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Commentary

Re-Framing the Latent Nexus between Land-Use Change, Urbanization and Demographic Transitions in Advanced Economies

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Abstract: The linkage between land-use change and demographic transitions in advanced countries has becoming increasingly complex because of the mutual interplay of environmental and socioeconomic spheres influencing the degree of sustainability of both regional and local developmental processes. The relationship between urbanization and economic development has been relatively well investigated by clarifying the consequent impacts on population dynamics. In the early phases of urbanization and economic development, population grew at a particularly high rate, declining (more or less rapidly) in the subsequent time interval. Improving income and education opportunities in urban settings resulted in further urbanization, leading to progressively lower fertility. At the same time, a more general view on the relationship between land-use change and demographic transition focusing on a broader spectrum of landscape processes (including farmland abandonment and forest expansion) at larger spatial scales (from regional to country and continental scale) is increasingly required. The present study provides an integrated view of the relationship between land-use change, urbanization, and demographic transitions with specific focus on Europe. Considering divergent processes of landscape transformations in a unified socioeconomic view may evidence the intimate linkage with recent population trends in both urban and rural areas.

Keywords: social modernization; landscape transformations; population trends; Europe

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1. Introduction

Demographic transitions and land-use change are intrinsically bonded since human activity is considered a key force of landscape transformation [1–3]. While climate regimes have a continuous influence on the development of vegetation, human activities with the consequent effects on soils have left even more evident traces that date back to the Neolithic era, at least as regards densely populated areas of the world [4]. In recent years, the interest of demographers in the relationship between population dynamics and the environment has grown significantly [5–7]. One of the most important areas of research in this sense concerns the effects of human activities on natural environments and rural landscapes, especially as far as land-use change is concerned [8]. Landscape modifications usually occur thanks to several interacting processes, which may differ according to particular local and regional conditions, being intrinsically molded by external forces [9].

To understand spatial distribution and extent of land-use change, landscape transformations in the second half of the 20th century were examined in the United States by county, considering dominant trends of population, agriculture, and urbanized soil through a variety of data from different sources and using an ecological classification of the region as a reference [10]. This study documented landscape dynamics characteristic of advanced economies all over the world [4]. Since the early 1970s, a convergence towards non-metropolitan areas was observed determining, together with a decrease in the average size of families and a reduction in local population density, important transformations in traditional settlement models, basically compact and radio-centric [8]. In 2000, the low-density urban development area beyond the periphery exceeded the higher-density urbanized development area by almost 15 times. At the same time, innovations in terms of efficiency and automation, together with the formation of commercial agricultural conglomerates, have favored a stable positioning of the cultivated areas through the corn belt and part of the western districts between 1950 and 2000. Conversely, activities related to the production of timber in forests and urbanization were recognized among the most influential pressures on land cover [9]. In this context, expanding rural areas together with the abandonment and subsequent conversion of cultivated land, mainly on the east coast of the United States, were very important, because they affect large areas of the country as well as the functioning of ecological systems and the potential for recovery [10].

The interest of demographers in environmental issues has clearly been influenced by population dynamics and economic development. Demographic research on environmental issues other than the intrinsic role of physical and natural constraints has been occasionally carried out [11]. Hogan focused on studies concerning the link between demography and the environment with a particular focus on migratory phenomena through a holistic approach. In fact, subsequent studies, based on the same approach, have tried to investigate this linkage by studying migration of small farmers' families in Brazil. Empirical findings show that areas characterized by grazing activities or perennial cover have contributed to the emigration of the new generations, by now grown up, but this phenomenon is not directly linked to any change in land use, in contrast to more classic models of family life. In essence, it would be appropriate to incentivize rural funding that slows down the exodus and develops the potential of these areas [12]

Just as land-use transformations may generate migratory flows and vice versa, changes in environmental conditions seem to be intrinsic drivers of migratory flows. In this sense, the relationship between climate change and migration can have different characteristics depending on the environmental disturbance; this situation has generated a category of migrants who are defined as "environmental migrants" [13]. Using data from the Chitwan Valley Family Study (CVFS) as input of risk models, Massey et al. [14] investigated the relationship between changing environmental conditions and migratory flows in Nepal. The study found that environmental migrations are primarily related to climate change but also to intrinsic processes of deterioration in the quality of life. Factors such as the distance of migration, gender, and ethnicity distinctions affect to a greater or lesser extent, the nature of the repercussions generated by these changes. Parry et al. [15] focused on the role of the provision of public services and the availability of natural resources in rural settlement models, based on data obtained from historical surveys, aimed at reconstructing migration. It was demonstrated that behind clustering around urban centers, there would be a lack of goods and services typical of urbanized areas, above all the lack of infrastructure for access to education [16].

Basically, the influence of the environment is not yet properly integrated into standard demographic theories. For instance, studies should increasingly aim at identifying the main economic, political, and social factors through which the environment influences migration and other demographic processes. In fact, by varying the environmental conditions, the quality and quantity of services both in the territory and in the urban centers consequently change. The outlined framework confirms that in advanced economies, either in North America or in Europe, the dizzying increase of the population, especially in the early 2000s (Figure 1), put pressure on every type of ecosystem, generating all sorts of changes

with respect to natural conditions, in turn triggering migratory flows, both internal and international, with a strong impact on the environment. Consequently, more attention needs to be paid to the role of decision-making policies regarding (internal and international) migration which can be used to guide new research aimed at predicting and studying the spatial distribution of population and human footprints [17].

