TeMA

Journal of Land Use, Mobility and Environment

There are a number of different future-city visions being developed around the world at the moment: one of them is Smart Cities: ICT and big data availability may contribute to better understand and plan the city, improving efficiency, equity and quality of life. But these visions of utopia need an urgent reality check: this is one of the future challenges that Smart Cities have to face.

Tema is the Journal of Land use, Mobility and Environment and offers papers with a unified approach to planning and mobility. TeMA Journal has also received the Sparc Europe Seal of Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ).

EXTREME WEATHER EVENTS CAUSED BY CLIMATE CHANGE

Vol.9 n.1 April 2016

print ISSN 1970-9889 e-ISSN 1970-9870
University of Naples Federico II

TeMA Journal of
Land Use, Mobility and Environment

EXTREME WEATHER EVENTS CAUSED BY CLIMATE CHANGE

1 (2016)

Published by
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

TeMA is realized by CAB - Center for Libraries at “Federico II” University of Naples using Open Journal System

Editor-in-chief: Rocco Papa
print ISSN 1970-9889 | on line ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

Editorial correspondence
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"
Piazzale Tecchio, 80
80125 Naples
web: www.tema.unina.it
e-mail: redazione.tema@unina.it

Cover Image: Wind travels across Lake Washington, buffeting the 520 floating bridge as the storm grows in strength. (Steve Ringman / The Seattle Times).

TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include: engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science and complex systems.

The Italian *National Agency for the Evaluation of Universities and Research Institutes* (ANVUR) classified TeMA as scientific journal in the Area 08. TeMA has also received the *Sparc Europe Seal* for Open Access Journals released by *Scholarly Publishing and Academic Resources Coalition* (SPARC Europe) and the *Directory of Open Access Journals* (DOAJ). TeMA is published under a Creative Commons Attribution 3.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

TeMA Journal of Land Use, Mobility and Environment

EXTREME WEATHER EVENTS CAUSED BY CLIMATE CHANGE 1 (2016)

Contents

TeMA Journal of Land Use, Mobility and Environment

TeMA 1 (2016) 89-107
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/3727

review paper received 13 January 2016, accepted 23 February 2016

www.tema.unina.it

How to cite item in APA format:
Mazzeo, G., Russo, L. (2016). Aspects of Land Take in the Metropolitan Area of Naples. *Tema. Journal of Land Use, Mobility and Environment*, 9 (1), 89-107. doi: http://10.6092/1970-9870/3727

ASPECTS OF LAND TAKE IN THE METROPOLITAN AREA OF NAPLES

GIUSEPPE MAZZEO[a], LAURA RUSSO[b]

[a] Institute of Studies on Mediterranean Societies (ISSM)
National Research Council (CNR)
e-mail: gimazzeo@unina.it

[b] Department of Civil, Architectural and Environmental Engineering (DICEA)
University of Naples "Federico II"
e-mail: laura.russo@unina.it

ABSTRACT

Land take is a phenomenon of great concern nowadays because of the large number of its negative impacts regarding biological, economic and social balance. In Italy, the development of urban and other artificial land has been irreversibly transforming a non-renewable resource such as soil, regardless the almost constant population rate, with different speed depending of the region considered. The aim of this paper is to analyze the phenomenon in the metropolitan area of Naples, which is an area highly affected by territorial aggression of human matrix. The data used are both by the Institute for Environmental Protection and Research (ISPRA) Report 2015 on the usage of the land and by ISTAT relating to the resident population up to the 1st of January 2015 and the extension of land for agricultural use (Census 2010). The mathematical combination of this data creates a new indicator that can be referred to as "residual land"; this residual area is of great extension with many different characteristics and it could represent the area where the phenomenon of land take most occurs. The identification, measurement and analysis of "residual land" provide new insights on the evolution of land take and this new indicator can represent a critical element to work on to prevent future land transformation and protect natural and agricultural areas within the Italian context.

KEYWORDS:
Land Take; Urban Sprawl; Soil Sealing; Metropolitan Area of Naples.

TeMA

有关土地使用、交通和环境的杂志

TeMA 1 (2016) 89-107
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/3727

review paper received 13 January 2016, accepted 23 February 2016

www.tema.unina.it

How to cite item in APA format:
Mazzeo, G., Russo, L. (2016). Aspects of Land Take in the Metropolitan Area of Naples. *Tema. Journal of Land Use, Mobility and Environment*, 9 (1), 89-107. doi: http://10.6092/1970-9870/3727

那不勒斯城区的土地占用现状

GIUSEPPE MAZZEO[a], LAURA RUSSO[b]

[a] Institute of Studies on Mediterranean Societies (ISSM)
National Research Council (CNR)
e-mail: gimazzeo@unina.it

[b] Department of Civil, Architectural and Environmental Engineering (DICEA)
University of Naples "Federico II"
e-mail: laura.russo@unina.it

摘要

土地占用给生物、经济和社会平衡带来许多负面影响，备受社会关注。在意大利，尽管人口增长率在各地区会有差异，总体上几乎保持稳定增长，但城市和人造土地的发展已经不可逆转地使土壤等不可再生资源发生了改变。本文研究的目的是分析那不勒斯城区被人类高度占领的现象。本文使用的数据来自于环境保护和研究所（ISPRA）于 2015 年发布的土地使用报告，以及意大利国家统计局（ISTAT）对 2015 年 1 月 1 日以来居住人口和农业用地扩张的统计（2010 年的人口普查）。对这些数据进行数学相加可以产生一个表示“剩余土地”的符号。剩余土地的大力扩张有许多不同的特征，它能代表土地占用现象最常发生的地区。对“剩余土地”进行定义、测量和分析能扩大我们对土地改革的认识，同时，这也是预防土地在未来发生转型，并保护意大利自然和农业区域的关键因素。

关键词：
那不勒斯城区；土地占用.

1 INTRODUCTION

The importance of a good use of the territories has been underlined by the European Commission in 2011, year of the publication of the Communication entitled "A resource-efficient Europe - Flagship initiative under the Europe 2020 Strategy", in which land represents one of the factors to consider in achieving an always greater efficiency in the use of natural resources. It follows the former "Thematic Strategy for Soil Protection" (EC, 2006).

In this context, this paper introduces land take in the metropolitan area of Naples. The aim of this work is to delineate this phenomenon in an area highly affected by territorial aggression of human matrix. This delineation is possible thanks to the use of significant numerical indicators. More specifically, the data used was both information by the ISPRA (2015) on the usage of land in 2012 and data by ISTAT relating to the resident population up to the 1st of January 2015 and the extension of land for agricultural use (Istat, 2010).

The paper is structured in three parts. In the first part, the concept of land take is introduced with some of the negative definitions connected to the phenomenon, relating both to the processes of biological depletion and to that of a reduction of life quality due to the spread of low-density urbanization (Mazzeo, 2009; Russo, 2014). In the second part, the main indicators of national and regional land consumption are analyzed focusing on those relating to the metropolitan area of Naples. It is pointed out that the area of analysis does not coincide with that of the province of Naples that, pursuant to the law 56 of 2014, has become the Metropolitan city of Naples. The area analyzed, indeed, includes an area which extension leaves aside functional and relational considerations. This area is made up of municipalities that are part of the Caserta's and Salerno's district and ones that were once considered part of Naples' district. The boundaries of this area have been built by Mazzeo (2010) and have been used in Papa & Mazzeo (2014). The third part of the paper points out how the difference between land cover, built-up area and agricultural area interests an unutilized part of the land of great extension and having itself a number of different characteristics. Because of its heterogeneity, this land has to undergo an in-depth analysis so to prevent more useless loss of natural soil.

2 LAND TAKE. GENERALITIES AND DEFINITIONS

2.1 ENVIRONMENTAL ASPECTS

Land take is a human-derived process that leads to the use of both agricultural and natural land to produce volumes, tools, and infrastructural systems. This has, as a result, the continuous transformation of these areas into built-up areas. Land take is an irreversible process. «Land is a non-renewable resource, as the period needed to form new soil is extremely long, fundamental not only for the production of food but for all human activity, but also as the preservation of biodiversity, support for the closing of nutritive elements' cycle and for the balance of the biosphere» (ISPRA, 2015, 1).

