

Spanish Contribution to 33rd IGC Beijing 2016

International Geographical Union, Spanish Committee

CRISIS, GLOBALIZATION AND SOCIAL AND REGIONAL IMBALANCES IN SPAIN



Spanish contribution to 33rd International Geographical Congress. Beijing 2016

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CRISIS, GLOBALIZATION AND SOCIAL AND REGIONAL IMBALANCES IN SPAIN

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International Geographical Union, Spanish Committee

Aportación Española al 33^{er} Congreso de Beijing 2016

CRISIS, GLOBALIZACIÓN Y DESEQUILIBRIOS SOCIALES Y TERRITORIALES EN ESPAÑA

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Presentation

As the President of the Spanish Committee of the International Geographical Union it gives me great satisfaction to present the Spanish contribution to the 33rd International Geographic Congress to be held in Beijing in August 2016.

Spain was a founder member of this institution in 1922, when the Spanish presence in the foremost international geographical organisation, represented by the Spanish Committee, was organised by the Spanish Royal Geographical Society. In the early 1980s the Spanish Committee saw the incorporation of the Spanish Geographers Association –founded in 1976–, followed by representatives of the National Geographic Institute (IGN), the Army Geographic Centre, the Institute of Economics, Geography and Demographics at the CSIC, and the regional Geographic Societies.

The functions of the Spanish Committee of the Geographical Union include organising and coordinating Spain's contribution to the International Geographical Union congresses held every four years. In recent years the Committee has been responsible for arranging the contribution to the Beijing Congress, conceived as a showcase for the latest and most important scientific and methodological research currently being undertaken by Spanish geographers.

The Spanish Committee considers that Spanish geography can contribute significantly to the theme of the 2016 IGU congress, "Shaping Our Harmonious Worlds", by providing an overview of its accumulated experience in geographic research on the spatial and social consequences of globalisation, the impact of the current crisis, and the spread of the territorial imbalances and socio-economic inequalities caused by the economic downturn. The aim is also to join the collective search for alternative ways to achieve the main goals of this scientific gathering, and move towards greater harmony between humankind and nature, society and the environment, with a focus on present and future risks and world conflicts.

The themed structure of our contribution, under the general heading "[Crisis, globalisation and social and territorial imbalances in Spain](#)", is designed to offer Spanish geographers an opportunity to articulate their contributions on the issue selected by the International Geographical Union for the Beijing Congress, as they have done since 1992.

The aim is to encourage researchers to explore these issues, which are structured around several general themes, in order to assist other geographers who may be interested in taking a closer look at the content of their research contribution as part of the Spanish participation as a whole. The variety of themes is sufficiently broad and diverse to deter no one from taking part in this initiative, whatever the scope of their work.

The Spanish Committee, based on prior consultations with the 15 work groups in the Association of Spanish Geographers and with the committee members themselves, has sought to ensure that this themed offering –as far as possible– includes the vast majority of the research topics, and inspires potential candidates to collaborate with the Spanish Committee on this initiative. In short, the aim was to encourage the maximum number of Spanish geographers to make use of this periodic opportunity to obtain an international outlet for the results of their geographic research.

The results were very favourable. The editorial board constituted for this purpose received around thirty papers for consideration, of which a small number were rejected on the grounds that they did not correspond to the themed areas. The full text of the articles underwent a rigorous process of blind peer review, after which some twenty were accepted. These works largely met the conditions; they addressed the theme and were of the required scientific standard.

The following authors have submitted the results of their research and their reflections in the category of "Environment and natural resources": Belmonte Serrato, Fernández Carrillo, Gómez Moreno, Luque Gil, Olcina Cantos, Peláez Fernández, Robledano Aymerich and Romero Díaz.

Jorge Olcina Cantos, from the University of Alicante, offers a broad and general overview of the issue of "[Planning resources and risks in the physical environment in Spanish geography \(2000-2015\)](#)". His study concludes that the use of natural resources in the Spanish territory has undergone intense processes of exploitation and transformation in the last 15 years. This has given rise to arguments around competences and conflicts of interest that have in most cases been resolved in favour of the supposed economic benefits of the uses of these resources. In some instances this has generated situations of risk by increasing the vulnerability and exposure of the physical environment to potential dangers. The paper analyses the processes that have affected the main elements in the environment (water, land, climate and natural spaces), and concludes with an assessment of the contributions of Spanish geography to this field.

In the same section Miguel Ángel Fernández Carrillo, Francisco Belmonte Serrato, Asunción Romero Díaz and Francisco Robledano Aymerich, from the University of Murcia, contribute an article entitled "[The afforestation of farmlands in the region](#)

of Murcia through rural development programmes in Spain: A measure with positive environmental impact on the rural environment”, and report that the abandonment of farming activity and rural areas and the modernisation and intensification of farming have caused wholesale changes in the population and the territory. The authors note that the EU and the governments have an important political tool in the rural development programmes, which are designed and adapted to the territory where they are applied and are generously funded, and that these initiatives can have an impact on territorial planning and biodiversity.

M^a Luisa Gómez Moreno, Ana M^a Luque Gil and M^a Ángeles Peláez Fernández, from the University of Malaga, suggest in their article “*Estimating the social burden on the nature reserves in the Mediterranean mountains. Methodological proposal*” that the concept of social carrying capacity, still being discussed and refined, is a tool for improving the management of the recreational use of protected natural spaces. The results of their research –which can be extrapolated to most of the Spanish nature reserves in the Mediterranean mountains in terms of both visitor frequency and the predominance of hiking as their recreational use– reveal, in the first place, a predominance of multi-purpose users and hence the incongruity between locating trails for public use in areas requiring maximum protection and the users’ own preferences; and, in second place, the advisability of relocating paths outside these areas where users’ preferences can equally be satisfied, but with a lower impact on environmental resources.

Benito del Pozo, Cañizares Ruiz, García Rodríguez, Pascual Ruiz-Valdepeñas and Silva Pérez have contributed research to the theme of “Landscape, territorial heritage and local development”.

As a general introduction, Rocío Silva Pérez, from the University of Seville, presents a study entitled “*Landscape, heritage and territory. Some notes from the Spanish geographic perspective*”, which offers some reflections on the basic conceptualisations and argumentations regarding landscape in general and heritage landscape in particular, considered as a recurrent object of study in geography. The main aim is to approach the theme through the Spanish geographic output of the last decade. The article also outlines new research avenues that have as yet been insufficiently explored and which open up numerous analytical possibilities.

In a similar line, José-León García Rodríguez, from the University of La Laguna, looks at the issue of “*Agricultural heritage, seawater desalination, environment and tourism in the eastern Canary Islands (Lanzarote and Fuerteventura)*”. Through a study of the various Canarian agricultural landscapes, which are conditioned by the Canary Islands’ location on the southernmost limit of the temperate zone in the subtropical anticyclone belt, the author examines the social procedures used in the original agrarian systems to combat aridity –albeit with modest results–, which historically limited their socio-economic development and demographic growth. These systems continued operating until the introduction of desalination plants and the start of the tourist boom in the last third of the 20th century and have bequeathed an important agrarian heritage. This has now been reinvented in this new stage of development as a tourist attraction due to its environmental and scenic value, with the result that both islands have been designated as biosphere reserves.

From another perspective, Paz Benito del Pozo, from the University of León, M^a del Carmen Cañizares Ruiz, from the University Castilla-La Mancha, and Henar Pascual Ruiz-Valdepeñas, from the University of Valladolid, analyse the industrial landscapes through the article entitled “*Approaches and actions in Spain’s industrial heritage and its importance as a resource in times of crisis*”. This work analyses Spain’s industrial heritage and its importance as a resource during the economic downturn. The aims of the work are to trace the progress of actions on cultural heritage in Spain from a conceptual and theoretical point of view; to revise and assess specific actions in comparative territorial spheres such as the mining area of Almadén (Ciudad Real), the urban area of Valladolid and the metropolitan area of León; and finally, to understand the importance of industrial heritage as a tourism strategy in deteriorated spaces such as Riotinto (Huelva) and Medina de Rioseco (Valladolid).

The category dedicated to the theme of “Rural Spaces and Development” includes studies by Caballero Pedraza, Hernández Hernández, Jiménez Barrado, Martínez Puche, Palací Soler, Pérez Morales and Romero Díaz.

As a general approach to the issue, María Hernández Hernández, from the University of Alicante, reflects extensively on “*Spanish rural spaces in response to urbanisation processes*”. The author starts with the premise that Spanish rural landscapes have undergone a significant transformation since the early 1990s due to the implementation of rural development policies and the new functions assigned to rural and natural landscapes, compared to their traditional use for the production of raw materials. The article uses a bibliometric study to explore Spanish geographers’ approaches to

urbanisation processes in rural spaces, with a particular focus on the factors, the territories affected, and the consequences of this territorial dynamic.

The work of Alfredo Pérez Morales, Asunción Romero Díaz and Agustín Caballero Pedraza, from the University of Murcia, also examines urbanisation processes, but in this case from a different approach. In their article entitled "[Urbanisation processes and their influence on the increase in flooding \(south-east Spain, region of Murcia, Campo de Cartagena-Mar Menor\)](#)"; they evaluate and analyse the urban transformations that have taken place in the area of Campo de Cartagena - Mar Menor (south-east Spain) as a result of urban sprawl, and how this affects the artificial sealing of the soil and the increased risk of flooding. The results of their research point to the fact that the heightened risk of flooding is closely related to the increase in the sealed surface, and thus with the vulnerability and exposure of the population to the danger of flooding.

At the University of Extremadura, the contribution by Víctor Jiménez Barrado also looks at the urbanisation of rural spaces in the article entitled "[Urbanisation of the countryside in rural areas with tourism potential. Second homes in the region of La Vera \(Spain\)](#)", and analyses the relation between the residential occupation of non-urbanisable land and the area's tourism potential, detecting possible interferences between both aspects. The case of this region in Extremadura illustrates the sweeping transformations affecting Spain's rural areas, caused primarily by the change in the productive system and the resulting emigration from the countryside to the city in the second half of the 20th century.

Antonio Martínez Puche and Joaquín Palací Soler, also from the University of Alicante, contribute a work on "[Participatory territorial strategies as renewed diagnostic tools in the context of the European Cohesion Funds, 2014-2020. The case of the Region of Valencia](#)". The premise of this work is that the European Union requires a participatory territorial and strategic diagnosis within the context of the Structural Funds (2014-2020), to guarantee that any potential investments are adapted to the actual needs of the territories and their citizens. The regional government of Valencia established the guidelines in Valencia's Territorial Strategy (1/2011 of 13 January), and proposed a territory that was economically more competitive, more respectful with the environment, and more socially cohesive and inclusive. The authors also share their know-how and the methodology implemented by the human geography research group in the current urban plans in the towns of Villena (Alicante) and Alfafar (Valencia).

Díaz Hernández, Domínguez Mujica, Fernández Mayoralas, García Coll, Parreño Castellano, Piñeira Mantiñán, Reques Velasco and Trillo Santamaría have submitted studies on the theme of "The socio-spatial and demographic effects of the crisis".

The contribution of the article entitled "[The socio-spatial and demographic effects of the crisis](#)" by Gloria Fernández-Mayoralas, from the Consejo Superior de Investigaciones Científicas (Higher Council for Scientific Research – CSIC), is based on the undisputed fact that all economic crises have been accompanied by effects associated to changes in cycle, not only in financial aspects but also in their territorial, demographic and social expression. Specifically, the premise is that due to its structural nature, the effects of this crisis –which has been defined by experts as a global crisis of the system– can be expected to be more profound and long-lasting. The aims of the work are to offer insight into the Spanish situation in the ten-year period from 2005-2015, when the first symptoms of the crisis appeared, and to pinpoint the elements that signal changes in trend or the reinforcement of other trends already under way in the areas analysed. The article contains a review –not intended to be exhaustive– of the selected bibliography on the crisis and its effects, supplemented with basic information, particularly from the National Statistics Institute.

M^a José Piñeira Mantiñán and Juan Manuel Trillo Santamaría, from the University of Santiago de Compostela, offer the results of their research on "[The effect of the crisis on vulnerable neighbourhoods: an approach to the Spanish context through a case study \(A Coruña, Galicia\)](#)". The study focuses on the harmful effects of the economic crisis on urban spaces, particularly in neighbourhoods that have historically been characterised by their vulnerability. After introducing theoretical considerations on urban vulnerability and outlining the specific consequences of the crisis in Spain, it presents a proprietary methodology for the analysis of urban vulnerability, structured around three dimensions: socio-demographic, socio-economic and residential. The article goes on to look at the case of A Coruña, a medium-sized city representative of the Spanish context. The contribution concludes with some final reflections and future lines of work.

Arlinda García Coll, from the University of Barcelona, and Pedro Reques Velasco, from the University of Cantabria, analyse the demographic and territorial effects of the economic crisis that began in 2008 in Spain in an article entitled "[The demographic and territorial repercussions of expansion and the economic crisis in Spain \(2001-2015\): an analysis at the](#)

municipal scale". Taking the municipality as the unit of analysis, they reflect on the territories that have been most negatively impacted by the economic recession, and those that have shown greater resilience or capacity for adaptation and response to its drastic effects. The study reveals a demographic situation of endemic vulnerability after the crisis, which affects municipalities that had expanded during the economic boom but then suffered from demographic decline after 2008. In summary, they conclude that the results point to the presence of a new territorial duality in Spain comprising resilient spaces as opposed to vulnerable spaces, and this duality is redefining territorial relations in Spain today.

At the University of Las Palmas de Gran Canaria, Juan Manuel Parreño Castellano, Ramón Díaz Hernández and Josefina Domínguez Mújica contribute a study on *"Migrations and external mobility of Spaniards in times of crisis. State of the issue"*. They claim that during the economic crisis there has been substantial emigration by young Spanish adults who have been unable to find work in their area of expertise, and particularly in the case of individuals with higher educational qualifications. This article analyses the emigration from Spain by these young people within the conceptual framework of globalisation, the southern European migratory model, and the international migrations of skilled young people. The internationalisation of business, the globalisation of the workplace and higher education, communication technologies, social networks, cross-border patterns and the profound disenchantment at the likelihood of political regeneration in Spain –along with the lack of employment–, are among the factors used by these authors to interpret this new stage of Spanish emigration.

Andrés López, Buzo Sánchez, de Lázaro y Torres, Martínez Vega and de Miguel González have contributed articles on the subject of *"Innovation and new technologies for research and education in geography"*.

The article *"Innovation and new technologies for research and education in geography"* by Javier Martínez Vega, at the Consejo Superior de Investigaciones Científicas (Higher Council for Scientific Research – CSIC), reviews the relation between both aspects during the period 2006-2015, and reports that Geographic Information Technologies (GIT) are continuing to revolutionise geographic research in Spain. The results of this analysis suggest that Spanish geographers have used these opportunities to produce new geographic information and develop new algorithms, analytical techniques and geographic models to the point that technology and innovation have become merged with geographic research. Although the role of geographers is not exclusive, these experts are jointly spearheading the advance of GIT, and as a result of these technologies, we are seeing greater collaboration between researchers from different fields of science. The developments in geographic research include an increase in multidisciplinary and internationalisation, greater participation by end users, and the transfer of data.

Also on this subject, the contribution by Rafael de Miguel González, from the University of Zaragoza, Isaac Buzo Sánchez, from the San Roque Institute of Secondary Education, and María Luisa de Lázaro y Torres, from the Complutense University in Madrid, examines the *"New opportunities for geographic education and teaching research: the Digital School Atlas"*. These authors confirm the fact that technological advances are revolutionising the classroom and enabling new forms of learning with which to integrate the cloud naturally into teaching practice. This is examined in the context of the Digital School Atlas (ADE), an interactive atlas intended to motivate students' in the geographic sciences, more efficiently handle quality open geo-data, and improve learning outcomes. The article promotes an active methodology that enables the acquisition of the spatial and digital skills that are necessary for the knowledge of today's world and for the professional future of 21st-century citizens.

Under the same topic, but using another approach, Gonzalo Andrés López, from the University of Burgos, contributes an article entitled *"Georeferencing old maps: online map archives and open-code GIS"*. The author starts from the premise that old maps have been essential as a teaching resource in geography and as an element of synthesis in the historic analysis of territories, and a tool habitually used by geographers. However, the possibility of georeferencing old maps and interrelating them geometrically with other maps has opened up new lines of research. The aim of the article is to reflect on the importance of georeferencing as a useful tool for contextualising old maps and for obtaining data, while highlighting the importance of our cartographic heritage.

Contributions to the section on *"City and territory. Planning and government"* were received from Jurado Almonte, López Redondo, Márquez Domínguez, Martín Oriol, Nel-lo Colom, Pazos García and Valenzuela Rubio.

Professor Manuel Valenzuela Rubio, from the Autónoma University in Madrid, proposes an article entitled *"Trends and challenges for urban planning and territorial government (2005-2015)"*. The article explores the problems deriving from the "extremely weighty" legacy left in Spain by decades of expansive urban planning and its accompanying speculation and corruption –to the point that its excesses have left their mark on the entire territory, although with particular virulence in

metropolitan and tourist areas. This phenomenon has had a devastating territorial and environmental impact, especially in more sensitive areas and protected spaces where rampant urbanisation has been more aggressive. The author believes that the only response to the magnitude of the challenge evidenced by this situation is to apply the principles of sustainability and governance in an attempt to regenerate the consolidated city and to search for solutions to the imbalances that have arisen after such widespread and irresponsible urban and territorial practices.

Oriol Nel-lo Colom, Joan López Redondo and Jordi Martín Oriol, from the Autònoma University in Barcelona, have submitted an article entitled "[The light of the city. The urbanisation process in Spain through nocturnal images of the Earth \(1992-2012\)](#)", which takes a closer look at the wholesale transformations that have taken place throughout the last two decades in the Spanish urban system. The authors report that the sources of information on land consumption have certain limitations for identifying and quantifying this development, and that advances in the availability, accuracy, territorial coverage and temporal recurrence of nocturnal satellite photographs can therefore be used to identify land transformation patterns. Starting from the hypothesis that there is a direct relation between luminosity and urbanisation level, this work identifies the development of the Spanish urban system between 1992 and 2012, and assesses the suitability of the source used for this purpose.

Three researchers from the University of Huelva, Juan Antonio Márquez Domínguez, José Manuel Jurado Almonte and Francisco José Pazos García, contribute the results of their work in an article entitled "[Frontier and governance in the European region of Andalusia \(Spain\), Algarve and Alentejo \(Portugal\)](#)". The premise for their study is the proposals made for integrated and inclusive development in the policy for European Territorial Cooperation (ETC), and particularly in spaces configured around national borders. The authors have verified that the policies of cross-border cooperation in the Euroregion formed by Algarve-Alentejo-Andalusia (AAA) have economically benefited their political structures, but have not had any knock-on effect on their governance nor on the "real" border space known as "La Raya Ibérica". The AAA Euro region has created such a broad framework of cooperation that the elimination of the border is diluting the role of the local scale in European Territorial Cooperation, where it would be advisable to encourage greater participation by local institutions.

The selection of studies presented here comprises a rich sampling of Spanish geographic research and a fertile collection of works that bear witness to the quality of Spanish geography. These contributions will most certainly also contribute to enriching international geography. Therefore I want to reiterate the gratitude of the Spanish Committee of the IGU to all authors who have collaborated with the fruits of their research to make this project and, especially, the evaluators who have helped with their revisions to improve the quality of the contributions.

CARMEN DELGADO VIÑAS,

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[Contributions]

Planning resources and hazards in the physical environment in Spain (2000-2015)

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“One day a man forgets a sea, a continent and a planet...”

Homero Aridjis

Imágenes para el fin del milenio, 1986

Abstract

Natural resources in Spain have undergone intense exploitation and change of use in the last fifteen years. This has given rise to competition and conflicts which have mostly been settled in favour of the arguments for the supposed profits to be made from such exploitation. In some cases, it has also generated hazard situations due to increased vulnerability and exposure to potential danger for the physical environment. A diagnosis is made here of the processes that have affected the main elements in the environment (water, land, climate and natural areas) and an assessment of the contribution made by the geographers of Spain to the issue.

Keywords: natural resources; water; climate; land; natural areas; coastland; landscapes; transformation; sustainability.

Introduction

The last fifteen years have been plagued by transformations in the physical environment of Spain and changes in how these alterations are interpreted. Furthermore, intense exploitation of natural resources has caused hazard situations which, in some cases, have resulted in a crisis when events of an extraordinary nature occur. Resources and natural hazards have merited various studies by Spanish geographers during this time, which have led to conceptual, methodology and diagnostic aspects, assessment of status and

proposals for planning and management. The above has enhanced the corpus of analysis of the physical environment of Spain, adding new perspectives which have brought the inclusion of ideas, concepts and methods, and where, fortunately, sustainability is gaining importance as the guiding force in the country. This means defending development in accordance with physical features, without exceeding their limits, and humans having respect for the dynamics of nature. In 2012, a conceptual approach was made by Spanish geographers to considering sustainability, including issues (mainly economic and human geography) where this new way of understanding the relationship between man and the environment had been most widely accepted (Olcina, 2012). At this point, the state of the issue on incorporating environmental and land sustainability in analysing elements in the physical environment must be put forward.

Below is a reasoned assessment of the contributions made by the geographers of Spain in planning resources and natural hazards; this is not a detailed list or description of work, but a synoptic approach based on a series of the main core topics linked to elements of the natural environment deserving most attention i.e. water, land, coastland, climate and natural areas.

The table summarises planning processes for resources and natural hazards implemented in Spain between 2000 and 2015, and gives the role played by the geographers in each case, in the form of studies, taking part in research projects, reports and official plans or



platforms for the defence of new values in planning natural resources (see Table 1).

Resources and natural hazards show a connection in the diagnosis by the studies made in recent years, since over-exploitation of natural resources has led, in many cases, to creating hazard situations and areas. Also, the land planning in these processes is mostly incorrect, inappropriate, inefficient or, quite simply, non-existent. All the above is reflected in studies made by the geographers of Spain during years of rapid

socio-economic and territorial change, but also of slow-downs, approval of lax laws together with other highly stringent ones, of feelings of collective euphoria and that anything goes, which have ended in the sad reality of a seemingly unstoppable crisis.

Resource and water hazard planning

From the beginning of this century, Spain has seen important events in planning and management

ELEMENT	ACTIONS AND PROCESSES	CONTRIBUTIONS FROM THE GEOGRAPHERS OF SPAIN
WATER	<ul style="list-style-type: none"> -Water Framework Directive (60/2000) -Law on Water (2001, mod. 2007) -Law on the National Hydrological Plan (2001, mod. 2005) -Drafting of new River Basin Districts Plans -Flood hazard management directive (60/2007) -Severe flooding events. -Hazard maps. Creation of SNCZI. -Drought management plans -Regional plans for hazard reduction (floods) 	<ul style="list-style-type: none"> -Studies on water planning and management: for or against the measures in the National Hydrological Plan. -Creation of platforms for sustainable management and new governance of water (new water culture) -Drawing up studies and flood hazard maps -Studies on danger and vulnerability New focus on hazard analysis (the role of humans as the creators of hazard zones). -Studies on the relationship between climate change and water resources (prior to planning).
CLIMATE	<ul style="list-style-type: none"> -Climate change reports (IPCC, 2007, 2013-14) -Report on climate change in Spain (2005) -Regional reports on climate change (Catalonia and the Basque Country) -Severe atmospheric pollution events in large cities -Proliferation of amateur meteorological associations 	<ul style="list-style-type: none"> -Studies on climatic elements -Studies on atmospheric dynamics (isobar connections: ENSO, NAO, WeMO) -Participation in international, national and regional reports on climate change -Studies on the effects of climate change: stances for or against the hypothesis of warming from the greenhouse effect -Studies on atmospheric pollution -Studies on alternative energy (wind, solar) -Geographers participating in amateur associations.
LAND and COAST	<ul style="list-style-type: none"> -European Spatial Development Perspective (1999) and Territorial Agendas -Land Laws (1998, 2008 and 2015) -Rapid transformation of resources (*building boom*) -Coastal Law 2013 (Regulation 2014) -"Artificialization" of the coastal fringe -Erosion processes -Change in use of rural land (to urban or for reforestation) -Severe forest fires 	<ul style="list-style-type: none"> -Participation in research projects at the Observatory in the European Observation Network for Territorial Development and Cohesion (ESPON) -Scientific opinion on the rapid transformation of land use (loss of resources) Drafting of the Manifest on the New Territorial Culture Scientific opinion on the artificialization of the coastal fringe -Drafting of a position paper on the the new Coast Law -Studies on erosion -Studies on changing land use from agriculture to urban -Studies on reforestation in abandoned agricultural land -Studies on forest fires (importance of the urban-forest interface)
NATURAL AREAS	<ul style="list-style-type: none"> -Law on Natural Heritage and Biodiversity (2007) -National Parks Law (2007) Declaration of new spaces -Laws on environmental impact (2008, 2013) -Regional regulations on natural protected areas -European Landscape Convention (2000) -Regional regulations on landscape (importance in land planning) -Creation of landscape observatories -Transformation projects for natural areas (coast and mountain -ski stations-) 	<ul style="list-style-type: none"> -Role of the geography in declaring new natural protected areas (national and regional) -Role of the geography in management plans for natural areas -Studies on the need for new governance in natural areas -Studies on scientific opinion against the transformation of natural areas -Studies on the relationship between natural areas and tourism -Studies on custody of the territory -Participation in landscape studies and plans -Active participation in landscape observatories Creation of a work group on landscape in the AGE

Table 1: Resource planning and risks in the physical environment and the role of the geographers in Spain (2000-2015)
Source: Own development



of resources and water hazard, to which Spanish geographers have responded with highly significant thoughts and contributions. The context in which this research and reflection has taken place must be remembered, as it has had various focal points. Thus, in 2000, the European Union approved the Water Framework Directive that would henceforth define the water planning agenda for Europe. There was a change in the basic tenets for managing and planning water, which until then had usually concentrated on quantity vs. quality, and supply vs. demand. The Water Framework directive 60/2000 gives priority to the quality of water and to managing demand as the central ideas in planning the resource. This reinforced support for improving water which had been established in Directive 91/271 on waste water treatment and had played an important part in obtaining new, “non-conventional” resources, excellent for water planning, especially in countries and regions lacking in natural resources. However, approval of the National Hydrological Plan (Law 10/2001) in the following year meant a reversal to water policies, as it upheld the “classic” principles for planning as the basic approach i.e an ever increasing water supply (diverting the river Ebro and desalination). In 2004, the articles in the National Hydrological Plan pertaining to the transfer (R.D. Law 2/2004) were repealed, and the “Water Programme” (Law 11/2005) was approved the following year, which had a different philosophy more in line with Directive 60/2000 and would continue to support providing water mainly from desalination as the guiding principle in water policies. Since then the ongoing work involved in one or the other has been affected by the financial crisis and either were not carried out or facilities (mostly desalination plants) have been completed but not started up, due to the recession or disagreements on policy between public administrations of different political parties. In addition to these legislative proposals, water planning has adhered to the schedules set out in the Framework Directive 60/2000. New hydrological plans on River Basin Districts have been drafted, leaving the way open to a new National Hydrological Plan being drawn up in the future and which should be in progress soon.

Together with this context of planning water as a resource, the government has carried out significant work on planning and managing water as a hazard, due to extreme flooding or drought events. Spanish geographers have taken part with scientific papers and research projects to assess the proposals and contribute to improving these with data and new approaches to risk analysis. The National Hydrological Plan included two articles (arts. 27 and 28) establishing

the precept for drafting drought and flood management plans. The first ones were drafted and approved within the River Basin Districts and are hugely important in risk management for drought and for water planning in the regions, especially on a local scale, by establishing supplies and thresholds according to the use of water. Plans for flood management found a suitable framework for development with the approval –and requirement for compliance– of Directive 60/2007 on flood management in Europe. This regulation was an essential milestone in treating flood hazard in Europe, as it prioritises non-structural means, especially in urban planning, as the main procedure in reducing risk. In Spain, the directive, which includes a three-stage implementation, has been adapted and generally complied with. A preliminary risk assessment has been made in pilot zones, also flood risk mapping following criteria established in the Directive, which has formed the base of the newly created National Mapping System for Flood Zones (SNCZI, Ministry of Agriculture) and flood risk management plans have been drafted, although some basins and regions are still in progress, which should end in adapting regulations on land and urban planning at state level and in the autonomous communities. In this context, the modification to the Building Code of 2008 (Legislative R.D. 2/2008) must be included, and the incorporation of an article demanding risk maps to be provided in urban planning. This law has recently been subject to a revised text 2015, which has not affected this important provision (Legislative R.D. 7/2015, art. 22). Moreover, several autonomous communities have approved regulations and plans for managing natural hazards, mainly flooding, with an impact on land zoning by becoming the compulsory instrument in assigning new uses of land. The experiences of the Basque Country, Catalonia, Community of Valencia, Andalusia, and the Balearic and Canary Islands should be highlighted. In these regions, planning documents have to be accompanied by mapping, which is essential to making decisions.

Spanish geographers have studied water planning from a different perspective than the criterion used in this policy i.e. an assessment backed by scientific arguments on the supply policy and its main medium of water transfers (Gil Olcina and Rico Amorós, 2007; Rico Amorós, 2010), and the approaches that basically defend planning depending on the demand (del Moral 2009 and 2014; Sauri, 2009). The importance of directive 60/2007 has been analysed for management and governance of water in Spain (del Moral, 2006; Sotelo Pérez, 2014). Non-conventional resources have also been studied for their use in planning and



managing water at state and regional level (Olcina and Moltó, 2010).

Many contributions have been made by Spanish geographers concerning water hazard planning; they all share the view of the increased risk seen in the last few decades due to man's improper or unwise actions on the land relating to its water resources. The floods should have definitely received greater attention. The changes in conceptual aspects have been assessed (Calvo, 2001; Sauri and Ribas, 2006; Olcina, 2008), the importance of risk mapping (Pérez Morales, 2012; Olcina, 2012), the efficiency of structural defence works (Pérez Morales, Gil Guirado and García Martín, 2015), the need to base flood risk studies on serious hydrological and hydrogeomorphological analyses (Segura, 2009; Camarasa and Soriano, 2008), the improvement in hazard studies (Perles y Cantarero, 2010), vulnerability analysis as an essential element in studying the current increase in risk (Calvo, 2003; Perles and Mérida, 2010) and the possibility of reducing risk by restoring river courses as a sustainable option to respect fluvial areas. (Ollero, 2015; Ibisate *et al.* 2015).

Likewise, approaches to analysing drought have not been lacking (Paneque, 2015; Pita, 2014; García Marín, 2008). Some approaches highlight the value of historical knowledge of flood and drought hazard in order to make a strict assessment of the current situation in regions affected by extreme events risk (Barriendos, 2012; Martín Vide, 2007; Giménez Font, 2009). The need to incorporate the new scenarios foreseen in climate change and its repercussions on rainfall into resource and risk planning have also been subject to approaches from Spanish geographers (De Luis *et al.*, 2010; Miró Pérez, 2014).

Resource planning and climate hazard

Various aspects of the atmosphere have recently been the focus of serious attention from Spanish geographers, including the geographical study on climate elements, climate change, atmospheric pollution, analysis of energy resources (wind and solar). Without doubt, climate change, or rather the hypothesis of climate change from the greenhouse effect which has held sway recently, has given rise to large numbers of papers on research and consideration (Martín Vide, 2008), since it not only affects climatic elements, but

also future initiatives on land zoning and the economy in Spain.

Spanish geographers have taken part in validating reports from the Intergovernmental Panel on Climate change (IPCC); in particular, in assessing the two latest reports (AR4-2007 and AR5-2013,14), as can be seen in the list of assessors included in the online edition of both (www.ipcc.org), both in the volume containing the physical bases (volume I) and those evaluating impact, adaptation and vulnerability (volume II) and mitigation actions (volume III). In such cases, assessment consists in reading the chapters in each volume and providing a critique by contributing ideas that are for or against the arguments in the official report, and which must always be accompanied by bibliographical references from others or from the reviewers, and which support their assessment. These papers must be published in international journals (ISI-JCR o SCOPUS) or in monographs from first class international publishers.¹

In 2005, an official report was drafted on the repercussions of climate change in Spain (Moreno Rodríguez, coord., 2015), which included work by a large group of Spanish geographers in several of its sections.² It must be said that this report was not followed up afterwards. In some autonomous communities (the Basque Country and Catalonia), the regional governments have made follow-up reports on climate change with work from geographers from both fields of activity; especially important is the Catalonia Climate Change Report which, since 2005, has had three updated editions and has counted with participation from many geographers from the region.

There are a great deal of recent contributions from Spanish geographers on evidence of climate change in climatic elements. The work has covered physical aspects of climatic elements, such as predictions, historical approaches (dendrochronology, edaphology, documentary references), statistical analysis and aspects of extreme events and their relationship to global warming and the regional and economic effects of climate change. Some geographers on the Mediterranean coast have also taken part in the *EPSON-Climate* project, overseen by the European Observatory in the land zoning network, and whose objective is the study of

1. The geographers Javier Martín Vide and Jorge Olcina have taken part in reviewing the reports, and so there are several bibliographical references to works on climate change by Spanish geographers.
2. Professors López Palomeque and Martín Vide took part as chapter coordinators, although the list of geographers working on drafting the report is longer (see Moreno Rodríguez, 2005).



social and economic aspects relating to the impact of global warming in Europe (Sauri *et al.*, 2013).

Worth mention is work by the Barcelona group (Martín Vide, Moreno, Raso, Gómez Martín, Gómez Ortiz, López Bustins, Meseguer, Cordobilla, Rubio Romero and Schulte), the Tarragona group (Brunet, Aguilar, Sigró), the Seville group (Pita López, Aguilar, Camarillo), from the Autonomous University of Madrid (Fernández, Cañada, Galán, Fidalgo and González), by Cuadrat Prats and Saz in the University of Zaragoza, by Estrela Navarro at the University of Valencia, by Quereda Sala and Montón Chiva at the Universitat Jaume I de Castellón, by Miró Pérez and Olcina at the University of Alicante; Rasilla and Codrón in Cantabria; López Bermúdez and Conesa in Murcia; Grimalt in the Balearic Islands; Martí Ezpeleta in Santiago de Compostela; Ortega and Morales in Valladolid; Martínez Ibarra in Granada; García Ruiz, López Moreno, Vicente Serrano, Azorín Molina at the Pyrenean Institute of Ecology; Marzol, Dorta and Mayer in the Canary Islands. Approaches by these geographers have been published in national and international journals, as well as acts in specialist seminars and congresses, and on more general (central government (AGE) congresses) or specific (Spanish Climatology Association) themes.

There have been many critiques of the current hypothesis on climate change that do not deny that the world's climate varies naturally, but doubt that the influence of greenhouse gases is contributing to altering climatic elements, especially temperature, over the last few decades (Sanz Donaire, 2007; Uriarte 2003; Quereda, Montón and Escrig, 2009).

There are interesting ideas on the relationship of the climate and its changes and fluctuations on plant life. This occurs with Marco Molina, Padilla and Sánchez Pardo (2006), in relation to the changes on the distribution of caudex Mediterranean plant species in the Sierra de Aitana (Alicante) due the increase in temperature seen in the last few decades. Likewise, there are approaches on the effects global warming and the disappearance of glaciers in Spain (Palacios Estremera *et al.*, 2013; Gómez Ortiz *et al.*, 2012).

Atmospheric pollution has been analysed from the point of view of environmental justice (Moreno *et al.*, 2010). The option for alternative energy, within the framework of current climate change has been studied by Espejo Marín and Ramón García (2012), also its imprint on the landscape (Frolova *et al.*, 2014)

Urban and coastal planning: resources and hazards

Spain has undergone a far-reaching transformation of the territory and drastic changes in land use affecting the whole country, although it was particularly significant in some areas (Madrid, the Mediterranean coast, Canary Islands). The land has been heavily altered to urban, tourism and infrastructure uses; the “artificialization” recorded was the most severe in Europe between 1997 and 2007. As described by Ruiz Urrestarazu and Galdós (2013), the most outstanding data provided by the *Corine Land Cover* project is the spectacular expansion of built-up areas which, between 1987 and 2006, grew by 347,471 ha, a relative increase of 51.9%; and speeded up between 2000 and 2006, with the surprising amount of 63 ha of new “artificial” surface, against the 31 ha of the period 1987-2000. Most of this increase was due to the proliferation what is known as discontinuous urban fabric. In fact, the increase in area happened during years of rampant construction consisting of a spectacular growth in house building and occupation of agricultural land, as the widespread development gained priority. As described by Burriel de Orueta (2008), between 1997 and 2006, the number of houses started in Spain was 5,636,231, almost double that of the previous decade. This figure represents an annual average ratio of 13.3 homes per 1,000 inhabitants, with the significant datum that in 1997, building started on 324,599 houses, which doubled in 2006 (760,170).

During this time of rapid change in land use, the building code promoted urban development, and in some regions, highly permissive transpositions of regulations (e.g. Community of Valencia). In short, there was a lack of a countrywide programme that clearly supported sustainability as the guiding principle in policies, and too much emphasis on the local scale, which became the driving force of changes in land use during this time, as well as a more or less approved absence of control and effective governance in urban planning. As already stated, the result was a huge change in land use into what could be described as real “desertification” by man of this natural resource. Together with the above, the lack of policies to control erosion as a natural process in land transformation, the lack of treatment or, quite the opposite, interventions going against nature after a forest fire, and no regulation of urban-forest and urban-rural spaces, have also contributed to changes in land resources. Neither should the loss or contamination of land though abusive agricultural practices be forgotten (over-ploughing, nitrates). In all these cases, the acts



or omissions of man have led to the loss of land as a resource in both quantity and quality.

This has been tackled by Spanish geographers in several projects, as well as those already mentioned, and academic and professional organisations have also taken an official position in defence of sustainable management of land. In fact, the Association of Spanish Geographers, in coordination with the Geographers Association and a large number of experts in urban development in Spain, launched the Manifesto for a New Culture on Land in 2008, which had far-reaching effects among academics and professionals in urban planning in Spain and South America. Significantly, the manifesto starts by referring to the rapid transformation and loss of land undergone in Spain in the “building boom” years at the start of the 21st century: “The evolution of land use in Spain, mainly because of encroaching mass urbanisation on land that is not always suitable, is highly worrying...”³ Ocaña Ocaña (2009), Romero González (2009, 2001), Delgado Viñas (2008, 2012), Burriel de Orueta (2008, 2009a, 2009b) have been the most prominent authors in analysing and using science to condemn the heavy transformation of land in Spain over the last fifteen years, which has had a devastating effect in the physical loss of the resource, not to mention the obvious lack of governance in the regions and the focus on financial investment (construction) that led to a worsening of the economic crisis that has been in progress since 2008 and a general loss of trust in the work of politicians. The modification of the Building Code (2008, revised text 2015), with the legal text including the precepts of Directive 42/2001 on environmental assessment of plans and programmes, is a step forward in controlling the transformation of land in documents on urban planning at local level. It is accompanied by approval of a new generation of laws for autonomous communities on land zoning which, on paper, establish filters and checks for changes in land use in their regions.

Also of note is the research carried out on land use for agriculture or forest and its evolution, in a dual sense: either because of change to urban use or implementing infrastructure (Spanish Observatory of Sustainability, 2012), or because abandonment gives rise to two processes – it encourages erosion (Romero-Díaz and Martínez Hernández, C., 2014) and at other times plant colonisation that brings with it natural reforestation (Buades and Marco Molina, 2011; Rubio Sesma

et. al., 2014). Lasanta *et al.* (2013 and 2014) have emphasised, as a prime objective, the need to recover abandoned terraces, due to their economic, ecological and landscape benefits, an aspect also tackled by Montiel Molina and Galiana in an assessment of the Forestation of Arable Land Programme (2004). In this respect, Delgado Viñas *et al.* (2020) analysed the role of the eastern Cantabrian mountains as ecocultural heritage and an element of regional development.

Land erosion, in the strict sense, has also been studied by the physical geographers of Spain. As described by Arnáez, a considerable increase in such studies in the last few decades has helped with three aspects: the environmental threat from soil erosion, the development of new techniques and field and laboratory methods supported by IT and automated mapping, and the need to provide effective solutions to control erosion (Arnáez, 2014).

The treatment, or rather the lack thereof, of the urban-forest interface in Spain has been the subject of analysis in interesting approaches by geographers from the Autonomous University of Madrid (Gema Herrero, 2011) and Autonomous University of Barcelona (Anna Badía *et al.*, 2010). They make clear the increase in hazard entailed by not intervening in these spaces where forest meets the town or rural mountain areas when faced with forest fires, and stress the need for regional planning (on several scales) that takes into account the use of land in these areas. Montiel Molina has done a great deal of work analysing the problem of forest fires in Spain, as well as assessing new detection techniques (Montiel Molina, 2013; Montiel Molina *et al.*, 2009).

The coast is a special field of analysis which, despite government regulatory standards in force since 1988 to oversee the use and, a priori, protect interface zones, has undergone highly significant changes over the last fifteen years. These are mostly changes arising from not applying the restrictions and limitations of the use of land already classified as for urban use, and in reclassification to reserve land on a local scale, supported by proceedings in the regulatory standards of the legislation. Added to this is the modification of the Coast Law with the new text approved in 2013 (Law 2/2013) and its regulations (Royal Decree 876/2014) which, as an extraordinary measure, has prolonged concessions for a further seventy-five years for installations and buildings in the public domain and, in many cases, awaiting final judgement on their abandonment.

3. Vid. <https://nuevaculturadelterritorio.files.wordpress.com/2008/05/manifiesto-por-una-nueva-cultura-del-territorio-d5.pdf>



As with land transformation, Spanish geographers have declared themselves in favour of sustainable management of the coastal fringe. In 2012, the Manifesto for the preservation and management of coastal areas was published,⁴ under the auspices of the Geographers Association and AGE (General Government Administration), emphasising the duty of the government to preserve the environmental quality of the coast and the moral obligation to promote the collective good before private interests in planning use of the land. Torres Alfosea made a critical review of government regulations on the coastal areas implemented in Spain since 1950 (Torres Alfosea, 2010) and Barragán defended the need for integrated management of the coast and included political action and public participation as key points. (Barragán, 2014). Approaches from the point of view of existing hazard have also been made in this coastal interface dealing with storms at sea, due to improper occupation by humans, as well as the need for rational planning for these spaces (Tros de Ilarduya, 2012; Rasilla and García Codrón, 2014).

Planning for natural areas

Spain is one of the countries in the European Union with most forest and the leading one in protected areas – ainly terrestrial– since the network of protected natural spaces reaches 17.7 million ha, 34% of the total surface area. In addition, Spain has the highest natural biodiversity in the European Union as it contains 50% of the 226 habitat types of interest in the community.

This matter entails, or should entail, a great deal of planning and management of these spaces, in order to comply with pertinent regulations (European, central government or regional). However, in the rapid transformation of land in Spain between 1998 and 2007, (see above), it is logical to think of the enormous pressure borne by natural areas if they pass to urban use or to implement infrastructure and equipment, which is connected to a less obvious interest from public administrations to address and manage these spaces correctly. This has resulted in competences and territorial conflicts that have not always come down on the side of legal protection of such areas. To give an example, in 2015 the European Union initiated sanctions against Spain due to a lack of management planning in a thousand sites of Community importance declared

by the autonomous communities, but improperly managed.⁵ This is a legal issue that joins reports from all over Spain of aggression against protected natural spaces, because of urban expansion, especially in coastal areas where the land has been heavily built up (Galicia, Cantabria, Catalonia, Valencia Community, Balearic Islands, Canary Islands, Andalusia, Murcia). A geographical assessment of protection procedures for natural spaces in Spain has been carried out by Mulero Medigorri (2002), who also highlighted the role of the landscape in protection policies for these areas (Mulero Mendigorri, 2013). The effects of the building bubble on protected areas on the Spanish coast were analysed by Delgado Viñas (2008, 2012). In view of this, the need for proper integration of natural spaces in land zoning is a logical step requiring suitable guidelines (Mata Olmo, 2005).

The coastal areas, with heavy pressure from urban and tourism interests, is especially sensitive to the proposals and actions on change of land use in areas of natural value. This includes parts of the Cantabrian coast (Ormaetxea *et al.*, 2008) and, most particularly because of the extent of change of land use, the Mediterranean (Ivars Baidal and Vera Rebollo, 2008; López Olivares, 2010).

Two natural areas of special value have received particular attention to provide the necessary protection, eventually granted (Guadarrama), or on the contrary, complaints of recreational use for tourism (ski station) with a widespread impact nearby (Picos de Europa). This is the case of work by Martínez de Pisón (2004, 2009) which was a determining factor in declaring the Sierra de Guadarrama National Park in 2013.

In the second of those carried out by Frochoso, Allende, González Pellejero and López (2005), backed by many scientific arguments and reporting the mega construction project of a large ski station in San Glorio, in the Cantabrian Cordillera, in a site of special natural value, as well as at a crossroads between the environment and administration. This project is on hold while legal proceedings take place, which could last for years.

Law 5/2007 on the National Park Network law 5/2007 on the National Park Network provided for autonomous communities to be responsible for ordinary management, organised and paid for by each one, while the central state administration oversees the

4. Vid. http://www.age-geografia.es/site/wp-content/uploads/2015/01/costas_version_final.pdf

5. On the 31 January 2015, plans had been drafted for only 518 of these areas. This covers 35.4% of the 1,416 sites of Community interest in Spain, with a surface area of 145,371 km² (Ministry of Agriculture, Food and the Environment).



system and establishes basic guidelines and ensures that the national network is consistent. Romero González (2009) pointed out the need to encourage new governance on natural spaces, with public administrations taking part from all over the country (national, regional and local).

With regard to the management of high value nature areas, which have not been considered by the Autonomous Regions as worthy of protection, land stewardship programs have been widely used in Spain in recent years as a way to safeguard these spaces. This is a process included in Law 42/2007, 13 December, on Natural and Biodiversity Heritage which, for the first time in a government regulatory text, includes provisions on land stewardship. There has been a demand for this feature from environmental groups in Spain since the 1980s, but in the last few decades has been receiving attention from academics (studies, doctoral dissertations⁶). It must be remembered that the law regulates the “promotion of land stewardship” and entrusts public administrations to encourage stewardship through agreements with stewardship organisations and landowners, and also includes the option for the central state administration to cede management of any land it owns to the stewardship organisations by drawing up the relative agreements. For land with stewardship agreements, the law provides incentives to positive externalities, tasking the autonomous communities with regulating the required mechanisms and conditions. The law also urges public administrations to promote the use of fiscal measures to encourage or discourage, as necessary, private initiatives to preserve biodiversity and sustainable use of the natural heritage. Moreover, it creates a fund for Natural and Biodiversity Heritage as a co-financing instrument to finance specific actions on land stewardship, among others. Royal Decree 1274/2011, approving the Strategic Plan on Natural and Biodiversity Heritage, was passed in order to implement the law. The plan places great importance on land stewardship for nature conservancy. Spain has been especially active in starting up land stewardship initiatives, as contained in the recent report “Life and Land Stewardship” (Račinska, Barratt and Marouli, 2015).⁷ Geographers have made highly interesting

approaches to general considerations on the liberal economic model and its relationship with nature. The analyses were mostly carried out in places with rapid changes in land use and have highlighted the need to rethink a predatory territorial model that swallows space (Mediterranean coast). Significant work has been done by the Research Group into Sustainability and Territory (GIST) at the University of the Balearic Islands, led by Rullán, Blazquez and Murray between 2005 and 2015. Capdepón Frías (2013) analysed actions on land stewardship in protected natural areas on the coast of Valencia. Sánchez Cabrera (2015) analysed the role of land stewardship in land, environmental and landscape policies, and García de Leonardo (2015) proposed the incorporation of land stewardship in urban planning. On a national level, Romero González (2011) tackled the need for a new land government to take effective control of land changes and find protection formulas for natural spaces of interest (stewardship). And some very interesting work has been done on the relationship between hunting and land stewardship as another way of preserving land values (Martínez Garrido, 2010).

The study, assessment, proposals for protection and intervention in landscapes have been a prominent feature in Spain. Spain joining the European Landscape Convention (2000) has opened up a great many opportunities for theoretical and applied landscape studies. Applied studies have helped to produce regional regulations on landscape to govern this natural, cultural and heritage resource as a fundamental process in urban planning. Theoretical approaches have given rise to a fortunate rebirth and adaptation to modern times of a subject of study by geographers which, with its vagaries and concept renewals, has always been present in the research corpus of Spanish geographers. Important projects from researchers at the Autonomous University of Madrid (Gómez Mendoza, Martínez de Pisón, Ortega Cantero, Mata Olmo, Sanz, Canosa, Galiana, Moya, Camarero), the Universities of Girona (Nogue Font), Barcelona (Tort), Málaga (Gómez Moreno, Ocaña Ocaña), Granada (Frolova, Gómez Zotano), Balearic Islands (Alomar), Valladolid (Molinero, Alario, Baraja), the Basque Country (Ruiz Urrestarazu, Galdos, Alberti, Porcal, Ibisate, Ormaetxea, Lozano), Cantabria (Delgado, Frochoso, González), Oviedo (Fernández García), Salamanca (Plaza Gutiérrez), Seville (Zoido, Silva), Pablo de Olavide (Ojeda), Córdoba (Mulero, Naranjo, Valle Buenestado), Castilla-La Mancha (Pillet, Cañizares), La Laguna (León Rodríguez), Alicante (Hernández, Giménez Font, Moltó Mantero), Murcia (Gómez Espín, Gil Meseguer, García Marín, Pérez Morales), Valencia (Hermosilla Pla, Iranzo, Antequera).

6. Vid. Durá Alemañ, C. J. (2013) “La custodia del territorio y sus nuevas técnicas para la conservación del patrimonio natural, el paisaje y la biodiversidad: un invento norteamericano y su expansión al resto del mundo”. Tesis Doctoral, inédita. Universidad de Alcalá de Henares.

7. Highly significant information can be found on the Land Stewardship Platform (<http://custodia-territorio.es/>).



In addition, there has been a notable creation of landscape observatories or study centres in some autonomous communities of Spain and active participation from geographers in these organisations, together with other professionals, mainly architects and environmentalists, either as direct decision-makers or members of advisory or management committees. Catalonia and Andalusia are particularly worth mention. Also noteworthy is the work on publishing scientific knowledge of the value of landscape carried out by the Duques de Soria Foundation Landscape Institute, closely linked from the start to academic geographers in Spain who have always taken part in coordinating landscape seminars or managing the Institute (García Fernández, Martínez de Pisón, Zoido Naranjo, Ortega Cantero). Finally, in 2014 a specific work group was created on landscape within the Spanish Geography Association which, despite its recent start, is already working hard on research and disseminating findings on landscape.

Conclusions

Spain has witnessed huge changes in land use over the last fifteen years. The times of strong economic growth have had a heavy impact on spatial planning, which has not gone unnoticed by Spanish geographers. Condemnation from scientists on the abusive transformation and change of use in the geographical space, as shown in numerous studies, has fortunately coincided with a significant boost to protection principles and the prudent use of natural resources, in order to avoid hazard situations that are mostly caused by man.

In fact, the argument for sustainability as the guiding force in planning resources and natural hazards in Spain has become deeply rooted among Spanish geographers over the last fifteen years. Where the scales of action of administrations' environmental and land policies have not implemented this principle, geographers have condemned this with scientific backing in research papers, contributions to national and international congresses or declarations on behalf of a new land culture in the widest sense that will ensure consistent development in harmony with nature.

Geographers, like scientists in the regions and their societies, have been able to interpret rapid transformation of natural resources and the creation of hazard areas from the need to know the physical bases of the land and its planning, under the principles of prudent and sensible development, ethics and environmental justice. Above all, natural resources are

the resources of the physical environment where they are located, and fulfil an ecological and environmental function; people should be aware of them and respect them, without trying to exceed the limits of rational exploitation that ensures their long-term survival or, in some cases, just their survival.

The next few years will be decisive for planning natural resources in Spain. A new formula for the planning and sustainable management of water is required, which will replace the one used hitherto in Spain based on promoting water supply; plans need to be designed on all administrative levels to assess their effects on natural resources and to integrally adapt the regions to climate change; a new management strategy is required for the coastal fringe, following the provisions of the current Coast Law (2013), which also takes into account possible effects of global warming on the sea (rise in sea level); incorporation of the landscape must be made really effective in regional and local land zoning; the new land culture must be upheld as a performance principle in future land use planning; checks must be made in urban planning on the degree of compliance with risk maps, which so far has been largely ignored; it is important to maintain levels of research into erosion and assessing the impact of forest fires, especially in sensitive, heavily populated areas; scientists must also maintain monitoring of natural areas of interest, whether or not they are protected, if there is any conflict with urban use or for building infrastructures.

The list of tasks remaining to be carried out in the coming years and decades in planning resources and for natural hazards is, therefore, very long and Spanish geographers should be part of it to provide scientific rigour and from the standpoint of social usefulness as a discipline to ensure the sustainability of land and new ways of governance for elements in the environment.

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Forestation of agricultural land in the Region of Murcia through Rural Development Programmes in Spain: a measure with a positive environmental impact on rural areas

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Abstract

The rural environment accounts for more than half of the Spanish landscape and is formed mainly of agricultural land and forests, which support varied uses and economic activities. However, the abandonment of agricultural activities and rural areas, or agricultural modernisation and intensification, produces important population and territorial changes. These processes are also evident in the Region of Murcia, and together with its geographical location, long agricultural tradition and high biodiversity, make it especially exposed to climate change. The EU and national governments can implement an important political tool (Rural Development Programmes), which, if designed and adapted to the territories where they are applied (together with adequate funding), can influence territorial order and biodiversity. An example of the above is aid related to forestation and its subsequent environmental effects. In this contribution, we analyse the forestation carried out during the 1990s (8300 ha) as regards the use of tree and bush species and their function in helping increase biodiversity.

Keywords: forestation of agricultural land; rural areas; biodiversity; land abandonment; southeast Spain.

