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Landscape Changes in Rural Areas: A Focus on Sardinian Territory

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Abstract: During the past decades the Italian rural landscape has undergone drastic alterations as a result of complex and contradictory transformation dynamics. This paper aims to investigate and evaluate these alterations in Sardinia, one of the most rural Italian regions. Land-use maps from different years were studied to identify the dominant rural landscape features of the region and the transformations they were subjected to over the course of time. The analysis investigates changes on three geographical scales: region, provinces, and "agrarian regions". An overall economic balance of landscape changes was calculated from the value ascribed to types of land use on the basis of the allowances (compensation for expropriation) provided by the local authorities (Provincial Commissions). This economic balance was considered in light of the regional policies which accompanied it. Results partially confirm the national and European general trend of loss of agricultural land when it is converted to new forms of exploitation. The analysis at different geographical scales has, in some cases, revealed data against the general trend, especially for some agricultural regions and for certain agricultural products. There is consistent with economic balance. This shows the need of a deep ex post evaluation of the effects of policies financed by regional and national community funds on the evolution of Sardinian landscapes.

Keywords: rural landscape; land-use maps; land economic value; agrarian regions; expost-evaluation

1. Introduction

In recent years, the landscape has acquired an increasingly important role in the discipline and practice of planning, following the emergence of the recognition of its the nature as a "public good", as an element that summarizes strategic aspects for the maintenance and development of territorial quality, and individual and collective well-being [1–3]. The awareness that landscapes provide a multitude of functions has generated a wide literature on "landscape services" and their management [4–6]. The purely aesthetic vision of the landscape, based on the concepts of beauty and uniqueness, has been superseded by the need to recognise the complexity and significance of a landscape and its social and natural environmental features. In particular, the European Convention on the Landscape of 2000 (ELC) [7] recognised the landscape as an essential component of the life of the people, an expression of the diversity of their cultural and natural heritage, and a foundation of their identity. It purposefully places landscape at the centre of disciplinary reflection and policy. According to the ELC the landscape, as a set of indivisible and mutually reinforcing natural and cultural elements that interact with each other, is worthy of protection in all its parts. This includes those landscapes considered "ordinary" or without "exceptional" character. Undoubtedly, the Convention has produced a new way of thinking and managing landscape in Europe and has heavily influenced the adoption of state regulations aimed at building protective tools focused on a functional and strategic design of landscape enhancement [8,9]. In this context there has been a flurry of studies, analyses, readings,

and interpretations of the landscape in order to identify and develop actions and plans able to achieve these goals [10].

If the traditional landscape preservation was associated with 'landscape mummification' [11], it is now a shared opinion that urban planning must focus on managing the future landscape rather than simply protecting the fabric of the past [12], pursuing an equilibrium between preservation and development.

Even if there has been a long debate on the definition of sustainability [13–16], since it is a very general concept, most agree that the landscape could be preserved by its sustainable use, intended as the ability to manage the dynamic balance between development and environmental protection. Many criteria for design and construction become well defined, but what makes for sustainable maintenances practices is less clear [17]. If it is true that the apparent paradox between landscape preservation and development can be solved by a sustainable approach, this approach is not easily implemented in practical work, especially because it is not possible to give a universal formula.

The achievement of sustainability goals depends on the quality of the activated policies and methods of their application. The coherence between planning theory and good practices must be guaranteed first of all through the knowledge of local, as well as national and global, processes.

Following agreement between the Ministry of Heritage and Culture and the Regions, and more recently, the Code of Cultural Heritage and Landscape, several initiatives along these lines were also started in Italy. De Montis [18] has recently observed that Italy has a moderately good performance with respect to the release of landscape plans which comply with the ELC, via the Code. Using the principles of sustainable development as their foundation, the landscape plans of "third generation" (following the entry in force of the "Urbani Code") are the most visible outcome of this logic, and have focused attention on one of the most sensitive aspects of the maintenance of the landscape: the need to counter the current trend of homogenisation, or even extinction, of landscapes [19]. In spite of the proliferation of the landscape in territorial policies, the rural dimension has often been left on the sidelines of the debate, even though it covers almost all of the national territory and, through a number of processes in place, the most sensitive and vulnerable Italian landscape [20,21]. At present, there is still a strong prevalence in the political-cultural debate for issues such as the structure of the coasts or the urban dimension, but the key to the future of many areas lies in the capacity of administrations and planners to implement actions for a sustainable and shared rural landscape project [22,23].

The current problems of rural landscape, are explained by the easing of the harmonic relationship between community-territory-economy and cultural practices that formed the historic landscape. On the one hand, a series of phenomena (contamination, separation between places, people and manufacturers, etc.) makes it exponentially more difficult to recognise the connections and rootedness of territorial communities and their two-way relationship with lands and landscapes. On the other hand, a range of processes (the explosion of the city beyond traditional boundaries, the difficulties facing the primary sector, the de-population of rural areas, and the emergence of intensive models associated with high levels of mechanization in production) call the landscape's survival into question [24,25]. Focusing attention on the rural landscape became important especially in those territories with a special vocation for the agro-livestock [21,26]. Leaving aside the different definitions of rural landscape that can be given [27–32], it emerged on multiple fronts the need to understand, locally, as the rural landscape is changing and what ties exist between changes and the policies adopted. It becomes strategic to become aware of the changes taking place to understand the trends that are underway and to better manage them or, if necessary, counter them in the future. Although various studies have dealt with different points of view, the theme of the rural landscape has yet to be taken as a key economic aspect [33].