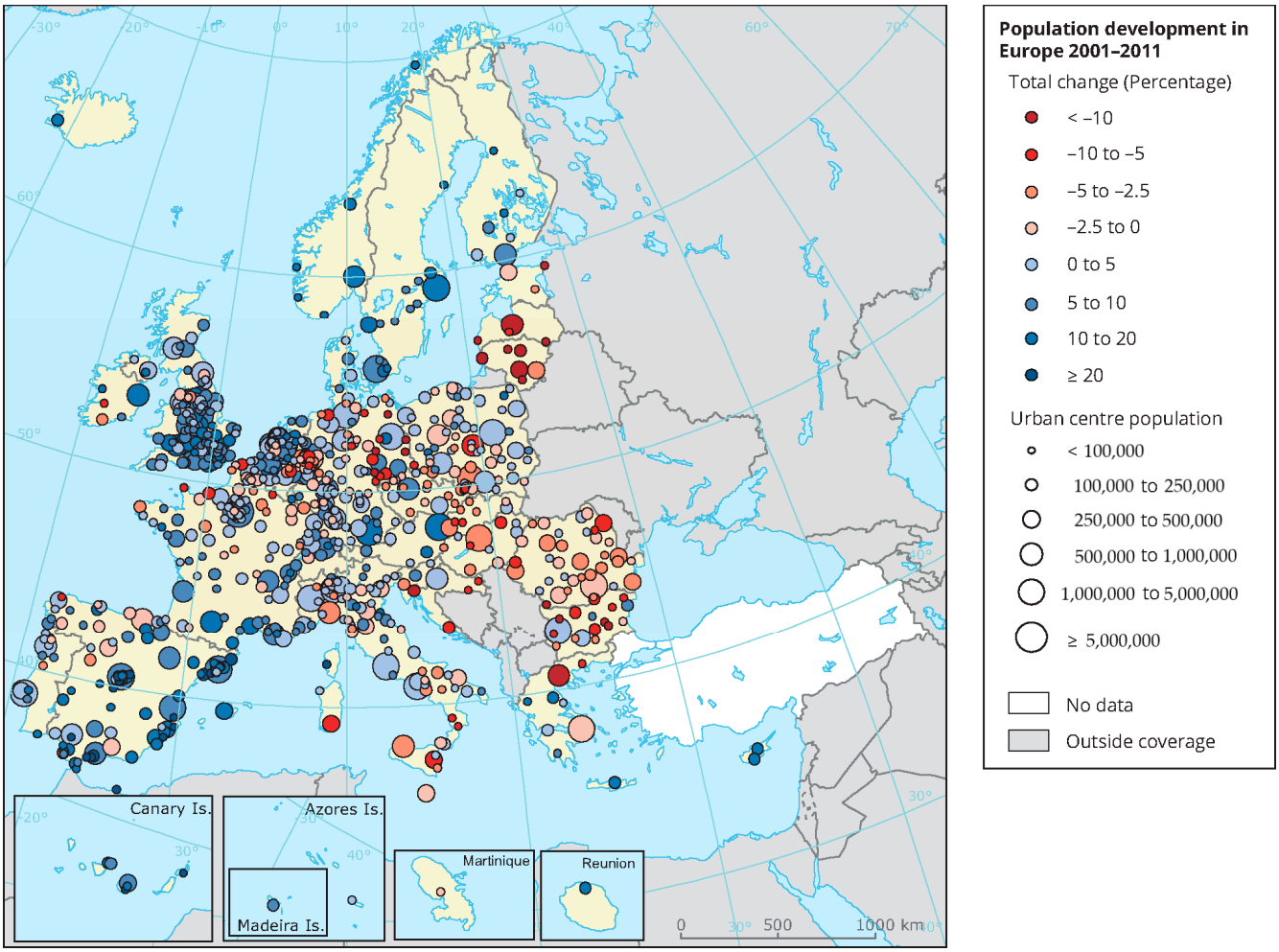

Figure 1. Population development and urban hierarchy in Europe, early 2000s (source: EEA).

1.1. Forest Transition and Demographic Transition: The Intrinsic Linkage between Theories

1.1.1. Landscape Transitions Led by Forest Change in Affluent Countries

The forest transition theory derives from stylized facts observed in some countries as far as long-term expansion of wooded areas is concerned. This theory suggests a comparison between what was deforestation in formerly developing countries, and deforestation in countries that are still developing today [18]. The transition can depend on many factors and those factors considered anthropic are dominant: economic development, industrialization, and urbanization. These three phenomena translate into a conurbation of population near the urban centers, attracted by the benefits and comforts that the city is able to offer compared to rural areas where life is clearly harder. Based on this assumption, the reduction of tree-covered areas is supposed to be the greatest in the initial stages of a country's economic development, decreasing in the growth phase and finally stabilizing, or even reversing, in truly advanced countries (Figure 2). As the rate of forest use decreases, forested areas end up increasing, advancing mainly at the expense of agricultural areas left uncultivated due to the depopulation of the countryside linked to urbanization processes [19]. Even in Italy, according to the most recent document on the state of Italian

forests [20] and other scientific papers [21–23], since the first half of the twentieth century, forest areas are growing. In particular, in the last 25 years they have gone from 31% to 38% coverage of the total national surface. Forest and demographic transition could be intimately connected because they depend on common factors and they can trigger a series of socio-economic events with considerable effects on the environment.