1. Introduction

In Spain, the rural landscape makes up approximately 57% of the surface area, and is mostly agricultural and forestal in nature. It supports an amalgam of uses and activities: agriculture, animal husbandry, forestry, the agrifood industry and, more recently, tourism. Therefore, events such as the abandonment of agricultural activities and rural areas or the modernisation and intensification of farming have a strong impact both on the land (territorial morphology, hydrology, biodiversity, landscape, etc.) and on the rural population. These processes can be observed perfectly in the Region of Murcia (Figure 1) with its long agricultural tradition, which, because of its geographical location (western Mediterranean), can be considered to constitute an area bordering on a desert climate (Figures 2, 3 and 4). This means that it is extremely exposed to any future climate change, which could aggravate the effects of torrential rainfall and long periods of drought. At the same time, south-eastern Spain is one of the most biodiverse regions in the whole of Europe, as it includes many endemisms and Ibero-africanisms (Figure 5).

As mentioned above, the European Union has a powerful political-administrative instrument for





Figure 1. Map of the location of the Region of Murcia

Source: Zonu.com [on line]

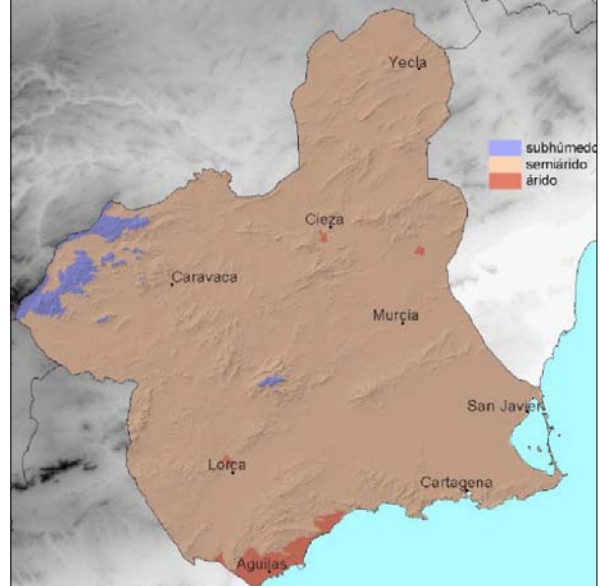


Figure 2. Map of the UNESCO aridity index in the Region of Murcia

Source: Garrido et al. (2013).



Figure 3 Degraded scrubland area in badlands (Alcantarilla-Murcia)

Source: M.A. Fernández Carrillo, 2005



Figure 4: Area of esparto grass and marginal dry crops (Lorca-Murcia)

Source: M.A. Fernández, 2014



Figure 5. Map of the biogeography of the Region of Murcia

Source: Sánchez et al. (2002)

improving rural areas and the quality of life of their inhabitants, called the Rural Development Program (RDP). It is funded by the Common Agricultural Policy (CAP) through EAFRD funds, and by national, regional and local governments, and promotes five-year regional programmes that can be prolonged. These programmes are designed for and adapted to the territory where they are applied, taking into account the views of various social agents. The programmes are structured along several axes and have a series of measures to directly fund or subsidise actions with very different objectives (socio-economic and/or environmental).

Due to the large amount of money involved and the way in which such measures can be directed, these programmes can have a strong quantitative and qualitative influence on territorial planning in rural areas and, especially, the biodiversity of species, types of ecosystems and landscapes which these areas have.



REGIONS	FORESTATION BUDGET RDP (Thousands of euros)				% COST / RDP	EXECUTED DEC. 2009 (Thousands of euros)	% EXECUT.
	M.221	M.222	M.223	Total			
1. ANDALUCIA	140,676.67	50.00	11,354.41	152,081.08	5.32	36,716.23	24.14
2. ARAGÓN	27,568.81	1,008.00	3,030.15	31,606.96	2.74	13,398.71	42.39
3. P. DE ASTURIAS	100.00	206.76	16,900.00	17,206.76	4.05	1,704.81	9.91
4. CANTABRIA	560.00			560.00	0.35	116.86	20.87
5. CASTILLA-LA MANCHA	171,000.00			171,000.00	9.23	57,187.51	33.44
6. CASTILLA Y LEÓN	146,993.00			146,993.00	7.51	106,142.47	72.21
7. CATALUÑA	1,100.000			1,100.00	1.04	369.74	33.61
8. C. VALENCIANA	3,800.00			3,800.00	0.76	1,568.02	41.26
9. EXTREMADURA	114,781.44	3,273.74	1,750.00	119,805.18	10.08	42,717.58	35.66
10. GALICIA	5,931.04	351.38	73,947.44	80,229.86	5.94	19,621.79	24.46
11. LLES BALEARS	1,139.32			1,139.32	0.88	224.29	19.69
12. CANARIAS	231.76		900.00	1,131.76	0.34	20.76	1.83
13. LA RIOJA	2,183.79		3,930.82	6,114.61	2.95	2,330.67	38.12
14. COMUNIDAD DE MADRID	14,000.00		4,550.00	18,550.00	7.70	1,585.85	8.55
15. REGIÓN DE MURCIA	18,434.37			18,434.37	4.07	2,011.94	10.91
16. C. FORAL DE NAVARRA	7,716.17			7,716.18	1.47	2,403.56	31.15
17. PAÍS VASCO	109.28			109.28	0.03	35.94	32.88
TOTAL	656,325.65	4,889.88	116,362.82	777,578.36		288,156.72	
MEAN AC.	38,607.39	977.97	14,545.35	45,739.90	3.79	16,950.39	28.30

Table 1. Summary of the predicted and executed cost (December 2009) on forestation aid (221, 222 and 223) in the different regional programmes

In bold, the costs of measures that were discarded from the programmes

Source: Made by the authors, based on information from regional programmes

A clear example of the above is the funds available for forestation or reforestation and the improvement of forested areas, which is the subject of this study.

2. Objectives

The main objective of this study was to analyse the measures directly related to forestation or reforestation of the land and their environmental repercussions contemplated in the RDPs from the 2007-2013 period. A more in-depth analysis is provided for the Region of Murcia regarding the forestations carried out in previous programmes (1994-1999), enabling evaluation of these forestations made 20 years ago.

3. Methodology

At the national level, we have used 17 regional RDPs as information sources, as well as their medium term evaluation reports. All the documents can be found in MAGRAMA-Programming period 2007-2013 [on line]. Although this information only covers the first half of the period, it serves to determine what is expected from these programmes. For the Region of Murcia, additional detailed information was obtained from the regional Administration, directly from the technical manager and, therefore, is more precise than the national information. All information was validated by numerous visits to the forest, which, together with photographic documentation from the beginning of the activities, has permitted a



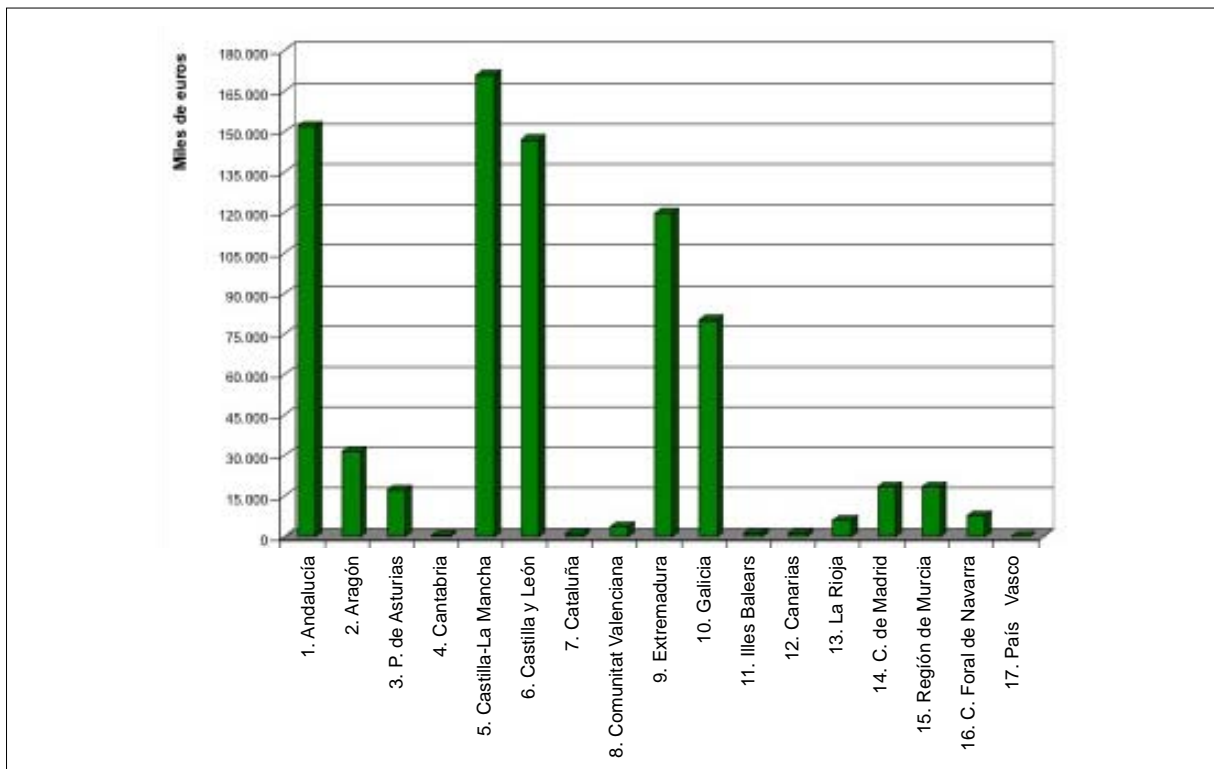


Figure 6. Budgeted costs of the RDPs for aid to forestation (221, 222 and 223) during the 2007-2013 programme.

Source: Made by the authors, based on information from regional programmes.

comparative analysis of the situation pre- and post-action. In particular, we studied 26 records covering the following years of application: 1 (year 1993), 7 (1994), 7 (1995), 6 (1996) and 5 (1998), which represent a total area of 757.4 ha, or 10.03% of the total surface included in this measure.

4. Discussion

4.1. Decision and quantitative evaluation of the measures of interest.

Although the RDPs for the different regions include other measures of lesser importance which may include some activities of this type, the measures that are clearly the most significant for this study are (following the division and coding given by the European regulations¹ and the Marco Nacional MAGRAMA, 2012): Forestations on agricultural lands (221), Agroforest systems (222) and Forestations on non-agricultural lands (223).

1. Council Regulation (EC) No. 1698/2005 of 20 September, on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and Commission Regulation (EC) No. 1974/2006 of 15 December, laying down detailed rules for the application of Council Regulation (EC) No. 1698/2005, of 20 September, on support for rural development by the EAFRD.

Measure 221 is aimed at funding forestation on land classified as agricultural. It usually covers the costs of planting (first year), an amount of money for annual maintenance per hectare for a maximum period of five years, and compensation for the loss of income from the previous agricultural use (an annual bonus per hectare, for a maximum of 15 years, depending on each individual case). In the case of short cycle productive species, only the first item is covered. In most regions there are lists of species that are more or less widespread or that are organised by type of species, botanical characteristics or suitable areas.

Measure 222 promotes the compatibility of extensive agricultural production and forest use. It represents an attempt to favour landscape diversity, biodiversity and the development of ecosystems characteristic of the region. In this case, the assistance only covered the costs of planting.

Lastly, measure 223 was designed for the forestation of land not benefiting from the aforementioned aid, including abandoned agricultural land. In some regions, other areas considered of environmental interest were considered (protection against erosion or increasing forest resources that contribute to mitigating the effects of climate change). Such measures are often linked to regional forestry plans. The aid includes the costs involved in planting and, in the case of



REGIONS	Nº BENEFICIARIES	SURFACE: PREDICTED	% NATIONAL	SURFACE: EXECUTED	% NATIONAL	% EXECUTION
1. ANDALUCIA	1,634	38,807.0	13.09	4,724.2	3.62	12.17
2. ARAGÓN	684	10,500.0	3.54	2,181.0	1.67	20.77
3. PRINCIPADO DE ASTURIAS	450	1,170.0	0.39	1,091.0	0.84	93.25
4. CANTABRIA	ND	ND	ND	35.1	0.03	-
5. CASTILLA-LA MANCHA	1,000	13,000.0	4.39	140.0	0.11	1.08
6. CASTILLA Y LEÓN	12,447	80,000.0	26.99	7,954.0	6.10	9.94
7. CATALUÑA	143	880.0	0.30	892.6	0.68	101.43
8. C. VALENCIANA	555	4,854.8	1.64	4,247.0	3.26	87.48
9. EXTREMADURA	2,350	80,000.0	26.99	68,035.0	52.20	85.04
10. GALICIA	3,599	49,101.0	16.57	26,437.0	20.28	53.84
11. LLES BALEARS	91	ND	ND	ND	ND	-
12. CANARIAS	108	800.0	0.27	20.7	0.02	2.58
13. LA RIOJA	340	8,350.0	2.82	553.1	0.42	6.62
14. COMUNIDAD DE MADRID	ND	5,210.0	1.76	4,219.0	3.24	80.98
15. REGIÓN DE MURCIA	253	ND	ND	9,562.2	7.34	-
16. C. FORAL DE NAVARRA	588	3,611.2	1.22	195.6	0.15	5.42
17. PAÍS VASCO	15	90.0	0.03	54.0	0.04	60.00
TOTAL	24,257	296,374.0	100.00	130,341.5	100.00	43.98
MEAN AC.	1,617.1	21,169.6		8,146.34		47.47

Table 2. Summary of the actual execution of aid for forestation in the different regional programmes (December 2009). Note: Area in hectares. (ND) No data available

Source: Made by the authors, based on information from regional programmes

abandoned agricultural land, the costs of maintaining the subsequent forest (similar to measure 221).

Together (Table 1), these three measures are an important investment (predicted national cost of 777.58 M€ for the 2007-2013 programme), although this figure must be treated with care: (I) firstly, it offers a prediction that may never be fulfilled. At the time that this study is being written, some measures have been eliminated in some regions and in others, there may be less funding available; (II) also, in most cases, the foreseen costs include the funding necessary to make the payments related to previous programmes (such is the case of the Region of Murcia) and, therefore, it is not really a new investment. According to these programmes, the aid available serves to plant a total forest area of 296,347

ha, for the whole of the national territory. In the Region of Murcia, since the 1990s, some 8,300 ha have been planted.

As can be seen from Table 1, measure 221 is the most important one in terms of the total budget (84.41%), although if we consider the measures already eliminated from some of the programmes, this percentage would increase significantly. As regards the cost of forestation in the different regions (figure 6), we observe that five of them would be over 75M€ (Andalucía, Castilla-La Mancha, Castilla y León, Extremadura and Galicia). Of note is the fact that locations with a higher risk of desertification (Region of Murcia, Community of Valencia and Balearic Islands), receive very little financing to apply these measures.



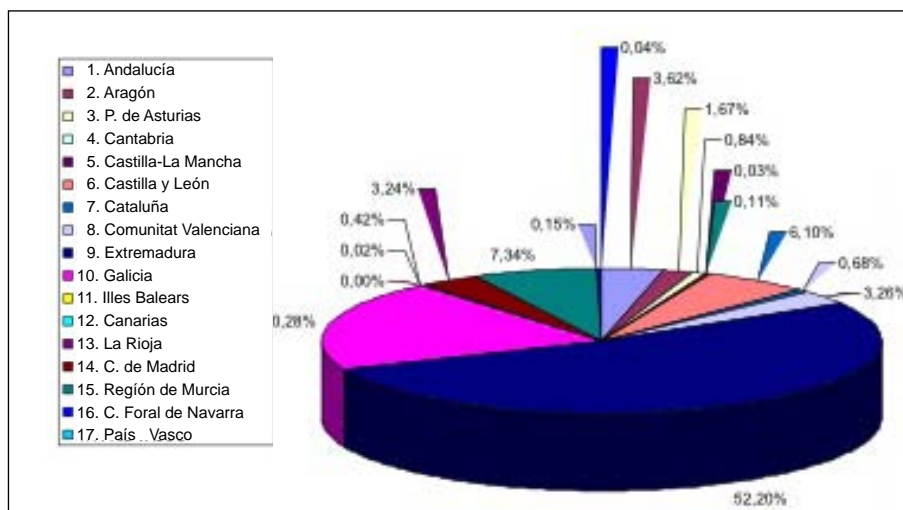


Figure 7. Percentage distribution of the area protected by forestal aid measures (221, 222 and 223) during the 2007-2013 programme for the different regions (data from December 2009)

Source: Made by the authors, based on information from regional programmes

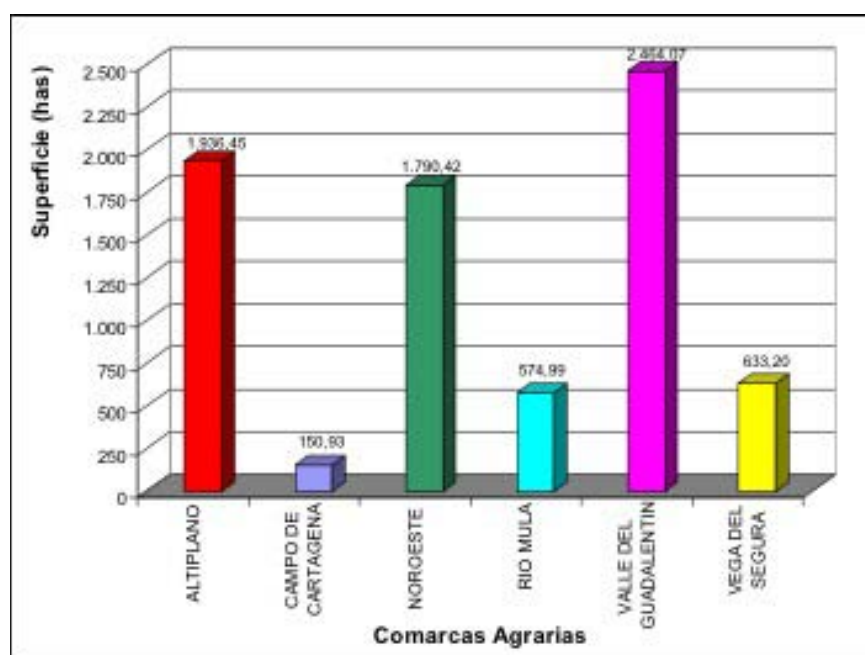


Figure 8. Distribution of surface used for forestation in the Region of Murcia by agricultural region

Source: Made by the authors, based on data from the administration (CAA-CARM, 2010).

On the other hand, if we analyse the results (executed) to date, according to the intermediate evaluation reports (Table 2) the 24,247 beneficiaries encompass 130,341.5 ha, which represents 43.98% of what was predicted. Although this figure seems high, much of the cost corresponds to forested surfaces from previous programmes. Another relevant aspect (Figure 7) is that most of the work carried out was in the regions of Extremadura and Galicia (72.48% in total).

4.2. Analysis of a particular case: the Region of Murcia

In the Region of Murcia, while this measure was not executed in the 2007-2013 RDP, we were able to study the measures taken between 1993 and 1999.

During this period a community programme of aid to cover forestation measures in agriculture and, particularly, to promote forestation funding in agricultural operations, was applied directly with state regulations.² This programme was overseen by an administrative technician, and therefore we have been able to evaluate a representative sample of forestation records made during these years, which will be detailed below.

Regarding the technical requirements and types of payment (planting, maintenance and compensation), they were very similar to those currently included in measure 221, as this first assistance was the precursor of current aid programmes.

2. Royal Decree 378/1993, of 12 March, establishing an aid system to encourage forestry investments in agricultural operations and actions to develop and use forests in rural areas.



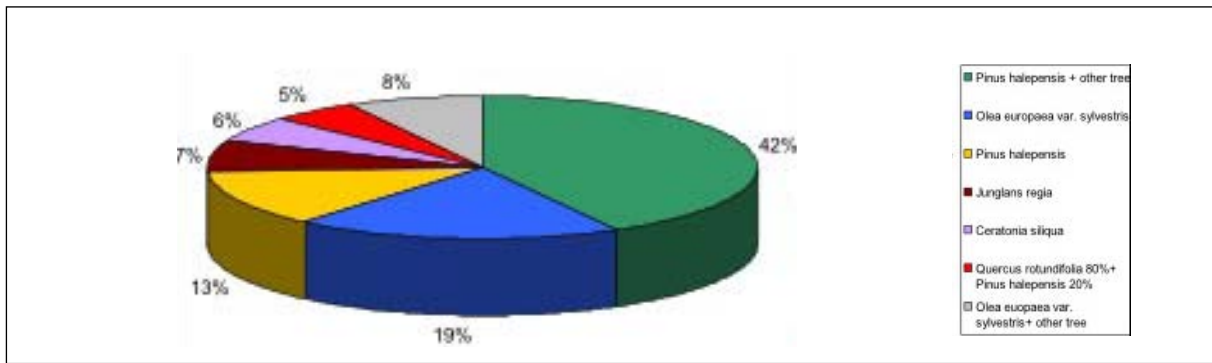


Figure 9. Distribution of plant species used for forestation

Source: Made by the authors, based on data from the administration (CAA-CARM, 2010)

As regards this programme, the total surface used for forestation was 7,550 ha (385 applications), with an average area of 19.61 ha per record. We must take into account that forested area for local government is not included, which amounts to about 750 ha. The regions with most forested surface were: Valle del Guadalentín (32.64%), Altiplano (25.65%) and Noroeste (23.71%), represented mostly by the municipalities of Lorca, Jumilla and Moratalla, respectively (figure 8). The average annual income for farmers over 20 years was 4,690.83 €/ha. The predicted average total cost for this measure was 35.42 Millions of euros.

The species most used by the farmers (figure 9) were (figure 10): *Pinus halepensis* (b), *Olea europaea* var. *sylvestris* (c), *Quercus rotundifolia* (a), *Ceratonia siliqua*, *Pistacia lentiscus* (d), *Junglans regia* (e), *Pinus pinaster*, and less frequently *Arbutus unedo*, *Celtis australis*, *Quercus faginea*, *Ephedra fragilis*, *Retama sphaerocarpa*, *Quercus coccifera*, *Pistacia terebinthus*, *Rhamnus alaternus* and *Tetraclinis articulata* (f).

In most cases, the forestations that were performed varied significantly from what the beneficiaries had asked for. At the outset the species requested were very limited and sometimes erroneous, tending to monospecific forestations and looking for the species that were the best funded regardless of the area's edaphoclimatic conditions. In this respect, the corrections made to these requests by the administration technicians were very important. The most recommended and used species thus became the Aleppo pine (*Pinus halepensis*), accompanied by several other species. According to the results, it is evident, at least with present day knowledge, that this species was the most resistant of the trees used. No other species has shown a similar growth rate, adaptation and viability, although (*Olea europaea* var. *sylvestris*), lentisco (*Pistacia lentiscus*), coscoja (*Quercus coccifera*) and tetraclinis (*Tetraclinis articulata*), also showed very good results where they

were used. Also, it is important to highlight that at that time there was a lack of suitable nursery plants, in terms of the type and quality of plants, which has negatively affected the forestation outcomes.

In addition to the above, the techniques used for preparing the surface and for planting seem to be key factors in forestation. One aspect of crucial importance is the choice of technique, which must reflect the type of soil and the forestation used (Romero Díaz *et al.*, 2010). One thing that has become evident is that the deeper the soil is prepared and the bigger the hole, the better the viability. Equally, the density of planting is another key aspect: in our climate and soil, it is more recommendable to have low densities (450 to 500 trees/ha), due to the lack of water and lower need for pruning. Other measures such as protectors, which facilitate vertical growth, and protection against drying and herbivores, the addition of organic matter, or even, the contribution of vegetal remains and stones next to the plant, also seem to have a positive effect on the plants; this last measure is probably due to the effect on moisture conservation and protection from solar radiation in the root area.

5. Conclusions

Generally, and considering the whole of Spain, the three measures directly related to forestation are of great interest, for several reasons:

- The duration
- The high degree of coverage that they offer the soil
- The control of runoff and water storage in the ground
- The long term deposition of carbon



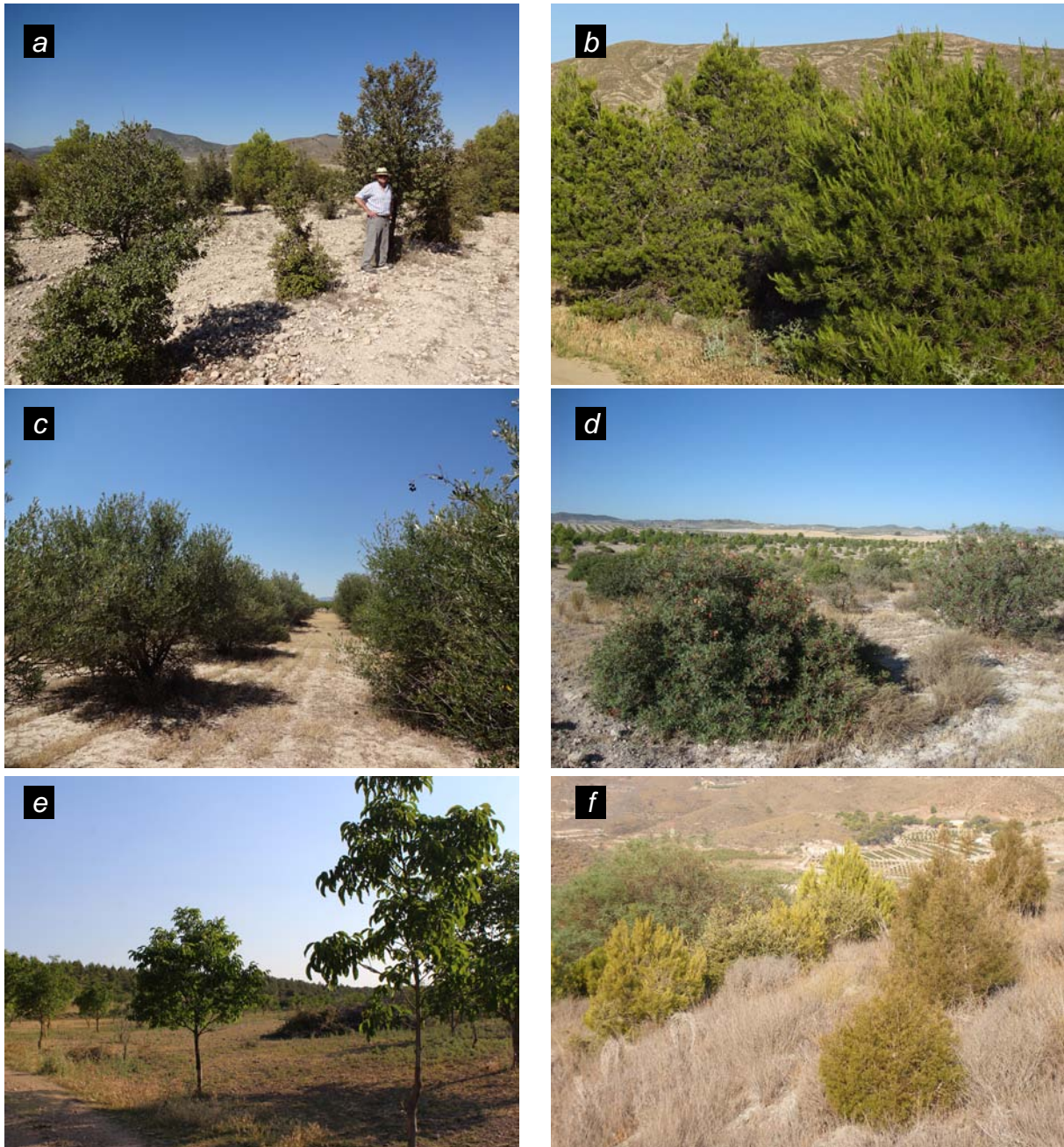


Figure 10. Details of some of the planted species: (a) *Quercus rotundifolia* 20 years old (La Paca-Murcia); (b) *Pinus halepensis* 21 years (La Paca-Murcia); (c) *Olea europaea* var. *syvestris* 20 years (Mula-Murcia); (d) *Pistacia lentiscus* 13 years (Mula-Murcia); (e) *Juglans regia* 19 years (Caravaca de la Cruz-Murcia); (f) *Tetraclinis articulata* (right) 12 years (Cartagena-Murcia)

Source: M.A. Fernández (2012 d), (2013 a); (2015 b, c, e) and M. Sánchez Martín (2010 f).

- The improvement in biological diversity and the possibilities for diversifying usage (direct or indirect)
- The improvement to the landscape in rural areas.

Measure 221, designed to promote the forestation of agricultural land, is especially interesting for the reuse of non-productive marginal areas or those that have simply been abandoned. However, the measure for non-agricultural land (223) is aimed at forest areas or those with a high ecological value, which, although also very

exposed to erosion processes and degradation, have a better probability of attaining natural regeneration than the above case and also have other sources of funding or action (other RDP measures or ERDF funding). Lastly, the measure related to the creation of agroforest systems (222), although less common, is very interesting for the development of agro-silvopasture activities, or for establishing localised forest structures compatible with maintaining agricultural activities, as they can be included in uses with special problems (gully, rills, ephemeral river and river banks). Therefore,





Figure 11. Example of forestation carried out with holes using Aleppo pine as the main species. Comparison after 16 years. Note the cover compared with dryland almond orchard and the proliferation of scrubland (Lorca-Murcia)

Source: left (M. Sánchez Martí, 1999); right (M.A. Fernández Carrillo, 2014)

this measure, in all its different regional versions, is very interesting for more disadvantaged rural areas. Because of all this, one of the most important aspects of the above measures is the capacity they have for territorial planning and reversing processes, so that certain areas that are not suitable for agriculture can be returned to their original state (Fernández Carrillo, 2015).

The lack of studies, evaluations or follow-up on these kinds of measures in other regions by the different administrations or the scientific community is of particular note. Based on the case studied here, involving a semiarid territory such as the Region of Murcia, the increase in biodiversity resulting from these forestations occurs on two scales and through different mechanisms:

- On the local scale (plot or property), directly through the planting of trees and bushes, and indirectly by the creation of new habitats for animal colonisation (including key species and species for hunting).
- At the landscape level, these new areas serve as connection between pre-existing forest areas, contributing to ecological connectivity and the functionality of spatial conservation networks.

Systematic evaluation of these effects is relevant in territories that are subject to an intense pressure of change, such as southeast Spain. In the Region of Murcia, of the numerous plant species established for use by present day legislation (organised by

bioclimatic zones), there are several tree and bush species (about 20), including *Pinus halepensis*, *Olea europaea* var. *sylvestris*, *Quercus rotundifolia*, *Pinus pinea*, *Ceratonia siliqua*, *Pistacia lentiscus*, *Quercus coccifera*, and *Juniperus phoenicea*, and even some others of special interest due to their rarity, such as *Tetraclinis articulata*. Moreover, the facilitating role that some of these species may provide will help increase diversity, promoting structural improvements and floral and faunal succession, and constituting useful tools for ecological restoration.

There is an evident lack of knowledge about the behaviour of different species according to zones. It was discovered that some species thought to be unsuitable for some zones were actually very well-adapted. On the other hand, the lack of species that can act as structural supports in Murcia's conditions means that the forestations show little resilience in the face of environmental changes or certain phytopathological attacks, such as is occurring now in the southeast with the Aleppo pine and "borers" (*Tomicus destruens* and *Orthotomicus erosus*). This, along with the extreme drought of the last two years is causing a high death rate for this species.

Last, but not least, we must emphasise the protective effect that forestation has on the soil, especially when compared with nearby areas of crops, abandoned land and even steppe and pasture land. Laminar erosion is reduced and the frequency in the apparition and significance of gullies and rills may be also be reduced (Figure 11). This aspect is especially relevant as the



land is the basis for all life in ecosystems and for the species that inhabit it.

Finally, we should mention the need to continue studying the effects of different measures related to forestation, especially with regard to the increase in animal and plant biodiversity. Together with the reduction of erosion and flooding after heavy rains, and the proven potential for carbon storage, such information would act as an indicator to justify the importance of this type of funding for society as a whole.

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Estimating social carrying capacity in protected Mediterranean mountain areas. Methodological orientation *

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Abstract

The concept of social carrying capacity, though open to debate and critique, is a valuable tool that enhances the management of recreational use in protected natural areas. In this study, conducted in Sierra de las Nieves natural park (Spain), we first categorised the hikers making use of the park and then, from the profiles obtained, analysed their perception of crowding on the trails. This assessment was subsequently used to analyse levels of user satisfaction and thus determine the psychosocial carrying capacity of the park. The results obtained can be extrapolated to most of the Spanish natural parks in Mediterranean mountain areas, due to their comparable levels of visitor numbers and the prevalence of recreational hiking use. The results suggest that management efforts should be directed toward relocating trails outside core areas, such that user preferences may be satisfied while less impact is made on the areas of highest environmental value.

Keywords: hikin; visitor classification; natural area planning and management; social carrying capacity.

1. Introduction

Natural parks (a status created by Act No. 4/1989 and equivalent to the IUCN Protected Area Category V-Landscapes/Seascapes (Dudley, 2008)) are widespread in Iberian Mediterranean mountains

as a result of their better biodiversity conservation compared to other agrarian environments. Accordingly, recreational practices in natural spaces are still at an embryonic stage of development, although visitor numbers are growing. This changing pattern reflects a situation similar to that already experienced in the sociological context of Anglo-Saxon countries, where the protection of natural spaces and the practice of recreational activities in such spaces date back to the 1950s and 60s. Accordingly, a review of the literature reveals that empirical information about number and motivation of users is inconsistent and scarce compared to the more in-depth, varied studies in Anglo-Saxon areas.

Working on this assumption, the aims of this study are:

- Understand users' motivation
- Apply motivation to the analysis of the crowding perceived by users as a basis for determining social charge.
- Generate an instrument for park planning and management, verifying the degree of consistency between management goals for the natural park and visitors' motivations.

The natural park of Sierra de las Nieves (Andalusia, Spain, see Fig. 1) has been chosen as a significant study site. The methods applied were:

- Territorial analysis of park planning and public outdoor recreation services.



- Planning and carrying out a survey focused on the users of the public trail network, the only outdoor activity included in natural park planning.
- Analyse survey results according to literature review about motivation, crowding and social carrying capacity

Due to the space limitation, the methods and results sections have been merged.

2. Methods and results

2.1. Motivation and crowding as components of social carrying capacity

To achieve these goals, a review of the literature revealed a relationship between three concepts: motivation, crowding and social carrying capacity. Early studies focused on estimating the social carrying capacity of recreational and protected natural areas (Wagar, 1964). Subsequently, differences in users' motivation were introduced as a factor underlying their perceptions of crowding (Driver, Brown and Perry, 1978; McCool and Petersen, 1982).

Knowledge of users' motivations is fundamental to our study's goals, as this factor is the basis for understanding the demand for recreational facilities and, at the same time, a valuable tool for developing

effective management measures (Arnegger, Woltering & Job, 2010; Saepórsdóttir, 2010; Farias, 2011) and for estimating social carrying capacity from perceptions of crowding. In this way, crowding perceptions, as subjective judgments by individuals, depend on a wide variety of social and/or psychological factors, including the type of user, the activity performed and the environment in which it takes place (Graefe & Vaske, 1987). A review of the literature also shows that surveys are usually the way to understand both motivation and crowding perceptions.

To develop these ideas, we start with territorial analysis (see 2.2) as a determining factor for survey planning (see 2.3) and finish with an analysis of the survey results (see 2.4).

2.2. Territorial analysis of user-oriented outdoor recreation environment

Study Area and Sampling

The natural park of Sierra de las Nieves (Andalusia, Spain, see Fig. 1) was selected as the study site for various reasons. First, it is a significant example of the function of Mediterranean mountain areas in the context of the European Union, as many natural parks are located in such areas; second, it reflects, in terms of visitor numbers and the hiking-oriented focus of the park's infrastructure and regulations, the user conditions prevailing in Spanish natural parks; third, its planning is based on the existence of *Abies pinsapo bois*, a high value tree from the biodiversity viewpoint.

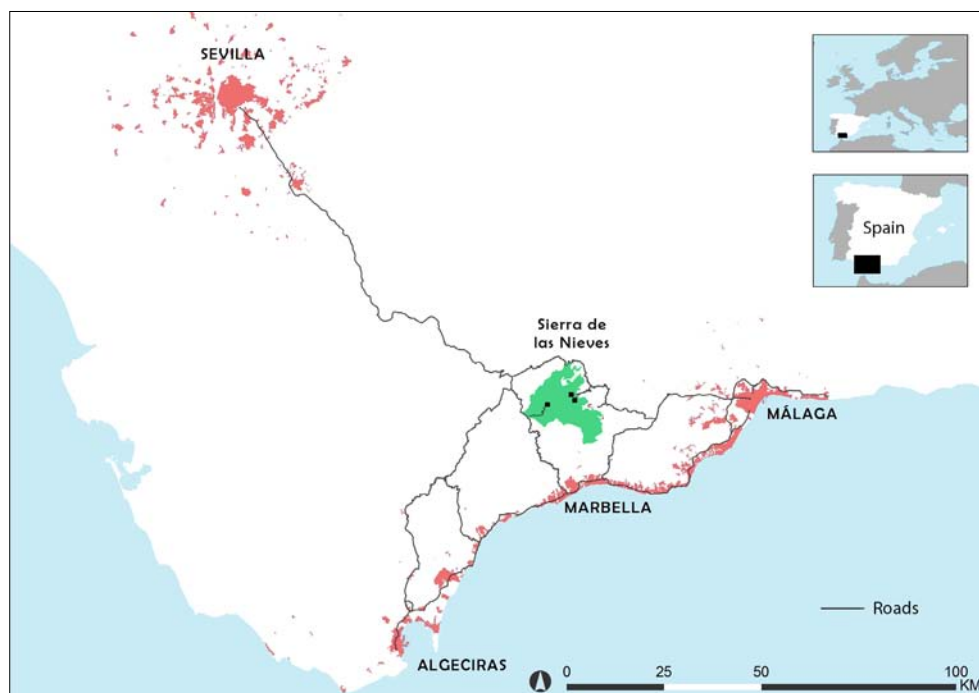


Figure 1. Study area: Natural Park Sierra de las Nieves



The number of park trails users is 23,000 per year, a piece of data available to us thanks to the data loggers (automatic data recorders) installed (see figure 2). If we contextualise this number, we can discover some significant information about the representativeness of the study area. This type of natural space, with relatively low visitor numbers, is the most common and accounts for the largest total surface area, both in Spain as a whole and in the region of Andalusia in particular, in the category of natural park (Cabalar, 2013; Muñoz, 2008). In this respect, Spain's parks are well behind those in the USA and other European countries (Fernández & Santos, 2010), and scarce, unreliable sources show a low number of visits (EUROPARC, 2013). Thus, 92% of these parks receive fewer than 50,000 visitors a year, and 64% receive 10,000-50,000 visitors (the Sierra de las Nieves Park is in this visitor range). On this point, and while it is a secondary factor in this study, it should be mentioned that there is a lack of automatic data recording devices. Often, the information available is only from visitors' centres, and we therefore cannot know if visitors' activity affects more vulnerable natural elements and there is no measurement of carrying capacity.

Focusing on hiking, it is significant that the only park activities assigned a specific location are those of

leisure (recreation areas) and hiking (see figure 2). Hiking is the most popular recreational activity, both in protected natural areas and among all outdoor recreational activities in Spain; according to a report published by the Spanish Centre for Sociological Research (CIS, 2010), 8.6% of people 14 years and older practise mountaineering, hiking and/or backpacking. Likewise, several studies (Cabalar, 2013; Farias, 2011; Muñoz, 2008) show that virtually all Spanish protected areas have public trails with or without signposting.

The definition and management of this natural park (with a total surface area of 20,163 ha) is the responsibility of the Andalusian Regional Government, in application of Act No. 4/1989 of 27 March on the Conservation of Natural Areas and Wildlife (Junta de Andalucía, 1989). This status is equivalent to the IUCN Protected Area Category V-Landscapes/Seascapes (Dudley, 2008). The fundamental justification for establishing this natural park is the delicate situation of two species, the Spanish fir (*Abies pinsapo bois*) and, to a lesser extent, the gall oak (*Quercus faginea ssp. Faginea*). The Spanish fir dates back to the Cenozoic era and is only found in a few areas of the Serranía de Ronda and in the Yebala range in northern Morocco. Thus, in terms of biodiversity, this area is of great

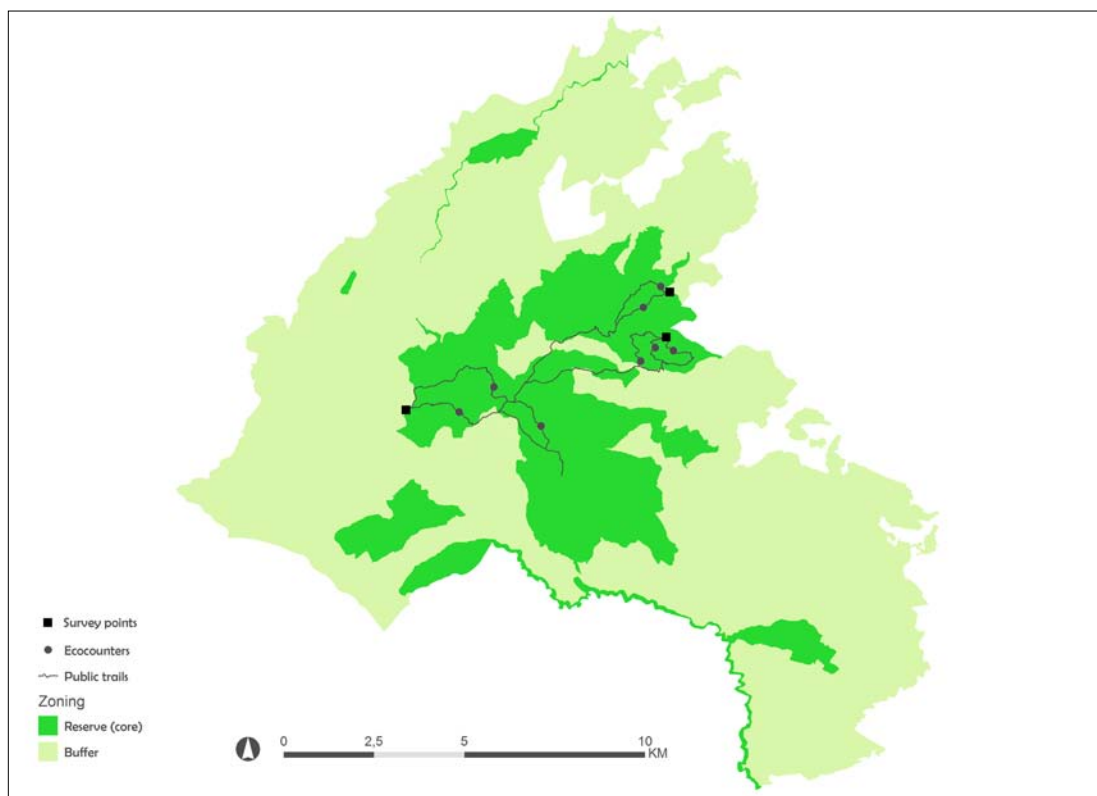


Figure 2. Data loggers and survey points located on public trail network. Natural park Sierra de las Nieves



importance. Nevertheless, processes of deforestation, incessant since the fifteenth century, had led to a clear risk of this species' extinction, a risk known to the National Forestry Department for several decades. In 1995, the (extended) area was declared a Biosphere Reserve, but in Spain there are no specific management and zoning regulations for this territorial category, and so it is subject to the regulations applicable to natural parks. Among other objectives, the park managers seek to consolidate and amalgamate the currently discontinuous presence of Spanish firs, previously found only in shaded valleys where the altitude and orientation provided the humidity and cool temperatures needed for their survival. Applying protectionist zoning criteria, these formations comprise the central area afforded the very highest levels of protection (see Figure 2), as stipulated in the Natural Resources Management Plan (Junta de Andalucía, 2003), although the same degree of protection was also granted to other isolated areas. In addition, a peripheral area of protection was established around the Spanish fir woods. In this way, we understand that the trail network is located in the areas with the highest biodiversity values due to planning linking with the earlier UICN proposals (environmental education).

However, the area presents other physical factors that are of greater significance for the nearby population, in the provinces of Málaga, Cádiz and Sevilla, namely its altitude and the presence of snow. Torrecilla Mountain, at 1,919 m above sea level, is the highest peak in the province of Málaga. Snow is a rare sight in coastal western Andalusia and so its presence on the slopes of Sierra de las Nieves ("*Snowy Mountains*") makes it a prime destination for winter recreation, despite the absence of any kind of infrastructure for snow sports, which would be unviable due to the season's short duration. The connection between the park and its snow cover arises from its location, concerning both the atmospheric conditions that produce snowfall and its altitude, determined by the geology of the mountains. The third physical factor also affects the park in terms of recreational activities, but for a much smaller population – speleologists. The limestone formations contain a series of chasms of international importance, especially the GESM sinkhole, which at 1,100 m, is the deepest in Andalusia and one of the deepest in Europe. Of these four factors – the Spanish fir, Torrecilla Mountain, access to snow and speleology – the first three constitute the main attractions for visitors, and as a result of their dependence on altitude, they share the same

space, namely the area afforded the highest levels of protection.

2.3. The survey: its planning and primary results

As has been mentioned, we followed the proposals of Graefe and Vaske (1987) for survey planning and based the surveys on a set of premises arising from the territorial analysis of the study area and the visitor traffic data provided by data loggers.

The first premise was the seasonality of park use. This issue was addressed in order to clarify the relationship between visitor numbers, natural cycles and the work year; for this purpose, the survey period was divided according to these criteria over a full year. The availability of data loggers facilitated an analysis of the annual distribution of visits; the fact that one year's accumulated data had previously been obtained was used as a criterion for timing the survey. The following selection criteria were applied with regard to natural cycles: high summer temperatures, seasonal changes in vegetation in accordance with the annual hydrological cycle, the existence of sunny days with mild temperatures during the winter months, and the presence of snow. According to the Natural Resources Management Plan (Junta de Andalucía, 2003), this last factor is associated with episodes of overcrowding. Data collection was interrupted during the hottest months of the year (June to September), as the data loggers reflect a sharp fall in the number of trail users in these months. As regards the advisability of conducting visitor surveys on days of rain or mist, we decided to determine visitor numbers during these periods before excluding them from the study period. Indeed, these weather conditions were found to be dissuasive, and so when the forecasts supplied by the National Meteorological Agency suggested the likelihood of unfavourable weather, surveys were not conducted. On the contrary, days when the presence of snow coincided with good weather conditions were specifically included in the survey programme (28% of the surveys). These weather conditions were identified directly by the interviewer as one of the items checked on the questionnaire. Regarding the work days versus holidays, the surveys were conducted on weekends (seven days, 58.6% of the surveys), long weekends (seven days, 17.4% of the surveys), Christmas holidays (10% of the surveys) and working days (two days, 1.2% of the surveys). The Easter holidays were excluded due to the abnormally rainy weather experienced in the year in question.



The second issue considered was how to include only those persons identified as users of public trails in the survey. To ensure this outcome, the survey was planned so that the survey sites were exclusively those where there was motor vehicle access to a trail head (see Fig. 1). Of these sites, we then selected the three which preliminary field work had shown to be most frequented by vehicles (see Fig. 2). The criteria for selecting respondents were that they should be over 16 years old and have hiked the trail in question, in full or in part. The visitors who agreed to participate in the study were given a brief description of the study goals. Data were collected from midday until sunset (the exact time depended on the month), and so the answers provided referred to activities that had already been carried out. The questionnaires were given by the interviewers. A total of 345 valid questionnaires were obtained.

The questionnaire contained three sections relating to the following study goals (Ocaña *et al.*, 2013): visitor characteristics (origin, age, sex, profession), motivation and perception of crowding (this latter aspect was fundamental to estimating social carrying capacity) and satisfaction with the trail experience, as described in the review of the literature. The characteristics of the respondents were similar to those reported by Wöran & Arnberger (2012) in a study carried out in the Austrian Alps. The age range was 16-75 years, with an average of 37.7 years (vs. 41.4 years in the aforementioned study), with a relatively low participation of women (28% vs. 47%). Half of the visitors were university educated and 81% were employed (vs. 74.2%), but the number of pensioners (2.3% vs. 11.9%) and students (2.6% vs. 10.0%) was very low. These differences reflect the social environment of recreational activities in Mediterranean societies, and the fact that such active, outdoor activities have only recently been widely adopted, hence the scant presence of retired persons. On the other hand, the low number of women is not consistent with the Spanish eco tourist profile (Muñoz, 2008: 294).

This profile coincides with the studies done by Ruiz and Galdós, 2007 in the Basque Country and Hidalgo (2009) in Andalusia, but not with the Cabalar findings from some natural parks in Galicia (Cabalar 2013).

This finding is also in line with Wöran & Arnberger (2012) regarding the prevalence of users from the same country, although the latter study did not report the proximity of visitors' area of origin or the duration of their visit. In both studies, visitors predominantly

arrived in their own vehicles (98.5% vs. 97%), which suggests proximity. Results for the duration of the visit, however, were unequal; in our study, 90% of the respondents were on a day trip (vs. 46.1% for Wöran & Arnberger). Our assessment of these data is that, in contrast to the universal nature of its biodiversity value, the spatial context of this natural park as a tourist destination is very limited.

2.4. Results: motivation and crowding perception

In relation to questionnaire content, a review of the literature showed that most surveys employ Likert scales and then analyse the results obtained using cluster or factorial methods that combine motivation items with sociological ones. Additionally, Spanish research has accepted some of these results and researchers have adapted them to a wide range of profiles (Muñoz, 2008). Nevertheless, given the lack of basic information about study area visitors, we decided to start with the definition of motivation proposed by Manfredó, Driver & Tarrant (1996), as "the individual's intrinsic or extrinsic incentive to engage with an activity", and to include Recreation Experience Preference (REP) items in the questionnaire (Driver, 1977 apud Galloway, 2012). Regarding the activity selected (Graefe and Vaske, 1987), the survey focused on public trail users, as the public trail network is the only outdoor recreation activity offered.

Therefore, we firstly needed to know what weight hiking had as motivation among public trail users. Specifically, Item 3 of the survey "When you go out into the country, is hiking your main reason for doing so?" with a closed yes/no line of response, provided a first line of segmentation. The answer divided the study group into *hikers* (those who answered yes, 87.8%) and *visitors* (those who answered no, 12.25%) (table 4).

After that we applied Recreation Experience Preference (REP) items (Driver, 1977 apud Galloway, 2012), taking into account the study's goals (to obtain basic information) and the embryonic stage of development of hiking in Spain. However, in order to prevent the questionnaire design from being based solely on the principles applied in previous studies and therefore perhaps obtaining biased results, we decided to combine closed- and open-ended answers (question 2 and counter question 36, see table 1). The closed-ended questions referred to the REP items listed in table 1,



selected from the REP items, such as “to enjoy nature”, “for physical fitness”, “to learn” and “to be in company” (in the latter case, meaning the respondent is motivated to share the experience with friends and family).

The open-ended responses allowed us to relate the users’ motivations with different management approaches, identifying the elements of the natural area that are most attractive to the respondents, whether or not they are included in the management approach. These responses were then assigned either to the items with which they were related (whether alone or in combination with others) or to the motivations listed in Table 1 as “related to park management objectives”. The questionnaire responses “to learn” and “related to park management objectives” raised a conceptual discussion, as their open nature meant they could be included both in the concept of “to learn” in general, and specifically, as a particular element of the natural park. We decided to divide these responses according

to how the attitude in question was addressed in the management objectives, and according to their possible relationship with larger numbers of users and thus the possibility of crowding. As a result, the following motivation responses were singled out:

- “To pick mushrooms”.
- “To see the snow”, because the presence of snow is recognised in the management objectives as one of the causes of crowding
- “To see Torrecilla mountain”, because this mountain is famous in the province and attracts many sightseers
- “To see the Spanish firs”. However, this motivation was eliminated because only one response to this effect was made, and the latter was included in the item “To learn” in response to question 36.

