From the Grand Duchy to the dawn of the 21st century: Tuscany's demographic transition

Do Grão-Ducado ao alvorecer do século 21: transição demográfica na Toscana

https://doi.org/10.26512/rhh.v12i23.51866

Giancarlo Macchi Janica
Università di Siena
https://orcid.org/0000-0002-2311-7987
macchi@unisi.it

Massimiliano Grava
Università di Pisa
https://orcid.org/0000-0002-5050-5846
massimiliano.grava@unipi.it

Abstract

This paper explores the field of geo-demography and population history, with a focus on the case study of Tuscany. The study emphasizes the importance of understanding population changes within specific locations by using a geographical approach. By analyzing population distribution patterns, the document explains how spatial frameworks help interpret the significant features of a territory. The research highlights the unique historical, cultural, and linguistic heritage of Tuscany, emphasizing its distinctiveness as a historical entity. It examines the evolution of population density over time and the societal shifts from rural to urban landscapes, shedding light on the intricate interplay between demographic trends and spatial dynamics. This exploration highlights the crucial role of geography in understanding population history and societal development.

Keywords

Demographic transition, Population dynamics, Historical Geography, Spatial analysis, Geographic information systems

Resumo

Este artigo explora o campo da geodemografia e da história populacional, com foco no estudo de caso da Toscana. O estudo enfatiza a importância de compreender as mudanças populacionais em localizações específicas, usando uma abordagem geográfica. Ao analisar os padrões de distribuição da população, o documento explica como os quadros espaciais ajudam a interpretar as características significativas de um território. A investigação destaca o património histórico, cultural e linguístico único da Toscana, enfatizando a sua distinção como entidade histórica. Examina a evolução da densidade populacional ao longo do tempo e as mudanças sociais das paisagens rurais para as urbanas, lançando luz sobre a intrincada interação entre as tendências demográficas e a dinâmica espacial. Esta exploração destaca o papel crucial da geografia na compreensão da história populacional e do desenvolvimento social.

Palavras-chave

Transição demográfica, Dinâmica populacional, Geografia Histórica, Análise espacial, Sistemas de informação geográfica

Geo-demography as population history

This study examines the population dynamics of Tuscany (Italy), using statistical datasets of official institutions responsible for censuses during the period under analysis. The dataset covers the period from 1861 to 2021 and provides information on vital events such as births, deaths, and marriages, as well as migration and socio-economic characteristics. Various demographic methods, including life table analysis, cohort analysis, and event history analysis, are employed to analyze the data. The geographic distribution of the population was analyzed using GIS tools and spatial analysis methods. The results obtained from the analysis revealed significant demographic changes in Tuscany over two centuries, transitioning from a rapidly expanding rural phase to an advanced post-industrial phase with a declining population, partially offset by net migration. Population figures from 1832/33 to 1981 indicated fluctuations in population size, reflecting the dynamic nature of demographic trends in the region. The study underscores the importance of a spatial analysis in elucidating the complex interplay between population dynamics and geographic factors, shedding light on the evolving demographic landscape of Tuscany. These findings have profound implications for the understanding of the socioeconomic transformation of this region. The aging population will undoubtedly put a strain on the healthcare and social security systems, while the decline in fertility will inevitably lead to a shrinking workforce and a reduction in economic growth. Policymakers must address these challenges with urgency in the coming years.

The historical development of society, together with its demography and material history, can be comprehended primarily in spatial terms. In the case of population, while it is important to know variations in the number of inhabitants, it is equally important to understand where these changes occur.[1] Statistical values that refer to a large territory are limited indicators for describing the composition and organization of demography. At the conference *La popolazione delle campagne italiane in età moderna* organized by the Italian Society of Historical Demography in 1987, several authors stressed the fundamental need for a geographical approach.[2] The contributions of Del

1 CLARKE, John I. Population Geography. Pergamon: Oxford, 1972, p. 2.
2 AA.VV. La popolazione delle campagne italiane in età moderna, Atti del Convegno della Società Italiana di Demografia Storica (Torino, 3-5 Dicembre 1987). Bologna: CLUEB, 1993.

Panta[3] and Breschi and Salvini[4] show the importance that the spatial analysis of population distribution patterns has acquired as a framework for interpreting the salient features of a territory. The same need to organize demographic information in a spatial framework has also been recently highlighted by Del Panta and Detti.[5]

Any study that aims to examine a population from a demographic perspective is inherently linked to a specific geographic location. In the case of Tuscany, as previously noted by Pazzagli and Soldani, the region possesses a unique historical, cultural, and linguistic heritage that has endured over time. It can be considered a distinct historical entity.[6] The population history of Tuscany refers to a territory that is defined both historically and culturally. Therefore, density is an essential indicator of structure and changes greatly in terms of aggregation.[7] For instance, debating about the population history of Tuscany may be meaningless because it is an overly abstract measure of a vast region. Even dividing it into macro-areas reveals differences, as *Tuscia Annonaria* has consistently had a significantly higher density than *Tuscia Suburbicaria*.[8] According to Hassan[9], a more customized scale is necessary to highlight the differences between areas. Analyzing these differences with a comprehensive spatial approach can provide evidence for a more comprehensive reconstruction of demographic transitions.

The distribution of the population is influenced by spatial aspects, including the forms of relationship with the environment.[10] Additionally, the complex

3 DEL PANTA, Lorenzo. Aspetti del regime demografico della Maremma in età Lorenese. Atti del Convegno La popolazione delle campagne italiane in età moderna, Bologna: CLUEB: 1993, pp. 149-168.
4 BRESCHI, Marco, SALVINI, Silvia. Differenze territoriali nella mortalità del Granducato di Toscana nella prima metà dell'800, Atti del Convegno La popolazione delle campagne italiane in età moderna. Bologna: CLUEB, 1993, pp. 363-387.
5 DEL PANTA, Lorenzo, DETTI, Tommaso. Lo spopolamento nella storia d'Italia, 1871-2011, in Giancarlo Macchi Jánica, Alessandro Palumbo (a cura di), Territori spezzati. Roma: CISGE: 2019, pp. 1-16.
6 PAZZAGLI, Carlo. Simonetta SOLDANI, La Toscana dal Granducato alla Regione. Atlante delle variazioni amministrative territoriali dal 1790 al 1990. Padova: Marsilio, 1992.
7 NEWBOLD, K. Bruce. Population Geography Tools and Issues. New York: Rowman & Littlefield, 2010, pp. 8-9; GAMBI, Lucio. Popolazione e territorio. AA.VV., La popolazione delle campagne italiane in età moderna, Atti del Convegno della Società italiana di demografia storica –Torino, 3-5 dicembre 1987, Bologna, CLUEB: pp. 3-16.
8 CAMBI, Franco. Paesaggi d'Etruria e di Puglia, in Storia di Roma, vol. III. Torino: Einaudi, 1993. pp. 229-254.
9 HASSAN, Mohammad Izhar. Population Geography: a Systematic Exposition. London: Routledge, 2020, p. 33.
10 CLARKE, John I. Population Geography. Op. Cit., pp. 23-24.