The idea of land consumption is analyzed under a three dimensional space (length and width and the narrow layer of mineral particles, organic material, water, air and living organisms) that, when scarified, is not able to be used for it's soil functions: growth of vegetable species and the trading processes between organic and inorganic materials. The thickness of this layer usually goes between a couple centimeters to few meters. If compared to the rest of the earth it is clear how extremely fragile the basis for biological life on earth is.

It has been said that once eliminated this layer would take an incredibly long time to form again and it is not certain that the process of formation would take place because of the complex interactions between the soil and natural matrices. An example would be the process of desertification that interest areas of land once productive. Furthermore, the same can be observed in the process of a massive use of chemical products on agricultural lands which reduce the biological characteristics of the soil eventually leading it to infertility.

From what has been stated, we cannot talk of land consumption when the process of reconstruction of the soil layer results reversible in short times. Anyway, land take is closely related to human transformations of the territory and has nothing to do with the natural evolution of the land.

2.2 URBAN ASPECTS

From a general point of view, it is possible to imply that land is composed by three principal parts (Chart 1): urbanized land, agricultural land, and natural land. The latest trends point out that both urbanized and natural land tend to grow diminishing this way the agricultural area which is the most interesting for its productive impact and for its regulative functions.

Land take is defined by EEA (2015) as the «increase in the amount of agriculture, forest and other semi-natural and natural land taken by urban and other artificial land development. It includes areas sealed by construction and urban infrastructure as well as urban green areas and sport and leisure facilities. The main drivers of land take are grouped in processes resulting in the extension of:

- housing, services and recreation,
- industrial and commercial sites,
- transport networks & infrastructures,
- mines, quarries and waste dumpsites».

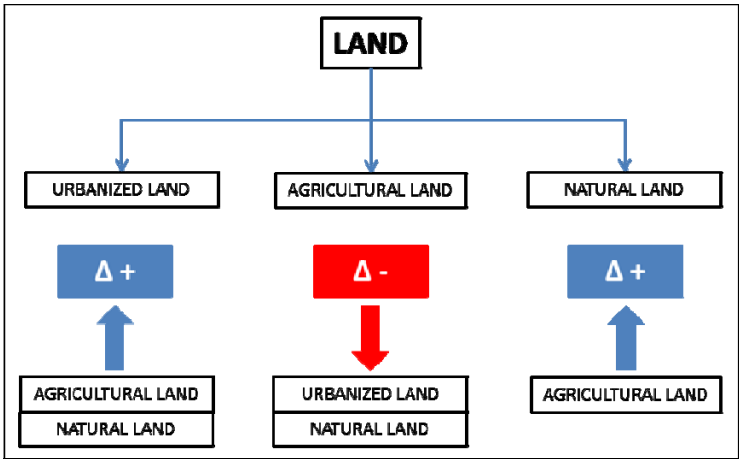

Chart 1 Land in its different forms and the trend variations

The debate relating to land take has become one of the main points in the analyses on urban evolution. Although a formal definition of land take exists, a shared methodology to measure the phenomenon is still missing, and this lack makes the implementation of strategies aiming at curbing land take more difficult and less effective (Zoppi & Lai, 2014).

Urban agglomerates tend to expand creating many issues on different fronts: from mobility to that of reduction of agricultural spaces, and from the modification of natural ecosystems to the change of the relations between people and social groups. Land take is one of the most outstanding aspects of urban expansion as the recent trend history of the cities always see this indicator in growth. If we start from housing manufacture, considered as the basic constructions of a city, we can imply that every new construction uses up land. This does not mean that the volumes of expansion are equal to a consumption of new land. More in depth three cases can be hypothesized:

- when new constructions are built on an area of land that has never been used before for urban aims. This is a typical example of volumetric increase (V2>V1) with a consequent increase of built-up area (S2>S1);

- when a new construction is built on a soil that had already been urbanized before. This is an example of volumetric increase (V2>V1) with no increase in built-up area (S2=S1);
- the third example relates to maintenance works, of renewal and renovation which can have as a result the same volume (V2=V1) or an increase of volume (V2>V1), that can end up in an increase of built-up area or the maintenance of the same built-up area (S2≥S1).

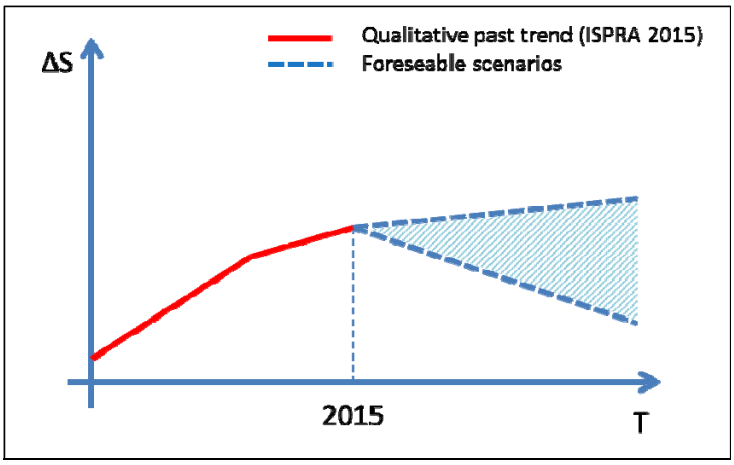

Chart 2 Intensity of land take in time in Italy

Extending this concept to the city, we can state that the evolution of the quantity of volumes on the corresponding coverage of land, resulting from the sum of all the transformations done, can reasonably be always considered positive even if it varies from time to time (Chart 2).
Another element that has to be considered in this analysis is population. In general, it is stated that the stabilization of the population (and in some cases its regression) does not have any effect on a parallel stabilization of the urban loads, even if the direct correlation is still used in urban studies (Zullo et al., 2015). This means that frequently an increase in the volume of built-up areas occurs in places where there is a decrease in the population (Chart 3).

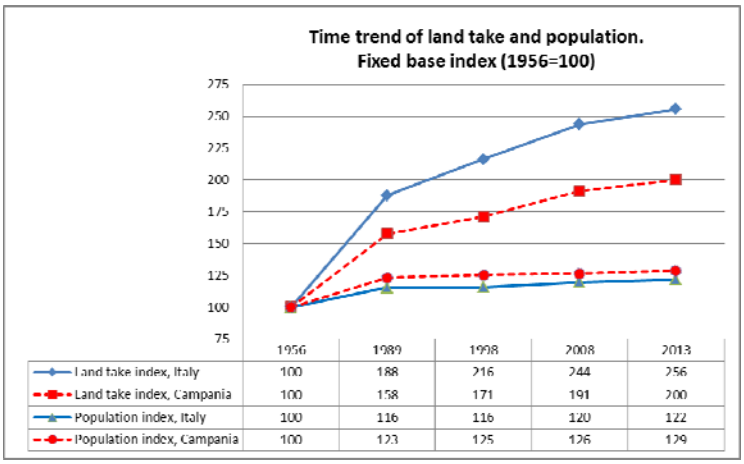

Chart 3 Trend in the growth of population and the use of land in time from 1956. Fixed base index 1956=100. Elaboration of the authors on data ISPRA (2015) and Istat

Population's trend and land take are two indicators considered directly dependent. This means that the growth of population produces an increase in soil consumption. Nevertheless, this direct relationship is not so immediate anymore, as it was in the past (Artmann, 2014).

In particular, for the whole period from the late Nineteenth century to the years of the economic development following the Second World War, we can assume a strong positive correlation, because population growth corresponded to a similar urban expansion process.

Today such relationship is weaker, given that the increase of new built-up areas occurs in the face of a stable population and with urban centres facing a phenomenon of physical and functional abandonment of inner areas to urban fringes. This means that the determinants of land take are more complex than a simple correlation with the population.