QUESTIONNAIRE QUESTIONS	MOTIVATIONS ASPECTS TAKEN FROM THE RECREATION EXPERIENCE PREFERENCE ITEMS (REP)				MOTIVATIONS RELATED TO PARK MANAGEMENT OBJECTIVES
	TO ENJOY NATURE	TO LEARN	FOR PHYSICAL FITNESS	TO BE IN COMPANY	
Question 2: Today, in particular, what is your reason for visiting the park?	<ul style="list-style-type: none"> • To spend a day outside • To see the sunrise 	<ul style="list-style-type: none"> • To see a specific aspect of the park • To walk the Cañada de las encinas trail • To visit a part of the park not previously visited • To see the Caridad woods • To show the park to a friend • To see the landscape • To see the birds 	<ul style="list-style-type: none"> • For open-air sport • Walking • Training • To explore new trails 		<ul style="list-style-type: none"> • To see Torrecilla mountain • To see the Spanish firs • To see the snow • To pick mushrooms
Question 36: What motivation would best define the reason for your visit?	<ul style="list-style-type: none"> • To get close to nature 	<ul style="list-style-type: none"> • To enjoy the countryside • To get to know the natural park • To appreciate its natural value • To appreciate its cultural value • I have already visited the park, and I like it 	<ul style="list-style-type: none"> • For physical exercise 	<ul style="list-style-type: none"> • To be with my friends 	

Table 1. Relation between the motivation aspects listed in the Recreation Experience Preference scales, the questionnaire items and the open-ended responses given by respondents

Source: Survey projects SEJ-2007-67690 & P07_HUM_03049 Items proposed; open-ended responses



QUESTION 36 What motivation would best define the reason for your visit?	QUESTION 2 what is your reason for visiting the park?				MOTIVATIONS RELATED TO PARK MANAGEMENT OBJECTIVES
	TO ENJOY NATURE	TO LEARN	FOR PHYSICAL FITNESS	TO BE IN COMPANY	
TO ENJOY NATURE	• To enjoy nature				
TO LEARN	• To enjoy nature and to learn	• To learn	• To enjoy nature and for physical fitness		
FOR PHYSICAL FITNESS		• For physical fitness and to learn	• For physical fitness		
TO BE IN COMPANY				• To be in company	
MOTIVATIONS RELATED TO PARK MANAGEMENT OBJECTIVES					<ul style="list-style-type: none"> • To see Torrecilla mountain • To see the Spanish firs • To see the snow • To pick mushrooms
MORE THAN TWO MOTIVATIONS					

Table 2. Contingency table to define motivations, combining question 2 and question 36

MOTIVATION		HIKERS Code	VISITORS Code
MOTIVATIONS ASPECTS TAKEN FROM THE REP	To enjoy nature	1	2
	To learn	3	4
	For physical fitness	5	6
	To be in company	7	8
MOTIVATIONS RELATED TO PARK MANAGEMENT OBJECTIVES	To see the snow	9	
	To see Torrecilla mountain	10	
	To pick mushrooms	11	
MORE THAN ONE MOTIVATION	To enjoy nature and to learn	12	13
	To enjoy nature and for physical fitness	14	15
	For physical fitness and to learn	16	
	More than two motivations	17	

Table 3. Identification codes for questionnaire respondents, according to their motivations

Source: Survey projects SEJ-2007-67690 & P07_HUM_03049



MOTIVATION		HIKERS		VISITORS		TOTAL MOTIVACIÓN	
		Nº	%	Nº	%	Nº	%
MOTIVATIONS ASPECTS TAKEN FROM THE REP	To enjoy nature	98	32.34	18	42.86	116	33.62
	To learn	7	2.31	6	14.29	13	3.77
	For physical fitness	36	11.88	4	9.52	40	11.59
	To be in company	10	3.30	6	14.29	16	4.64
MOTIVATIONS RELATED TO PARK MANAGEMENT OBJECTIVES	To see the snow	13	4.29			13	3.77
	To see Torrecilla mountain	10	3.30			10	2.90
	To pick mushrooms	4	1.32			4	1.16
MORE THAN ONE MOTIVATION	To enjoy nature and to learn	35	11.55	5	11.90	40	11.59
	To enjoy nature and for physical fitness	68	22.44	3	7.14	71	20.58
	For physical fitness and to learn	17	5.61			17	4.93
	More than two motivations	5	1.65			5	1.45
TOTAL MODALIDAD		303	100	42	100	345	100
% SOBRE TOTAL ENCUESTADOS		87.83		12.17			

Table 4. Classification of users of public trails according to their motivation and their self-identification as hikers or as visitors

Source: Survey projects SEJ-2007-67690 & P07_HUM_03049

The third way of identifying motivation aimed to find out if users had single or multiple motivation(s). The procedure applied was a contingency table (see table 2). When the user did not chose the same closed item for questions 2 and 36 or/and when the user gave open answers with different meanings, they were considered to be a multiple motivation user.

A motivation code was assigned to each survey respondent according to the profile resulting from this combination process (table 3) and including the earlier segmentation between *hikers* and *visitors*. Finally, table 4 shows the frequency of the different user motivations arising from these operations.

The analysis of these results regarding users' motivation begins with the difference between *visitors* and *hikers*.

Though quantitatively, there are far more hikers than visitors, we investigate more in-depth from a qualitative point of view, as a LEADER European Observatory report (2001) concluded that for most people, hiking is a recreational activity, not a sport, and is undertaken for many reasons, including an interest in the natural world.

This statement raises various considerations: if hiking is not in itself a motivation but an activity that can be performed for diverse reasons, do hikers have different motivations than those of other visitors? To what extent do those who identify themselves as hikers agree that a sports activity is the motivation for their visit? Table 4 shows that motivations are different. Thus, in general, visitors describe their motivations as mainly *to be in company* and *to learn*, while 100% of the motivations related to park management objectives correspond



NUMBER OF PEOPLE ENCOUNTERED	ASSESSMENT OF THE NUMBER OF TRAIL ENCOUNTERS						
	Unaffected	Slight	Acceptable	Excessive	No opinion	TOTAL	%
0		3	3	1		7	2.31
1 TO 5	1	16	21	1		39	11.3
6 TO 10	2	6	41	1	2	52	15
MORE THAN 10	10	8	159	69	1	247	71.4
TOTAL	13	33	224	72	3	345	100
%	4.05	9.54	64.74	20.81	0.87	100	

Table 5. Respondents' assessments of the number of trail encounters

Source: Survey projects SEJ-2007-67690 & P07_HUM_03049

to hikers. Furthermore, it is especially significant that about half of the hikers present several motivations at the same time. Additionally, it must be mentioned that only 12% of hikers identify their motivation as *physical fitness*, an amount similar to the visitors. Nevertheless, if we look at multiple motivations, *physical fitness* together with *to learn* and with *to enjoy nature* is chosen by 28% of hikers but only by 7% of visitors.

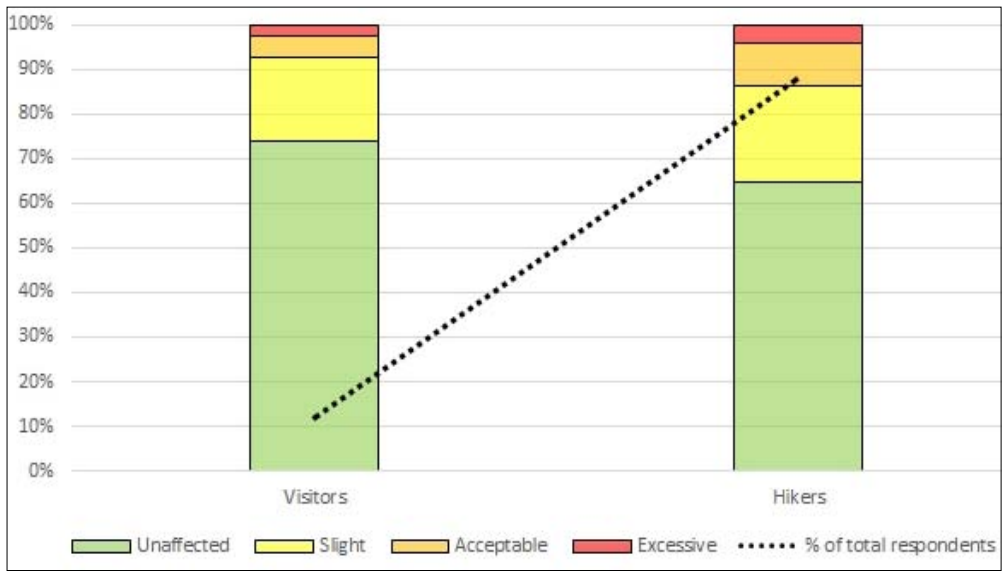
So, if we combine this dilution of fitness motivation with the supremacy of the motivation *to enjoy nature* both among hikers and visitors, the result is the predominance of *enjoy nature* among all users. However, what is *nature* for users? We propose linking *nature* with the biodiversity values that guide the natural park. In doing so, we are following another study goal, i.e. to verify the degree of consistence between management goals for the natural park and visitors' motivations. We consider that the main function of protected areas is to preserve spaces with high biodiversity values. These values can attract visitors as a subject for learning, and therefore environmental education goals become part of planning. Nevertheless, the concept *enjoy nature* does not include only biodiversity values. It can be linked to other experiences and subjects (landscape, peace, water) that do not depend on biodiversity values and that can be provided by spaces that are not protected areas.

Table 4 results reveal: first, the low number of respondents that chose *learn* as a single motivation (3.77 %); second, the differences between visitors and hikers, because visitors prefer *to learn* much more than

hikers (14% versus 2%). If we look at these answers more closely, we can deduce that the natural or cultural elements that natural park planning considers to be the most outstanding are not attractive for users. Only one person stated that the Spanish fir, the prime focus of the environmental education aspect of the park, was the reason for their visit, while none of the respondents chose the closed response *cultural value*. However, if we analyse the multiple motivations, the presence of *to learn* among them increases, but less than the combination with *physical fitness*. So, although the difference between hikers (increase from 2% to 19%) and visitors (increase from 14% to 26%) remains, if we combine all users, through multiple motivations *to learn* increases from 3.7% to 21.2%. If we take into account that among these multiple motivations the highest is the combination with *enjoy nature*, we can deduce that *to learn* as a motivation is not linked to the park's biodiversity value and that this is the largest difference in motivation between visitors and hikers. Finally, multiple motivations are linked to users that have more accurate visit aims.

To determine perceptions of crowding, our review of the literature led us to apply a procedure based on the use of surveys and on assessing the "*Number of encounters among users*", i.e., the "Encounter rules" method, whereby user experience is expressed in terms of the number, type and location of encounters with other people on the trail and on how these events affect the users' perceptions of quality in trail activity (Patterson & Hammitt, 1990; Shelby & Heberlein, 1986; Tarrant, Cordell & Kibler, 1997).





Graph 1.
Relationship between visitor and hiker segmentation and crowding perception

Source: Survey projects SEJ-2007-67690 & P07_HUM_03049

Accordingly, questions were asked about both number of encounters and presence of snow. Question 12 asked how many other people the users had passed on the trail, with one set of replies limited to closed intervals (1-5, 6-10 and more than 10) and another open-ended response specifying the number of such encounters. Question 13 asked how people viewed this number, among the closed options of “very few”, “reasonable”, “excessive” and “unaffected”. These items may be interpreted in relation to weather conditions on the day (item 77).

both concepts to be linked. This linking was possible throughout the code shown in table 3 and graphs 1 and 2 present the results. Since visitors and hikers have very similar evaluations (graph 1), we have joined both in categories defined by motivation. We have also combined the three motivations included in “Motivations related to park management objectives” to make it easier to present this information graphically. In effect, we can verify that the differences among respondents classified according their motivation is very small.

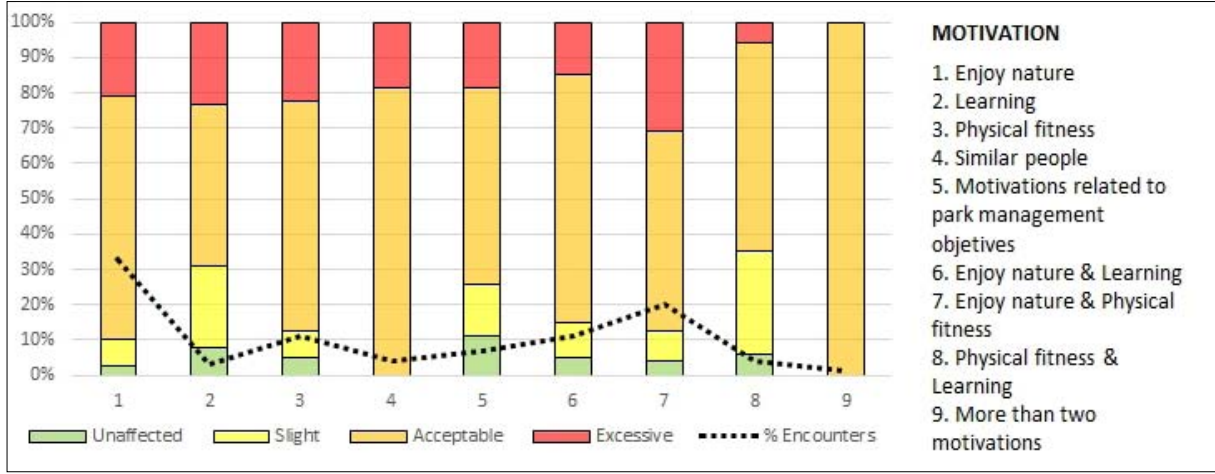
The results shown in table 5 are consistent with another finding from the literature, namely the influence of total visitor numbers on users’ perceptions of crowding (Galloway, 2012): users do not notice crowding as a factor that decreases outdoor experience quality when the total number of users is low. Therefore, only 20.8% of respondents assessed the number of encounters as “excessive”.

Based on these results, we will present the remaining study goals in the Discussion and Conclusions section.

Discussion and Conclusions

Although these results lead us to believe that motivation had little or no influence on perceptions of crowding, the estimation of social carrying capacity requires

- 1 Estimation of social carrying capacity and possibility of extrapolating study results to other natural parks in the Spanish Mediterranean mountains. Two facts about the study area, 1. focusing methods on hiking and 2. low total number of users, let us extrapolate the results to this type of Spanish natural park.



Graph 2. Relationship between motivation and crowding perception

Source: Survey projects SEJ-2007-67690 & P07_HUM_03049



- 1.1 Following an epistemological order, the first result is with regard to users' motivation. According to the Spanish literature (Hidalgo, 2009; Ruiz and Galdós, 2007) local users that identify themselves as hikers predominate. These visitors do not spend the night in the park and their motivation combines *enjoy nature with physical fitness* and, to a lesser extent, *to learn* about the surroundings. On the other hand, with much lower numbers, we have users that identify themselves as visitors; the only significant difference regarding motivation is that *to learn* is more prevalent among visitors. Therefore, these results verify the LEADER European Observatory (2001) approach: trail users don't identify hiking as a sport. With regard to this subject, our proposal is:
- 1.1.1 To see hiking as a multipurpose outdoor recreation activity and consider that multipurpose motivation does not blur users' motivation but, on the contrary, it should be understood as an improvement of the outdoor experience. From these conclusions, we have developed the following management proposal: to include both cultural and natural elements along trails.
- 1.1.2 That the *hiker/visitor* distinction be included in the statement of users' profiles, despite the low numbers of the latter.
- 1.2 The next results are with regard to the relationship between motivation and crowding perceptions in order to estimate social carrying capacity. The results show that users do not sense crowding regardless of their motivation. This is consistent with the low number of people visiting the park. Therefore, these results can be extrapolated by stating that crowding perceptions do not damage quality outdoor experience in Spanish Mediterranean mountain natural parks. Only the short and fleeting presence of snow is a *crowding pull factor* and it may be considered the main cause of *fluctuating crowding* (Hadwen *et al.*, 2011).
- 2 To apply social carrying capacity in order to improve management and planning in Spanish Mediterranean mountain natural parks.
- Generate an instrument for park planning and management.
- 2.1 With regard to verifying the degree of consistency between management goals for the natural park and users' motivations, these findings highlight the inconsistency between the park management objectives of environmental protection, the location of recreational facilities and the users' actual preferences. Thus, although the trail network is concentrated in the areas of greatest environmental value, possibly because of their relation with the goals of environmental education, and also in accordance with the first proposals by the IUCN, this environmental value is of only incidental importance to most users. Therefore, we have validated the suitability of understanding users' motivation as a management tool.
- 2.2 These results are interpreted as providing a reason for diversifying the location and type of the infrastructure within the natural park, and for creating a methodology for relocating trails in accordance with user preferences and environmental constraints, thus alleviating the pressure on areas that are currently over-utilised <http:// analisisgeografico.uma.es/sierranieves/>.
- 2.3 However, the appearance of snow as a *crowding pull factor* can only be resolved by restrictive measures, given its uncertain and ephemeral behaviour and its location in high biodiversity value areas.

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Legislation and regulations

Decreto 344/2003, de 9 de diciembre, por el que se aprueba el PORN y PRUG del Parque Natural Sierra de las Nieves http://www.juntadeandalucia.es/medioambiente/portal_web/web/temas_ambientales/espacios_protegidos/planificacion/PORN/PORN_PRUG_Sierra_Nieves/decreto344snieves. [consulta octubre 2015]

Ley 4/1989 de 27 de marzo de conservación de los espacios naturales y de la flora y fauna silvestres, aplicada en Andalucía a través de la Ley 2/1989, de 18 de julio, por la que se aprueba el inventario de espacios naturales protegidos de Andalucía, y se establecen medidas adicionales para su protección

Cartography

PN Sierra de las Nieves. *Junta Rectora Consejería de Medio Ambiente* (s/f). E.1: 80.000. Papel



Landscape, heritage and territory. Some notes from the Spanish geographic perspective

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Abstract

Landscapes in general and heritage landscapes in particular are the object of recurrent work in geography. Their consideration from different complementary perspectives, and in cooperation with other disciplines, has enriched the concept and the methodology, and raised some important challenges. This work takes a look at the ideas on landscape found in the body of work produced by Spanish geographers in the last decade. We propose some reflections on their basic conceptualisations and arguments, and outline new lines of research that have yet to be sufficiently explored, and which open up numerous analytical possibilities.

Keywords: landscape character; heritage assets; resources; Spanish geography

1. Introduction

Landscape is currently in fashion; we only need take a glance at the indexes of the main Spanish geography journals to see the profusion of monographic issues on landscape to confirm this (*Ería*, 73-74, 2007; *Cuadernos Geográficos de la Universidad de Granada*, 43, 2008 and 51, 2012; *Estudios Geográficos*, 71-269, 2010; *Ciudad y Territorio* XLVII-184, 2015). The creation in 2013 of the Landscape Working Group in the Spanish Geographers' Association, in addition to other groups for which landscape is a key element of their research (History of Geographic Thought, Rural

Geography, Urban Geography and more) is yet another example. Although there has been a continuous flow of contributions, an exponential growth can be seen since 2007, coinciding with the assumption of the hypotheses of the European Landscape Convention (Council of Europe, 2000, hereinafter ELC) and its ratification by Spain. Since then a significant proportion of the works on territorial ordination, protection of natural spaces, local development and urban geography have been focused from the standpoint of landscape.

In recent years many of these works have been reoriented towards the study of certain landscapes of exceptional value known or designated as "landscapes of cultural interest", "protected landscapes", "landscapes with exceptional heritage value", "outstanding landscapes", "unique landscapes", "cultural landscapes", "heritage landscapes" and so on. These are all concepts that should be classified as being second-generation, and derive from a combination of two notions that are in themselves somewhat slippery and susceptible to mutation: heritage and landscape (Gómez Mendoza, 2013). They generally refer to landscapes with some type of regulatory-institutional recognition aimed at preserving their assets, and –increasingly– to the use of these resources for the purposes of tourism and territorial development. This would appear to neatly close the landscape-heritage-development triangle, were it not for the fact that the relationships in this trio are currently under intense scrutiny, particularly with regard to the use and abuse of heritage properties for tourism (Troitiño Vinuesa and Troitiño Villalba, 2010).



This work aims to make a closer examination of some of the arguments considered to be key in the current debate on landscapes and heritage landscapes in order to identify some of the challenges and outline future lines of research. In view of the ambiguity of the notions, the approach is first to explore the evolution of the concepts of landscape and heritage, and then to focus the analysis predominantly on heritage landscapes, in two ways: their consideration within the body of work produced by Spanish geographers, and based on their ideas, as a new line of work which transfers to the territory the premises of the perceptive-valorative paradigms prevailing in the world of heritage. By way of an epilogue, we conclude by looking at some landscapes that have been granted heritage status for reasons of their geography, and their relationship with the development of the territory. Our information sources are derived from a review of Spanish geographic journals and other similar works¹, and other publications and congress minutes. We have also reviewed the results of a research programme on heritage landscapes with which the author has recently been involved (Ministerio de Economía y Competitividad, 2013-2015 and Junta de Andalucía, 2013-2017).

2. Landscape, landscapes. A journey through geography, from a geographic perspective

One decade has elapsed since the publication of the work by Javier Maderuelo (2005) entitled *El paisaje. Génesis de un concepto* ("Landscape. Genesis of a concept"). The notion of landscape was evidently not new, but was being rewritten in terms of the new concept of the ELC, hence the title of the book.

The concept of landscape is originally academic and multidisciplinary. This partially explains its protean and multifaceted condition, due to the multiplicity of focuses, dimensions and interests of the disciplines for which it is the object of study, including geography. The role of the ELC is to bring this concept in line with the standard, to delimit it and make it transdisciplinary (Ojeda Rivera,

1. The works consulted have been published in the last decade in the following journals: Boletín de la Asociación de Geógrafos Españoles; Scripta Nova; Estudios Geográficos; Ciudad y Territorio-Estudios Territoriales; Documents d'Anàlisi Geogràfica; Cuadernos Geográficos de la Universidad de Granada; Cuadernos de Turismo de la Universidad de Murcia; Pasos. Revista de Turismo y Patrimonio Cultural; Anales de Geografía de la Universidad Complutense; Investigaciones Geográficas and Eria.

2013), without renouncing the inherent polysemy contained in the definition of landscape as "any part of the territory as *perceived* by the population, and whose *character* is the result of the action and the interrelation of natural and/or human factors" (art. 1, the author's italics).

For geographers, the vision of landscape is both traditional and transgressive. Landscape involves issues that are within our competency as a discipline: the symbiosis between nature and culture; the idiosyncrasy of each territory, territorial structure and order. We feel comfortable with landscape. The current geographic landscape differs from –and also subsumes– the culturalist (see section 2.2.) and geosystemic approaches (Frolova Ignateva, 2006) of contemporary geography, but goes one step further: it has become imbued with the transdisciplinarity implicit in the text of the ELC and considers landscape as a combination of past, present, future, aesthetics, ethics, utility, reality, imagination and symbology (Zoido Naranjo, 2010). A key word in the geographic rewriting of landscape is *character*, which is akin to the fingerprint of each territory resulting from the unique and unrepeatable combination of a particular physical-natural environment, processes of historical construction, and social perceptions and representations. Landscape today is considered an intermediate reality between the object (its forms, integrated elements and functions) and the subject (his or her perceptions, meanings, intentions); these dimensions or facets are indissociable, but are analysed separately for practical reasons.

2.1. Landscapes, forms and prospects

The assumption of the hypotheses of the ELC led to the identification, characterisation and qualification of landscapes. Advances have been made in identifying landscapes thanks to a profusion of atlases and catalogues (Mata Olmo and Sanz Herráiz, eds., 2003). For the studies on *character* we used the methodological procedure of Landscape Character Assessment from the Countryside Agency and Scottish Natural Heritage (hereinafter LCA), and literary descriptions of its basic features. Here, landscapes are considered as a territorial and historic whole integrated by a succession of spatial (such as physical-natural structures, land uses, population units and communications routes) and temporal (evolved in successive historic periods) layers.



For analytical purposes these layers are broken down into their main constitutive elements –agricultural uses, plot boundaries, population, rural industries (Molinero Hernando *et al.*, 2014), free public spaces, landmarks and urban facades (Zoido Naranjo, 2012; Gómez Villarino *et al.*, 2013)– before reversing the process by recomposing and reintegrating these layers in the landscape as a whole through diagnostics and proposals for territorial and urban planning. This links with another emerging analytical perspective: landscape classifications with political-propositional purposes within the framework of a growing alliance between landscape and territorial ordination. In parallel there are increasing denunciations of the uniformisation, simplification and deterioration of landscapes as a result of the agricultural crisis and rural depopulation (Cascos Maraña, 2011; Maya Frades and Hidalgo González, 2009), or provoked by the indiscriminate advance of urbanisation in urban peripheries (Rullán Salamanca, 2012) and natural protected spaces (Delgado Viñas, 2008).

One aspect underlying these studies and which requires a more in-depth analysis is the question of scale. There is a certain consensus that the geographic scale for landscapes should be medium, regional and local. The spaces have highly variable dimensions, and include everything from large-scale regions through to more reduced areas in landscapes and urban environments. Regardless of whether the landscape *character* is predominantly rural or urban, alterations in scale lead to major changes in the elements acquiring significance in each scale, and this is a subject on which much progress has yet to be made. At the regional scale, the dominant features are interlinked, urban and rural landscapes are inserted into others in the manner of Russian dolls, and interscale interdependence becomes the norm. In methodological terms this has been addressed through the LCA and its differentiation between landscape types and areas (Gómez Zotano and Riesco Chueca, 2010); but these taxa and some others (such as associations, units, subareas of landscape and so on) are often used with different interpretations, giving rise to widespread confusion. More care is required with the use of terms.

2.2. The subjective and creative dimensions of landscapes

In addition to objective or objectivisable realities, landscapes are also views and representations, as

highlighted by the ELC, which refers to perception as one of the essential properties of landscape, as noted in the definition above. There are abundant allusions to landscape as a socially constructed reality (Nogué i Font, 2007), and to the social understanding of landscapes through surveys, interviews and discussion groups.

The emphasis on the subjective dimension of landscape has a strong tradition in Spanish cultural geography, and has been reinforced in recent years with an intimate, symbolic and identitarian approach (Ortega Cantero, 2009), closely resembling the discourses in the perceptive-valorative paradigms prevailing in the world of heritage (see section 3.1). There are numerous studies focusing on the significance and evocative capacities of landscapes, which have even been classified as territorial archives of collective memory (García Álvarez, 2009; López Ontiveros, 2009), and a number of references to creative exaltations that connote, singularise and canonise certain landscapes (Fernández Portela, 2015; Pillet Capdepón, 2014). In short, we have advanced from the aesthetic-formal classification of landscapes through to their valuation in terms of culture and identity, thus pursuing a parallel course to the one prevailing in the world of heritage, with which it is destined to converge.

3. From landscape heritage to heritage landscapes

The title of this section is transcribed from the article of the same name by Josefina Gómez Mendoza (2013), and alludes to the fact that the heritage landscape is a two-way concept. The ELC also points to this conclusion; first it emphasises the heritage values of the landscape,² and then refers to all landscapes, both exceptional and everyday and degraded landscapes (art. 2). Does it therefore make sense to return to the exceptionality of landscapes after assuming the hypotheses of the ELC? Regardless of the response to this question, there is no doubt that landscapes with exceptional value are attracting increasing interest, particularly since the incorporation of the new category of *cultural landscape* to the UNESCO World Heritage List (1972) in 1992, and the recourse to this by cities, districts and regions interested in presenting new candidacies for this status. The debate

2. "Landscape is a basic component of the European natural and cultural heritage, contributing to human well-being and consolidation of the European identity", according to the preamble to the ELC.



on heritage landscapes is far from over, although there is a need for greater precision in the concepts, and for new methodological proposals with which to identify new paths.

3.1. Heritage and territory. Some conceptual notes on historic-cultural heritage

The concept of heritage has an institutional and normative origin. Many of its definitions and guidelines are dispersed in a series of national and international regulations, laws and programmes. This is the case of UNESCO and its *cultural landscapes*, defined as places that represent the “combined works of nature and of man and which are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces” (paragraph no. 39 of the Operational Guidelines for the implementation of the Convention concerning the Protection of the World Cultural and Natural Heritage, 1994)³. This definition was later revised and reformulated by the National Cultural Landscapes Plan (Ministerio de Educación, Cultura y Deporte, 2012).

The institutional and regulatory dispersion of heritage and its concepts generated widespread confusion, which has been gradually clarified and systematised by some of the disciplines traditionally involved in the preservation and management of heritage assets. Geography has recently joined this debate, which is already mature in other branches of knowledge such as legal sciences, history of art, architecture and anthropology. This delay is both a consequence of and can be explained by the evolution in the understanding of heritage.

Until the mid 20th century, heritage was circumscribed to historic-artistic heritage, while natural resources

were considered to be another type of asset deserving of protection, but with no significant conceptual connection with the first. The notion of historic-artistic heritage has evolved from the assessment of specific elements conceived a-territorially (archaeological areas, monuments, museums) through to the consideration of the territory as a heritage object. This latter approach also has its own evolution; first it operates through the contextualisation of cultural assets in enclosed areas (environments, historic sites, buffer zones and so on) and in the last decades of the 20th century, the territory acquires heritage status through cultural itineraries and heritage landscapes. Another essential exponent of this evolution, with a thematic-qualitative nature, is the increasing social and institutional valoration of so-called emerging heritage elements (industrial architecture, intangible heritage and so on).

A new paradigm change has taken place in the world of heritage, involving a shift in the focus from the object (the heritage asset) to the subject (who creates, understands and enjoys that asset). In this approach, heritage is defined by certain tangible or intangible resources (a monument, a natural formation, a cultural landscape, a traditional skill and so on), but the quality of heritage is not inherent in the actual elements but in the value attributed to them (Prats Canals, 2006). This is a revolutionary concept that postpones tangibility to the *idea* of that tangibility, and focuses attention on the identity and institutional values conferred on certain natural recreational and cultural expressions (Beltrán Costa *et al.*, 2008). From this conception, so-called natural assets are in fact cultural, and the term *cultural landscape* is therefore redundant. This is the reason, as indicated above, that the term *heritage landscapes* is deemed more appropriate. In short, this is a heritage paradigm with far-reaching perceptive and valorative nuances that has informed the discourse of certain disciplines such as anthropology (Troncoso, 2010) and which to some extent runs parallel to –while not converging with– that of cultural geography with which it is destined to coexist.

In reciprocity with this evolution, cultural assets acquire a geographic interest: in studies on landscape insertions of archaeological sites (Caballero Sánchez and Zoido Naranjo, 2008; Manero Miguel, 2011) and monumental landmarks (Mata Olmo and Ferrer Jiménez, 2013); in research which highlights the heritage values of popular architecture (Velasco Barral, 2014) and certain utilitarian elements such as dry stone walls on terraces and land enclosures (Lasanta Martínez *et al.*, 2013); and in heritage territories such as cultural itineraries (Fernández Salinas, 2013) and heritage landscapes

3. These differing dates require some clarification. The category of cultural landscape first appeared in 1992, twenty years after the signing of the Convention for the Protection of the World Cultural and Natural Heritage in 1972. UNESCO's definition of cultural landscapes was delayed another two years, and had to wait until the updating of the Operational Guidelines of 1994 (the Operational Guidelines are the instrument used by UNESCO to update the text of the Convention without the need for it to be newly ratified by its signatories). The definition of the UNESCO Convention is prior to the ELC, and this latter document goes further in its proposals (as an example, the ELC's emphasis on perception is absent from the definition in the UNESCO Convention), and has influenced subsequent definitions, including that of the National Cultural Landscapes Plan.



(see section 3.2.). As this is a matter of memory and appropriations, names are important, and there is a proliferation of studies on the evocative role of toponymy (Riesco Chueca, 2010). This could be interpreted as resembling the new perceptive and valorative approach prevailing in the world of heritage, but its assimilation by geography is still in its embryonic stage, although it is making inroads thanks to new lines of research.

3.3. Heritage landscapes in geography. Between tradition and innovation

The study of heritage landscapes has already come a long way in geography. It has been approached from different angles and circumstances, in landscapes with a certain heritage tradition such as monumental cities (Mínguez García, 2007; Zárate Martín, 2012) and protected natural spaces (Rubio Romero and Muñoz Negrete, 2008; Mulero Mendigorri, 2013); in others which have already enjoyed some heritage status such as the old mining-industrial enclaves (Cañizares Ruiz, 2011; Ruiz Urrestarazu y Galdós Urrutia, 2015); or in more recent and incipient spheres of heritagisation such as agri-rural areas (Silva Pérez, 2009). The difference between landscapes and heritage landscapes is not always clear and rarely made explicit; the cultural resources and values of the landscapes are exalted, but they are analysed by alluding to the *character* of these landscapes.

Recent years have seen the opening up of a new type of geographic approach to heritage landscapes (Ministerio de Economía y Competitividad, 2013-2015). This assumes the perceptive and valorative proposals of the new heritage paradigm and extrapolates them to the territory, expressly differentiating between landscapes and heritage landscapes. A key concept is that of the *heritage vector*, which is different and complementary to that of *character*. *Character* is what makes some landscapes different from others, but not necessarily what makes them valuable. This value is the result of processes of social and institutional allocation of cultural significance to particular landscape components (the *heritage vectors*). The allocation of values or socio-institutional empowerment is territorially selective; it does not operate on all the components in the landscape but agglutinates around the aforementioned *heritage vectors*, which are realities (visible or not: a shrine or mountain, an agricultural or mining-industrial enclave, the Mediterranean diet, folklore) and processes which serve as the basis for cultural recognition (Fernández Salinas and Silva Pérez, 2015).

This new approach shares with the ELC the premise that landscape is a quality of the whole territory, and that all landscapes contain heritage values and are potentially heritagable. But when something is everything it becomes nothing, and heritage and heritagisation mean selecting what is significant or important within a broad universe of heritagable resources. Thus the category of heritage landscapes must be circumscribed to landscapes whose exceptional value renders them deserving of being the object of recognition and custodianship (Mata Olmo *et al.*, 2012). The territorial extrapolation of these proposals goes some way to resolving certain issues and opens up many possibilities. It answers the question of what are the heritage elements in a landscape, and where is the location of the elements endowed with heritage value, and also supplies some keys as to what to protect, order and manage in heritage landscapes. This presents new possibilities and lines of work to be explored in greater depth in future research.

4. By way of an epilogue. Landscapes that are heritagised for their geography, and their relationship with the development of territories

If, as has been said before, heritagisation implies selection, who decides what landscapes are heritage or not, and the vectors on which this heritagisation is or should be supported? This is the other debate open in anthropology (Troncoso, *op. cit.*) and which requires a territorial extrapolation of not only the *who* and the *what*, but also the *where*.

Geography as an academic reflection has contributed to heritagising certain landscapes. This is evidenced in the review of the bibliographic output in the last decade. We have already noted the prevalence of studies on monumental cities and protected natural spaces –in line with the accepted priority of urban-monumental historic heritage–, and the assimilation of the natural landscape with untamed, terrestrial and symbolic spaces (Martínez de Pisón Stampa, 2012). Other landscapes that are highly susceptible to geographic heritagisation are areas in decline or which have lost their former functionality and are seeking to overcome their economic slump by reinventing themselves and activating their cultural resources in terms of tourism and heritage. This is the case of many rural areas where tourism is seen as



an escape valve for relieving their situation of crisis and abandonment (Pulido Fernández and Cárdenas García, 2011), including former mining-industrial areas converted into tourist attractions (Castillo, A.M. *et al.*, 2010; Valenzuela Rubio *et al.*, 2008), and mature tourist destinations in monumental cities that use cultural and creative activities and urban-monumental revitalisation as a strategy to continue attracting visitors (Gil de Arriba, 2010).

Elements deserving of heritage status tend to be associated with the past, apt for inclusion in museums or under threat of disappearance. Vitality and functionality are separated –in spite of what the theory maintains– from what is heritagisable. This explains the recent and incipient geographic heritagisation of agricultural landscapes, with two significant exceptions that have historically been highly rated in heritage terms: traditional irrigated lands (Hermosilla Pla, ed., 2010) and vineyards (Cañizares Ruiz and Ruiz Pulpón, 2014). This assimilation is beginning to change, and an increasing number of studies now emphasise the use of territorial markers (as in the case of the designation of origin) as heritage labels against a backdrop of a corresponding increase in interest in gastronomic and wine tourism (Prat Forga and Cànoves Valiente, 2014; Fusté Forné, 2015; Hernández Mogollón *et al.*, 2015). Landscapes outside the heritage spotlight or in the process of losing their heritage status are those on the urban periphery, many of which have important heritage exponents or vectors (water wheels, irrigation channels, mills, old sugar refineries, farm buildings and so on), but decontextualised from their original functions and territorial structures.

The heritagisation of landscape for its geography is directly proportional to the tourist exploitation of the territory and inversely proportional to the recent urbanisation. The undesired consequences of this tourism-heritage-development relationship have been repeatedly denounced: the creation of stereotyped and banalised landscapes in rural environments (Barrado Timón, 2014) or the deterioration of historic sites due to their overuse for tourism (Zárate Martín, 2011). The voices that condemn the generalised tourist bias in heritage management are becoming more numerous, as are those who insist on the need to advance towards sustainable, balanced and intelligent proposals for the management of heritage resources (Troitiño Vinuesa, 2011). The management of heritage landscapes is another key aspect in the debate which requires further work. The fact that the new line of research on heritage landscapes mentioned above places particular emphasis on the key processes, vectors, instruments and actors

of social and institutional empowerment with landscapes may be of significant use for these proposals.

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Agricultural heritage, seawater desalination, environment and tourism in the eastern Canary islands (Lanzarote and Fuerteventura)*

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Abstract

The Canary Islands are located on the southern edge of the temperate zone, in the subtropical anticyclone belt. They therefore receive little rainfall, although this varies from island to island, with the easternmost islands, Lanzarote and Fuerteventura, being the driest. Because of this, their inhabitants created original agricultural systems to combat the aridity, although low yields have historically limited their socioeconomic development and population growth. These systems were operational until the introduction of desalination plants and the onset of tourism development in the last third of the twentieth century, the period of their ultimate decline. But they have left an important agricultural heritage, which has been put to use in the latest phase of development for its environmental and scenic value. These systems have become a tourist attraction and central to the two islands being designated biosphere reserves.

Keywords: agricultural heritage; environment; landscape; tourism; territorial development.

1. Introduction

The Canary Islands are located on the eastern edge of the mid-Atlantic, at the southern limit of the temperate

zone, with the Sahara desert to the east. They lie in the cold waters of the Canary Current and in the path of the trade winds generated by the Azores high. Because of their subtropical location, the Canary Islands as a whole receive little rainfall, although there is a marked difference in the amount of precipitation from one island to another due to their situation, stretching over 500 km from west to east, in relation to the main rain-bearing northwesterly winds. Another factor is the different elevation and slope aspect of the islands' terrain, which acts as a screen against the winds and gives rise to two distinct types: the damper north-facing aspect and the more arid south-facing one. Due to these conditions, the highest average rainfall is recorded on La Palma, which is the second highest Canary Island and located at the northwesternmost point of the archipelago, with an average of around 740 mm; and the lowest is recorded on Fuerteventura, with very little elevation, located at the southeast end, and less than 100 km from the coast of Africa, with about 120 mm of precipitation; the average for Lanzarote is just 157 mm. These figures place both the eastern islands below the conventional desert threshold, the 250 mm isohyet, despite which both have been inhabited at least since the beginning of our era, as evidenced by various archaeological and documentary sources (Cabrera Pérez, Perera Betancor and Tejera Gaspar, 1999).

The combination of these climatic factors in the interior of the islands results in a remarkable variety of



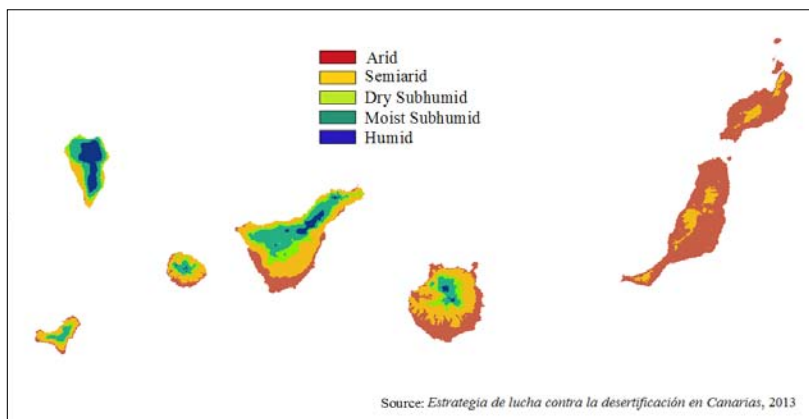


Figure 1. Map classifying aridity in the Canary Islands according to the Thornthwaite aridity index

landscapes and local climates, which has led tourism promoters to speak of “miniature continents” when referring to the climate of the Canary Islands, which in 2014 received nearly 12 million foreign visitors (AENA, 2015). Thus, and despite the modest size of the island region –only 7,447 km²– it is possible to find weather combinations that vary between arid, semi-arid, subhumid and humid. The temperatures and average rainfall of the different areas also vary, although the full diversity of local climates is only found on the more elevated islands: on La Palma, Tenerife and Gran Canaria (Figure 1).

The lack of rainfall has limited socioeconomic development and population growth on the two easternmost islands of the archipelago, particularly prior to the 1970s. Because of this, their inhabitants created original agricultural systems to combat the aridity, although yields have generally been low and food crises frequent in the past, leading to constant emigration. In these circumstances, the islanders used the soil of Fuerteventura to build gavias, water harvesting systems consisting of plots surrounded by low walls of compacted soil in order to increase the infiltration of episodic torrential rains that fall on the island and run down the slopes and ravines. In the case of Lanzarote, farmers used sea sand deposited on the beach of Famara and scattered by the wind through the interior of the island or the lapilli from volcanic eruptions to create enarenados that preserved the moisture from the rains, and even dew, and thereby improved crop yields or simply saved them from drought.

Both these agricultural systems were in operation until the introduction of seawater desalination plants and the arrival of tourism development in the 1970s, which progressively led to their decline as the population’s living standards gradually improved in consequence. Nevertheless, they have left behind an important agricultural heritage, which has been put to use in recent times for its environmental and scenic value. These systems have become a major tourist attraction,

particularly in Lanzarote, and have been central to the two islands being listed as biosphere reserves by UNESCO.

2. Aridity in the eastern Canary Islands

The term “aridity” is commonly used to characterise a territory where rainwater and natural vegetation are scarce, and is determined by the use of various quantitative indexes. In some cases these correlate precipitation and average temperature and, in others, total rainfall and the potential evapotranspiration of existing plants, plotting out a kind of general water balance of the site in order to measure its environmental conditions for sustaining life. These varying classification criteria make cartographic delimitation of arid or desert spaces difficult in terms of their impact on animal or plant populations on a global and, above all, local scale. An example of local scale is the introduction of seawater desalination plants, intended to meet urban demand and tourism development in island areas like the Canary Islands; these can change the “conventional” limits of arid areas both for practical purposes and in the perception of the local populace.

For biogeographical purposes, deserts are usually defined as regions where the potential evapotranspiration from plants is much higher than rainfall (Astaburuaga, 2004: 68) and where rain is also extremely irregular, which means that the moisture of the soil is lower than its water retention capacity in free drainage conditions. Both of these factors –low and erratic rainfall– impede a continuous ground cover of vegetation, allowing plants to grow in scattered clusters. In areas with more extreme conditions vegetation may even disappear almost entirely, as has occurred, for example, in some areas of Fuerteventura, affected for decades by overgrazing (Torres Cabrera, 2002: 47).



Type	Arid	Semi-arid	Dry subhumid	Damp subhumid	Humid
Lanzarote %	73,352 86.8	11,144 13.2	- -	- -	- -
Fuerteventura %	143,907 86.6	22,256 13.4	- -	- -	- -
Gran Canaria %	57,887 37.1	66,619 42.8	15,081 9.7	14,413 9.2	1,825 1.2
Tenerife %	32,107 15.8	77,976 38.3	32,919 16.2	51,944 25.5	8,550 4.2
La Gomera %	6,220 16.9	19,033 51.7	5,000 13.6	6,200 16.9	338 0.9
La Palma %	138 0.2	11,792 16.7	10,336 16.9	23,975 33.9	24,450 34.6
El Hierro %	3,611 13.5	13,942 52.0	3,481 13.0	5,800 21.6	- -

Table 1. Areas classified according to the Thornthwaite aridity index, in hectares

Source: Strategic plan to combat desertification in the Canary Islands. Proposed priority actions. The Government of the Canary Islands, 2013

In practice, more or less arbitrary precipitation thresholds, such as the 250 mm isohyet, are regularly used to determine the extension of deserts, without taking evapotranspiration into account. The Millennium Ecosystem Assessment of Spain (EME), promoted by the Ministry of Agriculture, Food and Environment in order to ascertain the conservation status of the country's terrestrial and aquatic ecosystems, uses a similar approach to define arid zones in Spain: those areas where annual rainfall does not exceed 300 mm. According to this criterion, arid zones occupy a reduced area of about 13,100 km², or only 2.6% of the total surface area of Spain. Of this area, 63% pertains to the southeast Iberian Peninsula, around 8,200 km², while the remaining 37%, about 4,900 km², is located on the Canary Islands (Puigfábregas Tomás, 2012: 155).

In this Atlantic archipelago, bathed by the cold Canary Current, the area classified as arid by the EME project represents 65.7% of the total area of the region. It is very unevenly distributed amongst the different islands: the easternmost islands, Lanzarote and Fuerteventura, are considered to be totally arid; the least arid is the island of La Palma, the most northwestern, although according to the aforementioned source, nearly 15% of the island is arid. Thus, in the Canaries, aridity decreases from east to west, more specifically from southeast to northwest, in relation to the prevailing direction of the polar front that causes the climate disturbances transporting most of the precipitation that falls on the islands. However, it also diminishes from south to north, particularly on the more elevated islands,

as a result of the damp northeasterly trade winds, especially when the vertical structure of this air mass is broken up by the arrival of Atlantic storms.

The Thornthwaite index was applied to the various island spaces by the authors of the *strategic plan to combat desertification in the Canary Islands* to obtain this classification of aridity in the archipelago. It offers a far more detailed and varied picture of the climate of the islands than that given by the Millennium Ecosystem Assessment of Spain, which is based solely on the selection of areas where precipitation is less than 300 mm. It is a classification system that, therefore, better reflects the diversity of ecosystems or agroclimatic zones that have been used in traditional agriculture to produce food in the archipelago, adapting farming techniques and crop varieties to the conditions of each place. These farming customs have led to a unique agrarian culture, especially in the areas of greatest water poverty, where aridity farming (García Rodríguez, 2013: 126) is found, and where crops have declined dramatically in recent decades, although highly original and practical agricultural systems are still conserved, such as *gavias* and *enarenados* in the eastern islands.

The areas considered arid according to the Thornthwaite aridity index occupy the coastline of all the islands (Figure 1) and add up to 3,172.2 km², representing 42.6% of the surface of the archipelago (Table 1). However, the differences between the islands are very pronounced, with aridity increasing from west to east: from 0.2% in La Palma to 86.8% in Lanzarote and 86.6% in Fuerteventura.



Fuerteventura is the most arid island in the archipelago due to its southeast geographical position and low elevation. The El Matorral and Tefía weather stations, located respectively on the coast and in the interior of the island, produce readings that correspond to a desert climate (BSh according to the Köppen climate classification scheme), with an average temperature of over 18°C. The low, erratic precipitation in both cases falls in winter and is no more than 120 mm per year. Relative humidity is above 70% throughout the year and the average temperature does not exceed 24°C (González Morales, 1993: 586).

Lanzarote rainfall records are similar to those on Fuerteventura, although there are contrasts relative to elevation and aspect. For example, Punta Pechiguera, on the coast of the southern tip of the island, receives 95.7 mm, while Órzola, on the north coast, receives 162.3 mm, and Tegoyo Mountain, located in the centre of the island, 370 m high, receives 275.6 mm (Reyes Betancort *et al.*, 2000).

Those areas classified as semiarid, where rainfall shortages are less pronounced, with average values between 250 and 500 mm (García Rodríguez *et al.*, 1990: 42), are also found on all the islands, totalling 2,227.6 km², which represents almost 30% of the total surface area. These areas are located on the coastline, especially on the outlying western islands, as well as on much of the mid-elevation vegetation belt, especially on the islands of Gran Canaria and Tenerife and the mountain ranges of Lanzarote and Fuerteventura (Figure 1).

The semiarid agri-environmental unit, together with the areas classified as arid from the climatic point of view cover almost 5,400 km²: more than 72% of the total surface area, which constitutes most of the fragmented and diminished arable soil of the islands. The thermal conditions are good for the development of a great variety of subtropical and temperate crops, even excellent in many areas, as has been demonstrated by the rich agrarian history of the Canary Islands since the sixteenth century. But water and soil are scarce for agricultural purposes due to the recent formation, in geological terms, of most of the island edifices.

3. Aridity farming systems on Lanzarote and Fuerteventura

Volcanic soils are considered by soil scientists to be the most fertile in the world. But in many places with little

overall rainfall, such as the Canary Islands, availability of water is a limiting factor for the development of agriculture. Because of this, farmers have, in the past, established various strategies to take advantage of available water for crops. In addition to directly using water from conventional and occasional rain, strategies have been designed that use runoff water and the nutrients carried as it flows down the slopes and ravines when rain falls over a prolonged period of time. Use has even been made of the dew from atmospheric moisture that condenses in certain porous volcanic materials, such as pyroclasts or *jables*, when the temperature drops at night.

These agricultural practices in arid areas have led to the creation of farming systems of remarkable originality that take advantage of local materials, as in other dry areas in the world, and serve a double function: firstly, to increase scarce water resources, and secondly, to contribute to soil conservation, especially on slopes. Moreover, another significant function may be also added: the creation of a unique island landscape of terraces, *nateros*, *gavias* and *enarenados* (Santamarta Cerezal and Suárez Moreno, 2012: 354), of immense agronomic and environmental, as well as ethnographic and cultural interest for islands that subsist to a great extent on tourism.

In short, the remarkable diversity of climatic areas on the archipelago has led farmers to develop various strategies and crop systems in relation to the water and soil available at each location. In the case of the driest areas on the least steep terrains, with sufficient arable soil, *gavias* have been built to soak up rainwater; in minor ravines and gullies *nateros* have been built, banking up the intermittent watercourse with successive walls to retain the fertile silt carried by the runoff water and thereby create plots; and finally, they have used *in situ* or artificially deposited porous pyroclastic materials from volcanoes or sea sand scattered by the wind over the arable land to capture and better retain environmental humidity through *enarenados* and *jables*.

These various techniques collectively represent an approach to farming in an arid environment, thought by some authors to be sustainable from an environmental point of view, although in terms of production yields they are low in most cases. The originality of these traditional systems of land use and the healthy relationship between man and nature have been recognised by international bodies such as UNESCO, which has declared the two eastern islands biosphere reserves.





Figure 2. Crops grown in *enarenados* and abandoned farmland in Haría, Lanzarote

Gavias and *nateros* are agricultural systems characteristic of arid and semiarid regions, adaptations that make optimal use of rainwater. The former are found on flat or gently sloping sedimentary terrain on the islands of Lanzarote and, above all, Fuerteventura; *nateros* are found in the beds of the ravines on several islands, and are formed by sediments carried in runoff water that are retained by stone walls to bank up and create arable soil. There are methods similar to both of these systems found in the arid areas of northern Africa, southern Europe and America.

In the Canary Islands, some experts consider these systems to be pre-Hispanic hydraulic strategies, which would have been consolidated with the arrival of Europeans in the sixteenth century (Cabrera Pérez, Perera Betancor and Tejera Gaspar, 1999: 143). Most of these systems are now abandoned, although they are important elements of the agricultural heritage in need of rehabilitation and conservation since, as well as their unquestionable scenic, environmental and cultural value, they are agrosystems that are conducive to sustainable development (Santamarta Cerezal and Suárez Moreno, 2012: 360).

The Canary Island *enarenado* is an original farming technique that in some cases uses a layer of calcareous sand from the sea and, in other cases, light, porous volcanic material to cover the arable soil

in order to retain or provide the moisture necessary to grow crops in areas of little or no rainfall on the coastal strip. In the first case, the *enarenado* is created naturally by the wind spreading organogenic sand over existing farmland. The local name for this type of *enarenado* is *jable* and it is typical of the central strip of the island of Lanzarote. This has traditionally been the main area for sweet potato crops, a tuber of tropical origin that, in the past, replaced potatoes in the island diet, due to the difficulty of growing them because of the arid conditions. In the second case, the *enarenado* may be natural or artificial in origin, man imitating nature, and the materials typically used are fine basic pyroclasts or *picón negro* found on most of the island of Lanzarote.

This *enarenado* system retains moisture in the soil for several months after little rain, barely 100 mm on average, and in some cases produces yields similar to those of irrigated farmland, according to some researchers. In the case of *lapilli* or *picón negro*, this is because this porous material quickly absorbs solar radiation, but its average thermal conductivity is low, only 0.15 calories per cm³ per degree, so when night falls, the *picón* cools rapidly. In doing so in an atmosphere of relative humidity of between 90 and 95%, water from the atmosphere condenses inside, which can then be used by plants (Santamarta Cerezal and Suárez Moreno, 2012: 364).



The introduction of *enarenados* as a dry farming method on the island of Lanzarote was induced by nature itself and by the well-known observational powers of farmers. The Timanfaya historical eruptions of 1730 to 1735 and the subsequent 1820 eruption buried entire villages and wide swathes of cropland (León Hernández, 2006). After the disaster, however, the farmers must have noted how the plants that had been half-buried in the *picón* had not only not disappeared, but had grown more vigorously than those left untouched by it. This was when the “natural *enarenado*” was first created, and it must have been the inspiration behind the idea of digging through the layers of volcanic ash covering the former fields to uncover the buried fertile soil and then plant vineyards and figs.

The agricultural “discovery” of the *enarenado* system transformed an arid and unproductive area affected by recent volcanic eruptions into an extraordinary landscape of thousands of funnel-shaped hollows called *gerias*, where mainly vineyards and some fruit trees, such as figs, are grown. The natural *enarenado*, formed in the volcanic surroundings of Timanfaya, subsequently spread to other areas of the island. The *picón* was transported from the mountains and unproductive areas to other parts of the island, where artificial *enarenados* were created, which ended up covering most of the Lanzarote farmland with a layer of 15 or 20 cm of the material, on which various varieties of vegetables and other crops were planted to supply the population and make the island self-sufficient. In some cases certain products have also been grown for export, such as onions in the sixties and seventies.

This laborious farming technique, akin to gardening and requiring abundant manpower on the small farms, made considerable agricultural productivity possible in traditional self-subsistence crops. This held true even in the case of water-intensive crops, like corn or sweet potatoes, despite dwindling and irregular rainfall on the island. These crops, along with fishing on the nearby Canary-Saharan bank, sustained the moderate population growth of Lanzarote for much of the twentieth century.

Population growth on Lanzarote has been much higher, in the regional context, than on the equally arid island of Fuerteventura, whose population remained stagnant or even declined due to emigration during recurring periods of drought and famine, as witnessed by Roldán Verdejo’s famous study (1968: 7) of the eighteenth and nineteenth centuries and census data from the twentieth century. Its population depended for decades on austere

dry farming of cereals, vegetables and some fruit trees that used the *gavia* and *natero* systems, and limited irrigated agriculture linked to local aquifers of brackish water and the meagre flow rates obtained with windmills from Chicago in the twentieth century. The traditional economy was complemented by extensive goat rearing that stripped the land of its natural vegetation. Grazing followed ancient sharecropping systems in medium to large holdings –in relative island terms– that belonged to non-local owners, who were ignorant of the permanent socioeconomic rigours endured by the island of Fuerteventura in the past (González Morales, 1989: 29-30).

4. The environmental role of traditional agricultural systems

As is well-known, arid and semiarid regions are fragile environments (Pizarro Tapia, 1999: 1) and human activity can easily destroy their natural vegetation if it oversteps certain thresholds. When this happens, erosion rapidly impoverishes the soil and the process of *desertification* begins. According to some geomorphological studies, an area of over 3,200 km² in the Canary Islands suffers severe erosion, affecting 43% of the total area and a loss of over 12 tonnes of topsoil per hectare per year (Rodríguez Rodríguez, 2001).