Some studies have debated the impact of changes in demand for agricultural products and agrarian production structure on landscape quality from a macro-economic perspective focusing on changes in the agricultural sector, or from a local perspective, by analysing recent changes in

landscapes for small case studies [34]. However, in what report are the transformations of the rural landscape and the economic values of its component parts?

Determining the value of agricultural land is, in itself, a rather complex field of analysis [35,36]. It has been studied for a long time by various authors, and it is still the subject of investigation and analysis [37,38]. Nevertheless, the data for this kind of information is very difficult to find. Whereas there is a widespread presence of lists with the prices of urban property values, similar information concerning the value of farmland is greatly lacking, or even entirely absent [39]. Except for analysis related to specific research activities, the only "structured" sources on this topic existing at the time in Italy are the RICA (Italian farm accounting network), the INEA (National Institute of Agricultural Economics) survey on the land market, and the so-called "average agricultural values" (VAM) to which this study refers. Variations in land values are undoubtedly a manifestation of appreciation of the land on the market; following their dynamics could be useful to understand which territories are most exposed to a possible change in land use [40–42].

This paper presents a local study on changes in land use in Sardinia at different scales: region, province, and "agrarian region", and calculates an overall economic balance of landscape changes using VAM. The work aims to analyse the rural landscape changes and their connection to economic values in order to contribute an effective land use policy formulation for a better-informed decision-making and management of the rural landscape.

The Context of the Study

Sardinia is the second largest island in the Mediterranean Sea (approximately 24,000 km^2). It is one of the most rural regions within Italy. Although there is no uniformity of views on the definition of the concept of rurality at different scales or across the disciplines, different analysis models applied to the island are consistent in affirming the predominant rural feature of the region, which undoubtedly has a long agri-pastoral tradition [43–45]. However, the crisis in the primary sector and the emergence of tourism as a new economy in which to invest, had a great influence in altering the character of that rurality. In recent years, the Regional Administration of Sardinia has proved one of the regions most active in landscape protection, and was the pioneer in Italy in adopting the first landscape plan consistent with the "Codice Urbani", that is the act (No. 42/2004) that received the principles of the ELC into the Italian legal framework [46]. Less attention, however, has been given to the rural dimension that remained in the background, and only now is the region mobilizing to address it. In any case, a framework of the current alterations and their economic balance is lacking. This, and the recent regional activities following the extension of the Regional Landscape Plan (PPR) to the inland areas, led to this type of analysis being deemed useful.

2. Materials and Methods

The geographic analysis is based on data from the CORINE (COoRdination of INformation on the Environment) Land Cover (CLC) created after the adoption of Decision 85/338/EEC by the Council of European Community. The data are freely available on the portal of the Network of the National Environmental Information System (SINAnet) of the Institute for the Environment Protection (ISPRA) [47]. The first CLC project elaboration was performed in 1990, which was updated in 2000, 2006, and most recently in 2012. The European CLC project information on land use has 44 classifications of items organized in three hierarchical levels. States and regions can decide to conduct further analysis up to level 4 or higher.

The analysis presented in this paper is based on a comparison of the geographic information recorded during 2000, 2006, and 2012. The geographical information obtained in shape file format was analysed using the open source software QGIS (QGIS.ORG , Switzerland). The change in the territorial extension of the categories of CLC measured in hectares (ha) was carried out at the regional and provincial level, considering the first class of the Corine model, and then performing a closer examination of the categories of the third class for the Agrarian Regions. The resulting data were

analysed on the basis of agricultural land values. These values were considered to be consistent with VAM at the provincial level, for homogeneous agrarian regions and types of crop, according to Law No. 865/1971 (known as "Law for Housing") and its subsequent modifications for the determination of compensation for expropriation. These values are determined annually by special committees on the basis of land values considered free from agricultural lease constraints and with reference to the crops actually cultivated in the area. They are based on the agricultural region. Even where VAM are not an obvious explanation of the market price, they can be reasonably used as a guide [48]. Their analysis is deemed useful in identifying the reasons behind certain local situations and spatial setups. Examples include the existence, or otherwise, of certain macro-crops in certain territories, or the degree of variability in the unit value of the same crops according to the types of breeding, farming systems, etc. [39]. Casini et al. [42] have shown that the determination of land values using VAMs is a critical operation if the aim is to find the precise value of a piece of land, but from a reading of the results, it clearly appeared that, observing the aggregate land values per farm or the values per hectare per municipality, possible errors tend to be irrelevant and the individual land values are perfectly congruent with the values expected.

To perform the economic analysis a link was sought between the classification items in the third Corine category and the Agricultural Regions classification legend. This analysis has identified six items as shown in the following table used for subsequent and more detailed geographical analysis (Table 1).

