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EATEN ITALY
PATTERNS AND TRENDS OF LAND TAKE

Introduction.- The issue of land take (or land consumption) is assuming a pivotal role in the wider international debate on urban sprawl, a settlement model of urban expansion characterized by low density of building, high fragmentation and dispersion of urban areas, and high requirements of land take.

According to conservative estimates (*Corine Land Cover* data), about 1.000 km², an area as large as Berlin, are annually subject to land take for housing, infrastructures, industry or recreational purpose (EC, 2012). Such a change of land use involves an almost irreversible loss of soil and its eco-systemic functions, with heavy impacts not only on the environment but also on the socio-economic development.

In this paper we discuss the concept of «land take» and its interpretations, focusing on the Italian experience. In particular, by using several sources of information that directly or indirectly deal with land use/land cover, we analyze the specific structure that this phenomenon has taken at national level, in order to highlight its characteristics, its spatial patterns and its evolutionary trends.

Interpreting the notion of land take.- As a first approximation, we can refer to «land take» as the process of transformation of agricultural and natural surfaces into

settlement areas (or artificial surfaces), through the construction of buildings (for housing, industry and other business locations) and infrastructures necessary to satisfy human needs. This change in land-use involves the loss, almost an irreversible one, of the upper layer of topsoil which, under natural conditions, «provides a very wide range of vital ecosystem functions» (EC, 2012, p.15): production functions (of food, forage, timber and biomass), protection functions (offering habitats for biodiversity, storing water and removing contaminants), regulation functions (in the global carbon cycle, in the water cycle and in the mitigation of «urban heat island effect»), environmental services (such as the recycling of urban wastes and products) and aesthetic functions through the landscape. This loss of eco-system services¹ is apparently compensated by the introduction of economic, social and cultural functions in response to development needs of a growing population.

In this respect, the notion of land take (or land consumption) hinges on the concept of territorialization, central in geographical studies (Turco, 1988; Raffestin, 1984, 2005). This is defined as the process of transformation of the environment through historically stratified cycles of civilization. As argued by Magnaghi (2000), the territory is just the historical outcome of this process, it does not already exist in nature per se. Hence it should be considered as a social construction, i.e. as the product of complex and dynamic co-evolutionary relationships between human beings and the environment². Territorialization is

¹ According to the Millenium Ecosystem Assessment (MEA, 2005, p.1-2) ecosystem services include «provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational and other nonmaterial benefits».

² Following this approach, agricultural landscapes are also the product of processes of territorialization and thus interpretable as anthropized soils, whose consumption (defined as loss of eco-system services) is related to the methods of agricultural production. It is obvious, for

therefore a large complex process, whereby land loses its natural character and it incorporates anthropological and social value (Turco, 1988).

In this perspective land take is the essence of the historical process of building the places through human activities: it could be interpreted, at first glance, as the inevitable price to pay in the name of progress, if not- in a paradox- as an indicator of development³.

However, the dynamics of land use over the last decades have led to a rethinking of the relationship (direct link) between settlement areas (for residential, productive or infrastructure purposes) and well-being.

In Italy, as well as in the majority of European countries, land take for urbanization purposes has grown at more than twice the rate of population growth, completely disconnected from housing and productive needs. This decoupling explains the negative value attributed to the term «land consumption» or «land take», value that denotes the emergence of a critical awareness⁴ in front of a model of socio-economic development that uses the soil-landscape resource in an inefficient and unsustainable way.

example, that an extensive farmland with land rotation will exhibit a lower eco-systemic impact than intensive cultivation based on the use of fertilizers that modify the biochemical structure of the soil or heavy machinery that compacts it.

³ In this regard Bonora (2013, p. 10) speaks of «reverse determinism» (*determinismo a rovescio*), since, in many of the contributions, the transformative capacity has become an indicator of the degree of progress of human societies.

⁴ The rise, in our country, of a change in the perception of this issue is confirmed by the spread of organizations and citizens' committees in defense of the territory (for example, «Stop al consumo di suolo»), as well as in studies and initiatives promoted by large organizations traditionally engaged in environmental issues such as Legambiente (2010), FAI (2012), WWF (2009; 2013). In this regard, it is useful to point out two interesting civic initiatives that have not only encouraged an increase in the level of public awareness, but also contributed to a first partial accounting of brownfields. The first initiative, carried out in 2012 by the Forum of the movements for the land and the landscape «Salviamo il paesaggio», (Save the Landscape), supported a campaign of the same name to push all the Italian Municipalities for the collection and disclosure of the number of brownfields and abandoned or vacant buildings. The second

On theoretical grounds, the adoption of a «territorialist» or place based approach (Magnaghi, 2000; 2001; Dematteis, 2001) requires a deep revision or even a reversal of the concept of land take, no longer interpretable as a measure of well-being and progress of society. In this different perspective land take emerges instead as the dramatic manifestation of the divorce between nature and culture induced by the process of de-territorialization that affects post-industrial urban societies⁵.

As noted by Magnaghi (2001, p. 20):

«the contemporary de-territorialization does not conceive, within the model of development that inspires the process as well as the settlement pattern that materializes it, a re-territorialization. It rather involves an ongoing process of de-territorialisation; the problems of unsustainability progressively caused by the destruction of natural ecosystems and land induced by the process of de-territorialization, are systematically dealt with by further increasing artificial areas, technological prosthesis, genetic manipulation, etc...» (our translation).

The results of this development model, which we may define as «market oriented» and «technology driven» are visible to everyone; cities dilated by sprawl⁶, disorderly and disqualified suburbia, without social identity, lacking of

initiative regards the campaign «Riutilizziamo l'Italia» (Let's reuse Italy) promoted by the WWF (2013), inviting citizens and associations to indicate the presence of sites or abandoned buildings, susceptible to transformation, also proposing social and environmental reuse. For a deepening on the paths of local resistance in defense of the territory see Vallerani, 2013.

⁵ According to Raffestin (1984, p. 78), the process of de-territorialisation in history is the abandonment of the territory that occurs in a time of crisis. Generally it follows a phase of re-territorialization, that closes a cycle TDR (territorialisation, de-territorialisation, re-territorialization), in a continuous transformative dynamic. According to Magnaghi (2001) a specific feature of the current phase of de-territorialization is its time span and long duration.

⁶ According to the European Environmental Agency (EEA, 2006a, p. 6) «urban sprawl is the physical pattern of low density expansion of urban areas under market conditions, mainly within the surrounding agricultural areas [...] . Sprawling cities are the opposite of compact

services, places of socialization and public infrastructure, but packed with empty buildings and brownfields.