In the case of Fuerteventura, roaming herds have exerted and continue to exert significant pressure on the land, both on plant resources and the soil, which is resulting in gradual degradation. Grazing also has a negative impact on plant diversity, density and extent of soil cover. This pressure is one of the reasons for the absence of potential vegetation on practically all of Fuerteventura, which has been replaced by various succession plant communities, even generating landscapes devoid of vegetation, which may be classified as proper desert, as described in the *strategy to combat desertification in the Canary Islands* (2013). Once the vegetation has disappeared, the soil is directly exposed to the action of water and wind. Moreover, the continuous trampling of the herds destroys the structure of the topsoil, making it much more susceptible to wind and water erosion (Tejedor *et al.*, 2013: 34).

Gavias play a prominent role in the conservation of soil and water, according to the *strategy to combat desertification in the Canary Islands* (2013), as they mitigate the effects of erosion and the salinisation/sodification of the soil and contribute to the recharging of the aquifers and maintaining soil potential, among



other factors that prevent or slow down the processes of desertification and land degradation. In areas covered by this system of *gavias*, the risk of soil erosion is closely related to their design and state of repair. When fully functional, they modify water conditions in the soil to the point that rainfed agriculture becomes possible, since some water becomes available to the plants during the winter and spring months. Conversely, in adjacent untended land and abandoned *gavias*, where only rainwater falls, it is impossible to grow crops.

The additional water that a *gavia* receives has been calculated by the Hydrological Plan of Fuerteventura to be around 200 mm, which, together with the rainfall averages, is responsible for the fact that rainfed crops may be harvested in these arid lands (Perdomo, 2002: 177). Furthermore, the *gavias* facilitate the natural renewal of the nutrients that keep the soil fertile enough to obtain yields commensurate with rainfed agriculture. This renewal is mainly due to the sediments transported by runoff water (Tejedor *et al.*, 2013: 96).

Moreover, the pyroclastic layer of the *enarenados* substantially improves water conservation in the soil because of its influence on two main processes –infiltration and evaporation– thus optimising scarce rainwater. According to the experiments conducted by researchers from the Department of Soil Science at the University of La Laguna, the moisture content of the soil covered by pyroclasts is three times higher than that of soil that is bare on the upper layers. Statistical tests show a 99% significant difference during all months of the year and at all depths, the largest differences being observed in summer, and the smallest, in winter (Tejedor *et al.*, 2013: 81). In addition, this pyroclast coverage carries out a protective function on the surface of the soil, intercepting the raindrops and dissipating their energy. This leads to a higher rate of water infiltration, and therefore reduced runoff and sediment loss. Similarly, the greater surface roughness of the *picón* also reduces the speed of runoff water (Tejedor *et al.*, 2013: 86).

However, despite the undoubted environmental benefits of traditional farming systems, the *strategy to combat desertification in the Canary Islands* (2013) notes that almost 82% of the surface of the archipelago is currently at risk of desertification. This danger does not affect all islands equally, being at its maximum level on Lanzarote and Fuerteventura and only partial on La Palma because it only affects 31% of this island. To address this problem, which is not only environmental but also social and affects development models, this paper considers essential the joint involvement of

various fields of knowledge and decision-making, such as the environment, agriculture, regional planning, education and the economy, among others. It concludes that the fight against desertification in the Canaries must undergo a major effort of coordination and integration.

5. Desalination plants, territorial heritage and tourism, profiles of the new development scheme for the Eastern Canary Islands

Since the 1970s, Lanzarote and Fuerteventura have progressively become more actively a part of tourism development in the archipelago. Climate conditions hitherto considered negative, such as the overall water shortage, persistent droughts, constant winds and high insolation (precisely those responsible for the constant problems that the traditional agricultural model has had to overcome to produce food), have become fundamental pillars of the tourism development scheme that has been put into action on both islands in recent decades. They have also been aided by another invaluable regional resource, one that had little economic value in the past: the excellent beaches of the two eastern islands. This development of the tourism model has led to a dramatic increase in the number of visitors, which in the case of Lanzarote has grown from about 25,000 tourists in 1970 to over 2 million in 2014, and in Fuerteventura, which reached 1.8 million in the same year, having started with even smaller numbers (ISTAC, 2015).

In this socioeconomic context of a revaluation of their own resources in the construction of the island territory, chronic water shortages were overcome with the installation of small seawater desalination plants. Built in Lanzarote in 1964 and in Fuerteventura in 1970, these plants were public initiatives that, while they certainly consumed a significant amount of energy from oil, produced 2,500 m³ and 2,000 m³ of potable water per day, respectively, solving the problem of water poverty on both islands, a problem that had hitherto been alleviated by Navy tankers (Fuerteventura Island Council, 2015).

The introduction of this powerful tool of development solved the problem of supplying water to the populations of the major tourist resorts that were being constructed. It has even enabled irrigation for some self-subsistence farming, found in the environs of many towns, in part of the Lanzarote *enarenados* and in the *gavias* of



Fuerteventura. The rapid increase in water production in the eighties and nineties, facilitated by the efficient reverse osmosis technique, meant that, by 2012, 65,000 m³ of water per day was being produced in Fuerteventura and more than 62,000 m³ in Lanzarote, between public and private desalination plants (Water Board, 2015). It would seem that an answer has finally been found to a historical obstacle to the development of the islands: water poverty.

5.1. The socioeconomic impact of desalination

The modest technological leap of seawater desalination has led to a new approach to the productive use of land resources on these islands with their arid subtropical climate and excellent beaches on the periphery of the European Union, in a period of extraordinary growth in European demand for sun and beach holidays. This demand has been met by an increased supply in the form of investment in the building of accommodation of different categories in the tourism sector. The result of this process of construction has been the creation, under the control of the regional planning authorities, of more than 71,000 hotel and non-hotel units in Lanzarote (blocking another 150,000 that had initially been planned), and some 67,000 units in Fuerteventura (ISTAC, 2015).

Meanwhile, construction of the infrastructure necessary for the operation of the new development scheme, such as roads, marinas and successive facility upgrades at the international airports of Lanzarote and Fuerteventura, has been completed over recent decades thanks to public and private investments required by the new situation. The socioeconomic and territorial impact of this process has been spectacular, transforming the limited, poor traditional farming and fishing model in Lanzarote and Fuerteventura into an urban economy based on construction and services. It has transformed the aridity of the environment into a scenic and aesthetic asset, which now has a minimal impact on the daily lives of the local population, whose position in the regional and national context has improved considerably, although their dependence on fossil fuels has been and continues to be very high.

Climate conditions have therefore gone from being considered the primary obstacle to the islands' development to becoming a singular factor of territorial differentiation and a nature-based pull factor for European tourism. They have been used by the island authorities as an argument for inclusion by Unesco of the two islands in the world catalogue of Biosphere

Reserves, owing to the unique relationship established over centuries between man and arid environment. The underlying aim is to preserve the natural and human landscapes that were created in the past and to promote sustainable development, at least in socioeconomic planning (*Lanzarote Strategy in the Biosphere*, 1998; *Lanzarote 2020 Strategy. For sustainable development*, 2014), in the face of the overwhelming momentum of urbanisation and unstoppable population growth.

On the island of Lanzarote, the population has grown from about 41,000 in 1970 to about 142,000 in 2014, representing an increase of 345% in just four decades. In the case of Fuerteventura, growth has been even greater: the island's population has increased from 18,000 inhabitants to nearly 107,000: 600% more than in 1970 (ISTAC, 2015). In both cases, Spanish and EU immigration has been instrumental in this recent demographic spike. However, as these islands were sparsely populated in the past, especially Fuerteventura, they are still far behind the islands of Tenerife and Gran Canaria in terms of population density, despite this recent upward trend.

One of the most visible consequences of the socioeconomic change in Fuerteventura has been the decline of croplands in recent decades, both the dry and irrigated farms for austere island self-subsistence and tomatoes and other export crops grown in greenhouses, which have shrunk to 516 hectares (*Fuerteventura Crop Map*, 2014). Moreover, yields for new aridity crops, such as aloe vera, jojoba and henequen, have not been very promising. According to the abovementioned document, this retreat has led to an estimated agricultural abandonment of nearly 8,600 hectares. This equates to a reduction in farmland of 94.3%, the highest proportion in the archipelago, if we take the utilised agricultural area (UAA) on the island of Fuerteventura to include abandoned arable land and current farmland, as the Regional Ministry of Agriculture does in some of its statistics. At the same time, there has been a marked increase in the abundant goat livestock, part of which is stabled, and which has specialised in the production of cheese, with or without designation of origin, for the regional market. Applying the same criteria to the quantification of *enarenado* abandonment on the island of Lanzarote, the total surface area that is no longer farmed is about 18,000 hectares on a UAA of around 23,000 hectares, representing 78.1% of the total (*Lanzarote Crop Map*, 2014).

This considerable shrinking of the historical farmland of Fuerteventura has had an immediate impact on the unique *gavia* system, with their abandonment causing a



major environmental problem as nobody is maintaining the low retaining earth walls. As a result, erosion and soil loss during periods of heavy rain has increased rapidly, while also decreasing infiltration and aquifer recharge capacity in areas of cropland.

The island authorities soon became aware of the problem this posed to the island during a period of gradual reassessment of the landscape, due to tourism development. An environmental action plan was launched whose objectives were to combat soil erosion and facilitate the recharging of aquifers by maintaining the *gavía* systems, building small dams in the channels of the gullies to force infiltration and replanting native vegetation in the areas most affected by agricultural abandonment and traditional overgrazing (Fuerteventura Island Council, 2015).

This type of mitigation measure has undoubtedly contributed to alleviating the deterioration affecting the ancient farmland and grazing areas for herds of goats. It has also bolstered the general rehabilitation of some landscapes populated by succession plants, colonising plant species resistant to the impact of humans and livestock. On much of the island, however, this has not prevented the encroachment of a sparse landscape with little human activity that is poor in natural vegetation; where it is possible to see the colours of bare ground, stones and undulating landforms eroded by the passing of time, the characteristic traces of geomorphological processes in arid areas (Criado Hernández, 1991).

5.2. Harnessing local resources

The new territorial and environmental reality of Fuerteventura identifies it with a “quasi-natural” landscape endowed with excellent beaches and sparse in population, which has been built in the recent period from remnants of the past. It has served as the basis for the island and regional authorities to prepare their application for an Arid Zone National Park in the “wildest” part of the island of Fuerteventura (Gallardo Campos, 2011): the westernmost strip. The objective of this project is to ensure the conservation of these landscapes and promote their use as a tourism pull factor on an island in an outermost region that is both developed and nearby for the European Union, and not in the distant heart of one of the great arid zones of the planet; although the location of this high-level territorial conservation project does coincide with the areas where goats were traditionally set out to pasture or rounded up (a local tradition known as an *apañada*) because conditions were too harsh for traditional farming. Therefore it could

also endanger the continued existence of this ancestral agricultural tradition, which has undoubtedly modulated, and in some cases also contributed to, the deterioration of this unique arid landscape.

The image of Lanzarote is that of volcanoes, *enarenados* and a multitude of hollows dug in the pyroclasts of La Geria in search of soil to plant vines. This labour has resulted in a unique combination of shapes and colours that make this agrarian landscape one of the island’s tourist attractions (Martín Martín, 2000: 102). Many thousands of visitors come to appreciate this emblematic landscape of the island every year. Its spectacular nature is due to the small semicircular walls of basalt stone, crowning the hollows where the vines are grown. The trade winds that constantly blow across the island have made it necessary to build these windbreaks transversal to the direction of the wind to protect the vineyards. Because of its attractive landscape this place was classified as a natural park by Law 12/1987 of 19 June, the Declaration of Natural Spaces in the Canary Islands, and subsequently reclassified as a landscape protected by Law 12/1994, of 19 December, on Natural Areas of the Canary Islands.

Due to this official classification, and faced with the danger of agricultural activity in this area being abandoned because of its low profitability, the Lanzarote Island Council, along with town councils in the area, formed a consortium to implement a major wine tourism project in the La Geria protected area. This project and similar projects that have succeeded it, such as *Salvar La Geria (Save La Geria)*, try to coordinate the actions of local institutions to protect the agricultural landscape of La Geria, to preserve traditional grape growing and wine production. They also aim to promote tourism with environmental and sustainability criteria, to help transfer resources from the tourism sector to farmers with which to finance the costly maintenance of this unique protected landscape (Lanzarote Island Council, 2015).

6. Conclusions

The introduction of seawater desalination plants on the islands of Lanzarote and Fuerteventura, in the last third of the twentieth century, brought about a major economic change, based on tourism development and the construction and services sectors. This change has resulted in a notable process of urbanisation and high population growth, driven by Spanish and European



immigration, and has caused a considerable leap in the living standards of the island population, bringing them in line with other regions of Spain.

As a result, in the case of Fuerteventura, there has been an almost complete abandonment of the austere and uncertain traditional rainfed agriculture, linked to the *gavias* and small wells of brackish water. Even promising vegetable crops for export have been abandoned, due to the produce not being able to compete in external markets. In the case of the Lanzarote *enarenados*, the decline in cropland has been more gradual and less pronounced, taking into account the relative inertia of the “extensive” island vineyards and the introduction of irrigation in some internal market-oriented crops.

The abandonment of most of the traditional farmland has affected the islands’ unique landscape and has increased erosion and loss of topsoil, especially on the island of Fuerteventura, which lacks the protective coverage that the Lanzarote *enarenados* supply, although a growing portion of these have also been abandoned in recent decades. The problems of environmental degradation have forced the authorities to intervene in the rehabilitation of *gavias* and dams and the conservation of *enarenados* to fight erosion, help recharge aquifers and facilitate the partial replacement of natural vegetation. In this territory, the relationship between man and the environment has become more distant, despite the recent inclusion of the two eastern islands in the world network of biosphere reserves.

The cost of seawater desalination has been supported in part by the State, so it is not a burden for the new development scheme on both islands, especially considering the favourable conditions of the remaining production costs, including labour. Moreover, renewable energies promise to replace conventional energies in the near future, as they are already doing in the desalination sector on the island of Fuerteventura (Water Supply Consortium of Fuerteventura, 2015).

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Focuses and initiatives regarding Spanish industrial heritage and its importance as a resource in addressing the economic crisis*

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Abstract

This study presents an analysis of industrial heritage in Spain and its importance as a resource in addressing the economic crisis from a threefold perspective:

1. The consolidation of focuses on industrial heritage as a territorial resource; 2. The interest of intervention experiences aligned with good practices or urban renewal processes; and 3. The tourism potential of industrial heritage in disadvantaged areas. The study's aims are to ascertain the evolution of cultural heritage initiatives in Spain from a conceptual and theoretical viewpoint (why and to what end abandoned production facilities are *redefined as heritage*, and what form the intervention takes); evaluate specific actions in established territorial spheres such as the mining district of Almadén (Ciudad Real), the urban area of Valladolid and the outskirts of Leon; and lastly, to understand the importance of industrial heritage in the tourism strategy of disadvantaged areas such as Riotinto (Huelva) and Medina de Rioseco (Valladolid).

Keywords: territorial culture; Industrial heritage; economic crisis resources; beautification of landscape; urban revitalisation.

1. Approaches and focuses regarding industrial heritage in Spain

In Spain, recognition for the heritage value of factories and industrial and mining landscapes has come late in

the day compared with other European countries with a history of industrialisation. Prior to the 1990s there was barely any notable social awareness or institutional initiatives promoting the protection, conservation and beautification of a legacy that is highly distinctive, but difficult to include in the monument status attributed unquestionably to a Roman bridge, a Greek temple or a Gothic cathedral without prior awareness-raising.

Having overcome initial reluctance or prejudice in order to transform our perspective on obsolete and/or abandoned factories and industrial facilities, there are now numerous regulatory and legal instruments that aim to protect, conserve and promote reuse. From the institutional perspective, particular mention should be made firstly of the heritage regulations that regional governments have updated since 1995 in order to include industrial heritage, along with the notable initiative by the Spanish government to establish specific regulations for the set of movable and immovable, tangible and intangible assets that comprise Spain's industrial heritage. This is demonstrated by the National Industrial Heritage Plan approved by the Spanish Cultural Heritage Institute (IPCE) in 2001, and updated in 2011, establishing the fundamental concept that "industrial heritage and the marks it has left on the territory have been transformed in Spain into new cultural assets and an active resource for fostering sustainable development programmes at the local and regional levels. These assets are integrated within a specific landscape, making it increasingly necessary to interpret heritage not as an element in isolation, but in its territorial context. The heritage of industrialisation,



with fragile and vulnerable elements which are on occasion poorly understood, must be considered as a new cultural asset represented and interpreted through an updated, integrated and scientific reading” (IPCE, 2011: 4).

Another aspect to be emphasised as progress towards the respect for and social recognition of this distinctive heritage is the creation of historical industrial heritage catalogues and inventories, an initiative championed by regional governments which arose and expanded in the 1990s and was consolidated in the 21st century over the last 10 years thanks to collaboration with universities and the support of mining and industrial heritage protection associations. The inventories and studies that have emerged in connection with the registration and preliminary analysis of the volume and conservation status of heritage are serving to gather quality information, documentation and rigorous knowledge as to abandoned or active industrial facilities and factories; vestiges of historical mining and the surrounding context; and a whole host of elements comprising the landscapes of industrialisation. Meanwhile, as progress is made in such comprehensive and well-founded knowledge, the initial idea suggesting that a heritage asset meant simply a monument is tending to be replaced by a more complex viewpoint that sees the territory as the basic unit of heritage, above all in order to consider intervention strategies based on the results of the inventories (Álvarez, 2007; Benito, 2008b; Biel & Cueto, 2011; Capel, 2014).

The change in focus regarding the notion of industrial heritage is another key aspect in understanding events in Spain over the last 20 years. As a result of national and regional historical and artistic heritage laws, which placed the emphasis on the concept of monuments, factories and other isolated industrial remnants were the first assets to capture institutional attention. As a result, until the first decade of the 21st century, the greatest efforts were initially concentrated on protecting and saving them, overlooking towns and rural regions with mining and manufacturing traditions. The most widespread intervention was therefore to refurbish and adapt industrial heritage for new uses, resulting in a host of factories and industrial units transformed into museums, enterprise centres, art galleries, hotels or other economic uses. These adaptations were based on mandatory respect for the manufacturing structure, often merely in architectural terms, while the buildings were stripped of their true identity and heritage essence. At this stage we see the enshrinement of the principle and idea that industrial heritage is an economic resource underpinning the singularity of

a neighbourhood or location and which adds value to generate a new offering of services and facilities. Intervention in a somewhat perverse manner became the norm: conserving industrial heritage for reuse simply as merchandise or real estate to generate new profits and revenues (Miró, 2000; Álvarez, 2007).

The intellectual debate generated at universities, conferences and scientific gatherings addressing industrial heritage, which have proliferated since the year 2000, combined with greater sensitivity to the “document record” aspect and the “identity” content of industrial heritage support a new interpretation as to conservation and beautification. This interpretation emphasises the territorial component, in other words the context/environment and the landscape of which each inherited industrial element and asset forms a part. The issue now is to intervene by taking into consideration the territorial context, aiming to reconstruct the visual and emotional narrative of the manufacturing structure, linking diverse elements in order to create pathways that explain the process of industrialisation in the place in question and to protect industrial landscapes for the sake of cultural reinterpretation. This shift is revealed by a critical review of the numerous articles occupying an ever greater space in the summaries of the most significant Spanish journals in the field of geography, such as *Scripta Nova* and *Boletín de la Asociación de Geógrafos Españoles* (<http://www.ub.edu/geocrit/nova.htm> and <http://boletin.age-geografia.es/>, respectively) as well as specialist local journals such as *Lámpara* (<http://lamparas.blogspot.com.es/>). This trend is also seen in the contributions filling the proceedings of national and international conferences promoted in Spain (proceedings of the TICCHI-Spain conferences (<http://ticcih.es/congresos/>) and proceedings of the INCUNA seminars (<http://incuna.es/jornadas-incuna/>). Meanwhile, there is an increasingly overwhelming need and call for intervention in accordance with a set of good practices to guarantee results that respect the integrity, authenticity and representative value of industrial assets (Ruiz de Lacanal, 2014).

To conclude, it should be emphasised that “from the economic perspective, heritage is essential because of its role in tourism and in local development” (Capel, 2014). In Spain, where tourism is a strategic activity, there exists, beyond the adaptive reuse of many industrial facilities and buildings (residential, business, cultural or recreational use), a predominant trend towards converting industrial sites into products and resources for tourism, in both urban and rural settings. This dimension



explains the proliferation of mining parks, steelmaking museums, agri-food industry museums, textile museums, etc. The objective of these initiatives, most of which are from the public sector, is to create an offering that integrates a visit to rehabilitated industrial assets with other elements of the territory or landscape, so as to create itineraries that will occupy visitors for one or more days, thereby generating positive impacts: expansion of trade, gastronomy and hospitality, increase in local employment and retention of population in disadvantaged areas. In cities, industrial museums and artistic venues and hotels and restaurants in former factories make a neighbourhood far more attractive. The idea is to create opportunities in de-industrialised locations and to strengthen the image of many industrial cities that fell into decline with the crisis of the Fordist model (Pardo, 2010; Benito and Piñeira, 2014). Some of the effects of this strategy are analysed below, allowing us to understand to what extent the economic crisis has served to promote or consolidate initiatives to restore heritage and industrial memory, in favour of processes of territorial development and growth.

2. Experiences of interventions with effects on local and urban development

2.1. The Almadén Mining Park (Ciudad Real)

One outstanding example of an initiative tied to the beautification of industrial heritage is the Almadén Mining Park located in the former cinnabar-mercury works in Almadén and Almadenejos in southwestern Castile-La Mancha. One of the most important mines in the world, dating back more than 2,500 years, from which a third of the cinnabar used by mankind was extracted (Cañizares, 2008). Its golden age came with the discovery of America, when mercury was used to amalgamate silver and gold from the Americas. It was also widely used in the 20th-century era, given the use of mercury for thermometers and in the chemical industry. The mine was closed in 2003 as a result of the introduction of the European Mercury Strategy, which required its closure due to environmental issues. From this point onwards, its tangible heritage legacy (buildings, furnaces, shafts, etc.) and intangible heritage (mining culture) have been placed at the service of territorial development to mitigate the lack of socio-economic attractions in an area of low demographic density with a highly rural nature, which has seen a

succession of different Rural Development Programmes since the 1990s.

With the creation of the Mining Park, in operation since 2004 (and officially opened in 2008), the aim was to provide a platform for cultural expression, education and quality tourism. Its fundamental objective was to offset the decline being caused by the lack of economic viability of the mines by showing visitors the mining and metalworking processes associated with mercury production through tours around the facilities. It comprises numerous elements with considerable heritage value resulting from the activity itself (conducted as both shaft and opencast mining), located in a space surrounded by the *mining enclosures*, which were used to separate the works, and of which a number of gates still survive, now restored, such as the Carlos IV Gate.

The basin can be visited in part by descending to the various subterranean shafts, along with access to a number of buildings located in the exterior. The interior route leads, for example, to the *Forced Labour Shaft*, built in the 18th century and used to connect the prison to the mines for the daily movements of the “forced labour” convicts condemned to work in the mines without seeing the light of day, and whose working conditions were extremely harsh. The chance to step inside a royal mine is one of the main attractions of the park, along with the opportunity to ride a mining train inside the mine, observing the reconstruction of mining tasks and geological points of interest.

The exterior tour around the basin reveals a number of elements of considerable technological value still preserved today, such as the pair of *Aludeles or Bustamante Furnaces* named “San Julián and San Eugenio”, used between 1720 and 1928 to convert the cinnabar into mercury, an unrivalled example of the technological exchange between Spain and the New World. There are also the *Horse Capstans* (18th-century): San Carlos with its brickwork structure and hexagonal roof that housed the capstan using animal power to extract the ore, and San Andrés, located inside the mine, both of which are seen as the precursors to vertical mining shafts. Visitors can also see refurbished facilities such as the mercury storeroom (1941), which has now been converted into the *Mercury Museum*, and the former compressor building, which now houses the *Mining Visitor Centre*, with its presentation of the different operational systems used in the mines.

In 2012, UNESCO acknowledged the universal value of this site by classifying it as a World Heritage Site entitled “Mercury Heritage: Almadén and Idria” in





Figure 1. Aludeles Furnaces at the Almadén Mining Park (Ciudad Real, Spain)

Source: M.C. Cañizares, image taken in April 2008

reference to the most important mercury works in the world, on an international scale, and also to its strategic importance following the discovery of America. Both are fundamental in understanding the economic, financial and technical exchanges between Europe and America, and represent the most important heritage handed down to us by the intensive extraction of mercury, above all in the modern and contemporary eras. This dual testimony provides a unique illustration of the various industrial, territorial, urban and social elements of a specific social and technical system employed in mining and the metalworking industry. Recently, in 2015, the Almadén Mining Park was also included in the *European Route of Industrial Heritage* (ERIH), as an Anchor Point of outstanding historical significance, offering a high quality experience to visitors.

A visit to the park, which attracted 10,829 people in 2014, is rounded off in the town of Almadén with a tour of the *San Rafael Royal Miners' Hospital* (18th century), the first hospital in Spain to specialise in mining-related illnesses. It is the home of the *Mining Museum*, with a display of tools, apparatus, maps and machinery connected with the mines; the *Hospital Museum*, with a recreation of the healthcare functions performed at the hospital itself; and the *Historical Mines Archive*, which preserves significant records from the company Minas de Almadén y Arrayanes, which owned the mines. The annual number of visitors to this site is more modest: 2,226 in 2014.

2.2. Restoration of industrial heritage and urban renewal: contrasting experiences in Valladolid

The inventory of industrial heritage buildings in Valladolid generally corresponds to the category of

urban manufacturing. In other words, they are buildings positioned within the city itself that have become significant features of the urban landscape, providing the backbone for interventions to restore marginalised or degraded urban areas. The Santa Victoria sugar works and the former Valladolid slaughterhouse represent eloquent examples of this type of initiative.

The slaughterhouse site groups together a number of buildings erected in 1936 in accordance with revised plans produced by Colomina and Botí, corresponding to the first Rationalist movement. Their location in the then newly-established neighbourhood of La Rubia was at the time some distance removed from the south of the urban fabric, although over the following decades progressive residential densification in the surrounding area ultimately merged this industrial facility with the surrounding neighbourhoods, making its location unsuitable. The loss of functionality of the facility and difficulties in fulfilling the new hygiene and health demands ultimately led to its operational closure. This was followed shortly afterwards, in 1989, by the approval of a modification to the General Urban Regulation Plan to include all the buildings within the original project in the catalogue of protected assets, at the level of structural protection (Benito, 2008b).

To an extent, the factors that led to its closure (the density of the population residing in the district and the gradual improvement of the sector's positioning as regards the city centre) were likewise the main arguments behind including the slaughterhouse complex in a special planning project in 1997 intended to develop the Integrated Southern Zone Centre, a major set of facilities serving to revitalise this urban area.

The architectural refurbishment and functional conversion of the slaughterhouse buildings were carried out in phases, one major element at a time, once the urban development and landscaping of the spaces comprising the city block had been undertaken. In addition to other social facilities, the complex consists of two major cultural promotion venues: the first opened to the public in 2007, while the second formally began operations in 2011.

Unlike this project to recover urban industrial heritage, equipping it with new social and cultural uses, the intervention undertaken at the Santa Victoria sugar works was planned without any defined end purpose. It was instead part of a major urban planning and property development which was subsequently suspended as a result of the economic crisis.





Figure 2. Youth Centre (left) and Valladolid Arts Laboratory (right) on the premises of the former slaughterhouse (Valladolid, Spain)

Source: Images taken by H. Pascual in October 2015

The origin of the factory, owned by the company Sociedad Industrial Castellana, dates back to the year 1899. Its location in the city corresponds to factors shared by all sugar works at the time, in particular proximity to the railway, in this case the junction between the Valladolid-Ariza and North-Madrid/Irún lines. Milling operations at the factory intensified over the following decades, although ownership of the company underwent a change in 1968 when Sociedad Industrial Castellana was taken over by Ebro Compañía de Azúcares y Alcoholes. This company then merged in 1990 with Compañía de Industrias Agrícolas to create Ebro Agrícolas Compañía de Alimentación, the company that decided to close the sugar works in 1991. From this point onwards the production site underwent a process of abandonment and deterioration, shared by the whole railway and industrial area of which it is part, despite the fact that as early as 1996 the Catalogue of Protected Assets corresponding to the Valladolid Urban Regulation Planning Modification Document proposed a number of levels of protection for the constituent

elements of the manufacturing complex (Calderón & Pascual, 2007).

The reversal of this situation of abandonment was directly linked to a major property development project launched in 2002, when Valladolid City Council and Azucarera Ebro Agrícolas Gestión de Patrimonio signed an agreement in order to organise the initiatives required for the urban conversion of the large-scale plots of industrial land owned by the company in the city. As a result, the former sugar production site was assigned to the local council. Within the context of the new central area planned for this substantial lot of industrial and railway land, the plans established the regulation of the sector and defined the scope of construction intended for public amenities, and the scope free of construction intended as parkland in the areas around and within the sugar plant site.

The Norias de Santa Victoria Urban Park intervention, formally opened in 2007, divides the space into three



Figure 3. "Norias de Santa Victoria" Park (left). Former sugar works buildings (right); in the foreground, the headquarters of the Jorge Guillén Foundation in the former executive house (Valladolid, Spain)

Source: Images taken by H. Pascual in October 2015



sectors. The first corresponds to the construction of a large plaza at the entrance to the factory complex, providing access to the park and retaining the trees, refurbishing the executives' and engineers' housing and the concrete shelter. The second includes the consolidation and exterior cleaning of the factory holding, although it remains closed as its amenity function has yet to be specified. Lastly, behind this construction a large parkland area houses the ponds, featuring the old waterwheels that give their name to the Park. A sports area was also created here by recovering other elements of the industrial complex, such as a large metal-walled cylindrical tank, used as a climbing wall, an open-air multisport court and a covered pavilion with multifunctional courts in one of the restored warehouses.

However, the suspension of the large-scale real estate projects planned for this sector of the city left the Parque de la Norias isolated, explaining the infrequent use made of it by local residents. Meanwhile, the lack of definition of the amenity function assigned to the factory has led to its rapid deterioration. All that remains in a decent state of upkeep are those properties with a new use, such as the executive housing which now contains the offices of the Jorge Guillén Foundation. Lastly, the shacks that occupied the land around the Park have also worsened the degradation of the sector included in the Rogers Plan for urban development of the land released by the railway undergrounding operation. This operation is currently suspended, seriously compromising the conservation and exploitation of a landmark complex that forms a part of the city's industrial heritage, and still maintains a substantial imprint on the urban landscape.

2.3. The Araú factory in Leon: a cultural amenity on the Camino de Santiago

On the outskirts of the city of Leon, to the northwest of the city and close to the industrial and railway districts, the Araú cured meat factory was founded around 1845 as a family business representing the low level of local industrialisation. It was located in the urban district of Trobajo del Camino, a small settlement with a population of around 21,000 which now belongs to the municipality of San Andrés del Rabanedo. The factory would have gone unnoticed were it not for its architecture and the fact that it stands on the Camino de Santiago pilgrims' trail. It is a unique architectural complex, described and studied by various authors (Balboa, 2006; Benito, 2008a; Revilla, 2011). The complex includes four buildings erected in different

periods with local materials - bricks and adobe - in an eclectic style inspired by Anglo-Saxon industrial architecture, giving it artistic value and heritage significance. Despite its values of representativeness and authenticity, it is its location on the Camino de Santiago which has unquestionably saved this factory from destruction and demolition, as it lies within a setting declared a Historic and Artistic Ensemble since 1962, and considered an Asset of Cultural Interest since 1985 (Revilla, 2011). The aforementioned protection did not prevent the factory from undergoing a process of abandonment and ruination following its closure for business at the end of the 1980s. This prompted an attempt by the municipality to demolish the buildings in 1997 in order to give the former industrial land a different use, despite the fact that a year earlier the Leon Provincial Authority had recommended a comprehensive refurbishment of the property. A political change at the local council, which was taken over by the Socialists in 1998, lay the foundations for a new destiny for Araú. However, it was not refurbished until 2007, following a number of failed attempts at intervention promoted at the ministerial level, including restoration and beautification for cultural and tourism use in the official cultural heritage programmes in 2001.

Prior to the rehabilitation of the old factory, the local council signed an agreement with the owners in 1998. In exchange for public ownership of the factory and surrounding land, plots in the vicinity were reclassified for the construction of 300 homes (*Diario de León* 25/05/2006), as reflected in the Urban Planning Regulations approved in 1999, along with the public amenity function attributed to the old factory. The quest for funding led the project to be taken over by the Ministry of Housing, which in 2005 organised a design tender, resulting in the project being awarded in 2006 to the practice ALF Arquitectos Asociados.

As described by Revilla (2011: 70) "in late 2008 intervention work began on the building, awarded to the contractor *Teconsa* with a budget of 4,508,910 euros and an execution deadline of 18 months. 80% of the cost was contributed by the Ministry of Housing, while the San Andrés del Rabanedo Local Council was to cover the remaining 20%, according to the agreement signed by the two public authorities on 20 May 2006". However, in 2009 the construction firm went bankrupt, and the project ground to a near halt, with work suspended and a lack of funding to continue. Finally, the Ministry of Infrastructure Development announced in March 2011 that it would be allocating more than 5.7 million euros to the refurbishment of Araú, recalling that this initiative was part of the investments in the



historical, cultural and social heritage of Castile-Leon, and emphasising that the restoration work must fully respect its industrial structure and promote cultural uses by following a project to divide the architectural complex into four buildings and an auditorium (Figure 4).

In building 1 (Figure 4, first on the right), originally used as housing and offices, a *library* will be installed, with reading rooms on three floors. Buildings 2 and 3 (Figure 4, occupying the centre) will house the main entrance lobby on the ground floor, and a tourism office. The upper floors will house the various exhibition galleries. Building 2 formerly provided the link between the housing (building 1) and the drying facility (building 3). Building 4 (Figure 4, left), formerly a warehouse, will be the site of an exhibition gallery, installation areas and storerooms, among other functions. At the rear of the complex, meanwhile, overlooking Calle Sampedro, will be the auditorium, a new building with a semi-underground layout (Press Release issued by the Ministry of Infrastructure Development Information Office, 23/03/2011).

The fieldwork conducted in August 2015 served to confirm that the restoration work is progressing, and that the Araú cultural complex is close to becoming a reality. In conclusion it may be asserted that this intervention strengthens the presence of Leon on the Camino de Santiago, serves to upgrade the settlement of Trobajo del Camino while generating a new cultural and tourism amenity (for the benefit of citizens), and also preserves a heritage asset linked to the town's historical memory. As regards territorial impact, it is particularly striking that this heritage asset interacts directly with a resource, the Camino de Santiago, which was recently declared a World Heritage Site in a UNESCO decision dated 5 June 2015. This suggests an added international profile for the future tourism and cultural complex and a greater socio-economic impact on a small town with a population of no more than 32,000, that depends on

the business activities concentrated within the Trobajo industrial estate and certain services dependent on urban development connections with Leon, which in turn provides other cultural resources for the pilgrims' trail.

3. The tourism potential of industrial heritage in disadvantaged areas

3.1. Riotinto Mining Park (Huelva)

The Riotinto Mining Park in the province of Huelva was the first to be created in Spain within the context of the closure of a number of mining operations, in this case copper, together with the beautification of industrial heritage, here specifically mining. Opened to the public in 1992, it offers visitors one of the most spectacular cultural landscapes anywhere on the Iberian peninsula, resulting from mining performed since the pre-Roman era, and now classified as an Asset of Cultural Interest in the Historical Site category.

Linked to the works that enjoyed their boom time with the presence of the English Rio Tinto Company Ltd during the period 1873-1954, they were closed down in the 1980s, leaving behind numerous tangible traces of underground mining operations and those operations subsequently performed on an opencast basis (cuttings), all within a hugely spectacular natural environment shaped by the singularity of the River Tinto. These elements have been used to structure an initiative, the Mining Park, that plays a fundamental role in the tourism strategy in this disadvantaged region, mainly through the *Rio Tinto Foundation for the Study of Mining and Metalworking*. This private and permanent non-profit cultural institution aims to preserve and restore the historical and mining heritage of the Riotinto Mining District, while also developing

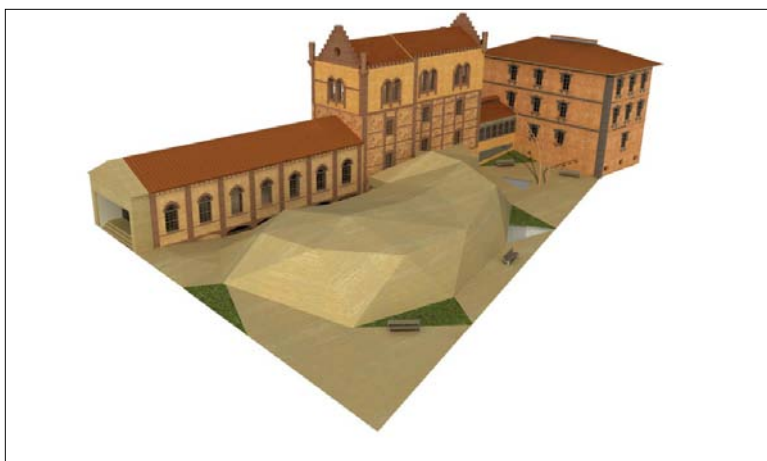


Figure 4: Reconstruction of the outcome of the Araú factory intervention according to the 2007 restoration project, in Trobajo del Camino (Leon, Spain)

Source: ALF Arquitectos Asociados, 2007



alternative employment for the mining sector and tourism operations in the region. The Henry Ford Heritage Conservation Award (1998) and the Europa Nostra European Cultural Heritage Award (2003) are clear examples of its efforts.

This initiative, the first of its kind in beautifying a Spanish mining district, now receives more visitors than any other mining heritage destination (67,148 in 2014), having reached its highest levels prior to the economic crisis, with 78,883 in 2008. The main site is the former Miners' Hospital built in 1927 to provide healthcare to both British and Spanish company employees, and even those unrelated to the British company who did not have the resources to pay for their own healthcare (Delgado and Cabello, 2006: 23; Cañizares, 2011: 27). It was expanded in 1965 and converted into the "*Ernest Lluch*" Mining Museum, which houses various exhibits (tools, machinery, etc.) that provide insight into the evolution of working tools and lifestyle of miners. The exhibits recreate a Roman mine and display railway machinery belonging to the *Rio Tinto Railway* company, in particular steam locomotives dating from 1907 and 1930 and the "Maharajah Carriage" built for Queen Victoria and brought here for a visit by King Alfonso XIII. The tour is completed by a visit to *House 21* in the Victorian settlement of *Bella Vista*, developed in 1883 to house the English engineers, and where a typical home has been recreated. Alongside, the Social Club (in days gone by for the exclusive use of the male population) remains open, along with sports facilities where pursuits such as tennis, cricket, squash, golf, snooker and, of course, football were played for the first time in Spain (Regalado, Moreno and Delgado, 2010: 50).

A tour of the Mining Park begins in the basin itself, a part of which can be visited by train. This train is one of the main attractions, with more than 12 kilometres of the former track having been restored along the route laid by the British in 1873 to link the mines to the port of Huelva (in operation until 1984), where the ore wharf that closed in 1975 can still be seen. Today this tourist railway offers visitors a unique experience, travelling through a landscape dotted with buildings, railways, small stations, traces of mine works, slag heaps, etc., with the red waters of the River Tinto in the foreground, as visitors are given the chance to alight from the train and go down to the banks of the river to see it first hand. There is also controlled access to two quarries or cuttings where opencast copper mining was performed: the *Corta Atalaya* in Minas de Riotinto, a hole measuring 1,200 m in diameter and 345 in depth, and the *Peña del Hierro* in the borough of Nerva, measuring more than 100 m in depth, where a 200 m long mine tunnel can also be



Figure 5. Riotinto Mining Park advertising poster (Huelva, Spain)

Source: Riotinto Mining Park (<http://parquemineroeriotinto.es/>)

visited, along with an exhibition featuring the Project MARS research coordinated by NASA (<http://parquemineroeriotinto.es/>).

The overall number of visitors consists mainly of individuals (60%) following the Coast-Doñana National Park and Uplands route, above all at weekends. The second group corresponds to educational institutions, given the teaching function of the Riotinto Foundation. Thirdly, there are trips organised by groups from Seville and the Huelva coastal resorts that purchase a visit to the Park as part of a tourism package. In terms of nationality, Spanish tourists predominate (80%), although the number of foreign visitors is far from negligible, above all German and British citizens holidaying in coastal establishments, followed by French mainly from Seville, and Portuguese (cross-border tourism) (García, Delgado and Felicidades, 2013: 145 and following).

3.2. The Castile Canal and the San Antonio Flour Mill in Medina de Rioseco (Valladolid)

Assets and activities connected with agri-food production are of particular economic, social and cultural significance in the region of Castile-Leon. The wide range of different types, construction characteristics, production processes and technical resources make this heritage sector one of the region's distinctive hallmarks. The Inventory of Industrial Heritage of Castile-Leon, drawn up between 2006 and 2011, groups together a total register of 4,887 classified assets, 58.5% of which are agri-food heritage assets according to the Cultural Heritage Directorate of the regional government. Of these, half correspond to buildings connected with the milling of grain (silos, mills, store rooms, bakeries), while 220 are flour mills. Following the closure of many such facilities during the second half of the 20th century, most of them are now abandoned and in a state of ruin. The elements defining this heritage sector include in



particular the flour mills located along the Castile Canal, one of the most significant hydraulic engineering works undertaken between the mid-18th century and the first third of the 19th century in Spain. The Canal was declared an Asset of Cultural Interest in the Historical Ensemble category in 1991, and it consists of 166 different elements (locks, wharfs, factories, warehouses, bridges, etc.) over the course of 207 km in the provinces of Burgos, Palencia and Valladolid (Arnáiz, 2011).

One of the distinctive elements located along the canal is the San Antonio Flour Mill in Medina de Rioseco (Valladolid). It was built in 1959 after the original plant was destroyed by fire a year earlier, and is positioned at the first spillway of the wharf on the Campos branch (Figure 6). It represents an outstanding example of industrial heritage, and furthermore retains the original machinery (Daverio system), which dates back to 1944 (Agreement 26/2010, of 4 March 2010, of the Regional Government of Castile-Leon), and has been preserved



Figure 6. San Antonio Flour Mill in Medina de Rioseco (Valladolid, Spain)

Source: Image provided by D. Pérez, taken in April 2013

in good condition since operations ended in 1990, leading it to be classified as an Asset of Cultural Interest in the Monument category in March 2010, emphasising its cultural and heritage value.

Under municipal public ownership since 2005, this industrial complex now forms an integral part of the valuable cultural and tourism resources of Medina de Rioseco, a town with an extraordinary heritage legacy. The Castile Canal, then, as the hydraulic infrastructure providing the backbone for an expansive territory, represents a route of great historic and environmental value, supporting the restoration of numerous elements for their inclusion within the heritage of the towns along the way (Geijo & Zulueta, 2010).

The exploitation of this resource for tourism and education has been structured through the

Valladolid Provincial Authority's organisation of a comprehensive offering that includes activities such as guided boat trips along the Castile Canal, guided tours of the flour mill, the rental of electric boats and canoes, the staging of sporting events around the Canal and the organisation of thematic workshops in the bread making facilities conditioned for this purpose. The offering of cultural and recreational activities is helping to draw more visitors, with sustained growth since 2005 amounting to more than half a million visitors by August 2015. The overall number of visitors comprises mainly those from the province itself, both individuals and organised tour groups and those from educational institutions, although there are also a great many visitors from the rest of the Autonomous Region. Cultural tourism from the regions of Madrid, Cantabria and Catalonia is also registering a significant increase, while dissemination and promotional efforts have helped to attract more than 25,000 foreign visitors to discover this outstanding heritage complex, a reminder of the area's past and a fundamental cornerstone in understanding the district's territory and landscape.

4. Conclusions

It would be fair to state that following a lengthy period of progressive beautification of industrial heritage in Spain, it has now become a resource for development, as demonstrated by a number of the interventions analysed here. In this regard, the Almadén Mining Park is a good example of the reinvention of a mining basin in a depressed area, while the facilities at the former slaughterhouse in Valladolid are tied in to an urban renewal project, and the Araú factory in Leon has become a cultural venue along the Camino de Santiago pilgrims' trail. They have not all been "good practices", as demonstrated by other examples presented, although the progress in new uses at the service of development and urban renewal is quite clear, above all in those initiatives generating consolidated tourism activity, such as the Riotinto Mining Park and the Castile Canal-Flour Mill in Medina de Rioseco.

In short, industrial and mining heritage is consolidating its position in Spain as a resource with great territorial potential, and is beginning to generate results open to evaluation over the last three decades. There is still a long way to go in order to achieve full cultural, social and economic returns on this type of heritage bequeathed to us by historic industrialisation.



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The effect of urbanisation processes on Spanish rural areas

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Abstract

Spanish rural landscapes have undergone a significant transformation since the early 1990s due to the implementation of rural development policies and the new functions (service provision) assigned to rural and natural landscapes, as opposed to the traditional production of raw materials. We carry out a bibliometric study to highlight how Spanish geographers have viewed the processes of urbanisation in rural areas with a particular focus on the factors, affected territories and the consequences of the territorial dynamic.

Keywords: rural areas; landscape; urbanization; multifunctionality; Spain.

1. Introduction

The community agricultural policy approved in 1992 (McSharry reform) gave rise to a new concept of agriculture and agri-environmental policy which advocated the adoption of a new model of sustainable exploitation of the land. These policies, which were intensified after the Maastricht Treaty, were also intended to mitigate the territorial imbalances produced by economic dynamics and which were still unresolved by the provisions adopted through to the late 1980s. The emphasis is now on a development model that enhances the value of endogenous resources, based on the view that the problems of economic development suffered by these areas cannot be settled by concentrating solely on the agricultural sector. The introduction of a new functionality is linked with the growing importance of leisure and the discovery of certain rural areas in so-called post-productivist societies; this is when we hear the first mention of the *new rurality* associated to the concept of multifunctionality (Hernández, 2009a). The functions the European Commission considers as developing agriculture, and which inform the notion of multifunctionality are: food production in competitive

conditions, the defence of landscape values and the rural environment, and the contribution to the viability of rural areas and to a balanced economic development from the territorial point of view.

These changes have gone hand-in-hand with the rediscovery of the landscape by so-called post-productivist societies. This recovery is articulated by three processes, namely the ordination and management of the transformations taking place in the territory, their social revalorisation, and their consideration as a “new” resource. The traditional productive function of providing raw materials is now joined by a new function, namely the offer of services, generally oriented towards rural and/or residential tourism (Hernández, 2009b). The landscape –understood as a sign of territorial identity– and the heritage resources associated to it have become the basis for activities linked to rural and residential tourism, in which the “selling” of cultural and natural landscapes constitutes one of its main offerings, as opposed to the homogeneous and prosaic offerings resulting from economic dynamics based on the intensification of agricultural operations and the expansion of urban uses.

2. Aims and methodology

The aim of this communication is to highlight how Spanish geographers have analysed the transformations undergone by rural spaces and, more specifically, the impact of the urbanisation processes caused by the new functions and values acquired by these spaces as a result of the changes in agricultural and rural development policies. However it is necessary to make a series of clarifications.

In the first place, and as indicated in the title of this communication, the aim is not to discuss all the works that analyse the new functionalities of rural environments, as they are innumerable and cover



very broad and diverse themes; this would go beyond the ultimate purpose of this contribution. The analysis will basically focus on the publications that explicitly analyse the processes of urbanisation in the rural environment. Themes that deal with the processes and dynamics affecting rural environments and which may in some way be interrelated with the purpose of this communication are excluded. These include particularly:

- a) the concept of multi-functionality in its strictest sense, or geared to activities with a pronounced agricultural or environmental orientation;
- b) activities relating to the implementation of rural development policies and, more specifically, to the development of initiatives in the area of rural tourism;
- c) the arrival of new settlers in rural environments –the so-called neo-rurals– attracted by the quality of life offered by these landscapes;
- d) the urbanisation or “natururbanisation” of natural spaces, as although they are supported on elements common to rural environments, they take place in protected spaces.

In second place, only contributions from geographers are included within the scope of this study. The cross-cutting nature of many of these issues means they have been analysed by economists, sociologists, agricultural engineers and demographers, among others. Without underestimating the interest and the synergies contributed by these disciplines, their omission is vindicated in view of the purpose of this publication.

In third place, we limit ourselves to the period between 2000 and 2015. There are evidently earlier studies that are extremely valuable from the academic point of view. The choice of this timeframe and the exclusion of all contributions prior to 2000 is justified by the goal of particularly highlighting the recent treatment of these processes by the Spanish geographic community.

Two criteria were considered when selecting the works for consideration in this compilation. For obvious reasons, it includes all the publications contained in books, book chapters and articles that refer expressly in their title or include as keywords the terms *urbanisation*, *residential tourism*, *rururbanisation*, *multifunctionality*, *rural space* and *Spain*. The list was compiled by searching social science databases and specifically the ISOC (CSIC) database, and DIALNET, the dissemination portal for scientific output. Particular attention (second criterion) was given to discussions and communications presented in congresses

organised by both the Spanish Geographers' Association and by the workgroups in this same association in the period 2000-2015. A specific target of study was the documentation available on the organisation's website and the minutes deriving from these activities. In contrast, unpublished communications presented in seminars or courses were not considered, as their high number, but above all their broad range of scales (from the local to the national) and organising bodies (universities, town councils, local stakeholder groups and so on), make it especially difficult to obtain and manage the documents. However it is necessary to make a series of clarifications. The analysis of the congresses held from 2001 to 2015¹ reveals the breadth of the themes. With the exception of one –with an explicit reference to expansive tourism (XXII Congress, 2011)– they either contain various communications under diverse headings, as in the case of congresses XIX, XXI and XXIV, or else the issue is not directly addressed by any of the participants. We consulted workgroups which *a priori* could have a relation with the subject of the analysis (*tourism, leisure and recreation geography, urban geography, population and rural geography*). However, in the three first categories, the contributions included are testimonial. This is the Rural Geography Group which has mainly analysed the processes of urban dissemination in rural environments. All the discussions², with the exception of the ones held in Baeza (2006) and Cáceres (2010) which produced no communication, have dealt with this issue to varying degrees. The discussions in Lleida (2000), Santander (2002), León (2004) and Murcia (2008) are particularly worth mentioning. The one in Lleida contained a talk on this theme (“*Impact of tourism, recreational activities*

1. Specifically, the following congresses organised by the Spanish Geographers' Association have been considered: XVII Congress. Form and function of the territory in the new century (Oviedo 2001), XVIII Congress. Geography for a global society, diversity and social exclusion (Barcelona, 2003), XIX Congress. Public spaces and private spaces: a debate on territory (Santander, 2005), XX Congress. Geography on the frontier of knowledge (Seville, 2007), XXI Congress. Geography, territory and landscape: the current situation (Ciudad Real, 2009), XXII Congress. Geography and territorial challenges in the 21st century (Alicante, 2011), XXIII Congress. Island and frontier spaces: a geographic view (Majorca, 2013) and XXIV Congress. Spatial analysis and cartographic representation: innovation and application (Zaragoza, 2015).
2. The following discussions organised by the Rural Geography Group were analysed: X Discussion. The rural world in the age of globalisation. Uncertainties and potentialities (Lleida, 2000); XI Discussion. Rural spaces today and tomorrow (Santander, 2002); XII Discussion. What does the future hold for rural spaces? (León, 2004); XIII Discussion. Spanish agriculture and the CAP: 20 years on (Baeza, 2006); XIV Discussion. Spanish rural spaces in the new century (Murcia, 2008); XV Discussion. Territory, landscape and heritage (Cáceres, 2008); XVI Discussion. Research into the rural environment (Sevilla, 2012); and XVII Discussion. Revalorising the rural space: reading the past to win the future (Girona, 2014).



and the residential phenomenon in rural areas”) and partially another two (“*Planning and development of rural spaces*” and “*The new socio-economic and environmental functions of rural environments*”). The second discussion in Santander covered the processes of urbanisation in the rural environment. One of the themed areas in the talk in León was entitled “*Invented rural spaces, conservation or banalisation?*”. Finally, and in response to the intense process of urban sprawl in the provinces on the shores of the Mediterranean, the third talk in Murcia dealt with *Urbanisation in the rural environment*.

The classification system used to group the works is structured in three major categories, namely:

- a) the factors and processes that favour urbanisation in rural environments;
- b) case studies;
- c) the repercussions caused by this territorial dynamic

This structure –although simple– facilitates the analysis as it responds to a basic grouping organised around three concepts. Although the proposed structure simplifies the assignment of the references to themed blocks, there are numerous publications that can be allocated to several of these categories given the interrelationships between them. In this case, they are included in the section with which they have the closest affinity according to their contents.

3. Urbanisation processes in the rural environment

Urbanisation processes in rural areas are not a new phenomenon. We only need to go back and look at the spread of urban uses in periruban spaces in the 1960s. The scope of the territories affected by these processes was significantly increased by the new functions acquired by rural environments after the 1990s; these will be considered in section 3.1. This expansion gave rise to the formation of a range of typologies which will be examined in section 3.2. The implications generated by the processes of urbanisation will be discussed in the final section.

3.1 Factors and processes favouring urbanisation in rural areas

The first of these themed categories deals with the various processes that explain the urbanisation of Spanish rural environments, but without analysing any

specific case study as their principal argument. Although not numerous, the contributions encompass several issues. The first group contains studies that examine the processes of ordination and management of these spaces (Tort, 2000; Font, 2000), and particularly the regulatory frameworks that have favoured the spread of these urban uses. They include authors who maintain that poor planning in rural areas has fuelled the proliferation of uses (Alberdi, 2002), and propose various strategies that can be adopted to halt these processes. Some of the most noteworthy strategies are the ordination of these spaces through protocols that assess the repercussions of the spread of these uses and the advantages of conserving agricultural uses (Alberdi, 2013), and their management and protection (Alberdi, 2004; Perxacs, 2008).