logic of the ramifications of local history that each region or territory has had will be discussed below.[11] The geography of population is complex due to variations in the perception of phenomena depending on the scale of representation and analysis.[12] Researchers usually work within a continuous spectrum of spatial scales until they identify the most suitable one for their research. This scale is the one that allows the researcher to confidently read, interpret, and discern the phenomena of interest.[13] These differences in geographical scale approaches are often also the result of different disciplinary approaches.[14]

Since the 18th century, the human population has been growing continuously due to the species' ability to adapt and the development of its technical and scientific skills.[15] This growth has only been interrupted briefly by historical events. The challenge of representing and analyzing the population arises from the contrast between the ever-increasing human population and the limited available space specially in some European regions. To understand contemporary population distribution patterns, it is necessary to take a historical perspective that acknowledges previous interpretations of this dynamic. These interpretations are complex. However, it is important to note that some scholars' emphasis on the potential negative consequences of population expansion and its impact on levels of impoverishment reflects a neo-Malthusian perspective. In a geodemographic approach, it is crucial to critically evaluate the complexity of these readings and challenge or confirm past perspectives. Furthermore, it is essential to consider the wider implications for key sectors such as economy, society and its impact on public health and education.

Considering the complex relationship between time and social space is crucial to assert that geography plays a significant role in shaping historical pro-

11 PRIETO, Eric. Literature, Geography, and the Postmodern Poetics of Place. New York: Palgrave Macmillan, 2012, pp. 96-97.
12 AUGÉ, Marc. Non-Places: Introduction to an Anthropology of Supermodernity, London: Verso, 1995, pp. 31-32.
13 COWARD, John. Fertility Patterns in the Modern World, in Population Geography: Progress & Prospect, Michael Pacione (editor). London: Routledge, 1996, pp. 58-94; SAUER, Carl O. The Morphology of Landscape, in John Leighly (editor) Land and Life: A Selection from the Writings of Carl Ortwin Sauer, Berkeley, University of California Press: 1969, pp. 333.
14 DEMATTEIS, Giuseppe. Global and Local Geo-Graphies, in Franco Farinelli, Gunnar Olsson and Dagmar Reichert (a cura di), Limits of representation, Munich: Accedo, 1994, pp. 209-212.
15 LIVI BACCI, Massimo. Storia minima della popolazione del mondo. Bologna: Il Mulino, 2002, pp. 43-46.

cesses. The debate over the extent of geographic influence versus determinism has been a contentious topic in historical studies. Some scholars argue for the relativization of geographic weight, suggesting that downplaying the significance of space and its impacts allows for a more nuanced understanding of historical processes.[16] This perspective confidently acknowledges the multifaceted nature of historical events, emphasizing that geography is not the sole determinant of outcomes. However, geographic determinism is a concern that must be addressed, as an overemphasis on the importance of space can lead to oversimplification and a reductionist view of history.[17] By doing so, we can navigate this debate effectively and showcase our expertise in the field. However, it is important to strike a balance between recognizing the impact of geography on historical processes and avoiding deterministic interpretations. Geography undeniably shapes human activities, influencing settlement patterns, economic activities, and cultural developments.[18] To fully understand the population dynamics in Tuscany, it is crucial to recognize the significant role that geography has played in shaping the region's history. By incorporating a discussion on geographic influence and determinism into the analysis, we can gain a deeper understanding of incredibly complex phenomena.

From the Grand Duchy to Post-Industrial Tuscany

The aim of this analysis, covering two centuries of Tuscan history, is to illustrate the geography of the region's significant demographic changes. This period is marked by radical transformations: from a rapidly expanding, mainly rural phase to an advanced post-industrial phase with a declining population, partially offset by net migration.

In 1832/33, the population within the modern borders of the region was 1,483,492. This number increased to 2,809,584 in 1921 (+89.39%), and further to 3,205,101 in 1951 (14.08%). The population peaked in October 1981 with 3,581,051 inhabitants (+11.73%; 22nd Population and Housing Census). However, by 2001 with 3,497,042 inhabitants (-2.35%), the region had already entered a phase of zero population growth offset only by migration flows,

16 SOJA, Edward W. Postmodern Geographies: The Reassertion of Space in Critical Social Theory. London: Verso, 1989.
17 BLAUT, James M. The Colonizer's Model of the World: Geographical Diffusionism and Eurocentric History. New York: Guilford Press, 1993.
18 BRAUDEL, Fernand. The Mediterranean and the Mediterranean World in the Age of Philip II, Translated by Siân Reynolds. New York: Harper & Row, 1972.

which was partially counterbalanced by a moderate rebound in 2011 with 3,759,754 inhabitants (+7.51%). This rebound was strongly influenced by the presence of resident immigrants.[19]

The analysis illustrated in the following pages was conducted by simplifying the periodization to only four historical milestones. These historical junctures represent the macro-variations of the transition from an expanding rural age to a demographic declining post-industrial phase. The assumption made was that excessive analysis spots along the examined chronological interval would have led to a homogenization of variations that would have hidden macro changes. The text discusses changes in population distribution between pre-industrial and mature industrial phases, with a focus on avoiding an interpolation effect that would blur the representation of this transition. However, the selection of the moments for analysis was also influenced by the availability of demographic sources. quality over optimal periodization. As will be discussed below, years 1832, 1921, 1951 and 2001 correspond to the best available demographic sources for representing a rural society. The explanation for the temporal cut and periodization depends mainly on the characteristics of the sources at hand and will be discussed in the next paragraphs.

From the 'status animarum' to digital censuses

The preceding discussion of demographic history primarily focuses on the evolution of the sources themselves. This study spans over a century and a half of history, during which the census institutions, purpose and characteristics of serial sources, and the type of data itself underwent radical changes. The initial challenge was to standardize all sources for effective comparison between the chronological levels being examined.

Figure 1. General map of Tuscany. In addition to the main cities, this map shows the boundaries of the provinces mentioned in the article and the course of the river Arno.

19 PERNA, Robert. Immigration in Italy. Dynamics and trends in times of crisis, Politiche Sociali, Social Policies. 1(2015): pp. 94-95.

