the plains, hills and volcanic reliefs, and in particular in the area that includes Naples, with all the other physiographic categories well below 2%, except for 4% of the coastal plains;
- in the year 2000, these conditions were greatly modified: although the volcanic landscapes were still affected by urban transformations, up to a total of 23%, coastal plains alone reached almost 18%.

According to the ISPRA definition, the Coastal Plateau is composed of plain or sub-plain areas, delimited by a low and/or high

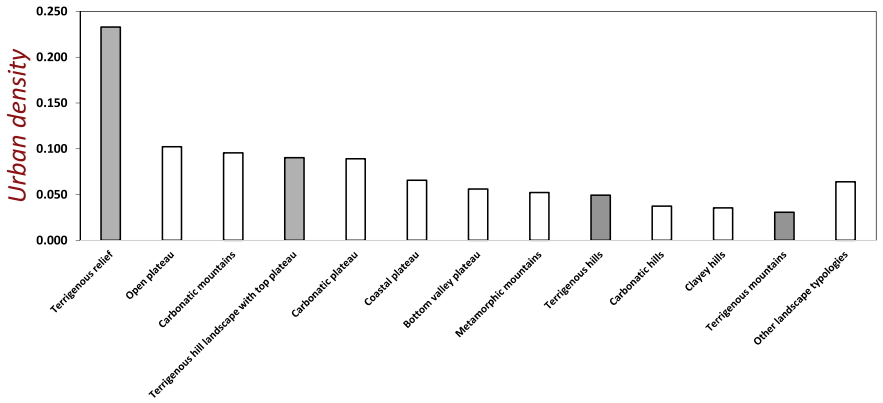


Fig. 7. The representative % of landscape types in the study area (terrigenous formations area are marked in grey), Source ISPRA (2004).

shoreline, typically elongated parallel to it with heights that do not exceed one hundred meters. The main types of stones are clay, silt, sand, sandstone, gravel, conglomerates, and their total surface in Italy is 1,164,000 ha. The loss of this landscape is therefore a serious phenomenon considering that its extension in Southern Italy is less than 7%, but it represents 40% of the "coastal plateau" of the whole Italian territory. Fig. 8 shows how already 14% of this type of landscape has been lost just as about 8% of the carbonatic and volcanic plains were lost quickly: 3.5 and 1.5 ha/day, respectively. Furthermore, for carbonatic plateau, comprising structures of extremely high landscape value, the risk is even higher. This involves flat and rocky areas, bounded by low slopes made up of limestone, dolomitic limestone and marl limestone that in Italy show an extension of less than 900,000 ha and is present almost exclusively in the study area, considering that it involves up to 80% of the national total.

The two types of landscapes highlighted are mostly situated in the narrow coastal strip that in this area plays a very attractive role for urbanisation, due to the long bathing season and excellent weather conditions. The coasts concerned are the Adriatic, Ionian and Tyrrhenian coasts and, considering a coastal buffer measuring a width of 500 m, overall urbanisation has grown by 500% over the last 50 years, increasing the urban density from 6% to the current percentage of 30%, thus demonstrating the important transformations that have occurred on the coasts. Today, the 500 m coastal strip of Southern Italy hosts more than 27,700 ha of urbanised land, with an average speed of transformation over 50 years estimated at 1.2 ha/day. The table in Fig. 10 shows the coastal situation in the different regions analysed: the lowest density is to be found in Basilicata, but the other three regions present values that are close to or even greater than one third of the total. The most serious phenomenon concerns Calabria, with almost 40% of the coastline consumed by the building activity at a rate of well over half a hectare per day for half a century.

