



Investigaciones Geográficas (Esp)  
ISSN: 0213-4691  
ISSN: 1989-9890  
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España

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Available in: <https://www.redalyc.org/articulo.oa?id=17664428013>



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# The spatial diffusion of economic activity in the Oviedo region (1970-2018)

*La difusión espacial de las actividades económicas en la comarca de Oviedo (1970-2018)*

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Investigaciones Geográficas (Esp), no. 72, 2019

Universidad de Alicante, España

Received: 03 April 2019

Accepted: 29 July 2019

Redalyc: <https://www.redalyc.org/articulo.oa?id=17664428013>

**Abstract:** The spread of economic activity in the Oviedo region in northern Spain in recent decades has deeply altered the territorial model. The traditional dichotomy between rural and urban landscapes is blurring, and many functions are being relocated in formerly rural areas. The construction of motorways, and other transport infrastructures, accompanied by the triggering action of both public and private investment, lax legal frameworks, and the amount of flat land, are the main factors that explain the process. Using historic aerial photographs and data gathered by public institutions, this article offers thematic maps to understand the phases and distribution of the spatial diffusion process. The spatial-temporal sequence of landscape changes helps us understand the processes of development in a peri-urban landscape characterised by a diffusion of functions and its role in landscape configuration.

**Keywords:** Spatial diffusion, economic activities, peri-urban landscape.

**Resumen:** La dispersión de las actividades económicas en la comarca de Oviedo durante las últimas décadas ha tenido como consecuencia una profunda alteración de su modelo territorial. La tradicional dicotomía entre paisajes rurales y urbanos se presenta hoy en día borrosa, debido a que funciones netamente urbanas han ido desplazándose hacia las zonas rurales. La construcción de autopistas y otras infraestructuras de transporte junto con diferentes políticas e inversiones públicas y privadas, además de un marco legal laxo en lo relativo a la ordenación territorial y la abundancia de suelos de topografía llana constituyen los principales factores que explican este proceso transformacional. Mediante el uso de fotografías aéreas históricas y datos recopilados por instituciones públicas, en este artículo se elaboran varios mapas temáticos con el fin de comprender las fases y la distribución del proceso de difusión espacial. La secuencia espacio-temporal de los cambios paisajísticos nos ayuda a comprender los procesos de construcción de los paisajes periurbanos en áreas caracterizadas por la difusión de funciones así como el papel de éstas en la configuración del paisaje.

**Palabras clave:** Difusión espacial, actividades económicas, paisaje periurbano.

## 1. Introduction

The impact of economic activities on the transformation of territory is extraordinary. They have an enormous potential to alter the economic, social and political structures that had been slowly created during centuries in a short period. Therefore, these processes are of great interest from the point of view of geographic research.

In the last four decades, drastic economic changes have altered the traditional processes of landscape construction in Western Europe

(Antrop, 2000). Former rural areas surrounding cities have been observed to undergo important transformations because of the diffusion of functions traditionally located in cities resulting in what is defined as peri-urban landscapes (Nilsson, Pauleit, Bell, Aalbers & Nielsen, 2013). These kind of landscapes are determined by a dispersed population, a high mobility and a great heterogeneity of land uses (Adell, 1999; Caruso, 2001). The landscape changes introduced by the spread of urbanization in Europe is closely related to industrialization and economic growth and spread with the innovations that the Industrial revolution prompted (Antrop, 2004) and also by the role of accessibility and infrastructures (Lewis & Maund, 1976).

In this vein, Indovina (1990) coins the term *città diffusa* to synthesize the main changes in contemporary periurban fringes. The author suggests a set of criteria to determine if a region is facing a diffusion process: displacement of the population, dispersed location of economic activities, a dense network of infrastructures, an increase on mobility and changes in lifestyle. Rather different from the traditional compact model of cities in southern Europe, the current concentration of population, activities and infrastructures leads to a heterogeneous space that does not necessarily have to be contiguous, as it is normally territorial lyblurred and connected through internal and external networks (Ascher, 1995). As a result, the previous dichotomy between rural and urban landscapes is nowadays unclear, with the emergence of new land scapesthat have been conceptualized and defined in different terms: rururban, periurban, sprawl, etc. A significant one is the German concept of *Zwischenstadt* or in-between cities adopted by Sieverts (1997), which seeks to restore the task of regional planning in order to answer to the social and environmental challenges of ourtime by placing the territorial questions in the centre of the matter. Focusing on three dialectical elements—place vs. world, time vs. space and city vs. landscape— Sieverts shed light on the variegated landscapesof the urbanized regions.

The history of landscape is also a valuable tool to provide better planning instruments in the future as highlighted by Marcucci (2000). Unfortunately, the available information in historical studies of peri-urban landscapes is poor. Therefore, a combined analysis of the legacies of planning and landscape ideals is necessary in order to perceive the contemporary character of the urban fringe (Qviström, 2010). The under- standing of this new territorial model and its phases of development requires a combination of qualitative and quantitative approaches as Nadal (2003) points out. Moreover, using different geographic scales helps us to approach the spatial trends in which economic changes unfold.

As many European regions, the centre of Asturias where Oviedo is located, have experimented a huge process of transformation in its peri-urban landscape in the last decades. Fernández García (2003a) identifies the main keys to understand the post-industrial territorial model that has emerged since the 1970s. Among the factors that triggered these recent changes, economic activities have a significant role. However, its

spatial outcomes are not so frequently studied. Aiming to understand the process of the spatial diffusion within the Oviedo region, this paper focuses on addressing the following research questions: i) how the spatial distribution of economic activities has changed since 1970; ii) what the factors that explain landscape transformations are; and finally, iii) what temporal phases and spatial patterns have characterized these recent transformations. The purpose of shedding light on these questions seeks to enhance comprehension of the regional transformations induced by recent economic changes.

### *1.1. The emerging of a new territorial model*

As Tortella (2000) states, industrialization in Spain was mainly a phenomenon of the twentieth century. In the last four decades, transformations in both economy and society have had an important role in recent urban and rural changes across the country. Among the Spanish academic contributions that have focused on economic geography, the Industrial Atlases of Fernández Cuesta & Fernández Prieto (1999) and Nadal (2003) are the main sources to obtain an accurate description of the industrialization process in Spain. Since the 1970s the spatial distribution of economic activities in Spain has been deeply altered, with winner and loser regions. Asturias is clearly among the latter. The decrease in active population, low gross value added and the demographic decline are the main indicators of the diminishing weight of Asturias in Spanish economy. Besides, the closure of heavy industries, the disappearance of coal mining and the stagnation of mature sectors are some of the reasons for the decay in economic activities.

In the course of the Franco dictatorship (1939-1975), Spain underwent at least two different periods of economic policy making. From the striving for self-sufficiency, also called the autarkic period, during the 1940s to a growing degree of economic liberalism and the adoption of the planning mechanism in the 1950s and 1960s (Harrison, 1978). The second stage was characterised by the adoption of the Stabilisation Plan in 1959 and First Development Plan in 1964. The so-called developmentalism era had a strong impact in the Oviedo region with the promulgation of a Development Pole in the centre of Asturias. This policy implied important state investments and the concentration of industrial soil in the region as Fernández García (1984) and Benito del Pozo (1990) highlighted. The economic systems existing in Asturias during the last years of the Francoist regime were characterised by a strong dependence on heavy industries and State patronage. The protection policy used defensive tariffs and prevented foreign competitors from entering the inner market (Nadal, 2003).

The return of democracy and the incorporation of Spain to the European Union in 1986 were the prelude to a free market economy. The transition process supposed the privatisation of several national companies, the fall in productivity and the loss of a large number of jobs, especially in regions with heavy industry like Asturias (Pascual Ruiz-

Valdepeñas, 1992). The huge economic and social crisis fostered the passing of the Law on Reconversion and Reindustrialization of 1984. The aim of this law was to encourage new investments that enhanced the creation of new industries and concentrated labour force in the more dynamic zones. For this purpose, the law gave credits and subsidies only in some zones declared of urgent reindustrialization (ZUR) and zones of economic promotion (ZPE). This policy was also applied in the Oviedo region, consolidating its role as an emerging economic location in Asturias. However, according to Fernández García (1997), this policy has not achieved significant improvements either in the economic recovery or in the creation of employment in the region.

Although Asturias is sometimes identified as a peripheral province in the Iberian Peninsula, it has experienced within its boundary limits the same process of polarisation that happened in the rest of Europe. Thus, the Oviedo region has emerged since 1970s as one of the winner area. Its flat topography adds to the largest area of Asturias with a slope less than 3%. Furthermore, its proximity to other Asturian cities, good accessibility through a dense network of motorways, roads and railways, reinforced by weak planning instruments are the conditions on which a diverse and dispersed productive fabric has been developed in the last decades.