As remarked by an extensive literature (EEA, 2006a; Burchell, 1998; Ewing, 1994; Camagni, Gibelli and Rigamonti, 2002; Burchfield et al. 2006; Gibelli and Salzano, 2006), this massive urban footprint leads to impoverishment of the environment and landscape. It generates increasing diseconomies, resulting in higher energy consumption, higher pollution (due to the massive use of private vehicles and the enlargement of the basins of mobility⁷), inefficiency in transport infrastructure, loss of food production capacity and blocking ecosystem services. These features, in the medium to long term, are likely to turn into new costs related to environmental emergencies, growth of social malaise and marginalization that affects the big anonymous blocks in peri-urban areas, as well as the old town centers degraded and deprived of many functions (or affected by intense processes of gentrification).

To reverse this route a move towards a territorialist or place based development model is required. Recognition of land as a «common good» (Settis, 2012, Di Simine and Ronchi, 2012) is to be acknowledged. This means that the “real” value of soil is reflected only with distortions in the private usage value and the market price of what is built over it. It should be measured in terms of the natural exchange, and it should be considered a relationship resource (Pileri, 2011, p. 21) and, therefore, as a fundamental component of

cities, they are full of empty spaces that indicate the inefficiency in development and highlight the important consequences of uncontrolled growth».

⁷ Newman and Kenworthy (1989), comparing data on 33 cities, showed that an increasing sprawl (lower population density) spurs a rise in demand for private mobility (fuel consumption per capita). For example, sprawled cities like Houston, Los Angeles or Washington make record fuel consumption, significantly higher compared to cities like Hong Kong or Tokyo, where the compactness of urban areas favors the use of public transport.

the landscape, the ecosystem, the well-being, the quality of life, etc. The consideration of the soil as a common good implies the need to use this limited and not renewable resource wisely and sustainably, considering the effects that each hectare of land take produces not only on the environment, but also in social and economic terms⁸.

Classifying land take- The growing attention to the issue of soil sealing, also prompted by the European Commission (EC, 2006, 2011, 2012), has created a strong demand for information on land use. A request which cannot be fully satisfied, due to the adoption of different monitoring methodologies that produce dissimilar measurements of land take, not easily comparable.

A first critical issue is the lack of a univocal and shared definition of the term «land consumption». This is not merely a matter of terminology because, in establishing what is to be meant and what it exactly should be classified as land take, it affects the recognition, the analysis and the measurement of the phenomenon. Consequently, it affects planning and control strategies and actions put into place to manage it.

In general, each portion of land withdrawn from the previous agricultural or natural use is defined as consumption. Nevertheless according to the final use destination, the impacts can be very different and should be measured with different approaches. For example, it is undeniable that the permanent cover of land area with impermeable artificial material, such as concrete or asphalt,

⁸ Interesting in this regard are the results of a research on the costs of urban sprawl in the United States conducted by Richard Burchell (1998), based on the comparison between and sprawled non sprawled counties. This Author estimates that a «controlled growth» (i.e. compact urbanization) could save, for the same amount of built up areas, 25% of land, 11.8% of road infrastructure , 7% of the cost of local services and 6% of the cost of real estate development.

involves the irreversible loss of the ecological functions of the soil. More controversial is, instead, the impact and therefore the classification of land areas that are affected by transformations that do not alter irremediably the soil structure, such as parks and green spaces usually located in settlement areas, sites for the production of renewable energy, or open spaces in peri-urban enclosed within infrastructure networks. These forms of soil consumption, although not directly involving soil sealing, contribute, to a more or less variable extent, to alter the landscape and they affect the environmental value of the soil hosting them.

Within the classifications proposed and adopted by the European Union (Prokop et al, 2011; EC, 2012) it is customary to distinguish between sealed soil and settlement area. Sealed soil is defined as the permanent covering of an area with asphalt, concrete or other impervious materials. Whereas portions of territory altered but not sealed and used for housing, industrial, commercial, social, and recreation purposes are classified as settlement areas or artificial areas. The latter broader category includes, therefore, both sealed areas and non-sealed areas, altered in a more or less invasive manner by human activities, i.e., quarries, mines, landfills, but also sports fields, greenhouses, gardens, urban parks, etc. As remarked in the Report on *The State of Soil in Europe* sealed soil is a sub-category of artificial soil and it is deemed as «the most intensive form of land take» (EEA and JRC, 2012, p.19).

A simplified scheme to classify the possible transformations of land cover is proposed and described by the European Environment Agency (EEA, 2006b, p. 49) through the image of the triangle of the transitions (Fig. 1). This is

reported below as proposed in a revision by *Osservatorio Nazionale sui Consumi del Suolo* (ONCS, 2009)⁹.

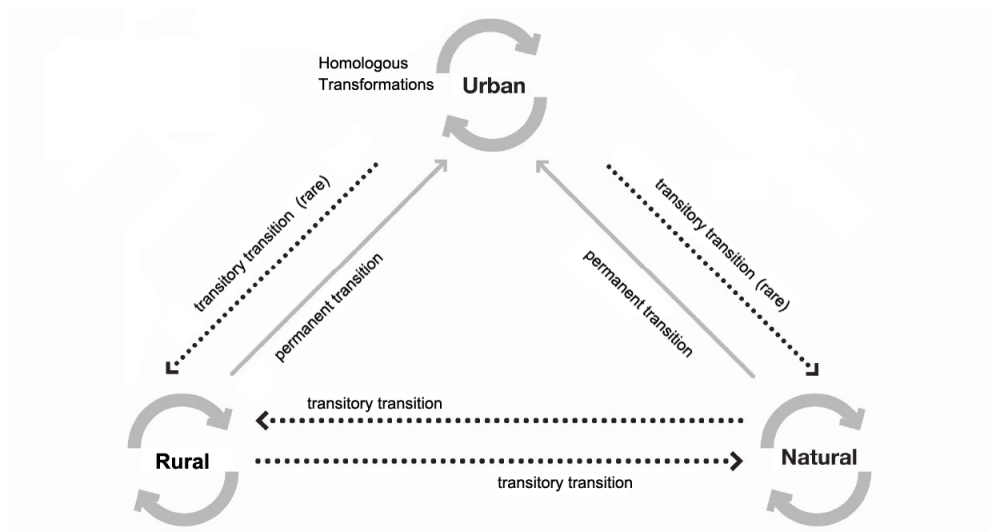


Fig. 1 - *The triangle of transitions*

Source: Osservatorio Nazionale sui Consumi del Suolo, (ONCS), 2009 (our translation)

At the vertices of the triangle lie the three main categories of land cover (natural, agricultural, urban), whereas arrows describe the «transitions», i.e. the possible changes in coverage destination by type (homologous, not homologous), duration (temporary, permanent) and outcome (agricultural,

⁹ The Observatory, after transformed in the Research Centre on Consumption of soil (CRCS), was founded in 2009 by Legambiente, INU and the Department of Architecture and Urban Studies at the Politecnico of Milano, has many merits. First of all it has cast lights on such an important issue, stimulating certainly the legislative initiative on the part of the national government. More importantly it has been committed in identifying criteria, tools and methods for the measurement (quantitative and qualitative) of land take, recognizing the importance of improving data quality on land use in order to improve regulatory approaches.

urban, natural). Human transformations of the soil induce different characters, measured on the basis of the three variables considered, and can therefore be classified accordingly. For example, the transition from an agricultural coverage to an urban coverage is classified, according to this scheme, as a non-homologous transformation (i.e. a transformation that does not occur within the same category), permanent and artificial. The passage from a natural coverage to agricultural coverage will be classified as temporary, non-homologous and semi-natural transformation. As noted by Pileri (2009), only in the first case one should talk about soil consumption, both in terms of the duration of the transformation (permanent) and in terms of the resulting impact (net loss of ecosystem functions).