The considerations expressed on the evolutionary dynamics of settlements and on the effects on landscape are summarised in the diagram of Fig. 10, in which the powerful transformation energy exerted on the Calabria's coastal strip emerges in all its magnitude. Although the phenomena are well noticeable even in Campania and Puglia, Calabria's evolution appears clearly more pronounced, especially in the 500 m of coastline with many municipal district sectors that exceed urbanisation rates by 70%. It is also true that even higher values can be found in Campania; however, this region, unlike Calabria, includes the metropolitan area of Naples,

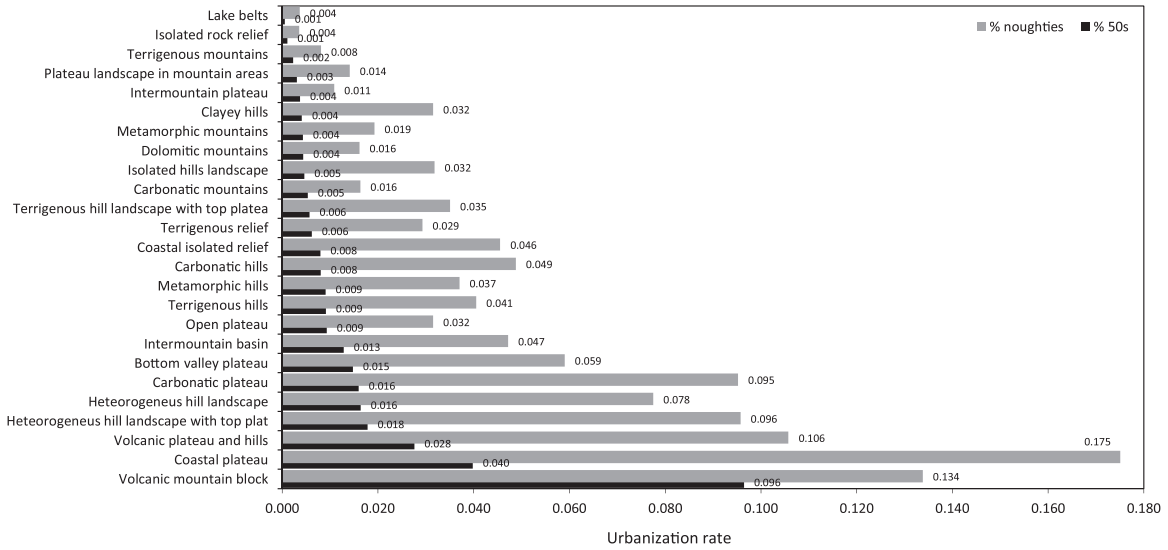


Fig. 8. Urbanisation rate dynamic in the physiographic units.

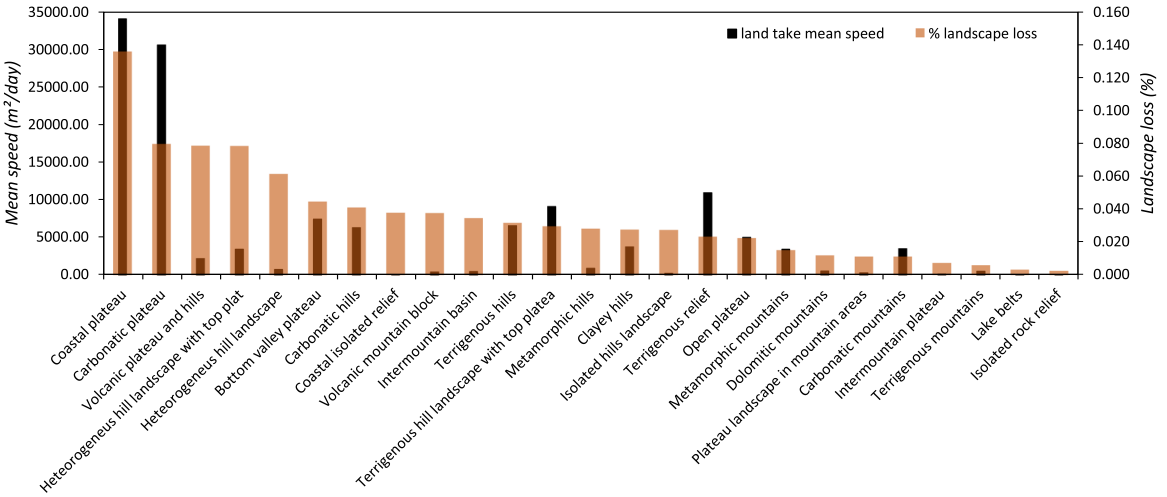


Fig. 9. Urban erosion rate in the natural landscape categories and average speed of land take between the 1950s and after the year 2000 (the data is referred to the sample of regions examined).