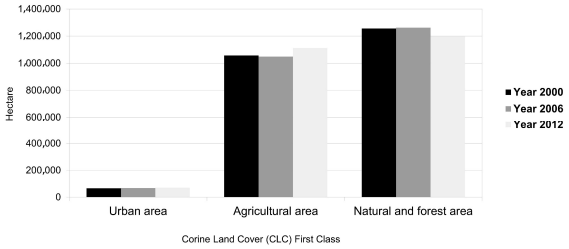
Table 1. Correspondences between CLC and RA categories (authors' elaboration).

Corine (CLC) Categories 1 Level	Corine (CLC) Categories 3 Level	Agrarian Region (RA) Categories
Agricultural areas	Non-irrigated arable land	Arable Land (ex seminative)
	Permanently irrigated land	Horticultural crops Irrigated sowable Reed
	Olive-grove	Olive-grove
	Fruit trees and berry plantations	Orchards
	Pasture	Pasture
	Agro-forestry areas	Pasture wooded
	Rice fields	Rice fields
	Vineyard	Vineyard
	Land principally occupied by agriculture, with significant areas of natural vegetation	Wooded sowable
Forest and semi natural areas	Coniferous forest	Coniferous forest
	Broad-leaved tree	Coppice
	Mixed forest	Mixed forest

3. Results and Discussion

The analysis on a regional scale using the Corine first class, confirms the agricultural and forestry vocations of the island. However, between 2006 and 2012 there was slight reduction in "forest areas" and a parallel increase in "agricultural areas". In all three periods, the data, in line with the general trend, indicates a steady and gradual expansion of artificial areas (Figure 1). These results are, in part, consistent with other studies such as the work of Falcucci et al. [49] on changes in land-use/land-cover patterns in Italy. Their results showed a national increase in forests, an increase in artificial areas, especially in coastal zones, and a decrease in pastures. Puddu et al. [50] considering four maps covering Sardinia and ranging from 1935 to 2007, measured an increase of the rate of forest changes. In other regions, a reduction of the agricultural surface, almost counterbalanced by an increase of natural land, was shown. This is as a widespread trend detected in different rural areas [51], as Statuto et al. have argued in their studies on the Basilicata region [52,53]. The founded expansion

of artificial areas is totally consistent with other results at the national level. Regarding this, several studies showed that the factors related to taking land (changing the amount of agriculture, forest, and other semi-natural and natural land by urban and other artificial development) are usually [54] location-related (size, slope, and distance from the closest marketplace, that is, the closest urban centre, accessibility), socio-economic elements (population density, per capita income), planning code determinants (urban tools rules, endowment of protected areas) [55,56], and pressure for future land development [57]. However, in the case of Sardinia, more than the increase of population and density and the distance from the coast is of particular importance since coastal land is demanded for future tourism development.



Class 1	Analysed Year		
	2000	2006	2012
	%	%	%
Urban Area	2.78	2.84	2.97
Agricultural area	44.23	43.94	46.57
Natural and forest area	52.55	52.90	50.13
Wetland	0.42	0.30	0.31

Figure 1. CLC variation in the Sardinia region (authors' elaboration).

The regional trend is also confirmed at the provincial level, but with a few differences between the four historic provinces, as shown in the following histograms (Figures 2 and 3). The provinces of Cagliari and Nuoro are characterized by the dominance of the forest areas. However, Nuoro shows a decline in forest areas and an increase in agricultural areas. The provinces of Sassari and Oristano, historically and morphologically suited to agriculture, confirm this feature with an increase in all three periods.

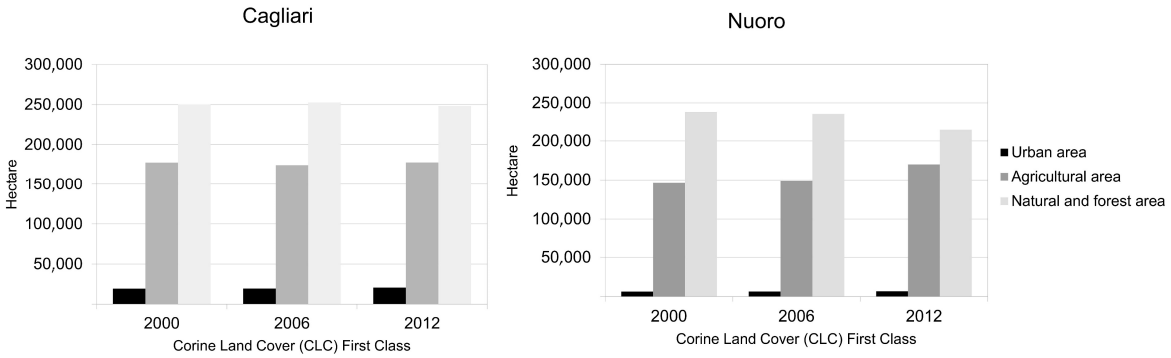


Figure 2. Trend of territorial transformation in Cagliari and Nuoro provinces (authors' elaboration).