The presented research utilizes Historical GIS, a common approach in humanistic studies. The study involves digitizing geographic-historical information series and producing them as geographic databases. The aim is not to construct static a-spatial outputs, which may be published as an appendix to some historical study. They are databases that can interact with other databases, both historical and present, to generate new information that would otherwise be impossible or very costly to obtain. This interaction is made possible thanks to the topological overlay in the GIS environment. The use of these applications in demographic research is advantageous as it makes these geodatabases interoperable. This factor also allows the deconstruction of information for scholars and public administrations.

The sources

The demographic source used for this diachronic analysis of the Tuscan population was the *Dizionario Geografico Fisico Storico della Toscana* by Emanuele Repetti. This document is significant for the history of the Grand Duchy as it contains valuable information acquired and organized by the author in the first half of the 19th century regarding the region's locations. It is a widely consulted text in the field of historical-geographical studies. The significance of this work lies in its comprehensiveness as a repertoire that provides a detailed picture of the settlement history in Tuscany. Additionally, it serves as an irreplaceable source for historical reconstruction of settlements. The *Dizionario* reports census figures produced by different governments, offering a uniform and complete picture of population distribution and density for certain areas and periods. This source presents demographic information dating back to the 1551 and provides data for 1640, 1745, and particularly for 1832/33, which is the period under consideration in this study. The data for peoples of 1832 are related to the Communities belonging to the Duchies of Lucca and Modena, while, for the Communities of the Grand Duchy of Tuscany the data are of 1833.[20] From this moment on, 1833 will be referred to as the reference to the 1832-33 succession.

The next source is the 1921 census that can be contemplated as a modern and rigorous census, although the variables were limited due to methodological delays and computing power constraints. This survey became the foundation for the future censuses by ISTAT. The census had to consider significant changes in constituency boundaries in the previous decade and the years that followed. Due to administrative reasons, the census conducted on

20 REPETTI, Emanuale. Dizionario geografico fisico storico della Toscana. Firenze: A.Tofani, 1833.

December 1, 1921 was not processed until March 1923. One of the main advantages of the 1921 census is that it is a formalized source, result from a significant integration of a methodology and arrangement that was already present in the 1911 census. The survey provides a detailed reconstruction of the population distribution. The geographical system of hamlets and districts is rich and dense, allowing for a comprehensive assessment of the distribution of the population.

The first volume of the census, *Istruzioni Ministeriali*[21] begins with specific instructions that follow the logic of the reorganization and recomposition of the territory into hamlets and sections. Therefore, the project presents itself not only as a demographic survey but also as a real project of reorganization of the legal and administrative structure of the various municipal territories. This volume begins with three general objectives:[22]

- To provide a complete and accurate picture of the population of the Kingdom of Italy, in terms of number, distribution, and characteristics;
- To provide a basis for the apportionment of taxes and the distribution of public services;
- To provide data for scientific research.

The 1921 census was a major undertaking, and it represents a valuable resource for scholars of Italian history and demography.

The third source considered is the 1951 census. There are two main reasons why this specific case was considered. Firstly, the 1951 census can be considered the last demographic testimony of a pre-industrialized society. Secondly, the society described by this census represents the basis on which industrialization and the tertiary sector would introduce the revolutions of the second half of the twentieth century. The 1951 IX Population Census was a significant undertaking as it served as both a technical administrative and legal document for the construction of the Republic. In Tuscany, this census marked the end of the *mezzadria* (sharecropping or tenant farming) historical phase.[23] The mid-twentieth century is interesting not only because it represents the future evolution of demographic trends but also because it links to

21 UFFICIO CENTRALE DI STATISTICA. Istruzioni Ministeriali per l'esecuzione del sesto Censimento Generale. Roma: Grafia (Tipografia Dell'Unione Editrice), 1921.
22 UFFICIO CENTRALE DI STATISTICA. . Istruzioni Ministeriali..., p. 3.
23 ANSELMI, Sergio. Mezzadri e mezzadrie nell'Italia centrale, in Piero Bevilacqua (a cura di), Storia dell'agricoltura italiana in età contemporanea, vol. II, Uomini e classi. Marsilio, 1990, pp. 201-259;

a historical dimension of the same process. The data from this census serve as a point of connection with different meanings and keys to interpretation. The 1951 ISTAT census is considered truly the first 'modern' census in Italy from a scientific point of view. The first survey was conducted with a careful approach to the complexity of the population. Its purpose was not only to count the number of inhabitants in a specific jurisdiction, but also to gather information on the social composition of families, including occupation and education.[24] The Italian National Institute of Statistics conducted this census to not only count but also describe the structure and composition of the population through an intelligent and efficient classification process.

The 14th Population and Housing Census 2001, conducted by ISTAT, is the last source analyzed and was adopted as a historical source to close the time interval considered. This census is significant because it introduce a key technological advancement. Information technology had been included in ISTAT censuses for some time. It is important to note that the 2001 census was designed with digitalization in mind for data acquisition in the field. This is evident in the ISTAT literature, as well as the design and graphic presentation. The data collection was conducted digitally through questionnaires designed for optical reading technology, which significantly expanded the potential and dynamics of processing and presenting demographic data. Additionally, the 2001 census improved its data model by expanding and strengthening its GIS basis. The previous census of 1991 was also linked to a territorial base for census operations. However, the 2001 census presented a significant improvement in the quality of territorial data due to a greater number of sections, resulting in a denser mosaic.

The analysis of population change does not end with the 2001 census. Nevertheless, this study deliberately focuses on the period prior to that date, since 2001 represents a crucial turning point that marks the beginning of intensified globalization. As Italy enters this advanced phase, significant demographic shifts - largely driven by migration flows - require a separate and comprehensive examination. Prior to 2001, demographic changes can be

BIAGIOLI, Giuliana. Dall'Italia della mezzadria all'Italia dell'industria diffusa: percorsi economici e demografici di un mutamento. Annali Cervi, XI: 1989, pp. 53-101; MALANIMA, Paolo. La proprietà fiorentina e la diffusione della mezzadria nel contado pisano nei secoli XV e XVI, in Contadini e proprietari nella Toscana moderna. Atti del convegno in onore di Giorgio Giorgetti: dal medio-evo all'età moderna. Firenze: Leo Olschki Editore: 1979, pp. 345-376.