counting one million of inhabitants, which are half those residing across the entire Calabria region. Fig. 9 stresses the distribution of the two landscape categories at greater risk of degradation: on a total coastline length of approximately 2,000 km more than a half is occupied by coastal plains (52%), which are well distributed but mostly located in the Ionian area of Calabria, which is without any doubt the most threatened sector by the progression of urban development. Carbonatic plateau are definitely rarer, with 13% of them almost entirely situated on the Adriatic coast of Puglia, but also these are subjected to transformation pressures that once were, but still are, enormous.

Some of these Landscape Physiography Units are located only in Calabria ("Heterogeneous hill landscape with top plat" and "Plateau landscape in mountain areas") or in Southern Italy (Terrigenous relief). For this reason, these landscape units are more sensitive than others. About 16% (408 km^2) of urban transformations have affected these units with an average speed of transformations of 2.2 ha/day. The actual urban density for these categories is 3.1% while in the 1950s it was 0.6%, thus showing a variation of over 400%.

After considering the coastline overview, it is explanatory to note also how all the hilly areas, which were urbanised overall by 10% in the first years after WWI, have experienced density growth by over 40% since 2000. Such an aspect shows a tendency towards a massive settlement in these morphological categories, with significant risks of major agricultural landscape alterations as well as of significant deterioration of the ecosystems, since more than 25% of the Natura 2000 areas, part of the European environmental network (SCIs), are located in the hilly areas.

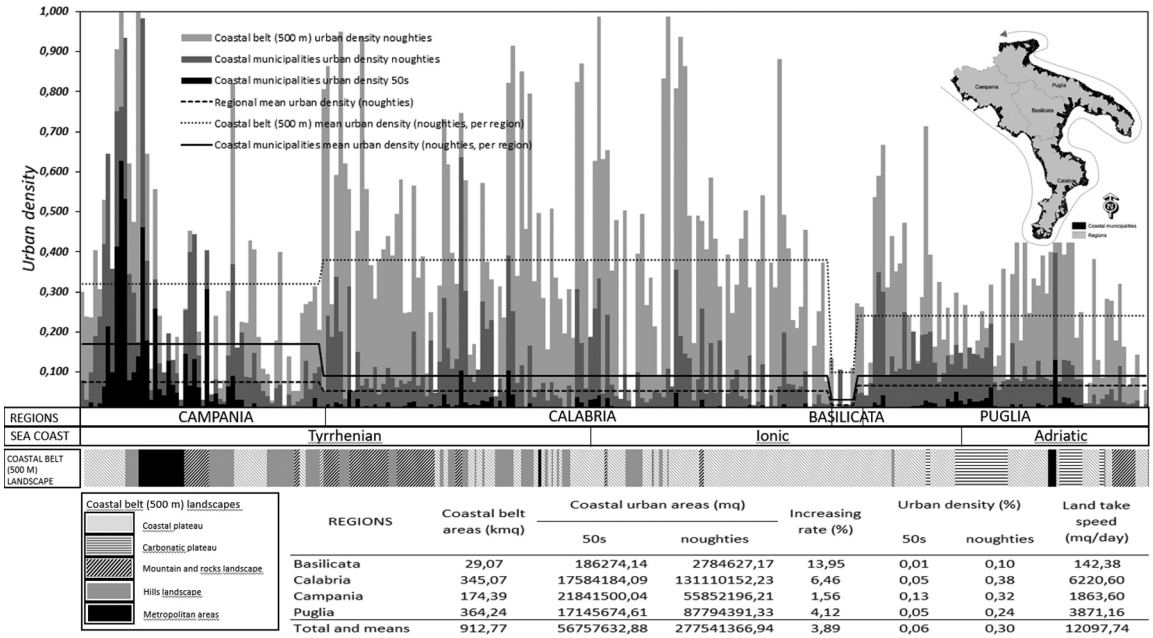
Summing up the average urbanisation speeds for all the hilly landscape categories over the time period taken into account shown by Fig. 9, the result is more than 7 ha per day, but it could represent even just the trigger signal of a more evolutionary development.