The triangle represents a useful although simplified scheme to describe the complex (Markov) chain of transitions in the use of soil. It needs to be complemented by quantitative and qualitative «measures» of such transitions in order to characterize the process of transformation of the soil and to inform policy response and government's regulations for the management of the territory and the environment.

Analysing the land take. –Table (tab. 1) shows the estimates of the land take in Italy, as elaborated by European and national environmental agencies and other bodies dealing with data provision about land cover and land use¹⁰. A

¹⁰ Land use and land cover provide different territorial information. Land cover refers to what is physically present on the land surface, such as forests, crops, water bodies, bare rock, etc. (bio-physical evidence). Land use refers to the purpose for which the resources are used (socio-economic functions). It is important to keep in mind that a single type of coverage can have different destinations of use, whereas a given destination of use may be the outcome of different coverages. It's clear, therefore, that coverage data can be properly captured by aerial or satellite images, while land use information only partially emerge from such sources.

remarkably large variability of estimates emerges, ranging from 4.3% to 8,8%. This rather significant discrepancy depends mainly on the use of different measurement methodologies in terms of detection techniques, size of minimum mapping unit (MMU), temporal and geographic coverage, nomenclature or classification systems (Munafò, 2013; ISPRA, 2014; Iovino, 2014).

Tab 1 -Estimates of land take in Italy

Database	% land take	year
CORINE Land Cover (EEA-ISPRA):	4,9%	2006
Copernicus HRL Imperviousness (EEA-ISPRA)	4,3%	2009
LUCAS (Eurostat)	7,8%	2012
Rete di monitoraggio (ISPRA-ARPA-APPA)	7,3%	2012
IUTI (MAT*TM):	7,1%	2008
POPOLUS (MiPAAF)	8,8%	2009
Basi territoriali (ISTAT)	6,7%	2011

Source: Author's elaboration

According to Corine Land Cover data¹¹, Italy exhibits 14.740 km² of settlement area, equal to 4.9% of the national surface (2006 data), ranking slightly above

¹¹ *Corine Land Cover* (CLC) is one of the four projects in which the program CORINE (COoRdination of Information on the Environment) is organized. CORINE was started by the European Council in 1985 to monitor the state of the environment in European countries. The *Corine Land Cover* project, managed by the EEA, is an survey map of land cover based on the photointerpretation and digitalization of satellite images and presented as a cartographic product at a scale of 1:100 000, with a classification system organized in three hierarchical levels at increasing detail.

the European average (4.4%). Higher than average is also the percentage of sealed territory (2.8 compared to 2.3%). In about sixteen years 130.000 hectares of land have been consumed: 80.000 between 1990 and 2000 and 50.000 in 2000-2006, with an increase of 9%.

Wide underestimation of the phenomenon is, however, built in such data¹². The main reason is that the CLC protocol suffers from a high degree of approximation due to the excessive size of the minimum mapping unit (25 ha for *CLC* and 5 ha for *CLC Change*): a straightforward argument suggests that such a criterion does not allow to capture all the scattered settlement areas that, in recent decades, represented the main patterns of urbanization in our country. In other words this criterion is less effective to monitor exactly the most problematic form taken by the recent urbanization process in Italy and in other developed countries. As argued by Bonora (2013, p.17), urban sprawl is «the main suspect in the process of cannibalization of the rural and natural areas, scattering portions of artificiality in the territory that are very small and therefore difficult to measure, but profuse enough to alter the equilibrium» (our translation). Despite these problems, CLC data allow us to measure the spatial patterns of the phenomenon and its changes over time (since 1990) and they can be effectively used for the comparative analysis of extended territorial areas, i.e. at continental and European scale.

¹² Underestimation induced by CLC data has been widely proved by studies and databases developed at a local scale. Emblematic is the case of Lombardia where, according to CLC, in the period 2000-2006 the detected land take was 6.300 ha, while the Regional Database (DUSAF) has estimated the increase of artificial surfaces between 1999 and 2007 in 34.000 ha, which means more than 4.200 ha per year (CRCS, 2012).

More detailed information is provided by the High Resolution Layer Imperviousness within the *Copernicus* Program¹³, even if data collected within this program only concern the built up areas (i.e. the areas covered by artificial material of long duration) and do not provide any information about their use. Data on Italy indicate that soil sealing in 2009 pertains to 4.3% of the national territory, a figure which differs significantly from the figure, 2.8%, indicated by the CLC data.

Compared to databases obtained from satellite imaging, the LUCAS Survey¹⁴, which adopts a statistical approach, provides more reliable and updated estimates (2012 data) of land take at national level. Italy, with 23.500 km² of artificial land, equal to 7,8 of the national territory, is positioned not only far above the EU average (4,6%), but scores first in the ranking among nations of comparable demographic size. Only Malta, Belgium, the Netherlands and Luxembourg have, in fact, higher land take.

¹³ Copernicus Land Monitoring Services comprises a pan-European component (which includes Imperviousness HRL), a global component and a local component (which includes Urban Atlas). The pan-European component provides data on changes in land cover between 2006 and 2009 (Imperviousness change 2009-2012 is in progress) and the land cover in 2006, 2009 e 2012 for the 32 member countries of the EEA and for six Balkan countries. The dataset is in raster format and it is organized into five high resolution (20 m) layers, the first of which (Imperviousness HRL) maps the built-up areas, with an indication of the degree of Imperviousness expressed in percentages.

¹⁴ LUCAS (Land Use and Cover Area frame Survey) is a project managed by Eurostat. It aims at collecting data on the cover and land use, landscape and biodiversity in support of agricultural and environmental policies of the European Union. The monitoring in 2012 involved 27 EU countries for a total of 270.389 sample points (just over 20.000 for Italy), classified according to a harmonized nomenclature. However, given the small size of the sample, LUCAS is adequate to provide reliable estimates at the European and the national level, but it is not suitable for analysis at local scale.

Another, quite interesting, information is provided by LUCAS on the destination use of urbanized areas¹⁵. From this indicator it emerges that the «built-up areas», i.e. those hosting buildings with a prevailing residential destination (LUCAS distinguishes buildings up to three floors from those with more than three floors) represent a lower share in Italy than other types of artificial areas, those gathered under the issue of «artificial non built areas». These latter include linear infrastructures (roads and railways) and surface infrastructures (industrial areas, commercial zones and malls, parking slots, recreational areas, airports and so forth).