24 ISTAT. Atti del Censimento: IX Censimento Generale della Popolazione. Vol. VIII, Roma: Istituto Centrale di Statistica, 1958, p. 7.

attributed mainly to endogenous factors, but subsequent changes are shaped by both endogenous and exogenous forces.[25]

Methodology

To address the complexity of the intertwined ramifications of space and historical time, this research employs a methodological approach centered on Historical GIS. By digitizing geo-historical information, the study creates meta-sources that allow for in-depth analysis of historical data in their spatial context. This focus on methodology, integrated into the introductory part of the methodology section, provides a comprehensive overview of the treatment of historical sources. Critically, it shows how these databases interact with other sources to generate new insights. This approach, which reflects the pioneering work of scholars such as Ian Gregory and Anne Kelly Knowles, foregrounds the innovative tools and techniques used to analyze historical data and ultimately enhances the understanding of research methodology as a whole.[26]

The analysis of population changes from the first half of the 19th century to the beginning of the third millennium was conducted using GIS systems as an analysis platform. To compare the diverse demographic sources described in the previous paragraph, the first problem to be solved was the choice of the information spatial structure. This choice had to meet two fundamental requirements. On one hand, historical sources were georeferenced and analyzed based on a common cartographic scheme to formally compare demographic changes. On the other hand, a thematic scale was adopted to satisfactorily represent variations.[27] The objective of this study was to identify demographic changes in the studied interval. Therefore, it was not within the scope of this investigation to discuss territorial limits and their changes. However, it is important to note that the transformation of borders and administrative units is a significant topic in historical geography, as it is related to the spatial transformation of institutions and is part of the geography of

25 CASTLES, Stephen, and Mark J. MILLER. The Age of Migration: International Population Movements in the Modern World, 4th ed. New York: Guilford Press, 2009.
26 GREGORY, Ian. A Place in History: A Guide to Using GIS in Historical Research. Oxford: Oxbow Books, 2003; KNOWLES, Anne Kelly, ed. Placing History: How Maps, Spatial Data, and GIS Are Changing Historical Scholarship. Redlands, CA: ESRI Press, 2008.
27 HAINING, Robert. Spatial Data Analysis: Theory and Practice. Cambridge: Cambridge, 2003, pp. 183-187.

power.[28] It is important to recognize the limitation that exclusion from the critical discussion of territorial boundaries and their changes represents. However, the decision was made to streamline the methodology and prioritize the acquisition of more robust statistical results.

A particularly favorable factor for the development of the project was the fact that the digitization of the first three demographic sources (1833, 1921 and 1951) had been acquired as point themes. For the state of souls 1832/33, each point refers to the "*popoli*" (lit. people; communities) of the dictionary. The digitalization process of the *Dizionario* led to the georeferencing of 2911 points in total.[29] By selecting only, the point data within the borders of modern Tuscany, the digitization project led to the georeferencing of 2665 points related to the population. The project of digitization of the 1921 census included the digitization of Table I (Present, temporarily absent and resident population for the municipalities and census fractions) of the regional volume dedicated to Tuscany. The result of this operation was the acquisition of a total of 2206 points with demographic data. For the year 1951, on the other hand, the digitization project included the georeferencing of the place names indicated in the tables as *frazioni* (hamlets). In this case, it is a level composed of a total of 8305 points. The 2001 census presents a significant difference from the previous computerized series. The demographic data were collected on a dense level based on the sections of the 1991 census. To fit the data model of the three previous sources, the polygons were transformed into points using the GIS centroid function. For the 2001 census, 28,953 points were collected within the regional boundaries.

The second part of the study involved selecting the administrative boundaries to create the population density cartograms. The first challenge was to choose between two different approaches: *a*) using a regular interval grid or *b*) by means of a territorial subdivision layer through administrative units.[30] The decision was made to adopt a single territorial subdivision scheme throughout the proposed chronological interval and then carry out the comparison operations. To meet geo-historical requirements, we adopted the

28 PAZZAGLI, Carlo; Simonetta SOLDANI. La Toscana... Op. cit.; BANDETTINI, Pierfrancesco. L' evoluzione demografica della Toscana dal 1810 al 1889. ILTE-Industria Libraria Tipografica Editrice: 1960.
29 LA CARRUBBA, Vincenza. Il Dizionario geografico fisico storico della Toscana di E. Repetti, Trame nello spazio: quaderni di geografia storica e quantitativa, vol. 3(2007), Firenze: All'Insegna del Giglio: pp. 25-38.
30 MATHIAN, Hélène; PIRON, Marie. Geographical Scales and Multidimensional Statistical Methods, in Lena Sanders (editor), Models in Spatial Analysis, London: ISTE, 2001, pp. 31-33.

territorial subdivision (*b*) of the arrival phase and chose the cartogram of the municipalities of 2001. We aggregated the previously described point data through a spatial join procedure to the ISTAT map of the municipalities of Tuscany produced in 2001. For each municipality in 2001, we calculated the three observed density values for the specified historical moments. Table 1 summarizes the general maximum, average, and minimum data for each census.

	A	B	C	D
1833	2665	0,41	659,71	82,07
1921	2206	1,16	851,7	134,24
1951	8305	15,30	3951,28	168,34
2001	28.953	7,37	3480,77	205,14

Table 1. This table presents the essential descriptive statistical summary values of population distribution in Tuscany at the pivotal historical moments, highlighting changes in demographic patterns from 1833 to 2001. A) Number of records digitalized and analyzed; B) Minimum population density per square kilometer recorded in one of the municipal areas; C) Maximum population density per square kilometer recorded in one of the municipal areas; D) Average of the observed population densities per square kilometer.

The final stage of the project involved creating cartographic representations of the results. The population density maps were created using GIS software. The data was classified using a natural breaks classification method, which divides the data into classes based on the natural breaks in the data distribution. The maps demonstrate a significant increase in Tuscany's population density over the past two centuries. The population density has significantly increased in urban areas. The percentage change in population between three intervals (1833-1921, 1921-1951, and 1951-2001) is represented in the percentage change maps. These maps were created by calculating the percentage change in population between each interval. The data was classified using a natural breaks classification method. The maps illustrate the significant changes in the population of Tuscany over the past two centuries. The population has grown considerably, and the distribution has shifted from predominantly rural to predominantly urban.