Considering the Copernicus data, already mentioned in the "Data and methods" section, over the entire period of the study, going from 2012 to 2015, the recorded increase in urban coverage is 1%, while the rate was 2‰ from November 2015 to May 2016, an increase corresponding to an average speed of transformation of approximately 6 ha/day.

Over the same time ranges, on the 500 m coastline the rates recorded were 3‰ between 2012 and 2015, and 28 ha more over the already mentioned six months between 2015 and 2016. Therefore, the latter value corresponds to an average urbanisation speed of approximately 1500 m^2/day. A comparison with the last column of the table shown in Fig. 10 explains how the magnitude is substantially similar to that of the previous 50 years for the Campania coast and slightly less than half for Puglia. At the regional level, it is 12% of the value recorded from 1950 to 2000, but this is not to underestimate given that today's situation in terms of economic push, social ambitions and theoretical control of the territory is still far from resembling that of the '60s'–'80s', when the majority of the coast transformations occurred. A speed rate of 1500 m^2 per day could plausibly turn into other 600 ha of coastal plateau (corresponding to 12 km of the 500 m coastline) lost in the next decade, since, as already seen, this landscape category is the most threatened by settlement pressures. The confirmation of a significant activity still in progress comes from the ISTAT data on constructions, which recorded more than 17,500 residential buildings on the coastline between 2001 and 2010, half of which in Calabria and 40% in Puglia.

5. Discussion

The research carried out in the Southern Italy regions highlighted several fundamental elements: firstly, a convergence of the per capita regional average urbanisation values of 208 m^2/inhabit., which represents a standard corresponding to about two thirds of the national one. However, Puglia, Basilicata and Calabria are rather aligned to the Italian value of 350 m^2/inhabitant, while only Campania, for the reasons mentioned earlier in this paper, presents a standard corresponding to one half. These values, spontaneously



REGIONS	Coastal belt areas (kmq)	Coastal urban areas (mq)		Increasing rate (%)	Urban density (%)		Land take speed (mq/day)
		50s	noughties		50s	noughties	
Basilicata	29,07	186274,14	2784627,17	13,95	0,01	0,10	142,38
Calabria	345,07	17584184,09	131110152,23	6,46	0,05	0,38	6220,60
Campania	174,39	21841500,04	55852196,21	1,56	0,13	0,32	1863,60
Puglia	364,24	17145674,61	87794391,33	4,12	0,05	0,24	3871,16
Total and means	912,77	56757632,88	277541366,94	3,89	0,06	0,30	12097,74

Fig. 10. The urbanisation data in the municipal districts and on the 500 m coastline in relation to the distribution of the coastal landscapes (the categories were grouped starting from the ISPRA data).

reached in half a century by the different regions, starting from very different bases, could reliably be considered as reference thresholds for future planning, which must not be exceeded to prevent the consumption of additional land for urban development.

Also in this area it was clear how the increase in urbanised areas had little or no connection to the demographic trend, whether this was positive or negative, and that, in other words, the development of urban areas has occurred over the last 50 years with a huge dispersion through poorly governed forms under rules that were difficult to interpret, systematically multiplying a city model "without urban planning". If this disconnection is quite normal in regions with well-developed industrial and service sectors, it is less obvious in the four investigated regions, whose disconnection was essentially caused by too many vacation houses, which are represented also by most of the aforementioned 17,500 buildings built in only ten years after 2001 within the 500 m coastal strip.