In order to achieve a finer territorial detail and for dynamic comparisons over the medium long run, it is useful to consult data from the monitoring network ISPRA¹⁶. It is the only national data source with a specific task in the survey of land take. Collected data, covering a long span between 1956 and 2012, show that the share of artificial land in that period raised, in Italy, from a 2,8% to 7,3% (tab.2).

¹⁵ Compared to CLC, LUCAS provides more precise and reliable information on land use, as it adopts a classification system that distinguishes the coverage information from use information (while CLC adopts mixed classes of land cover /land use).

¹⁶ ISPRA monitoring network on land consumption, by using a sample larger than LUCAS (150.000 points), is able to cover the regional level and selected areas at a local scale.

Tab. 2 - *The land take in Italy according to ISPRA*

year	Land take (%)	Land take (km ²)	Land take pro-capite (m ²)
1956	2,8	8.300	170
1989	5,1	15.400	272
1996	5,7	17.250	303
1998	5,9	17.850	313
2006	6,6	19.900	339
2009	7,0	21.170	359
2012	7,3	21.890	369

Source: ISPRA, 2014

It turns out that, starting from the 90s, around 10 square meter per second have been consumed, amounting to around 70 ha per day. As a term of comparison, this means that every single year an area 2,5 times the city of Naples has been subject to urbanization.

Over the whole period (1956-2012) additional artificial cover of land per year has passed from 8.000 to 22.000 km² (ISPRA 2014). This is only partially due to demographic growth, as proved by the trend in per-capita land take: it was 170 m² in the aftermath of the II world war and 369 m², larger than doubled during the period in Italy.

In line with data provided by Lucas, data from ISPRA document that almost 50% of the land take occurs due to the building of infrastructures and roads (only 30% is due to residential building, or production facilities). Interestingly, a non-negligible fraction of these roads (20%) are secondary transport facilities and dirt roads. This figure confirms the increasing role of dispersed residential

pattern in our country: the raise of urban sprawl pulled a larger network of diffuse, although secondary, country roads¹⁷. To artificial areas used for infrastructure building, an additional 15% of land use can be imputed to complementary infrastructures in urban sprawl, like parking slots, mines, construction sites and quarries.

At the regional scale an interesting heterogeneity in the consumption of soil also emerges (estimates 2012, see fig. 2a). Northern Italy is the part of the country where land take is more important, with Lombardia and Veneto at the top of the rank of artificial surface (9-12% of regional territory), followed by Emilia Romagna and Friuli. Large figures are registered also in Lazio, Puglia, Campania and Sicilia. Southern Italy, overall, exhibits figures lower than the national average (6,5% in 2012), although an increasing trend emerges in recent years in the latter regions too. At a local scale (Comuni), ISPRA provide figures referring exclusively to the sealed soil (fig. 2b). High levels are reported for all the main cities, peaking (at more than 50%) in those municipal areas where the city has already passed the traditional historical and administrative borders, like in the cases of Milano, Napoli and Torino. Lower figures, by contrast, are registered in the case of municipalities with rather ample territorial extension, as in the case of Roma. The absolute level of soil sealing in the Italian capital city is large in absolute value (34.069 ha), making Roma one of the biggest cities in Europe (1.287 km², two and a half times the surface covered by Madrid), but the relative share is small (26,1% of the municipal area).

¹⁷ In this regard Newman and Kenworthy (1989) denoted «automobile dependence» the growing trend in advanced countries to conceive, design and build a car-friendly city.

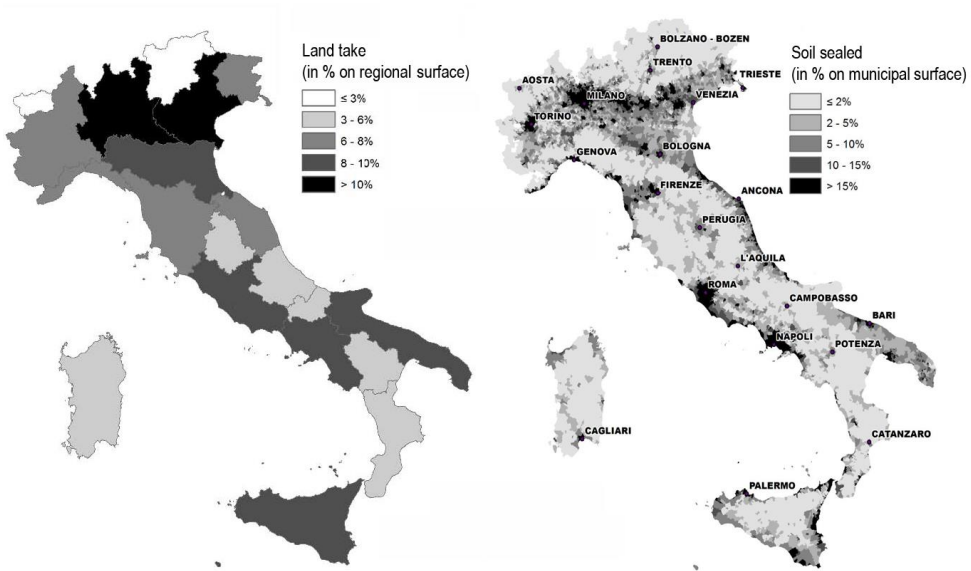


Fig. 2 – Land take at regional scale estimates 2012 (a) and soil sealed at local scale year 2009 (b)

Source: ISPRA, 2014; ISPRA on Copernicus data

Different figures emerge from ISTAT accounts *Basi Territoriali*¹⁸. The extension of urban areas, measured by including the perimeter of both *Località Abitate* (*Centri e Nuclei*) and *Località Produttive*, has been assessed at around 20.300 km², achieving an estimate of 6,7% of the total surface of the country.

¹⁸ *Basi territoriali* a data-base realized by ISTAT, is organized into sub-municipal subdivisions (about 402,000 *sezioni di censimento* ie census sections and more than 61,000 *Località abitate* or inhabited areas in 2011). These units cover the entire national territory and data are produced every ten years since 1951 from the general census. The workload of each interviewer depends on the design of the minimum units of detection (*sezioni di censimento* or census sections), designed by photo interpretation of aerial photos. This explains why their territorial extent is related to the distribution of the population (in urban areas much lower than in rural areas) and why it is considered useful to classify them by type of settlement. So we distinguish between *Località abitate* (which includes *Centri*, *Nuclei* and *Case sparse*) and *Località produttive* (production areas located in suburban o peri-urban areas).