The disruption of the spatial distribution of economic activities in the Oviedo region started in the 1970s. As Nadal (2003) points out, the outcome of the so-called Third Industrial Revolution is characterised by a deep reorganisation of the structure of production system, which implies changes in the articulation of companies and new regulations on labour force. In the previous decades, the traditional spatial model of the economic activities was characterized by the creation of large business groups (George, 1977). By contrast, the current territorial model is determined by the role of the storage, logistics and services economy (Bryson & Daniels, 1998). The externalisation of some services also encouraged the division of productive units into smaller and specialised ones, whose spatial outcome is the dispersion of small and medium-size enterprises (SMEs) over the most accessible areas (Fernández Cuesta & Fernández Prieto, 1999).

Apart from the changes in the distribution of economic activities, there are some indicators of a huge transformation in both population and mobility. Recent demographic dynamics have been analysed in Obeso Muñiz (2018) showing a population concentration in Oviedo region in the last four decades. In 1970 the region had 210,098 inhabitants making up 20% of the Asturian population, whereas in 2011 its population grew to 300,918 which constitutes 28% of the total population of Asturias. In terms of mobility, the sum of private cars, trucks, motorcycles and buses in Asturias soared up from 22,427 vehicles in 1960 to 637,867 in 2014 according to the Statistical Yearbook of the National Traffic Authority (DGT, 2019). In relation to private car availability, the relation between private-car ownership and population soared up from 0.5% in 1960 to 7% in 1971, and to almost 20% in 1980, whereas in 2014 this percentage reached 46.6%. The increase in car ownership, a good infrastructural

network of roads and motorways running through a region with flat topography and lax regulative framework in terms of urban and regional planning are the main factors that explain the shift in the territorial model.

Transformations were thus mainly triggered by the anthropic action. Fernández García & Herrán Alonso (2013) recognise three stages in this process. Firstly, from the mid-nineteenth century to the mid-twentieth century meadow pastures replaced croplands as a result of specialisation in dairy. In this stage, the first communication infrastructures were built and, for the very first time, industries were located in former rural landscapes. The second phase was developed between 1950 and 1975 and characterised by the increase in urbanisation and the rapid advance of motorization. Moreover, the industrial function was consolidated in the periphery through the creation of industrial parks. Finally, the authors identify a last stage, which encompasses recent transformations that began in the 1980s whose most significant result was the consolidation of periurbanisation with the relocation of a large number of functions in the periphery.

### *1.2. The weakness of regional and urban planning instruments*

The legal framework in Spain gives the Autonomous Region the responsibility to rule regional planning and therefore to establish planning instruments in order to manage land uses and activities at a regional scale. Furthermore, the Spanish law confers municipalities the scope of the urban planning task concerning zoning and functions within the boundaries of local administration. The democratic transition experienced in Spain in 1977 granted local and regional governments these policies. This is partially one of the reasons why territorial culture is so weak, because of its lack of tradition. Not all municipalities have developed their urban planning documents at the same time, and their objectives and regulations are also different. At urban scale, the first planning instrument approved was in Oviedo in 1986, two years later Siero promulgated its own plan, whereas Llanera and Noreña had basic subsidiary rules. As a result, between 1970 and the end of the 1980s there were no regulations other than the National Land-use Law. The main element of the Spanish planning system is the division into three types of land: urban, developable and undevelopable land.

As Larsson (2006) highlights, Regional Planning is not obligatory in Spain. However, some Autonomous Regions have developed their own instruments, generally including non-binding guidelines. Thus, in Asturias, a regional planning instrument was approved in 1991. Since then, regional planning policies have suffered an extraordinary abandonment especially in the central area, where Oviedo region is located. As a consequence, each municipality has planned its development at its own will and there is no harmony among instruments or in the application of current regional planning theories. Municipalities, direct State policies and private initiatives are the actors giving form



to the current territorial model and paying little attention to regional disparities, environment issues, social disparities, public housing or a rational use of land. Despite the fact that Spain was one of the pioneering countries in the creation of national parks, there is no much sensibility with natural areas in the periurban fringe. In addition to that, the scarcity of flat soil within the Oviedo municipality and its abundance in the neighbour councils of Siero and Llanera, as well as the dense infrastructure network and a weak planning framework, have helped to establish economic activities beyond its municipality boundaries.

## 2. Methodology

Aerial imagery has proved to be a valuable asset not only to make thematic inventories and monitor changes, but also to describe holistic aspects of complex landscapes (Antrop & Van Eetvelde, 2000). Particularly, historic aerial photography is a significant tool when analysing the landscape dynamics as it encourages awareness of changes that normally happen at a slow rate in relation to the perception time scale of the inhabitants (Svenningsen, Brandt, Christensen, Dahl & Dupont, 2015). The Provincial Deputation photogrammetric flight (Provincial Deputation, 1970) is a valuable source to understand landscape transformations through time. This paper's aerial photographs have been scanned at 600 DPI for additional digital processing in the photogrammetric software Agisoft PhotoScan, which solves the triangulation and the block adjusting of a set of frames. As result, a georeferenced orthophoto mosaics radiometrically and geometrically corrected is obtained. The 1970s product are compared with the latest images provided by the national aerial orthophoto program in Spain (PNOA, 2017).

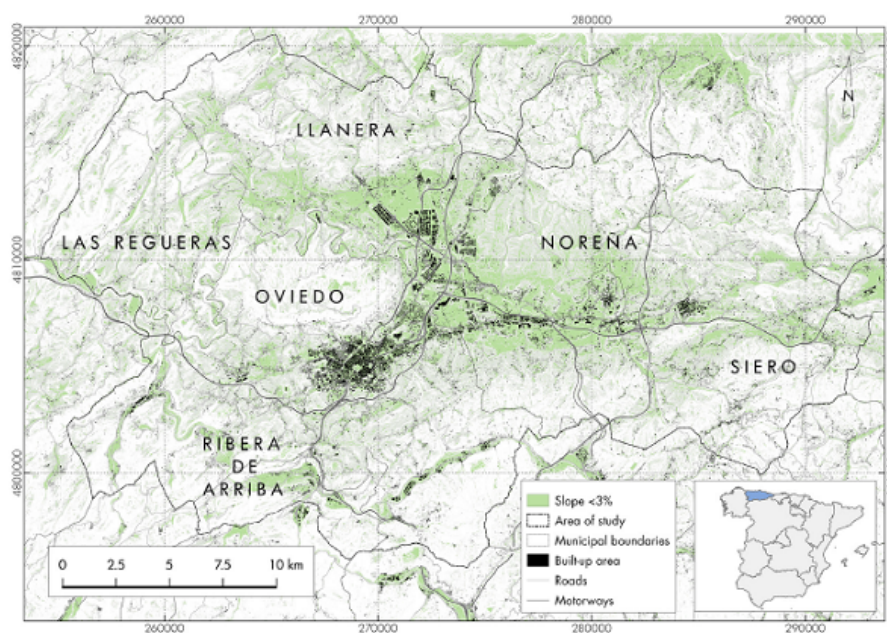
Later, they are integrated into a GIS software in which several geographical information sources have been added, such as the National Topographic Base of Spain provided by the National Geographic Institute of Spain (NGIS, 2019) at 1:25 000 scale (BTN25), Spanish Cadastral Cartography (Spanish Cadastre, 2019) and the Industrial locations provided by Economic Development Agency of the Principality of Asturias (IDEPA, 2019). BTN25 includes 88 layers of geographic information covering topographic and thematic data, designed for exploitation by GIS and production of cartography. Cadastral Cartography is composed by Cadastral Parcel and Buildings datasets, the latter is particularly interesting for the study of the different stages of industrial diffusion process because it provides the date of construction of each building. Finally, the information related to industrial land is obtained in the form of shapefile from LINEA, a geographical information system of IDEPA.

From these data sources, different thematic maps, graphs and tables have been produced. The figures show a spatial pattern characterised by the dispersion of the industrial function. The tables reveal different aspects such as the role of different actors, whether public or private, in the production of industrial land. In order to determine the different

phases of the industrial diffusion process towards the rural landscape, the indicator of square meters of surface per year has been used. Likewise, the date of construction of the main transport infrastructures is indicated in thematic cartography.