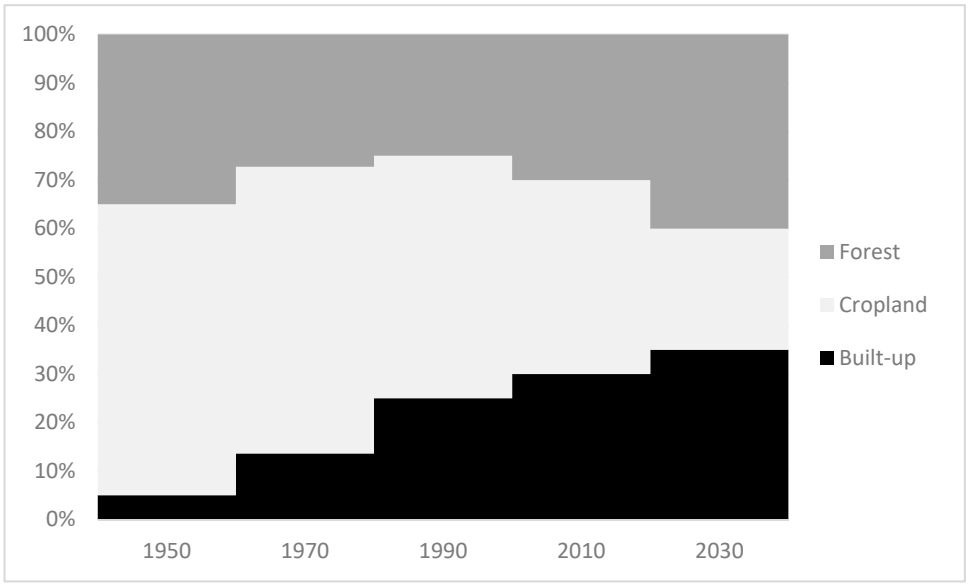

Figure 2. Dynamic evolution of land-use changes for advanced economies according to the forest transition theory.

1.1.2. Demographic Transitions in Advanced Economies

Demographic transition (DT) symbolizes the development from high to low birth, fertility, and death rates by means of a country maturing from a preindustrial to an industrialized reality with subsequent socio-environmental differences [24–26]. It occurred in western countries from the 18th and 19th centuries onward and during the second half of the 20th century around the world [27–29]. In demography studies, two kinds of demographic transitions can be distinguished, transforming high fertility and mortality rates characterized by young populations toward decreasing demographic rates and population ageing [30–36]. The first demographic transition showed birth and death rates decreasing from traditionally high levels [37]. It occurred in the 1950s and 1960s, reaching a peak of urban concentration at the end of the first demographic transition in the 1970s [38,39].

However, following [40], the early signs of the second demographic transition emerged in the 1950s when divorce rates were rising, especially in the United States and northern/central Europe. From the second half of the 1960s onward, fertility started falling from its "baby boom" high. Moreover, the trend in ages at first marriage was reversed again and the number of singles started rising. It became apparent that premarital cohabitation was on the rise and that divorce and widowhood were followed less commonly by remarriage and more often by post-marital cohabitation. Since the 1960s, there was a drastic revolution in the pattern of household formation and reproduction in north-western Europe [27]. The age at first marriage rose again after falling to an unprecedented low during the 1960s. Premarital and post-marital cohabitation improved and procreation in such informal unions soon followed. Divorce rates continued to increase together with high separation rates between cohabitants. In the 1970s, total fertility rates in western countries of Europe essentially reflected differential postponement; while in the 1990s, they mainly capture differential degrees of catching up after age 30 [27]. With the 1980s, the second demographic transition was therefore related to demographic changes, e.g., decreasing birth rates, rising life expectancy, and structural changes in households (decreasing size, increasing number, and diversity) as well as the destabilization of traditional

patterns of marriage, family, and divorce linked to societal changes in life scripts, lifestyles, and professional careers [36,40–42]. Urban areas were the first to be affected by these changes [41,43,44]. The second demographic transition has happened together with social changes and demographic redistribution developments visible at regional scale [45]. It informs the revolution in, e.g., individual and household characteristics, fertility, sexual and childbearing behaviors [33,34,36,37].

Demographic transitions can be assumed to be an actual sign of "a pathway to change" which has happened in the contemporary societies and economies [28]. They triggered a greater heterogeneity in population dynamics, time of childbearing, household size, individual choices concerning marriage or cohabiting, and a widespread population ageing [46–49]. Demographic dynamics are sensitive to economic episodes [29,30,50–53], exposing a real bond among socio-demographic and economic variations [29,54,55]. Demographic factors, e.g., the changing rates of marriage, cohabitation, and separation [55], have been evident during the second demographic transition [56]. Moreover, attitudes to gender roles emerged as women's socioeconomic characteristics [27,42,56,57], e.g., their labor market engagement [58,59] and their educational achievement [60,61] defined new fertility purposes and behaviors [56]. With demographic transitions, life expectancy turns out to be longer with joint decreases in mortality and fertility, which can be detected following the spatial variation of population growth rates [30,32,62–64]. In fact, the demographic transitions reflect each socioeconomic change along the urban–rural gradients [65,66], changing the distribution of economic roles at the territorial scale, e.g., regional or metropolitan [31,67,68].

Demographic and family behaviors in southern Mediterranean Europe, in terms of couple formation, fertility, and living in the parental household, are currently quite different from those of central and northern Europe; the explanation of these individual behaviors may also lie in the socio-cultural specificity of Mediterranean Europe [69]. Family ties may represent the keystone of socio-demographic evolution in Europe, and especially in specific parts of Europe such as southern and eastern countries [70–72]. The patterns of family relationships (between spouses, between parents and children, between older and younger generations) that largely characterized, at least until a few years ago, southern European families may be considered quite close to the intra-household relationships in North Africa [69]. Population growth has been a major driver for the rapid expansion of both large- and medium-size city regions [73]. Rapid population growth was one of the most relevant characteristics of the post-war development of European cities, especially along the Mediterranean arc [74–77]. In southern Europe, demographic data indicate two patterns due to different stages of demographic transition. Population in the five southern European EU-member countries doubled between 1950 and 2000, while that of the remaining Mediterranean countries increased more than nine-fold [38,78–80].