A first consideration is related to the needs and necessities of today's society. According to Munafò (2013, 20), «if in 1956 each Italian person was associated to a loss of 170 square meters of land, in 2010 this value doubled, rising to more than 340 square meters». This means that changes within the society have also influenced its demands and have created a greater need (effective or induced) for per-capita areas.

A second consideration is of economic nature. The transformation of land in built-up areas is a way to immobilize large financial resources because real estate is still considered a good field of investment. Meanwhile, the taxation of real estate has become one of the main financial resources for local authorities. These aspects are pushing towards the realization of new volumes and a reduced attention to territorial control (Ombuen, 2013).

Using soil means using a natural resource as a building site to enhance its value. An hypothesis that can be made is related to the dimension of the multiplier as there is a suspect that it diminishes, at least for two reasons: the first one is lack of demand (if the demand is the same but the volumes increase the cost to use them decreases), the second is for the potential risk increase that the transformed territory under goes.

A third consideration is related to the fact that still today there is a lack of attention to environmental goods, reflecting the perseverance of indifferent economic policies to the negative implications of an indiscriminate use of resources. In other words, the fact that environmental goods are not clearly associated with a tangible economic value makes them scarcely evaluable in economic analyses, despite it is well established that their loss is to be considered a net cost.

A fourth consideration concerns the farmlands. For a long time, they have been considered as reserve areas devoted for future urbanization and not as specialized functional areas dedicated to a primary economic activity to be protected and enhanced. It is interesting to note that there has been a difference in treatment between natural and agricultural areas: while the former were seen as areas to be protected for their ecological and landscape characteristics, the latter have not received the same attention.

This different treatment comes from the fact that, normally, the agricultural areas are closer to built-up areas than the natural ones and, therefore, are automatically more attractive and less easily protectable.

The extension of built-up areas develops on a physical substrate, which is the territory. The choice of the land to urbanize results from a number of factors (Graph 1).

Physical factors, such as the morphological conformation of land, administrative factors, which insert the piece of land into the usable land, economic factors such as the existence of people willing to work on the territory and of a sponsor fund, infrastructural factors such as the existence or the plan for communication networks and of specialized networks.

Many critical issues relating to the physical factors can be overcome with expensive advanced engineering techniques. Administrative factors define a variable use of the territory that extends from the complete prohibition to the total use conditioned by specific parameters. Price factors and the presence of sponsors become more evident in a phase after that of planning unless the planning does not already contain the sponsors' investment plans and includes them in a more general plan. In conclusion, the role played by the infrastructures is fundamental, especially for the introduction of new tools and facilities these networks create in the investment on the territory.

FACTORS	SPECIFICAL TERRITORIAL INDICATORS
1. Physical factors	1.1 soil morphology 1.2 geological soil structure 1.3 soil productivity
2. Administrative factors	2.1 juridical state of the new areas for urbanization 2.2 juridical state of the areas for transformation 2.3 juridical state of the bounded areas 2.4 necessity of stock by the public authority 2.5 time needed to start the activities
3. Stakeholders and financial resources	3.1 presence of both public and private employees 3.2 will of the employees to start the project 3.3 financial availability
4. Infrastructural factors	4.1 existing infrastructures 4.2 planned infrastructures 4.3 physical accessibility 4.4 accessibility to information

Graph 1 Factors that influence land choice

The combination of these four factors can be highly variable and can be related to other factors which have not been considered. This determines a transformation parameter that describes the easiness or not of the investment in a certain territorial area. In particular, it describes the advantage of using new land (new buildings or new infrastructures) compared to the utilization of already built-up areas. In the urbanized areas, in fact, there could be specific problems that make them less attractive such as the need of drainage. Therefore, the combination of these factors determines area's potential of transformation. The indicators can be manipulated so to be used also to predict trends speculating on the fact that some can be influenced by external factors not predictable in the beginning phase (Mazzeo, 2012); for example, some of these factors would be the trend in the cost of fuel and energy or factors related to the trend of local or national wealth. These and other trends can influence, even in a relevant way, the preference of a location's choice.

3 LAND TAKE IN ITALY

3.1 NATIONAL AND REGIONAL DATA

The problem of land take has been one of the principal issues for urban planners for a while and has created a complex interdisciplinary debate (Ewing, 1997; Antrop, 2004; Gibelli et al., 2006; Pileri, 2009; Berdini, 2009). The main concerns pointed out by researchers are based on the dimension of the phenomenon. This has moved the focus on the way tools to measure land consumption are built and to how to keep under control the dynamics of the evolution of the phenomenon (Munafò et al., 2013; Artmann, 2015). This concern has grown with the dispute that the urban expansion in Italy (not only) has followed completely autonomous rules. At first glance, it might be thought that population and expansion are tightly related. Actually, it has been so for a long time but it is not anymore. As a result, even though the population stays stable land occupation will continue growing regularly (Artmann, 2014). This can imply that the phenomenon is more related to economical process than to the population, meaning that there are investments made even if there is no need of new infrastructures or building and ignoring the fact that there are unused stocks in continuous growth.

A third aspect that has contributed to the focus on this phenomenon is the ecological importance of soil. Given that the new agricultural techniques make production more efficient and possible in different

environments, the agricultural soil remains the main source of food production for humanity. The idea of reducing its extension is a growing insanity, especially in the geographical areas such as Italy where it's products quality is recognized worldwide.