Possible and appropriate choices of limitation in the further urbanisation of the territory are also motivated by other research results, which highlighted a very consistent building load also in protected areas and especially in some relatively rare landscape types and that are highly represented here at a national level, such as the carbonatic plateau and the coastal plateau. The investigated regions have a huge responsibility towards the aforementioned geomorphological categories, since 40% and 80% of their entire national surface are, respectively, present in this southern part of the country, and both are under severe artificialisation pressure.

Most of these pressures have no rational and economically justified reasons. As mentioned above, Calabria is one of the Italian regions, together with Campania and Molise, with the highest rate of unauthorised buildings, estimated to be over 60%, and which is mostly located on the coastal strip. In spite of an abnormal increase in the number of buildings, with an average coastal urban density of almost 40% and the dynamics clearly visible in the diagram of Fig. 10, Calabria remains the Italian region with the lowest GDP per capita, compared to all the other regions (€16,600), despite the amount of buildings made available for the considerable summer tourist flow visiting its coasts every year. A situation like this almost certainly highlights the strong distortions in the economic system related to the tourism building industry, with economies that are not fully inclusive and a non-standardised management.

Moreover, the coasts are still seriously threatened by transformation pressures, given that the Copernicus data denounced an average land take of 1500 m^2 per day in six months between 2015 and 2016, a situation that would correspond to an additional 12 km of artificialised coastal strip over the next decade.

In this sense it should be recalled that Puglia, in particular, has a coast with a very high concentration of Natura 2000 sites, concerning both land and sea: the Salento alone has 56,000 ha covering 90% of the entire 250 km coastal strip.

6. Conclusions

The aim of this research was to evaluate the urban evolution in the four regions of Southern Italy (Campania, Basilicata, Puglia and Calabria). The study, which starts from the methodology already developed for the description of the national urban transformation [37], has gone to deepen the urban dynamics in relation to both naturalistic qualities and landscape aspects and socio-economic conditions typical of the considered areas. As already stated, this study is an extension of the basic data processed for the whole country through a research lasted from 2006 to 2015, concerning an extremely important and peculiar geographical focus for Italy. Such basic information, available for the whole country and retrievable from the bibliographic references further on in the text,

is standardised for all the regions but still adaptable to the specific features of each territory, as already occurred for the Alps, Po Valley, Central Italy and the national coastal areas.

In response to the questions posed in the Introduction, the results of the research have shown how, in the long span of half a century, the policies of control and management of southern Italian urbanisation have been very little organic, affected by a chronic lack of planning and projects.

In particular, the results highlighted in this study can be a reference for urban coordination tools so that they can contribute to stabilising the quantities of artificialised surfaces and reorganise the forms and functions of urban spaces, although without a more general effort to legalise the building industry activity, it will be very difficult to make progress in this direction (Martellozzo, Amato, Murgante, & Clarke, 2018). In fact, even if in Italy there are some plans on a supra-municipal scale, such as the Territorial Co-ordination Plans developed by the Provinces and some Regions, the strategic planning layer is substantially missing because the regulatory force (cogency) of these tools has always been very insufficient. Hence, it emerges an extreme complexity in dealing concretely with the topic of land take and the necessity to reform in depth the procedures and tools of planning and the territorial planning itself.

The present scenario, outlined by the latest data available, highlights the unsustainability of current settlements with respect to problems related to energy, services, transport, climate, ecological systems and the quality of social life. Therefore, it is necessary to increase the awareness and response both at a political-regulatory and management level and at a technical-scientific level. From this point of view, it is important to underline that over the last few years, some of the regions taken into account, such as Campania and Puglia, have adopted regulations in order to protect the soil as a common good and non-renewable resource, essential to the defence of both the ecosystem and landscape features. Such regulatory tools, although important, are imperfect, since they consider as soil erosion only that related to the reduction in agricultural land, while neglecting other issues, such as for example the loss of natural areas due to the same cause.