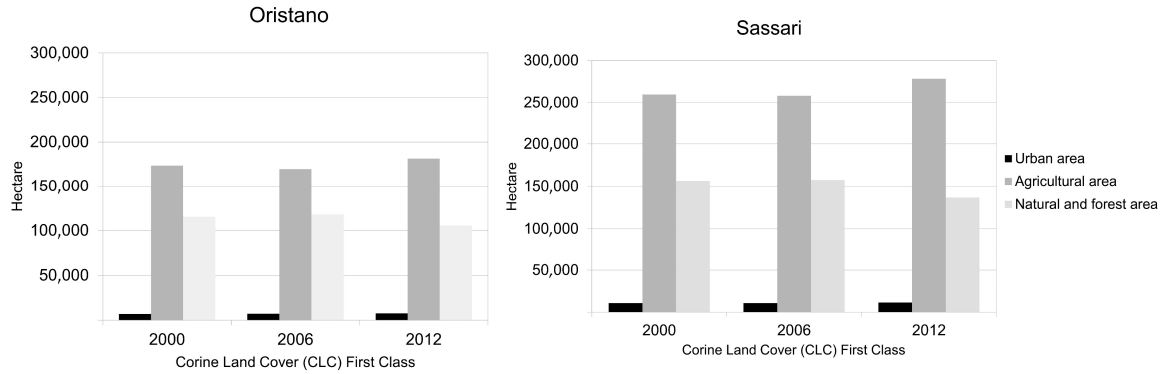
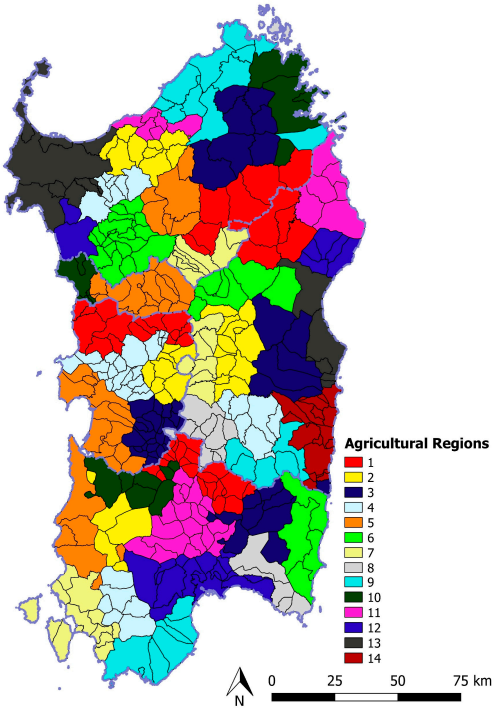


Figure 3. Trend of territorial transformation in Oristano and Sassari provinces (authors' elaboration).

The geographic analysis of Agrarian Regions (AR), considering only the six categories selected, continues to confirm the general trend previously exposed. Overall, the RA included in the provinces of Cagliari and Nuoro are dominated by forest cover (prevalently broad-leaved forest and mixed forests), while the RA of the provinces of Sassari and Oristano are, respectively, characterized by the cultivation of olive trees and rice fields. The analysis shows, however, the doubling of the wine and olive production in RA in the province of Cagliari. The major areas for the cultivation of olives are located in the RA13 of Prov. Sassari, more precisely in the municipality of Sassari, with over 6000 ha cultivated. Wine production is most developed in the province of Cagliari, with over 4500 ha of these located in RA 7 (2200 ha). The cultivation of rice, historically concentrated in the province of Oristano, is, again, confirmed by this study, with 4400 ha. Looking at the individual RA production, 2600 ha takes place in RA 5, in particular in the municipality of Oristano, which has 1900 ha. RA4 in the same province is equally important for rice cultivation, with approximately 1700 hectares. In this case based in the municipality of Simaxis, with 790 hectares. As previously noted, forested areas are concentrated in the mountain areas of the Nuoro Province in RA 2 and 3, with over 40,000 hectares. The affected areas correspond to the historical and geographical region of Barbagia.

About the economic balance it is to note that the Sardinian region is divided into 45 "agrarian regions" (AR), 12 of them fall within the Cagliari area, five within Oristano, 14 in the Nuoro, and 13 in Sassari (Figure 4). VAM are published yearly for each AR. However, currently complete VAM figures have only been published and consulted for the years 2005–2006–2007. In that time there has been an increase of about 5% of the value of land in all regions and for all crops, except in some cases, among which, in particular, include "reeds" in the region RA 11 in the area of Cagliari and "vineyard" in region RA 5 in the area of Oristano, respectively, with an increase and a decrease of more than 20% of the initial value (Figure 4).



Area	Agrarian Region (RA)	Crops	VAM Variation
Cagliari	4	Vineyard	−10.00%
Cagliari	11	Reed	+21.51%
Cagliari	7	Horticultural crops	0.00%
Cagliari	8	Horticultural crops	−1.82%
Cagliari	9	Horticultural crops	−10.81%
Cagliari	10	Horticultural crops	+6.18%
Cagliari	11	Horticultural crops	+7.71%
Cagliari	12	Horticultural crops	−12.04%
Cagliari	4	Wooded sowable	+9.56%
Cagliari	4	Wooded sowable	+13.00%
Oristano	5	Vineyard	−21.10%
Sassari	6	Mixed forest	+9.06%
Sassari	7	Mixed forest	+6.78%
Sassari	7	Olive grove	−4.52%

Figure 4. Agricultural region distribution in Sardinia and most relevant modifications (authors' elaboration).