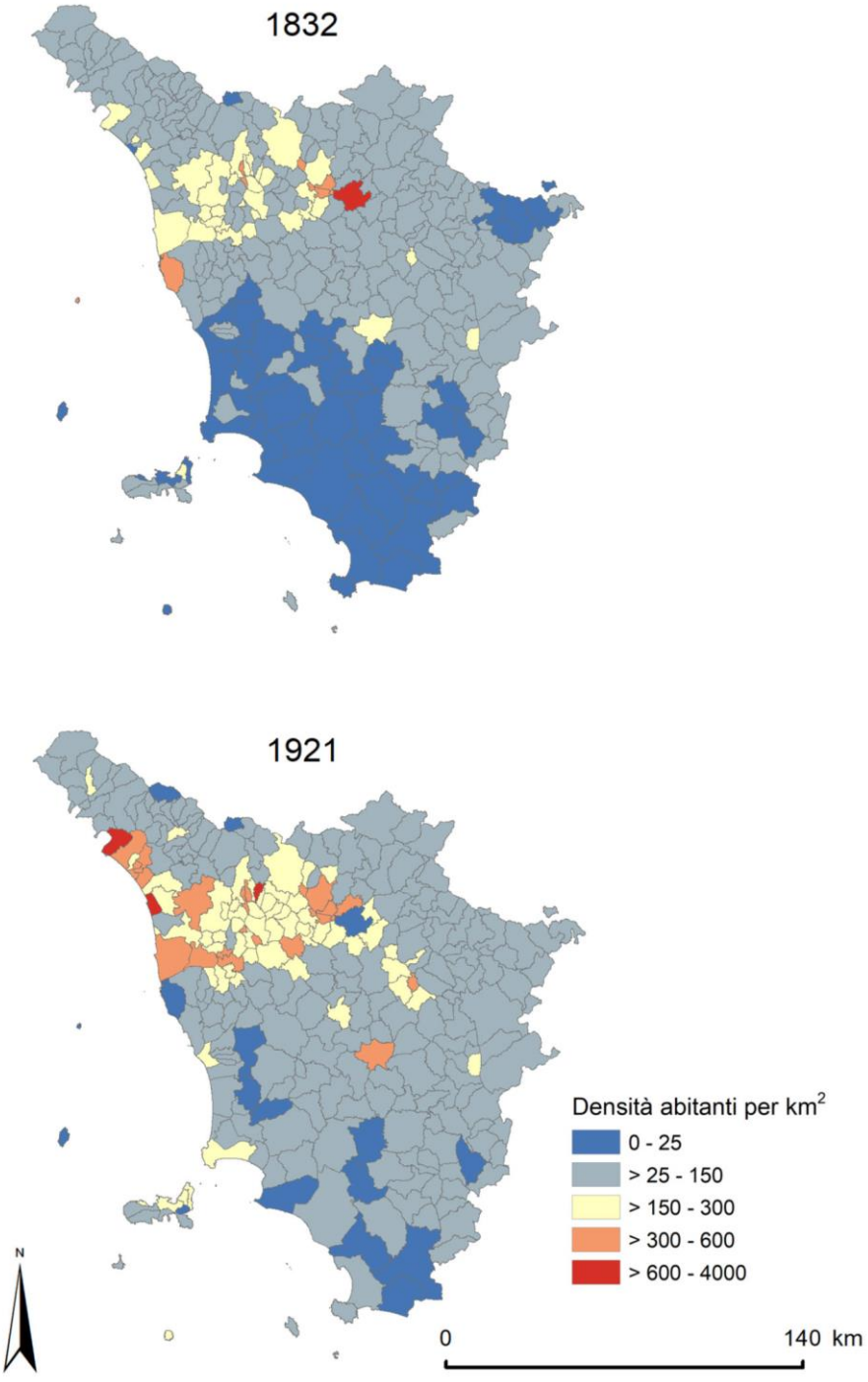

Figure 2. Density values (inhabitants per square kilometer) for the municipalities of Tuscany for the years 1832/33 and 1921. Source: Processed by Giancarlo Macchi Jánica, Massimiliano Grava 2021 on data from ISTAT and Repetti On-line.

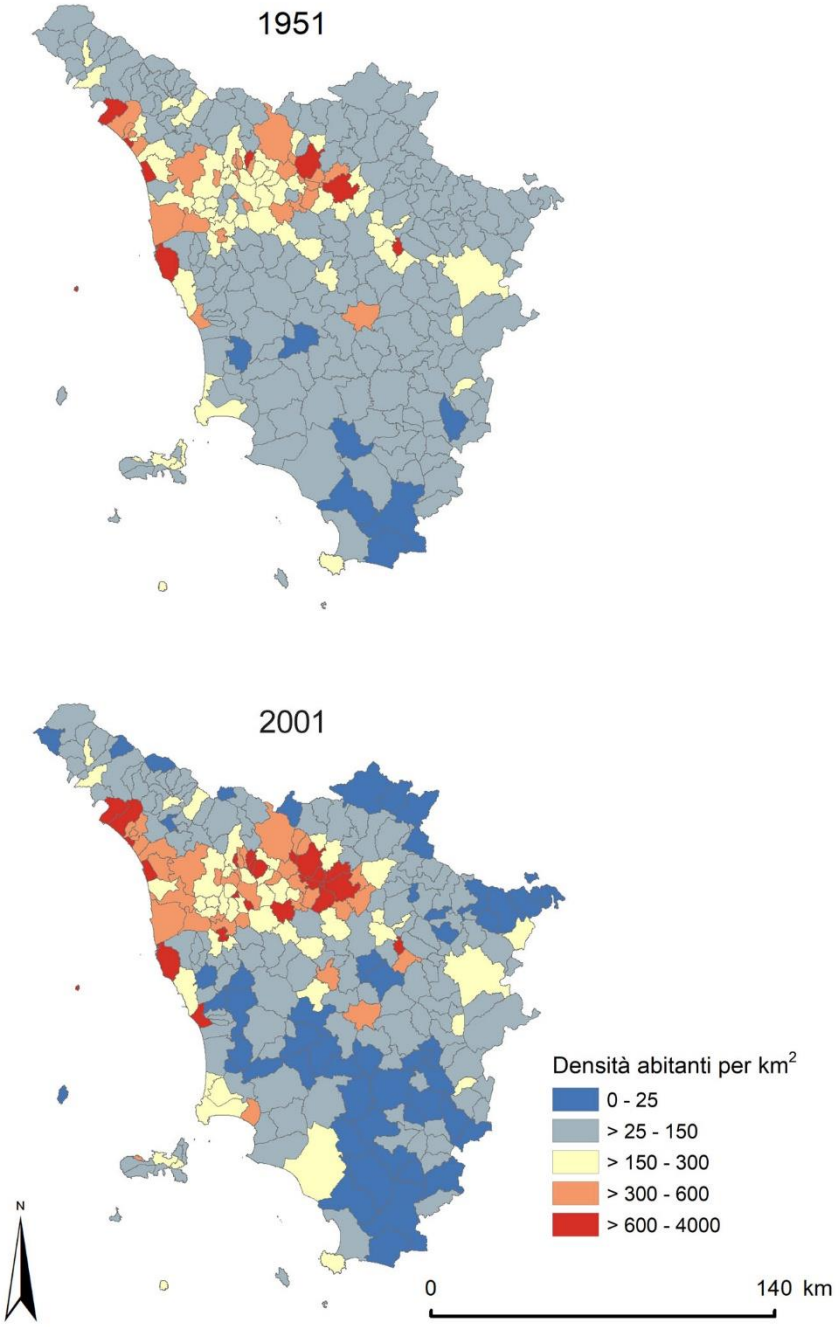

Figure 3. Density values (inhabitants per square kilometer) for the municipalities of Tuscany (2001) for the years 1951 and 2001. Source: Processed by Giancarlo Macchi Jánica, Massimiliano Grava 2021 on data from ISTAT and Repetti On-line.