In any case, we cannot neglect an innovative action of urban planning in the inversion of an expanding model, using the background that has been developed for a long time on the international sprawl (Tachieva, 2010).

The desired land-use government policies should first and foremost be focused on the systematic implementation of measures for the recovery and functional reconversion of disused urbanisations, but, in order to do so, it is necessary to have monitoring and technical-administrative communication tools based on real data of land transformation among the different local authorities.

Such tools currently do not exist and this happens not only in Southern Italy, but throughout the whole country; thus, each municipality proceeds in total autonomy in terms of the size and allocation of urbanised areas of all kinds. Such a disconnected system of urban planning makes it almost impossible to control the transformations at least on a regional scale and, therefore, an indispensable first step towards regulation requires the establishment of regional observatories and land registers through which it is possible to monitor (Salvati, Munafò, Gargiulio Morelli, & Sabbi, 2012), with advanced GIS techniques, the development of the phenomenon at different levels and scales. Bearing this purpose in mind, it would be appropriate to create at least a regional database where to convey the plan forecasts once approved, with the aim of monitoring both the quantity and the different types (residential, production, services) of urban surface they provide for. Thus, the availability of the tiling of municipal tools would be of paramount importance in order to adopt effective government and control measures for soil consumption.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jum.2018.09.003.

References

Albanese, S., Iavazzo, P., Adamo, P., Lima, A., & De Vivo, B. (2013). Assessment of the environmental conditions of the Sarno river basin (south Italy): A stream sediment approach. *Environmental Geochemistry and Health, 35*, 283–297. https://doi.org/10.1007/s10653-012-9483-x.

Astengo, G., & Nucci, C. (1990). It.Urb.80, Rapporto sullo stato dell'Urbanizzazione in Italia. *Quaderni di urbanistica informazioni* (pp. *8*). Roma: INU.

Barrington-Leigh, C., & Millard-Ballb, A. (2015). A century of sprawl in the United States. *PNAS, 112*(27), 8244–8249. https://doi.org/10.1073/pnas.1504033112.

Bonifazi, C., & Heins F. (2001). Dynamics of urbanisation in Italy. In *Proceedings of XXIV general population conference* (pp. 1–26). Salvador, Brazil: IUSSP. 18–24 August.

Cardoza, A. L. (1994). The large landed aristocracy of piedmont, retreat and adaption 1880–1930. In P. P. D'Attorre, & A. De Bernardi (Eds.). *Studi Sull'agricoltura Italiana* (pp. 65–88). Milano: Feltrinelli.

Chen, D., Wang, Y., Ren, F., & Du, Q. (2016). Spatio-temporal differentiation of urban-rural equalized development at the county level in Chengdu. *Sustainability, 8*(5), 422. https://doi.org/10.3390/su8050422.

CRESME (2018). Focus Cresme - Il mercato della casa in Italia: tra domanda e offerta. 〈http://www.edilbox.it/e-shop/19/i-focus-del-cresme.aspx〉 (Accessed on 26 April 2018).

Cubellis, E., Carlino, S., Iannuzzi, R., Luongo, G., & Obrizzo, F. (2004). Management of historical seismic data using GIS: The Island of Ischia (Southern Italy). *Natural Hazards, 33*, 379–393. https://doi.org/10.1023/B:NHAZ.0000048465.40413.17.