A second sub-theme contains an overall analysis of the factors that have favoured this dynamic (López Palomeque, 2002). In generic terms, all the authors attribute it to the new relationships established between the rural and urban environments, with particular emphasis on the new functions acquired by the rural environments in urban societies due to their productive (their offering of services) and environmental values (Gómez Mendoza, 2012). The first involves factors such as quality and the newly-acquired appeal of rural landscapes in highly urban societies, and whose physical manifestation is the proliferation of residential spaces in rural environments (Tulla, 2008), giving rise to what some authors have called “the city in the countryside” (Barros, 2006). There is an examination of the factors that have facilitated this new territorial dynamic, but many approaches take a critical standpoint and highlight the uncertainties generated by these processes (Pavón, 2001).

Landscape quality, the pursuit of a way of life in closer contact with nature, the improvement in transport networks that reduce the time spent on travel, and the spread of electronic communications have favoured the processes of counterurbanisation (Ferrás, 2000). The features inherent in this process (the migration of urban residents to rural environments) and the particular traits of each territory lead certain authors to question whether this dynamic takes place in every territory (Lardiés *et al.*, 2011). These neo-rurals comprise two groups: people in search of a new way of life, enabled by the possibility of engaging in activities linked to the new functionality of rural environments or to jobs which have been dislocated from the strictly urban environments thanks to the new technologies, thereby producing a certain demographic revitalisation (Guirado and Cuadrado, 2008). Particular emphasis is given to the foreign population who



–attracted by the mild climate– settle in areas near the coast but shun the built-up areas along the seafront (Rodríguez, 2004; Valero, 2009). One last theme addressed in the study links the spread of residential uses and the implementation of rural development policies (Picornell and Arrom, 2006; Martín, 2012; Mercado *et al.*, 2012). Given the intensity of this process in the last decade, certain authors such as Martínez and Palací (2011) have suggested that the proliferation of second homes may contribute to degrading the very resources which support the initiatives favoured by rural development policies.

3.2 Case studies

This is the theme that has received the greatest attention from geographers in the period considered. The impact is examined on several territorial scales, based on a brief analysis of the factors that have enabled the spread of these new functions. All the studies highlight the functional and social change triggered by the residential dynamic in rural environments (Armesto *et al.*, 2005; Buenaga, 2002). The scale of the analyses ranges from local studies to the autonomous region. Balearic islands, Catalonia, Region of Valencia and the Basque Country have the greatest number of contributions. The criterion chosen, taking into account that all the contributions mention generic factors that enable the spread of urbanisation processes (analysed in section 3.1), is the ongoing relationship between rural spaces and urban territories, and how these urban territories may have contributed to this new territorial dynamic. Three typologies are differentiated:

- a) periurban environments; that is, those defined as being in transition between urban and rural;
- b) the so-called rururbans, namely sectors near coastal areas with tourist uses and/or major metropolitan areas;
- c) areas considered “deeply rural”, characterised by a clear and marked contrast between the urban and rural world.

These two latter typologies are predominant in the publications by Spanish geographers between 2000 and 2015.

Periurban areas continue to be the object of study by part of the scientific community of geographers, but to a much lesser extent. Unlike in previous periods, and except in some publications (Herrero, 2002; Shallcross, 2002), the object of study is not so much the process

itself but the urbanisation based on the existence of smaller population nuclei –as occurs for example with Basque farmsteads (Alberdi, 2001)–, and the impacts on cultural landscapes (Alemany and López, 2015). A novel sub-theme is the spread of new, more widespread urban models (detached and semi-detached housing) in cities with low demographic dynamism. This is the case, for example, of the city of Segovia (Velasco, 2011), Logroño (Lasanta, and Nogués, 2005) and some Galician cities (Iglesias, 2000; Aldrey, 2002).

The second type described (rururban landscapes), and which receives the most attention in the period analysed, is the result of two diverse dynamics: first, the processes of urbanisation in coastal environments with a strong tourist presence. These are linked to the spread of new economic functions in the two last decades caused by activity in the property market and the spread of residential estates to satisfy the acute demand for housing by foreign and Spanish residents. These territorial processes have taken place in rural spaces, often in mountain areas very near the urban-tourist backbone along the coastline, and particularly in the municipalities near the communications routes that connect the main urban conglomerations on the coastline with the interior. As the urbanisable land on the beachfront and one row behind has been exhausted, property developers have moved their sights towards rural areas with lower situation rents. Significant for their intensity are the processes occurring in the Region of Valencia (Giménez and Díez, 2009; Hernández *et al.*, 2008; Cutillas, 2008), Murcia (Andrés, 2004; Serrano, 2007; Aliaga *et al.*, 2008), Catalonia (Tort, 2002; Molleví and González, 2007), the province of Malaga (Galacho, 2011) and Balearic islands (Ramis *et al.*, 2008; Ramis, 2011). Some of the contributions point out the importance of the foreign community in this process (Binimelis, 2002; Carvajal, 2004; Membrado, 2015), as well as the uncertainties generated by this dynamic (Amat, 2011). In second place the contributions look at the urban spread from the major metropolitan areas, revealing that the process affects ever more distant sectors (Cors, 2000), but they particularly analyse the processes of counterurbanisation. The Basque Country is the subject of numerous publications (Torres, 2006; Ruiz and Galdós, 2008). The authors of these works point out that “the cities are turning to the countryside” (Ruiz and Galdós, 2005) or to nearby mountain sectors, as is the case of the Hernio massif (Galdós and Ruiz, 2012a) and Gorbea (Galdós and Ruiz, 2012b).

The final type analyses the spread of urbanisation processes toward sectors that could be described as deeply rural; that is, those characterised synthetically by



a marked demographic recession and ageing assets, and by the predominance of agricultural activities, where the urbanisation of rural environments is very recent and fuelled by the initiatives conceived to revitalise these areas (Bustos, 2006); this can be seen in the proliferation of second homes. This dynamic affects the autonomous regions of Castile-León (Molinero and Baraja, 2011), Castile-La Mancha (López González, 2012) and the inland municipalities of Andalusia (Montosa, 2002). These processes are highly significant in Cantabria (Álvarez, 2005; Delgado, 2008) and in the province of Toledo (Sánchez, 2000; Sánchez, 2002), and in some cases show similarities with the rururban model, were it not for their development in a markedly rural context. In both cases the improvement in communications and the proximity to cities like Bilbao and Madrid has encouraged the presence of second homes.

3.3 The repercussions of this territorial dynamic

The third line of argument contemplates the effects of these processes. As occurred in the first category, there are very few publications in this block. This is sometimes because they are analysed as part of a case study, and are therefore included in the previous section. Most of the communications concur in highlighting the risks associated to intense and rapid urbanisation. The first of these consequences –expressed both explicitly and implicitly– is the change in land uses or in rural areas in general (Binimelis, 2004; Arrom *et al.*, 2008). Some deal particularly with the socio-economic and legislative implications (Delgado, 2011) and the impact generated by this activity (Santos, 2000), which is classified as not very sustainable. Secondly, there is also an emphasis on the tensions and conflicts arising between traditional uses (farming) and the new residential uses (Madrazo *et al.*, 2002; García, 2008). Other topics of study are the impact of the proliferation of urbanised areas in rural environments. These include particularly:

- a) the fragmentation of rural areas, which may facilitate urbanisation processes as it raises the price of land (Lasanta and Errea, 2012);
- b) the progressive enclosure of rural plots, which accentuates the disorganisation of rural environments (Blázquez, 2011);
- c) the visual impacts generated by these buildings (Pardo *et al.*, 2011) and by urban styles that clash with traditional constructions, and which on occasion

simply involve transposing the residential models adopted in suburban areas around the cities, thus giving rise to what some authors have termed as “urbanalisation” (Molina and Ruiz, 2008).

Finally, some authors signal the progressive disappearance of these cultural landscapes (Ponce, 2011; Ruiz *et al.*, 2012) due to the intensity of the process.

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The Urbanisation Process and its Influence on the Increase in Flooding (Region of Murcia, Campo de Cartagena-Mar Menor, South-east Spain)

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Abstract

We evaluate and analyse urbanistic transformations that have occurred in Campo de Cartagena-Mar Menor (south-east Spain) as a consequence of the expansion of new building and how flooding has increased in the area as result of artificial sealing of the soil. The results showed that the higher risk of flooding is closely related to the increase in soil sealing and the greater vulnerability and exposure of the population as a consequence of building on high-risk areas.

Keywords: land use change; soil sealing; urban expansion; risk of floods; south-east of Spain.

1. Introduction

The coastline of the Province of Murcia (in the south-east of the Iberian peninsula), as well as the vast majority of the Spanish Mediterranean coast, has experienced the phenomenon known as “urban expansion” (Squires, 2002) in recent decades, which is associated with residential tourism. Consequently, the area has undergone one of the most notable changes of land use and landscape in this area in recent history.

The number of “residential immigrants” registered in Spain multiplied by 7.5 between 1991 and 2012 (Membrado Tena, 2015). The vast majority of them (95%) chose Spanish coastline regions

with a Mediterranean climate, which includes the administrative district (“Comarca”) known as Campo de Cartagena Mar Menor (CCCMM).

The arrival of these residents had an effect on the Spanish housing market and triggered a construction boom, mainly along the Mediterranean coastline. Some of the negative environmental consequences of this inadequate urban expansion are: notable changes in the use of the landscape (IGN, 2006; Burriel, 2008, 2009a and 2009b; Gaja, 2008; Belmonte Serrato *et al.*, 2011a; Rullán, 2011, Membrado Tena, 2013); destruction of the landscape; drought in regions with water shortage (Vera, 2006); and artificial soil sealing (Docampo, 2011; Romero Díaz *et al.*, 2011; Ruíz Sinoga *et al.*, 2011), with the consequent increase of flood risk (Romero Díaz *et al.*, 2010; Pérez Morales *et al.*, 2015). This seems an inevitable consequence of irrational and uncontrolled growth (Gaja 2015).

What is especially worrying, as seen here, is the relationship between the increase in built-up areas and the increase in ground impermeabilisation due to artificial sealing. Besides the loss of habitat for both flora and fauna, which may be irreversible, the effects include the alteration of natural water balance and, subsequently, an increase in surface runoff and drainage discharge. The combination of these effects has led to an increase in the severity of the risk of floods in the form of larger flood areas and catastrophic episodes (Gil-Guirado *et al.*, 2014).



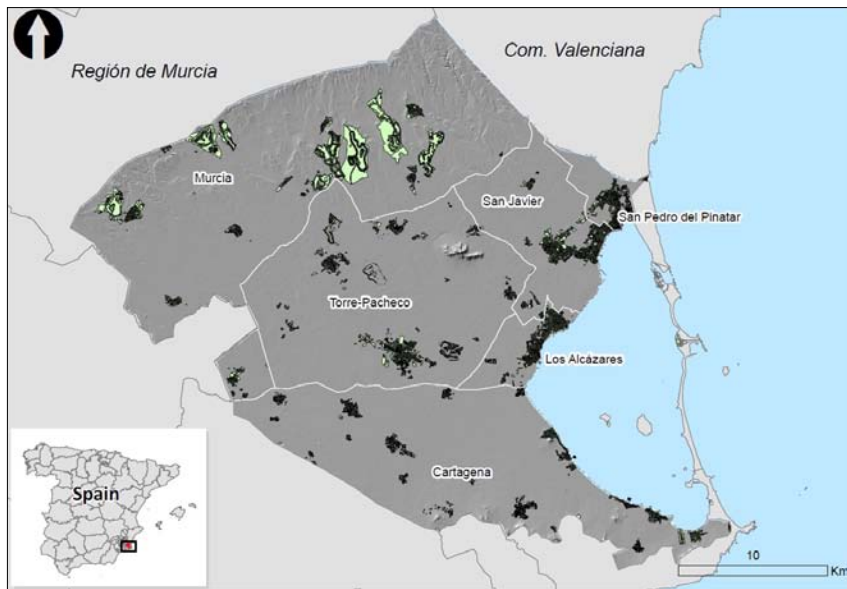


Figure 1. Location of the study area

Source: Made by the authors

1.1. Ground sealing and relation to flooding

Ground sealing is of worldwide interest and, according to the European Environment Agency (Jones *et al.*, 2012), it is one of the eight main types of degradation that affects European soils. Soil sealing has been defined, as the covering of the ground due to the construction of buildings and infrastructures.

The greatest impacts related to sealing take place in those places where an important development of infrastructures such as homes, roads, services, etc. has taken place. Among countries that stand out for their high urbanisation rate are the Netherlands and Germany (Jones *et al.*, 2005). In Western Europe, there has been a substantial increase in soil sealing in recent decades as a consequence of the increase in population in towns and the influence of tourist demand in certain regions and parts of the coast, especially along the Mediterranean coastline (Membrano Tena, 2013).

According to the Environmental Profile of Spain 2005 (MMA, 2006), in the last 14 years, artificial areas (especially in towns), have increased more in Spain than the European average. Indeed, the increase in urbanised surface was practically double that of the rest of Europe during the 1990-2000 period. While in the EU in general there was an increase in population of 3.5% and an increase of built-up areas of 13.8%, in Spain the figures were 4.3% and 25.4%, respectively. The reason behind this lies in changes in the city model. Cities have become more spread out and there is a higher presence of single-family homes, in addition to the growth of transport infrastructures and the consequent fragmentation of the territory (MMA, 2006).

As urban areas and roads (both asphalted and unsurfaced) grow, mainly at the expense of farmland, there is an increase in soil sealing. This reduces the infiltration of water into the ground, the natural refilling of aquifers, the conservation of wetlands and biological diversity. The destruction and impermeabilisation of natural cover substantially modifies the runoff process and, according to Crespi *et al.* (2007) and Martínez Ibarra (2012), increases the areas at risk of suffering floods.

We consider both urbanised areas and road surfaces to be artificially sealed areas.

1.2. Objectives

The general objective of this study was to evaluate and analyse the expansion of urbanised areas in Campo de Cartagena-Mar Menor (CCCMM), in light of the reduction in the tradition agricultural landscape, and how this has increased soil sealing and the area affected by the risk of flooding.

2. Study area

The CCCMM is a wide plain sloping toward the Mar Menor, a salt water lagoon separated from the Mediterranean Sea by a 22 km long strip of land, La Manga. It is limited by a range of medium high mountains (less than 1,000 metres), and situated in the south-east of the province of Murcia (Figure 1). The region of Mar Menor includes the municipalities of San Pedro del Pinatar, San Javier, Los Alcázares and Torre Pacheco, although the study also includes areas sloping towards the Mar Menor belonging to the municipalities



Type of road	Width (m)	Type of road	Width (m)	Type of road	Width (m)
Motorway	35	Living street	7	Pedestrian	5
Motorway junction	35	Service area	7	Track	5
Junction	35	Road	7	Unclassified	5
Junction link	22	Secondary	6	Dual carriageway	5
Highway	10	Secondary junction	6	Railway	5
Main road junction	10	Local road	6	Path	4
Residential	9	Local road junction	6	Service road	4
		Footpath	3	Cycle lane	3

Table 1: Classification by type of road and width assigned

of Murcia and Cartagena. With the exception of the municipalities of Murcia and Torre Pacheco, they all have a coastline on the Mar Menor lagoon. The study area measures 776.45 km².

From a geological standpoint, the area is part of the Baetic System. The climate is characterised by scant rainfall (around 300 mm annually), which is very irregular and, occasionally, very intense. Temperatures are mild in winter and high in summer, with an annual average of 17 °C. The number of hours of sun per year can be as high as 3,000 (Romero Díaz and Belmonte Serrato, 2011). The climatic characteristics and the nearby presence of the Mar Menor have made the CCCMM a centre for tourists, on a regional, national and international scale.

The study area has no permanent river, due to the low elevation of the surrounding terrain, the extreme dryness of the climate and the absence of non-native watercourses. However, it does have numerous “ramblas” (mostly dry water channels used as thoroughfares). The main ramblas from North to South are the Maraña, Albuñón, Mirando, Miedo and Carrasquilla, and when there is intense rainfall they may carry large quantities of water and cause floods (Romero Díaz *et al.*, 2011). Current land use changes have favoured the frequency and intensity of flooding.

Economic activity centres on tourism and agriculture. Tourism is concentrated around the Mar Menor (municipalities of Cartagena, Los Alcázares, San Javier and San Pedro del Pinatar); and agricultural activity extends throughout the whole of Campo de Cartagena, mainly the municipalities of Fuente Álamo, Torre Pacheco, north of Cartagena, south of Murcia and, to a lesser extent, Los Alcázares, San Javier and San Pedro del Pinatar. Traditionally, the aridness of in this area limited agricultural activity, but the opening of the

Tagus-Segura water transfer system has significantly transformed the agricultural potential of the region.

3. Methodology and sources

The process of artificiality and soil sealing in the CCCMM was studied by means of a triple analysis:

- Official data provided by both regional and national statistics institutes (CREM and INE, in their Spanish abbreviations) were analysed to assess the importance of residential tourism.
- The number of buildings and roads, and the area they occupy, were evaluated. For buildings we used the information provided by General Cadastre Directorate (Ministry of Finance and Public Administration) updated in January 2014 (MHAP, 2014). This provided information on cadastral plots for each municipality in alphanumeric form. As regards roads, we used the information provided on the Open Street Map downloaded through the OSM plugin on QGIS 2.2. As this provided information in a linear manner, we had to reclassify the roads based on their widths according to the values established in Table 1 and the subsequent calculation of areas of influence for the surface measurements.
- Finally, we used the information on floodable areas for return periods of 10 (RP10), 50 (RP50), 100 (RP100) and 500 (PR500) years from the national register of floodable zones (National System of Flood Zone Mapping, MAGRAMA) in order to spatially characterise the risk factor.

Using a geoprocessing intersection these last data were combined on a GIS with the cover of cadastral plots.



Municipalities	Total		Main		Secondary		Empty	
	2001	2011	2001	2011	2001	2011	2001	2011
Los Alcázares	20689	21,442	3,181	5,988	16,838	14,783	670	671
San Javier	29,962	39,554	6,774	11,080	21,365	23,365	1,823	5,109
San Pedro P.	16,256	19,708	5,382	8,374	4,157	8,844	6,717	2,490
T. Pacheco	9,200	20,386	7,132	10,744	285	2,316	1,783	7,326
Comarca*	76,107	101,090	22,469	36,186	42,645	49,308	10,993	15,596
R. Murcia	592,613	776,700	378,252	515,367	118,772	132,216	95,589	129,117

* excluding the municipalities of Cartagena and Murcia

Table 2: Number and type of home in the CCCMM according to the 2001 and 2011 censuses

Source: Based on data from INE

Municipalities	Main %		Secondary %		Empty %	
	2001	2011	2001	2011	2001	2011
Los Alcázares	15.4	27.9	81.4	68.9	3.2	3.1
San Javier	22.6	28	71.3	59.1	6.1	12.9
San Pedro P.	33.1	42.5	25.6	44.9	41.3	12.6
Torre Pacheco	77.5	52.7	3.1	11.4	19.4	35.9
Comarca	29.6	35.8	56.1	48.8	14.5	15.4
R. Murcia	63.8	66.4	20	17	16.1	16.6

* excluding the municipalities of Cartagena and Murcia

Table 3. Percentage and type of home in the CCCMM according to figures from the 2001 and 2011 censuses

Source: Based on data from INE

We were thus able to determine the location of the surface area exposed to potential flood risk according to the probability of occurrence for the return periods and to precisely evaluate (within metres) the constructed surfaces now potentially at risk as a result of soil sealing.

4. Results

4.1. Housing types in the CCCMM

A comparison of the two last national censuses carried out in 2001 and 2011 (INE, 2013) shows that out of all the autonomous regions the Autonomous Community of Murcia was ranked first for growth in the number of homes (31.1%) and fourth if the figures are considered on a provincial scale. Moreover, for municipalities with over 20,000 inhabitants, Torre Pacheco was the third-ranked city in Spain for growth in the number of homes (115.5%).

The type of housing should be mentioned at this point since this reflects the influence of the second home (residential tourism), which climaxed in the boom that took place throughout Spain from 1998-2007. Although

some of their respective municipal areas were included in the study area, the cities of Murcia and Cartagena, which contain the highest numbers of inhabitants in the province, were excluded from the analysis.

In 2011 (the last census of buildings and people carried out in Spain), second homes in the province of Murcia represented 20% of the total, compared to 14.6% for Spain as a whole. This made the province seventh in the list of autonomous communities with the highest percentage of second homes (INE, 2013).

Of note is the large part of these second homes in the study area (CCCMM), particularly the municipalities of Los Alcázares, San Javier and San Pedro del Pinatar, all three on the shores of the Mar Menor (Tables 2 and 3).

Based on the information contained in the two above-mentioned censuses (one pre- and the other post-crisis, 2001 and 2011), it can be seen that the construction of secondary homes diminished in absolute terms (Table 2) only in the municipality of Los Alcázares. In relative terms (Table 3), the percentage that corresponds to this type of construction compared to the construction of main family homes fell in Los Alcázares and San Javier, and increased in Torre



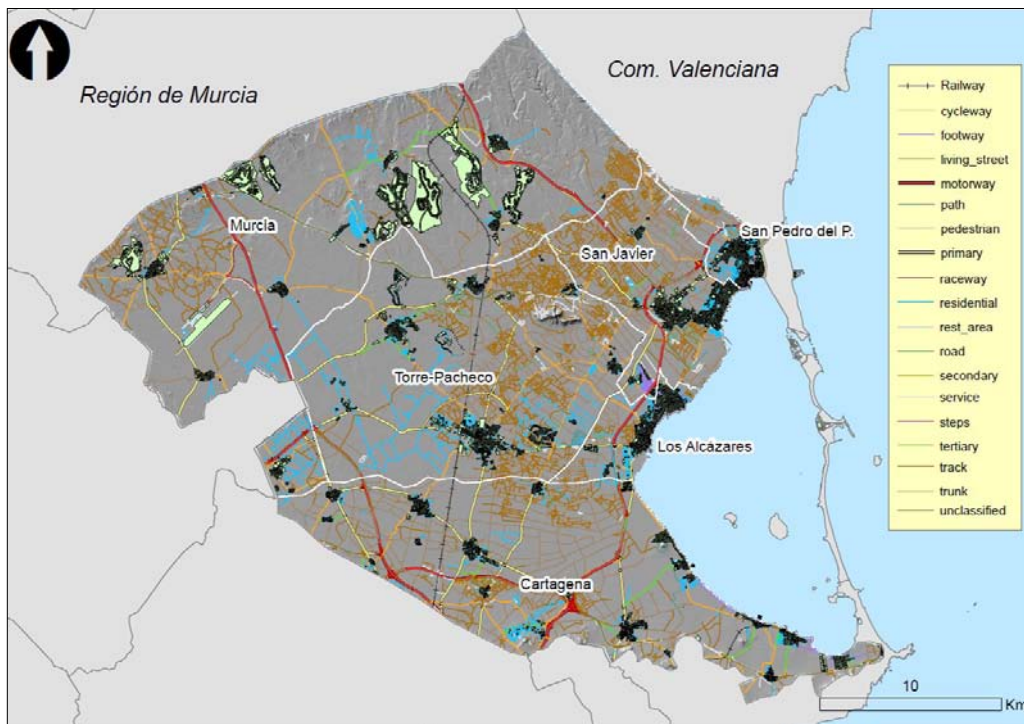


Figure 2. Localisation of built-up areas (buildings and roads)

Source: Made by the authors

Pacheco and, especially, in San Pedro del Pinatar, where the variation reached 19%.

As can be seen, we have listed a third housing type (“empty”), mainly the consequence of speculative building and the housing bubble followed by an economic crisis. According to INE (2013), the number of empty houses in Spain rose between 2001 and 2011 by 10.8%, with Galicia, la Rioja and Murcia having the highest percentages in this category. Among municipalities with more than 20,000 inhabitants Torre Pacheco led the way with the highest number of empty houses: 35.9% (INE, 2013).

For the CCCMM as a whole, empty houses represent 15% of the total. Undoubtedly, these high values for this type of housing reveal the high number of houses built during the housing boom and their low occupancy rate.

4.2. Urbanised area in the CCCMM according to land registry

The evolution of construction in Spain in recent years is a phenomenon that has achieved international significance due to the disproportionate number of buildings built in a short period of time. (Figure 2) This process has been particularly intense in the coastal area, where the recent urban growth has been described as a real “developer tsunami” (Gaja, 2008).

According to Olcina Cantos (2003), three moments in recent history are key to understanding the intense alterations that the study area has experienced:

(1) the passage of the so-called 1953 Decree and the beginning of the work to construct the Tagus-Segura water transfer system in 1968, which would profoundly alter the agriculture of the region; (2) the urban-tourism expansion of the second half of the 1980s and (3) the second housing boom of the last few years of the 20th century and the beginning of the 21st century.

1. The above decree brought to an end the use of the water in the study based exclusively on its natural hydrograph, since the construction of the Cenajo dam meant that there was a more regular supply of water. At the same time, the agricultural value of Campo de Cartagena, Mazarrón and Águilas began to increase as subterranean water sources began to be exploited. Traditional water wheels and windmills were replaced by motorised pumps which permitted deeper extraction. Irrigated agriculture began to replace predominantly dryland agriculture. The process took an additional step in the 1980s as the first water from the Tagus-Segura water transfer system arrived (hydrological year 1979/80). At the same time, the water from the system permitted the construction industry to play its part in the future of the region. Until that time water had been in short supply but now the water from the Tagus would permit the second spatial convulsion of the 1980s as homes and industrial plants were built.



Municipalities	N° buildings	%	Area (m ²)	%
Los Alcázares	5,050	11.0	2,773,579.93	11.0
San Javier	7,772	16.9	4,437,245.5	16.9
San Pedro del Pinatar	8,397	18.3	2,386,928.11	18.3
Torre-Pacheco	8,264	18.0	5,745,353.01	18.0
Murcia*	5,367	11.7	24,439,698.9	11.7
Cartagena*	11,110	24.2	5,411,714.6	24.2
Total	45,960		45,194,520.1	

* only the area within the study area (CCCMM) is considered

Table 4 Buildings and surface area constructed in the CCCMM

Source: Made by the authors based on data from Land Registry

- The second event mentioned above is related to the change in land use towards a predominantly touristic-residential focus. This had already begun on the coast (mainly the Mar Menor) in the 1960s and 70s, but it picked up speed with the first town-planning laws of the newly democratic Spain.
- Finally, the third moment of change responsible for the greatest transformation seen by the CCCMM occurred in the second half of the 1990s. The low cost of borrowing money, the expansion of second home ownership by people from outside the province (both Spanish and foreign) led to a new housing boom, which would last until the beginning of the global financial crisis in 2008.

A radical change occurred as construction moved away from the coast (already saturated in many parts) to occupy agricultural space further inland. New residential property and resorts took over what was a predominantly an agricultural landscape, frequently of environmental interest but lacking any formal protection.

The above process has had a direct effect on the increase in exposure and vulnerability of the population

to flooding. Far from respecting the elements that make up the natural environment, this has led to greater soil sealing, and the occupation of floodable zones previously dedicated to traditional agricultural practices which used the occasional flood water (Morales Gil, 1968).

In absolute terms, 45,194,520.1 m² (5.8%) of the study area (776,455,160 m²) has been built on as part of this process (Table 4). With Cartagena at the head, followed by San Pedro del Pinatar and Torre-Pacheco in the number of buildings and the area occupied.

4.3. Road network

The CCCMM's productive model, based on residential tourism and export-oriented agriculture and industry, depends to a great extent on adequate communications infrastructures (Table 5). For this reason, much effort has been put into supplying the study area with a dense network of roads capable of moving large numbers of people and goods with relative ease.

Municipalities	Area (m ²)	%	Length (km)	%
Los Alcázares	570,817	7.2	275.5	6.4
San Javier	1,293,267	16.3	668.9	15.5
San Pedro del Pinatar	412,906	5.2	221.3	5.1
Torre Pacheco	1,862,131	23.4	1,082.6	25.1
Murcia*	1,450,701	18.3	921.5	21.4
Cartagena*	2,336,121	29.4	1,127.5	26.2
TOTAL	7,925,943		4,297.3	

* Only the area within the study area (CCCMM) is considered

Table 5: Area of the CCCMM occupied by road network

Source: Made by the authors based on data from OSM



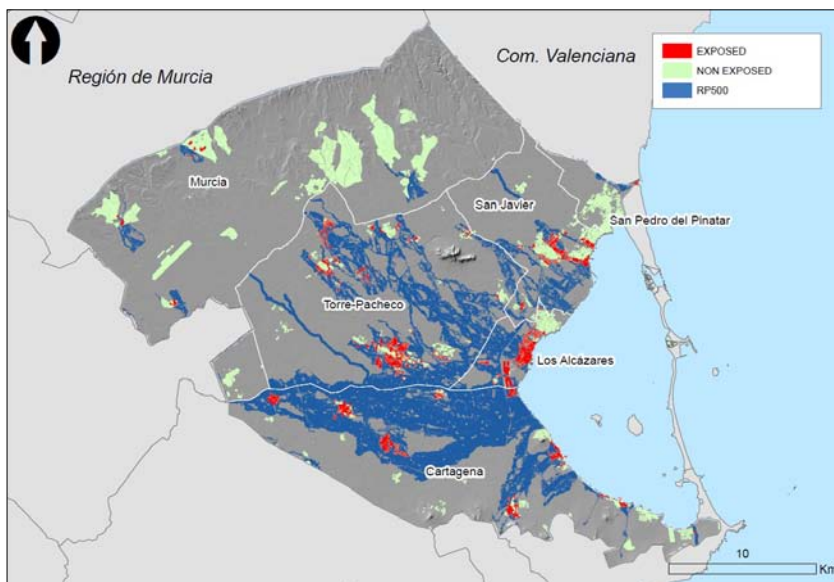


Figure 3: Built up areas in the CCCMM that are also exposed to the RP500 floodable zone

Source: Made by the authors

The final years of the 20th century also saw the construction of a large network of roads connected to the Mediterranean corridor, including toll motorways. The idea was to provide fresh impetus to an area covering 16% of the total area of the province of Murcia and lying next to more southerly coastal areas that were showing signs of saturation.

Until 1984, when the autonomous communities took on responsibility for the roads of municipal, the CCCMM only had a few kilometres of trunk roads, whose main purpose was to facilitate communication with Madrid. Communication, both internal and with neighbouring provinces, depended on an outdated system of roads in a poor state of repair, which became increasingly evident with the arrival of the first foreign tourists in the 1970s. New roads, especially the A-30 dual carriageway, put an end to this relative isolation, especially with regard to the Mediterranean Corridor. However, secondary roads were also vastly improved, improving internal communication within the area.

Such construction was complemented by another network of roads and tracks designed to facilitate access to the growing area dedicated to irrigated agriculture that was benefiting from the Tagus-Segura water transfer system.

At present, the CCCMM administrative district boasts a road network of 4,297 km. The area which this represents (see Table 5) has undoubtedly contributed to the problem of soil sealing in the zone.

4.4. Risk of flooding

The socio-economic changes experienced in Spain have thrown up many questions about land use

and, according to the evidence, about the exposure to natural dangers (Barredo *et al.*, 2012). This is especially true in coastal areas where the way in which land has been occupied has been largely uncontrolled - and where the consequent risks are largely uncontrollable (Figure 3).

As can be seen from Table 6, the surface area and number of buildings constructed in floodable zones, defined by the different return periods, has undergone continuous growth in this coastal Region of the Murcia, reaching 13,778 buildings and a total of 8,504,614.779 m² (RP500). In relative terms, the figures are alarming. For the period analysed the plots represent 29.9% of the total area constructed and the exposed area represents 18.8%. However, if we look at Figure 4, the highest percentage of urban plots in areas liable to flooding are in the RP 10 flood zone, precisely the one most frequently affected. This alarming situation is frequent in a geographical zone where the hydrological network is mainly composed of intermittent streams which are dry for lengthy periods, which contributes to the low perception of flood risk (Llasat *et al.* 2008; Belmonte Serrato *et al.*, 2011b).

Unexposed	Build.	32,182
	Area (m ²)	36,689,905.821
Exposed (RP500)	Built-up	13,778
	% (total=100)	29.9
	Area (m ²)	8,504,614.779
	% (total=100)	18.8
Total	Built-up	45,960
	Area (m ²)	45,194,520.6

Table 6: Surface area and number of buildings constructed exposed to flooding RP500

Source: Made by the authors



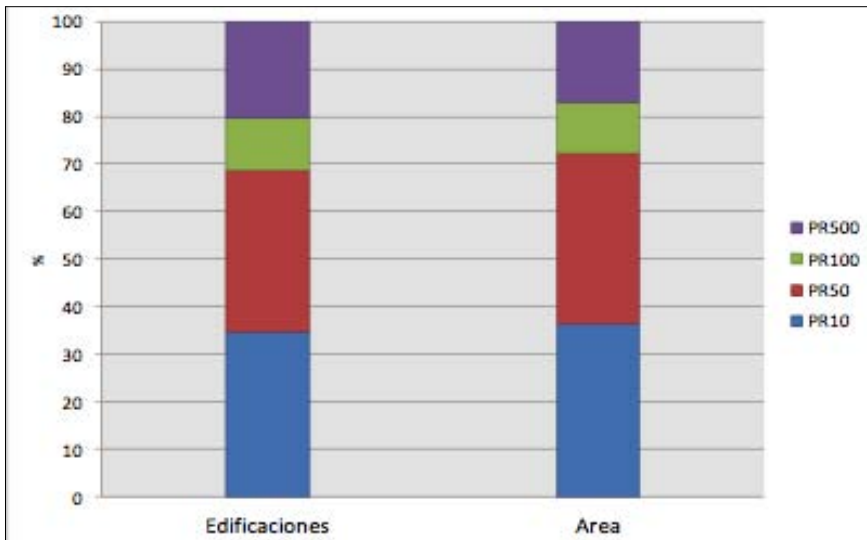
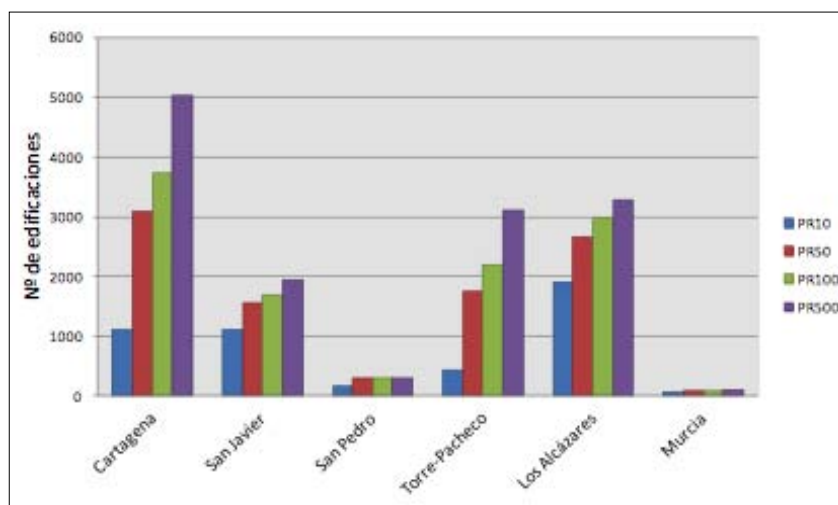


Figure 4. Percentage of buildings and surfaces for different return times

Source: Made by the authors based on data from Land Registry

Figure 5. Number of buildings constructed in floodable zone per return period

Source: Made by the authors based on data from Land Registry



Needless to say, this situation reflects extreme negligence on the part of the authorities.

If we look at the information at the municipal level (Figures 5 and 6), the absolute results obviously are in line with the surface area of each municipality in the study area. In some areas, such as Torre Pacheco, there are houses that have traditionally occupied the

land for agricultural reasons along with new buildings associated with the phenomenon of tourist resorts. In both cases, a substantial number of buildings are affected by the combined effect of soil sealing and its repercussions on runoff and the floodable area. A lack of awareness of the presence of the drainage network has led to a profound alteration of its layout, to the point that in some places it ceases to exist completely, which has

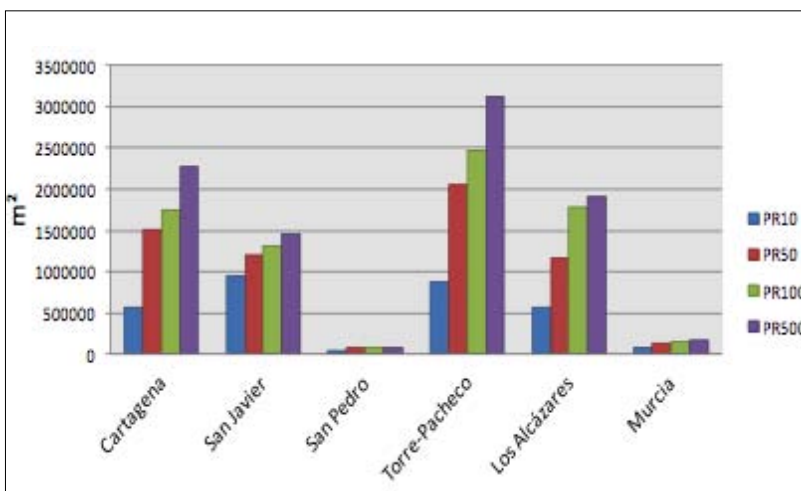


Figure 6. Area (m²) constructed in floodable zone per return period

Source: Made by the authors based on data from Land Registry



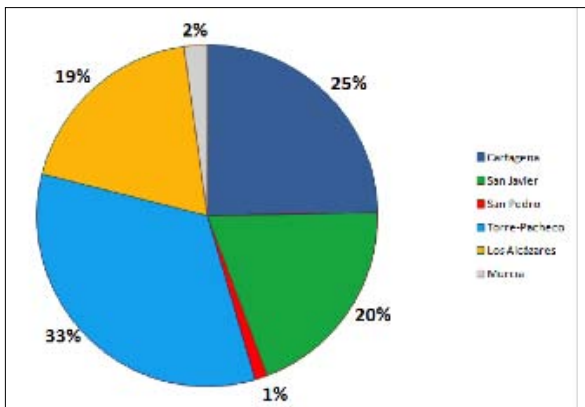


Figure 7. Percentage of the area constructed in the RP50n floodable zone

Source: Made by the authors based on data from Land Registry

the Rambla del Albuñón, since much of its route has been engulfed, or the Carrasquilla, where the artificial modification of the headwaters has increased the floodable area.

In Figure 7, which represents the area constructed in the RP 50 floodable zone, for Cartagena, Torre Pacheco, San Javier and Los Alcázares the numbers are quite high, but there are two cases where the percentages are small. This is because San Pedro del Pinatar is built on an elevation, which keeps it above potentially floodable zones, while the part of Murcia lying in the study area is located at the head of the drainage channel where the areas affected by overflows and flash floods is smaller than further downstream.

resulted in greater occupation and exposure. The most obvious cases are in the middle and lower sections, near the mouth of the stream, where development pressure is more intense. Specific examples include

Lastly, from a spatial point of view, the result of this urban expansion into floodable areas has been the gradual integration of river courses into the urban

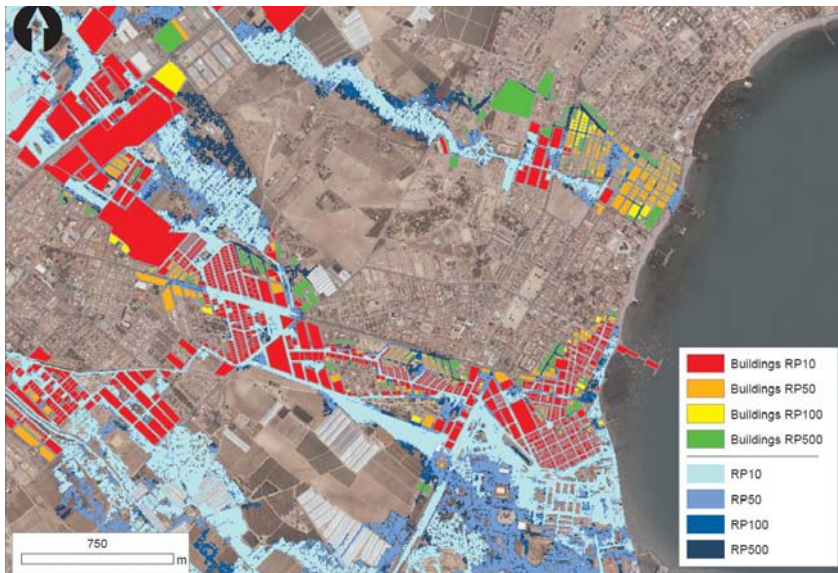


Figure 8. Floodable buildings and surface areas according to different return periods in San Javier

Source: Made by the authors based on data from Land Registry

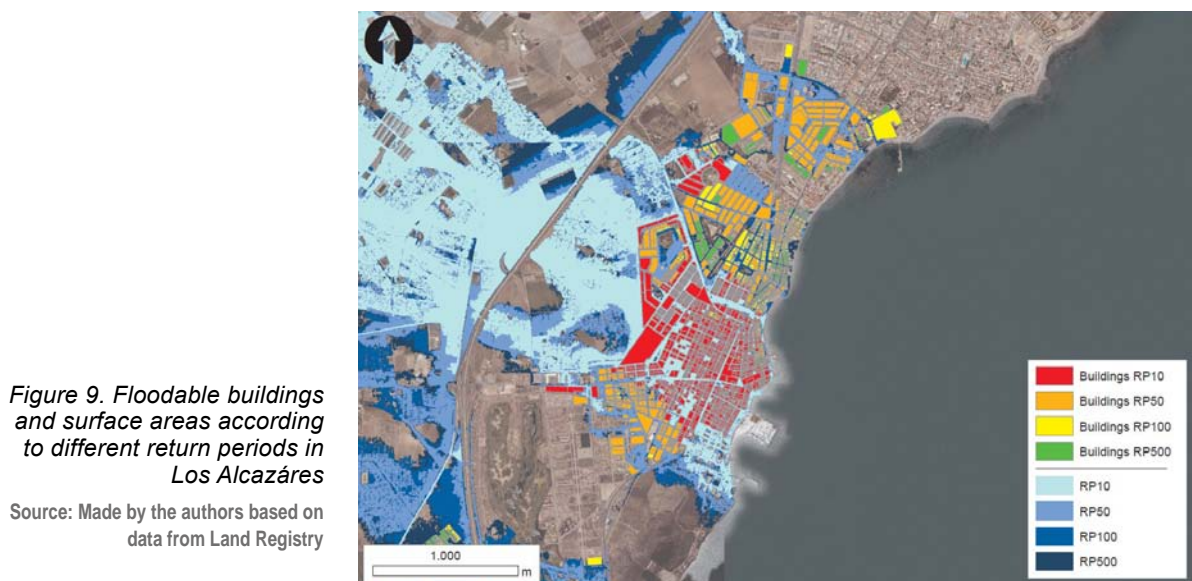


Figure 9. Floodable buildings and surface areas according to different return periods in Los Alcázares

Source: Made by the authors based on data from Land Registry



setting with the consequent increase in flood risk, as can be seen in Figures 8 and 9.

5. Discussion and conclusions

Analysis of the construction work carried out in the study area reveals the extent of second home building during the housing boom of 1998-2007. This is particularly the case in Los Alcázares, where 70% of buildings were of this type in 2011, and in San Javier (59%). As regards the number of empty houses, Torre Pacheco has the highest percentage (36%) of all the municipalities in Spain with a population of over 20,000 (INE, 2013).

The construction of housing destined to remain unoccupied has led to heavy economic losses; however, equally heavy, but largely unmentioned, are the resulting environmental losses. This building boom and the construction of associated roads and communications networks have led to a very large degree of soil sealing in the CCCMM. The 45.19 km² of buildings together with the 7.91 km² covered by roads give a total area of 53.1 km², representing 7% of the total area of the administrative district. However, the real percentage is even greater as other impermeabilised areas such as pavements, squares etc. have not been included in the calculation. We should also take into consideration the vast area covered by greenhouses, which has been estimated as 30.32 km² (Caballero Pedraza *et al.*, 2015). In other words, the sealed area represents about 16% of the total area of the CCCMM.

This sealing has mainly taken place on the riverbeds of major fluvial collectors in the study area. Consequently, the process of artificiality, both with regard to what is covered with asphalt and what is exposed to danger, probably caused a significant increase of flood prone areas and exposed buildings. In order of importance, the situation in the municipal areas of Torre-Pacheco, San Javier and Los Alcázares is significant. In all cases, the hazard map indicates a type of drain diffused flood motivated by a marked misconfiguration of the limits for the regular flow of watercourses such as Maraña or Albuñón. These channels, mouths or end sections that have not been overly modified, appear to have been forcibly integrated into the street plan with no continuity.

According to the above and considering that to date there is no conclusive evidence that there has been an increase in the rainfall episodes that cause flooding (Benito *et al.*, 2005; Turco and Llasat, 2011; Gallego *et al.* 2011; Benito and Machado, 2012), it can be

affirmed that the risk of flooding during the period and geographical area studied is due more to the greater vulnerability and exposure of the population than to an increase in danger, as suggested by climatic models covering forthcoming decades. The findings of this study agree with those suggested by the European Directive (EC, 2007) and Jiménez *et al.* (2014), which pointed to rising human settlement and economic activity in flood plains as one of the principal factors contributing to the increased probability of flooding in the world and the associated negative effects. The results also agree with studies carried out using a similar methodology in a European context (Jongman, *et al.*, 2014) and with land use studies (Rojas *et al.*, 2013; Früh-Müller *et al.*, 2014). However, it should be emphasised that the growth in construction experienced in the south-eastern coastal regions of Spain far exceeds the growth experienced at both national and European levels (Burriel, 2008).

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Urbanization of the countryside in rural areas with tourism potential. Second homes in the region of La Vera (Spain)

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Abstract

Rural areas in Spain have undergone deep transformations mainly motivated by changes to the production system and the resulting migration from the countryside to the city in the second half of 20th century. The recurring and seasonal return of migrants and their families is now accompanied by a stream of urbanites to inland areas with a greater tourism potential. The region of La Vera in Extremadura has all these features and therefore its economy has diversified. Since the beginning of the century, the proliferation of second homes and tourist accommodations has changed the landscape of the region. The aim of this paper is to analyse the connection between residential occupation of undeveloped land and the tourism potential of the area and identify likely interactions between the two.

Keywords: illegal urbanisation; rurbanisation; tourism; second homes; Extremadura.

1. Introduction

Today, the border between rural and urban lifestyles has become diffused through first world technological and infrastructural improvements. Urban sprawl in the agricultural environment is partly due to these advances, but also caused by people growing tired of excess agglomeration and a new conception of the country as a place for leisure and recreation. These aspects do not have to join to trigger the appearance of

second homes. However, the combination of both can substantially increase the chances of finding a greater number of buildings.

The scientific community, in general, has named this process rurbanization. This expression describes “the spread of metropolitan dynamics to old rural areas, which results in hybrid forms between rural and urban” (Gómez, 2010: 115). Depending on the environment in which the buildings are located and the motivations behind construction, we can find some variations of this phenomenon. These include naturbanisation, the “processes of demographic attraction to rural areas recognised for their environmental and landscape qualities” (Prados and Cunningham, 2002: 429).

Gradually, the importance of agriculture in the developed rural world decreases, while other sectors, especially the tertiary, are on the rise. As a result, the rural world is not only considered to be “an agricultural and marginal area, but an attractive place to live” (Alvarado, 2006: 138). Inland areas with natural, environmental, ethnographic and/or landscape resources have the necessary elements to diversify their economy, and simultaneously, to keep people and even attract new inhabitants. In this sense, easy access to a large city, and therefore, to a large potential market, could lead to the development, through the tourism sector, of a depressed rural area.

This is the case of the region of La Vera, located less than two hours from Madrid, and which boasts a wealth



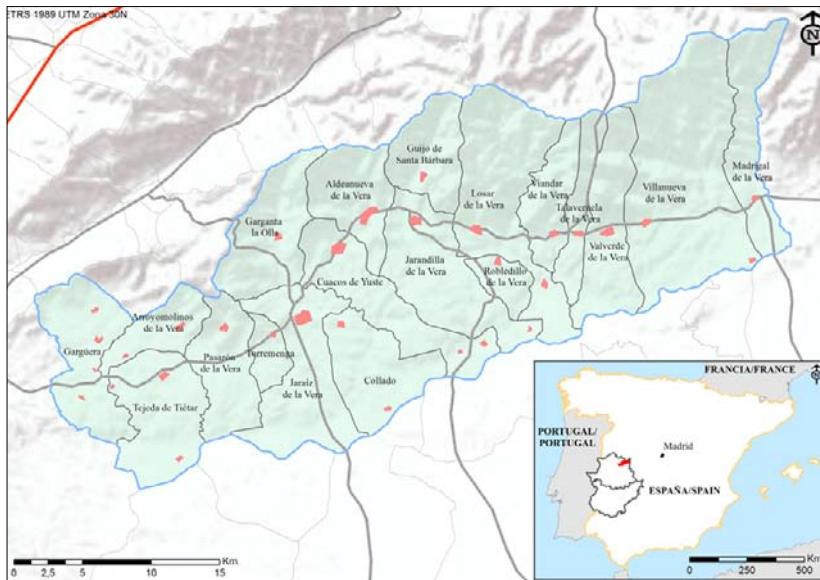


Figure 1. Geographical location of the region of La Vera (Extremadura, Spain)

Source: Prepared by authors using National Geographic Institute maps

of heritage resources, which are now being converted to tourism products aimed at a currently expanding market. The region is easily accessed by motor vehicle through express roads (A-5 and EX-A1 highways) from the capital of Spain, thereby linking the region with the largest potential demand in the country. Additionally, the bordering market, Castilla-Leon and Castilla-La Mancha, which consider this area a good destination for short holidays.

Moreover, within the region's limits we can find a significant number of Protected Natural Areas (PNA) which act as tourist attractions along with other nearby areas outside of the region, which are nonetheless of great importance, such as the Monfragüe National Park. All this, combined with a significant increase in tourist accommodations, has allowed this northeastern region of Extremadura to improve its future opportunities.

Meanwhile, the heritage resources in this area have increased the number of second homes, which are not always legal, on undeveloped land. In fact, the region of La Vera is one of the areas of Extremadura where we have detected a high number of illegal and clandestine housing. All those elements that have favoured the development of the tourism industry have also seduced newcomers. These people see the agricultural area of La Vera as the perfect place to build their second home. They join those locals and/or their descendants, who "after a few years away come back and build modern-style homes" (Gómez, 1975: 9).

The aim of this study is to measure the degree of residential occupation of undeveloped land in the region of La Vera and find out the preferred location for said residences. Therefore, we are interested to see if the location of heritage resources, now converted into

tourism products, is closely linked with the construction of second homes. Finally, we try to discover whether the appearance of these buildings interferes with tourism development and environmental protection.

2. The natural region of La Vera: a geographical area of great potential

The region of La Vera is a geographical area located on the southern slope of the Sierra de Gredos (Figure 1), composed of 19 municipalities located in the northeast of the Autonomous Community of Extremadura. It covers an area of 883.44 km², and is strongly influenced by its natural environment. Within its boundaries are numerous rivers, that due to steep slopes become gorges in granite rock, now transformed into a major tourism resource in this area. Its whole river system ends in the Tiétar River, one of the major tributaries of the Tagus River. The presence of the mountains gives the region a microclimate (Csb) characterised by average annual temperatures around 15°C and heavy precipitation in comparison with its surroundings (900-1700 mm/year), with a marked dry season in the warmest months. The mild summer temperatures combined with water resources help to transform the region into a benchmark of rural interior tourism.

Settlement in this area is concentrated, despite the existence of 31 towns. The municipalities are located along a path that crosses the region SW-NE, which is today the EX-203 interregional road. This road acts as a corridor allowing for travel between all of the municipalities and Plasencia (one of the most important cities in the region, which is also connected



to Madrid by train). All other roads cut across this corridor (NW-SE), and connect the main towns with high capacity roads, such as the aforementioned A-5 and EX-A1 highways.

The population of this region is 25,072 inhabitants (28.38 inhab./km²), although since the beginning of the century a slow but steady process of depopulation (-4.49%) has been experienced. The largest city is Jaraiz de la Vera (Table 1), with 6,515 inhabitants, but there is population stagnation. This municipality acts

tobacco during the first decade of the 21st century. In fact, only four municipalities have escaped demographic decline, all with very small relative values, except Torremenga.

From a purely economic standpoint, the region of La Vera was an area traditionally used for agriculture (in the areas of the Tiétar Valley) and ranching (mountain areas). However, with Spain's entry into the European Union, "these traditional activities have been phased out as tobacco plantations have become more and more

Towns	Population 2014	Area (km ²)	Population density (Inhab./ km ²)	Demographic trend 2000-2014 (%)
Aldeanueva de la Vera	2,163	37.62	57.50	-12.14
Arroyomolinos de la Vera	474	23.21	20.42	-18.70
Collado de la Vera	156	44.96	3.47	-32.47
Cuacos de Yuste	877	52.66	16.65	-8.36
Garganta la Olla	994	48.09	20.67	-4.42
Gargüera	106	51.64	2.05	-45.08
Guijo de Santa Bárbara	423	34.56	12.24	-13.50
Jaraiz de la Vera	6,515	62.56	104.13	0.56
Jarandilla de la Vera	2,994	61.54	48.65	-3.51
Losar de la Vera	2,846	82.11	34.66	-8.02
Madrigal de la Vera	1,751	41.64	42.05	4.41
Pasarón de la Vera	659	38.99	16.90	-5.99
Robledillo de la Vera	312	12.84	24.30	-4.59
Talaveruela de la Vera	350	21.34	16.40	-23.58
Tejeda de Tiétar	862	52.87	16.30	-15.98
Torremenga	641	12.16	52.73	18.05
Valverde de la Vera	522	46.97	11.11	-6.79
Viandar de la Vera	272	28.01	9.71	-15.79
Villanueva de la Vera	2,155	129.69	16.62	7.43
Region of La Vera	25,072	883.44	28.38	-4.49

Table 1. Demographic and territorial summary of the municipalities of La Vera

Source: National Statistical Institute (2014)

as the regional capital, and is followed in importance by Jarandilla de la Vera, Losar de la Vera, Aldeanueva de la Vera, and Villanueva de la Vera, all above 2,000 inhabitants. Its terrain has largely caused the region to become an area "of population flight due to the lack of employment opportunities caused by poor agricultural conditions and the absence of a business network" (García, 2013: 329). As a result, most of the municipalities have a high degree of aging, partly offset by the arrival of North African immigrants who harvested

profitable as a result of Common Agricultural Policy grants". (IDOM, 2008: 4).