2. Landscape, Urbanization Processes, and Demographic Transitions

Based on the intrinsic integration of theories of forest transition and demographic transition, the present section focuses on the relationship between land-use changes and demographic evolution of metropolitan regions. This section discusses whether discontinuous and dispersed urban growth can be associated with a specific demographic transition, with a specific focus on Europe [81]. A specific analysis of the relationship between urbanization processes and demographic transition was relatively scarce and oriented toward local exercises and applications [82]. However, urbanization and economic development start (more or less) simultaneously: specifically, in the early phases of urbanization and economic development, the population growth rate increased, but it declined in succeeding years [83]. Moreover, advancing urbanization reduces fertility since urban growth and demographic transition share a local connection that is worthy of investigation [1]. Improving income and education opportunities in urban settings results in urbanization, leading to lower fertility [84]. Demographic transitions reflect socioeconomic processes influencing urban configurations, shaping socio-spatial gradients, and altering the distribution of economic functions over large metropolitan regions [85]. Socio-demographic evolution may

reflect both apparent or hidden changes in urban structure and functions, re-densifying and spreading metropolitan landscapes [80,86–88].

Following economic and social transformations, the demographic regime has changed in developed countries and is now substantially different from the one observed in the immediate aftermath of World War II [40]. Heterogeneous population dynamics associated with the 'second demographic transition' have involved new family relations, fewer and later marriages, declining fertility rates, ageing populations, postponement of childbearing, and smaller households [41,45,49,89]. Such dynamics are having a powerful transformative effect on both inner cities and suburbs, re-densifying these areas and creating more diverse and complex social landscapes [86–88]. Recession shocks often lead to added spatial complexity within the structural changes of urban populations and this may be reflected in the local-scale outcomes of the second demographic transition [90–92].

Trends over time in socioeconomic indicators (e.g., fertility rates)—reflecting (directly or indirectly) the demographic dynamics associated with the second transition—have rarely been associated with heterogeneous settlement dynamics depending on suburbanization [93]. The short-term impact of the economic crisis on settlement dynamics was also occasionally investigated. Generally speaking, recent urbanization dynamics coincide with an increase in low-density urbanization together with an abandonment of rural land, an effective agricultural transition, and a new population structure influenced by recent demographic dynamics [94]. For instance, several influences may contribute to the high fertility in suburbs, correlated with family-friendly areas, populated by larger and lower density houses where families are more prone to childbearing [95–97]. Since the demographic transitions have been accompanied by a period of urbanization, e.g., urban dispersion, today's young population, eager to live in low-density contexts in larger houses and with expectations of having children, finds itself restrained in dispersed contexts where it is essential to use a car to reach a service or another activity [98]. This outcome emerged as a basic characteristic of suburbs, first in the United States and then in Europe: as a matter of fact, suburban life has been considered as a part of the 'American dream', picturing younger and larger families. Nevertheless, today, suburbs are aging both in North America, and in Europe [99].

The theory of demographic transition intimately links the emergence of a 'small family ideal' with the rise in urban and industrial living, but the role of urbanization in fertility decline remains a matter of debate [100]. Rural–urban fertility differences are merely considered as a spatial manifestation of the differential steps of structural changes of society [101]. When compared to rural areas, urban living increases the costs of childrearing since cities also offer more avenues for socioeconomic mobility because of the rise of nonagricultural employment and the increased educational level of the population, thereby increasing the opportunity costs of fertility [100]. City structures were also more exposed to the negative fertility effects of financial crises. These structural forces of fertility decline are brought about and accelerated by population concentration and may thus be considered as an integral part of the urban effect [73,102,103]. Starting from similar fertility levels by place of residence, the rural–urban difference increased sharply in the opening phase of the demographic transition due to an earlier and faster fertility decline in cities [104]. Later, rural fertility levels tended to converge to the lower urban standard as the lagged decline in rural areas was also very marked [100].

Cultural factors may also explain urban–rural fertility variation [105]. The literature has revealed that individuals living in rural areas and small towns retain traditional attitudes and lifestyles, with a value orientation towards large families and a preference for extended families [106,107]. A rural and small-town population can consequently be considered a 'family-oriented' sub-culture within a country [108,109]. The 'family-oriented' sub-culture forms a normative context for couples to draw upon when they make various decisions. Cities, in turn, remain a stronghold of 'post-modern' values and are the places where the 'second' demographic transition began and spread [108]. Cities promote individual autonomy and individual choices, which usually means fewer children. There is also more heterogeneity in cities: while a 'family-oriented' subculture may exist there,

particularly in the suburbs, cities are also places that support (or at least tolerate) the 'culture of singlehood and childlessness' [105].

2.1. Urbanization Processes and Demographic Transitions in Europe

Demographic transitions have coincided in Europe with a new trend of urbanization processes, where populations choose to live in suburban areas in respect to the urban city [25]. A recent territorial structure has progressively established in European countries, defining a new spatial configuration among cities and suburban centers [35,37,87,110–115] that have gradually begun to exert increasing pressure on semi-natural areas (Figure 3). Suburbanization is the most common type of development in Europe responsible for the increase of suburban areas physically separated from compact urban agglomerations [116–118], through the construction of related industrial infrastructures and public transport (Figure 3). The development, and the related more intense use, of road and railway networks has led to an increase in artificial barriers intersected in the European territory and in the habitats of the species that populate it, decreasing connectivity not only [119–121] between the habitats themselves but also their surface, with a negative effect also on the species [122]. Besides the ecological consequences of this phenomenon, observed in most European countries, there is also an evident conflict between urban and rural areas [123]. The time period between the 1950s and the early 2000s was characterized by the decline of agricultural land with the transformation of many landscapes, mainly agricultural, into predominantly urban landscapes, creating transition zones between city and countryside (e.g., [119,124,125] where crops located in plains close to large cities and well-connected areas have had the greatest impact [126–128].