### 2.1. Area of study

The area studied is placed in the North of Spain (aprox. 43.4° N, 5.8° W) and it covers 598.4 km<sup>2</sup>. The region was defined by the addition of five municipalities: Oviedo, Siero, Llanera, Noreña, Las Regueras and Ribera de Arriba. This selection is related both with topographical and functional factors. Within the regional limits, a moderate topography basin is located. Oviedo, the capital city of the autonomous region of Asturias concentrated the most of the activities. However, since 1970 an urban diffusion process altered the traditional landscapes that surrounds the city; thus, several functions have been removed from urban fabric and relocated in to rural areas. This shift has produced changes in the land uses. This region is an example of the contemporary transformations that characterize the peri-urban areas and more generally, those located in the rural areas of industrialized countries



**Figure 1.**  
Area of study

Source: National Geographic Institute of Spain, 2019. Own elaboration

## 3. Results

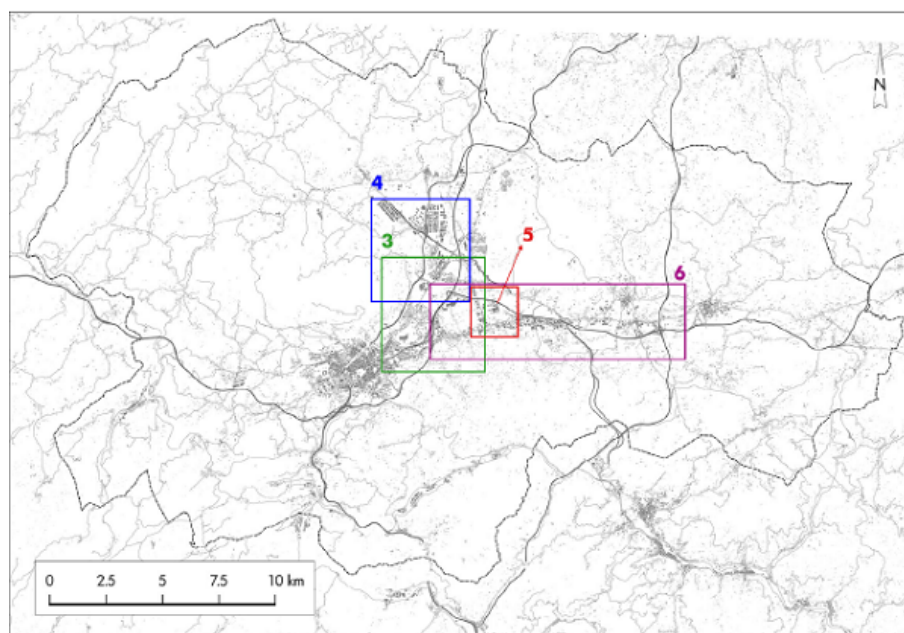
The spatial diffusion process of industrial activities in the peri-urban area of Oviedo region is analysed by using two different approaches. On the one hand, landscape transformations are summarised in the sequences of historic aerial photographs and the production of specific thematic maps.



On the other hand, some landscape metrics have been calculated in order to quantify the evolution of industrial soil by year. Both perspectives lead to a comprehensive understanding of the process.

### 3.1. Landscape transformation through historic aerial imagery

Aerial photographs obtained from the Provincial Deputation photogrammetric flight of 1970 carried out over Asturias are compared with the most updated orthophoto taken by the National Geographic Institute of Spain to produce a set of spatio-temporal sequences that encourages understanding of the recent peri-urban landscape transformations in the Oviedo region. Moreover, historic aerial photographs provide a holistic framework as well as a tool to compare previous configurations of landscape and; therefore, constitutes a valuable resource to improve our perception of the dynamic component of landscape.



**Figure 2**

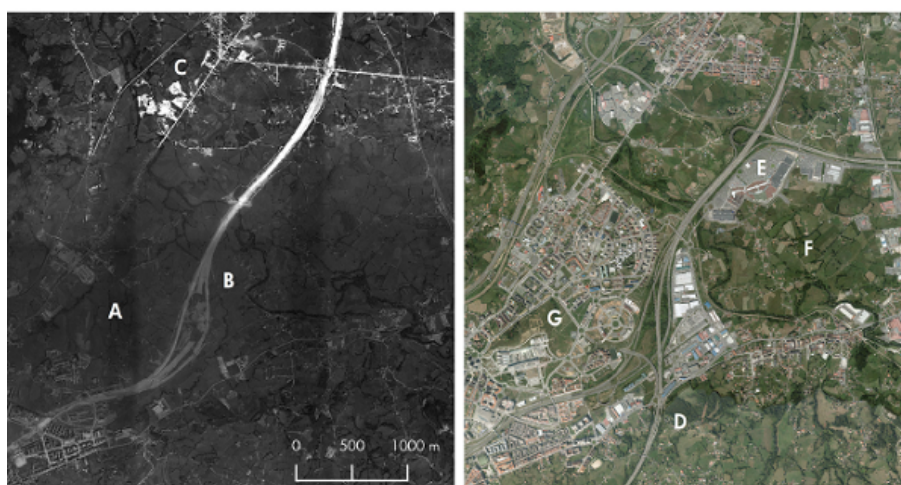
General map with the number of the figures corresponding with the location boxes of the four analyzed landscape transformations

Source: National Geographic Institute of Spain, 2019. Own elaboration

The image (Figure 3) shows transformation in the eastern side of the city of Oviedo (A). When the aerial photo was taken the A-66 motorway, which links the cities of Oviedo, Avilés and Gijón, was under construction (B). It is possible to identify the terrain movements and the lack of asphalt. This is nowadays the most important infrastructure of transport and mobility in Asturias. The town of Lugones (C) located in the old road between Oviedo and the North of Asturias has experimented a huge transformations process, both in the growth of its urban fabric and in its economic activities as Herrán Alonso (2002) has deeply studied. There are some signs indicative of a low slope terrain, the first one is

that River Nora flows over a flat topography therefore creating meanders, the second is the predominance of a straight layout adopted by the road network.

The traditional dispersion of the rural areas in the North of Spain can also be perceived in the photography taken in 1970. Over this traditional spatial pattern, the recent functional dispersion is imposed. The identification of the traditional dispersion of the residential function in rural areas of North Spain was deeply studied by García Fernández (1975) who stated that rural settlements were composed by houses, granaries, farms, stable and other auxiliary buildings related to agricultural practices and plots of lands devoted to crops or pastures. Since the 1970s some changes happened. The addition of new urban developments such as La Corredoria (A), the new Central Hospital of Asturias (G) or the large shopping mall built in the proximity of the junction between the A-66 and A-64 motorways (E) as well as by-pass motorway southwards of Oviedo (D). Furthermore, there are some areas characterized by the abandonment or decess of agricultural activities (F) a clear symptom of the risk of disappearance of rural society (Lizet & Ravignan, 1987).



**Figure 3.**

Landscape transformations in the boundary limit, the river Nora, between the municipalities of Oviedo and Siero

Sources: Left, Orthomosaic derived from the photogrammetric flight of the Asturian Deputation 1970. Dept. of Geography, Oviedo University. Right, Orthomosaic derived from the photogrammetric campaign of PNOA, 2017



**Figure 4**  
Landscape transformations in the northern side of Lugones  
(Siero) and the south of the municipality of Llanera

Sources: Left, Orthomosaic derived from the photogrammetric flight of the Asturian Deputation 1970. Dept. of Geography, Oviedo University. Right, Orthomosaic derived from the photogrammetric campaign of PNOA, 2017

Figure 4 shows landscape transformation occurring in the proximity of Lugones, 5 km to the north-east from Oviedo. This is one of the places where industrialization begins in the region, this location is mainly explained due to the proximity to labour force in Oviedo, the presence of raw materials —kaolinite and clay—, and the good communications with the rest of Asturias. On the left photograph, the previous works to construct the industrial park of Silvota can be identified (A), the explosives factory (B) and the steel factory and refractory plant located in the north side of Lugones (C).

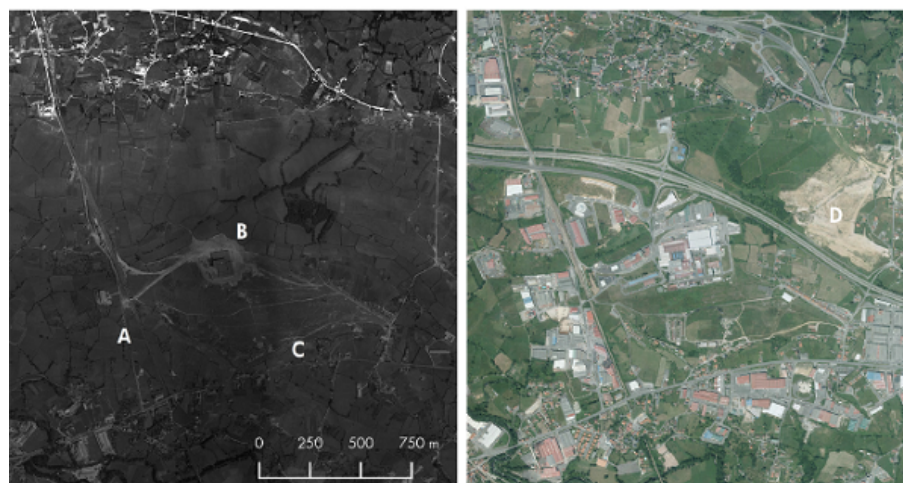
The photo was taken in the moment of construction of two important infrastructures for the central area of Asturias: the Silvota industrial park and the A-66 motorway. Silvota industrial park is mainly the outcome of the Economic Development Pole declared during the Francoist regime to reinforce the diversification of economic activity in the Oviedo region. The park is well linked with the motorway through an important linkage (D) and therefore constitutes a fundamental element to understand the recent landscape dynamic in the peri-urban area of Oviedo.

