Land Use Policy 36 (2014) 369–380

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Land-taking processes: An interpretive study concerning an Italian region

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ARTICLE INFO

Article history:
Received 30 April 2013
Received in revised form 9 September 2013
Accepted 12 September 2013

Keywords:
Land take
Regional planning
Tobit models

ABSTRACT

Land take is a process of significant relevance in the countries of European Union (EU).

Land take is the "Change of the amount of agriculture, forest and other semi-natural and natural land taken by urban and other artificial land development" (European Environment Agency, 2013a).

In 2011, the European Commission (EC) put in evidence that an important milestone for the EU should be to reach the goal of no net land take by 2050, and to take under strict control the impact on landtaking processes of the EU policies in the new Structural Funds programming period (2014–2020) (Communication of the EC to the European Parliament COM(2011) 571 of 20.9.2011).

In this paper we analyze the Sardinian land-taking process as related to factors which are identified as relevant variables in several studies concerning land take, such as area size, accessibility, proximity to regional and local cities and small settlements, natural risk, proximity to nature conservation areas.

Introduction

According to European Environment Agency (2013a), land take is the "Change of 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 EC indicates that land take in the EU amounted to more than 1000 km^2 per year between 1990 and 2000, decreasing to about 920 km^2 between 2000 and 2006 (European Commission, 2011), and that, as a consequence, the objective of no net land take by 2050 would imply a decrease rate of about 800 km^2 per year.

Land take in Italy parallels the difficult general situation of EU countries. Figures at the national level put in evidence that in 2009 a 7.3% of the Italian land had an artificial land cover (European Commission, EUROSTAT, 2010), with an average growth rate of about 6% between 1990 and 2000 and of about 3% between 2000 and 2006 (ISPRA, 2011, p. 479). The implementation of analyses of land-taking processes at the regional level is problematic since currently available geographic databases and information systems do not provide systemic information on the phenomenon (CRCS, 2012).

However, some Italian regional administrations, such as Lombardy and Sardinia, have set up regional information systems that address land-taking processes. The geographic information systems of these regions allow to relate land take with spatial, economic and planning-policy related variables, and to infer on correlations between such variables and the land-taking phenomenon.

We study the land-taking process through the land cover maps of Sardinia, made available in 2003 and 2008 by the Sardinian regional administration.[2] The results and inferences of our study could be easily generalized to other Italian and EU regions, under the necessary condition that geographic databases and maps were available for these contexts as well.

This paper is organized as follows. In the second section we propose the definition of land take for the purpose of this paper. We feel that we have to clarify what we mean by land take, which is a rather controversial issue. In the following section, we discuss the set of variables that we use as covariates to frame the Sardinian land-taking process in the context of relevant studies concerning this topic. Explanatory and dependent variables are described and

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[2] The 1:25,000 "Land Use Map of the Region of Sardinia – 2003 Edition" and "New Land Use Map of the Region of Sardinia – 2008 Edition" are actually two land cover maps that cover the whole island. Data were obtained mainly from photo-interpretation of aerial photographs, satellite images, and orthoimages, but other vector data sets (e.g. regional digital cartography) were also used, together with on-site surveys. The maps' minimum mapping unit (Longley et al., 2001, p. 151) equals 0.5 ha in urban areas and 0.75 ha in rural areas. Both maps can be freely downloaded from http://www.sardegnageoportale.it/index.php?xsl=1598&s=141401&v=2&c=8831&t=1 (accessed 05.09.13).

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http://dx.doi.org/10.1016/j.landusepol.2013.09.011

spatially represented in the fourth section, and correlations between covariates and the dependent (land take) variable discussed.

The fifth section presents the results of regression models which use the land take variable and covariates in order to analyze if, and to what extent, the land-taking process is related to the covariates altogether. In the concluding section, we discuss the influence of the factors/variables found relevant on land take that could be taken into account to define regional planning policies to limit or possibly prevent land take, and, by doing so, help implementing the EC recommendation on no net land take by 2050 into EU regional policies.

What is land take?

As we stated in the introduction, land take is a process of change of natural and semi-natural land taken by residential, industrial, infrastructure, service and other development. Moreover, we put in evidence that the EC considers to reach no net land take by 2050 as an important milestone for a roadmap to a resource-efficient Europe.