De Biase, C., & Losco, S. (2017). Up-granding illegal building settlements: An urban-planning methodology. *Procedia Environmental Sciences, 37*, 454–465. https://doi.

org/10.1016/j.proenv.2017.03.016.
Ding, C., & Zhao, X. (2011). Assessment of urban spatial-growth patterns in China during rapid urbanization. *Chinese Economy, 44*(1), 46–71. https://doi.org/10.2753/CES1097-1475440104.
Efe, R., & Öztürk, M. (2014). *Tourism, environment and ecology in the Mediterranean region.* USA: Cambridge Scholars Publishing.
European Commission (2006). Urban sprawl in Europe: The ignored challenge. *EEA Rep. 10*.
EUROSTAT (2018). 〈http://ec.europa.eu/eurostat/documents/2995521/7962764/1-30032017-AP-EN.pdf/4e9c09e5-c743-41a5-afc8-eb4aa89913f6〉 (Accessed on 26 April 2018).
Fiorini, L., Zullo, F., & Romano, B. (2017). Urban development of the coastal system of the italian largest island: Sicily and Sardinia. *OCMA, 143*, 184–194. https://doi.org/10.1016/j.ocecoaman.2016.12.008.
Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Chapin, F. S., Coe, M. T., Daily, G. C., Gibbs, H. K., Helkowski, J. H., Holloway, T., Howard, E. A., Kucharik, C. J., Monfreda, C., Patz, J. A., Prentice, I. C., Ramankutty, N., & Snyder, P. K. (2005). Global consequences of land use. *Science, 309*, 570–574. https://doi.org/10.1126/science.1111772.
Gariano, S. L., Rianna, G., Petrucci, O., & Guzzetti, F. (2017). Assessing future changes in the occurrence of rainfall-induced landslides at a regional scale. *Science of the Total Environment, 596–597*, 417–426. https://doi.org/10.1016/j.scitotenv.2017.03.103.
Gibelli, M. C., & Salzano, E. (Eds.). (2006). *No sprawl*. Firenze: Alinea.
Indovina, F. (Ed.). (2009). *Dalla città diffusa all'arcipelago metropolitano*. Milano: Angeli.
ISPRA (2004). Carta dei tipi e delle unità fisiografiche d'Italia scala 1:250.000. 〈http://www.isprambiente.gov.it/it/servizi-per-lambiente/sistema-carta-della-natura/carta-della-natura-alla-scala-1-250.000/i-tipi-e-le-unita-fisiografiche-di-paesaggio〉 (Accessed on 26 April 2018).
ISPRA (2018). 〈http://land.copernicus.eu〉 (Accessed on 26 April 2018).
ISTAT (2018). Rapporto Bes 2015: Il benessere equo e sostenibile in Italia. 〈https://www.istat.it/it/archivio/175169〉 (Accessed on 26 April 2018).
Jaeger, J. A. G., Bertiller, R., Schwick, C., & Kienast, F. (2010). Suitability criteria for measures of urban sprawl. *Ecological Indicators, 10*(2), 397–406. https://doi.org/10.1016/j.ecolind.2009.07.007.
Jenni, S., Goes, S., Giardini, D., & Kahle, G. (2006). Seismic potential of Southern Italy. *Tectonophysics, 415*, 81–101. https://doi.org/10.1016/j.tecto.2005.12.003.
Jiang, L., & Zhang, Y. (2016). Modeling urban expansion and agricultural land conversion in Henan Province, China: An integration of land use and socioeconomic data. *Sustainability, 8*(9), 920. https://doi.org/10.3390/su8090920.
Li, D., Wang, D., Li, H., Zhang, S., Zhang, X., & Tao, Y. (2016). The effects of Urban Sprawl on the spatial evolution of rural settlements: A case study in Changchun, China. *Sustainability, 8*(8), 736. https://doi.org/10.3390/su8080736.
Martellozzo, F., Amato, F., Murgante, B., & Clarke, K. (2018). Modelling the impact of urban growth on agriculture and natural land in Italy to 2030. *Applied Geography, 91*, 156–167. https://doi.org/10.1016/j.apgeog.2017.12.004.