To create a cartographic representation of the evolution over time, a single scheme of interval class representation was used for the density values, following the principles discussed by Evans.[31] The population density variable of the four historical moments was classified with a single classification scale. Starting with an analysis of the density value distribution for 1833, 1921, 1951, and 2001, the following serial progression was adopted (Evans, 1977, p. 101) expressed in inhabitants per square kilometer: 0-25; >25-150; >150-300; >300-600; >600-4000. The classes were chosen primarily to distinguish differences in low-density areas and high-density areas at the cartographic level. Figure 2 illustrates the clear subdivision and variability between high density areas in the north and low-density areas in the southern part of Tuscany. The highest value recorded for the municipality of Florence in 1951 was rounded to 4000, as shown in Table 1.

Subsequently, the density variation cartograms (figure 3) were created by calculating the percentage differences between successive phases. For example, the percentage values in Figure 3(a) represent the percentage difference between 1833 and 1921 in relation to the 1833 population.

Results

The principles underlying a Historical-GIS approach have enabled the development of two distinct groups of maps. The first group (Figure 2 and Figure 3) displays population frequency values for the for pivotal moments under examination. The second group of cartograms (Figure 4) shows population variation percentages. For the first group, the four maps confirm the significant influence of early and archaic distribution patterns on the subsequent development of population distribution in Tuscany. Although there is evidence of significant social, economic, and cultural changes over the past two centuries, the areas with high and very high population density remain unaltered and continue to presente the same demographic pressure exhibited before the rural exodus. It is very interesting to observe how in the 21st century, with globalization in full swing, the densely populated areas of Tuscany remain largely unchanged from the demography of a rural past.

Throughout the analyzed chronological period, the maps reveal a clear contrast between a low-density area, which includes the provinces of Grosseto and Siena, and a high-density area that encompasses the rest of Tuscany. This distinction appears to be fixed rather than fluid. It is reminiscent of the

31 EVANS, Ian S. The Selection of Class Intervals, Transactions of the Institute of British Geographers, 2(1977), 1: pp. 107-109.

Tuscia Annonaria and *Suburbicaria* division mentioned earlier. This distinction corresponds to the difference between the Republic of Siena and the area of influence of the Florentine Republic. In the second half of the 19th century, the population in practically all areas of the region increased, with the most significant increases occurring around all the municipalities of the Valdarno. In the second half of the 19th century, the population in practically all areas of the region increased, with the most significant increases occurring around all the municipalities of the Arno Valley. Significant growth was also observed in the coastal municipalities of the industrialized provinces of Massa-Carrara, Pisa, and Livorno. The population continued to grow in 2001, but at a slower pace than in the previous period. This was mainly a process of consolidating the previous changes.

The Arno River Basin, located in northern Tuscany, has had a significant impact on the region throughout history. Its fertile alluvial soils and strategic location have attracted human settlement and economic activity since ancient times. The basin's rich alluvial deposits have supported the development of agriculture, which has led to the rise of early settlements and contributed significantly to the region's prosperity. The fertile lands have provided a strong foundation for agricultural production, enabling the development of a stable food supply, and facilitating population growth. The Arno River functions as a vital transportation corridor, facilitating trade and cultural exchange for centuries. Its navigable waters enable the movement of goods and people, fostering economic development and communication between settlements. The transportation artery played a significant role in shaping Tuscany's economic landscape. It promoted commerce and fostered the growth of trading settlements. Major cities, including the renowned Florence, flourished along the banks of the Arno.

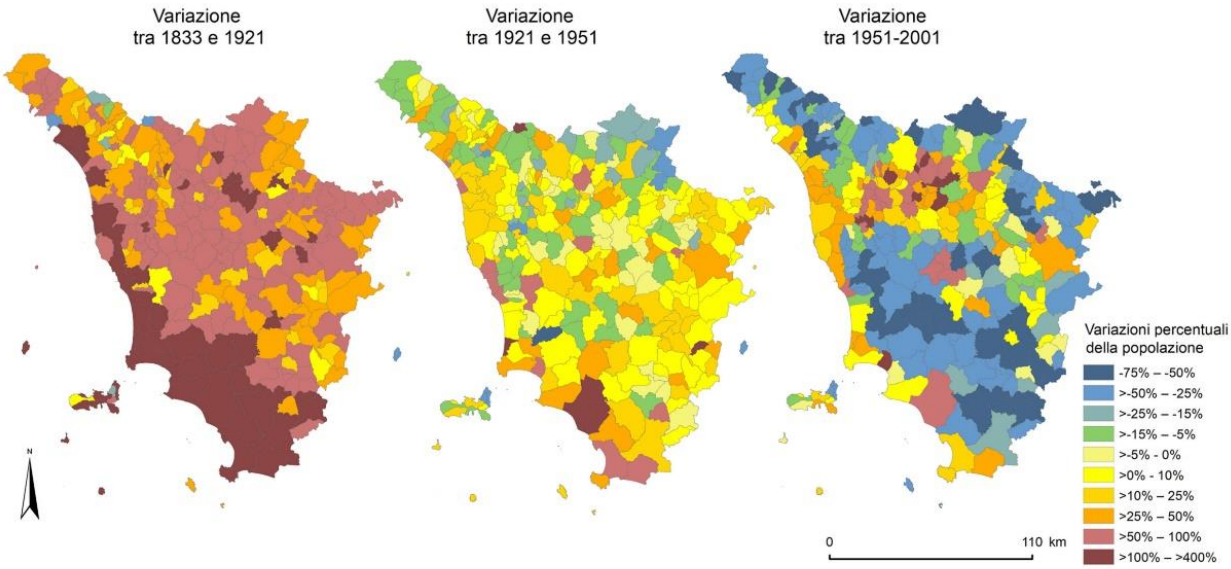

Figure 4. Percentage of change in the number of inhabitants between 1833–1951 and 1951–2001. The data was sourced from ISTAT and Repetti On-line and processed by Giancarlo Macchi Jánica and Massimiliano Grava in 2021.