Apart from the aforementioned elements, there are other pieces of landscape that explain the recent transformation: quarries, the Industrial park of Puente Nora, the very first shopping mall in Asturias (Fernández García, 2003b) whose location is a clear result of closeness to the motorway link (E). The urban development of Lugones also follows the direction of the two major roads, the one that links Oviedo with the north of Asturias and the axis to Santander. There is also a change in land uses in the urban fabric of Lugones due to the cessation of activity of two of the major industrial plants in the north of the village. Their soil is nowadays dedicated to a combination of new industrial companies, sport public facilities while the rest is a vacant plot that can be identified as a social fallow waiting for better economic perspectives. New uses are develop



ed also in the proximity of Silvota industrial park, a technological park (G) was built during the nineties to host small innovative and high-tech companies.

Moreover, the implantation of a sewerage plant (F) can also be observed. It aims at providing water sanitation of the Nora and Noreña rivers and at the same time allows treatment of the wastewater from the main population centres. The water treatment plant of Villaperi was built on the site of a former set of mills linked to traditional activities of the primary sector (García López del Vallado, 2006).



**Figure 5.**

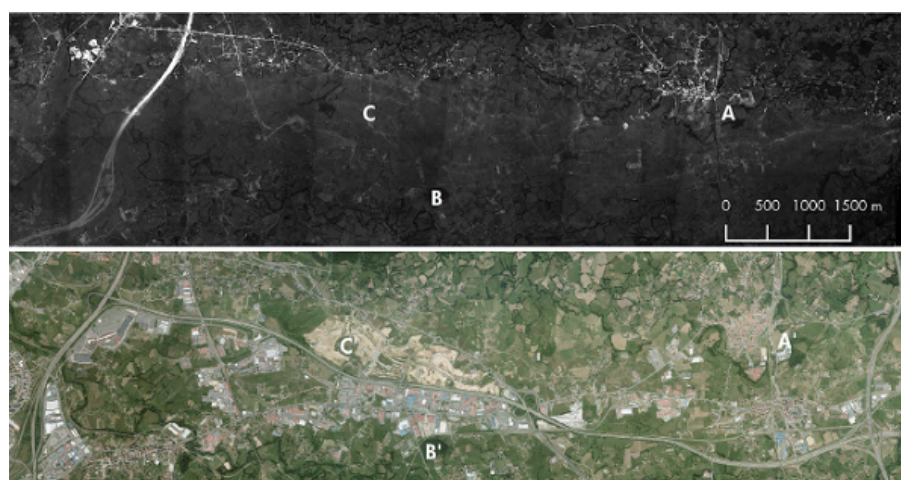
Landscape transformation in the proximity of Viella, Colloto, Granda, Meres and Bobes

Sources: Left, Orthomosaic derived from the photogrammetric flight of the Asturian Deputation 1970. Dept. of Geography, Oviedo University. Right, Orthomosaic derived from the photogrammetric campaign of PNOA, 2017

The comparison between the two images of Figure 5 shows the cross between the N-634 road and the Viella Road (A). This is the area where the most industrial locations were built due to private initiative without the planning of an industrial park. It is made of dispersed factories, industries mixed with car sellers, commerce, warehouses, logistic companies, furniture stores, beverage distribution companies, restaurants and nursing homes, etc. In the image on the left, a huge industry appears isolated, which corresponds to the Central Dairy factory of Asturias (B). This company has played an important role in landscape transformation in Asturias as it has triggered the orientation of cattle towards dairy and therefore of the landscape too (Sevilla Álvarez, 2015). As such, cereal crops have been substituted by pastures and forage plants. As it can be observed, the original factory has been gradually enlarged until forming the current complex.

By the 1970s, the main route was the N-634, which runs at the bottom part of the image (C). There was no motorway planned and major transformations happen in two different axis of communication: the one that goes towards the eastern side of Asturias, where many warehouses, small-size industrial parks promoted by private initiative, commercial activities and restaurants coexist with some dispersed houses. The other axis was formed alongside the Viella Road, which runs parallel to the

railway. The functionality of this corridor is similar to the aforementioned in its mixture of uses and activities. This is a spatial phenomenon similar to what Domingues (2009) calls *Rua da Estrada*, which is very common in the north-west of the Iberian Peninsula —Galicia, North of Portugal and Asturias— where the traces of new economic activities with other demands of soil and with other architectural styles were superimposed over a traditional dispersion of rural settlements. In a different work of the prominent Portuguese geographer (Domingues, 2009), the territories resulting from this combination are defined as transgenic landscapes because of the heterogeneity of land uses, economic activities, the difference between the slow landscape construction processes of traditional agricultural societies and the coexistence with the hyper-connectivity, both physical and virtual, provided by technology and infrastructures. The construction of the A-63 motorway, which links Oviedo to the East, reinforced this landscape transformation already glimpsed in 1970s decade. The number of small-size industrial activities exploded and therefore a complex system of economic activities emerged alongside the two aforementioned axes. At the eastern side it appears an area with terrain movements (D). It corresponds to the future industrial park of Bobes, a failure public initiative to promote an industrial park. The works started in 2005 but at the moment only the vegetation cover has been removed, some roads have been built and some basic infrastructures have been installed.



**Figure 6.**

The formation of the Siero Corridor over the pre-littoral depression located eastwards from Oviedo

Sources: Left, Orthomosaic derived from the photogrammetric flight of the Asturian Deputation 1970. Dept. of Geography, Oviedo University. Right, Orthomosaic derived from the photogrammetric campaign of PNOA, 2017

In order to synthesise the whole process, a complete image of the Siero corridor it is provided in Figure 6. The image encompasses all the landscape transformations occurred since 1970s in the pre-littoral depression of the Oviedo region, located eastwards of the capital city of Asturias. This is one of the places exposed to intensive changes in the recent history of the region. Its flat topography and the improvements in infrastructures of mobility and transport fostered the consolidation of this mixed economic activities corridor.



The national road N-634 channelled development in this direction. On both sides of the road many small industries were installed coexisting with traditional houses and other activities such as commercial, restaurants, etc. During the 1980s an unplanned set of small-size industrial parks were built between Col- loto and Granda forming an uneven industrial corridor (B-B'). Also it can be observed the densification of the town of Noreña (A-A') a municipality where happened a notable increment both in population and in urban fabric.

The inauguration of the A-64 motorway reinforced this location and new industrial parks were built, this time under planning instruments, following a grid layout and well connected with the motorway and other roads. Therefore, the Siero corridor has experienced a process of consolidation since 1970s that can be continued in the future if the failed industrial area of Bobes (C-C') leaves its current state of abandonment and paralysis. In this context, the industrial area of Bobes is one of the biggest initiatives to provide industrial soil in the Oviedo region. The regional administration has expropriated the soil and the public-private company Sogepsa urbanised the land until 2009 when the effects of the burst of the financial bubble arose. Since then, only a few terrain movements have been carried out. The lack of financial resources has paralysed this industrial park, which had initially been conceived as parallel to the construction of the new AS-III. Nowadays, the soil is abandoned without any possibility for recovery of former agricultural uses while expecting a future resolution. Another kind of social fallow waiting for better times. Meanwhile allochthone species such as *Cortaderia selloana* covers the land resulting in a phantasmagorical landscape, a sort of duster-landscape without cleaning effects.

To sum up, during the last decades the landscape of the Oviedo region has experimented a huge and quick transformation mainly due to the construction of new infrastructures and the relocation of economic activities. With the deindustrialization of the mining coal basin and the stagnation of big state companies, a new economic geography model derived from the division of units of production and labour, mainly adopting the form of regional SMEs which seeks flat soil, good connections to infrastructure and flexible plots has emerged. For this purpose, the Siero and Viella Corridor as well as the industrial areas north from Lugones become extremely suitable. As such, with the spatial diffusion of the economic activities— mainly the industrial — the dispersion of new functions to the countryside begins, while former traditional urban functions such as residence or commerce start to move out to the urban fabric and are relocated in the peri-urban area.

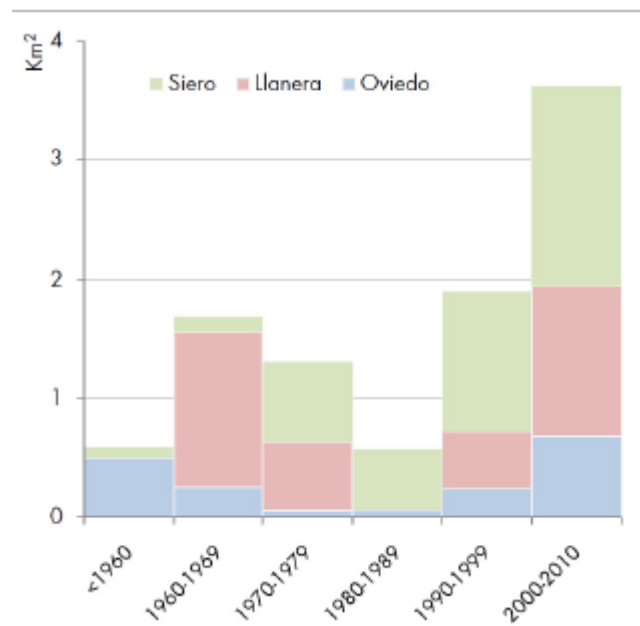
### *3.2. The stages of the spatial diffusion*

Spatial diffusion was commonly studied in geographical research according to three different approaches as Haggett (1979) pointed out. One of them deals with the expansion of spatial phenomena, a second perspective studies the relocation of geographical features and, finally,

the third delves into the combination of relocation and expansion. The spread of economic activities within Oviedo region is the result of the coexistence of two processes: relocation of traditionally urban functions that moved to rural environments and the enlargement of the area characterized by the diffusion of functions due to the improvement of accessibility provided by a dense network of infrastructures. According to Geyer & Kontuly (1993) a differential urbanization process can be observed, because several phases of spatial diffusion of economic activities are identified. Therefore, the spatial diffusion of economic activities can be seen, as occur with urbanization, as a diffusion wave (Pacione, 2013).