The substantial decrease in available surfaces has led to an intensification of activities in the remaining land, making the mosaic of land use monotonous with consequent loss of vegetative species and related ecosystems [31,129,130]. Indeed, an advanced phase of fragmentation increasingly isolates the remaining habitats and ecosystems, interfering with physiological and migratory processes and producing negative effects on the information structures of flora and fauna [131,132]. Numerous studies have already demonstrated the importance of the presence, outside the forests, of single trees or small plant formations able to keep otherwise isolated habitats connected [133]. A disturbance of this equilibrium would over time also compromise the ecosystem functions of the landscape of extreme importance also for human activities.

According to the processes of the 'second demographic transition' [42], the urban population in the whole of Europe is undergoing a further differentiation in terms of a rising diversity of household structures. The new phase of urban growth would not mostly be explicated by second demographic transition variations in some European countries, but the arrival of labor-related foreign immigrants has been of great importance. For instance, these international flows, mostly from central and eastern Europe and other developing countries, have been particularly strong, with highly segregated labor markets in Spain and other southern European countries [134,135]. They incline to settle in core cities, predominantly in low-quality neighborhoods [136] since central areas offer them more work opportunities, better public transport, cheaper housing, and easier networking among different immigrants [136–139].

The theory of demographic transition is founded on the understanding of population history, dealing with transitions in birth and death rates in developed countries over time [24,26,40]. The transition usually contains four stages: (i) death rates and birth rates are high and unevenly balanced corresponding to the late 18th century, when this balance ended in western Europe; (ii) the death rates drop rapidly due to improvements in food supply and sanitation; (iii) birth rates fall owing to access to contraception, rises in wages, urbanization, a decrease in subsistence agriculture, growth in the status and education of women, and additional social changes; and (iv) low birth rates and low death rates [140,141]. The decline in the birth rate started in the late 19th century in northern Europe. By the late 20th century, birth rates and death rates leveled off at lower rates in

rich countries [141]. Though this model foresees ever-declining fertility rates, beyond a certain level of development fertility rates rise again [142]. As with all models, this is a multi-dimensional (although still partial) interpretation of population change in advanced economies. Germany, Slovenia, Italy, and Spain are some countries which have experienced an advanced stage of the 'second demographic transition' [29,143], as evidenced by recent rapid declines in fertility and marriage rates, the postponement of child-bearing and rising divorce rates and household numbers [138].