By analysing the three years separately, a 5% increase emerges, occurring mainly between 2005 and 2006 for almost all crops in almost all ARs, while between 2006 and 2007 the values remained constant almost everywhere, with the exception of a few cases (Table 2).

Table 2. Corps which differ from a 5% increase (authors' elaboration).

Area	Corine Categories—3 Level	Crops	Agrarian Area RA	VAM Variation	Area	Corine Categories—3 Level	Crops	Agrarian Area RA	VAM Variation
2006					2007				
Cagliari	Permanently irrigated land	Irrigated sowable	5	+21.42%	Cagliari	Permanently irrigated land	Reed	11	+16.00%
		Horticultural crops	7	−4.76%				12	−4.74%
			8	−6.50%			Irrigated sowable	4	+12.98
			9	−15.60%				5	−13.53
			10	+1.13%		Vineyard	Vineyard	4	−10.00%
			11	+2.50%		Agriculture, with significant areas of natural vegetation	Wooded sowable	4	+9.56%
			12	−16.22%	Nuoro	Non-irrigated arable land	Arable Land	13	0.00%
Oristano	Vineyard	Vineyard	5	−24.85%				14	0.00%
Nuoro	Agro-forestry areas	Pasture wooded	4	+5.00%	Sassari	Mixed forest	Mixed forest	7	+10.44%
	Non-irrigated arable land	Arable Land	13	+5.00%		Olive-grove	Olive-grove	7	−4.52%
Sassari	Mixed forest	Mixed forest	1	−4.77%		Pasture	Pasture	6	+10.35%
			2	−4.75%		Agro-forestry areas	Pasture wooded	4	0.00%
			3	−4.76%					
			4	−13.36%					
			6	+3.86%					
			7	−3.32%					
	Coniferous forest	Tall trees wood	5	−1.53%					
	Pasture	Pasture	6	−4.85%					

The average values recorded for individual crops show that "citrus grove" has the highest agricultural value, followed by "horticultural crops" and "orchards" in all agrarian regions, while "uncultivated productive", "bush pasture", and "reeds" have the lowest scores. The measurement of changes in land use is reflected in terms of land values, in line with the UDS analysis, in a negative performance in all the areas only for the "mixed forest" (overall loss of about 13 million euro). The performance is positive for all other cases except for "vineyard" (less 9 million) although split unevenly between areas (+13 Sassari and 14 Cagliari, −22 Oristano and −36 Nuoro) and the "orchards" in Nuoro (less almost 2,000,000) (Table 3). Table 4 shows an extract of community VAM averages and the variance between the agrarian regions belonging to the same area (authors' elaboration). Table 4 shows the values of the VAM averages for the different crops and geographical areas, along with the variance between the agrarian regions belonging to the same area.

The influence between the increase and decrease in land use and landscape value is mutual. That is, one may affect the other in a positive or negative manner. It is not possible to define a certain and direct cause of the identified differences, since there is not only one reason for them. The underlying dynamics, in order to be correctly assessed, required detailed qualitative and quantitative studies of the features of the agrarian regions and the analysis of others elements.

Obviously, identifying a direct association between changes in land use and their inputs requires a broad vision and a detailed exploration of the different situations and local contexts, taking into account a number of factors not mentioned here, such as social capital [58,59], population characteristics, and demographic changes, and a reasoned comparison with trends in the rest of the Italian territory. Landscape certainly changes as a result of land use transformation. This process sometimes involves losses in the comprehensive financial balance of the territory, and sometimes earnings, as well. Obviously, this varies with the value of agricultural land-oriented business decisions. However, estimated economic value alone does not take into account the historical and cultural identity, aesthetic, or environmental significance of the landscape, one that considers the quality of the landscape ahead of its economic value. Land value is a necessary, even if not sufficient, element to know about landscape alterations. The economic aspect contributes to an understanding of landscape change and the landscape patterns that develop, even if does not fully explain it.

Table 3. Higher positive and negative budgets for land use and agrarian region (RA) (authors' elaboration).

Broad-Leaved Trees			**Mixed Forest**			**Orchard**		
2000–2006	2006–2012	2000–2012	2000–2006	2006–2012	2000–2012	2000–2006	2006–2012	2000–2012
Ca_RA12	Ss_RA3	Ss_RA3	Nu_RA12	Nu_RA5	Nu_RA12	Or_RA4	Ca_RA1	Or_RA4
7,385,493	10,304,460	10,516,898	580,658	394,870	656,080	13,289,764	699,986	13,511,520
Nu_RA5	Ca_RA10	Ca_RA5	Ca_RA6	Ca_RA12	Ca_RA12	x	Nu_RA5	Nu_RA5
−2,303,310	−3,414,362	−4,104,678	−3,358,267	−5,225,854	−5,246,740	x	−903,196	−903,19724
Rice Field			**Olive-Grove**			**Vineyard**		
2000–2006	2006–2012	2000–2012	2000–2006	2006–2012	2000–2012	2000–2006	2006–2012	2000–2012
Ca_RA10	Ca_RA11	Or_RA4	Or_RA1	Ca_RA2	Ca_RA2	Ss_RA10	Nu_RA14	Nu_RA14
736,656	1,938,955	2,428,141	881,599	36,620,655	36,178,937	2,328,564	10,255,746	10,256,048
Or_RA5	Or_RA4	Or_RA5	Or_RA4	Nu_RA10	Or_RA4	Ca_RA10	Nu_RA10	Nu_RA10
−750,173	−205,129	−551,019	−9,938,204	−754,348	−10,109,170	−1,484,347	−46,303,687	−46,303,687