Compared to 2001, the increase has been of 1,636 km², i.e. 8.8%. In other words, according to ISTAT (Baldacci and Sabbadini, 2013), in the period 2001-2011 the dynamic of land take has been of 45 ha per day. It is a much lower figure than that registered by ISPRA (70 ha), due to the methodology used by the institute to outline urban areas. Indeed, the procedure for delimiting both residential units, *Centro Abitato* and *Nucleo Abitato*, involves the drawing of a border that runs at the outside of a number of at least 15 buildings or along a linear infrastructure, as transport facilities, roads or hydrographic borders. As a consequence of the procedure all of *Case Sparse*, residential units of less than 15 proximate buildings, are not included in the urban areas. Those Case Sparse would host, according to ISTAT, about 6% percent of the national population (3.400.000 inhabitants). The same happens for infrastructures *extra-moenia* (outside the city borders) and for the artificial no built up areas (such as quarrying and dumpsites). Viceversa, the figures produced by ISTAT include semi-natural surfaces like parks, gardens and sport infrastructure built *intra-moenia*, within the urban area (and hence as consumed).

Despite these limitations, *Basi territoriali* represents a valuable source of information to reconstruct at a fine detail the evolution of Italian settlement starting from the 1950s . Not less important is the fact that *Basi territoriali* allow to combine the geographic data, with the rest of information contained in the population Census.

The map (fig 3a) shows the results (still provisional) for the 2011 Census. There clearly emerges the strong concentration of settlements in coastal and lowland areas, with a high prevalence of urban areas in the Po Valley . In the South, with the exception of metropolitan area of Naples, the settlement

pattern is less dense and especially less dispersed than in the Centre-North (with a higher concentration around the main urban centers)¹⁹.

Quite alarming signals coming from the time comparison (Fig. 3b). The map of changes in urban surfaces in the period 2001-2011 shows a marked expansion of settlement areas in much of the national territory, with a trend of growth higher (above the national average) just in areas departing from major surfaces agricultural and natural. The South, stands out with five regions registering record variations well above the national average (8.7 %), with the highest values in Basilicata (located at the top of the national ranking with 19%), Molise (2th place with 17.2%), Puglia (3th with 13.5%). Sardinia (6th with 11.1%) and Sicily (7th with 10.3).

¹⁹ There is no doubt that the current patterns of land use are strongly rooted in the past historical evolution of the settlements throughout the country as well as the social and economic trajectories occurred in its territorial articulation. It is clear, for example, why in the South the historic weakness of the manufacturing and the presence of a traditionally centralized settlement structure have acted as restraining factors on land use. Conversely, in the central and northern regions the urban sprawl, favored by the presence of dense and polycentric urban systems, strengthened in the seventies and eighties with the rise of the industrial districts of the Third Italy. This topic would deserve further investigation, not possible here for space constraints. We limit ourselves to mentioning a few important studies, dating back to the nineties, dealing with the settlement evolution. One is the research on the "Diffusione Territoriale dello Sviluppo" directed by Fua (1991), performed within the CNR project «Structure and evolution of the Italian economy»; another is "ItUrb" coordinated by Astengo (1990) which reconstructs the processes of urban expansion in Italy in the period 1951-81 and is the first to operationalize the notion of land take; a third is the research CNR-IPRA (1988), *Interaction and competition of urban systems with agriculture for the use of soil resources*; finally and more recently, we mention "Itaten", directed by Clementi, Dematteis and Palermo which proposes a diachronic reading of the Italian territory articulated for «rooms» or «ambienti insediativi locali» (local environments settlements), «diversified in their characteristics due to the different physical and social morphologies, as well as the different historical sedimentation of which they are the expression» (1996, p.4, our translation)

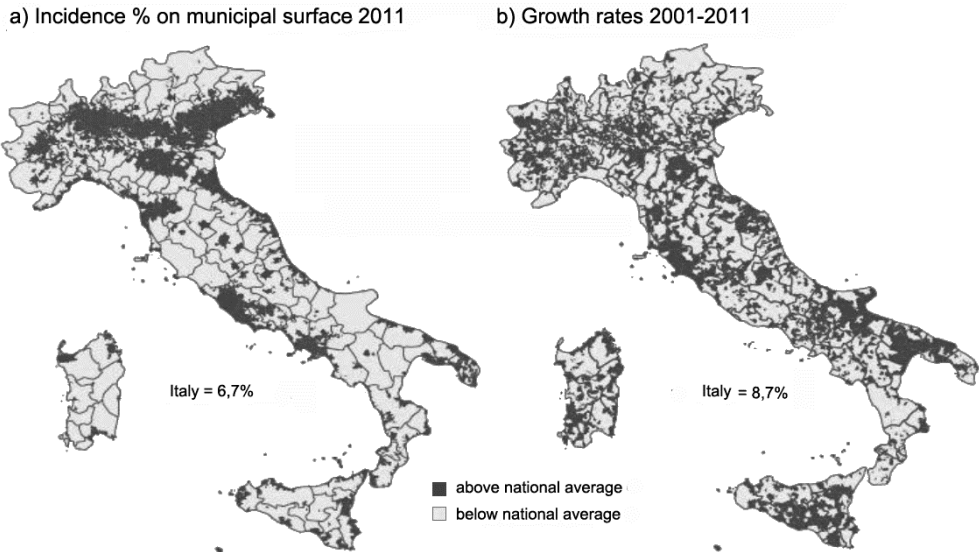


Fig. 3 – *Incidence of Località Abitate by Municipality according to Istat*

Source: Istat, Basi territoriali 2001 and basi territoriali 2011 (provisional data)

It seems, in essence, that the South is moving with a delay toward urban configurations marked by low density, scattered urban areas and thus very high levels of land take, catching up with the rest of the country.

Figures released by Istat about new *Località abitate*²⁰ seem to confirm this trend: the South shows the highest increases. The construction of new agglomerations concerns, in particular, regions with large agricultural and rural areas such as Puglia (+ 21,1% compared to 2001), Sardegna (+ 13,6%), Sicilia (+ 10,7%). By contrast, the most virtuous regions are Valle d'Aosta and Trentino Alto Adige, where the containment of urban sprawl is the result of

²⁰ Changes in urbanized surface are registered after an expansion of already existing *Località abitate* (Recently inhabited localities), after two or more adjacent *Località abitate* are merged, after the birth of new *Località abitate*. According to ISTAT of the 1.024 new *Località abitate*. identified in 2011 more than 88% (908) are concentrated in the South of Italy.

appropriate spatial planning policies, the outcome of a more careful approach to the problem of land take. The moderate data of Liguria, both in terms of change of urbanized area (+ 2.4%) and in terms of increase in the number of (+ 0.4%) are rather due to the saturation of regional surface, given its unique geo-morphological conformation²¹. By relating geographical data from *Basi Territoriali* with socio-economic data, additional hints on the evolution of land take and its drivers can be obtained. For example, by comparing the extension of urban areas with the population density a good correlation between the two variables emerges (Fig. 4).