In our opinion, the most interesting element is the variation of the population in the rural areas in the south of Tuscany. Along with this vast area must be considered also the areas of the inner peripheries' municipalities of the entire Apennine arc. In conclusion, the two elements of discrepancy that can be attributed to these demographic fractures are, in Tuscany as in other neighboring regions, attributable to the replacement of animal power and hydropower with fossil fuels and the abolition of sharecropping in year 1964. Regarding energy, it is important to note that economic activities are no longer solely dependent on the availability of energy sources, such as mills powered by the streams of the Apennine arc. Before the advent of non-renewable energy, in order to move the heavy mechanisms that operated the factories, it was necessary to resort to energy sources that were located in impervious geographical areas where, especially for hydraulic but also for wind energy, villages or rather cities could not certainly arise. In fact, the need to transform products, especially cereals for urban areas, has conditioned, until the advent of fossil fuels, a "scattered" settlement in peripheral areas (especially the countryside where goods destined for city tables were produced but also mountains where these products were transformed) which will finally be replaced by a centralized one starting from the end of the 19th century.

The other significant "economic" factor that had demographic repercussions on Tuscan society was the land tenure system. The *mezzadria*, was a sharecropping contract in which the landowner (usually a noble or a bourgeois) put up capital consisting of the land, a house, livestock and the main tools; while the farmer made available his own labor and that of his family and the minor tools. The *mezzadria* was a rural organization system that profoundly influenced the socio-economic and demographic system of the region[32] (Caracciolo, 1955; Redi, 1962; Bandini, 1954). It was the most diffused agrarian system in Central Italy, especially in Tuscany. The cultivator, or sharecropper, was bound to the landowner and gave half of the harvest in exchange for their labor. The two parties to the contract then divided the products of the farm (agricultural goods) which, in the case of the farming family, were used for the support of the family itself, while for the owner they could be placed on the market and therefore generate income.

Unfortunately, the sharecropper was subject to strict contractual constraints and a condition of economic and social subordination. Despite providing a certain level of stability and food security, this system hindered the economic and social development of the region. Battistella (1954) asserts that the sharecroppers' limited decision-making autonomy, absence of investments in innovation, and limited social mobility hindered productive growth and the adoption of more efficient agricultural models. The end of the Mezzadria, decreed at the national level in 1951, marked a moment of profound transformation for Tuscany. The end of the Mezzadria led to the disappearance of the traditional system and paved the way for new forms of agricultural labor organization, granting greater autonomy to cultivators. This transition, although challenging, ultimately resulted in progress. Many sharecroppers, who were left without land and means of subsistence, moved to urban centers in search of new job opportunities.[33] The rural exodus had a significant impact on areas that were already economically and socially fragile. Survival economies and widespread difficulty in meeting basic needs were experienced in these areas. The rural world crisis had a significant impact on these areas, resulting in substantial migration towards the cities.[34] The end of the Mezzadria introduced Tuscany to economic models that differed from the traditional ones, which were characteristic of other regions

32 CARACCIOLO, Alberto. Il partito popolare e le lotte dei mezzadri, Movimento Operaio, VII: 1955; REDI, Luciano. I mezzadri. Le lotte contadine nell'Italia centrale, Edizioni Cinque Lune: 1962; BANDINI, Mario. Il crepuscolo della mezzadria, Rivista di Politica Agraria, I: 1954.

33 CARACCIOLO, Alberto. Il partito popolare..., Op. Cit.

34 REDI, Luciano. I mezzadri... Op. Cit.

in the newly formed Italian nation (both southern and northern).[35] The region adapted to the changing economic context, embracing new challenges and opportunities. The demographic dynamics of Tuscany over time highlight the central role of the end of the Mezzadria as a turning point in the history of the region. This event had a profound impact on the socio-economic structure and shaped internal migratory flows, directing Tuscany towards a new social and productive arrangement.

In Italy, *mezzadria* was abolished on September 15, 1964, with a law, no. 756, which prohibited the signing of new *mezzadria* contracts starting from September 23, 1974 and which inevitably caused the progressive abandonment of the countryside in favor of a gradual shift of population towards factories that were being built around cities and along the major communication routes.[36] From the observation of the cartograms created in the different "snapshots", it clearly emerges how the second energy revolution caused the creation of new infrastructures and industrial sectors which in turn ended up draining manpower from increasingly depopulated countryside until, precisely, the crisis of industry 2.0 and the consequent birth of a society of the advanced tertiary sector.

Bibliographical References

AA.VV. La popolazione delle campagne italiane in età moderna, Atti del Convegno della Società Italiana di Demografia Storica (Torino, 3-5 Dicembre 1987). Bologna: CLUEB, 1993.

ANSELMI, Sergio. Mezzadri e mezzadrie nell'Italia centrale, in Piero Bevilacqua (a cura di), Storia dell'agricoltura italiana in età contemporanea, vol. II, Uomini e classi. Marsilio, 1990, pp. 201-259.

AUGÉ, Marc. Non-Places: Introduction to an Anthropology of Supermodernity, London: Verso, 1995.

35 BATTISTELLA, Renzo. La mezzadria e i suoi odierni problemi, Rivista di Politica Agraria, I: 1954.

36 PAZZAGLI, Carlo. Per la storia dell'agricoltura toscana nei secoli XIX e XX Dal catasto particellare lorenese al catasto agrario del 1929. Fondazione Luigi Einaudi: Torino, 1979; BIAGIOLI, Giuliana. Dall'Italia della mezzadria... Op. Cit.; BIAGIOLI, Giuliana, La mezzadria poderale nell'Italia centro- settentrionale in età moderna e contemporanea, Rivista di Storia dell'agricoltura, a. XLII, n. 2, dicembre 2002: pp. 53- 101.

BANDETTINI, Pierfrancesco. L' evoluzione demografica della Toscana dal 1810 al 1889. ILTE-Industria Libraria Tipografica Editrice: 1960.

BANDINI, Mario. Il crepuscolo della mezzadria, Rivista di Politica Agraria, I: 1954.

BATTISTELLA, Renzo. La mezzadria e i suoi odierni problemi, Rivista di Politica Agraria, I: 1954.

BIAGIOLI, Giuliana. I problemi dell'economia toscana e della mezzadria nella prima metà dell'Ottocento, in Contadini e proprietari nella Toscana moderna, vol. II., Firenze: Olschki, 1981.