Table 4. Community VAM averages (aver.) and variance (VAR) between the agrarian regions belonging to the same area (authors' elaboration).

Prov	Value	Citrus Grove			Wood of Tall Trees			Copse			Mixed Wood			Rushes		
		2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
Ca	aver.	36,500	38,324	38,324	4174	4383	4383	-	-	-	-	-	-	2596	2725	2705
	VAR	22,311,540	37,254,126	37,254,126	499,044	550,349	550,346	-	-	-	-	-	-	65,612	90,046	91,755
Or	aver	31,470	33,043	33,043	4002	4202	4202	3630	3811	3811	-	-	-	2445	2567	2567
	VAR	13,332,867	14,697,974	14,697,974	19,296	21,274	21,274	0	0	0	-	-	-	209,967	231,488	231,488
Nu	aver	24,273	25,486	25,486	4284	4476	4497	4022	4223	4223	3791.7143	3981	3981	1955	2053	2053
	VAR	22,534,009	24,845,240	24,845,240	61,920	69,926	68,237	18,816	20,745	20,745	104,164.57	114,955	114,955	0	0	0
Ss	aver	22,456	23,579	23,579	4000	4208	4200	3472	3646	3646	3212	3389	3304	-	-	-
	VAR	1,727,647	1,904,400	1,904,400	35,516	39,155	39,036	0	0	0	114,260	131,763	148,731	-	-	-

Prov	Value	Carrubeto			Chestnut			Orchard			Uncultivated			Almond Trees			Hazel Grove		
		2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
Ca	aver.	5846	6138	4802	-	-	-	19,195	20,154	19,789	1405	1475	1455	8270	8683	8721	8277	-	-
	VAR	815,364	899,140	5,810,940	-	-	-	9,246,195	9,992,577	9,992,577	81,680	109,311	109,311	2274,912	1,668,211	1,668,211	-	-	-
Or	aver.	-	-	-	5250	5512	5512	17,686	18,570	18,570	1400	1470	1470	8120	8526	8526	-	-	-
	VAR	-	-	-	-	-	-	18,661,030	20,575,116	20,575,116	0	0	0	1479200	1,638,818	1,630,818	-	-	-
Nu	aver.	-	-	-	5139	5396	5396	9850	10,343	10,343	1535	1612	1612	5997	6297	6297	8649	9082	9082
	VAR	-	-	-	334,738	368,766	368,766	4,559,595	5,026,820	50,268,207	3461	3766	3811	0	0	0	159,612	176,418	176,418
Ss	aver.	-	-	-	5331	5597	5597	14,341	1505	15,057	1588	1668	1668	-	-	-	-	-	-
	VAR	-	-	-	-	-	-	11,134,927	12,275,254	12,275,254	57,060	62,837	62,837	-	-	-	-	-	-

Prov	Value	Grove			Horticultural Crops			Irrigated Horticultural Crops			Pasture			Wooded Pasture		
		2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
Ca	aver.	-	-	-	12,222	12,832.667	12,832.667	18,811	19,492	18,776	3104	3276	3276	3460	3720	3720
	VAR	-	-	-	11,868,496	13,082,033	13,082,033	7,053,246	7,874,317	5,320,345	218,493	252,190	252,190	301,397	274,946	274,946
Or	aver.	-	-	-	12,390	13,009	13,009	16,608	17,438	17,438	3320	3486	3486	3638	3819	3819
	VAR	-	-	-	-	-	-	12,196,070	13,447,447	13,447,447	750	811	811	50,920	56,139	56,139
Nu	aver.	6422	6743	6743	11,653	12,236	12,236	12,910	13,556	13,556	3374	3543	3543	3476	3636	3650
	VAR	543,494	599,480	599,480	2,903,993	3,202,371	3,202,371	8,315,364	9,167,994	9,167,994	131,653	144,995	144,995	123,639	133,879	136,188
Ss	aver.	-	-	-	9664	10,147	10,147	14,277	19,994	19,994	3555	3746	3746	3296	3461	3461
	VAR	-	-	-	1,444,961	1,592,565	1,592,565	9,701,531	10,690,539	10,690,539	440,556	480,652.02	480,652	35,179	38,684	38,684