According to different sources, the total amount of industrial soils accounts for about 2% of the region. The IDEPA official dataset states 10 km<sup>2</sup>, whereas in the Land Cover/Land Use Information System of Spain (SIOSE, 2014) industrial soil amounts to 10.9 km<sup>2</sup>. It should be mentioned that although in Spain this soil is defined as industrial, its use is not only devoted to activities of the secondary economic sector, but also includes other activities such as logistics, storage, retail, services, etc. Therefore, the Anglo-Saxon term of Business Park or the German Gewerbegebiet appear more accurate, as their definition is more related to mixed economy. As to the area studied in the present paper, services represent 48% of the total activity while industry merely constitutes 33% as expressed by the 2019 dataset. In order to quantify the stages of the process, the dataset gathered by the IDEPA has been used. From these data, an indicator of the production of industrial soil per year has been calculated.

As the Figure 7 shows, industrial soil had a weak presence in the area of study before 1960. Only a few factories near raw materials were in operation, and their territorial footprint was low. These factories were located in the north of Lugones, Trubia valley, the surroundings of Oviedo and the coal mineshafts in Olloniego, Carbayín and Lieres. The total amount of industrial soil built before 1960s was 0.59 km<sup>2</sup>. In the following decades, from 1960 to 1979, an important increment of industrial function in the Oviedo region took place. The impulse of the State through the declaration of the central area of Asturias as Development Pole resulted in the attraction of capital investments and therefore new companies were settled in this area.



**Figure 7**

Production of industrial soil by square kilometre in each decade

Source: LINEA, a geographical information system of IDEPA, the Economic Development Agency of the Principality of Asturias (IDEPA, 2019). Own elaboration

During the 1980s decade, the pace of industrial space production diminished. The collapse of the Francoist regime, the peak of the oil crisis and consequent national economic depression are some of the factors that explain the scarce increase in industrial soil. Although Spain joined the European Union in 1986, the spatial consequences of the allocated regional development funds were not visible until the following decades. Moreover, the role of Autonomous Regions and the impulse due to the upward economic cycle experienced in Spain at that time fostered soil production in a way that had not been seen before. In fact, from 2000 to 2010 the amount of industrial soil production was the largest since 1960 in the Oviedo region. Thus, the production of industrial soil is strongly related to successive economic cycles, but also to regional and town planning instruments and the allocation of European funds. Analysing the dataset year by year, three different phases can be distinguished. The first comprises the period from 1968 to 1974, the second phase encompasses the years between 1982 and 1993, and finally, the last stage starts in 2000 until 2010. Even though the dataset does not collect data beyond 2000, the comparison between aerial images taken in 2009 and 2017 shows no growth in industrial soil. Mainly due to the financial crisis, these last years have been characterised by cuts in direct investments at European, national and regional level. Consequently, the slowdown in the economy has slowed both the initiative to produce land as well as the demand for the setting up of new activities.

Hagestrand (1968) introduces the study of spatial diffusion in Geography. He identified four different stages to explain the process. The primary stage, when the process begins, is characterized by contrast in produced space —some territories present diffused phenomena whereas

others remain unchanged—. This stage took place in the region of study at the beginning of 1970s, when the traditional dichotomy between urban and rural landscape persists. The second wave identified by Hagerstrand, called expansion step, is related to the process occurred in the Oviedo region until 2008 when the financial and real estate bubble burst. The period between the 1980s and 2008 was characterised by a considerable expansion of the spatial diffusion of economic activities in the region mainly due to its infrastructural network. The remaining steps are condensation and collapse. Further studies should be carried out in order to identify if future landscape transformations can be defined as such. The Swedish geographer also pointed out a transcendental key to interpret recent landscape transformations —the barrier effect—. That is, diffusion does not happen at the same pace at all times and over all the space. There are some constraints; that is, factors that play an important role in the configuration of a territory. Generally, these factors are physical, social, and economic. Consequently, those regional studies that have an exclusively economic approach should be discarded, since they consider territory as something isotropic without taking into account the aforementioned barrier effects.

**Table 1**

Industrial soil by square kilometre in each decade in Oviedo, Llanera and Siero

	Oviedo	Llanera	Siero	Total
Before 1960	0,50	-	0,09	0,60
1960-1969	0,26	1,30	0,14	1,70
1970-1979	0,06	0,58	0,68	1,31
1980-1989	0,06	-	0,51	0,58
1990-1999	0,24	0,48	1,18	1,91
2000-2010	0,69	1,26	1,67	3,62
<b>Total</b>	<b>1,81</b>	<b>3,63</b>	<b>4,27</b>	<b>9,71</b>

Source: LINEA, a geographical information system of IDEPA, the Economic Development Agency of the Principality of Asturias (IDEPA, 2019). Own elaboration

### *3.3. Mapping the spatial diffusion*

The spatial distributions of economic activities are no random but related in space in an identifiable way that geographers called patterns. Such patterns are the spatial outcome of socioeconomic processes, although these may be subject to constraints in the environment. Geography has come a long way to be freed from the notion that constraints are merely environmental and nowadays the process and patterns are analysed together. For this purpose, geographers use to arrange data spatially, to construct maps that help us to understand complex processes. Once the main landscape transformations were analysed and the stages of the process were summarized, the next step is to analyse spatially the diffusion of economic activities in the area of study. Some thematic maps are produced in order to understand how the process unfolds. The first

depicts the process of construction of the motorway network, the second illustrates the data of construction of every industrial and business park and finally, a synthesis of the spatial outcomes of the diffusion process is represented.

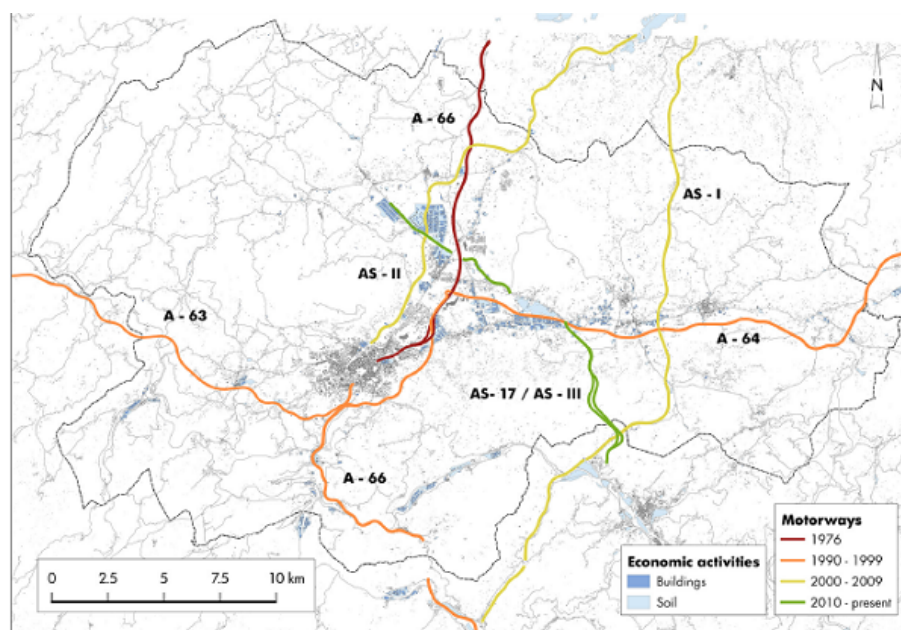
As mentioned before, the improvement in accessibility and the reduction in the time required to travel a distance has had a strong impact on the emergence of a new territorial model characterised by spatial diffusion. Figure 8 illustrates the development of the motorway network in the area of study. In general terms, there are more than a hundred kilometres of motorway in a region of merely 598 km<sup>2</sup>.

The first step in the creation of the network was the construction of the A-66 motorway in the mid- 1970s. The infrastructure was inaugurated in 1976, which became the first motorway in Asturias linking its three main cities. It was developed in the last years of Francoist regime and was one of the outcomes of the direct investments of the State channelled through the Development Pole. As a consequence, the area located north of Lugones was developed due to its proximity to the motorway link, resulting in the appearance of the industrial parks of Silvota and Asipo.