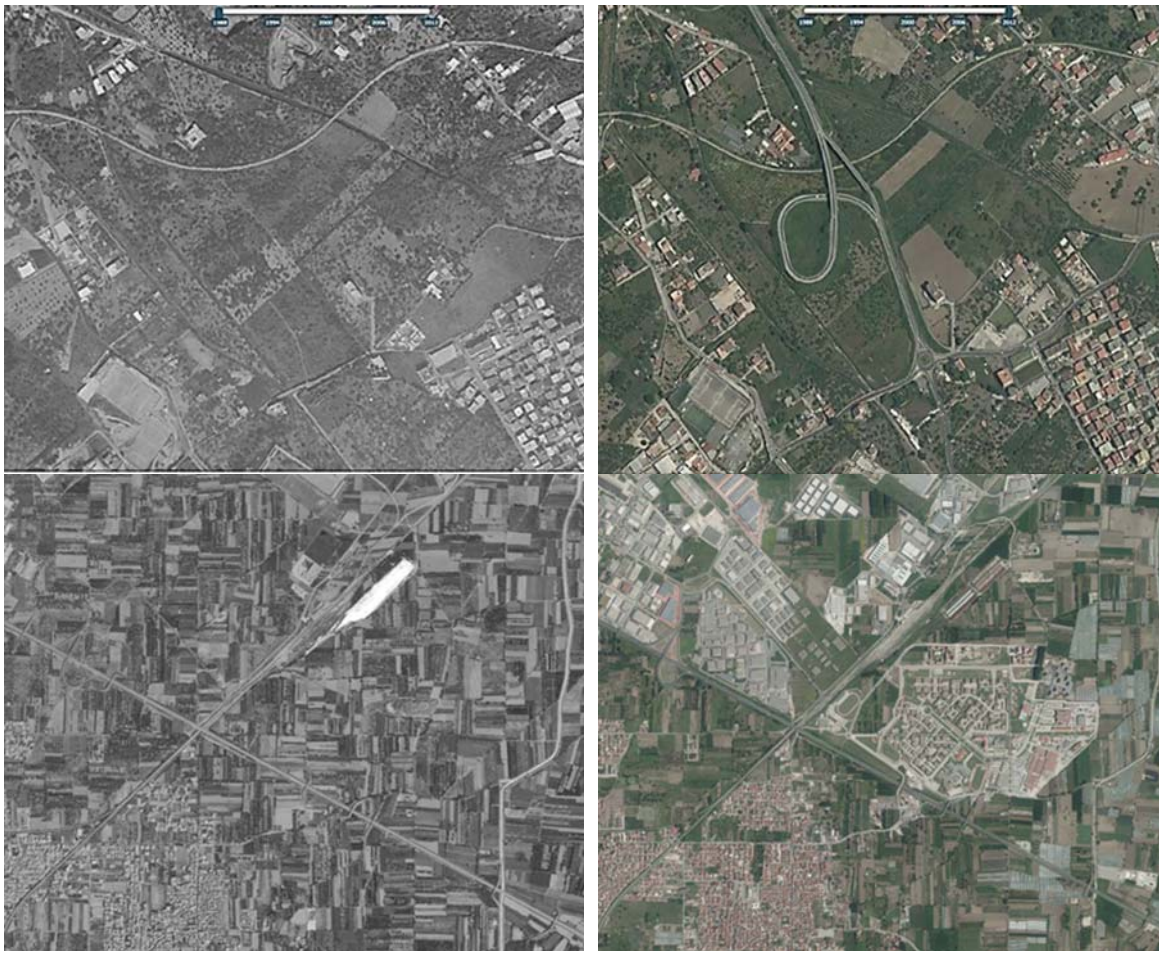

Chart 4 (a) Farming land between Cercola, Pollena Trocchia and Massa di Somma. (b) Farming area between Aversa, Caivano and Marcianise. Images 1988-2012. Source: Rete Natura 2000 (2015)

In 2014, ISPRA has presented its first Report on the consumption of land in Italy, updated with the 2015 edition. In this last edition, ISPRA has made accessible to the regions, municipalities and provinces a system of open access data, referred to 2012. The following analyzes have been created based on data from ISPRA 2015. Graph 2 defines the different kinds of areas in which the two categories of built-up and not built-up areas are collocated. These two categories are analyzed in general with different geographical scales by the Rapporto ISPRA without the report being in the dimensional specification of the subtypes. The study of ISPRA 2015 explains all the methodological indications given here from granted.

The first data shows the percentage of built-up land on the total. In order, Campania results as the third Italian region with an incidence of 8,33% preceded only by Lombardia and Veneto.

Some preliminary remarks. The kind of development of the two northern regions is due to the economic growth of the last decades. The urban expansion is closely related to the economic expansion and to the production of incomes. In Campania, this process barely exists. It can be so said that the urban development partially results from economics having as main drive other kinds of powers and practices not legal. The element that increases the phenomenon's seriousness is that this process has involved the most productive areas once known as the Campania Felix.

BUILT-UP LAND	NOT BUILT-UP LAND
* Buildings, Sheds	* Trees or shrubs in urban areas
* Asphalted roads	* Trees or shrubs in farming land
* Dirt roads	* Trees or shrubs in natural areas
* Squares, parking places, yards and other paved or dirt areas	* Areas for planting
	* Meadows, grass vegetation
* Train stations and railway site	* Water plants
* Airports and ports (only decks, runways and waterproof areas)	* Riverbeds
	* Wetlands
* Waterproof sport tracks	* Rocks, soil, sand, dunes
* Permanent greenhouses	* Glaciers and areas with permanent snow
* Photovoltaic ground fields	* Non waterproof sports areas
* Not renaturalised extractive areas, dumps	* Non waterproof urban areas
* Other waterproof areas	* Non waterproof farming areas
	* Non waterproof natural areas

Graph 2 Classification used to evaluate the use of land (ISPRA, 2015)

The data shown in Graph 3 helps to create an indication on the ratio between resident population up to the 1st of January 2015 and the built-up area, which is the number of residents on every square kilometer of built-up land (Chart 5 and Graph 3). We can observe that the values are very variable among each other, going from a minimum of 2.346 of Friuli-Venezia Giulia to a maximum value of 5.353 of Lazio, while the average is around 3.000.

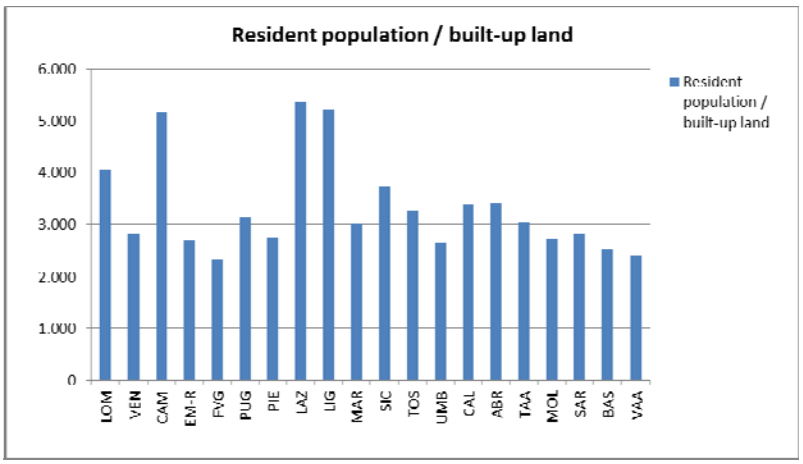

Chart 5 Resident population for every unit of built-up land calculated by the authors

We could say that this ratio is an indicator of the efficiency of the territorial management system, in the sense that when it grows the density in the used land grows too. The ratio can also be considered as a value of incidence of the spread of the population on the built-up area and as a possible indicator of the urban sprawl.
If we consider an analysis of the consumption of land between 1956 and 2015 and we reclassify the regions in terms of the percentage increase of land use, the ranking changes completely (Graph 4 and Chart 6). In the period 1956-2015 the region which has had the greatest "acceleration" in the consumption of land is Lazio, that passed from 1,86 to 6,39, with an increase of 243%. Second place is Emilia Romagna with an increase of over 200%. Campania is at the 14th place, with an increase of 85%, another interesting fact is that urbanization has been present in the region from ancient times making Naples, a century ago, one of the most populated cities in the world. In 1956 only the region Lombardia had more built-up areas than Campania (4,49 for Campania against 4,86 for Lombardia).

REGION	BUILT-UP LAND [KM2]	NOT BUILT-UP LAND [KM2]	NOT CLASSIFIED AREAS [KM2]	BUILT-UP LAND [%]	RESIDENT POPULATION (2015 ISTAT)	RES. POP. / BUILT-UP LAND (AUT)
Lombardia	2.464,17	21.254,68	144,26	10,39	10.002.615	4.059,23
Veneto	1.744,11	16.582,36	80,39	9,52	4.927.596	2.825,27
Campania	1.135,95	12.508,60	26,05	8,33	5.861.529	5.160,04
Emilia-Romagna	1.642,17	20.777,26	32,78	7,32	4.450.508	2.710,13
Friuli Venezia Giulia	523,10	7.306,82	32,24	6,68	1.227.122	2.345,88
Puglia	1.302,52	18.238,00	0,00	6,67	4.090.105	3.140,15
Piemonte	1.608,49	23.135,93	642,29	6,50	4.423.467	2.750,08
Lazio	1.100,68	16.123,93	7,23	6,39	5.892.425	5.353,45
Liguria	304,58	5.031,64	79,92	5,71	1.583.263	5.198,23
Marche	513,71	8.883,29	4,19	5,47	1.550.796	3.018,84
Sicilia	1.369,18	24.310,93	151,91	5,33	5.092.080	3.719,06
Toscana	1.156,12	21.802,56	27,91	5,04	3.752.654	3.245,90
Umbria	336,96	8.125,52	1,64	3,98	894.762	2.655,38
Calabria	583,52	14.507,35	130,74	3,87	1.976.631	3.387,42
Abruzzo	390,27	10.389,58	51,64	3,62	1.331.574	3.411,89
Trentino-Alto Adige	348,18	12.899,95	356,59	2,63	1.055.934	3.032,71
Molise	115,16	4.312,84	32,44	2,60	313.348	2.721,04
Sardegna	590,27	23.467,50	41,99	2,45	1.663.286	2.817,86
Basilicata	228,55	9.843,26	1,30	2,27	576.619	2.522,91
Valle D'Aosta	53,58	3.197,46	9,81	1,65	128.298	2.394,37