Table 4. *Cont.*

Prov	Value	Shrubs Covered Pasture			Rice Field			Sowable			Wooded Sowable			Irrigated Wooded Sowable		
		2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
Ca	aver.	1740	1826	1826	-	-	-	6245	6427	6427	6164.9167	6490.8333	6490.8333	9695	10,179	10,179
	VAR	10,966	11,015	11,015	-	-	-	5,004,503	5,217,119	5,217,775	3,518,901	3,824,951	3,824,951	1,454,287	1,603,504	1,603,504
Or	aver.	1942	2039	2039	16,730	17,566	17,566	5412	5682	5682	6074	6378	6378	12,550	13,177	13,177
	VAR	720	794	794	0	0	0	2,438,570	2,688,068	2,688,068	3,235,880	3,567,716	3,567,716	-	-	-
Nu	aver.	1892	1976	1987	-	-	-	4183	4358	4392	4979	5227	5227	-	-	-
	VAR	76,240	80,101	84,094	-	-	-	357,391	358,723	394,065	394,711	435,226	435,226	-	-	-
Ss	aver.	2033	2135	2135	-	-	-	5067	5320	5320	-	-	-	-	-	-
	VAR	85,698	94,330	94,330	-	-	-	572,962	631,266	631,085	-	-	-	-	-	-
Prov	**Value**	**Irrigated Sowable**			**Basin**			**Cork Forest**			**Olive Grove**			**Vineyard**		
		2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
Ca	aver.	12,624	13,167	13,323	10,994	-	-	-	12,212	12,822	12,646	-	-	13,494	14,169	13,676
	VAR	6,789,776	8,384,133	7,167,330	-	-	-	-	3,010,124	2,303,573	2,303,573	-	-	8,829,562	9,499,288	9,499,288
Or	aver.	13,595	13,908	14,222	-	-	-	4170	12,264	12,877	12,877	4378	4378	12,298	12,913	12,037
	VAR	5,042,891	5,558,800	5,610,760	-	-	-	-	280,630	309,475	309,475	-	-	7,100,570	7,829,288	1,359,753
Nu	aver.	7979	9480.125	9480.125	-	-	-	4274	10,416	10,937	10,937	4487	4487	116,03	12,183	12,183
	VAR	12,973,563	2,916,045	2,916,045	-	-	-	34,776	8,774,251	9,673,858	9,673,858	38,307	38,307	2,551,346	2,813,220	2,813,220
Ss	aver.	9018	9469	9469	-	-	-	4514	12,102	12,576	12,576	4793	4793	11,660	12,243	12,243
	VAR	1,877,423	2,069,429	2,069,429	-	-	-	131,550	2,144,293	2,841,023	2,841,023	144,913	144,913	4,311,261	4,752,628	4,752,628

The landscape is, by nature, a dynamic element that is constantly reshaped and transformed, mostly reversibly, by people. However, although this change is within the natural order of events, the way in which this is carried out gives completely differing results. Various studies have shown that the political measures intended to stimulate agricultural production methods which are compatible with environmental protection requirements do not seem to find an effective balance between production and consumption of the landscape [60,61]. In contrast, the agricultural and rural landscape is increasingly becoming an object of consumption designed to meet a growing demand. Zoppi et al. [62] showed evidence of a strong correlation between the stability/increase of agricultural land use and the ROP-EAGGF investment (Regional Operational Programme-European Agricultural Guidance and Guarantee Fund), even though its impact is quantitatively less important with respect to other physical, economic, and social characteristics concerning local development.

How can the protection of the existing rural landscape be ensured? How, too, can we protect the lifestyles that created these landscapes, yet, at the same time, stop the processes that have led to the deterioration of some rural areas? Obviously, there are important differences between states and regions, and between developed areas and underdeveloped areas where the high economic pressure heavily impacts land use. Building different paths needs specific studies of the local dynamics and their relationships with global processes. In Europe the rural development policy is based on the concept of multifunctionality to foster the development of alternative sources of income while preserving the environment [63]. In Italy some authors observed how landed mobility, access to land, and protection of soil are central issues in the debate concerning the lack of young people in agriculture, the problem of agricultural land consumption, the continuous loss of agricultural land due to abandonment, and the request for more sustainable agricultural production processes [64].

Indeed, an emerging concern of the new European Union CAP is an awareness of how it previously failed to protect different landscapes. Certainly the common agricultural policy has influenced, and influences, the value of land in member countries. General guidelines for economic and agrarian policy, in particular the system of aid and contributions to agricultural activity, which may take the form of tax relief, direct aid, or credit facilities [39], have a considerable importance in determining the value of land and, therefore, in the farmers choices [65,66]. At a general level, agriculture affects most rural landscapes, and when agriculture changes, landscapes change. In this sense farmers are the key agents concerning landscape management decisions and practices. Even if it is demonstrated that each farmer type shows a different relationship between landscape factors and land use changes [67], several authors highlighted that decisions made by farmers to develop agricultural land are often strongly influenced by economic opportunities [68,69]. For example, changes in the type of crop production or intensification of farming methods are often driven by changing economic returns [70]. That farmers are risk averse and profit maximisers is a shared opinion in the regions studied [71]. It is recognized by many that in the primary sector agricultural policies can influence, even in a decisive way, the economic performance of the farms [42] and that, in the absence of such policies, if a farm was not competitive on the market, it could cease the productive activity. In these cases the land, no longer cultivated, would be abandoned or subject to other use and, therefore, land would change from agricultural to non-agricultural. The so-called "set aside" EU regime (EEC Regulation 1272/88) aimed to control the overproduction of cereals and other crops in order to avoid an excessive reduction in agricultural prices, indicated by several authors as the cause of the progressive decrease of agricultural areas to the benefit of natural vegetation [52]. The literature on CAP highlighted the multiplicity of the effects of decoupling on farms choices: income effects, risk effects, incentives/disincentives to the cultivation of specific crops [72]. Peerlings et al. [73] found that small family farms would be forced to exit the agricultural sector if the CAP support was abolished.