The cultivation of tobacco depends heavily on EU subsidies and has a permanently uncertain future. Tobacco production in the region accounts for about 35% of annual production in the country according to data from the Survey on Employment and Social Importance of the Tobacco Crop in Extremadura (FOREM, 2011: 11). This is proof of the relative weight



of this sector in the regional economy, on which thousands of direct and indirect jobs depend. However, agriculture still accounts for 35.19% of Social Security contributors, while the tertiary sector (including tourism) accounts for 47.89%, with the rest belonging to the secondary sector¹.

Given the risks involved in monoculture, the farmers of La Vera and the government are committed to economic diversification. In the new model they intend to combine tobacco production with new cash crops and other traditional crops such as pepper, supported by a powerful Protected Designation of Origin².

Tourism plays an important role in this economic transformation, thanks to the enhancement of economic, cultural and scenic resources in the region. Today, tourism represents a significant portion of the economy of La Vera, and also employs a large number of workers.

3. Tourism resources and industry in La Vera

The region of La Vera has a lot of natural, historical and cultural resources that are officially recognised. The new socio-economic situation has forced the region to perform a reconversion that seeks a return on this heritage in order to maintain the population by making tourism an economic cornerstone. To achieve this objective, the Tourism Promotion Plan of La Vera was passed. It includes a number of strategies, programmes and actions aimed at specialisation and tourism promotion.

The natural and landscape value of the area is undeniable; for this reason the Natura 2000 network has an important representation within its boundaries (three SCIs and two SPAs). Additionally, there are another five areas included in the Network of Protected Natural Areas of Extremadura (RENPEX), bringing the environmentally protected land to a total area of 323.33 km², i.e., 36.60% of the region. Finally, there are a large number of bathing areas, associated with gorges and natural pools.

1. The Social Security contribution data are from the Institute of Statistics of Extremadura. (June, 2015)
2. Pimentón de La Vera is a culinary product derived from pepper that acquired the status of Product with Protected Designation of Origin in 2005. (Order APA / 4178/2005 of 22 December)

The region's built heritage includes those areas declared Places of Cultural Interest (PCI). A total of nine spaces (four Historical-Artistic Places, four Monuments and one Picturesque Landscape) have been deemed by the Autonomous Community of Extremadura to be some of the most valuable in the region due to their historical and cultural value.

These include the Monastery of San Jeronimo de Yuste, declared a Royal Site by the Government of Spain and European Heritage Label by the European Union, a distinction that in Spain is only shared by the Archives of the Crown of Aragon (Barcelona) and the Residence of Students (Madrid). Associated with the existence of the monastery and Emperor Charles V's stay and death, the region of La Vera is included within the European Cultural Routes. Furthermore, La Vera is known for its mountain architecture, characterised by its lattice construction. In this sense, "considering the historical, architectural, artistic, anthropological and cultural values of vernacular architecture should result in the declaration of heritage and sustainable heritage conservation to keep these signs of cultural identity alive" (Campesino, 2014: 109).

The intangible heritage includes the Festivals of Regional Tourism Interest such as "El Peropalo" (Villanueva de la Vera), "Los Empalaos" (Valverde de la Vera), "Los Escobazos" (Jarandilla de la Vera) and "Route of Charles V" (region of La Vera). To this we must add other events with the potential to attract tourism, such as the region's gastronomy and its flagship product, Pimentón de La Vera (paprika).

3.1. Supply of tourist accommodations.

The tourism sector in the region of La Vera has experienced significant growth and transformation in the last decade. The 19 municipalities have 120 accommodations, with a total capacity of 5,072 beds. That means one bed per five local people, which provides for the weight the tourism sector has in the economy of rural areas. To this figure we must add other tourism-related establishments, like restaurants (490), so there are 610 in total.

Rural accommodations, hotels and apartments are the leading types of accommodations. In fact, rural accommodations are the most numerous type of accommodation in the area, with 53 businesses, followed by apartments and hotels, each with 28. With regard to the number of beds, the picture changes entirely due to the characteristics of each



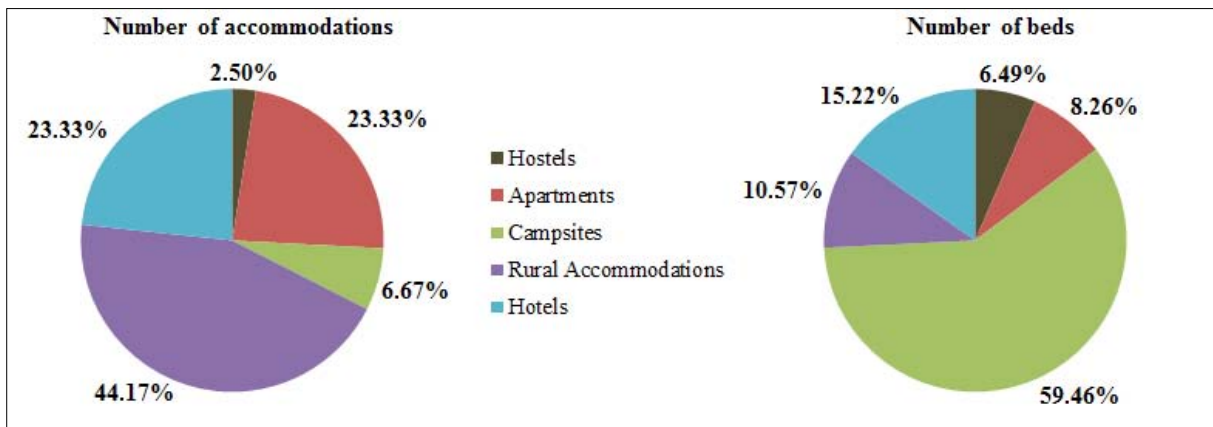


Figure 2. Percentage of establishments and beds by type of accommodation.

Source: Prepared by author using data provided by the Socioeconomic Observatory of the Provincial Council of Cáceres (2013)

facility (Figure 2). Thus, campsites take the lead (3,016 beds), followed by hotels (772 beds) and rural accommodations (536 beds), which still manage to maintain a significant weight.

The tourism accommodations on offer are unequally distributed by municipality. The number of establishments and beds is closely related to the size of the towns and their attractions. In this particular classification, Jarandilla de la Vera ranks first with its 1,473 beds spread over 15 accommodation establishments, followed by Losar de la Vera (1,063 beds/11 establishments), Cuacos de Yuste (744 beds/20 establishments) Madrigal de la Vera (673 beds/12 establishments), Aldeanueva de la Vera (463 beds/8 establishments), Jaraiz de la Vera (150 beds/11 establishments) and Villanueva de la Vera (148 beds/7 establishments). The other municipalities have fewer than 75 beds and two municipalities do not have any at all (Robledillo de la Vera and Viandar de la Vera).

If we compare accommodation capacity with the number of inhabitants, Cuacos de Yuste (0.85 beds/inhab.), Jarandilla de la Vera (0.49 beds/inhab.), Madrigal de la Vera (0.38 beds/inhab.), Losar de la Vera (0.37 beds/inhab.) and Aldeanueva de la Vera (0.21 beds/inhab.) stand out.

3.2. Characterisation of the tourism demand

Based on the latest data provided by the Tourism Observatory of Extremadura, an agency of the Government of Extremadura that studies and advises on the tourism sector, we can say that the region of La Vera, along with Valle del Jerte, has become the main rural tourism destination in the region. The data analysed, corresponding to the year 2014, belongs to three tourism offices (Jaraiz de la Vera, Jarandilla de la Vera and Villanueva de la Vera).

Tourism demand in the northern region of Extremadura has a predominantly domestic origin (92.8%), and the rest is mostly European (UK, Germany and France). Within this context, the Autonomous Community of Madrid (one province) represents 40.17% of tourists, followed far behind by the other provinces (Figure 3). Therefore, the Madrid market is essential for tourism, as its demand is 4.56 times that of Extremadura (Cáceres and Badajoz). Also noteworthy is the importance of other large urban centres. If we analyse the data by regions, Madrid remains in the lead, followed by Andalusia (9.22%), Extremadura (8.80%), Castilla y León (7.29%) and Castilla-La Mancha (5.50%), that is, neighbouring regions.

The socioeconomic profile of the average tourist is middle-aged people or adults (86.4% with an age

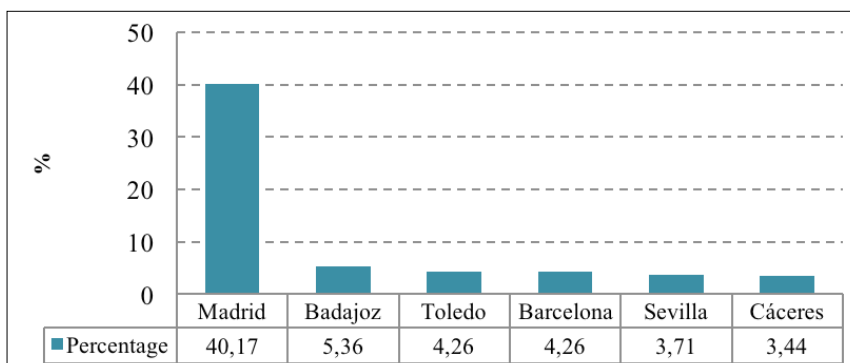


Figure 3. Percentage of tourists by their province of origin

Source: Tourism Observatory of Extremadura (2014)



between 30 and 65 years) travelling together (62.6%) or on family trips (23.4%), with advanced levels of education (70.8% university education, 24.1% secondary education) and who are first-time visitors to Extremadura (67.3%). The main purpose of their visit is to rest on holidays during short periods (weekends) as well as their interest in historical and cultural heritage, the natural environment and gastronomy.

93.9% of tourists say that they will spend the night in Extremadura, although nearly six out of ten do so for a period equal to or less than three days. These records confirm a trend seen throughout the province of Cáceres: "The average length of stay is short compared to other interior spaces with a rural tourist typology" (Rengifo *et al.*, 2013: 626). Combining several destinations, within or outside of the region, is one of the options for completing a longer journey. In fact, a large percentage of La Vera tourists visited other sites of interest in the region such as Monfragüe National Park (27.9%), Plasencia or Cáceres. With regard to the most popular accommodations, rural accommodations or apartments are at the top (20.1%), followed by 4/5 star hotels (13.9%) and 1 to 3 star hotels (11.6%).

In summary, tourists' assessments about key aspects of this tourism destination such as the conservation of cultural and natural heritage, lodging and restaurants, tourist signs, or public safety, are very good, as approximately 50% of tourists rate it with a quality equal to or greater than eight on a 0 to 10 scale, a figure that increases to 75.4% if we talk about overall satisfaction with the destination.

4. Second homes on undeveloped land in the region of La Vera

Traditional land use in rural areas has been replaced by the introduction of new uses detached from agricultural use. There are currently many more houses currently being built in the country than 15 years ago, of which "the leading customers for this kind of building are no longer agricultural producers but the urbanite user of second homes and tourism" (Cantó, 2007: 23). Leading up to this situation, Spain has experienced a significant real estate boom that has accelerated the process of artificiality. In Extremadura, construction on undeveloped land "is reaching levels that may cause concern in some locations" (Junta de Extremadura, 2005: 9). This is much more dangerous in areas with tourism potential such as La Vera.

Towns have welcomed some of this urban growth, although it is undeveloped land which accumulates the largest number of buildings of this type. This peripheral location allows for detached homes, which can be much larger and cheaper, and with adjacent gardens. The owners arriving from the city see "the countryside as a place of recreation and leisure, because they have all their basic needs covered thanks to the current model of development, and they are no longer forced to exploit the resources that the earth provides" (Ruíz, 2006: 455). We should note that in addition to these buildings, there are other second homes that belong to the local people. The construction of these homes is not always performed legally, so their growth is, in many cases, uncontrolled. Because the appearance of this type of building could potentially harm the natural environment, it may compete with the model of tourism development in the region. In fact, rural interior tourism takes advantage of existing resources in the natural environment to turn them into products. Therefore, any environmental interference may affect the tourism sector.

Territorial and urban planning is essential to combat this problem. The region of La Vera is one of the most advanced in the Autonomous Community in terms of land management. The La Vera Territorial Plan, finally adopted in 2008, is one of three regional planning instruments of this type that are in force in the region. In terms of urban planning, the situation is far worse. Only Madrigal de la Vera approved a PGM adapted to urban legislation, while the other towns (with the exception of Gargüera, which does not have any planning instrument in place) have very outdated Subsidiary Planning Standards.

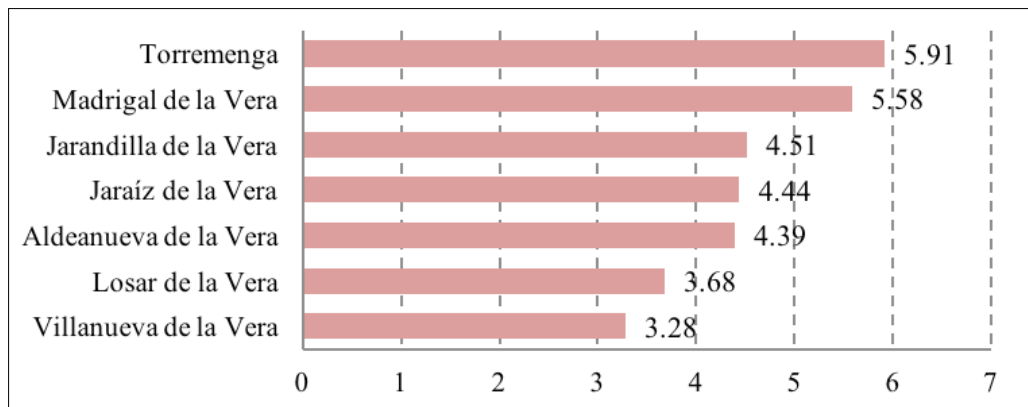
Undeveloped land makes up 98.85% of the region of La Vera, with no major differences between municipalities, as the percentages range from 96.61% (Jaraiz de la Vera) to 99.59% (Collado de Vera)³. In this geographical area, there are 17,515 buildings. By sweeps at a 1: 2,000 scale on the most current available orthophotography (2012), we proceeded to detect elements built on undeveloped land in order to subsequently digitise them, on a scale between 1: 200 and 1: 300. Then, we divided the buildings into four types: homes, possible homes, auxiliary buildings for housing and other.

3. Gargüera was excluded from the calculation of percentages as it does not have municipal urban planning laws that classify the land as urban, developable and undeveloped. However, statistics regarding the number of homes in this town are included in the study. For calculations performed on peripheral construction, we have used the urban land delimitation from the Directorate General of Land Registry



Figure 4.
Housing density on undeveloped land in the region of La Vera

Source: Prepared by authors



We found 2,315 homes, 572 possible homes, 1,858 auxiliary buildings and the rest, 12,770 buildings, belong to the “other” category, which includes all remaining possible types. Therefore, being conservative in our estimate, that is, considering only those buildings registered as homes, 13.22% of the existing buildings on undeveloped land have a residential use. On this last point, we begin to notice significant differences between municipalities. While residential construction accounts for over 20% of the total in places like Aldeanueva de la Vera (26.31%) and Madrigal de la Vera (24.60%), in other towns like Arroyomolinos, Gargüera and Tejada de Tiétar it does not even reach 4%.

If we consider only the number of homes, the parallels between the number of tourist accommodations and the number of homes on undeveloped land is evident. The villages that lead both fields are exactly the same, but appear in a different order. Therefore, towns that stand out due to their number of buildings are Villanueva de la Vera (410), Losar de la Vera (300), Jarandilla de la Vera (274), Jaraíz de la Vera (269), Madrigal de la Vera (233), Aldeanueva de la Vera (161) and Cuacos de Yuste (124). It is also

worth recalling that those are the most populous municipalities, with the best road connections, except for the last.

In terms of the density of housing on undeveloped land, the region of La Vera has 2.65 houses per square kilometre. These values may seem small, but we must bear in mind that the population of this area is concentrated, so the appearance of dispersed housing clashes with the traditional model.

Only the towns mentioned in the above paragraph are located above that average, plus Torremenga (Figure 4), which receives the highest value (5.91 houses/km²) due to its small size (the smallest in the region at 12.16 km²) and its proximity to the regional seat of government, Jaraíz de la Vera. At the other end of the spectrum, the municipalities that do not reach one house per square kilometre of land classified as undeveloped land are: Gargüera (0.60 houses/km²), Viandar de la Vera (0.51 houses/km²) and Tejada de Tiétar (0.32 houses/km²). The latter are among those municipalities with the fewest tourism resources and accommodation units with 12, zero and 36 beds respectively.



Figure 5.
Scattered houses on undeveloped land in the region of La Vera

Source: Prepared by authors



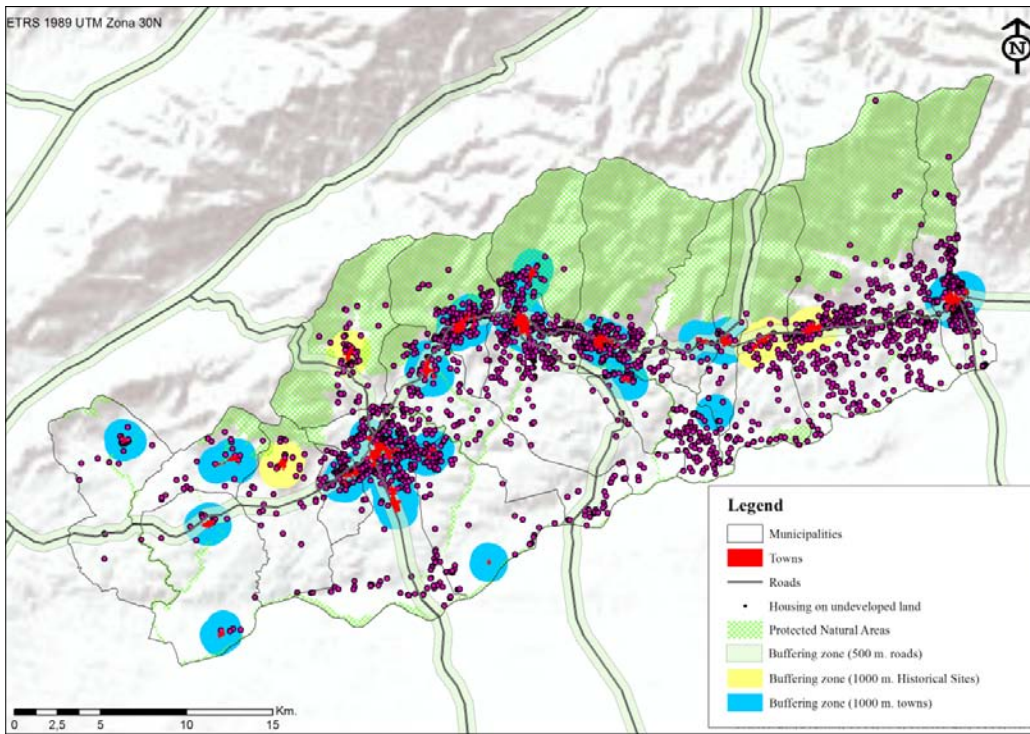


Figure 6. Location of housing on undeveloped land in the region of La Vera

Source: Prepared by authors based on fieldwork and GIS sweeps

We should note that legal construction on undeveloped land is also possible (Figure 5). In the geographical area studied, 134 homes have been authorised since 2001 (the beginning of the term of the legislative framework), by adopting urban classification files for ex novo construction, expansion, refurbishment or adaptation of buildings for residential use. There have been many requests for those authorizations (898), although only 14.92% have achieved final approval; the rest were dismissed for not meeting the requirements or not respecting administrative delays. By municipality, the town of Villanueva de la Vera leads with 79 authorizations (58.96%), followed far behind by Cuacos de Yuste, Valverde de la Vera and Jaraiz de la Vera with 12, 11 and 9 respectively. Also the absence of authorisations in Arroyomolinos de la Vera, Garganta la Olla, Gargüera, Guijo de Santa Bárbara, Pasarón de la Vera and Losar de la Vera is interesting, and the latter case is particularly striking due to the intense residential occupation of its undeveloped land.

Residential building outside the limits of urban and developable land has distinctive features compared to the towns' typical buildings, which are very attractive to the population. According to our analysis, the average area of housing on undeveloped land is 165.83 m²; this figure does not dip below the 106.72 m² registered in Gargüera, and reached as high as the average value of 229.01 m² registered in the municipality of Cuacos de Yuste. Generally, these homes are detached, single-family, with attached buildings and, in a high percentage of cases, with facilities for leisure and an adjacent

garden and pool. The artificiality of the territory that is due to buildings designed to offer residence in the undeveloped land in the region of La Vera is estimated at 383,891.81 m², to which should be added the sum of the surfaces of the attached auxiliary buildings and facilities that do not qualify as buildings (swimming pools, asphalt, etc.).

As for the location of these houses (Figure 6), their preferred location is in the peripheral areas. In fact, 52.40% of the houses are built less than a kilometre from an urban border. Looking at the distribution and size of the land, we can see that as we get closer to the town, it is much more fragmented. This is due to its older agricultural and livestock use in the subsistence economy, now replaced by secondary residential use.

This transformation becomes an urban issue in towns, and also has a significant impact on the landscape, which is particularly worrying in those towns declared to be Historic Places. Additionally, the terrain on which towns are located, the southern slope of a mountain range, causes a higher landscape footprint for this construction. In relative terms, at the municipal level, the concentration of housing around these four towns is among the lowest in the region, but its values are not negligible (between 16.83% and 65.57%). However, it is easier to determine the impact if we consider the absolute values: Pasarón de la Vera (18), Valverde de la Vera (29), Garganta la Olla (40) and Villanueva de la Vera (69).



The influence on the towns' landscape is not limited to those with cultural protection. The municipalities with the largest population and the highest total number of homes on undeveloped land is where the highest concentrations of housing close to urban centres are recorded, consistently above one hundred: Jaraíz de la Vera (193), Losar de la Vera (162), Madrigal de la Vera (139), Aldeanueva de la Vera (134) and Jarandilla de la Vera (128).

Other preferred locations are near roads. Considering only the major roadways, 37.15% of housing on undeveloped land is located within fewer than 500 meters. Good connections become a key aspect, especially relevant for homeowners whose primary residence is in another region.

If we consider the two aspects studied, the percentage of homes that meets at least one of these requirements increases to 63.15%. Accessibility and available services (restaurants, shopping areas, leisure, etc.) in urban areas are comforts that the urbanite is not willing to give up even during holiday periods in inland tourism destinations.

Nature, understood as a tourism resource, is a great attraction factor for those seeking rural interior tourism. A sustainable balance between protection and use of protected natural areas is difficult to maintain. In this regard, the uncontrolled construction of second homes may cause environmental damage that will be difficult to repair by mass tourism environments. Fortunately, illegal construction on natural areas in the region of La Vera does not currently amount to a quantitatively significant problem. Only 4.23% of homes are located within environmentally protected areas; however, these 98 buildings, though few in number, represent a serious environmental impact. Monitoring of these areas must be constant, as the PNA are surrounded by "belts of buildings that are suffocate it, negating the existence of the essential protected perimeter areas" (Delgado, 2008: 299). In the area studied, we found 237 homes at a distance of less than 100 meters from the outer limit of the PNA, increasing to 1,040 second homes (44.92% of the total) if we expand that area of influence outwards to 500 meters.

Tourism professionals and the public administration should be aware that the region's infrastructure and natural and cultural resources are, simultaneously, the drivers of tourism activity and an element of attraction for the occupation (sometimes illegal) of undeveloped land. Tourism promotion in these areas has led to the growth of tourism and La Vera's economy, while also attracting new seasonal residents whose buildings may

be detrimental to one of the drivers of the economy, affecting the very landscape and heritage environment that is the basis of this growth. Territorial, strategic, environmental and heritage planning can be a great ally to protect environmental quality and regulate economic activity, which would result in the orderly growth of a tourist destination with great potential such as the region of La Vera.

5. Conclusions

The urbanisation of the countryside for residential purposes has a higher impact in areas that, such as region of La Vera, combine tourism resources, products and accommodation. A powerful tourism sector is based on a territory with a well-connected, attractive rural environment, factors that in turn attract new seasonal residents who build second homes.

The proximity of important markets such as Madrid strengthened the tourism industry in its early stages, which led to the creation of a significant number of establishments and hotel rooms compared to the number of local people. This fact has modified the economic structure of a traditionally agricultural region, thus providing opportunities for the population to remain in the area. However, tourism product seasonality causes the occasional overcrowding of destinations and the overflow of supply in very specific moments. Second homes, traditionally belonging to local people have increasingly become an option for enjoying the landscape studied here. In fact, this area has experienced a significant increase in the number of houses built in the countryside, far greater than other parts of the region. Nevertheless, considering the number of homes built on undeveloped land and the number of authorised urban classification permits, we notice a disturbing trend in illegal residential growth.

The economic return from these new residences (which are not used continuously throughout the year) for the region of La Vera is almost negligible. If we focus on those homes built illegally, neither their construction or use, nor their non-existent tax contribution or owners' consumption justifies the occupation and the environmental impact. Furthermore, their location limits the legitimate growth of towns, crowding roads and protected natural areas, in clear confrontation with traditional sustainable regional and town planning.

High densities of buildings also match the most populated towns and those with the greatest tourism



potential, and even compete unfairly with legal tourism. The more attractive the location of illegal housing, sometimes within or on the border of areas with high ecological value, the better these buildings are positioned in the tourism offer. Also, because they ignore legal requirements, they are larger and better equipped than tourism accommodations.

In conclusion, the government should tighten control over this unlawful growth, especially when the region's economy depends heavily on tourism. The proliferation of housing on undeveloped land affects the area's landscape, and even interferes with legal tourism activity. Therefore, this process must be stopped in order to strengthen tourism in the region of La Vera.

6. Acknowledgments

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Participatory territorial strategies as renewed diagnostic tools in the context of the European Cohesion Funds, 2014-2020. The case of the Region of Valencia*

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Abstract

The European Union requires participatory territorial and strategic diagnoses in the context of the Structural Fund (2014-2020). Their aim is to adapt possible investments to the real necessities of the territories and of their citizens. City councils, as actors of local development, are developing strategic plans. In the Valencian Community, they established the Valencian Territorial Strategy (1/2011, January 13), which promotes an economically more competitive territory that is more respectful of the environment and more cohesive and integrated in terms of social development. Since this strategy was approved, municipalities like Cocentaina, Villena, Alfafar, Torreveja, and others have implemented these plans, with a marked participatory character. Therefore, we would like to share the know-how and the methodologies implemented by the Human Geography research group for the plans carried out in the municipalities of Villena (Alicante) and Alfafar (Valencia).

Keywords: civic participation; territorial strategy; cohesion fund; good practices in local development.

1. Introduction

Local governments face a major challenge: changes in productive, political, regulatory, fiscal and communication processes require increasingly fast and flexible decisions and responses that increase community benefits. In order to address this challenge, greater participation and opportunities to make decisions are also being demanded. We must adopt a management style that enhances aspects like leadership and networks of partnerships in a proactive context of public service in the local government, which could be threatened by new changes in the *Rationalization and Sustainability of Local Government Law* (Law 27/2013).

Given this scenario, both national governments and international organisations promote management tools, spaces for reflection and economic resources that incorporate city councils in this context where local development has a key role in new European funds. There is a shift in the use of these tools as a means through which local governments can encourage processes (long-term financing) instead of a tool by which local governments achieve projects (short-term financing).



Despite similarities in problems and the partial or whole solutions adopted, case studies have their own local development policy depending on the different countries of the European Union. Country organisation, level of decentralisation, development and identification of local production systems and application of comprehensive or sectoral policies determine specific local development actions depending on the territory and therefore need to be analysed in their territorial context (Romero J. and Farinós, J., 2011: 296). In fact, faced with regional policies that have been used over the past three decades, a renewed concept in the implementation of local development policies has been established, a concept that has been evolving over this decade. Governance as a methodology and system has the ability to increase capital, activities and knowledge through commitment and a sense of belonging to the territory. This allows for new policies to be established but not replaced, because there are a set of institutions and actors that are outside the government sphere (Delfour, C., 2007; 41). Therefore, governance should involve the promotion of network participation in order to achieve finite projects, as well as promoting self-assessment capacity for further improvement. All this must also take into account the consideration of administrative and territorial levels and the ability of the local community to have autonomy in decision-making, as well as encouraging public and citizen participation and also enhancing cross-disciplinary, coordinated actions.

Indeed, governance arises in the context of a so-called “crisis of governance”. This discourse emphasises the relationships between local authorities and their citizens and promotes horizontal coordination among multiple social actors in policy-making (Natera, A., 2005: 55; Font, J., Montero, J.R. y Torcal, M., 2006: 27).

Certainly, municipalities as the representative bodies closest to the citizens and as managers of local policies are seen as the administrative body that does the most with regard to implementing actions and decision-making in terms of “good governance”. Local democracy in Europe has evolved and over the last three decades different forms of articulation, action models and levels of decentralisation have been established. Four decades ago the most important problems for local authorities were the acquisition and optimisation of basic services like water supply, paving streets, redevelopment of industrial and commercial areas, sewers, etc. In this most recent decade, citizens have demanded other measures and renewed solutions that take into account the new context and needs.

2. New possibilities in the European cohesion policy (2014-2020). “Research-action-participation” methodology to help local governments

The current European policy on integrated local development is based on the reform of the Structural Funds regulated by EEC/2052/88 of the European Council of 24 June, 1988. This reform is implemented by four regulations promulgated on December 29, 1988 and entered into force on January 1, 1989. The reform of the Structural Funds combined local development with the regional policy framework through Community Initiatives (Martínez, A. Pérez, D. and Sancho, I., 2000: 50).

The concept of integrated local development was incorporated into the priorities of the European Social Fund (ESF) and included in the financing of regional operational programmes and Community Initiatives (1991-2006) (Horizon, Now, Integra, Adapt, Leader, Urban, Equal, etc.). Local Development reached a prominent role linked to the exploitation of so-called “new employment fields” with the publication of the White Paper on Growth, Competitiveness and Employment in 1993. The summits of Amsterdam and Luxembourg gave new impetus to local development by including it as a priority in the European Employment Strategy, which was incorporated as a new section in the Treaty on European Union.

In the last 20 years, the LEADER approach for local development carried out by local communities, based on the experience of an initiative financed by EU Structural Funds and designed to help rural actors consider the long-term potential of their regions, has proved an effective and efficient tool in the implementation of development policies. The European Commission has also promoted this method of execution through other community initiatives such as URBAN and EQUAL. In the case of LEADER, for which the EU has provided continuous support since 1991, the programme has become an important element of rural development policy with a high level of acceptance throughout Europe (Esparcia, J. *et al.*, 2015: 356). Indeed, the proposal provided for in Regulation (EU) n° 1303 of the European Parliament and of the Council of 17 December, 2013 and Articles 30 and 31 for Community-led Local Development (CLLD) is based on the LEADER approach and concerns all funds covered by the Common Strategic Framework (the European Regional



Development Fund, the European Social Fund, the European Agricultural Fund for Rural Development, the European Maritime and Fisheries Fund and Cohesion Fund) in the 2014-2020 programming period (the MEC funds). CLLD is a specific tool for use at the sub-regional level, which supplements other development support at the local level¹. What is more, Article 174 of the Treaty on the Functioning of the European Union (TFEU) provides that, in order to strengthen its economic, social and territorial cohesion, “the EU shall aim at reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions or islands. Among the regions concerned, particular attention shall be paid to rural areas, areas affected by industrial transition, and regions which suffer from severe and permanent natural or demographic handicaps such as the outermost regions, the northernmost regions with very low population density and island, cross-border and mountain regions”.

Certainly, territorial cohesion is present and taken as an effective and efficient tool to promote participative local development, considering the territory's potential and local needs to be essential, as well as relevant sociocultural characteristics. The responsibility to develop and implement local development strategies should be given to local action groups representing the interests of the community. Specific provisions regarding the definition of the area and population to which local development strategies are applied should be established in the relevant programs under the Fund-specific rules.

In general, the objectives to be attained are (Martínez, A., *et al.*, 2014: 168):

- Encourage local communities to develop integrated bottom-up approaches in cases where there is a need to respond to territorial and local challenges that require a structural change
- Build community capacity and stimulate innovation (including social innovation), entrepreneurship, the capacity for change by encouraging the development and detection of untapped potential in communities and territories
- Promote community ownership by increasing participation with communities and a sense

1. Regulation (EU) No 1303 of the European Parliament and the Council, December 17, 2013 (Articles 30 and 31)

of involvement and ownership to improve the effectiveness of EU policies

- Assist multi-level governance by providing a route for local communities' full participation in carrying out the implementation of EU objectives in all areas

During the 2014-2020 period, one of the major tasks for local authorities is to develop Integrated Sustainable Urban Development Entities, which are required to finance activities of this nature in cities with FEDER funds. In order to achieve this goal, an integrated strategy or general strategic plan will be needed to provide a territorial and sectoral reference framework define, carry out and evaluate actions”².

As already noted above, the Local Entity must present an Integrated Strategy to access this funding because in the 2014-2020 period these strategies must be assessed, not isolated projects. It will be the Local Entity which proposes actions included in this strategy that is co-financed with FEDER funds, always with the validation of the managing authority (in this case the Ministry of Finance and Public Administration)³.

Certainly, as a European guiding principle for participatory territorial strategies, it is necessary to mention the Partnership Agreement with Spain 2014-2020, submitted to the European Commission on 22 April 2014 and approved on 30 October 2014, which states that “new urban development proposals will be required to be supported by a clearly defined long-term strategy to provide a territorial and sectoral reference framework for all operations or interventions to be implemented which should contribute to that strategy coherently”. Accordingly, it is necessary to note that the challenges of the Europe 2020 Strategy are also a basis for this local policy document, as they aim to define the place that European territories should occupy in a global world in 2020. The related local integrated development strategies must be consistent with the specific programmes in the Common Strategic Framework (CSF) Funds. Moreover, local strategies should define the area and population covered by the strategy;

2. Ministry of Housing, Public Works and structuring of the territory, *Orientación a los municipios para el acceso a la financiación FEDER en las intervenciones urbanas*, November 2, 2015

3. Working Group for Urban Initiatives Network (RIU) of the Spanish Federation of Municipalities and Provinces www.femp.es “Recomendaciones para Estrategias Integradas de Desarrollo Urbano Sostenible durante el periodo de programación 2014-2020”



include an analysis of the area's development needs and potential, including an analysis of strengths, weaknesses, opportunities and threats; describe the objectives and the integrated and innovative character of the strategy, including targets to be achieved as a result. Strategies should also include an action plan showing how the objectives will be translated into concrete projects, management and monitoring agreements and financial plans.

3. Affiliated territorial strategies in the Valencian Community: from theory to practice

Current strategic planning in Valencia cannot be understood without reference to the Valencian Community Strategy approved by Consell Decree 1/2011 of 13 January, which laid the foundation for participative strategic plans carried out by municipalities. Since then, forecasts and recommendations for the Valencian sub-regions have been established which envision a more competitive territory at all levels, thereby creating added value. That document addresses topics such as citizen participation, territorial cohesion, cultural heritage, sustainability, environmental resources, infrastructure, and other parameters. The document is synthesised in seven main areas. The first one is the *effectiveness* of the territories in terms of their consumption of resources such as land, water and energy; *connectivity* for the dissemination of knowledge and better distribution of territorial dynamics for the advancement of the territories; *proximity* between housing, services and people in order to create more sustainable and efficient development and consumption; the *diversity* of the territories to ensure that they can adapt better and more quickly to different economic, social and environmental situations. The Valencian Territorial Strategy protects and strengthens a territory where population, land use and economic activities live harmoniously. Furthermore, it promotes *innovation* as an instrument to create value through both higher quality in traditional sectors and new activities related to the knowledge society, including the evaluation of the personality and singularity of the Valencian territories in order to be competitive in a global market without losing their uniqueness. In short, it seeks social cohesion through territorial governance that is able to create frameworks for stable and transparent public-private agreements, thereby simplifying administrative requirements and procedures.

In this context, the Department of Human Geography at the University of Alicante has been serving

municipalities developing participatory strategies. Thus, our team believes it is necessary to provide meaning and content to words such as participation, citizenship, strategic planning, collective intelligence, open government, governance, representation, economic development, and innovation.

3.1. Methodology and implementation of the Participatory Territorial Strategy (2012-2015): the cases of Villena (Alicante) and Alfafar (Valencia)

Territorial Strategies for municipalities have to be flexible and an inductive instrument and should therefore be subject to the town's social, economic, environmental, cultural and political dynamics, allowing for programmatic action and systematic government arising from a previous process of reflection and participatory analysis in order to establish a protocol of objectives and actions. This protocol enables the public to evaluate and monitor in order to define the basic guidelines that should govern socio-economic management in the municipality under an integrated approach and create conditions that qualify for European support under the *European Cohesion Policy* (2014-2020). Our objective is to develop the "research-action-participation" methodology, which generates spaces for exchange and dialogue between researchers, policy makers and citizens. After that, the methodology also obtains feedback that allows for a diagnosis and proposed actions.

The above facilitates the process of including the largest possible number of actors and institutions, thereby enabling a greater sense of local ownership and a greater capacity to create a collective project. This, in turn increases community cohesion around some of their own goals and also the need to find the cultures, markets and capital required for their present and future development.

In accordance with the above, public participation is understood as the process that allows a society to influence and take part in making policy about the decisions that affect them (environment, services, culture, health, immigration, etc.). Otherwise, participation becomes the "practice of too much talk, too little action". Therefore, in general, the Territorial Development of these municipalities should be based on:

1. Identifying opportunities at the provincial, regional and municipal levels to develop innovative projects in the field of employment and local development



2. Recognising environments and territories that are innovative or favourable to the generation and diffusion of innovation
3. Identifying good practices by sectors and comprehensively
4. Distributing and/or strengthening the concept of regional innovation
5. Defining, implementing and developing a methodology for identifying opportunities for innovation, talent, and leaders in the local context through citizen participation
6. Informing and spreading awareness of the need and importance of proactive participation

The socio-demographic groups we have worked with include young people, retirees, housewives, associations, socio-economic sectors and municipal officers. We have focused on an analysis of specific issues based on the nature and characteristics of the city, including the historic centre, industrial parks, natural areas and tourism, etc. Also discussed were instrumental actions related to land use such as urban planning and preservation and management of natural resources; and socio-economic issues such as promoting new fields of employment, support for entrepreneurship and boosting employment. All of these programmes fit into the European Cohesion Policy (2014-2020).

3.1.1. Villena's Territorial Strategy + Innovation (ETV+i) and Alfafar 2020. A model for the municipalities of the Valencian Community

We will use two towns that have based their strategic plan on citizen participation, and that choose to benefit from the ERDF funds for 2016 as a reference. Thus, our study areas were Villena, with a 2014 census population of 34,530 inhabitants, dedicated to agriculture, industry and commerce; and Alfafar, with 21,305 inhabitants and dedicated to services, largely benefited by the presence of an IKEA.

In April 2012 the ETV + i, a project funded by the city of Villena (Alicante) and coordinated by the Department of Human Geography of the University of Alicante, started. We soon realised that a regular diagnosis or usual descriptive study, as has been done in other cases, was not necessary. In late 2012, the large number of strategic plans developed in the province of Alicante forced the

community to hold a meeting to optimise the initiatives undertaken at the request of different organizations: the University of Alicante, the Chamber of Commerce, Coepa (Confederation of employers) and the Diputació de Alicante (the Provincial Delegation), among others. The excess of strategic documents had caused a considerable paralysis in the actions proposed.⁴ These plans were further hindered by an apparent disconnection from the reality of each territory, the lack of prominence of citizens, the high costs of some of the projects submitted and the partisan interests of the city councils and other institutions. In this scenario, two separate strategic plans existed in the municipalities of Elche (2011) and Alicante (2012), which did not contribute to considering strategic planning as an effective, efficient and useful tool, rather than just a utilitarian instrument. In fact, the general perception is that many of these documents have been used for a descriptive diagnosis, with no consistent proposals or proactive actions, and without true public participation of citizens⁵. Following the management and development model of the ETV+i, we began Alfafar 2020 in January 2015; the strategic plan's name comes from the suburban area of this town within the area of the city of Valencia and located in the region known as l'Horta Sud.

Both strategies included among their objectives the reconciliation of some of the guidelines of the Territorial Strategy of the Valencian Community, adopted on 13 January 2011 by the Generalitat Valenciana, and its forecasts for the regions of Vinalopó and l'Horta Sud. It also aimed to promote a more cohesive and inclusive territory through the proposals. We must not forget that Villena is the second largest municipality in the province of Alicante (345 km²), and has a productive system traditionally based on shoe making and agriculture and that, above all, services play a particularly noteworthy role in the local economy. Alfafar also stands out with an area of 10.1 km². More than 80% of the Albufera natural park is located within the municipality and it connects three commercial and industrial areas, one of which includes the Swedish store IKEA.

Plans, analyses and diagnostics were prepared and workshops, conferences, symposia and citizens' assemblies were held with the following objectives:

4. "Los expertos apuestan por revisar los planes estratégicos para reactivar la provincia. El urbanista Alfonso Vegara y los catedráticos Andrés Pedreño y Joaquín Melgarejo abogan por impulsar proyectos e ideas que no requieran grandes inversiones" *Diario INFORMACIÓN*, Saturday, November 10, 2012
5. *Impulsa Alicante. Diagnóstico competitivo y grado de desarrollo de la ciudad de Alicante* (2012), Deloitte and Alicante Town Hall, 321 p. ; *Elche. Proyecto Ciudad* (2011), Fundación Metrópoli and Ajuntament d'Elx, 233 p.



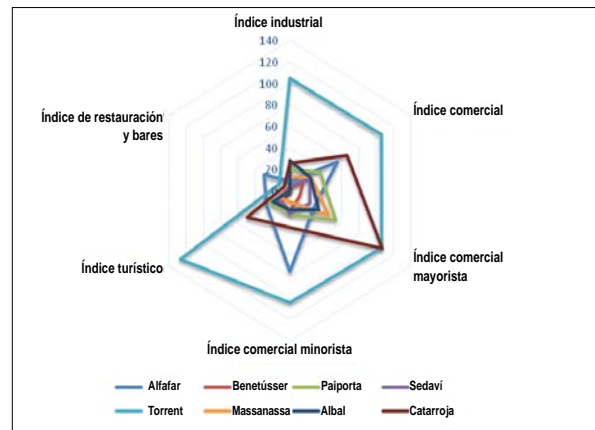
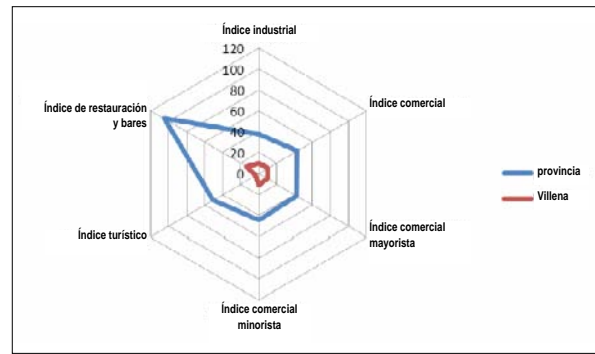
- Detect, identify and diagnose the municipality's existing and potential needs, grouped by areas of management needs: economy and employment, tourism and heritage, environment and agriculture, urban development and infrastructure, governance and citizenship, etc.
- Systematise the documentation provided by public and private entities in order to establish a final report containing proposals for action with efficiency and effectiveness criteria (with their subsequent general development and special plans at the municipal level)
- Promote collective and shared reflection on the territorial model and government actions, involving citizens, the private sector and local government throughout the process

In short, the methodology has been *ad hoc*, with a strong flexible, innovative, experimental and experiential nature. First, doing a compilation and analytical synthesis of the previous projects since 1980s. The Highlights include *Local and Provincial Strategic Plans*, plus the analysis of the documentation provided by some people.

To systematise the information obtained, a file analysis was constructed with the following sections: *Motivation (Why)*, *Objectives (What for)*, *Methodology (How it is done)*, *Content (what has been done so far)*, *Results (what has been achieved)*, *Conclusions (Evaluations)*. The intention was to obtain an overall idea of the town, beyond the mere statistics and socio-economic figures that are commonly used by foreign consultants in their conventional strategic planning, where a certain degree of ignorance of the actual circumstances of the municipalities under evaluation has been detected.

Secondly, a system of indicators was applied. This system measured industrial and commercial indexes and commercial activities, and was used to create comparisons with other towns in what has been called the "development polygon" (Figures 1 and 2). Thus, we identified and defined the territorial innovation opportunities in Alfafar and Villena, as compared to nearby towns, in order to strengthen the qualitative aspects extracted from participatory workshops and citizens' assemblies from a quantitative point of view.

Citizens have also voluntarily assumed an active role through open and sectorial meetings that



Figures 1 and 2. Development Polygons for Villena and Alicante Province and Alfafar and neighbouring municipalities

Source: Produced by authors

have received people and groups of all kinds. The reason behind this was to achieve a double process: data collection (workshops and interviews) and determination of priorities and needs (citizens' assemblies), while generating greater involvement from citizens in the development of ETV+i and Alfafar 2020, who attended to gain information, in the spirit of voluntary and legitimate participation, and who had no organisational or legal motives (by belonging to an association, union or organisation).

The involvement of citizens in the process of drafting the *Territorial Strategy for Villena + Innovation and Alfafar 2020*, materialised in a series of workshops with an agile, innovative, easy to apply methodology adapted to the needs of the territory and the group that attended.

a) *Open and closed surveys*. This technique allowed us to agilely produce and organise a wide range of ideas on various topics (urban planning, social institutions, economy, equipment, forward planning of the city). The dynamic was split into three parts. At first the participants were distributed in groups. Next they talked about the matter presented. Finally, the moderator presented each group's conclusions





Figure 3. Mind Map: Local Resources of Villena (Alicante)

Source: Prepared by authors

- regarding positive and negative aspects and proposals for change or new proposals on a screen to all attendees.
- b) *Focus group*. This technique encouraged small group discussion on a specific topic. They were usually done with groups that had prior first-hand knowledge of the issue which would be discussed, either because they were members of an association related to the matter or because they worked on those same issues daily. This fostered a strong interaction between all members, resulting in a synergistic effect that triggered a barrage of responses and brainstorming among all who were there.
- c) *Elevator pitch*. This involves presenting the main ideas that occurred to participants in relation with the question asked in less than a minute. The dynamics of the participation workshops followed this structure. First, each participant presented their vision for the municipality to all the other attendees, taking into account the past, the present and the idea of the city they wanted for the future. They were then divided into three groups of four participants comprising representatives of a political party or other association group. Each group agreed upon and wrote down the key issues for the social, territorial and economic development of Villena. Finally, the spokesperson from each group presented the ideas to all the other attendees.
- d) *Mind and concept maps*. Mind maps are a very effective way of extracting information from a synthetic method. We tried to apply a logical and creative method to express ideas which consisted of literally mapping reflections on a subject. In this case, this methodology was used in workshops with young high school students, who could illustrate their perception of the municipality's main elements through symbols, words and images (Figure 3). It should be noted that over one hundred subjective or mind maps were created by the students of Villena's three high schools.
- As for the elements and monumental milestones, the most frequently featured in their drawings turned out to be the castle, appearing in 96.3% of the final results. This was followed by the bullring, with 80.4% and then the historic centre and monuments such as Santiago, Santa Maria and the historic districts, with a total of 64.5%.
- e) *SWOT / CAME*: This dynamic follows the following pattern: we divided the participants into groups. Each of the groups extracted the municipality's **S**trengths, **W**eaknesses, **O**pportunities and **T**hreats and compared them with the aim to **C**orrect the weaknesses, **A**dapt to the threats, **M**aintain the strengths and **E**xplore the opportunities. This method was applied to analyse the socio-economic aspects of future employment, land and infrastructure use, environment, culture and heritage.



In the case of Villena and Alfajar, these methods were performed with different groups and political parties. In this regard, the performance of the political groups from Villena stands out, due to its greater variety of political parties. Sixteen representatives from the five parties in the municipality of Alfajar (Partido Popular, Ciudadanos, Compromís, Izquierda Unida and Partido Socialista Obrero Español) attended the dynamic, which applied the SWOT-CAME method on four fundamental aspects: the socio-economic future and employment, applications and infrastructure planning, environment, and culture and heritage.

Moreover, the approach was flexible, as it was not a closed and fixed method. It had the ability to be adapted in order to change and to respond to developments as they arose, incorporating them in a systematic way. Hence, the process benefited from those elements that might be useful and enriching.

Public communication achieved five essential functions: ensure the transparency of the process, provide information on and publicise the activities carried out, raise awareness through explanation, encourage discussion, and finally, motivate people to participate in a key process for strengthening coexistence and future town planning initiatives. We also used social networks and email, with more than 350 addresses, to invite citizens to every workshop and assembly.

Thus, communication has assumed different functions throughout this process: a *means and purpose*, as an instrument for informing society as well as an inspiring and guiding principle in management; a *strategic factor*, with a planned, coherent approach to achieving development objectives; a *conversation*: not only people have been informed, but there has been in-person and digital participation; a *redefinition* of “telling what is done”, as this has become “telling with those who do it”, and which is why we have not sought a picture for purely propaganda purposes; a *showcase*, to give visibility to the collective work of the people who have participated in the various activities (workshops and meetings), thus increasing transparency and facilitating accessibility. In short, we can say that in order to participate, you must first know how; to get involved, you need to understand how; and finally sharing requires trust. Only then can we connect the will of all in a common project (Figure 4).

In this sense, the system of conventional media communication can be compared to an iceberg: the visible part, the top, is occupied by the media (newspapers, radio and television). They are usually

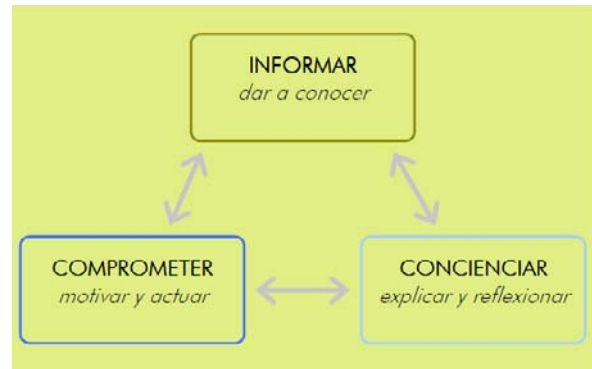


Figure 4: Functions of communication in participatory strategies

Source: Created by authors

responsible for providing visibility for issues that shape the “reality” and “what is happening”. However, they also have the power to set the agenda for the issues that should be considered “relevant” (*agenda setting*). During the development and implementation of regional strategies, the media has echoed, at all times, the motivations, actions and results through successive public appearances and, above all, the constant sending of press releases. Then the newspapers, radio and local, regional and provincial television have taken care of (re) transmitting and sending back (bi-directionality) this information to all citizens.