Graph 3 Built-up and not built-up land of all Italian regions, in total and percentage. Columns 2-5 are by ISPRA 2015 (data 2012). Column 6 is by ISTAT 2015. Column 7 is a derived calculation by the authors

REGION	BUILT-UP LAND [%] 1956	BUILT-UP LAND [%] 1989	BUILT-UP LAND [%] 2012	CHANGE 1956-2015 [%] (AUTHORS)
Lazio	1,86	5,43	6,39	242,76
Emilia-Romagna	2,39	6,67	7,32	205,87
Sicilia	2,08	5,49	5,33	155,80
Veneto	3,90	6,07	9,52	144,11
Umbria	1,69	3,42	3,98	135,08
Abruzzo	1,62	3,51	3,62	123,28
Friuli Venezia Giulia	2,99	5,35	6,68	123,10
Toscana	2,28	4,60	5,04	120,70
Piemonte	3,04	5,36	6,50	113,93
Lombardia	4,86	7,91	10,39	113,84
Liguria	2,76	5,12	5,71	106,86
Marche	2,73	4,83	5,47	99,92
Puglia	3,42	6,24	6,67	94,84
Campania	4,49	7,12	8,33	85,59
Trentino-Alto Adige	1,49	2,10	2,63	76,90
Calabria	2,37	3,93	3,87	63,30
Sardegna	1,66	2,63	2,45	47,45
Molise	2,01	2,91	2,60	29,39
Basilicata	2,25	2,96	2,27	0,94
Valle D'Aosta	1,71	2,39	1,65	-3,62

Graph 4 Share of built-up land referring to the calculations of 1956, 1989 and share of variation of built-up land between 1956 and 2012. Columns 2 and 3 by Rete di monitoraggio del consumo di suolo, ISPRA 2015. Column 4 by ISPRA 2015. Column 5 calculation by authors

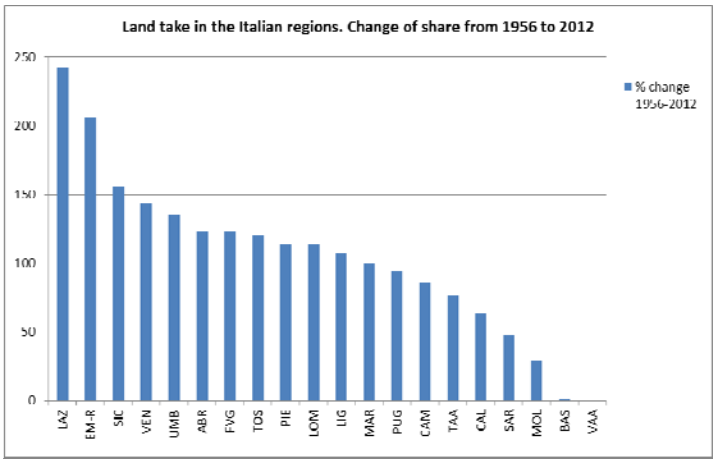

Chart 6 Share of variation of built-up land between 1956 and 2012. Calculation by authors

3.2 THE REGION CAMPANIA AND IT'S PROVINCES

Campania is affected by a number of disorders due mostly to the distribution of the population. There are more explanations for these disorders such as morphological causes: a belt of coastal plains is a counterpoint to an internal land mostly composed by hills, with a relevant presence of mountain systems. All of these considerations can be found in the data on the land take phenomenon in these areas.

Graph 5 underlines the importance of this process in Naples' province, both in percentage (29,51%) and absolute values. High values are present both in Caserta's districts (8,03) and in Salerno (6,53). Relevant values have been found also in the provinces of Avellino (5,47) and Benevento (5,22), comparable to the national average.

PROVINCE	BUILT-UP LAND [HA]	NOT BUILT-UP LAND [HA]	NOT CLASSIFIED AREAS [HA]	BUILT-UP LAND [%]	NOT BUILT-UP LAND [%]	NOT CLASSIFIED AREAS [%]
Napoli	34.793,90	83.099,87	0,00	29,51	70,49	0,00
Caserta	21.234,99	243.193,00	699,64	8,03	91,97	0,26
Salerno	31.429,70	463.489,73	485,68	6,35	93,65	0,10
Avellino	15.341,20	265.239,85	15,42	5,47	94,53	0,01
Benevento	10.794,92	195.837,80	1.404,22	5,22	94,78	0,67

Graph 5 Total and share of Built-up land in the provinces of the region Campania. Ordered by the share of built-up land. Data related to 2012 by ISPRA 2015.

PROVINCE	BUILT-UP LAND [KM2]	RESIDENT POPULATION (2015, ISTAT)	RESIDENT POP. / BUILT-UP LAND (AUTHOR)
Napoli	347,94	3.118.149	8.962
Caserta	212,35	924.592	4.354
Salerno	314,30	1.108.509	3.527
Avellino	153,41	427.936	2.789
Benevento	107,95	282.321	2.615

Graph 6 Resident population by unit of built-up land in the provinces of Campania. Column 2 by ISPRA 2015. Column 3 by ISTAT 2015. Column 4 by authors

In general, the province of Naples is affected by the largest amount of built-up land, followed by the province of Salerno, which values are really close to those registered by Naples. The vast extension of this region helps reduce the share values. If the same indicator used for the regions is applied to the Neapolitan

provinces (resident population/ built-up land) the variability arises (Graph 6). It is to keep in mind that the regional values were already higher than the national average which affects the provinces' values, especially that of Naples. Even Caserta and Salerno have values higher than the national average while Avellino and Benevento have lower values.

Looking to municipal data, Graph 7 shows the distribution and the trend of the share of built-up land for the districts in Campania (551). The chart shows the deep difference between the highest value (Casavatore 85,35%) and the lowest (Valle dell'Angelo 0,41%).

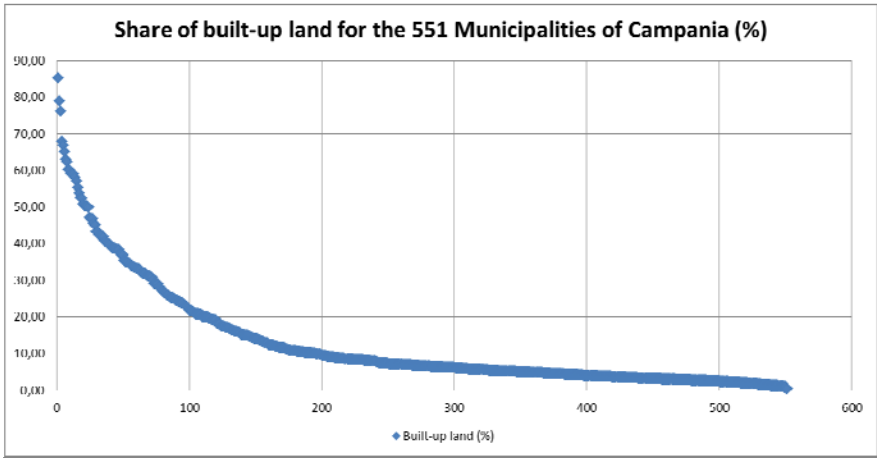

Chart 7 Distribution of the trend of land use in percentage for the Campania's 551 municipalities

PROVINCE	MAX BUILT-UP LAND [%]	MIN BUILT-UP LAND [%]	MAX – MIN DIFFERENCE (AUTHORS)
Avellino	26,52	1,18	25,34
Benevento	17,00	1,16	15,84
Caserta	60,02	1,27	58,75
Napoli	85,35	6,40	78,95
Salerno	39,67	0,41	39,26

Graph 7 Maximum and minimum share of built-up land in the municipalities of Campania and their difference. Data by province. Column 2 and 3 by ISPRA 2015. Column 4 by authors