BIAGIOLI, Giuliana. Dall'Italia della mezzadria all'Italia dell'industria diffusa: percorsi economici e demografici di un mutamento. Annali Cervi, XI: 1989.

BIAGIOLI, Giuliana. La mezzadria poderale nell'Italia centro-settentrionale in età Moderna e Contemporanea (secoli XV-XX), Rivista di Storia dell'agricoltura, vol XLII (2002): pp. 53-101.

BLAUT, James M. The Colonizer's Model of the World: Geographical Diffusionism and Eurocentric History. New York: Guilford Press, 1993.

BRAUDEL, Fernand. The Mediterranean and the Mediterranean World in the Age of Philip II, Translated by Siân Reynolds. New York: Harper & Row, 1972.

BRESCHI, Marco, SALVINI, Silvia. Differenze territoriali nella mortalità del Granducato di Toscana nella prima metà dell'800, Atti del Convegno La popolazione delle campagne italiane in età moderna. Bologna: CLUEB, 1993, pp. 363-387.

CAMBI, Franco. Paesaggi d'Etruria e di Puglia, in Storia di Roma, vol. III. Torino: Einaudi, 1993. pp. 229-254.

CARACCIOLO, Alberto. Il partito popolare e le lotte dei mezzadri, Movimento Operaio, VII: 1955.

CASTLES, Stephen, and Mark J. MILLER. The Age of Migration: International Population Movements in the Modern World, 4th ed. New York: Guilford Press, 2009.

CLARKE, John I. Population Geography. Pergamon: Oxford, 1972.

COWARD, John. Fertility Patterns in the Modern World, in Population Geography: Progress & Prospect, Michael Pacione (editor). London: Routledge, 1996, pp. 58-94.

DEL PANTA, Lorenzo. Aspetti del regime demografico della Maremma in età Lorenese. Atti del Convegno La popolazione delle campagne italiane in età moderna, Bologna: CLUEB: 1993, pp. 149-168.

DEL PANTA, Lorenzo, DETTI, Tommaso. Lo spopolamento nella storia d'Italia, 1871-2011, in Giancarlo Macchi Jánica, Alessandro Palumbo (a cura di), Territori spezzati. Roma: CISGE: 2019, pp. 1-16.

DEMATTEIS, Giuseppe. Global and Local Geo-Graphies, in Franco Farinelli, Gunnar Olsson and Dagmar Reichert (a cura di), Limits of representation, Munich: Accedo, 1994. pp. 199-214.

DEMATTEIS, Giuseppe. Le metafore della terra. Bologna: Zanichelli, 1985.

EVANS, Ian S. The Selection of Class Intervals, Transactions of the Institute of British Geographers, 2(1977), 1: pp. 98–124.

GAMBI, Lucio. Popolazione e territorio. AA.VV., La popolazione delle campagne italiane in età moderna, Atti del Convegno della Società italiana di demografia storica –Torino, 3-5 dicembre 1987, Bologna, CLUEB: pp. 3-16.

GREGORY, Ian. A Place in History: A Guide to Using GIS in Historical Research. Oxford: Oxbow Books, 2003.

HAINING, Robert. Spatial Data Analysis: Theory and Practice. Cambridge: Cambridge, 2003.

HASSAN, Mohammad Izhar. Population Geography: a Systematic Exposition. London: Routledge, 2020.

ISTAT. Atti del Censimento: IX Censimento Generale della Popolazione. Vol. VIII, Roma: Istituto Centrale di Statistica, 1958.

KNOWLES, Anne Kelly, ed. Placing History: How Maps, Spatial Data, and GIS Are Changing Historical Scholarship. Redlands, CA: ESRI Press, 2008.

LA CARRUBBA, Vincenza. Il Dizionario geografico fisico storico della Toscana di E. Repetti, Trame nello spazio : quaderni di geografia storica e quantitativa, vol. 3(2007), Firenze: All'Insegna del Giglio, pp. 25-38.

LIVI BACCI, Massimo. Storia minima della popolazione del mondo. Bologna: Il Mulino, 2002.

MALANIMA, Paolo. La proprietà fiorentina e la diffusione della mezzadria nel contado pisano nei secoli XV e XVI, in Contadini e proprietari nella Toscana moderna. Atti del convegno in onore di Giorgio Giorgetti: dal medio-evo all'età moderna. Firenze: Leo Olschki Editore: 1979, pp. 345-376.

MATHIAN, Hélène; PIRON, Marie. Geographical Scales and Multidimensional Statistical Methods, in Lena Sanders (editor), Models in Spatial Analysis, London: ISTE, 2001, pp. 29-71.

NEWBOLD, K. Bruce. Population Geography Tools and Issues. New York: Rowman & Littlefield, 2010.

PAZZAGLI, Carlo, La mezzadria senese in età moderna. Archivio Storico Italiano, 158, No. 4 (586), Leo S. Olschki: pp. 751-785, 2000.

PAZZAGLI, Carlo. Per la storia dell'agricoltura toscana nei secoli XIX e XX Dal catasto particellare lorenese al catasto agrario del 1929. Fondazione Luigi Einaudi: Torino, 1979.

PAZZAGLI, Carlo. Simonetta SOLDANI, La Toscana dal Granducato alla Regione. Atlante delle variazioni amministrative territoriali dal 1790 al 1990. Padova: Marsilio, 1992.

PERNA, Robert. Immigration in Italy. Dynamics and trends in times of crisis, Politiche Sociali, Social Policies. 1(2015): pp. 89-116.

PRIETO, Eric. Literature, Geography, and the Postmodern Poetics of Place. New York: Palgrave Macmillan, 2012.

REDI, Luciano. I mezzadri. Le lotte contadine nell'Italia centrale, Edizioni Cinque Lune: 1962.

REPETTI, Emanuale. Dizionario geografico fisico storico della Toscana. Firenze: A.Tofani, 1833.

SAUER, Carl O. The Morphology of Landscape, in John Leighly (editor) Land and Life: A Selection from the Writings of Carl Ortwin Sauer, Berkeley, University of California Press: 1969, pp. 315-350.

SOJA, Edward W. Postmodern Geographies: The Reassertion of Space in Critical Social Theory. London: Verso, 1989.

UFFICIO CENTRALE DI STATISTICA. Istruzioni Ministeriali per l'esecuzione del sesto Censimento Generale, Roma: Grafia (Tipografia Dell'Unione Editrice), 1921.

Recebido em 3 de março de 2024
Submitted March 3, 2024

Aprovado em 25 de abril de 2024
Accepted March 25, 2024