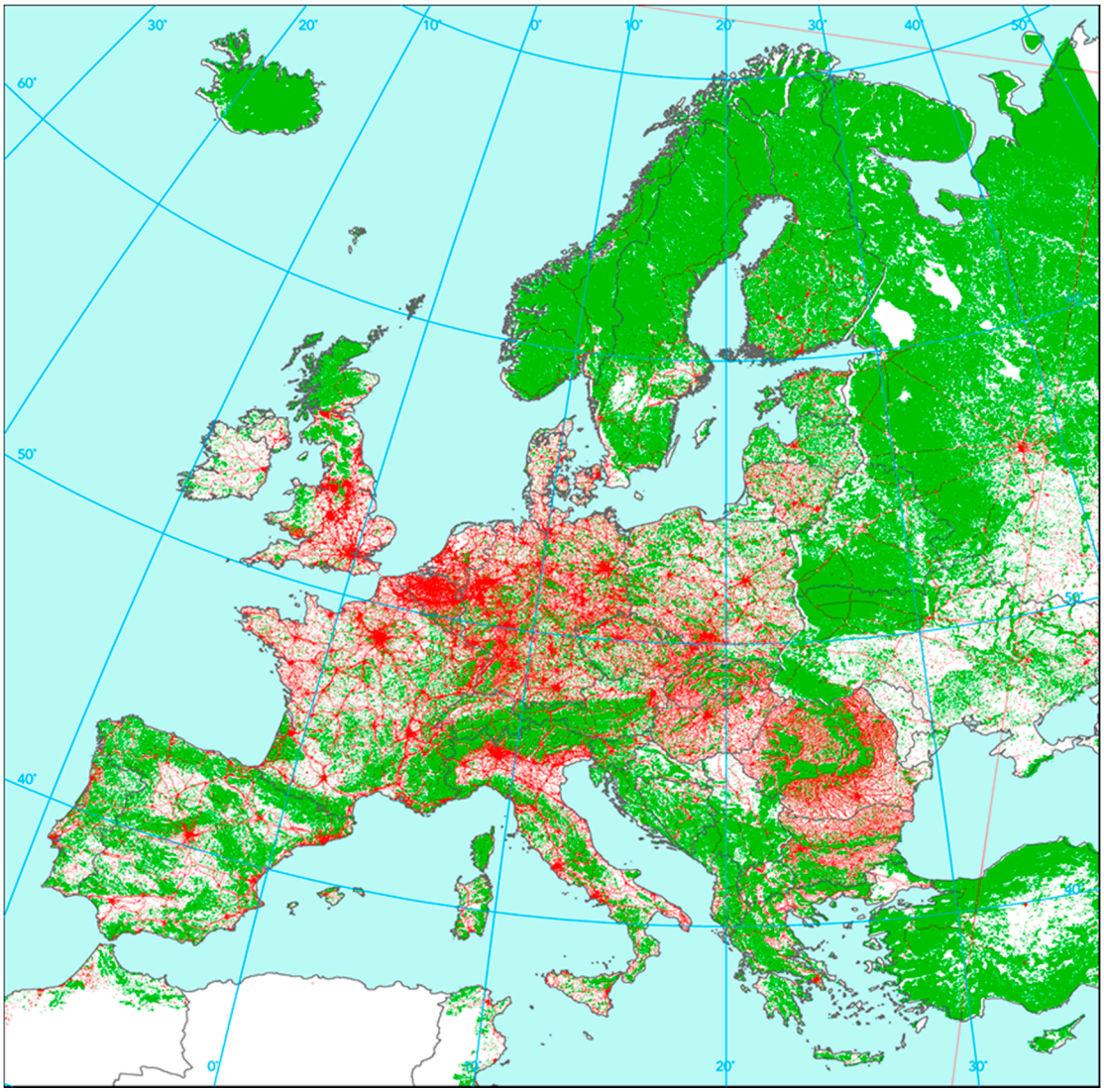

Figure 3. Pressures of urbanization and transport on semi-natural areas in Europe until 2009 (source: EEA). Transport and urban areas are red colored, wooded areas are green colored, others land covers are white colored.

Simultaneously, they are undergoing interrelated processes of economic and welfare restructuring, albeit for different reasons, as (the former East) Germany and Slovenia are well into the post-socialist transformation, while Italy and Spain are moving towards post-industrial service economies [143–145] and 'workfare' states [146]. In all four countries, the ageing of urban populations has been exacerbated by the emergence of counter-urbanization and suburbanization trends during the past few decades [147]. Many of these processes are still under way, despite numerous policy efforts to 'bring back' capital and population to the inner urban fabric [138] (Figure 4).

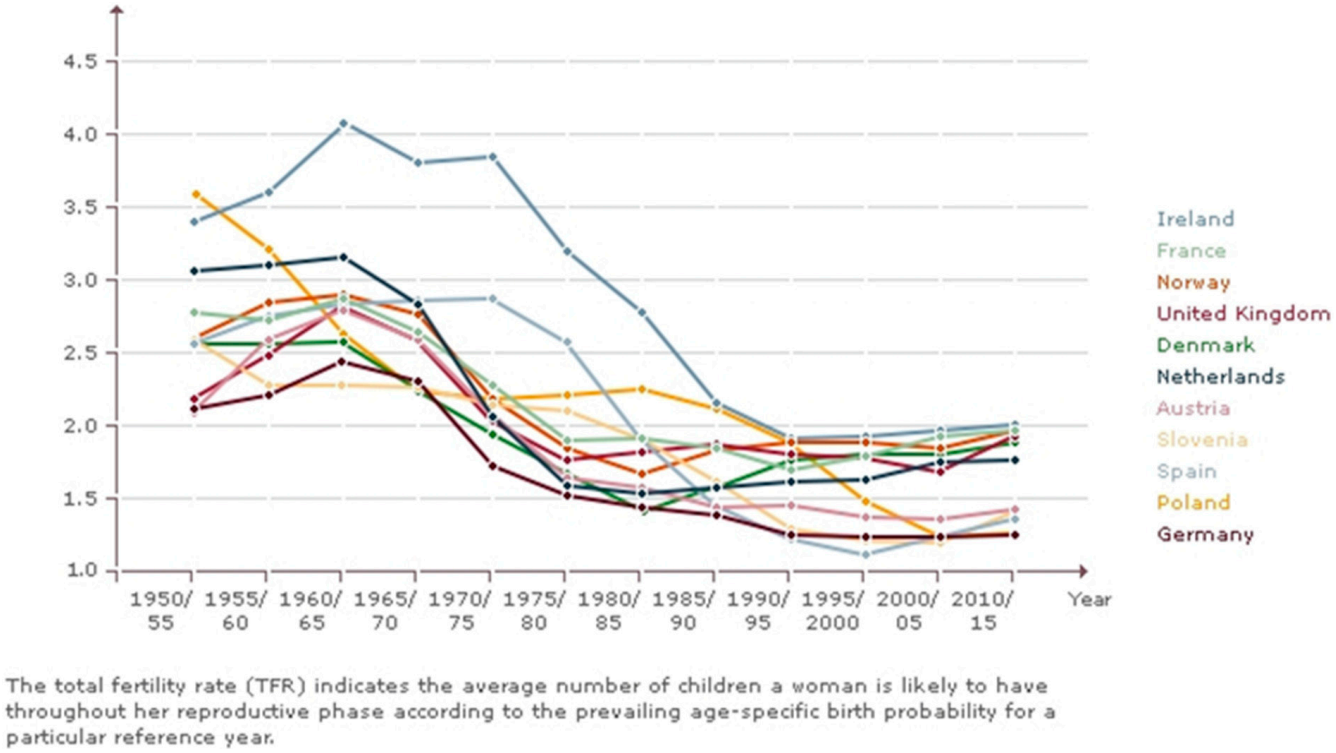

Figure 4. Total Fertility Rate (TFR) in Selected European Countries from 1950–1955 until 2010–2015 (Source: UN World Population Prospects; 2012 Revision).

2.2. Urban Development and Mediterranean Landscapes

As a paradigmatic case in Europe for rapidity of landscape changes in a truly ecologically fragile context, the determinants of urban growth observed in Mediterranean Europe include intense demographic processes driven by rural transformations and powered by land development policies causing a disproportionate expansion of urban areas [67]. Population growth has placed the Mediterranean regions at the forefront of new crucial issues, since peri-urban areas, coasts, and uplands were the areas of the highest demographic expansion. Combined with the demographic transition and the undeniable cultural change, the shift of production from industrial economy to the tertiary sector is another feature of Mediterranean urban evolution [68,145]. This transformation per se is not the dominant characteristic of the region [148].