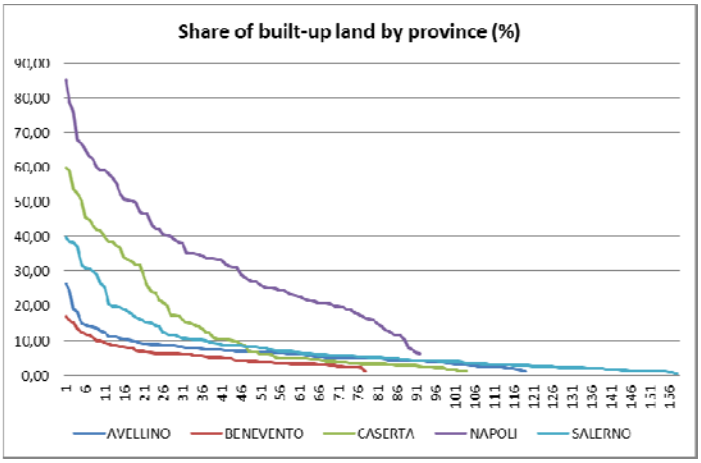

Chart 8 Distribution of share of built-up land in the municipalities of the five provinces of Campania

The distribution of the built-up land sees the districts from the province of Naples and Caserta in the first places, those of Avellino and Benevento at the end (on a national classification the first 15 places belong for

11 to the province of Naples and other 2 to the province of Caserta). The province of Salerno is in the middle with a wider extension.
Furthermore, Graph 7 shows how the distribution of built-up land has its greatest variability between the provinces of Naples and Caserta while it is more stable in those of Avellino and Benevento. Chart 8 represents the graph of distribution for each province.

4 LAND TAKE IN THE METROPOLITAN AREA OF NAPLES. THE "RESIDUAL LAND"

In a recent publication, Papa & Mazzeo (2014) have underlined the changes in the territorial system of the metropolitan area of Naples. The research analysed the evolution of the resident population from the late 1800's to 2001 in the districts belonging to the suburbs around Naples. The paper assumes an area that contains all the municipalities of the Naples' province, with the addition of a number of municipalities belonging to the provinces of Caserta and Salerno. This choice was not an attempt to define a new urban boundary, but the answer to the need of defining a territory in which to deeply analyse the urbanization process. Moreover, this wider extension includes areas with strong functional relations with Naples. For the opposite reason, we think that a boundary matching with the Province of Naples is highly reductive.
For these reasons the spatial analysis reported in the study starts by choosing a study area consistent with the physical and functional characteristics of the Neapolitan conurbation but without any actual relapse in administrative terms. It is a space that includes 142 Municipalities belonging to the provinces of Naples, Caserta, and Salerno (Chart 9). These municipalities were assigned to five belts roughly concentric, with Naples at the core pole. The correspondence of the 142 Municipalities to the 6 areas (1 core and 5 belts) is made according to the criterion of the geographical proximity. Starting from Naples (core 0), belt 1 contains the closest Municipalities, and so on up to the fifth belt formed by the insular municipalities of the Naples Gulf and by the farthest localities of the Sorrentina Peninsula.
To analyze this territorial system, the database has been enriched with elements contained in the database from ISPRA 2015 and updated to the population up to 2015 and with the data from the agricultural census of 2010. Graph 8 shows the summary of the land use values for each belt, in percentage and absolute value, and the data relating to the ratio between resident population and built-up land.

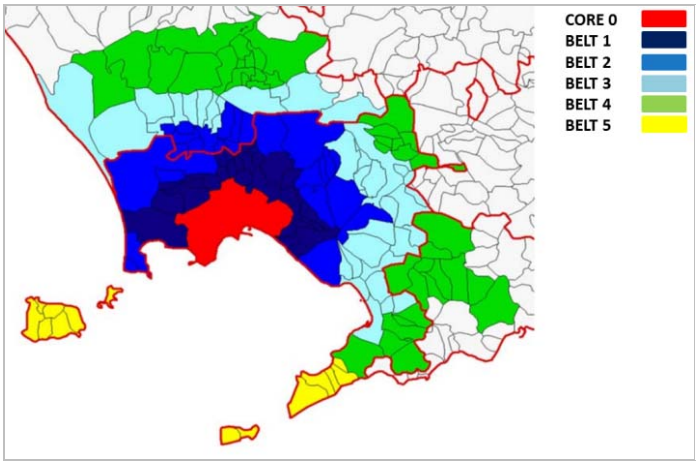

Chart 9 Metropolitan area of Naples studied by Papa & Mazzeo, 2014

A first consideration that can be made refers to the fact that going from Naples towards the outer suburbs the value of built-up area diminishes, with a growth in the 5th belt. The interpretation of the use of land in absolute values is completely different and obviously determined but the territorial characteristics of each belt.

	LAND AREA [HA] (ISTAT)	POPULATION 2015 (ISTAT)	BUILT-UP LAND 2012 [HA] (ISPRA 2015)	BUILT-UP LAND 2012 [%] (ISPRA 2015)	RESIDENTIAL POP. / BUILT-UP LAND [AB/HA] (AUTHORS)
Core 0 (1)	11.727	978.399	6.783,42	57,84	144,23
Belt 1 (27)	21.376	919.357	8.968,31	41,96	102,51
Belt 2 (25)	39.116	719.812	10.034,43	25,65	71,73
Belt 3 (35)	56.180	643.616	12.491,58	22,23	51,52
Belt 4 (40)	65.730	677.022	11.188,14	17,02	60,51
Belt 5 (14)	10.408	149.871	2.491,02	23,93	60,16
Metro Area	**204.537**	**4.088.077**	**51.956,90**	**25,40**	**78,68**
Campania	1.367.095	5.861.529	113.595,00	8,33	51,60
Italia	30.134.000	60.794.612	1.751.127,00	5,81	40,40

Graph 8 Metropolitan area of Naples in the organization analyzed by Papa & Mazzeo, 2014. Columns 2 and 3 by ISTAT. Columns 4 and 5 by ISPRA 2015 (data 2012). Column 6 by authors

The cross-reading of the values confirms the phenomenon of urban sprawl that has occurred in the plain of the region Campania, especially in the belts from 1 to 4 and it confirms that this phenomenon has occurred with a decrease in the population's density which is typical of urban sprawl. There is, in fact, a flow from 144,23 inhabitants for each acre of used land in the central area to 51,5 in belt 3 and 60 in belt 4 and 5. Graph 9 indicates the values of the total of farming land in 1982 and 2010 calculating the difference between the two years in percentage. It is important to underline the loss of farming land in these 28 years, going from 37% in belt 4 to 67% in belt 1. The average of the loss of farming land was 44,34% with the highest values in belt 2, 5 and 1. Again it is pointed out how the loss of farming area is higher in the central belts rather than the ones outer in the suburbs with the exception of belt 5, which has its own characteristics. It is in fact composed by municipalities with a high touristic affluence so the loss of farming area is due to the development of touristic activities more than the closeness to the city of Naples.

	TOTAL FARMING AREA 1982 (Ha) (ISTAT)	TOTAL FARMING AREA 2010 (Ha) (ISTAT)	FARMING AREA CHANGE 2010-1982 (%)
Core 0 (1)	2.319,69	1.063,69	-54,15
Belt 1 (27)	9.797,85	3.214,61	-67,19
Belt 2 (25)	24.639,71	12.847,07	-47,86
Belt 3 (35)	31.873,55	19.215,86	-39,71
Belt 4 (40)	40.178,74	25.218,67	-37,23
Belt 5 (14)	5.133,08	1.865,86	-63,65
Metro Area	**113.942,62**	**63.425,76**	**-44,34**

Graph 9 Metropolitan area of Naples in the organization analyzed by Papa & Mazzeo, 2014. Trend of the total farming area 1982-2010. Columns 2 and 3 by ISTAT 2010. Column 4 by authors

At this point, it can be interesting to combine both the data from ISPRA and that of ISTAT starting from the following characterizing data:

- the value of land area, which is an official value;
- the value of built-up land, referred to 2012 but published by ISPRA in 2015;
- the value of farming land, as certified in the Agricultural Census of ISTAT (2010).