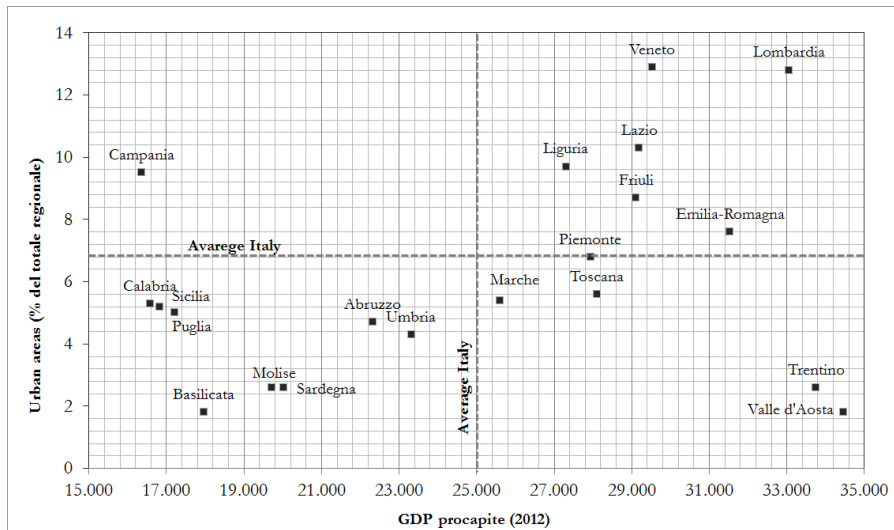


Fig. 4- Urbanized areas and population density by region

Source: Author's elaboration on Istat data

²¹ As shown by ISPRA data (2014), land take is negatively correlated to altimetry, i.e. it decreases with increasing altitudinal gradient, while it is positively correlated to coastal proximity. With reference to 2012, the percentage of land take is 11,4% in lowland areas below 300 meters a.s.l, 5,7% in areas between 300 and 600 meters and 1,9% in areas above 600 meters. In contrast, the percentage of sealed soil is 10.5% within 10 km away from the coast, compared to 6.5% beyond 10 km.

It turns out that the most densely populated regions are also those with the highest incidence of urbanized land. By contrast, regions with a low population density, such as Valle d'Aosta, Basilicata, Trentino, Sardegna and Molise, register a quite smaller incidence of artificial areas.

Also interesting is the comparison between the amount of urban areas and income, measured in terms of GDP per capita (fig.5).

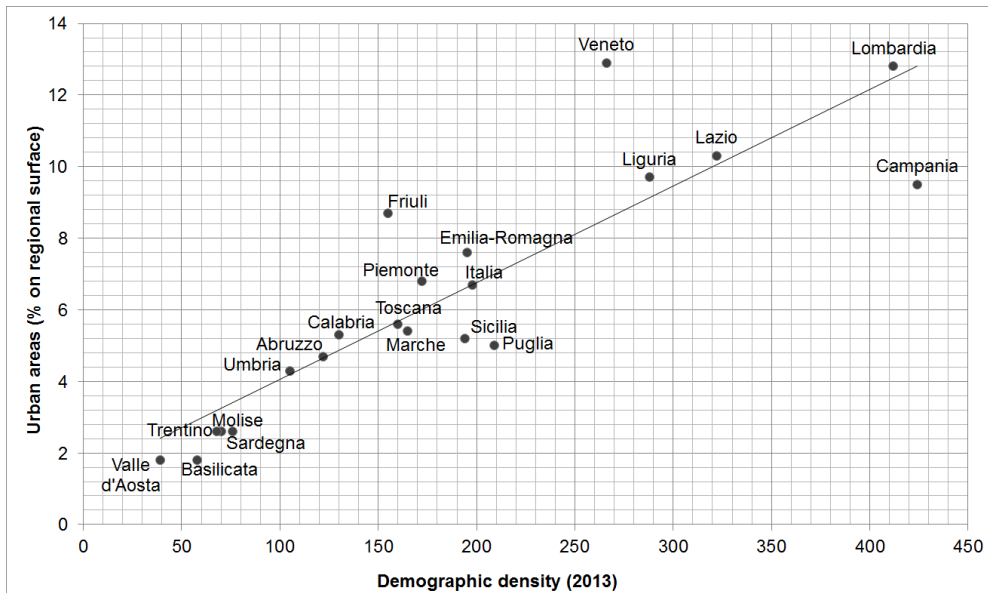


Fig. 5 - *Urbanized area (2011) and GDP per capita (2013) by Region*

Source: Author's elaboration on Istat data

As shown in the figure, four different situations can be identified, corresponding to the four quadrants in the graph. A first group of regions, including Lombardia, Veneto, Lazio, Liguria, Friuli, Emilia Romagna and

Piemonte, shows a positive correlation between the two variables, i.e. high values of GDP are associated with significant proportions of urbanized areas. A second group, formed by the southern regions, records both GDP levels and urban areas lower than the national average. A third group, consisting of Toscana, Marche, Trentino and Valle d'Aosta, is characterized by high levels of income and a relatively small land take. Particularly critical is the situation of Campania, the only Region located in the upper left quadrant, due to a high incidence of urban areas and income levels far below the national average. Consider that, at the national level in the period between 1995 and 2011, building permits were released by the municipalities (ISTAT data) for about 4,1 billion m³, 243 million m³ per year, of which 80% for new building (+ 7,6% in the decade from 2001 to 2011, compared with a population growth rate of 4,2%). In other words, every Italian was, on average, allowed for about 70 m³ of new construction permits²², corresponding to approximately 23 m². The diachronic analysis of the data shows that the growth curve of built up areas peaked in 2005. A gradual decline started after that date, a sharper one emerges in 2009 as a result of the recession. In line with the data from other sources, ISTAT survey also shows the predominance of new building for production and services (60%) compared to residential use (40%). The phase of terraced houses²³ that had prevailed in the recent past, between mid-seventies and mid-nineties, seems to have reached a stop, and to have left space to new forms of

²² Among the legacies of this process of overbuilding, the spread of legal and illegal quarries throughout the country should also be considered: nearly 19.000, according to estimates by Legambiente (Rapporto cave, 2011), of which 69% abandoned, with peaks in Lombardia (3.446 quarries), Veneto (2.180) and Campania (1.712).

²³ According to CRESME data on the newly built residences, the ratio between mono or two-family residences compared to multi-family residences was 0,62 in 1982 (more than 1 mono or duplex dwelling every 2 multi-family residences) passing in recent years to 0,19 (1 every 4).

land destination like shopping malls, logistic and transport platforms, new spaces for recreational activities.

Beyond the «official» buildings those built illegally should be considered also. Italy is a special case in this respect: when compared with the rest of Europe, unauthorized development reaches a disproportional size. According to recent estimates of CRESME (2012) illegal buildings represent about 5% of the legal building production (a flow measure) in the North, 10% in the Center and 30% in the South.

The positive trend of permit release for new buildings testifies, on the one hand, the sense of favorite asset that the real estate (house) has for most Italian households (it represents 60% of households' wealth). On the other hand rents from real estate assets, reached 32% of GDP, a share that, as noted by Bonora (2013, p. 12) «is more than twice the amount considered physiological (about 15%) to a balanced economic system» (our translation).