During the 1980s, several economic activities were located along the N-634 and new industrial parks were planned around this axis. The role of the Siero corridor was definitively reinforced in the 1990s with the development of the A-64, which links Oviedo with the eastern boundary of the region. As a consequence, this area was in part densified as a result of the agglomeration of economic activities, especially between Meres and Granda. Also in the 1990s, the A-66 was enlarged southwards in direction to León and Madrid. The city of Oviedo was surrounded by a bypass or ring road that connects the A-66 and A-64. Towards the West, the A-63 was built during the 1990s and so when the decade ended, a complete motorways axis was available from East to West and from South to North.

However, the construction of motorways did not stop and new ones were added. During the 2000s two new motorway routes were built, but this time through regional funding. Firstly, the AS-I linking Gijón with Mieres and Langreo, two towns located in the mining coal basin. Secondly, the AS-II that constitutes a new way to commute from Oviedo to Gijón. As a result, there are nowadays two different motorways connecting both cities. Recently, the former regional road AS-17 has been turned into a motorway in some sections. By now, there are three operative parts while the rest remain a single road. The lack of financial resources from 2008 onwards has hindered the development of a complete reform of that road into a new motorway, the AS-III. Apart from the aforementioned motorway network, there is a dense road grid, with some roads allowing to driving up to 90 km/h, such as the one running southwards alongside the industrial soil of Olloniego-Tudela, the AS-116, or the national road N-634, connecting Oviedo eastwards and westwards. Furthermore, in the last years, local stakeholders seek to promote a new road surrounding the North of Oviedo, but, at the moment there are only drafts, blueprints and some controversy between political groups.





**Figure 8.**

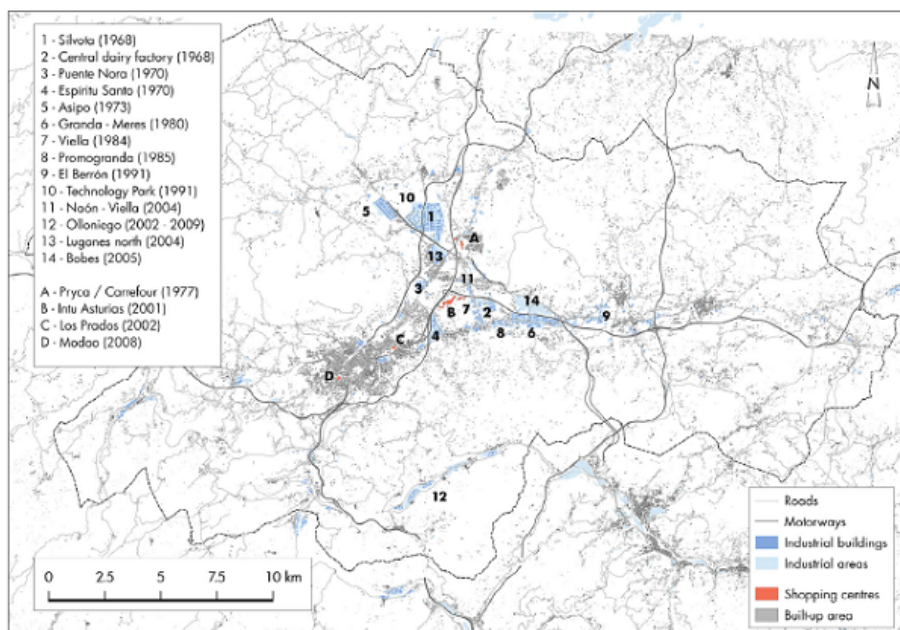
The development of the motorway network in the area of study

Sources: NGIS, 2019. Own elaboration

The Figure 9 shows the spatial distribution of industrial areas and commercial centres within the Oviedo region. Two main axis concentrate industrial soil, northwards linking the region to the cities of Gijón and Avilés and eastwards to Santander. Apart from these main corridors, there is another one following the Nalón Valley in the south of the Oviedo region. The three corridors were developed thanks to political action, a suitable topography and infrastructure network. Thus, public and private investments in industrial parks have been deeply focused in this area.

Private investment in this area was introduced with the construction of the Asipo industrial park in 1973 and followed in the activity corridor existing between Oviedo and Siero, where the juxtaposition of multiple private initiatives led to a somehow chaotic industrial agglomeration that was mainly due to the lax normative on planning, especially in the proximity of Meres and Granda. Public investments were firstly allocated in the promotion of the Silvota industrial park in 1971 —the biggest industrial area in the region—. Other interventions were mainly focused on medium-size industrial parks devoted to local SMEs seeking good connections with the infrastructure network and aiming at slowing down industrial dispersion. The main failure in these interventions is the one projected in Bobes in 2005 that has not been finished yet. Although terrains were expropriated and lands removed in Bobes, there is still no sight of industrial park mainly due to the financial problems of Sogepsa, the public-private-partnership and because of the burst of the real state crisis in Spain. Parallel to this abandoned landscape there are also some sights of a timid bloom in industrial activity that can be observed in the construction in Llanera of the Technological Park of Asturias in 1991 or the spaces of opportunity linked to closed equipment within the Oviedo

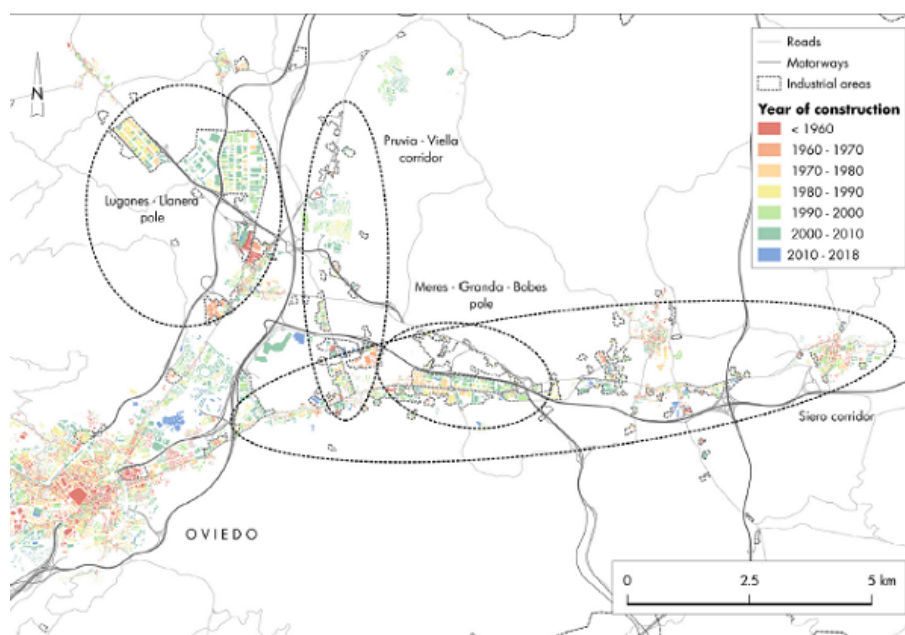
urban fabric such as the ancient Royal Weapons Factory of the former Asturian University Central Hospital.



**Figure 9.**

The spatial diffusion of economic activities in the Oviedo region

Sources: NGIS, 2019. Own elaboration



**Figure 10.**

The spatio-temporal process of the diffusion of economic activities in the region

Sources: NGIS (2019) and the Spanish Cadastre (2019). Own elaboration

The Figure 10 shows the built-up area within the Oviedo region classified by its year of construction. Industrial areas have been enclosed within a black thin dotted line and the main economic activity poles and corridors have been depicted using a dotted line polygon. As it can be observed in the map, the pattern of the spatial diffusion follows

mainly two directions, one northwards to Avilés and Gijón and the other to the East. The chronology of the process shows a strong presence of green range colours; thus, built between 1990 and 2010. As seen before in figure 7 both decades had a huge impact in the current territorial model. Alternatively, since 2010 there are almost no new constructions.

Besides, in the map there is a mixture of functions determined by the proximity of industrial to residential function. Furthermore, the motorway network constitutes the basis or the structure which supports the mobility in this area. The map depicts three corridors and two poles conformed by the aggregation of economic activities in the area of study. The sequence of events has evidenced the strength of some locations where the coexistence of public initiatives such as the industrial parks added to the private initiative and the dispersed economic activities due to the lax regulative framework produced a mixed landscape in which the economic activities are placed near to towns, villages. To sum up, in this chapter an interpretation of every map is given because it would be sterile to map something and leave it at that. Maps are tools; hence, it follows that mapping must reflect a conceptual framework which suggests that things need to be mapped (Jones and Eyles, 1977).