3.2. Results of the workshops

Both ETV+i and Alfajar 2020 were structured into subject areas for study and proactive, participatory and applied analysis, relying on transparency and communication (media, training activities, sectorial meetings and blogs). From the workshops carried out with all the demographic and professional profiles discussed earlier, the idea of the role that the city could play for the town of Villena in the districts of Vinalopó and Alfajar in the metropolitan area of the city of Valencia stood out (The role that the cities could play in their influence areas. Villena in the district of Vinalopó and Alfajar in the metropolitan area of Valencia)

As for the elements that need to be maintained and strengthened, those chosen as a first option were the historic centre, the industrial and commercial areas, natural areas and tourism. There was a need for activities to be better positioned than they are today. Among the actions that need to be taken, the workshops first highlighted instrumental actions linked to land use (such as General Urban Development Plans, the preservation and management of natural resources) and socio-economic actions, such as the promotion of new



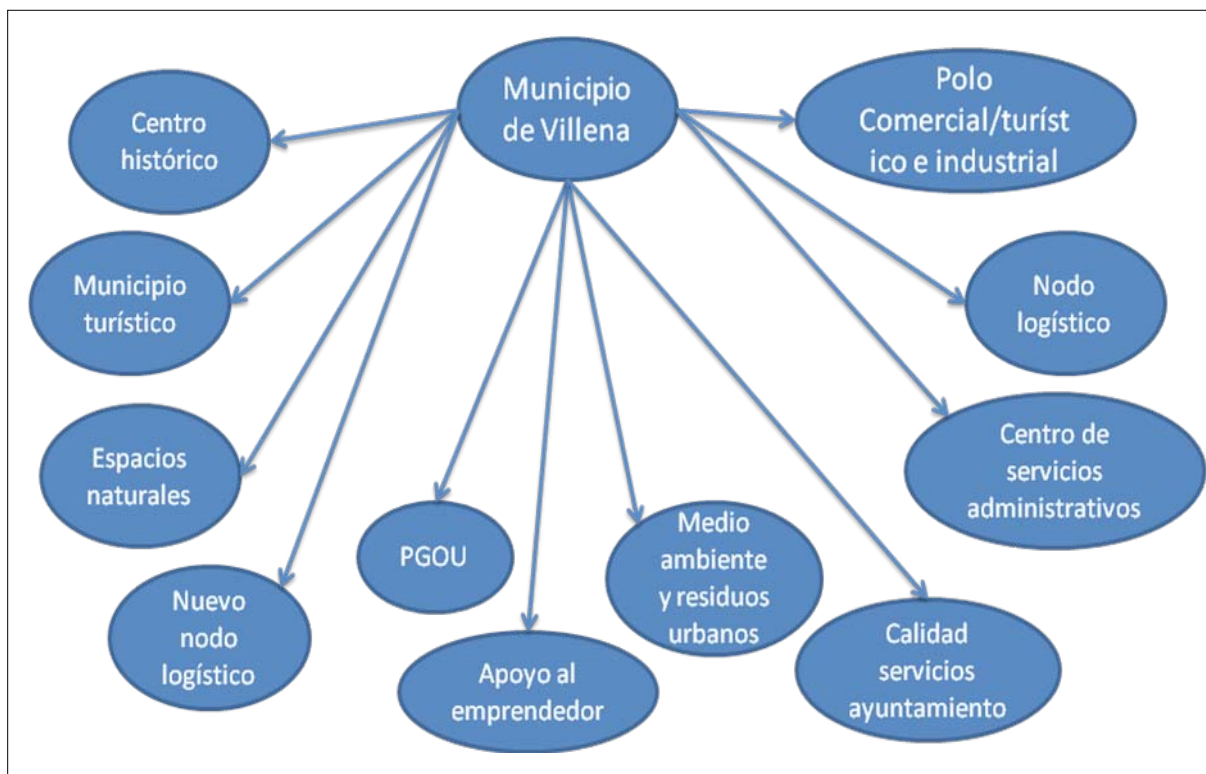


Figure 5. Strategic lines that need to be worked on and strengthened in the town of Villena (Alicante)

Source: Created by author

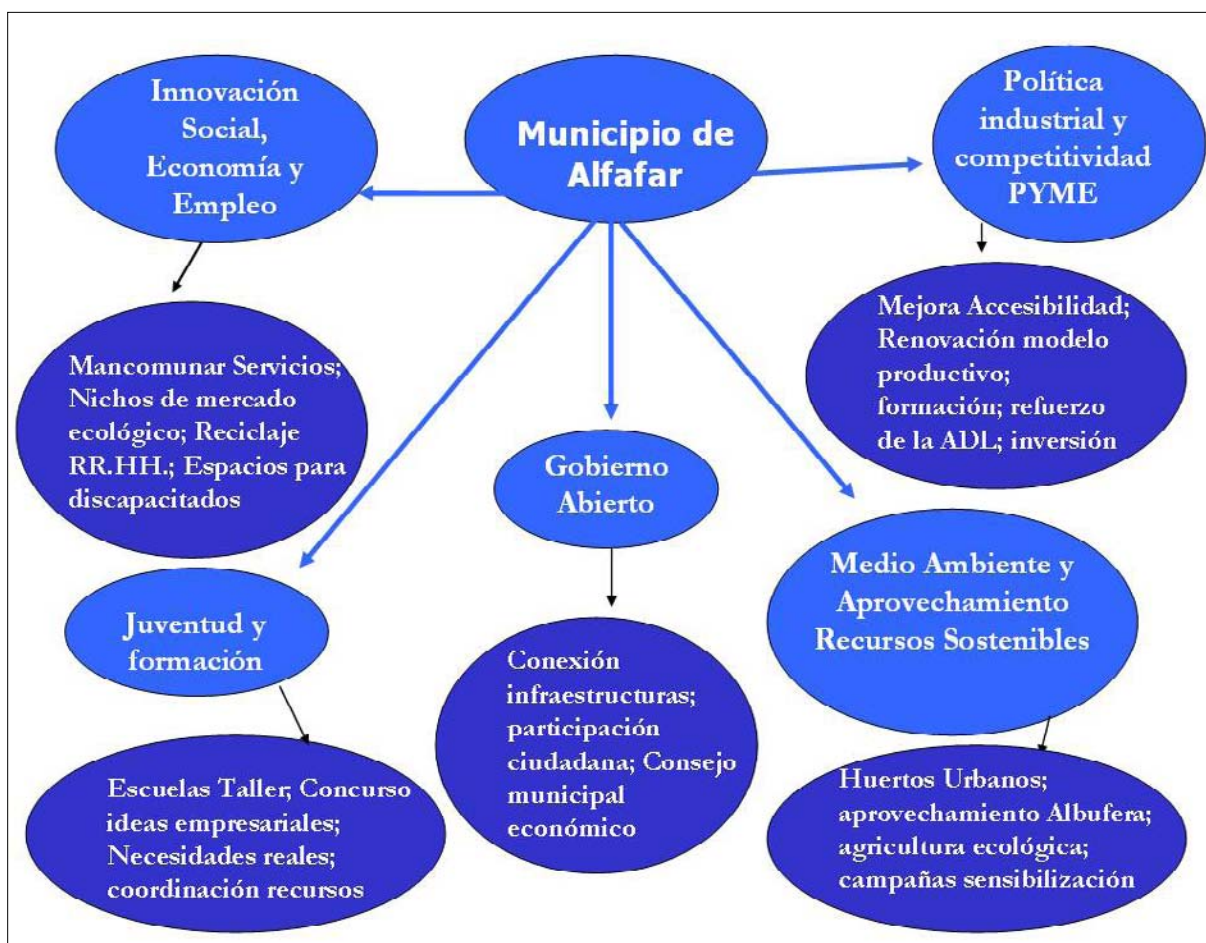


Figure 6. Strategic lines that need to be worked on and strengthened in the municipality of Alfafar (Valencia)

Source: Created by authors



sources of employment, support for entrepreneurship and strengthening employment, and the environmental management of municipal resources (Figure 5 and 6).

However, we could highlight the following general results from the content of the workshops:

- a) The need for continuity in the management of the municipal government, as due to the alternation of the last four terms, a different government every four years, a line of work in project planning has not been able to be consolidated. To this we must add the lack of political leadership
- b) A commitment to diversifying economic activities (agriculture, tourism, heritage, trade, business and commercial sector, etc.)
- c) The implementation and development of tools for municipal management (PGOU, coordination of municipal services initiatives, Comprehensive Plan for La Huerta, IKEA Business Polygon, Albufera of Valencia Management, etc.)
- d) A revaluation of environmental and land resources management (optimisation of municipal resources, procurement and rationalisation of groundwater use, waste and garbage, etc.) which should consistently provide management of local resources and territory
- e) To pay more attention to citizens, through their participation and greater involvement, not only when there are elections

4. Conclusions

These purposeful and proactive diagnosis tools in both municipalities, which are also being implemented elsewhere in the Valencian Community, have sought to promote a genuine and different process. It is hoped that this process will go beyond a draft diagnosis, providing a process to define strategic lines and specific actions, and thus leading to a medium –and long– term process. These goals are reinforced by the University of Alicante, which has supervised the process, and have the support of those politicians who have created the necessary conditions in order to not “selfishly manipulate” the process. A final report was written, not only as a diagnosis but also with purpose, and which had the participation of the citizenship from start to end. Thus, a research-action-participation methodology was applied, which complies with the new guidelines

established by the European Cohesion Funds (2014-2020). In both municipalities, their strategies were unanimously approved in two town meetings, in which opposition groups also voted in favour. In Villena this process has also generated an Economic and Social Forum⁶, in which a group of citizens, together and voluntarily, have led to the formation of a municipal organization, approved in the BOPA (Provincial Bulletin of Alicante)⁷ on 30 September 2014. This new civic organization, operational since late 2014, serves to deliberate, make decisions and propose measures on matters of common interest that affect citizens and the municipality’s management.

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The socio-spatial and demographic effects of the crisis

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Abstract

All economic crises are accompanied by effects associated with a change in cycle, not only in the financial sphere, but in their territorial, demographic and social expression. Due to the structural nature of this crisis –which has been defined by experts as a global crisis of the system–, these effects can be expected to be more profound and long-lasting. The aim of this work is to offer the reader an approach to the Spanish situation in the ten-year period from 2005-2015 from the time the first symptoms of the crisis appeared, and pinpoint the elements that signal changes in trend or the reinforcement of other trends that are already underway in the spheres in the analysis. We therefore conduct a review –not intended to be exhaustive– of the selected bibliography on the crisis and its effects, supplemented with basic information, particularly from the National Statistics Institute.

Keywords: economic crisis; spatial effects; demographic changes; social consequences; literature review; Spain

1. Introduction

Coinciding with the onset of the sub-prime crisis in the United States in the summer of 2007 and its negative consequences for the financial markets, economic growth in industrialised countries began to flag. Immediately after, the situation deteriorated still further with the Lehman Brothers collapse in September 2008,

and, in spite of massive government intervention, the USA and most European countries entered recession.

As in other previous crises, this one is accompanied –albeit with a certain time lag– by effects associated with a change in cycle, not only in the financial sphere but also in terms of its territorial, demographic and social ramifications, all of which unfold at a different pace. This wholesale crisis whose effects have been seen in every component of economic activity –investment, production, savings, consumption and employment– has been defined by experts as a global crisis of the system –not a one-off event but a structural dysfunction that is “profoundly destabilising for the model of growth” (Manero and Molina, 2014: 40). Its effects are expected to be more profound and far-reaching, and to be felt in multiple spheres and at different scales, as corresponds to a multi-dimensional phenomenon.

This work pinpoints elements that signal a change in trend, or the reinforcement of other trends already underway, in territorial, demographic and social parameters. The aim is to offer the reader an approach to the Spanish situation in the ten-year period from 2005-2015, from the onset of the first symptoms of the crisis through to the present day. We have conducted a review –not intended to be exhaustive– of the relevant bibliography on the crisis and its effects, incorporating the geographic perspective through the most important Spanish-language geographic journals and the outlook of authors –fundamentally geographers– who have from the earliest signs of the downturn reflected on its significance for all these spheres and scales, and on its future directions.



2. The crisis in Spain in the European context¹

Whereas before the crisis there was talk of a Europe of the North and another of the South, the image that emerges from analysing the trends post-2008 corresponds more closely to a central-peripheral spatial pattern, where we can identify a continuous central zone in which the effects of the crisis have been low or moderately low. This area comprises Germany, and extends to neighbouring regions in a less homogeneous way, including a large part of Poland, the Czech Republic and Slovakia. Then come a group of peripheral countries where the impact has been high or very high, comprising Ireland, Spain, Portugal, Greece and a large part of Italy (Milio, 2014).

Spain, together with other southern states, is thus a representative of the European Union that has been most seriously affected by the economic crisis and is still struggling to recover. For the whole EU the crisis has brought a drop in real GDP per capita and put an end to a decade of economic growth, accompanied by a sharp rise in unemployment –from an average of 7.1% of the population in 2008, to 10.5% in 2012. Meanwhile, in countries like Portugal, Greece and Spain, unemployment has risen to 16%, 24% and 25% respectively, to which must be added the fact that long-term employment has quadrupled, and youth unemployment now exceeds 50% in Greece and Spain (de Beer, 2012).

Why has the impact of the economic downturn been so severe in a country like Spain? The current crisis can be subdivided into a manufacturing crisis, a construction crisis and a financial crisis, each one associated with a specific region (Milio, 2014). The countries affected by the manufacturing crisis (primarily Nordic countries and the industrial heartlands) appear to have a greater capacity to recover. In contrast, the construction sector –less dependent on global demand and more on local financial and property markets– is less likely to recover rapidly, and thus the regions at the forefront of the economic boom of the last decade, along with tourist regions (mainly the Baltic States, Ireland and Spain) show greater vulnerability. Finally the problems in the financial sector tend to be concentrated in the

major financial capitals (London, Paris, Frankfurt) and in regions with overheated property markets such as Spain.

In this scenario of increasing unemployment, the regulation of the labour market also assumes a crucial role in an analysis of the heterogeneous effects of the crisis. According to de Beer (2012), in countries where employers are unable to adjust their workforce rapidly and therefore have to resort to internal flexibility –either by reducing the number of work hours (such as in Germany) or cutting real wages (as in the United Kingdom)–, the consequences of the crisis are more uniformly spread among the workforce. The reduction of work hours may lead to an accumulation of substantial work and hence fewer effects on the unemployment levels. On the other hand, in countries where it is relatively easy for employers to reduce the workforce either by laying off permanent workers (as in Denmark) or temporary workers (as in Spain), the crisis results in a sharp increase in unemployment and creates a clear dividing line between people who lose their jobs –with serious consequences on their conditions and quality of life–, and those who remain in employment and who –relatively speaking– are barely affected by the crisis or who perceive it in the form of greater indirect tax pressure and indirectly by cuts in the services of the welfare state.

It is precisely this increase in inequality and poverty that is seen as one of the key impacts of the private debt crisis on social cohesion, according to the International Federation of Red Cross and Red Crescent Societies (2013). Whereas on other continents poverty appears to have declined, the EU has seen a significant increase in its population at risk of poverty, from 6 million in 2009 to 130 million in 2013. On that date, according to Eurostat, 16.6% of the population of the EU-28 was in a situation at risk of poverty after state subsidies (25.9% before the subsidies), and in five member states –namely Greece (23.1%), Romania (22.4%), Bulgaria (21%), Lithuania (20.6%) and Spain (20.4%)– the poverty and exclusion rates were higher than the European average. A relatively small difference can be seen in the rate for the risk of poverty (after state subsidies) between men and women in the EU-28 (16.1% vs 17.2% for women), although in Portugal, Denmark, Hungary and Spain, the poverty risk rates were slightly higher for men. The unemployed were particularly vulnerable: in 2013, almost half (46.4%) of the unemployed in the EU-28 were at risk of poverty, compared to 8.9% of those in work, although relatively higher rates were recorded among employed workers at risk of poverty in Romania (18%), Greece (13.1%), Luxembourg (11.2%), Poland,

1. This section is partially prepared with data from the report entitled *Impact of the economic crisis on social, economic and territorial cohesion in the European Union*, commissioned by the Committee on Regional Development of the European Parliament (see MILIO, S., 2014).



Italy, Portugal and Spain (10%). In contrast, only approximately one in every seven retirees in the EU-28 (12.6%) was in a situation at risk of poverty.

The increase in poverty is particularly acute in some of the countries that have suffered the sharpest drop in average income in the market, such as Ireland, Spain and Greece, but also France. This scenario has led to the broadening of the social gap and a shrinking middle class, and has also given rise to territorial imbalances insofar as the increase in poverty has halted labour immigration and the mechanism of remittances. At this point it is worth recalling that the fight against inequality, poverty and social exclusion is part of the EU's 2020 strategy (European Commission, 2010).

3. Sociodemographic and territorial effects of the crisis

The experts agree that “the current crisis is far more than an economic crisis. It is also a social crisis, set against the backdrop of an ecological and geopolitical crisis which most certainly confirms a historic rupture” (Askenazy *et al.*, 2011: 10). According to Méndez (2014), beyond being seen as a simple and isolated episode, “there is a growing awareness that we are facing a systemic crisis that heralds a new normality, with sweeping changes that we are only just beginning to glimpse” (Méndez, 2014: 17).

In view of the global and multidimensional nature of this phenomenon, it is a complex task to select the spheres where its effects may be most clearly visible, even at the risk of overlooking others that are equally important but less evident. Moreover, the spheres selected also coincide with the areas that have been the priority focus of social research in Spain.

A search was conducted of the most important bibliography on the socio-spatial and demographic effects of the crisis in order to shed light on the trends in research on this issue in the last ten years². The sources used were the databases of the ISOC (Consejo Superior de Investigaciones Científicas – Spanish National Research Council)³. To focus on the

2 The author wishes to express her thanks to Gloria Lence, Biblioteca Tomás Navarro Tomás, Centro de Ciencias Humanas y Sociales, Consejo Superior de Investigaciones Científicas for their assistance in the bibliographic search and for their valuable suggestions for improving the results.

3 Searches were made in the catalogue of the network of libraries in the CSIC (CIRBIC), and the rankings of RESH journals (Spanish Journals of Social Sciences and Humanities), selecting those specialised in

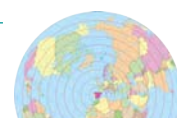
geographic perspective, the search was confined to the journals *Scripta Nova*, the *Bulletin of the Spanish Geographers' Association* and *Estudios Geográficos*. We obtained a total of 780 references from which, after review, we selected the documents which explicitly refer to the recent economic crisis and its effects. We also examined the themes and publications from the congresses organised by the Spanish Geographers' Association in the same reference years, and included basic information, particularly from the National Statistics Institute and Eurostat.

4. Effects of the crisis on the territory

As stated earlier, the economic crisis in Spain has been accompanied by an acute crisis in the construction sector after the housing boom, which started in the late 1990s and led to the construction of 5.5 million housing units authorised by means of municipal licences between 1998-2010, out of a total stock of 26 million, with 17.3 million residential homes (Manero and Molina, 2014).

In this scenario, 16% of the jobs in the Spanish economy were destroyed between 2008 and 2012, in widely varying volumes according to the sector of activity. The construction industry saw the greatest drop in its workforce, and by the end of 2012 had shrunk to 39% of its size in 2007 (Alonso Santos, 2014). In addition, the fall in per capita GDP effectively put paid to the process of regional convergence which had been reactivated at the end of the last century after the crisis of the 1980s, on the back of the strong growth in production and employment. This pattern was reversed with the crisis, “when the trajectories of the

geography and –in order to limit the quantity of the results– choosing the two that are present on the science websites *Scripta Nova* and the *Bulletin of the Spanish Geographers' Association*, which had an impact rating in 2014 of 0.195 and 0.103, respectively. A subsequent phase also included the journal *Estudios Geográficos*. Following the proposed theme of block 4 for the Spanish contribution to the 33rd International Geography Congress in Beijing, the following keywords were selected: Census – Economic crisis – Demography – Population density – Agrarian development – Community development – Urban development – Population dynamic – Healthcare economy – Industrial economy – Rural economy – Urban economy – Economy and society – Emigration and immigration – Population – Welfare state – Family – Fertility – Population geography – Urban geography – Rural geography – Construction industry – Industry – Madrid-Geography – Return migration – Internal migration – Mortality – Residential mobility – Ageing – Demographic forecast – Progress – Rural situation – Overpopulation – Demographic transition – Housing – Vulnerable areas – Gender – Industrial development – Rural development – Territorial imbalance/s – Economic inequality/ies – Social inequality/ies – Territorial inequality(ies) – Employment and territory – Homes – Territorial impact – Labour market – Migratory movements – Birth rate – Unemployment – Joblessness – Labour patterns – Population and employment – Poverty – Territory.



different autonomous regions took divergent paths, thus accelerating the rate of inequality” (Albertos Puebla, 2014: 253).

Two effects are associated with these facts: on the one hand, a spectacular and rapid rise in unemployment, particularly in areas that had oriented their socio-productive structures toward construction, as opposed to a much less unfavourable behaviour in others which had greater diversification in their productive economy (Fernández Tabales and Cruz Mazo, 2011); and on the other hand, a series of consequences on the territory, environment and landscape, producing a significant visual impact deriving from the suspension of housing activity and the paralysis of public works in Spain (del Río Lafuente and Rodríguez Moya, 2014).

Indeed, as the unemployment data show, the dynamism of the construction sector in some areas –which in the most extreme cases can be classified as dependence– can be seen to be clearly associated with the vulnerability or fragility evidenced by the local socio-economic structures which, with the onset of the economic crisis, led to their collapse, dragging down a large part of the local economic fabric in the process (Fernández Tabales and Cruz Mazo, 2011).

The fallout from the collapse of the housing bubble on the urban landscape has been dealt with in depth by Burriel de Orueta (2008, 2014). According to this author, the housing stock left by the property bubble can be estimated at 2.3 million, including new unsold homes, those acquired for speculative reasons, housing in the hands of banks, and the second-hand market. Many are located in “ghost cities” –housing developments, most of which are dispersed and distant from urban centres, and of very poor quality construction. As they have very few residents they are insufficiently equipped with basic public services, have poor accessibility, and are not seen as being profitable for private services (Burriel de Orueta, 2014). This author also calculates that the crisis has meant that between 65% and 85% of approved potential urban planning projects are still pending, giving a total stock of residential land in the whole of Spain that could range between 250,000 and 290,000 ha. The same excesses in urban planning and management that took place during the bubble also occurred with industrial land. Most of these lands have not been urbanised in any way and remain in the form of undeveloped rural plots, or have been suspended halfway through their transformation process, giving rise to singular spaces that the author calls “urbanised deserts” which are often “captive”; that is, “unproductive, caught between an agrarian past which is difficult

to recover, and a future with little hope of urban development” (Burriel de Orueta, 2014: 122).

Also known as “modern ruins” (Manero and Molina, 2014: 50), they are an environmental waste of natural land. Economically, this is an unsustainable model of urban planning, as, aggravated by falling revenues due to the reduction or suspension of income from urban planning licenses, along with the excessive financial burdens assumed during the bubble, councils now have to support the cost of maintaining sprawling land developments that are urbanised but without homes, or with homes, but most of which are vacant, and therefore with insufficient remuneration by residents. Breaking this vicious circle would require revising the urban plans in the pipeline, creating new ones with a “different urban philosophy, with supralocal guidelines based on a rigorous analysis of the territorial dynamic, rethinking the current urban planning model from the economic, territorial and urban planning point of view and in line with the city’s production system” (Burriel de Orueta, 2014: 103, 137).

Thus from the point of view of the crisis and regional inequalities, the regions with productive structures closely associated to specialisation in the construction sector are the ones that are seeing their future most constrained, whereas “the regions that are most successfully weathering the storm are those that have seen less shrinkage of the construction sector and also have productive sectors and competitive companies in new sectors that are acquiring or reinforcing their basic role in the regional economies” (Albertos Puebla, 2014: 245).

5. Effects of the crisis on demographic changes

A crisis is a short-term disturbance lasting a few years, whereas demographic changes are long processes which may last a decade and be considered secular events. This is the view of Börsch-Supan (2010) in a report commissioned by the European Parliament on the social impact of the crisis, the demographic challenges and the pension system. Unlike others, this author believes that this is just one more among many crises. Its impact on pensions is between 5%-15% in the countries of the EU 27 –significant, although eclipsed by the effect of the ageing population which is approximately ten times greater.

Castro-Martín *et al.*, 2015 in their recent study on what they call the “imprint of the economic crisis on Spanish demographics”, also consider the impact of the crisis



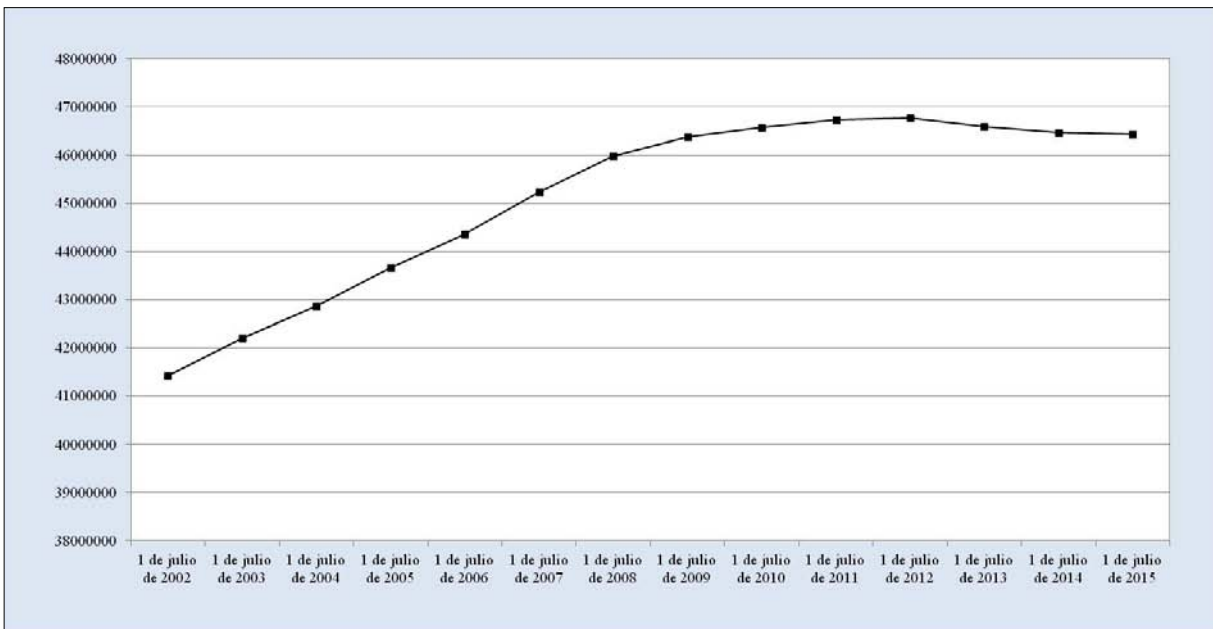


Figure 1. Evolution of the population resident in Spain, 2002-2015

Source: INE, INEbase

on most demographic indicators to have been relatively modest. These authors find that “the long-term structural factors underlying demographic trends have greater weight than the isolated factors pertaining to a particular situation”. However, they exclude from this diagnosis the decrease in population size and the shift in the migratory balance towards negative values, and point out that there is a certain time lag in demographic dynamics which delays the demographic effects of economic changes.

This is the case with the change in trend in the evolution of population size, with a first slowdown in growth since

2008, a subsequent stabilisation, and a further decline starting in 2012 (Figure 1).

The influx of immigrants at an almost exponential rate since 2000 (Figure 2) was essential to the growth of the population, and was not only indispensable for Spain's economic development but also favoured the rejuvenation of its population and led to greater pluralism. This contributed to sociocultural change (Cebrián *et al.*, 2010), and could also be considered one of the primary factors driving the urban transformation of recent years (Domínguez *et al.*, 2010).

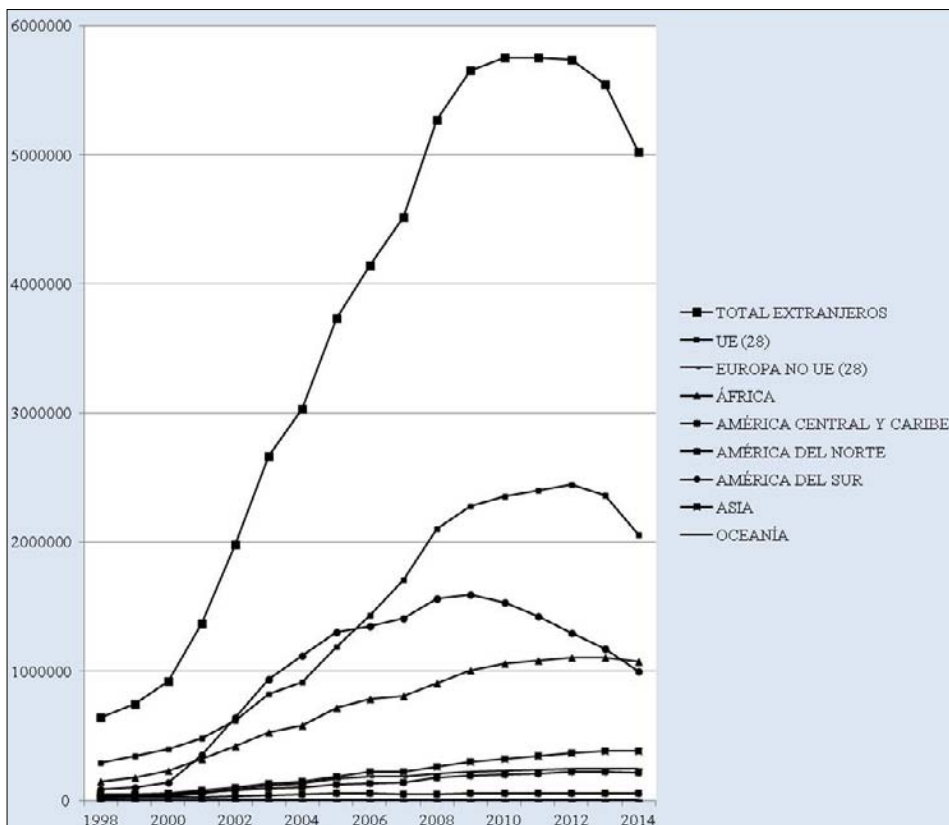


Figure 2. Foreign population by nationality. Spain 1998-2014

Source: INE



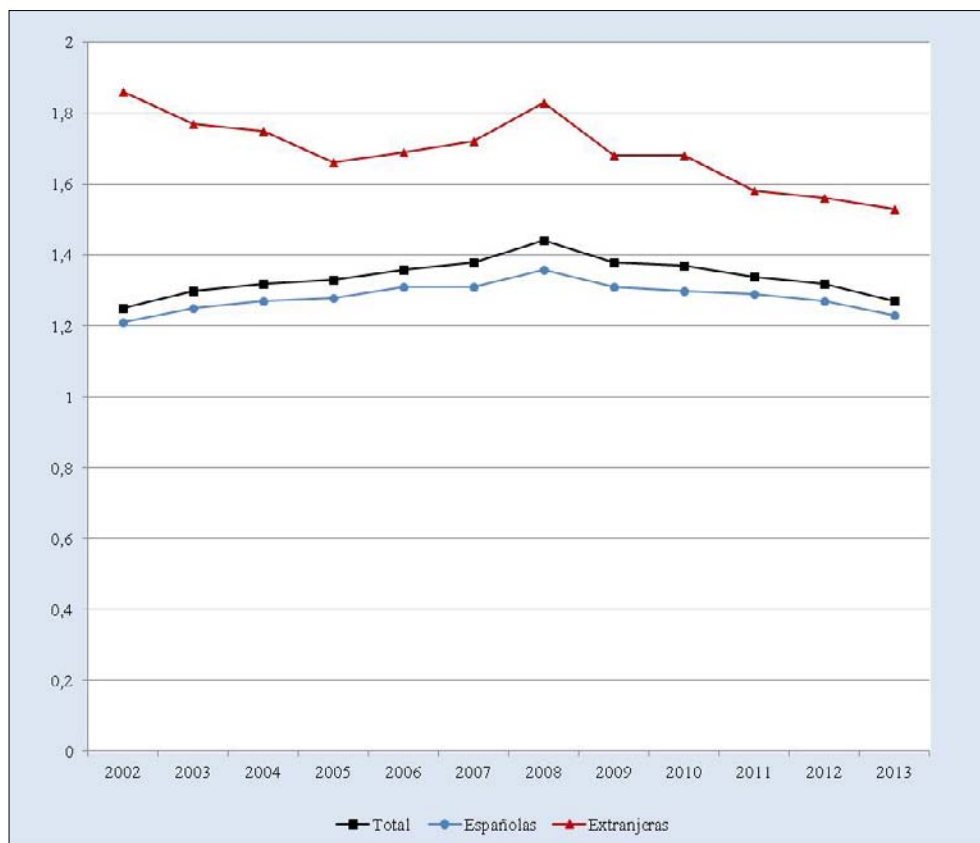


Figure 3. Fertility rate, Spain 2002-2013. Number of children per woman according to mother's nationality

Source: INE. Basic demographic indicators. Provisional data, 2013

Perhaps one of the most visible signs of the crisis in the demographic sphere concerns the change in the migratory dynamic, seen first in the expected fall in migratory flows and the progressive increase in the departure of foreigners, and subsequently in the incipient emigration of Spaniards (Domingo and Sabater, 2013).

On the one hand, by interrupting the incorporation of new immigrants –and given the differential youth of the new arrivals–, the economic crisis could indirectly also lead to a rise in the average age of the immigrants remaining in Spain, and cause a more significant increase in the elderly segment in the relatively near future (López González and Aldrey Vázquez, 2014).

In terms of the return migration of foreigners –whose figures have increased substantially since the onset of the crisis–, the downturn is particularly affecting the immigrant labour market. In addition, the increase in interest rates has meant that most of those who are paying a mortgage or have outstanding payments (a little over 80.2% of property-owning immigrants in 2007) are now in a clear situation of vulnerability (Domínguez *et al.*, 2010). However, García Ballesteros *et al.*, (2014) observes that the underlying causes are not economic but have a family-related and/or personal origin, associated mainly with children or with the change in the situation of the immigrants' parents, which could be linked to “the crisis in the care system” and the type of return, which overwhelmingly affected women. The economic reasons –the second cause– include above all the lack of employment when this affects several

members of the same family, and the availability of state subsidies for returning, which explains why there is more migratory return among nationals from Latin American countries. The same authors are of the opinion that at least so far, the departure of foreigners does not affect the current high rates of unemployment, but if the scale of returns continues to grow, it could affect consumption in a housing market that was dependent on this sector of the population (García Ballesteros *et al.*, 2014).

Finally, and although there is still insufficient data to draw any definitive conclusions, the incipient emigration of Spaniards –although relatively scarce compared to the massive departures of recent immigrants– is rising fast, especially since 2010. This outflow originates predominantly in the provinces of Madrid and Barcelona, and the main destination is Europe and countries in the Americas. The maximum average age is between 25-35, and is practically equally balanced in terms of gender (Domingo and Sabater, 2013).

But the effects of the crisis are also visible in other demographic phenomena. This is the case of fertility, which until 2008 appeared to be recovering somewhat from extremely low levels, particularly among Spanish women. It then entered a gradual decline which was more pronounced among foreign women, perhaps also as an indirect effect of the crisis by reducing the arrivals of young immigrants (Figure 3).

The crisis has not only affected the number of children but has also delayed the onset of maternity –both common



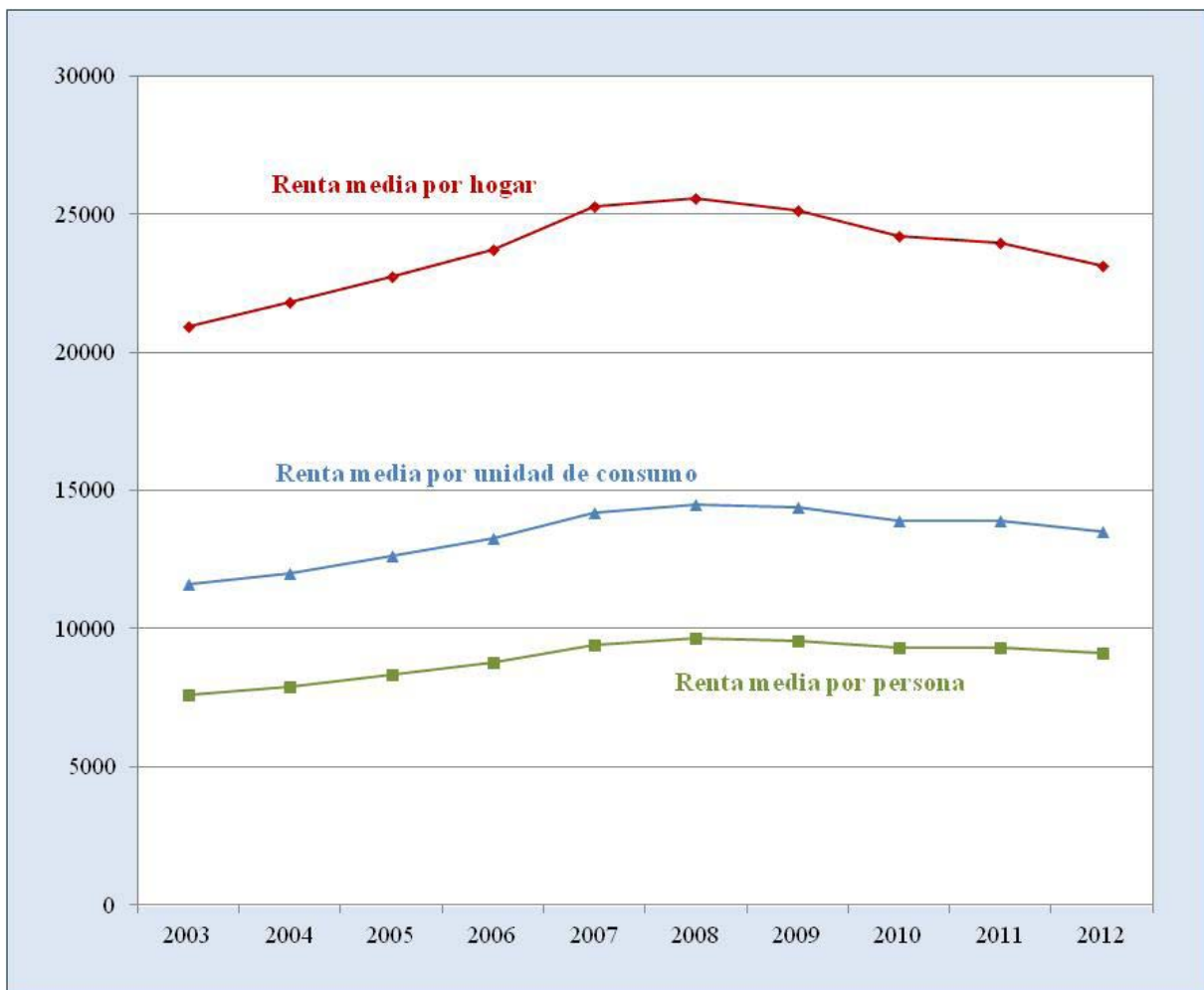


Figure 4. Evolution of average annual net income per household, person and consumer unit (in euros). Spain 2003-2012

Source: INE, Survey on living conditions 2013. Provisional results

effects in times of recession. However, the severity and duration of this economic crisis, together with the new macroconditions generated both in the labour market and in the policies of austerity and public service cuts may signify something more than a mere postponement of births, relegating birth rates in Spain once again to some of the lowest in the world (Castro-Martín *et al.*, 2015).

It is precisely the decline in public expenditure on social programmes and healthcare during the crisis that may be responsible for the deterioration in the living standards of vulnerable groups such as the elderly – who have seen a considerable rise in the proportion of their time living with disability–, and the increase in the differences between social groups and territories, where it can be seen that those with higher incomes and better education are more equipped to withstand the fallout from the crisis (Abellán *et al.*, 2015).

6. Effects of the crisis on the social sphere

One of the most evident effects of the economic crisis is the increase in social inequality. The latest

reports from the FOESSA Foundation (Renes, 2008; Lorenzo Gilsanz, 2014)⁴ offer a good illustration of the impact of the downturn based on the evolution of income (Figure 4), poverty and social cohesion. The 6th Report on Exclusion and Social Development in Spain 2008 revealed that the growth enjoyed by Spain between 1995 and 2007 did not result in a more equal distribution of income or in a reduction of poverty. In other words, growth during that phase was not accompanied by greater social protection, nor by solutions for the urgent problem of social integration. The processes of social exclusion and vulnerability cannot therefore be considered to be generated by the crisis, but rather as structural characteristics of Spanish society that have not been significantly transformed in the periods of economic bonanza and which are now being extended and aggravated by the crisis (Renes, 2008).

4. The 6th FOESSA report introduced as a methodological novelty an analysis of social exclusion based on a synthetic social exclusion index (ISES) built with a set of 35 indicators. This analytical system was applied to the FOESSA Foundation's Survey on Integration and Social Needs (EINSFOESSA, 2007 and 2009-2010).



Precisely due to the structural nature of this crisis, in only three years (Surveys on Integration and Social Needs by the FOESSA Foundation, 2007 and 2009) a significant increase was observed in fragility and social exclusion, with over 8 million people affected by processes of social exclusion and more than 10 million below the poverty line (Laparra, 2010). The crisis has aggravated the female profile of social exclusion and particularly affected younger households and those with a more complex structure such as single parent households. In contrast, households headed by the over 65s, in which there is some other older person, appear to be the ones that are most successfully withstanding the social effects of the crisis. The ethnic groups that were most affected by exclusion in the boom times continue to be in a clearly disadvantaged situation. However the territorial variable –the type of neighbourhood, which was shown to have great significance in 2007– is assuming ever greater importance, and the more deteriorated neighbourhoods are seeing their processes of exclusion extended more proportionately (Laparra, 2010).

Among the dimensions most severely affected by these processes of exclusion are employment and housing, although the greatest impact of the change can be seen on employment –one of the most tangible effects of the financial crisis and which was already evident in the first quarter of 2008 (Figure 5).

This aspect combines the economic hardships deriving from youth unemployment and the obstacles for accessing housing. It is clear that young households in the near future will face much harder conditions of access to housing, as their economic situation will be worse in the short- and possibly medium term. However, the substantial stock of new housing standing empty will need to enter the market in one way another, and there is every likelihood that it will do so in the form of rental, or through other novel ownership models that are increasing every day (López-Colas and Módenes, 2014).

Finally, on the processes of exclusion, López Jiménez and Renes (2011) analysed the data from both FOESSA

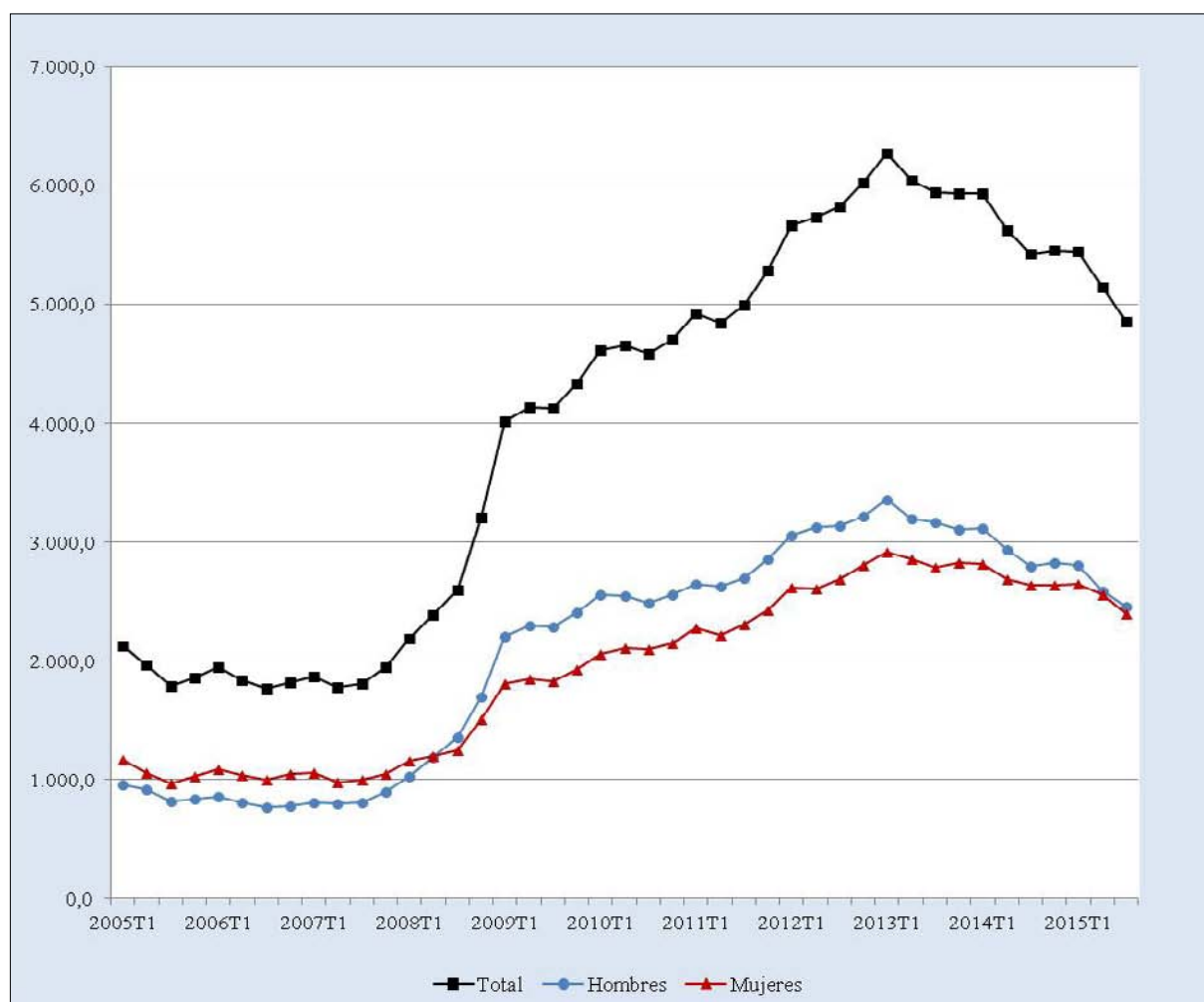
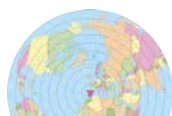


Figure 5. Evolution of the jobless population, by sex (in thousands). Spain 2005-2015

Source: INE, Active Population Survey



surveys and identified four itineraries or trajectories corresponding to households in Spain in the different integration spaces in response to social exclusion as the crisis began to bite:

- Stable integration, in households that appear not to have significant problems of exclusion, representing 70.9% of the sample. The relative poverty of this group went from 14.4% in 2007 to 19.1% in 2009. These are households corresponding to groups that have habitually had the least likelihood of suffering processes of social exclusion.
- Lapsing into exclusion. These are households that go from situations of social integration in 2007 to situations of social exclusion in 2009, and represent 12.8% of the sample. This negative itinerary has had a greater effect on single-parent households and those with a larger and more complex structure, households headed by people with no education, and unemployed people without benefits. This category includes significantly more households headed by women.
- Processes of integration occur in households that go from situations of social exclusion in 2007 to situations of social integration in 2009, and represent 10.6% of the sample. Almost 40% of the households in this positive trajectory are headed by people aged 65 and older.
- Ongoing exclusion, affecting households that were in situations of exclusion in 2007 and remain so in 2010. These represent 5.8% of the sample. In these households the ethnic group, neighbourhood and educational level act as a significant brake on social betterment and enhance the risk of chronicity in the future.

7. Conclusions

This contribution is based on a non-exhaustive bibliographic search, which represents certain limitations to these conclusions. Furthermore, and as mentioned at the start, given the multidimensional nature of this phenomenon, we have been unable to review all the most conspicuous effects. For example, we have not dealt here with the geopolitical or strategic effects of the crisis from the perspective of the “geography of wealth transfer”, which focuses on the impact it has on the international financial markets (Fernández Cela, 2015). Nor do we identify the public policies for social protection, and specifically the pattern of expenditure

on family policies that could help mitigate the effects of the crisis on vulnerable groups such as women, thereby allowing them more opportunities to engage in a range of activities and helping make them compatible with work in the home (Comas, 2012).

In spite of this, the references in the review confirm that most of the research concurs in highlighting the fact that the ongoing crisis is not simply one more crisis, but that many of the processes of inequality and divergence described derive from its structural nature. Thus the effects of the downturn can be perceived essentially insofar as it reaffirms certain trends while cancelling others. But there is no doubt that this crisis still has a long way to run, and that its most profound and long-lasting effects still remain to be seen.

One view even suggests that there are several overlapping crises facing Western Europe: moral, growth, social, financial, political, institutional and governance; in other words, this is a crisis of the European Social Model, which has laid bare a “geography of social fractures” and led to an increasing degree of fragmentation of our societies and a notable emergence of levels of inequality and social exclusion, particularly within certain social groups (children, young people, women, the elderly and immigrants) that drastically reduce the degree of social cohesion (Romero, 2013). This crisis in Spain is also institutional, with actions stemming from a deficient or territorial culture, in which territory is seen as obeying a “rationale that is profit-seeking, speculative, largely insensitive to the impacts generated, and reluctant to look at the long-term view”, in addition to being qualitatively deteriorated (Manero and Molina, 2014: 49).

As is only natural, the territorial and sectorial effects of the crisis have been discussed in greater detail from the perspective of economic geography, highlighting here the book coordinated by Albertos Puebla and Sánchez Hernández (2014), which contains theoretical reflections and empirical analysis of the impact on various sectors and at different scales, and which also suggests territorial strategies for emerging from the crisis. It is also worth noting the increasing prevalence of multidisciplinary research into the effects of the crisis on different spheres and scales, comprising economists, demographers, sociologists, and other researchers in the social sciences.

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The effect of the crisis on vulnerable neighbourhoods: an approximation of the Spanish context through a case study (A Coruña, Galicia)*

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Abstract

The economic crisis has had harmful effects on urban spaces, mainly in those neighbourhoods that have historically been characterised by their vulnerability. In the case of Spain, the crisis is making its mark in certain neighbourhoods which are experiencing a regression in their socio-economic situation to past times through the reappearance of social segregation processes, even though their conditions might have improved in times of growth. After introducing theoretical considerations on urban vulnerability and describing the specific case of the consequences of the crisis in Spain, we will present our own methodology for analysing urban vulnerability in regards to three dimensions: socio-demographic, socio-economic and residential. The case of A Coruña, a representative medium size city in Spain, will be studied below. This contribution will be concluded with some final remarks and future lines of research.

Keywords: crisis; neighbourhoods; vulnerability; A Coruña; Galicia.

1. Introduction

The crisis that Spain has been suffering since 2008 has jeopardised the system that guarantees the social well-being of its population. Long gone are the days of happiness and safety knowing that the economy

was doing well and that all social welfare systems were untouchable. Previously, the middle classes had the ability to save money, increase their wealth and enjoy a level of income that allowed access to movable and immovable property, to go on holidays and afford ‘some luxuries’; the elderly enjoyed their pensions and activities promoted by the government such as organised holidays, meals, and so on; and the youth had the opportunity to receive scholarships for education and research. In this context, people considered problems related to poverty (malnutrition, infant poverty, bad health conditions, lack of housing) to be far away, because they were not widespread and only affected groups that were in a situation of social exclusion.

With the arrival of the crisis, the population has come to the realisation that their world was not as secure as they believed it to be. Banks that so kindly offered them credit now put pressure on them to meet their payments and threaten to take their property away; many businesses have closed and a quarter of the population has been hit by unemployment; and cuts carried out in education, health and social affairs by a government that is in debt and troubled by corruption have increased. That is, with the crisis we have gone from stable work to precarious work, from some family and economic stability to uncertainty, from personal and social certainties to vulnerability. The result is reflected in a deep sense of mistrust and the proliferation of



vulnerable urban spaces to accommodate a significant percentage of the population affected by these problems.

This paper is framed within a line of research that seeks to find analytical tools to explore the consequences of the crisis on urban environments: the census tracts and neighbourhoods most affected by the crisis and their degree of vulnerability will be analysed. To do this, we will first explain the concept of urban vulnerability and the factors that determine it. Secondly, we will analyse the impact of the crisis in the Spanish context. Then, we will propose our methodology for analysing urban vulnerability, to be applied to the case study of a medium size city such as A Coruña (Galicia), with 244,810 inhabitants. We will finalise with a conclusions section in which we point out future research possibilities.

2. Urban vulnerability: interpretation of the concept

For the past eight years, society has had to cope with the consequences of the crisis, such as unemployment, the loss of purchasing power, severe material deprivation, poverty, social exclusion and inequality. All of this has led to an increase in social vulnerability, which is understood as the context in which there is a high exposure to certain risks and uncertainties, coupled with a decreased ability to protect or defend oneself against these risks and cope with their negative consequences (United Nations, 2003).

Due to this lack of security and social guarantees, after a period of shock, society has begun to react in different ways to withstand and absorb the impact of the crisis. These include charity, anonymous donations, food banks, community kitchens, the organised occupation of homes and exchange networks (Alaminos, Penalva and Domenech, 2014). However, these resilience strategies are not sufficient to offset the lack of social protection to which the population in general is being subjected, and which affects young people, immigrants and the long-term unemployed in particular.

This situation becomes more evident in the suburbs of our cities, where there are more small shops that close in the absence of customers and that have difficulty making payments; where a phenomenon that in medium-size cities had remained dormant since the mid-1980s has been on the rise, i.e. street robberies and burglaries; where there are increasingly more people begging and where urban degradation processes begin due to a lack of funds in the local

government to undertake improvements. Therefore, these neighbourhoods are at risk of suffering segregation processes in the medium term. This is a phenomenon that, according to Pacione (2009), must be interpreted based on socio-economic status, family status and lifestyle, geographic mobility and belonging to a minority. In this sense, the work of Carman, Vieira and Segura (2013) proposes a classification of four types of segregation by degrees:

1. *Silent segregation* refers to an invisible segregation, linked to assistance measures or urban recovery practices that can mask the neighbourhood's real social problem
2. *Segregation by default* is a version of the above and refers to the socio-spatial effects of the State's prolonged abandonment of inhabitants in an area of urban relegation
3. *Indolent segregation* is materialised by the processes of self-segregation of the wealthy classes that drive "undesirable" activities out of the city's prestigious neighbourhoods
4. *Aggravated segregation* refers to the combination of some of the aforementioned aspects of segregation

Therefore, we can say that segregation and vulnerability are two phenomena that go hand in hand and are manifested in the city's unrest, with a perception of insecurity and fear at the possibility of downward social mobility, with the related worsening of current living conditions.

There are numerous studies concerned with the issue of urban and social vulnerability in the context of crisis. In Spain, the work by Arias (2000), which adapts the criteria for identifying distressed urban areas of the Distressed Urban Areas Project Group (OCDE, 1998), is a landmark for specialists. The analyses of distressed neighbourhoods in Spain by Bruquetas *et al.* (2005), or the more specific research by Goñi (2008) on the distressed census areas of the metropolitan region of Barcelona, are two good examples. The former defines vulnerability as "the set of (environmental, social, economic and political) circumstances that enhance social exclusion and hinder the regeneration of certain urban areas by discouraging investment and job creation and facilitating the marginalization of certain groups" (Bruquetas *et al.*, 2005: 11). If this risk materializes, there will be a situation of consolidated exclusion, defined by the authors as "unfavourable".



Goñi (2008) takes the unemployment rate and the illiterate population rate as the two indices to develop his case study. Also based on census tracts, other authors study the processes of segregation with regard to different social groups, in particular, the upper classes. This is the case of Rubiales *et al.* for Madrid (2013) and Barcelona (2012), using data from the 2011 census and the list of professional categories registered by the Spanish social security service in 2007 and 2011. Other authors have stressed the need to incorporate environmental justice (Moreno, 2010) or the empty housing stock (Vinuesa, 2008) as factors to be considered when defining urban vulnerability.