The mathematical combination of these three indicators creates a fourth indicator which can be referred to as "Residual Land", calculated by subtracting the amount of farming land (ISTAT, 2010) and the urbanized land (data 2012, ISPRA, 2015) to the total land area.

Two methodological issues are important to be underlined. The first one relates to the difference between the years the data was taken (2012/2010) even if they are close, it can so be hypothesized that the two time periods can be related in the same formula. The second and the maybe more important issue is the fact that the data comes from two different sources that might have used different methods to achieve it. Chart 10 illustrates graphically the process while Graph 10 shows the results obtained for each belt.

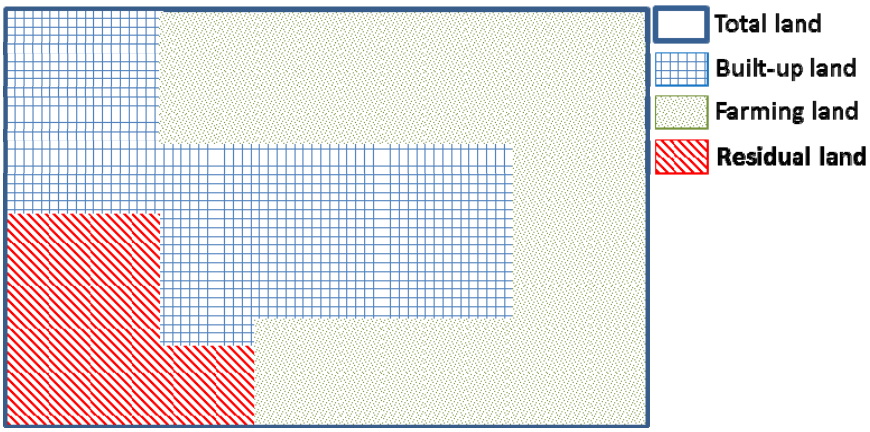

Chart 10 Residual land as difference of built-up land and farming land

The category of the residual land is of great interest and there are many possible considerations that can be made on it. It includes different kinds of land such as completely unavailable lands (constrained areas, regional or national parks, areas with an hydrogeological constrained) or areas with a major availability and areas that have been completely abandoned waiting for a new employment which would be more remunerative. Graph 11 shows the different not built-up area categories by ISPRA 2015 and their division in the two categories of farming land and residual land. The division is the same shown in Graph 2.

	(A) TOTAL LAND AREA (HA)	(B) BUILT-UP LAND, ISPRA (2012, HA)	(C) FARMING LAND, ISTAT (2010, HA)	RESIDUAL LAND, AUTHORS (RL=A-B-C, HA)	RESIDUAL LAND, AUTHORS (RL, %)
Core 0 (1)	11.727,00	6.783,42	1.063,69	3.879,89	33,09
Belt 1 (27)	21.376,00	8.968,31	3.214,61	9.193,08	43,01
Belt 2 (25)	39.116,00	10.034,43	12.847,07	16.234,50	41,50
Belt 3 (35)	56.180,00	12.491,58	19.215,86	24.472,56	43,56
Belt 4 (40)	65.730,00	11.188,14	25.218,67	29.323,19	38,37
Belt 5 (14)	10.408,00	2.491,02	1.865,86	6.051,13	58,14
Metro Area	204.537,00	51.956,90	63.425,76	89.154,34	43,59

Graph 10 Metropolitan area of Naples in the organization analyzed by Papa & Mazzeo, 2014. Absolute and per cent values of Residual land. Columns 2 by ISTAT. Column 3 by ISPRA 2015. Column 4 by ISTAT 2010. Column 5 and 6 by authors

The table 11 is built on the finding that in the category of non-built areas are classified a number of areas between them very different. Some of them fall into the category of agricultural land, while others can be classified as Residual Lands. Furthermore, it is evident how the Residual Lands may also be divided into two categories in relation to the environmental significance which they are constituted: the higher this significance, the higher the level of protection which must be subjected.

The interest in the residual areas is that the size of the areas of this category is relevant. The metropolitan area is composed by 90.000 hectares that are part of this category, with the percentage of almost 50% in

the central nucleus (0) and in the outer belts. The need of an in-depth analysis is clear to improve the knowledge on the characteristics of this category, defining precisely the number of subcategories that compose it and their extension. This analysis can also be considered as a major proof of the sizes considered: the sum of each category has to result in the value of the total land area. This means that if the sum results in less than the total then some parts have been left out while if it results as a higher number than the territory this would mean that some parts have been counted more than once, being this hypothesis more realistic than the other.

NOT BUILT-UP LANDS (ISPRA, 2015)	FARMING LANDS	RESIDUAL LANDS	ENVIRONMENTAL SIGNIFICANCE OF THE RESIDUAL LANDS
Trees or shrubs in urban areas	=	**SI**	**Medium-low**
Trees or shrubs in farming land	SI	**=**	
Trees or shrubs in natural areas	=	**SI**	**High**
Areas for planting	SI	**=**	
Meadows, grass vegetation	SI	**=**	
Water plants	=	**SI**	**High**
Riverbeds	=	**SI**	**High**
Wetlands	=	**SI**	**High**
Rocks, soil, sand, dunes	=	**SI**	**High**
Glaciers and areas with permanent snow	=	**SI**	**High**
Non waterproof sports areas	=	**SI**	**Low**
Non waterproof urban areas	=	**SI**	**Medium**
Non waterproof farming areas	SI	**=**	
Non waterproof natural areas	=	**SI**	**High**

Graph 11 Not built-up land kinds by ISPRA, 2015 and their differentiation in farming land and residual land

In this analysis, a special thought has to be done on the farming land. The paper has considered these areas as a specific category, based on the importance this land has and the fundamental necessity that none of it must be lost. On the other hand, the trend from 1982-2010 shows a constant reduction of farming soil which seems to still occur (Di Marco, 2010). The farming land has in fact suffered from relevant loss in absolute value, reducing its extension of 90% in some areas as it is considered being economically less important and the easiest to be transformed. As to this an intervention to protect and a reclassification of the farming land is imminent.

If you observe the data it is clear that the reduction of the agricultural area is not due only to its transformation in built-up area. A part of it, indeed, is transformed back into the natural or seminatural land (Arcidiacono, 2011). This is due to a long period of agricultural crisis, as it continuously lost employees and produced less. This resulted in the abandonment of the production sites and in their slow transformation into natural areas or building areas. This phenomenon is relevant especially in the internal areas of the Appennini. Other than some appositions to the limitations of farming land use, a second possibility would return the land to agriculture working on the opportunities the "farm to table" offers as these areas are close to big urban systems. This possibility depends on the size of the land that will be re-naturalize (from which comes the possibility to create urban gardens other than more extended farms), but it mainly depends from the willing of sponsors to invest on agriculture so to increase its occupational power.

In conclusion, the area considered "farming area" is not free from waterproofing that are easily noticeable with ISPRA's optical techniques. This means that a number of these territories have been classified by ISPRA as used land while ISTAT classified them as farming land. More details can be reached if we consider not only the farming land but farming land actually used.

5 CONCLUSION

This paper has analyzed the phenomenon of land take in the metropolitan area of Naples underlining how the extension of the phenomenon, already high in the rest of the country, tends to multiply in the area analyzed, both for historical (urbanization started long ago) and social reasons (the construction of building both legal and illegal is a basis of the local economy). This leads to the absence of reliable tools for urban and territorial planning.

The first part of the paper has introduced the concept of land use finding its negative aspects regarding biological, economic and social balance. This phenomenon exists because of the little consideration given to the natural land and to the complex processes it takes part to.

The analyses have underlined the areas with a major value of land use focusing on the metropolitan area of Naples. This area encloses many kinds of areas all negatively impacted by land use. These kinds would be agricultural area which is of high quality, incredible landscape, and a high life quality in the metropolitan area that has incredibly diminished.

