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# UNIVERSITÀ DEGLI STUDI DI TORINO

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# **From rural to urban, landscape changes in NW-Italy over two centuries**

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## **ABSTRACT**

Landscape changes during the last two centuries were analysed comparing two rural areas of about 5000 ha at the interface between the Alps and the Po plain (NW- Italy). Two centuries ago the areas were both enclosed in a rural context. In the last decades one of the two (15 km from Torino) became mainly residential. The comparison has been performed using ancient cadastral maps focused on land use dating back to the eighteenth century (Napoleonic cadastre) and recent land use maps based on aerial photographs. The comparison highlights that changes of socio-economical frames determine different rural landscape dynamics in spite of geomorphologic similarities.

## **KEYWORDS**

Landscape changes, GIS, rural landscape, urbanization.

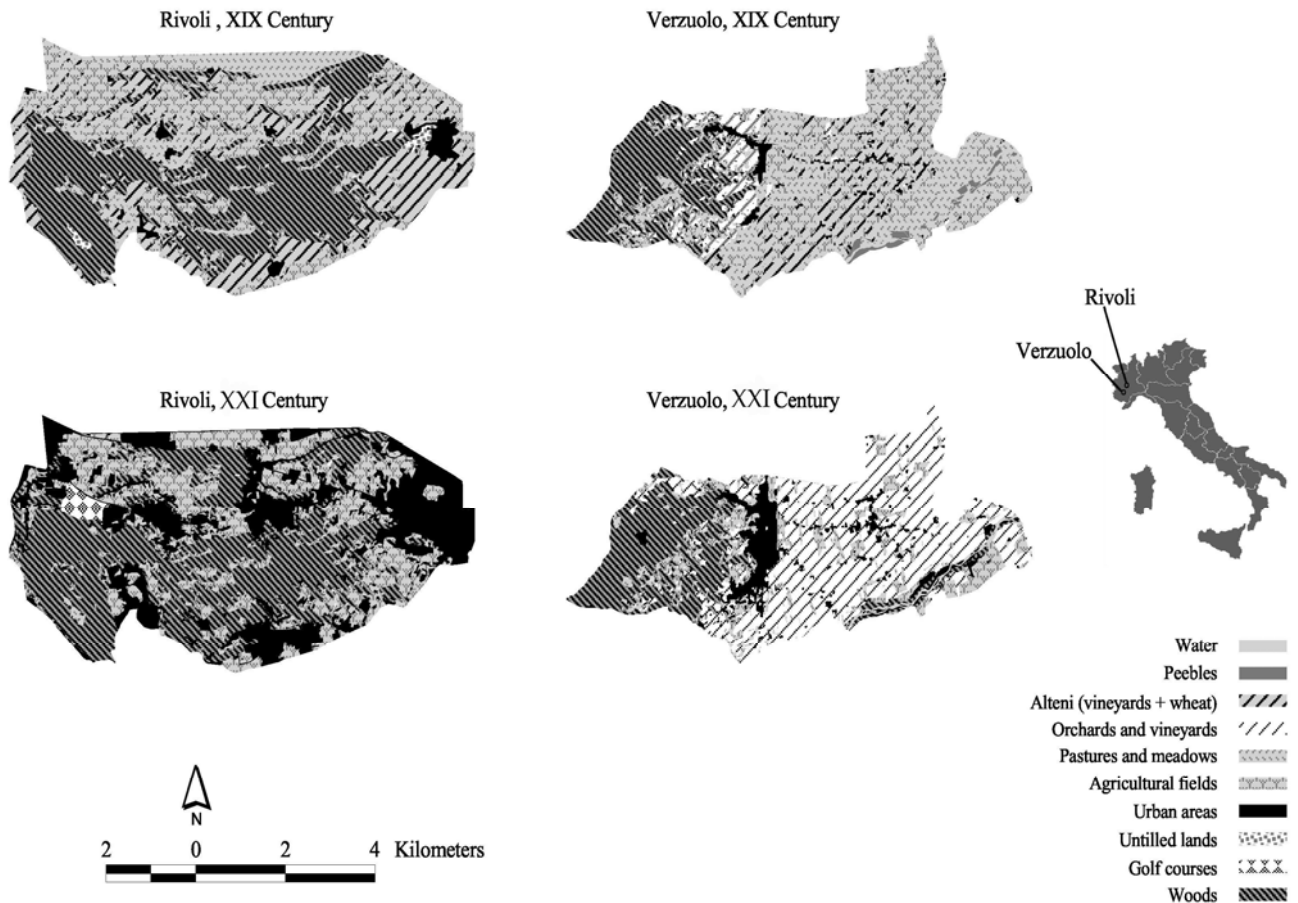
## **INTRODUCTION**

As well as in many other European countries, landscape changes in Northern Italy are mainly due to abandonment of rural marginal areas and to the expansion of urban centres. These two events are related to socio-economical changes that occurred mainly in the XIX century, and which resulted in a reorganization of the land in order to adapt its use and spatial structure to the changing social demands [1]. Usually the rapid transformation causes a loss in diversity, coherence and identity. This is one of the reasons why the European Landscape Convention expresses the opportunity of analysing changes over time to evaluate them and obtain information to be used to predict and optimise future landscape development [2]. The analysis is particularly useful in rural areas where cultural landscapes have been shaped by traditional, long lasting land-uses [3].