Investment in real estate has undoubtedly represented, in recent decades, the most profitable investment in Italy. It ensured rates of return exceeding 9% in large urban areas and 8% in medium-size cities (data CRESME for the period 1995-2010 reported in Bellicini, 2011). The excess rent associated to this asset with respect to other forms of wealth is one of the main drivers of residential and productive decentralization that feed urban sprawl.

According to CRESME/SI (the information system of the Centre) in the period 1992 to 2008 the ratio between real estate rents in central cities and peripheral areas fluctuated, around 1.9 (fig. 6a). This means that the price of housing per square meter in the metropolitan ring was about half of that paid in the city centre.

The population outflow from the major cities towards peri-urban areas is confirmed by a recent survey conducted by ISTAT (Baldacci e Sabaddini, 2013) on 16 large municipalities (in terms of population), capitals of *Regione* or *Provincia* (fig. 6b).

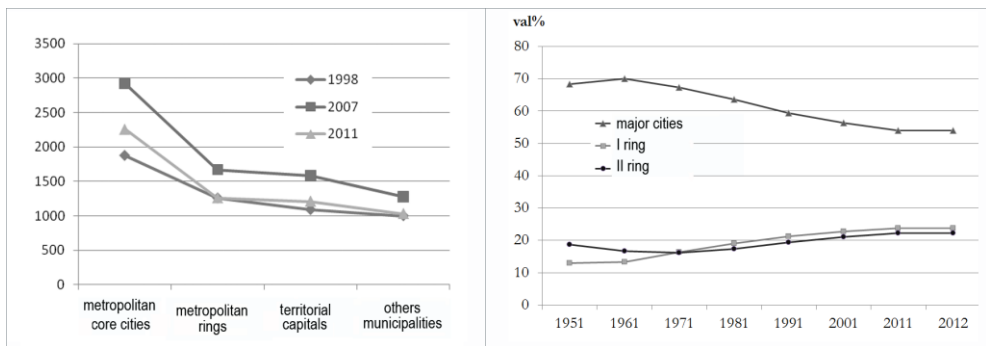


Fig. 6 - *Distribution of urban income (a); Population by type of municipality (b)*

Source: Ferlino, 2015 (on CRESME data); Istat

For these cities the evolution of the population since the 1951 census was analyzed, considering the main city and all municipalities located in the first and second urban ring, for a total of 500 municipalities hosting about 30% of the Italian population (17,4 million in 2012). The results show a progressive loss of demographic weight of all central cities, in favor of neighboring municipalities located in the first and the second ring. In all cases the growth of urban areas (measured in terms of the extent of inhabited areas) has been, over the last decade, much stronger than the rate of population growth (+ 7,5% against + 2,8%). This figures provide further evidence in

support of the decoupling between land use and population dynamics, already highlighted at national scale²⁴.

A significant contribution to urban sprawl also comes from cultural factors such as housing preferences in favor of peripheral residences, providing more space at a lower costs and in many cases, the perception of closer proximity to nature²⁵. Census data confirm the steady increase in the average surface of housing, as well as the expansion of the «residential basins» of the households (the spaces of daily life), measured on the basis of local labor systems (*Sistemi locali del lavoro SLL*), delimited by ISTAT at each census²⁶.

Another interesting aspect is the change in the households' composition, particularly relevant for its impact on demand for housing. Indeed, although in the last decade the overall population grew by 4,2%, households increased by 16,7%, due to the reduction in the number of components²⁷. This suggests the presence of an actual component of residential demand, largely unmet by the market as shown by the increase of new residential units unsold, about 400.000

²⁴ Besides the issue of land rent, several political and institutional factors impact on the expansion of urban areas including the lack of an adequate planning for large territorial areas (*area vasta*), and the excessive administrative fragmentation (more than 8.000 municipalities) that multiplies the decision-makers in the regulation of land uses (Pileri, Granata, 2014), the key role of real estate taxes in municipal revenue, as well as the possibility to use most of the urbanization charges for their current spending (transitory rule in the Finance Act of 2001, then confirmed in the following financial Acts, to compensate the reduction of state transfers to municipalities).

²⁵ Several sociological contributions highlighted the role played by cultural factors in the processes of urban sprawl. According to Nussbaum and Sen (1993), an increasing share of the population tends to leave the congestion of the city center in favor of surrounding rural places due to new forms of urban life styles closer to the countryside. Other authors, conversely, attribute a prominent role to the rise of an increasingly individualistic lifestyle.

²⁶ The number of local labor systems identified by ISTAT on the basis of daily commuting flows decreased over time: they were 955 in 1981, 784 in 1991, 689 in 2001 and 611 in 2011. Their territorial extension increased as a consequence.

²⁷ The drivers of this change include factors such as the growth of separations and divorces, the aging of the population and the consequent increase of old people living alone.

according to CRESME (CSAPPC-CRESME, 2013), foreclosures and evictions²⁸.

In other words, it seems to us reasonable to conclude that the massive construction activity that has been unfolding, at least until the recent crisis in 2008 (4 million residential units built in 15 years), was prompted by speculative purposes intended to meet a demand for housing in rural areas and in coastal and mountain resort areas. According to the latest census data, the stock of second and third houses is about 1/5 of all existing houses: almost 6 million out of a total of 28,7 million houses.

In this regard, it is emblematic the case of the coastal and volcanic areas of particular environmental and landscape value, subject to restrictions under the Law Galasso (n. 431/1985) implemented by the latest Code of Cultural Heritage and Landscape (D.Lgs n. 42/2004). During two decades (1981-2001) these areas have been affected by an increase in the density of residential units of 23,6% (coastal areas) and 26,6% (volcanic areas) respectively, against a national average of 0,8% (Baldacci e Sabaddini, 2013). The violation of the regulation was highest in the South, where the index of urbanization in areas under environmental restrictions rose from 68,6 buildings per km² in 1981 to 88,1 in 2001. The highest values were registered in Puglia (778,4 buildings per km²) Molise (525,5) Campania (259,4), Sardegna (181,2) and Sicilia (145,9).

Another important aspect to consider is the impact of land use on agriculture, both in terms of loss of potential productive capacity and in terms of soil and landscape fragmentation and degradation.

²⁸ As reported by Bonora (2013, p. 14) the foreclosures due to insolvency reveal the presence of 150.000 residential units (Adusbef estimates on data collected in the courts), «a medium-sized town now in the possession of the banks» (our translation).