Recently, Mediterranean cities in Europe have been relevant cases to evaluate the implications and consequences of the 2007 crisis on urban populations by considering both the short-term changes in demographic dynamics and the population redistribution at a metropolitan scale [51,136,141]. However, the combined effect of multiple drivers on urban change, such as demographic transition, suburbanization and recession (inter)acting at different spatiotemporal scales, has been rarely investigated in southern Europe and, more generally, in the whole continent [73]. Identifying similarities and differences in basic demographic indicators before and during recession may shed light on recent urban transformations in metropolitan regions under volatile business cycles [86,137,149]. City-scale changes in demographic indicators reflect recent trends in urban expansion [52,150,151] and can be easily compared with empirical evidence stemming from narrative and quantitative analysis of urban design, city planning, and land-use policy.

3. Discussion

With demographic transitions, new types of household formation through more protracted single living, premarital cohabitation, and progression to parenthood within cohabiting unions have progressively gained ground in Europe [40,152,153]. Initially, these

demographic transitions appeared in northern Europe in the 1960s, spread to western Europe in the 1970s, reached southern populations in the mid-1980s and apparently expanded to central Europe as well during the 1990s. Current household types, age of childbearing and at marriage, education, and occupation are correlated to urban features, outlining similar household types in different European regions [27]. This commentary seeks to match basic knowledge in regional demography with a broader perspective typical of environmental studies. This may stimulate further research that contributes to integrating existing macro-level approaches with a micro-level analysis of individual decisions relevant to demography and social dynamics. Such frameworks can also highlight distinct urban phases, evidencing, e.g., divergent rates of fertility and mortality, marriage, and migration. Together with the role of socioeconomic background, neighborhood context, and institutional local/regional assets, empirical models should clarify how demographic processes indicative of urban–rural life cycles exert significant effects on the prominence of land uses with distinct environmental implications (e.g., urbanization, crop intensification, land abandonment, and forest recovery).

For instance, clear signs of land-use changes in Spain derived from dominant factors can represent an excellent source of data capable of informing legislators about the real effects of management choices and policies [154] (Figure 5). Political actions should offset the negative effects of these changes by incentivizing finance and development in these areas. To do this, there are simulation models that work at different scales that can provide indications and translate the conditions into scenarios characterized by demographic, economic, and political changes related to land use changes in Europe [9]. The advancement of agricultural borders is often correlated with environmental, social, and economic changes. However, it is not possible to systematically verify the hypothesis and make a generalization of the phenomenon. According to Rindfuss et al. [155], Mill's method was used based on the agreement approach aimed at obtaining results from seven long-term case studies concerning the change of land cover in border areas. Variations were also observed in the aforementioned areas in the distribution and organization of activities in cultivated land. Recently there has been a spread of national policies that recognize and promote the protection and importance of ecosystems and open spaces. This is more difficult in countries characterized by internal and external conflicts or unstable political situations. Political-demographic control and environmental protection are distinctive targets that can influence the philosophy underlying urban and regional planning in different ways.

In the study by Orenstein and Hamburg [156], the case of Israel was investigated with the aim of verifying if these two different paradigms can coexist and influence the decision-making policies of land management. The aforementioned was chosen as a case study because, despite being a country characterized by a long history of land use and management practices based on political-demographic control, in recent years it has begun to adopt decisions that are more influenced by the environmental paradigm. This topic is clearly of broader interest, since demographic change has become a major issue regarding land-use and 'landscape persistence', especially in metropolitan regions. Thanks to the recent decrease in birth rates, aging, and shifting household structures, demographic change were demonstrated to significantly affect urban land use, fabric, housing markets, and infrastructures [153,154,157]. Current socioeconomic drivers of land-use change associated with globalization are producing contrasting land-use trends on a global scale. Increasing global food (and biofuel) demand, on the one hand, accelerates deforestation in areas suitable for modern agriculture, threatening natural ecosystems and biodiversity (Figure 6). On the other hand, high yields in modern agricultural systems and rural–urban migration promote the abandonment of marginal agricultural lands, encouraging the recovery of the ecosystem in mountain and desert areas and areas with low-quality soils, increasing human well-being. The transition from extensive to intensive cropping systems could increase production, while helping to save areas for the restoration and conservation of natural habitats. This new scenario stimulates a rethinking of soil and landscape conservation policies, especially in ecologically fragile areas [157,158].