Marzaioli, R., D'Ascoli, R., De Pascale, R. A., & Rutigliano, F. A. (2010). Soil quality in a Mediterranean area of Southern Italy as related to different land use types. *Applied Soil Ecology, 44*, 205–212. https://doi.org/10.1016/j.apsoil.2009.12.007.
Munafò, M., Salvati, L., & Zitti, M. (2013). Estimating soil sealing rate at national level—Italy as a case study. *Ecological Indicators, 26*, 137–140. https://doi.org/10.1016/j.ecolind.2012.11.001.
Nappi, R., Gaudiosi, G., Alessio, G., De Lucia, M., & Porfido, S. (2017). The environmental effects of the 1743 Salento earthquake (Apulia, southern Italy): A contribution to seismic hazard assessment of the Salento Peninsula. *Natural Hazards, 86*, 295–324. https://doi.org/10.1007/s11069-016-2548-x.
Pileri, P., & Maggi, M. (2010). Sustainable planning? First results in land uptakes in rural, natural and protected areas: The Lombardia case study (Italy). *Journal of Land Use Science, 5*(2), 105–122.
Pinotti, P. (2015). The economic costs of organised crime: Evidence from Southern Italy. *The Economic Journal, 125*, F203–F232. https://doi.org/10.1111/ecoj.12235.
Ramankutty, N., & Coomes, O. T. (2016). Land-use regime shifts: An analytical framework and agenda for future land-use research. *Ecology and Society,* 21. https://doi.org/10.5751/ES-08370-210201.
Reid, Jr, & Joseph, D. (1975). Sharecropping in history and theory. *Agricultural History, 49*, 426–440.
Romano, B., & Zullo, F. (2013). Models of urban land use in Europe: Assessment tools and criticalities. *IJAEIS, 4*, 80–97. https://doi.org/10.4018/ijaeis.2013070105.
Romano, B., & Zullo, F. (2014a). Land urbanization in Central Italy: 50 years of evolution. *Journal of Land Use Science, 9*, 143–164. https://doi.org/10.1080/1747423X.2012.754963.
Romano, B., & Zullo, F. (2014b). The urban transformation of Italy's Adriatic coastal strip: Fifty years of unsustainability. *Land Use Policy, 38*, 26–36. https://doi.org/10.1016/j.landusepol.2013.10.001.
Romano, B., & Zullo, F. (2015). Half a century of urbanization in southern European lowlands: A study on the Po Valley (Northern Italy). *Urban Research Practice, 9*(2), 109–130. https://doi.org/10.1080/17535069.2015.1077885.
Romano, B., Zullo, F., Fiorini, L., Ciabò, S., & Marucci, A. (2017a). Sprinkling: An approach to describe urbanization dynamics in Italy. *Sustainability, 9*. https://doi.org/10.3390/su9010097.
Romano, B., Zullo, F., Fiorini, L., Marucci, A., & Ciabò, S. (2017b). Land transformation of Italy due to half a century of urbanisation. *Land Use Policy, 67*, 387–400. https://doi.org/10.1016/j.landusepol.2017.06.006.
Salvati, L., Munafò, M., Gargiulio Morelli, V., & Sabbi, A. (2012). Low-density settlements and land use changes in a Mediterranean urban region. *Landscape and Urban Planning, 105*(1–2), 43–52.
Salzano E. (1992). *La città sostenibile*. Milano, Ed. delle Autonomie.
Sargolini, M. (2010). Adriatic urban sprawl and environmental continuity. In S. Lardon, (Ed.). *Agricultural management in peri-urban areas* (pp. 86–93). Pisa: Felici Ed.
Shaban, R. A. (1987). Testing between competing models of sharecropping. *Journal of Political Economy, 95*, 893–920. https://doi.org/10.1086/261495.
Tachieva, G. (2010). *Sprawl repair manual.* U.S.A: Island Press.
The Worldwatch Institute (2007). *State of the world, our urban future.* New York: Norton.
Zanfi, F. (2013). The Città Abusiva in contemporary Southern Italy: Illegal building and prospects for change. *Urban Studies, 50*, 3428–3445. https://doi.org/10.1177/0042098013484542.