On the basis of the data produced by European Environment Agency (EEA 2010b), in the context of Corine Land Cover (CLC), the detected loss of farmland in the decade 1990- 2000 can be estimated in 970.000 hectares at the European scale (20 countries). In absolute terms, Germany, Spain, France and Italy are the countries where the greatest losses have been recorded, a figure between 150.000 and 200.000 hectares each. A particularly negative outcome has been registered for Spain and Italy: in the period 2000-06 they exhibit an increase in the consumption of agricultural land compared to the previous decade. The fact that urban settlements, for reasons related to the historical organization of food supply, lied close to the most fertile areas explains why the current processes of land take tends to affect the best lands, such as alluvial ones, generating a strong impact on both the environment and on food production. This insight is confirmed by a recent study by Gardi et al. (2015) also reported in the guidelines on soil sealing of the European Commission (EC, 2012). There, an estimated 6,1 million tons of wheat is reported to be the loss occurred in production capacity between 1990-2006 in 19 Member States. It amounts to a loss of around 1% of their agricultural potential and about a sixth of the annual harvest of France, the largest European producer. As pointed out by the authors, to compensate for the loss of one hectare of fertile land in Europe, an area up to ten times greater elsewhere around the world should be put into use.

As for Italy, further information on the transformation dynamics of agricultural soils can be obtained from the data of the Census of Agriculture and from the databases *Populus* and *Agrit*. Those two projects, aimed at the detection of agricultural activities, estimated for different time intervals (2004-

2009 *Populus* and 2009-2011 *Agrit*) the consistency of the transitions from one class of land use to another, employing a matrix of flows²⁹.

The integrated reading of these data shows a significant erosion of agricultural land: in 1982 the total agrarian surface (SAT) represented about two-thirds of the national territory (74,1%), the share fell to 56.5% in 2010, with a particularly strong negative trend in the decade 1990-2000 (-12%). This reduction is not uniquely due to urbanization, but also to land abandonment and re-naturalization. This latter process has been of larger importance than the first in the decade 1990-2000.

More specifically, areas affected by urban sprawl represent 20% of SAT, with values generally higher in the Centre-North, while land abandonment and re-naturalization has interested 28,3% of SAT. It is important to remark that land abandonment historically regards agricultural areas that are more likely to be marginal³⁰. Instead, agricultural areas currently affected by urban sprawl are generally areas of considerable value both in terms of agricultural productivity and localization «flat, fertile, easily workable and accessible land such as the urban fringes, coastal areas and the plains» (MiPAAF, 2012). The urban-rural competition takes its starkest form in Veneto, where agricultural erosion due to urbanization affects 50% of the regional SAT. High values can also be found in Lazio (45,4%) and Liguria (31,8%).

²⁹ The *Agrit* project, initiated in 1988 by *Ministero delle Politiche Agricole, Alimentari e Forestali* (MiPAAF) is based on a sampling procedure (55.000 sample points, almost exclusively of agricultural type), which, after an initial phase of photo-interpretation, have occurred *in situ* and have been classified in 86 classes. *Populus* is a project managed by *Agenzia per le Erogazioni in Agricoltura* (AGEA), which serves as the sampling basis for the survey frame *Agrit*. It is based on a grid of 1.206.536 sample points, classified into 25 classes (10 for artificial areas).

³⁰ The erosion due to abandonment affects mainly the mountain areas. The highest values were recorded in some southern regions (Basilicata, Calabria, Abruzzo and Molise) and two northern regions (Liguria and Valle D'Aosta).

To assess changes and mutations in recent years it is possible, as already argued, to use data basis *Populus* and *Agrit*. From the first data base it is possible to assess the loss in SAT occurred in the years 2004-09 around -2.4%, with the larger transitions into re-naturalization (+1,8%) and a smaller role for land take (+0,6%). Estimates from *Agrit* suggest that for the period 2009-11 the loss in SAT is estimated to be -2,2%, with a lower part (1,1%) due to land abandonment vis a vis land take.

Whereas SAT has decreased by around -24% in the period 1982-2010 (Census data) a much smaller decrease (-18,8%) has been registered in the SAU (actually utilized agricultural surface): as a consequence the relative weight of SAU has significantly increased passing from 70,2% to 75,3% of the SAT in the same period. This suggests that the conversion of farmland to other uses creates more pressure on the remaining productive land and encourages intensive techniques, with the usual environmental impacts (soil compaction and sealing, poor drainage, loss of biodiversity, reduction of fertility and minor ability to filter soluble pollutants, etc.).

Conclusions. – The provision of data about land cover/land use has recently increased but remains very fragmented and heterogeneous, due to the use of different measurement methods in terms of detection, classification systems, territorial coverage and time span, scale and purposes of the survey. The final result is that the information provided are difficult to be used in an integrated way at different geographical scale of analysis.

Nevertheless, the availability of a plurality of information sources, diverse in methods and aims, can be advantageously exploited to obtain a more articulate and exhaustive framework of the phenomenon and/or to investigate specific

issues related to the determinants of land take or issues related to the impacts generated (such as the weight of land rent in the processes of urbanization or the outcomes on agricultural production and landscape).

Our analysis has shown that, despite the fragmentation of the data sources, much can be learned from these data. In particular direct and indirect indicators have been provided to support the hypothesis that urban sprawl has been recently very significant in Italy, with important implications on both environmental and the socio-economic sustainability. We have seen how, in the last decades, not only a lot of land has been taken, but of the better quality in terms of location and geophysical characteristics (planes and coastal territories with high accessibility and infrastructuring), agronomical value, landscape and even social and historical identity.

This loss is of even more serious concern if one considers that in Italy -due to the peculiar shape and geomorphologic conformation, the high population density and the heavy and dense network of small cities that history delivered - land is a resource absolutely scarce and subjected to multiple interests.

Instead of protecting this «common good», absolutely vital «in a country whose hydrogeological structure is so delicate and whose landscape and ecological network is so minute» (Lanzani, 2009, p. 41, our translation), forms of expansion of urban areas have been encouraged. Aggressive and uncontrolled forms of urban sprawl has set Italy in the lower ranks among European countries in terms of highest incidence of land take.

Even more troubling is the decoupling- we documented from the integrated analysis of different data sources- between urban growth and the demographic and economic dynamics. Lots of hectares of high values lands have been taken, valuable rural and coastal landscapes have been destroyed to the aim of

generating, extremely weak urban structures, with no clear positive effects on the well-being of residents.

In other words in the last decades we assisted to the rise and reinforcement of a settlement model whose ability to coordinate long run interests of the environment with short run speculative initiatives can be considered rather weak. The result, in the light of the ongoing crisis, is that of an overall social, cultural and environmental waste that has only produced the illusion of enrichment and the illusion of realization of diffuse aspirations in the very short run.

To turn the route, therefore, a paradigm shift is required: It seems necessary to move away from the sprawled city, energy-intensive, polluted, individualistic and anomic residential model in favor of a model of city physically compact and socially oriented, a city that, as emphasized by Bonora (2013, p. 253) «knows how to combine the plurality of interests in the direction of the principles of social justice and collective good».

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EATEN ITALY: PATTERNS AND TRENDS OF LAND TAKE – In this paper we discuss the concept of «land take» and its interpretations, focusing on the Italian experience. In particular, by using several sources of information (that directly or indirectly deal with land use/land cover), we analyse the specific structure that this phenomenon has taken at national level, in order to highlight the characteristics, the patterns and the evolutionary trends.

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