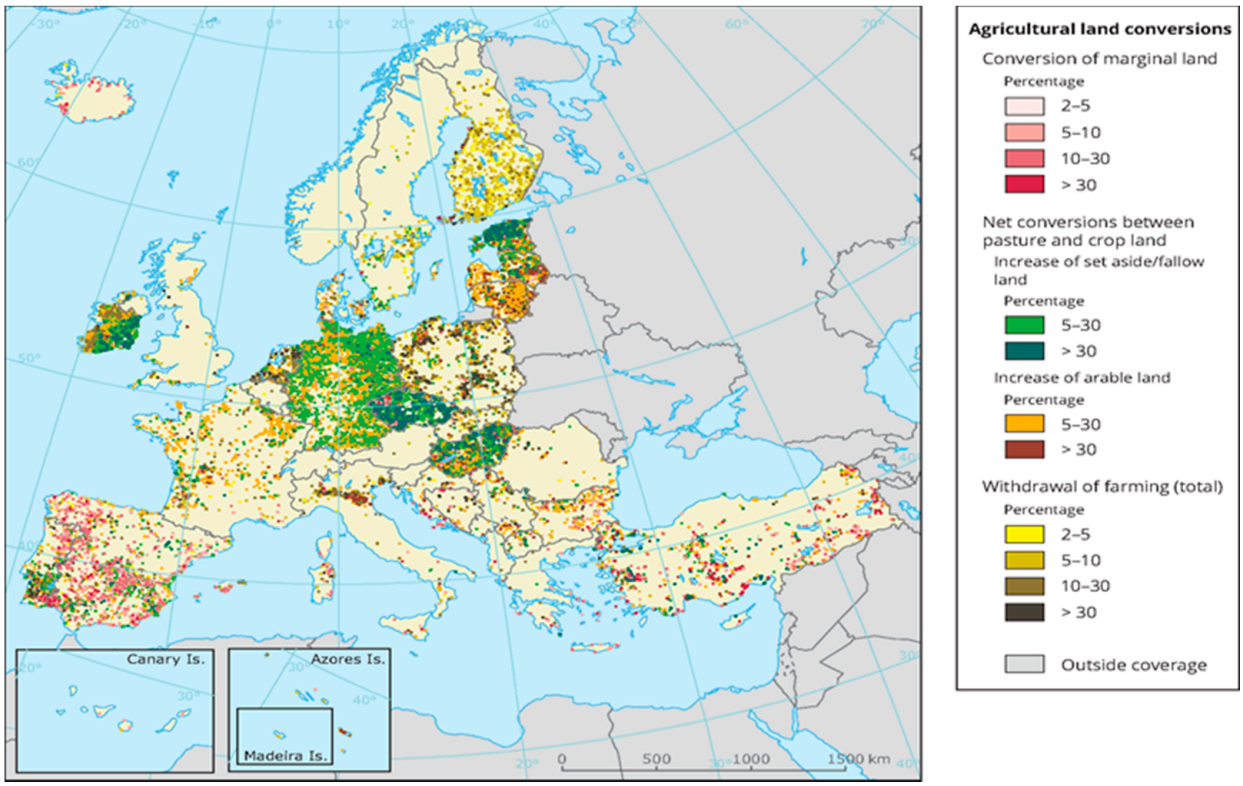

Figure 5. Agricultural land conversions in Europe until 2017 (source: EEA).

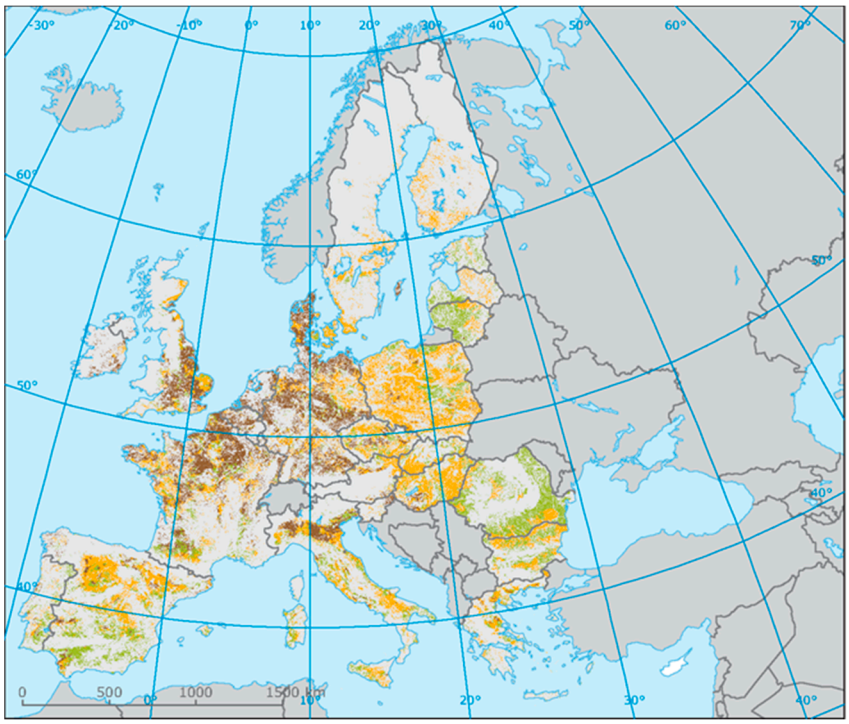

Figure 6. Agricultural land use intensity in Europe (2015); green, yellow, and brown respectively depict extensively used, moderately intensively used, and intensively used arable land; light grey represents non-agricultural land; dark grey indicates countries not covered (source: EEA).

4. Concluding Remarks

Humans have significantly influenced all types of ecosystems worldwide as a consequence of anthropogenic impacts. In an attempt to obtain an even greater well-being, modern societies have induced profound environmental changes at local scales. Consequently, ecological approaches have been increasingly interested in a comprehensive understanding of the overall impact of human activities on ecosystems, e.g., integrating notions and knowledge typical of human demography. A land management strategy oriented toward human-natural interactions is increasingly required to be no longer grounded exclusively on a solely political-economic approach, being in turn able to integrate environmental paradigms into management processes. A similar strategy should have a final objective of sustaining an economically viable agricultural production while keeping the environment (more or less) intact. This vision may encourage a sort of 'holistic planning' adapting to different spatial scales. Being flexible to new operational paradigms that are not only local, such visions take an appropriate account of flows of people or goods involving entire regions (and even continents). The theory of forest transition can specifically contribute to this new planning paradigm, demonstrating how industrialization and urbanization can lead to the abandonment of agricultural land and marginal areas, favoring the return of natural crop systems such as forests. However, such a process would not only bring positive effects, and in any case, there are still many political, social, and economic factors that prevent its advent. For such reasons, a new, interactive, and pro-active decision-making policy is necessary, given that future human activities will likely lead to ever more marked and evident changes in land use. Considering the tight linkage between land use, environmental quality, and demographic dynamics, human activities leading to profound variations in the spatial structure of landscapes should be better governed and regulated from a holistic perspective, reconnecting economic and environment targets into a 'sustainable development' vision.

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