In this work we analysed two different cases of landscape changes over two centuries in rural areas close to the interface between the Alps and the Po plain (NW-Italy). The aims of this work are to highlight landscape dynamics over time, to quantify them with the use of statistical indices and to correlate the transformation to the different socio-economical frames.

## **MATERIALS AND METHODS**

The first area (Rivoli) is geomorphologically homogeneous, located on morainic hills, 15 km west from the city of Turin and the second one (Verzuolo) is partly in the plain and partly on the hills at the foot of the Alps, 50 Km south from Turin. The surface of both areas is about 4000-5000 ha. The comparison has been performed using ancient cadastral maps focused on land use and vegetation physiognomy dating back to the eighteenth century (Napoleonic cadastre) and recent land use maps based on aerial photographs (1996 and 2002). After georeferenciation and digitalization several maps have been derived with a GIS software using both raster and vector data highlighting the persistence of specific landscape elements. Patch density, Shannon and Simpson indexes and Landscape Shape index have been calculated using the software Fragstats [4].



**Figure 1:** Land use maps of Rivoli and Verzuolo in the XIX and in the XXI centuries.

## RESULTS AND DISCUSSION

The analysis of cadastral maps (XIX century) showed that two centuries ago the areas were both enclosed in a rural context (figg. 1 and 2); Rivoli area was characterized by the presence of vineyards (23%), cereal fields (28%) and prairies (10%); Verzuolo area was characterized vineyards (7%) and “alteni” (vines with cereals in the inter-rows) (13%), 30% cereal fields (30%) and prairies (17%). Broadleaves woods (chestnut and oaks) were abundant in both areas, with highest values (38%) in Rivoli area and lower values in the Verzuolo one (20%), just on the hills. The map shows a clear difference between the left part of the area which is characterised by hills and the right one which is located in the plain. Urban areas were 1-2% of the total area in both sites. Landscape changes in the Rivoli area have been mostly determined by urbanization that completely altered the identity of this rural area. Woods maintained their coverage (38%) while vineyards were almost completely transformed in urban areas that now are covering almost one third of the total surface. In the Verzuolo area, the abandonment of marginal areas of the hills and the fragmentation of the plain were major responsible of landscape dynamics. In this area the percentage of wood coverage remained at about 20%, while urban areas increased from 2 to 7 % of the total area. Landscape dynamics is documented by the transformation map (fig. 3) in which the persistence of woods and the development of urban areas on agricultural lands is spatially represented. The calculation of spatial indexes (tab. 1) leads to further considerations on landscape dynamics.

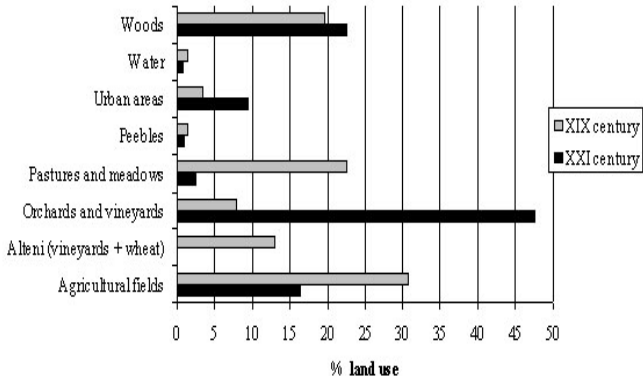
**Table 1:** Spatial indexes applied to the two areas. (PD: patch density; SHDI: Shannon Diversity Index; SIDI: Simpson’s index; LSI: Landscape Shape Index; PLAND: Percentage of Land. See [4].

	RIVOLI		VERZUOLO	
	1800	2000	1800	2000
<b>PD</b>	8.46	14.95	14.59	15.57
<b>SHDI</b>	1.42	1.35	1.31	1.40
<b>SIDI</b>	0.72	0.70	0.65	0.69
<i>Woods</i>				
<b>PD</b>	0.55	1.13	1.06	0.49
<b>LSI</b>	10.70	14.62	8.24	7.07
<b>PLAND</b>	38.70	36.79	19.72	20.61
<i>Urban areas</i>				
<b>PD</b>	0.33	5.27	3.75	4.70
<b>LSI</b>	4.80	16.67	10.33	11.33
<b>PLAND</b>	2.36	28.33	2.80	9.41
<i>Orchards and vineyards</i>				
<b>PD</b>	2.79	0.27	1.89	2.46
<b>LSI</b>	15.89	4.27	10.23	11.85
<b>PLAND</b>	22.56	0.12	7.10	47.51