#### 4. Discussion

This paper demonstrates the changing location patterns of economic activities through the comparison of aerial imagery in different periods: from the proximity to raw materials and labour force to a location based on accessibility, a usual phenomenon in recent landscape transformations across Europe, as Antrop (2004) reveals. It also confirms that, as Fernández Cuesta & Fernández Prieto (1999) and Nadal (2003) point out, the division of the units of production and the rise of service economy fosters the spread of economic activities across the territory, especially in well-connected areas through motorways. In a similar vein, previous research of Fernández García (2007, 2009 and 2012) highlighted that the first stage of spatial diffusion in the area of study is due to the relocation of industrial activities in former rural areas. As demonstrated by the present study, there is a spread of economic activities in the region, mainly performed by small and medium-size enterprises settled in industrial buildings. In some areas, they adopt the form of activity or business parks, whereas in others they articulate corridors.

Spatial diffusion in the region thus becomes possible by the construction of a dense infrastructure network as it is represented in the thematic maps produced. In other words, the role of the roads and motorways is crucial to understand its recent landscape dynamics. The industrial park of Silvota and the A-66 motorway, which links the main cities in the centre of Asturias, triggered the early stage of landscape transformations. Other aspects such as a flat topography and the regional planning framework also stimulated the concentration of functions within the Oviedo region. In addition to that, the crisis of the mining activities and other mature industrial sectors boosted the

consideration of the region as an attractive place for the installation of economic activities, mainly regional small and medium-size enterprises. This sharp transformation was carried out, mainly, at the expense of a huge loss of arable land as Morán Alonso, Obeso Muñiz, Hernández de Aja & Fernández García (2017) have pointed out.

As stated in the previous chapters, the spatial diffusion of economic activities in the Oviedo region begins in the 1970s. The starting point has been defined following the research studies of Fernández García (1984) and Benito del Pozo (1991), both focused on the spatial implications of the economic development pole declared in the region in 1964. However, the results obtained in the present paper reveal that, among the different stages of the process, the most transformations took place between 1990 and 2009. As such, the spatial diffusion process occurs in the area of study as the combination of two processes: relocation and the spread of activities and functions. Benito del Pozo (1991) had deeply studied the industrial landscape in Asturias and had previously identified the emergence of the Siero Corridor alongside the Nora river. Nevertheless, as this study demonstrates, this corridor is consolidated due to the creation of several industrial parks in the nineties and because of the improvements in connectivity —mainly the construction of new motorways—. Apart from this corridor, two more are recognised in this paper, the one following the road between Viella and Pruvia, and another one following the Nalón river between Olloniego and Tudela-Veguín. Furthermore, this research presents evidences of the conformation of two poles or hubs in the region due to the concentration of economic activities: one located North from Lugones and the other in the proximity of Meres, Granda and Bobes. Therefore, the main contribution of this paper is to update the previous research studies focused on the spatial distribution of economic activities in Asturias.

On a broader scope, this article's findings also support research developed by several scholars on recent periurban landscape dynamics in Europe. The spread of traditional urban functions, the increase in accessibility in former remote areas and the socioeconomic changes occurred since the 1970s have had a clear spatial outcome: a blurred landscape halfway between the traditional compact city and rural areas. The main characteristics of this kind of landscapes are the heterogeneity of land uses and the mix of activities and functions, as well as the transcendent role of a dense infrastructure network. In this sense, this paper covers a gap in establishing a relationship between the generalist studies of Nilsson *et al.* (2013) or Antrop (2004) and the highly-influential regional of authors like Indovina (1990) or Sieverts (1997), which are related to the spatial diffusion of economic activities and the resulting landscape transformations in peri-urban areas.

However, there are still authors that define inaccurately this spatial phenomenon as urban sprawl (Rubiera Morollón, González Marroquin & Pérez Rivero, 2016). It should be more adequate to define this landscapes as diffused city or peri-urban landscapes, because urban sprawl is the result of a wide suburbanization process (Hayden, 2004).



Therefore, it is an extended spread of merely the residential function, a north American reality that do not fit very well with the landscape of the area of study where the spatial diffusion acts over all the functions: industrial, commercial, residential, etc. but any of them reaches the extension of the north American suburban developments. In this senses, Hesse & Schmitz (1998) and Müller & Rohr-Zänker (2001) suggest the radical differences existing in peri-urban landscapes in Europe and North America discouraging the use of the term urban sprawl to define these spaces.

## 5. Conclusions

The impact of spatial diffusion of economic activities in the European region has produced extraordinary landscape transformations during the last four decades. The disruption of the traditional process of landscape production started in the 1970s. Prior to that period, rural and urban landscapes could be easily delimited. Urban fabric concentrated functions such as residence, commerce, industry and services, whereas rural areas were characterised by the presence of mainly agricultural activities. In the Oviedo region, this process started at the beginning of the 1970s when some state initiatives like a prominent industrial park and a motorway accelerated landscape transformation triggering the relocation of many urban functions in surrounding rural areas.

As a consequence, landscape transformations have been driven by change in the location patterns of economic activities. From a standpoint characterised by the presence of big factories and the proximity to urban fabric or raw materials to a current territorial model characterised by a variety of functions and land uses and a mixture of small buildings in which the role of accessibility through the infrastructural network is determinant. Although it seems that nowadays spatial factors have less influence, it is stated that the availability of flat topography in the Oviedo region has fostered the intensive landscape transformation experimented in the last four decades, which is also in part due to the weakness of regional planning instruments.

However, recent transformations should not only be interpreted as the appearance of new landscape elements, functions or activities, but also with regard to the disappearance of former features. Indeed, agriculture is an economic activity. In this sense, further research is needed to address the impact of a new territorial model characterised by spatial diffusion in traditional rural landscapes; especially in seasonal practices, vernacular architecture, management of commons and the socioeconomic changes that these transformations imply. In fact when the structure of a traditional landscape collapses and it is forlorn, it constitutes a clear symptom of a society in risk of disappearance.

The factors that explain recent landscape transformations are therefore the increase of accessibility, the topography, the materialisation of global economic changes and the role of regional planning policies. The improvement in accessibility is mainly due to a dense network of



infrastructure and increasing motorisation. The role of flat topography is crucial because of a major surface of soils with slopes under 3%. Global economic changes since the 1970s are characterised by the soaring strength of the tertiary sector in detriment of agricultural and industrial activities. This sharp economic transformation has led to the abandonment of agricultural landscape and intense soil consumption adopting the form of industrial corridors and dispersed economic activities.

The pattern of spatial diffusion of economic activities in the Oviedo region adopts the form of poles, corridors and disperse elements. In general terms, the magnitude of these spatial phenomena is extended up to 30 km eastwards from the city following the pre-littoral depression. Northwards this spatial diffusion is noticeable until the northern administrative and mountainous boundary that separates the Oviedo region from the North of Asturias. Two big poles are identified: the Llanera pole —in which two big industrial parks, a technological park and a logistic centre are concentrated— and the pole of Meres-Granda-Bobes —where the agglomeration of medium-size private and public initiatives has shaped a hub of intense concentration of economic activities—. Moreover, three activity corridors have been identified. One of them is almost consolidated from Oviedo to the eastern limit of Siero and, the other one is in formation from Colloto to Pruvia through the Viella Road, and the third one was constructed in the Nalón valley. Apart from these corridors and poles, there are several economic activities dispersed through the territory.

The process of spatial diffusion intensified in the periods of the 1970s 1990s and 2000s. The first stage was impulsed by the intervention of the State through developmentalist policies. The second peak was reached between 1990 and 2008. In this period, the influence of regional European funds, the bullish economic period experimented in Spain until the burst of the real estate bubble fostered an intense landscape transformation with the construction of several motorways and industrial parks. Notwithstanding, since 2008 there has almost been no landscape transformation in the region, which demonstrate that economic activity has a strong potential to develop contemporary peri-urban landscapes.

## References

- Adell, G. (1999). *Theories and models of the peri-urban interface: a changing conceptual landscape*. London, UK: Development Planning Unit, UCL.
- Antrop, M. (2000). Changing patterns in the urbanized countryside of Western Europe. *Landscape ecology*, 15(3), 257-270. <https://doi.org/10.1023/A:1008151109252>
- Antrop, M. (2004). Landscape change and the urbanization process in Europe. *Landscape and urban planning*, 67(1-4), 9-26. [https://doi.org/10.1016/S0169-2046\(03\)00026-4](https://doi.org/10.1016/S0169-2046(03)00026-4)
- Antrop, M., & Van Eetvelde, V. (2000). Holistic aspects of suburban landscapes: visual image interpretation and landscape metrics. *Landscape*