Furthermore, policies for rural development or the environment have guided the local government, but in very differ manners from country to country. The CAP adopted in 2003 gave a large independence to the Member States about the choices for adapt the CAP to specific territorial realities (historical and hybrid models for the implementation of the Single Payment Scheme are an

example). The implementation of an environmental policy that took place due to Directives has been more subject to negotiation and influence by domestic stakeholders [74]. Furthermore, the European Convention on Landscape was implemented in different moments and with different tools within Member States. As demonstrated by De Montis ELC implementation has been influenced by historical national attitudes towards government and land planning [18]. All this has not always happened in a consistent way with the emergence of the concept of sustainable development and the protection and enhancement of the rural landscape. Promoting both the economic development and increasing production capacity of rural areas has often translated into actions which are indifferent to the features of the landscape. In Italy, despite full formal adherence to the ELC since 2000, the concrete actions to implement it only started relatively recently. Five years after the "Codice Urbani", the number of regions with a "third generation" landscape plan were still very few [18]. Additionally, Sardinia, despite having been the first Italian region to approve a landscape plan according to the new guidelines, did not address the issue of the transformation of rural landscape in a straightforward manner. Above all else, what emerges is the lack of an ex post evaluation designed to measure the effectiveness of policies and the practice effects on the territory.

The conservation of landscapes diversity requires actions at the global and local scale. Several authors highlight the importance of considering multiple spatial scales for landscape management (municipal, provincial, regional, national). When the response of farmers to certain policies is not taken into account, such policies often do not achieve the desired results. In addition, responses of farmers need to be aggregated, since policies are developed, implemented, and evaluated at a higher scale than the farm. At the regional scale, policy-makers may have different, and in some cases non-complementary, goals, such as economic development and environmental protection. Much has been written, for example, about the ELC and its implementation, on the local, national, and supranational level [75]. Several authors have highlighted the role of regions in the implementation of landscape policy [76]. They reveal that regions play a substantial role in contemporary Europe, since they have the necessary capability and infrastructure to work with the public, seek their opinions, and encourage involvement in the implementation of the ELC in a way that the state cannot. However, in accord with other studies, Lefebvre et al. [77] showed how the European CAP focuses quasi-exclusively on landscape management at the farm scale, with very limited attention to the other scales. Several studies argue that policy instruments could be refined for the CAP to better integrate the other scales in order to facilitate the coordination of farm actions and avoid the risk of homogenization and maintain diversity of agricultural landscapes at the EU level. Whereas the focus of the CAP is mostly restricted to the modification/conservation of practices at the farm level, we see a growing concern for landscape issues within the multi-functionality framework of the agricultural policy.

4. Conclusions

In spite of the continuous high risk of losing this important resource, the protection of the agricultural landscape is still a problem a long way from finding a solution. The analysis presented in this paper, in line with national data [47], confirmed the progressive expansion of artificial areas, the orientation of agriculture towards intensive forms of production, and high income in Sardinia. The regional trend is also confirmed at the provincial level, with a few differences between the four historic provinces and at the Agrarian Regions (RA) level.

The direct consequence of this trend could be the reduction of agricultural areas with high natural value and the loss of more balanced traditions and models of land management. It was demonstrated that, in Europe, land conversion from different land cover types to artificial surfaces takes place with continuing consumption of more productive areas from its land resources [78,79]. Often, distortions are also caused by inflexible or obsolete planning tools. In this way environmental policy should be aimed at both the prevention and mitigation of negative externalities which are often produced by economic policies at the European level, and also to produce positive effects, even if defined and

quantified indirectly. Effective protection firstly requires a change in how landscape resources are considered. Landscape cannot continue to be thought of as an impediment to economic development, but as an integral part of the capital base that characterizes an area. This approach leads to a view of landscape not as a conditional limit to change, but a resource that must be preserved and protected and, because of this, it should also be designed [57]. In economic terms, this approach means landscape conservation through landscape development, in the sense that a landscape can be preserved when it is produced by our economic processes.

Our work could also be applied in other contexts (even if entering different specific regional economic values). Although we think that this type of analysis needs to be accompanied by other assessments that allow the evaluation of information collected on the basis of the specific features of the contexts, we believe that it is a useful tool for increasing the knowledge necessary for manage the landscape and, specifically, for a greater awareness of the rural landscape status in Sardinia. Results represent a base for studying behaviours, choices, and transformations in order to guide the use of the territory by political decision-makers and planners. Future developments of this research will directed the deepening of the reasons for certain transformations by crossing this study with other aspects not analysed here.

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