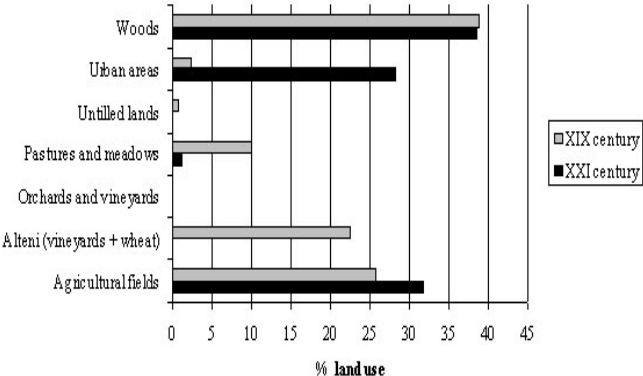
Patch density (PD) greatly increased in the Rivoli area over the two centuries, and showed no changes in the Verzuolo one. Patch density (PD), fragmentation (LSI) and the percentage of each category referred to different land use types highlighted great changes in Rivoli, with special reference to vineyards for all parameters, to fragmentation for woods, to patch density for urban areas. For the Verzuolo area, changes are mainly documented by an increase of orchards and urban areas. The most important cause of fragmentation is related to expansion of orchards (apples, pears and kiwi) replacing

cereals in the second part of the last century and to the increase of the road network. In spite of geomorphologic similarities this analysis could well represent how the changes of socio-economical frames could determine different rural landscape dynamics. This analysis may offer useful knowledge for sustainable planning and management for future changing landscapes.

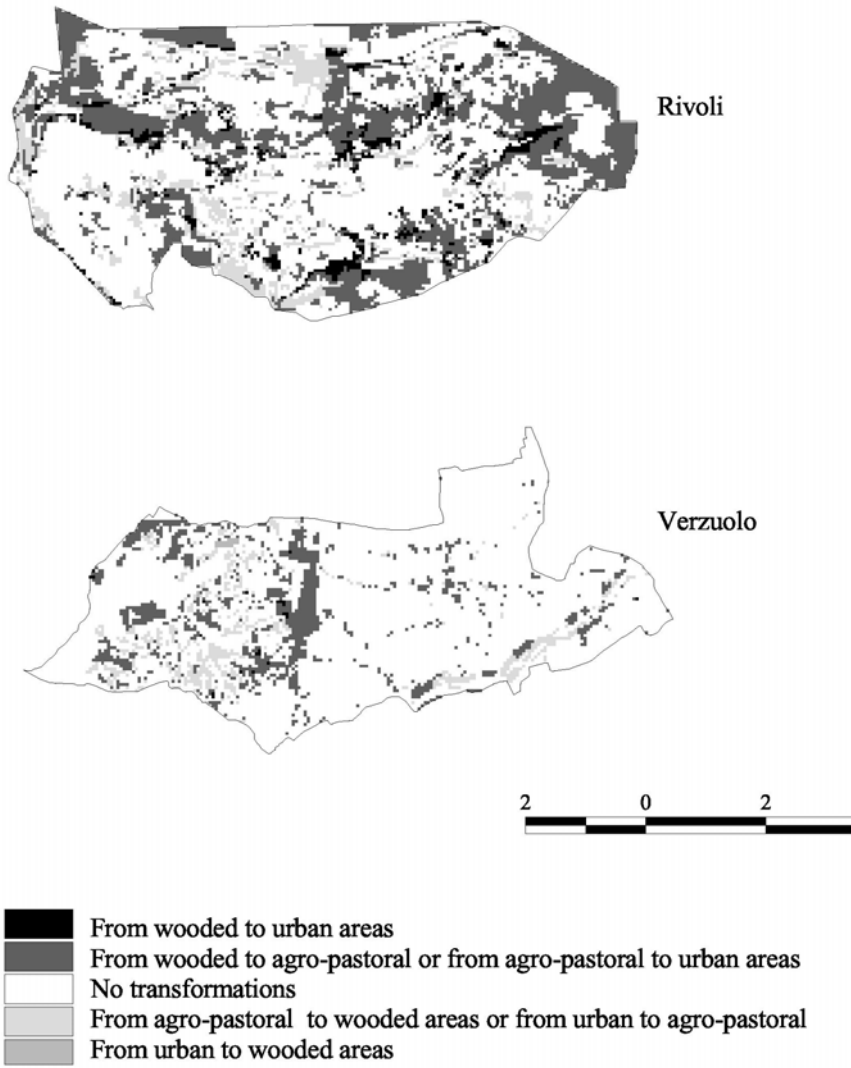
**Verzuolo**



**Rivoli**



**Figure 2:** Land use changes in Rivoli and in Verzuolo in the XIX and in the XXI century.



**Figure 3:** Transformation maps of the two study areas.

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