The third part has underlined an interesting data that needs to be analyzed more in depth. The difference between farming land and built-up land results in an area of residual land of great extension with many different characteristics and that could represent the area where the phenomenon of land consumption most occurs. For this reason, Graph 10 shows a first hypothesis of critical issues in residual lands. This analysis hypotheses levels of critical issues based on the higher or lower risk that the area considered can be used again. This was of thinking needs an insight as there is a difference between a land's classification and the laws that regulate its transformation into something else. We could create two different layers if we wanted to classify different areas for their potentialities and the effective transformations that can be done. Layer 1 would be made by all the transformations allowed by the laws and by classification rules which are established by complex political and technical compromises. On the other hand, Layer 2 would be made up of all the transformations really done on the territory which have followed or not the rules present in Layer 1. Layer 1 and Layer 2 together can tell us details about how much of the land use is truly legal and the level of respect for the territory. This shows how important the union of the two layers is and how useful cutting down on layer 1 would be to prevent future land consumption.

In regards of national and regional territories, the paper has pointed out an already known detail: the continuous loss of agricultural land both in absolute and percentage and the need of containment so to prevent a future transformation of these areas in urbanized land.

Regarding already built-up land, it is useful to find parts of it that can realistically be qualified and where new buildings can be edified without using more land.

In conclusion, the importance of the phenomenon of land take has reached a terrifying peak in the metropolitan area of Naples. For this reason, it is important not to lose any more natural and agricultural land, but without precluding the possibility of a turn of trend where there can be a renaturalization of big portions of land.

Notes

Although the paper grounds on a common research work, paragraph 2 has been written by L. Russo, paragraph 3 by G. Mazzeo and paragraphs 1, 4 and 5 have been written by G. Mazzeo & L. Russo.

REFERENCES

Antrop, M. (2004), Landscape Change and Urbanization Process in Europe. *Landscape and Urban Planning*, 67, 9-26.

Arcidiacono, A. (2011). Consumo di suolo. Il suolo, bene comune e risorsa finita. Limitare il consumo e governare l'uso.

In P. Properzi (Ed.), *Rapporto dal territorio 2010*. Roma: INU Edizioni. 243-249.

Artmann, M. (2014). Institutional efficiency of urban soil sealing management–From raising awareness to better implementation of sustainable development in Germany. *Landscape and urban Planning*, *131*, 83-95. DOI:10.1016/j.landurbplan.2014.07.015.

Artmann, M. (2015). Managing urban soil sealing in Munich and Leipzig (Germany) - From a wicked problem to clumsy solutions. *Land Use Policy*, *46*, 21-37. DOI:10.1016/j.landusepol.2015.02.004.

Berdini, P. (2009). Il consumo di suolo in Italia: 1995-2006. *Democrazia E Diritto*. 1, 60-73.

Di Marco, M. (2010). Cosa succede al territorio dell'agricoltura. In P. Properzi (Ed.), *Rapporto dal Territorio 2010*, Roma: INU Edizioni. 251-256.

EC - European Commission (2006). *Thematic Strategy for Soil Protection*. Communication (COM(2006)231).

EC - European Commission (2011). *A resource-efficient Europe - Flagship initiative under the Europe 2020 Strategy*, Communication (COM(2011)21).

EEA - European Environment Agency (2015), *Land take*. http://www.eea.europa.eu/data-and-maps/indicators/land-take. Access 07/11/2015.

Ewing, R. (1997). Is Los Angeles-style sprawl desirable?. *Journal of the American Planning Association*, 63(1), 107-126. DOI:10.1080/01944369708975728.

Gibelli, M.C., Salzano, E. & Baioni M. (2006). *No sprawl: perché è necessario controllare la dispersione urbana e il consumo di suolo*. Firenze: Alinea.

ISPRA (2015). *Il consumo di suolo in Italia. Edizione 2015*. Rapporto 218. Roma: ISPRA.

ISTAT (2010). *Censimento dell'agricoltura*. www.istat.it.

ISTAT (2015). *Popolazione residente al 31 dicembre 2014*. Datawarehouse. www.istat.it.

Mazzeo, G. (2009). Dall'area metropolitana allo sprawl urbano: la disarticolazione del territorio. *Tema. Journal of Land Use, Mobility and Environment*, 2(4), 7-20. DOI: 10.6092/1970-9870/100.

Mazzeo, G. (2010). Remarks from the evolution of the urban system of Naples. Atti della Sesta Conferenza Nazionale INPUT 2010, Potenza, 13-15 settembre 2010. In G. Las Casas, P. Pontrandolfi, B. Murgante (Eds.), *Informatica e Pianificazione Urbana e Territoriale*. Melfi: Libria Editore. Vol. 3, 103-116.

Mazzeo, G. (2012). Scenario Analysis: Toward a Change in the Use of the Soil Consumption Paradigm. *TeMA, Journal of Land Use, Mobility and Environment*, 5(1), 21-32. DOI: 10.6092/1970-9870/746.

Munafò, M., Salvati, L., & Zitti, M. (2013). Estimating soil sealing rate at national level - Italy as a case study. *Ecological indicators*, *26*, 137-140. DOI:10.1016/j.ecolind.2012.11.001.

Munafò, M. (2013), "Il consumo di suolo in Italia", *Urbanistica Informazioni*, XXXXI-247, 19-21.

Ombuen, S. (2013), Rendita urbana, consumo di suolo, globalizzazione finanziaria. *Urbanistica Informazioni*, XXXXI-247, 24-25.

Papa, R., Mazzeo, G. (2014). Characteristics of sprawl in the Naples Metropolitan Area. Indications for Controlling and Monitoring Urban Transformations. ICCSA 2014, 14th International Conference, Guimarães, Portugal, June 30 - July 3, 2014, Proceedings, Part II. B. Murgante, S. Misra, A. Rocha, C. Torre, J. Rocha, M. Falcão, D. Taniar, B. Apduhan, O. Gervasi, (Eds.). *Lecture Notes in Computer Science*, 8580, 520-531. Springer International Publishing Switzerland. DOI: 10.1007/978-3-319-09129-7_38.

Pileri, P. (2009). "Consumo di suolo, consumo di futuro". *Urbanistica*, 138, 81-117.

Rete Natura 2000 (2015). http://www.pcn.minambiente.it/viewer/index.php?project=natura. Access 20/11/2015.

Russo, L. (2014). The Effectiveness of Planning Regulation to Curb Urban Sprawl. The Case of Striano (NA). *Tema. Journal of Land Use, Mobility and Environment,* 7(1), 101-114. DOI: 10.6092/1970-9870/2280.

Zoppi, C., & Lai, S. (2014). Land-taking processes: An interpretive study concerning an Italian region. *Land Use Policy*,

36, 369-380. . DOI:10.1016/j.landusepol.2013.09.011.

Zullo, F., Paolinelli, G., Fiordigigli, V., Fiorini, L., Romano, B. (2015). Urban development in Tuscany. Land uptake and landscapes changes. *Tema. Journal of Land Use, Mobility and Environment*, 8(2), 183-202. DOI: 10.6092/1970-9870/2864.

IMAGE SOURCES

Paper main image: by Giuseppe Mazzeo, all rights reserved. Chart 1-10: by Authors.

AUTHOR'S PROFILE

Giuseppe Mazzeo

Researcher at the National Research Council (CNR), Institute of Studies on the Mediterranean Societies in Naples. Adjunct Professor of "Environmental Impact Assessment" at the Faculty of Science and Technology, Parthenope University of Naples, and of "Urban Planning Technique" at the Faculty of Engineering, University of Naples Federico II. It carries out research activity at the Department of Civil, Architectural and Environmental Engineering (DICEA, University of Naples Federico II) in urban and operative planning, strategic environmental assessment, and urban regeneration.

Laura Russo

Engineer, Ph.D. student in Civil Systems Engineering at University of Naples Federico II. She received a master's degree in Architecture and Building Engineering with a thesis on urban expansion and the sprawl phenomena, with particular attention for Campania.