One of the most dangerous consequences of land take is soil sealing, but other related phenomena are soil contamination and erosion, decrease of soil organic content and of agricultural production and productivity. In a recent study published by the Italian Institute of Urban and Regional Planning (CRCS, 2012), a systematic discussion on the impacts of land-taking processes is proposed; such impacts are grouped as follows:

- impacts on the carbon cycle: a decline of the power of the soil's organic content to fix carbon dioxide in the atmosphere and an increase in concentration of carbon dioxide generated by the mineralization of the carbon present in the excavated soil of new urban developments;
- impacts on the water cycle and microclimate: soil sealing implies: (i) a significant decline of stored ground- and underground water; (ii) an increased flood risk due to the rising quantity of rainfalls which run directly into rivers, augmenting their levels, turbulence, and sediments in the water; (iii) impacts on urban microclimate, since the decrease of the soil evapotranspiration power may very possibly generate an increase in atmospheric temperature;
- impacts on biodiversity: land-taking processes cause the soil's impoverishment and, as a consequence, the loss of huge quantities of microorganisms, which could mitigate soil contamination, filter percolation waters and make nutrients available for vegetation and pastures;
- impacts on agricultural production: potential agricultural crops are heavily and progressively hindered by land take and soil sealing.

However, if we read the relevant paragraph concerning land-taking processes of the EC communication quoted above (paragraph 4.6), it will be rather difficult to derive a rigorous definition of land take, which should be based on its unwanted impacts in order to effectively address and mitigate their consequences.

Let us consider, for example, the Land Use and Cover Areas frame Survey (LUCAS) of EUROSTAT (European Commission, EUROSTAT, 2010), and the COoRdination de l'INformation sur l'Environnement (CORINE) Land Cover vector map (CLC) of the European Environment Agency (EEA) of the EU (European Environment Agency, 2013b). In LUCAS, "artificial land", that is land taken by land-taking processes, is classified into two main groups, that is "built-up" and "non built-up" areas, where the former are further classified according to the number of floors of their buildings, while a separated sub-group is represented by greenhouses (Technical reference, document C-3 – Land use and Land Cover: Nomenclature, pp. 14–16). In CLC, "artificial surfaces" are classified into four groups (CORINE Land cover – Part 2: Nomenclature, p. 1): (i) urban fabric; (ii) industrial, commercial and transport units; (iii) mine, dump and construction sites; and, (iv) artificial, non-agricultural vegetated areas. Even though both LUCAS and CLC address the issue of artificial land cover, propose definitions of artificial vs. non-artificial land cover, and identify artificial and non-artificial areas, it is quite clear that CLC and LUCAS greatly differ from each other.

The above example shows that it is quite difficult and controversial to frame and identify a precise measure of land take, which in some way can make it difficult to implement rigorous quantitative studies on this subject. From this perspective, there are at least two relevant general issues to be taken into account. First, it is rather controversial to state univocally that land take is always negative in terms of the negative impacts indicated above, since there are types of land take which do not generate those impacts. For example, soil sealing, one of the most dangerous impacts, is not a necessary consequence of land-taking processes, as indicated by the EC, which puts in evidence that soil sealing is limited to about a 50% of the land taken: "In the EU, more than 1000 km^2 are subject to 'land take' every year for housing, industry, roads or recreational purposes. About half of this surface is actually 'sealed'." (EC COM(2011) 571, paragraph 4.6).

Second, there is the trade-off critique. This critique considers land take as a process caused by a strong pressure in favor of settlement development, which implies that the land taken will increase its market value once new land uses displace existing uses. So, why, in principle, existing uses should be preferred over the new ones? Moreover, is a prohibitionist, normative, approach the most efficient way to prevent the negative impacts of land-taking processes from taking place in the long run? Neo-liberist positions support this critique (see, for example: MacCallum, 2003; Moroni, 2007). From this point of view, heavy taxation on land rent could possibly be the most effective means to counter demand for land take, which is consistent with Henry George's proposal of eliminating land monopoly "by shifting all taxes from labor and the products of labor and concentrating them in one tax on the value of land." (George, 1971, p. viii).

In this paper we do not propose a judgment on the rightness or wrongness of land take, but we analyze land-taking processes in order to detect which factors, and possibly to what extent, can be considered relevant to explain the phenomenon. We implement our analysis with reference to the Sardinian region. Sardinia is located to the west of Central Italy, off the west coast just below the French island of Corsica. Sardinia has advanced land-cover maps based on the CLC classification, available for 2003 and 2008, that make it possible to analyze the dynamic of land cover through the comparison of land cover classes which are consistent with each other. So, we use the CLC-based maps of Sardinia to study land take processes, since the LUCAS data, available for 2008 only, would have not allowed us to study land take as a dynamic process.

In the CLC classification, non-artificial surfaces are classified into four classes (at Level 1): (i) agricultural areas; (ii) forests and semi-natural areas; (iii) wetlands; and, (iv) waterbodies. The land-taking process is identified in this study as the passage of areas from non artificial classes in 2003 to the artificial land-cover class in 2008. Sardinia has experienced an increase in artificial land from 2.75% in 2003 (66,206 ha) to 3.22% in 2008 (77,516 ha).

Table 1 shows the variables that describe non-artificial and artificial land cover and their descriptive statistics. The variables refer to spatial units identified with the 377 municipalities of Sardinia.