- and urban planning*, 50(1-3), 43-58. [https://doi.org/10.1016/S0169-2046\(00\)00079-7](https://doi.org/10.1016/S0169-2046(00)00079-7)
- Ascher, F. (1995). *Métapolis: ou l'avenir des villes*. Paris: Odile Jacob.
- Benito del Pozo, P. (1990). *El espacio industrial en Asturias* (Doctoral Thesis). University of Oviedo. Oviedo.
- Benito del Pozo, P. (1991). Descentralización productiva y nuevas formas de agrupación industrial: los corredores industriales en Asturias. *Ciudad y territorio: Revista de ciencia urbana*, 90, 81-88.
- Bryson, J. R., & Daniels, P. W. (1998). *Service industries in the global economy*. Cheltenham: Edward Elgar Publishing.
- Caruso, G. (2001). *Periurbanisation, the situation in Europe: A bibliographical note and survey of studies in the Netherlands, Belgium, Great Britain, Germany, Italy and the Nordic Countries*. Paris: Datar.
- DGT (2019). *Statistical Yearbook of the National Traffic Authority*. Dirección General de Tráfico.
- Domingues, Á. (2009). *A rua da estrada: o problema é fazê-los parar!*. Porto: Dafne Editora.
- Fernández Cuesta, G., & Fernández Prieto, J. R. (1999). *Atlas industrial de España: desequilibrios territoriales y localización de la industria*. Oviedo: Nobel.
- Fernández García, A. (1997). La nueva política estatal de desarrollo regional y sus efectos en Asturias (1985-1995). *Ería: revista cuatrimestral de Geografía*, 43, 238-242.
- Fernández García, A. (2003a). Las pautas del crecimiento urbano posindustrial: de la rururbanización a la ciudad difusa. *Ería*, 60, 88-92.
- Fernández García, A. (2003b). Hipermercados y centros comerciales en Asturias. *Ería: Revista cuatrimestral de geografía*, 62, 341-349.
- Fernández García, A. (Coord.) (2007). *Población, administración y territorio en Asturias*. Oviedo: Consejo económico y Social del Principado de Asturias.
- Fernández García, A. (2009). Difusión urbana, Ordenación del Territorio y desarrollo sostenible. *Ambienta: La revista del Ministerio de Medio Ambiente*, 88, 20-27.
- Fernández García, A. (2012). Difusión urbana y ordenación del territorio. In M.R. Alonso Ibáñez, & J.M. Pérez Fernández (Coords.), *Espacio metropolitano y difusión urbana: su incidencia en el medio rural* (pp. 13-24). Oviedo: Consejo Económico y Social del Principado de Asturias.
- Fernández García, F. (1984). El polo de desarrollo de Oviedo. *Ería*, 7, 135-147.
- Fernández García, F. y Herrán Alonso, M. (2013). III. 1.4. El área periurbana de Oviedo. La cuenca del río Nora. In F. Molinero Hernando (Coord.), *Atlas de los paisajes agrarios de España* (pp. 389-398). Madrid: Ministerio de Agricultura, Alimentación y Medio Ambiente.
- García Fernández, J. (1975). *La organización del espacio y economía rural en la España atlántica*. Madrid: Siglo Veintiuno Editores.
- García López del Vallado, J. L. (2006). Los molinos de Xinicio (Oviedo, Asturias). *Ería: Revista cuatrimestral de geografía*, 71, 338-344.
- George, P. (1977). *Geografía económica*. Barcelona: Editorial Ariel.
- Geyer, H. S., & Kontuly, T. (1993). A theoretical foundation for the concept of differential urbanization. *International Regional Science Review*, 15(2), 157-177. <https://doi.org/10.1177%2F016001769301500202>

- Hagerstrand, T. (1968). *Innovation diffusion as a spatial process*. Chicago: Chicago University Press.
- Haggett, P. (1979). *Geography: a modern synthesis*. New York: Harper & Row edition.
- Herrán Alonso, M. (2002). La evolución del paisaje en un espacio periurbano: Lugones-Posada de Llanera (Asturias). *Éria: Revista cuatrimestral de geografía*, 57, 25-48.
- Hesse, M., & Schmitz, S. (1998). Stadtentwicklung im Zeichen von "Auflösung" und Nachhaltigkeit *Informationen zur Raumentwicklung*, 7, 435-453.
- IDEPA (2019). LINEA, a geographical information system of the Economic Development Agency of the Principality of Asturias.
- Indovina, F. (1990). *La città diffusa*. Venezia: Daest.
- Jones, E., & Eyles, J. (1977). *An introduction to social geography*. Oxford: Oxford University Press.
- Lizet, B., & de Ravignan, F. (1987). *Comprendre un paysage: guide pratique de recherche*. Versailles: Editions Quae.
- Marcucci, D. J. (2000). Landscape history as a planning tool. *Landscape and urban planning*, 49(1-2), 67-81. [https://doi.org/10.1016/S0169-2046\(00\)00054-2](https://doi.org/10.1016/S0169-2046(00)00054-2)
- Morán Alonso, N., Obeso Muñiz, Í., Hernández de Aja, A., & Fernández García, F. (2017). Challenges for the revitalisation of peri-urban agriculture in Spain: Territorial analysis of the Madrid and Oviedo metropolitan areas. *Moravian Geographical Reports*, 25(3), 192-207. <https://doi.org/10.1515/mgr-2017-0017>
- Müller, W., & Rohr-Zänker, R. (2001). Amerikanisierung der „Peripherie“ in Deutschland? In K. Brake, J.S. Dangschat, & G. Herfert (Eds.), *Suburbanisierung in Deutschland* (pp. 27-39). [https://doi.org/10.1007/978-3-663-11566-3\\_3](https://doi.org/10.1007/978-3-663-11566-3_3)
- Nadal J. (Ed.). (2003). *Atlas de la industrialización de España (1750-2000)*. Bilbao: BBVA Foundation.
- NGIS (2019). Vector files with the latest updates from the National Topographic Maps at 1:25 000 scale. National Geographic Institute of Spain.
- Nilsson, K., Pauleit, S., Bell, S., Aalbers, C., & Nielsen, T. A. S. (Eds.). (2013). *Peri-urban futures: Scenarios and models for land use change in Europe*. Berlin, Heidelberg: Springer Berlin Heidelberg. <https://doi.org/10.1007/978-3-642-30529-0>
- Obeso Muñiz, Í. (2018). Dinámica reciente de la población en la comarca de Oviedo (1970- 2011). *Geographicalia*, 70, 55-74. [https://doi.org/10.26754/ojs\\_geoph/geoph.2018703280](https://doi.org/10.26754/ojs_geoph/geoph.2018703280)
- Pacione, M. (2013). *Urban geography: A global perspective*. London: Routledge.
- Pascual Ruiz-Valdepeñas, H. (1992). Reconversión y reestructuración industrial en Asturias. *Éria: Revista cuatrimestral de geografía*, 28, 151-164.
- PNOA (2017). *National Aerial Orthophoto Program in Spain*. Approximate scale 1:25.000. National Geographic Institute of Spain.
- Provincial Deputation (1970). *Provincial Deputation photogrammetric flight of 1970*. Approximate scale 1:20.000.
- Qviström, M. (2010). Shadows of planning: on landscape/planning history and inherited landscape ambiguities at the urban fringe. *Geografiska Annaler:*

*Series B, Human Geography*, 92(3), 219-235. <https://doi.org/10.1111/j.1468-0467.2010.00349.x>

- Rubiera Morollón, F., González Marroquin, V. M., & Pérez Rivero, J. L. (2016). Urban sprawl in Spain: differences among cities and causes. *European Planning Studies*, 24(1), 207-226. <https://doi.org/10.1080/09654313.2015.1080230>
- Sevilla Álvarez, J. (2015). España (1952): Características geográficas de su implantación a través del ejemplo de la central lechera asturiana (CLAS). In TICCIH, *El Patrimonio Industrial en el contexto histórico del Franquismo 1939-1975. Patrimonio y Arqueología Industrial*. (pp. 189-194). Gijón: TICCIH.
- Sieverts, T. (1997). Zwischenstadt. Zwischen Ort und Welt. *Raum und Zeit, Stadt und Land*. Braunschweig: Vieweg.
- SIOSE (2014). Land Cover/Land Use Information System of Spain. National Geographic Institute of Spain Spanish Cadastre (2019). Vector mapping cartography (Shapefile format). Cadastral Electronic Site, Directorate General for Cadastre.
- Svenningsen, S. R., Brandt, J., Christensen, A. A., Dahl, M. C., & Dupont, H. (2015). Historical oblique aerial photographs as a powerful tool for communicating landscape changes. *Land Use Policy*, 43, 82- 95. <https://doi.org/10.1016/j.landusepol.2014.10.021>
- Tortella, G. (2000). *The development of modern Spain: an economic history of the nineteenth and twentieth centuries*. Cambridge, Mass: Harvard University Press.
- Harrison, J. (1978). An economic history of modern Spain. Manchester: Manchester University Press.
- Hayden, D. (2004). Building suburbia: Green fields and urban growth, 1820-2000. New York: Vintage Books.
- Larsson, G. (2006). Spatial planning systems in Western Europe: An overview. Washington DC: Ios Press.
- Lewis, G. J., & Maund, D. J. (1976). The urbanization of the countryside: a framework for analysis. *Geografiska Annaler: Series B, Human Geography*, 58(1), 17-27. <https://doi.org/10.2307/490775>

## Additional information

*Funding:* Financial support from FPU grant (FPU14/04710) from the Spanish Ministry of Education is grate- fully acknowledged