We can also highlight the study on vulnerable neighbourhoods carried out by the Ministry of Development (2011a,b; Arias, 2000). It suggests that vulnerability should be understood as a combination of objective and subjective factors, with labour and residential exclusion as two of its triggering factors. As with the study aiming to establish criteria for defining urban segregation, the authors of this study did the same for urban vulnerability, which they subdivided into four factors (Alguacil, Camacho and Hernández, 2014):

1. Socio-demographic vulnerability, which is broken down into three variables: demographic ageing, the complexity of a households' structure and the "boom" of foreign immigration from non-developed countries
2. Socio-economic vulnerability, broken down into three variables: unemployment, job insecurity and low educational levels of the working classes
3. Residential vulnerability
4. Subjective vulnerability

On the basis of this definition of urban vulnerability, three indicators were established to identify the vulnerable areas in Spain through the grouping of adjacent census tracts that have certain urban homogeneity: the unemployment rate, the percentage of the illiterate and uneducated population; and the percentage of homes that have no toilet or bathroom. Once these areas were delimited, and through the analysis of 20 indicators (five for each of the four vulnerability groups), the study identified the most vulnerable neighbourhoods in Spain.

The Institut de Govern i Polítiques Públiques (Nel-lo, 2014) published a report on the evolution of urban segregation in Catalonia. It focused on the study of four

variables to define vulnerable areas: the proportion of the foreign population, the unemployed population, the rateable value of the homes and their average floor area.

All these studies highlight that cities are the spaces that have suffered the most from the recession, since they have a high concentration of population, economic activity, and specialisation and innovation centres. This recession is reflected in the economic, labour and social spheres and the quality of places (Lois, Macía, Piñeira and Calvo, 2014).

Using these references, a logical outline of what we understand by urban vulnerability, the factors that determine it and its consequences has been defined (Figure 1). There are three main areas:

- Economic vulnerability, linked to the collapse of the construction sector (which was supporting the economic model prior to the crisis), and to the increase in levels of unemployment. The most affected groups are young people who are forced to continue studying or to move to other countries in search of better opportunities; the long term unemployed and foreigners, especially those who lived with precarious employment contracts and are now unemployed.
- Social vulnerability and inequality in accessing goods and services, which implies a reduction in quality of life for certain sectors of society caused by the difficulties of accessing the labour market, adequate housing, education, health, leisure, consumption, social participation, environmental quality and so on.
- Residential vulnerability from the impossibility of accessing housing in accordance with personal financial resources, lack of adequacy of housing needs and the lack of stability and/or security to enjoy continued housing use.

In the next section we will discuss the consequences of the crisis in Spain, explaining the emergence of a context that has enabled urban segregation and vulnerability.

3. From stability to vulnerability: the impact of the crisis in Spain

Based on the accumulation model, after the mid 1990's the last expansive economic cycle began in Spain.



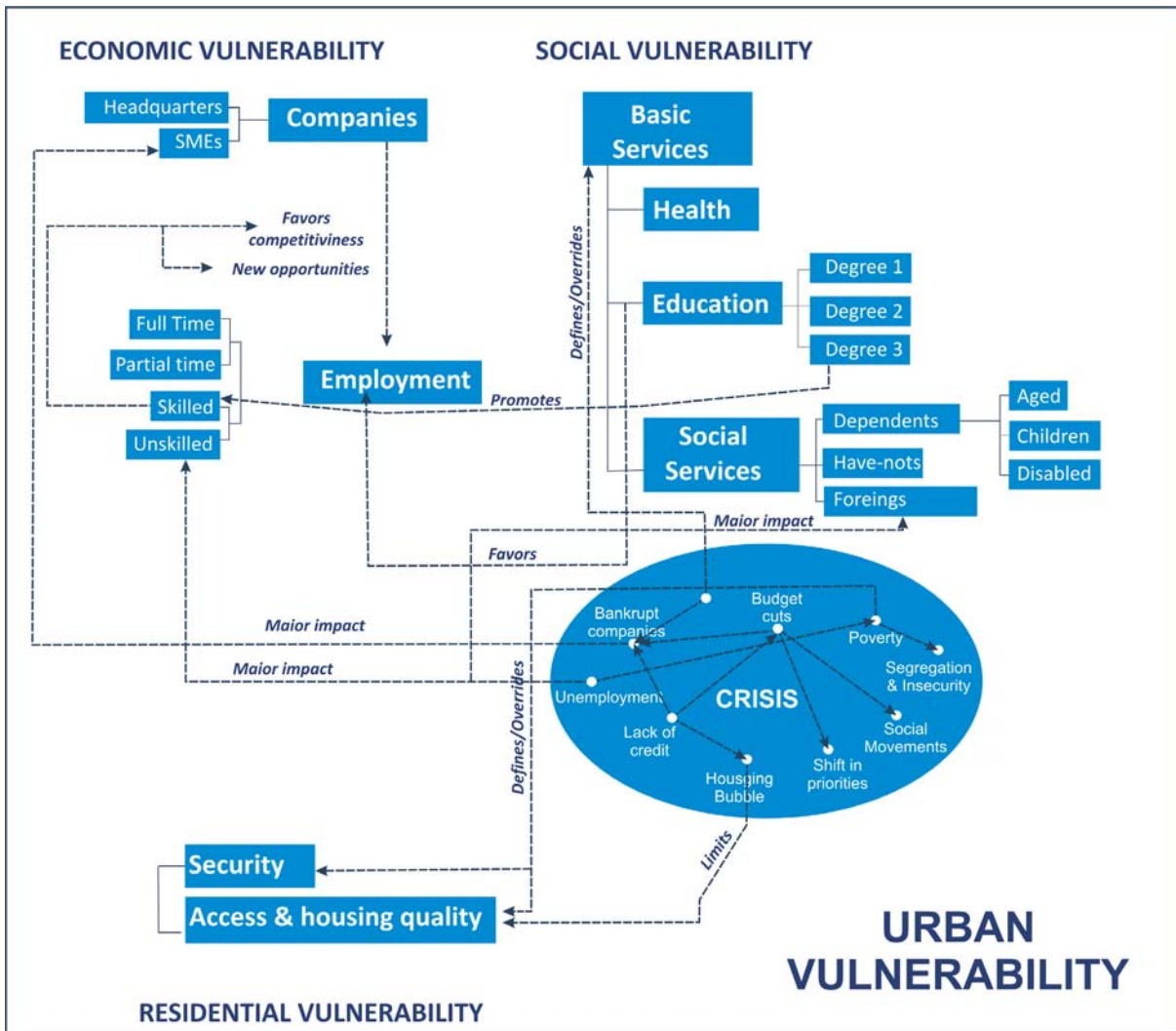


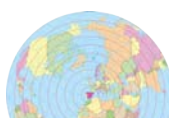
Figure 1. Urban vulnerability conceptual map
Source: Own work

According to Revuelta and González (2009), in just four years economic growth accelerated from less than 2% to reach an annual rate of 5%, while in the following years, this pace was reduced to 3%. As these authors also point out, one of the most successful sectors was construction, whose added value went from 6.8% in 1995 to 11.6% in 2006. Thus, the integration of the Spanish capitalist economy in the European and Western context was carried out by powerful real estate and construction sectors, a major lobby involving owners, developers, banks and savings banks, and companies in the sector (Lois and Piñeira, 2015).

It was a model that undoubtedly led to extraordinary economic growth and an increase in employment in the services and construction sectors. However, as Alguacil (2009) states, the counterpart to this situation led to the strengthening of a perennial structural weakness in the Spanish economy: the attraction of poorly skilled labour; an oversized construction sector which weakens other more efficient sectors; and an increase in the

productivity gap in relation to the rest of the Spanish economy. This reality became evident with the outbreak of the crisis in 2008, mainly due to the bursting of the housing bubble and the deficiencies of financial regulation.

The crisis has had an undeniable impact. From 2007 to 2013, 234,094 companies (16.65%) closed, i.e. an average of 180 companies disappeared every day, which meant a loss of more than two and a half million jobs. This has been reflected in high rates of unemployment in recent years. According to the Economically Active Population Survey (EAPS) in the third quarter of 2015, the unemployment rate is 21.2% (it was 8.5% in 2007); the rate of youth unemployment (under 25 years old) is approximately 50%, which has led to the withdrawal of more than one and a half million young people of working age from the labour market; and households with all potential workers unemployed is 8.5%. This situation is affecting thousands of families who see that every day they are losing their ability to



cover their most basic expenses, placing them in a situation of great social vulnerability and inequality. This fact is corroborated by an increase in the Gini coefficient of almost 10%, and an increase of nearly 30% in the difference in income between the 80th percentile and 20th percentile (Lorenzo, 2014).

The income of Spaniards is similar to what it was more than ten years ago (€18,500), and since the beginning of the crisis has fallen by about 4% while prices have risen by 10%. Lower income families have been hit the hardest; while the average real income has decreased in almost all the autonomous regions, the richest 10% of the population has best withstood the crisis, and has even increased its average income in some territories such as La Rioja, Aragón, Asturias, Cantabria, Castilla y León and Galicia.

According to the VII Foessa Report (Lorenzo, 2014), all the indicators of material deprivation have increased with the crisis, especially those related to financial problems. In just five years the material deprivation synthetic index went from a value slightly greater than 15% to one closer to 25% of households. The increase in cases in which material and monetary deprivation occur at the same time is particularly concerning, with a figure that has increased by 50% since the beginning of the crisis. One of the most visible manifestations of poverty and social exclusion is, undoubtedly, the deprivation of decent housing (Ayala and Navarro, 2005).

Even families that have kept their jobs have great difficulty reaching the end of month and have problems coping with the payment of their mortgages. This factor has meant that in Spain, since the crisis began, residential vulnerability has become more evident due to the rapid rise in the number of home evictions, from 26,700 to 68,091 in 2014. This is happening in a country where there is a vast stock of new empty housing (which reached its peak in 2011 with 626,670 units and is still around 535,734, according to data from the Ministry of Development, in 2014, which means there is 2.1% of new empty housing compared to total housing) and where large amounts of public resources are being diverted towards a financial sector that has not claimed responsibility for its management of the crisis and is not cooperating to get out of it. And all at the expense of significant cuts to public services, mainly care, education and health.

In the social sphere, despite having the right to basic services such as education, health, pensions, or unemployment benefits, there is a fear of the risks

lurking in society related to: employment that is increasingly more precarious, poorly paid and unstable; the fact that there is no certainty that pensions will be guaranteed at the time of retirement; the reduction or cuts in some hitherto universal basic rights (privatisation of education and health); and the risks of exclusion which affect those who are denied citizen status. As a result, the population has begun to mobilise and claim their rights, confronting urban redevelopment policies implemented by local authorities which are currently responsible for excessive spending. At the same time they are claiming access to housing, employment, education and health, as well as direct democracy and cities for the citizens (Lois and Piñeira, 2015).

However, the impact of the crisis has not affected all cities the same way. As Perló (2011) states, larger cities with a higher percentage of globalised sectors are potentially the most vulnerable to recession. However, at the same time, thanks to diversified economies, they would be in a better position to cope with the consequences of the crisis. On the other hand, small cities, often very dependent on vulnerable sectors, would be left in a more difficult situation. In any case, what is clear is that, in the present circumstances, the process of transition towards economic recovery is a great effort for many cities. In this contribution we will analyse the case of a medium size city, A Coruña, and we will discuss whether new socially, economically or residentially vulnerable sectors have emerged with the crisis or if “traditionally” problematic neighbourhoods are still the ones that register the worst values.

4. A Coruña, a medium size city as a case study

In order to confirm the impact of the crisis in medium-size cities, the case study of A Coruña, in northwest Spain, and one of the main urban agglomerations of the autonomous region of Galicia is presented. The city has been characterised by a predominance of very diverse activities carried out by mid-size companies, which has meant that the effects of economic regression have had a lower impact on urban growth. It is a city of services (82.4% of employed workers in 2014), although in earlier decades it stood out due to the increase in industrial activity and construction. The 1960s were especially notorious, when the percentage of the population employed in these sectors reached 25.73% and 10.33%, respectively, while today they are around 10.1% and 6.2%. Primary sector activities have always had a minor impact on the economy, and were more prominent just at the beginning of the century



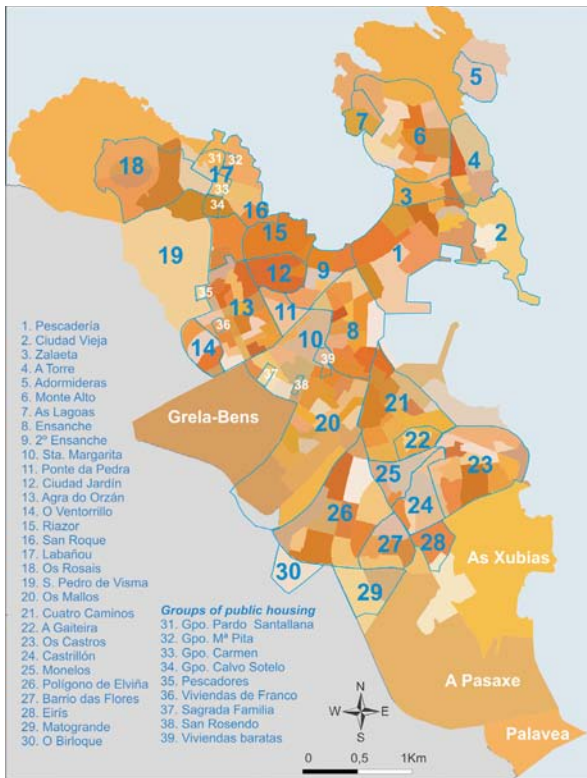


Figure 2. Neighbourhoods of A Coruña

Source: Own work

when 7.87% of the population engaged in agricultural and fishing activities. Today, this number is around 1.4% and, arguably, fishing is responsible for the vast majority, since the port of A Coruña is one of the chief ports in Spain for catching fresh fish. Agriculture, on the other hand, has virtually disappeared as a result of urban growth and the absorption of rural villages.

The city has 244,810 inhabitants, of whom 77% live in the residential neighbourhoods that are located on the periphery of the consolidated urban area and were built in the period from 1960 to 1970 as a result of the massive influx of people from neighbouring municipalities and other areas of the province to work in the new industries, mainly in the refinery (Figures 2 and 3). Many of them (Barrio das Flores, Monte Alto, Gaiteira, Sagrada Familia, Labañou) were considered problematic, given crime and conflict levels, in addition to being sources of drug addiction, as shown in previous

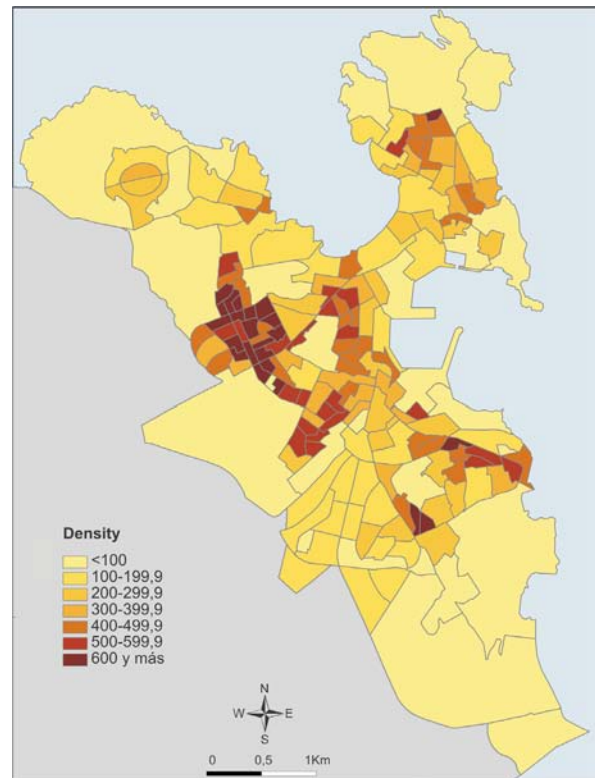


Figure 3. Population density / 10,000 m²

Source: Own work from the 2011 Population and Housing Census. INE

research on urban perception (Piñeira, 2005; Escudero and Piñeira, 1997). However, this perception decreased during the years of economic growth. The improvement in employment, social support, the disappearance of a troubled generation due to drug use and urban regeneration processes led to an improvement in living conditions. However, the impact of the crisis has caused the situation to worsen.

4.1 Methodology

Based on the above considerations, both as regards the concept of urban vulnerability and the Spanish economic situation, an analytical methodology to define and measure urban vulnerability has been developed (Table 1). Using the available statistical data at the census tracts level for A Coruña (2011), consulted in the National Institute of Statistics (INE) and the Galician

VULNERABILITY		
Socio-demographic	Socio-economic	Residential
Ageing	Unemployed	Empty homes
Immigration	Working population replacement	Rateable value of the home
Educational level	Rateable value of commercial premises	

Table 1. Urban vulnerability

Source: the authors



Institute of Statistics (IGE), a number of key indicators have been selected. These indicators are classified according to the three main vulnerability groups identified in Figure 1.

The first group refers to socio-demographic vulnerability, broken down into three aspects. The first focuses on ageing, measured by three indicators: *ageing index*, *number of pensioners/1,000 inhabitants* and *pension income*. After an overview of the ageing population thanks to the first index, we see that the second index introduces a key economic aspect, and with the third we observe possible vulnerability in relation to pensioners' purchasing power. The second aspect refers to immigration which, while in times of prosperity is fundamental for alleviating the effects of population ageing, in times of crisis can become a sector gravely affected by vulnerability, due to the shortage of employment and precarious employment situations (when they are not part of the unemployed population). The third aspect deals with the educational level, because it seems that people who are better educated can face the crisis with fewer problems.

With regard to the socio-economic vulnerability aspect, a key factor to take into account is the volume of unemployed workers measured by the *unemployment rate*. This indicator relates, in an obvious way, to the ability to deal with basic-needs costs, especially in cases of long-term unemployment with no unemployment benefits. If we relate this indicator with the ageing of the population, it is of interest to analyse the *working population replacement rate*, which measures the relationship between persons who are between 60 and 64 years old that are ending their working lives, with people who are in the 15-19 year old range and starting to work. This indicator shows that in the case of an ageing population the number of workers entering the labour market is lower but essential to maintain the welfare state. Finally, we have taken into account the *rateable value of commercial premises* based on the values from 2001, the last ones available for the city. Through this value we will be able to analyse the segregation processes in terms of commercial location, derived from the price of the land for these types of establishments.

The third group of factors relates to residential vulnerability. Numerous studies have shown that the speculation process resulted in a housing bubble and high number of *empty houses* (Rullan, 2012; Burriel, 2006; Lois and Piñeira, 2015). It is possible that developers never got to sell these homes, and when sold, they may remain empty as they have been

purchased as investments and not out of necessity. We can argue, in any case, two reasons that may account for the numbers of empty homes: a) they are unoccupied because the owners were elderly people who died or changed their residence to live with relatives; b) they are abandoned because they do not meet the necessary habitability conditions. The second indicator analysed is the *rateable value of the home* which, as with commercial property, helps us to show how the land prices can define the place of residence of the population based on their ability to meet its cost. In some areas this cost can be considerably higher than the rateable value, doubling or tripling the selling price.

4.2 Urban vulnerability analysis in the case of A Coruña

In the next few paragraphs we will proceed with the analysis of urban vulnerability in A Coruña. To this end, the three largest vulnerability groups and associated identifiers are examined (Table 1).

4.2.1 Socio-demographic vulnerability

In Figure 4 we see that almost all of the tracts that make up the historical centre, the peninsula and the first fringe of residential neighbourhoods are affected by

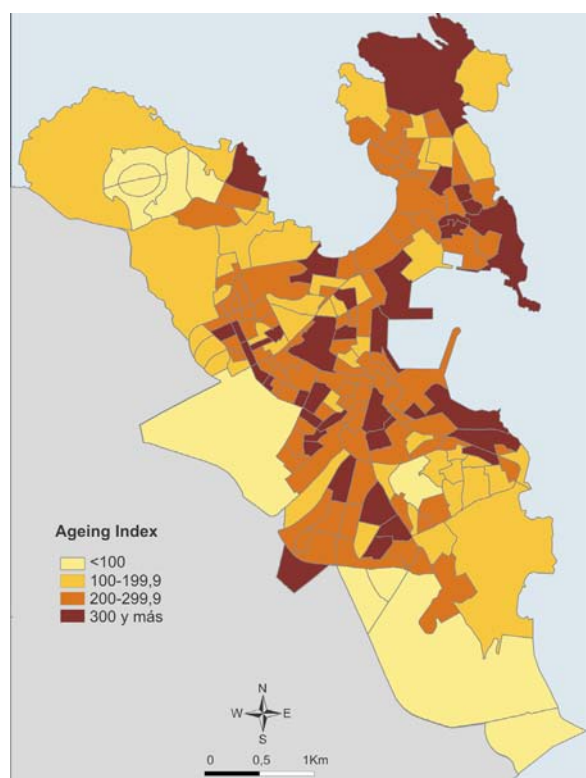


Figure 4. Ageing rate

Source: Own work from the 2011 Population and Housing Census. INE



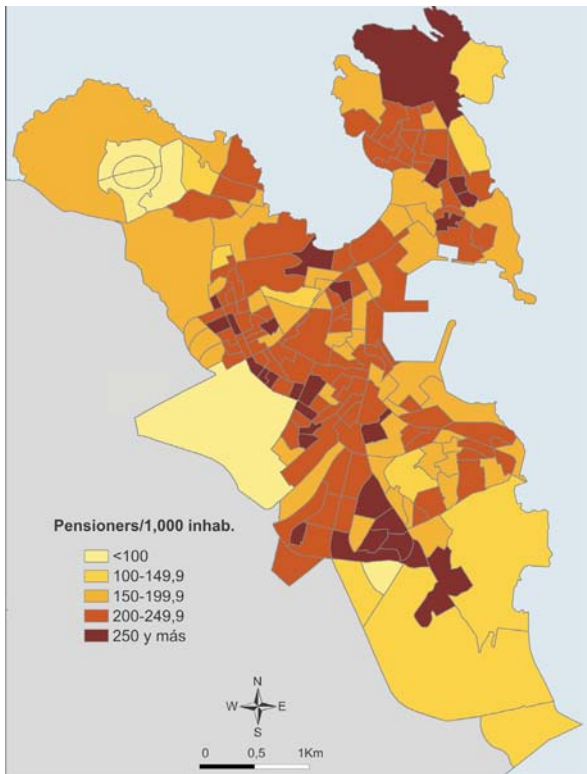


Figure 5. Pensioners per 1,000 inhabitants
 Source: Own work from the 2011 Population and Housing Census. INE

ageing rates exceeding 200. In some cases they even reach 300, as is happening in neighbourhoods such as Labañou, Agra do Orzán, Os Mallos, Santa Margarita, Elviña, Barrio das Flores and a large part of Os Castros. It is also observed that the area located to the west of Os Rosales and Ventorrillo have high values. This area corresponds to transit zones bordering the urban area of Arteixo.

The above data is more visible if we relate them to the number of pensioners/1000 inhabitants (Figure 5). Although the results are very similar, we can observe how in the Barrio das Flores, Eiris or Monte Alto a fair part of all tracts reach 250 pensioners/1,000 inhabitants. While we understand that these neighbourhoods are the most vulnerable in terms of ageing, when considering the pension income we observe that values exceeding 1,000 euros are located in the historic centre, the districts of Riazor and Zalaeta, the port area around the city extension area and its expansion towards Cuatro Caminos, next to Os Castros, and a sector of Elviña which corresponds to a cooperative of teachers' houses (Figure 6). This information very much reduces the vulnerability in relation to the prior ageing indicators. The case is very different in the neighbourhoods that stretch along the curve from Labañou to Eiris, where the average pension is lower. In this sense, areas in which lower pension income is recorded are those which are not yet consolidated in urban terms, such as Visma,

Bens and Meicende, located to the west of the Agra do Orzán and Os Mallos.

With regard to the second factor of socio-demographic vulnerability, we observe that the tracts with a greater volume of foreigners are in Agra do Orzán, where the foreign population exceeds 14%, and in some cases, 20% (Figure 7). Much of this immigrant population is unemployed, often spending days in groups on the street, and rather frequently having to rely on charity. In fact, a brief stroll through the main street in this neighbourhood will allow us to see the situation for ourselves. Other spaces in which the percentage of immigration is around 14% and 19% are Labañou, especially homes from the María Pita Group, and Os Mallos, in particular around the train station and next to the Elviña estate. It is particularly striking that the Pescadería area also registers similar percentages, since it is in the city centre and the housing has high rateable values, as we will discuss below. The explanation for this phenomenon may be the existence of a set of streets in which these values are significantly lower. This reduction is due to different deterioration processes, both physical and economic, which may result in the proliferation of affordable moderate rents for immigrants with fewer resources.

Thirdly, we note that areas with high numbers of uneducated population largely coincide with those in

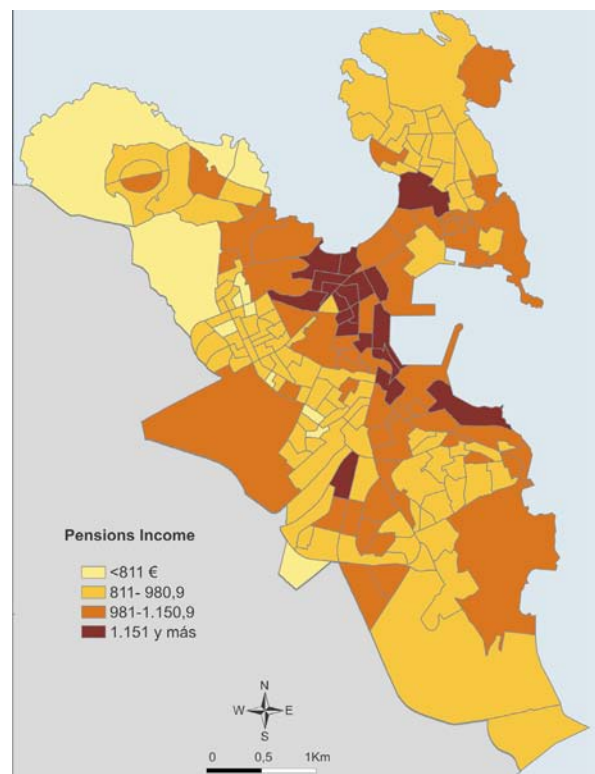


Figure 6. Pension income
 Source: Own work from the 2011 Population and Housing Census. INE



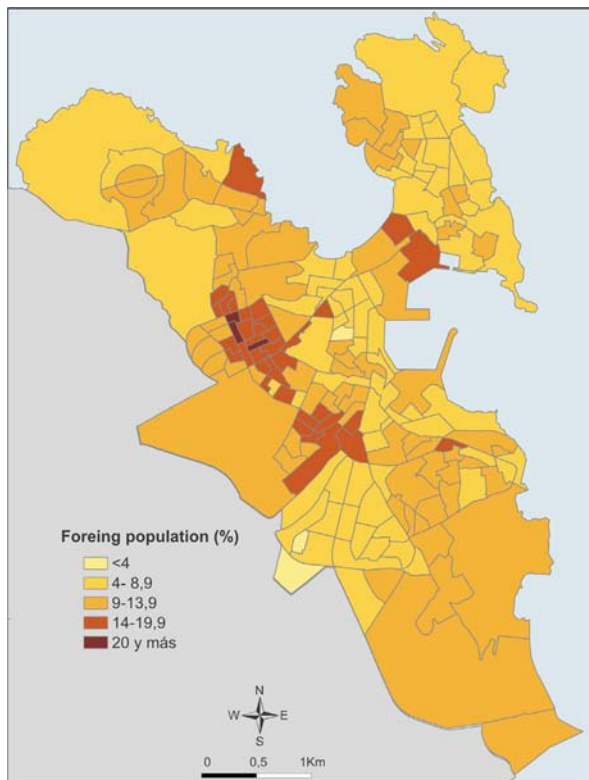


Figure 7. Percentage of foreign population
Source: Own work from the 2011 Population and Housing Census. INE

which the highest rates of ageing are recorded (Figure 8). This is the case, for example, in the neighbourhood known as Eiris, some tracts of Barrio das Flores and Agra do Orzán, as well as the rur-urban areas located in the northwest of the municipality. The population with a first degree education (Primary) is concentrated in the fringe of neighbourhoods stretching from Agra do Orzán to Eiris. At the same time, this same area corresponds to lower population levels with second degree (Secondary or equivalent) or third degree (University studies) education.

4.2.2 Socio-economic vulnerability

The unemployment rate in Spain has remained very high during the years of the crisis. This fact helps explain why the high percentages reported in A Coruña are not restricted to the neighbourhoods that have a higher concentration of the vulnerability indexes, but have been observed in a large majority of census tracts (Figure 9). Therefore, we can find high unemployment rates in areas with different purchasing power. In any case, we note a certain concentration on the edges of

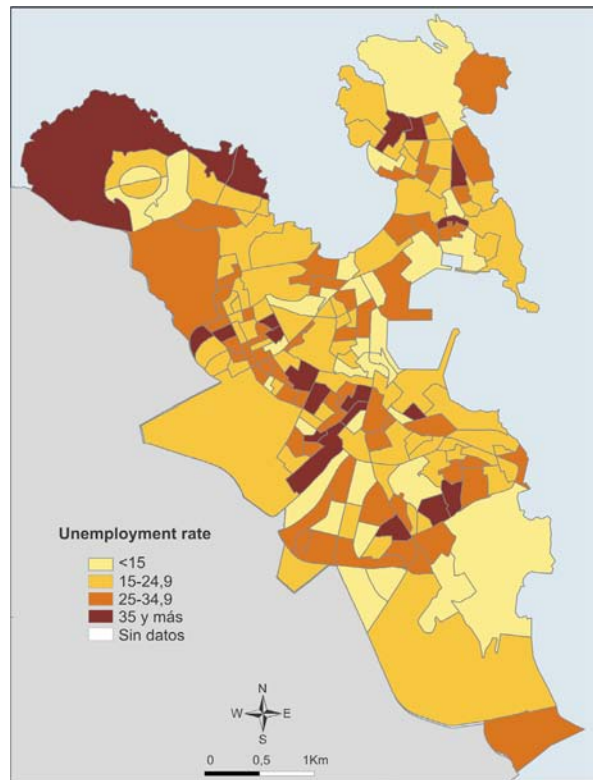


Figure 9. Unemployment rate
Source: Own work from the 2011 Population and Housing Census. INE

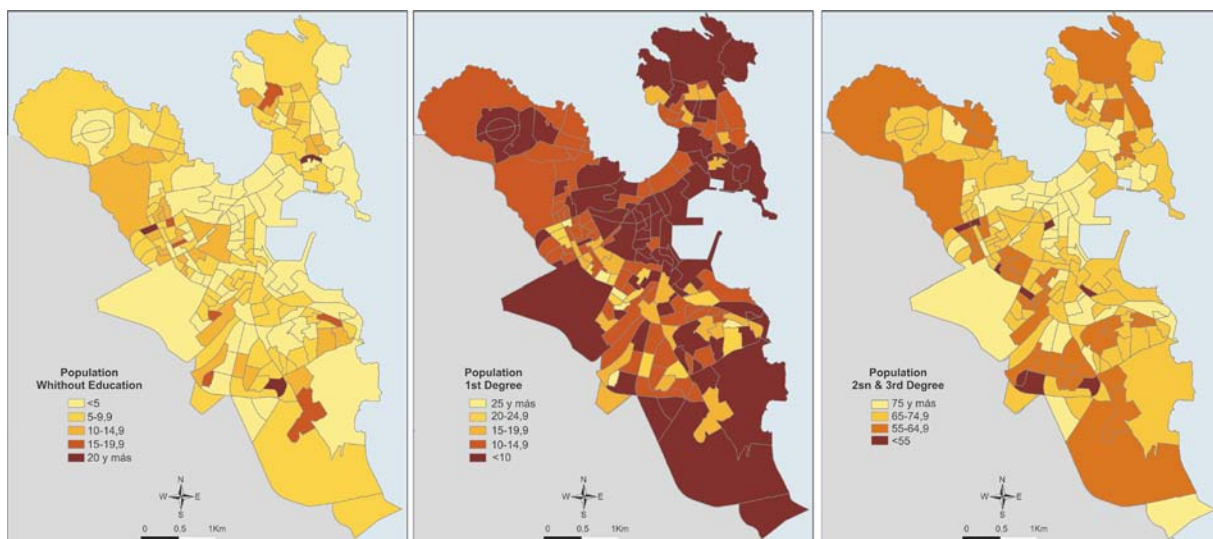


Figure 8. Percentage of uneducated population and population with 1st and 2nd-3rd degree education
Source: Own work from the 2011 Population and Housing Census. INE



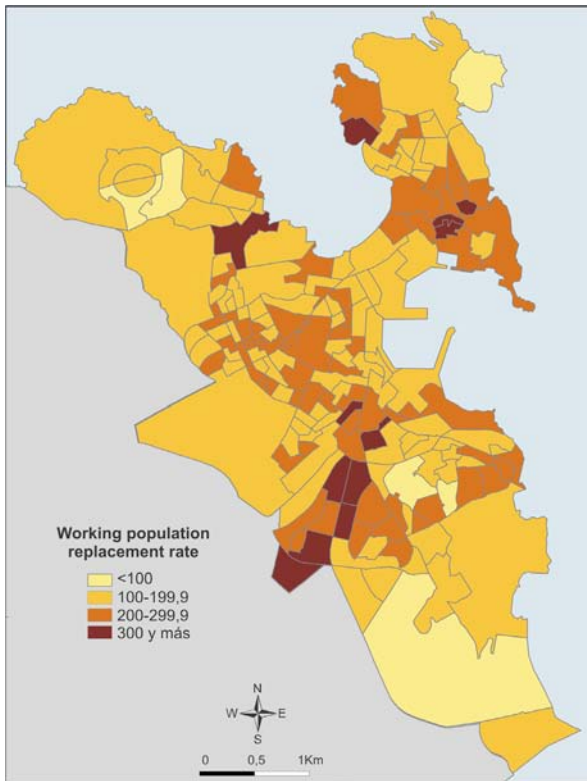


Figure 10. Working population replacement rate
Source: Own work from the 2011 Population and Housing Census. INE

the neighbourhoods of Labañou, San Pedro, Agra do Orzán, Os Mallos especially around the train station Barrio das Flores, Eiris and Castrillón. We also identified some tracts around Monte Alto, north of the city.

In terms of the second indicator of socio-economic vulnerability, the working population replacement rate has high values (surpassing 200) in neighbourhoods such as Elvina, As Lagoas, San Roque, the sector of Labañou corresponding to the El Carmen group, and O Birloque (Figure 10). However, the highest number corresponds to the historic centre, with a value of 515, which means that in the future a working person will contribute to pay the pension of 5.15 pensioners.

Finally, the rateable value of commercial premises shows that neighbourhoods that until now were affected by increased vulnerability have recorded average to lower values (Figure 11). On the contrary, in other areas such as Pescadería, Ensanche and Cuatro Caminos, values are significantly higher. Moderate figures in the former neighbourhoods favoured the proliferation of small businesses, focused on the demands of the resident population. However, the crisis has seen many of these businesses close and a change in the type of activity they house. In fact, a fieldwork study carried out in 22 streets and commercial areas of the city by the Galician Socialist Party (2012), showed that in just a year and a half 283 out of 1249 business closed



Figure 11. Rateable value of commercial
Source: Piñeira (2005)

—almost a quarter of the total. These figures allow us to speak of a crisis of the small business sector, hit hard not only by the existence of 11 shopping centres in town (Ponte, 2014) but also by other three difficulties: a) the purchase of commercial premises due to high land prices; b) the price of rent, between 2,000 and 4,000 euros per month in downtown streets; c) increased taxes in times of a significant reduction in spending. This situation is also observed in other Spanish regions such as Asturias and Madrid, and has been widely studied by Lois and González (2015).

4.2.3 Residential vulnerability

Of the four reasons given as a possible explanation for the existence of empty housing, the one that suggests a greater degree of vulnerability would be the abandonment of homes due to poor conditions of habitability (Figure 12). This phenomenon can be identified in some areas of the old town centre or specific sectors of the Pescadería. In any case, tracts where a higher percentage of empty housing is recorded correspond to speculation. Thus, for example, the so-called ‘golden mile’ is located on the outskirts of the old town, extending to the Pescadería; here there are values of between 30% and 43% of empty housing.

Connecting this information with the second indicator, the ‘golden mile’ matches the area where rateable



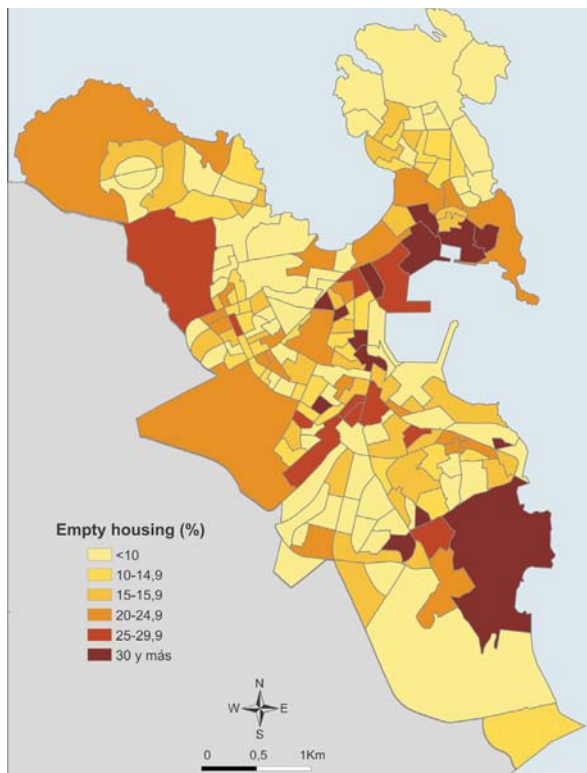


Figure 12. Percentage of empty homes premises
Source: Own work from the 2011 Population and Housing Census. INE

values of the home are higher (Figure 13). Therefore, we can deduce that the main reason leading to the non-occupation of these houses is the inability to purchase them, especially in this current time of crisis. This is also occurring in the area of As Xubias; however, the rateable values of the home are lower, since they are on the periphery of the consolidated urban area. In this area, many residential complexes have been built in recent years which, according to the data, remain unoccupied.

5. Final remarks

The economic crisis has left its mark on different parts of A Coruña, especially in those areas that began with less favourable conditions. After years of growth brought improvements in socio-economic conditions, the effects of the crisis have taken those neighbourhoods back to the past. This is the case in the neighbourhoods of Labañou, Agra do Orzán, Elvina, Barrio das Flores, Eiris, Os Mallos and Monte Alto. Here, the urban vulnerability indicators analysed tend to show their maximum values. In light of these data, we share the idea of a circular process of urban and social segregation postulated by Alguacil, Camacho and Hernández (2014). In this process, neighbourhoods that historically have had higher degrees of vulnerability see their weaknesses accentuated during a crisis.



Figure 13. Rateable value of the home
Source: Piñeira, 2005

This same idea is shared by Goñi (2008), who studied distressed census tracts in the metropolitan area of Barcelona.

On the other hand, we also note that with the crisis new realities arise in the field of urban vulnerability. This is the case in the Pescadería, in the historic centre, where some indications in specific sectors have been detected which may lead to degradation. This could result in new processes of segregation in places that had never experienced it, with the arrival of immigrants with lower purchasing power. At the same time, the Pescadería is also a reflection of the consequences of the crisis in the construction sector. The 'golden mile', located at the eastern part of that neighbourhood, has recorded a high percentage of empty housing arising as a result of speculation.

In conclusion, we have established that the practical application of our methodology yields outcomes of interest. Not only does it illustrate accentuated urban vulnerability in neighbourhoods that have had problems over time, but it also shows new effects of the crisis in areas that were not previously vulnerable. After studying one city in particular, we believe that this analysis model could be applied to other cases, so that a comparative study could be done. This would complement previous studies on urban areas, such as those on Madrid and Barcelona (Goñi, 2005; Rubiales *et al.*, 2012 and 2013),



that were also based on census tract data. Likewise, in subsequent research we propose extending the model to include a new aspect that is of great interest in understanding vulnerability: the subjective aspect. Therefore, field work (population surveys, in-depth interviews with local actors) would properly complement the quantitative analysis developed here.

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The Demographic-Territorial Repercussions of the Economic Boom and Crisis in Spain (2001-2015): An Analysis at Municipal Level

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Abstract

This paper analyses the demographic-territorial effects of the economic crisis that has been troubling Spain since 2008. Using municipalities as the scope of analysis, it reflects upon which areas have been adversely affected by the economic recession and which have shown greater resilience, adaptive capacity or better response to its dramatic effects. The study has revealed that there is a demographic situation of endemic vulnerability which, in the wake of the crisis, has come to include municipalities that grew during the time of economic boom but fell into population decline after 2008. Meanwhile, only one quarter of Spanish municipalities have sustained positive population growth since the outbreak of the crisis. The findings ultimately point to the existence of a new territorial dichotomy in Spain defined by resilient *versus* vulnerable areas, a dichotomy that is redefining territorial relations in Spain today.

Keywords: economic crisis; population change; territorial resilience; vulnerability; demographic-territorial structure; Spain.

1. Introduction: Aims and Objectives

Though changes in Spain's production structure had begun decades earlier,¹ the new international division

1. In fact, in the final decades of the 20th century, economic restructuring – subsequent to the energy crisis of 1973-1975 – and adjustments related to Spain's entry into the European Union contributed significantly to the onset of said transformations.

of labour, inextricably linked to globalisation, fuelled its acceleration over recent years. This has led to the progressive specialisation and modernisation of primary sector industries –uniquely in agriculture and livestock farming–, a process of sustained deindustrialisation and, at the same time, the development of sectors such as finance, consumption services, tourism and, related to the latter, albeit not only to it, the real estate sector (Martín-Rodríguez and García-Delgado, 2013).

The hypothesis set forth in this paper is that this intense process of change spawned by the economic crisis that broke in 2008 has resulted in a new territorial model in which the rural-urban dichotomy that for decades accounted for Spain's dynamics has shifted to a new dichotomy: resilient *versus* vulnerable areas. Thus, the spatial impact of the socio-economic processes indicated, both for the period of economic growth (until 2008) and the crisis (2008-2014), differed enormously according to the characteristics of each region, county and even municipality, also revealing significant internal contrasts, for example, in the context of major metropolitan areas.

An understanding of the effects on population both during the boom –or “false boom” (Sebastián, 2015)– and the crisis calls for knowledge of the territory's characteristics. Spain is a country determined by its sharp internal disparities: some regions, prior to the crisis and in the present day, are characterised by strong and diversified economic and production structures, as well as high per capita income, equal and comparable to those in the most dynamic European regions. Other regions, however, show weaker and more specialised structures, less human capital (Méndez *et al.* 2015) and lower per capita income and,



therefore, are less capable of withstanding the blows of the economic crisis.²

Against this socio-economic and regional backdrop, the effects of the crisis (rising inequality, difficulties integrating young people who wish to gain employment and adults who have lost their jobs into the labour force, dwindling wages, the loss of opportunities, precarious employment and recruitment, among many other consequences) have hit the most disadvantaged social sectors the worst, that is, young people and foreign immigrants. Geographically speaking, the crisis seriously affects the most vulnerable areas, characterised by less economic vibrancy and more dependence on employment and public investment. As a result, the country has lost social (FOESSA, 2014) and territorial cohesion.

Based on these facts, this paper focuses on addressing the demographic aspect of transformations experienced by Spain in the period 2001-2015, underpinned by the analysis of two well-differentiated economic periods, i.e. 2001-2007 and 2008-2014.³ Therefore, its overarching goal is to tackle an issue poorly addressed thus far, that is, to ascertain and analyse the demographic-territorial effects of the economic crisis in Spain, using municipalities as the scope of analysis. The paper seeks to reflect on which territories have been most adversely affected by the shift in economic cycle and manifest greater vulnerability to the crisis and which territories show greater resistance to its dramatic effects, in other words, which appear to be more *resilient*, at least in terms of population.

The concept of resilience, which finds its origins in physics, was traditionally employed in engineering and architecture and concerned the resistance and resilience of building materials and structures. In the middle of the last century, it began to be used in psychology and medicine in general, referring to the ability to cope in the wake of trauma or disease. Subsequently, the concept was incorporated into ecology and, since then, it has come to bear on various applications, including so-called “territorial resilience” (Polèse, 2010, and Méndez, 2012). Mario Polèse

(2010), for instance, affirms that a city or region will be resilient if it : “a) is home to a highly skilled and educated population; b) is centrally located, at the heart of a rich market, and/or well positioned for trade with expanding markets; c) has a diversified economy with a significant proportion of high-order services, largely untainted by a legacy of rustbelt-type industries; d) boasts a climate and/or natural setting superior to most other cities in the nation”.

Meanwhile, in this paper, vulnerability is understood as the weakening of mechanisms to address risks and threats, a process that is produced by the combination of multiple factors (Castel, 1996).

The impact of the crisis affords fully-fledged meaning to the use of the concept of *territorial vulnerability* and *resilience*, understood as a region’s capacity (or not) to withstand an adverse context or to adapt by way of strategies that allow the desired balance to be restored. Hence the rationale behind its application in this paper, in the adverse context marked by the outbreak of the crisis in 2008 and its reverberations on population dynamics.

2. Sources and Methodology for the Municipal Study of the Demographic Impact of the Crisis

One of the major problems encountered in the territorial analysis of socio-demographic processes in Spain is insufficient data at municipal level for the country’s 8,117 municipalities today. The primary source of data used in this paper is the *Padrón Continuo*, which provides updated figures on the Spanish population on 1 January every year. Despite the limited information provided by the *Padrón* (total population, broken down by age, residents according to nationality and according to place of birth) and the problems associated with its use,⁴ the *Padrón* is the main –and often the only– source facilitating a municipal-based analysis of population trends and population structure by gender and age

2. As a result thereof, territorial cohesion, which has generated much rhetoric in recent decades (and for which so few compendious indicators are available in Spain as a whole), is more a political desire than a social reality.
3. Because whatever the indicator analysed, whether completed vacant housing, the cost of housing (Rodríguez López, 2011), the change in the number of companies, the evolution of the working population, young people’s rate of emancipation, foreign immigration, residential variations, unemployment benefit recipients, among others, the existence of a before and an after 2008 is confirmed, which affords meaning to executing a comparison between these two periods

4. In addition to the traditional issues associated with the use of the Register and new problems generated by strong growth of the immigrant population, new misgivings over its use have recently emerged. The updating of the registered population executed by the INE (Spanish National Statistics Institute) is performed on the basis of birth and death data and residential variations recorded during the period, but it is also adjusted on the basis of a rectification that incorporates the total number of expired residence permits for *Non-EU Foreigners without Permanent Residence Permits* (ENCARP), the trial balance for *EU or Non-EU Foreigners with Permanent Residence Permits* (non-ENCARP) and the *Balance of Other Non-Residential Variations* (INE, 2015).



in Spain. At this time, the latest available municipal-based data concerns the population on 1 January 2014, whereas for Spain as a whole, preliminary data as of 1 January 2015 is also available.

The second source of analysis is the annual registry of births and deaths at municipal level from the *Movimiento Natural de la Población* for the period under analysis. At present, the most recent data published corresponds to births and deaths in 2013 at municipal level, and the provisional data for 2014, though the emergence of findings broken down by municipality is still pending for said year. In this regard, population dynamics can be examined in the period 2001-2007 and 2008-2013.

On the basis of total growth data and natural increase figures, the net migration for each period studied is determined, which allows the intensity of growth to be estimated on the one hand, and the role of the various components of growth to be appraised on the other.

The methodology employed is based on calculating and mapping the growth indicators and their components (births, deaths and migrations), which facilitated the territorial analysis of peculiarities, both in the period of economic expansion (which began in 1993 and, for the purposes of this paper, corresponds to the period 2001-2007) and the crisis (2008-2014). The idea behind comparing the trends observed in both periods, coupled with an examination of territorial patterns, was

to allow the findings obtained at municipal level to be systematised and to facilitate a reflection on territorial resilience from a demographic perspective.

3. The Demographic Impact of the Crisis in Spain

Spain commenced the new century by exceeding the threshold of 40 million inhabitants and immersed in a period of intense population growth closely related, firstly, to the effective performance of economic indicators and, secondly, to the sustained influx of foreign immigrants, largely attracted by employment opportunities offered by the Spanish economy (Domínguez-Mujica *et al.*, 2014; Pumares *et al.*, 2006). However, if the trends recorded as of 2001 are noted, population changes are further testimony to the country's economic turnaround. In the period 2001-2007, the Spanish population therefore rose by 12.5%, translating into more than five million people (Table 1), growing from 41.1 to 46.2 million inhabitants. However, between 2008 and 2015, the rise corresponded to 443,127 people, raising the Spanish population to 46.6 million people according to provisional data on 1 January 2015. The highest recorded growth was reached in 2007, when the annual rate exceeded 2%. From this point on, the pace of growth rapidly and clearly began to dwindle and, since 2012, the country has seen a regression in its growth and the onset

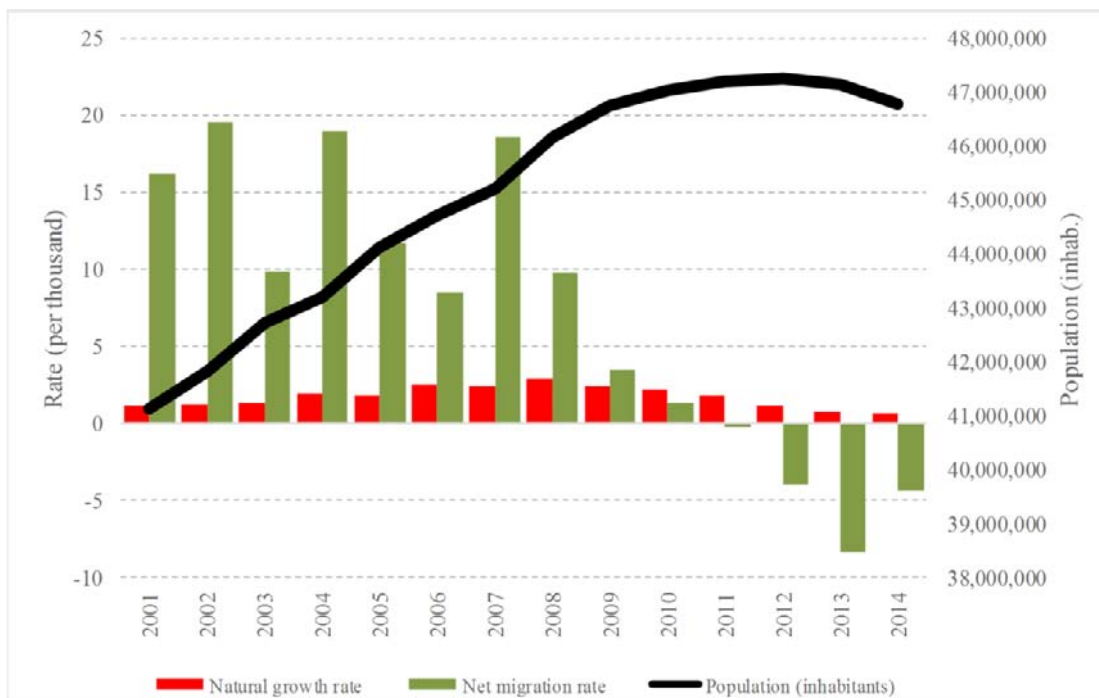


Figure 1. Population Growth Components in Spain before and after 2008 economic crisis

Source: Compiled by authors based on INE: *Padrón Continuo*, 2001-2015 and *Movimiento Natural de la Población*, 2001-2014



YEAR	TOTAL POPULATION (January st)	ABSOLUTE VALUES			RATES (‰)		
		Population Change	Natural Increase	Net Migration	Population Change	Natural Increase	Net Migration
2001	41,116,842	721,052	47,733	673,319	17.38	1.15	16.23
2002	41,837,894	879,170	51,642	827,528	20.80	1.22	19.57
2003	42,717,064	480,620	58,076	422,544	11.19	1.35	9.84
2004	43,197,684	910,846	83,608	827,238	20.87	1.92	18.95
2005	44,108,530	600,434	79,755	520,679	13.52	1.80	11.72
2006	44,708,964	491,773	111,904	379,869	10.94	2.49	8.45
2007	45,200,737	957,085	107,889	849,196	20.95	2.36	18.59
2008	46,157,822	587,985	134,305	453,680	12.66	2.89	9.77
2009	46,745,807	275,224	110,508	164,716	5.87	2.36	3.51
2010	47,021,031	169,462	105,018	64,444	3.60	2.23	1.37
2011	47,190,493	74,828	84,536	-9,708	1.58	1.79	-0.21
2012	47,265,321	-135,538	52,226	-187,764	-2.87	1.11	-3.98
2013	47,129,783	-358,442	35,840	-394,282	-7.63	0.76	-8.40
2014 (*)	46,771,341	-170,392	31,678	-202,070	-3.65	0.68	-4.33
2015 (*)	46,600,949						
2001-2007	--	5,040,980	540,607	4,500,373	16.50	1.80	14.70
2008-2014 (*)	--	443,127	554,111	-110,984	1.36	1.70	-0.30

(*) Provisional data

Table 1: Components of Population Growth. Spain. 2001-2015

Fuente: Elaboración propia a partir de INE: *Padrón Continuo*, 2001-2015 y *Movimiento Natural de Población* (2001-2014)

of population decline. This behaviour is the result of negative net migration and exceedingly low natural growth, which tended to weaken further from 2008 when values close to zero were noted (Table 1 and Figure 1).

The demographic reasons accounting for this transformation are known and well documented in various recently published papers. On the one hand, in the first period analysed, natural increase was slightly boosted by very low mortality and rising life expectancy, at a rate of three tenths per year for men and two tenths for women.⁵

Furthermore, this component was also strengthened by fertility that, albeit with very low indicators, began to recover slightly, after years in decline and stagnating at values that were among the lowest in the world. In 2001, the fertility rate was 1.24 children per woman and was in the midst of modest recovery, reaching 1.44 children per woman in 2008 (Table 2). This slight increase was

explained by the contribution of foreign women with a higher fertility rate than that of Spanish women (Delgado and Zamora, 2006), together with the effect of policies advocating the conciliation of family and professional life and initiatives to promote natality implemented by governments.⁶

The crisis has marked the emergence of a new demographic and socio-economic reality. On the one hand, mortality does not appear to be affected by the shift in economic cycle, but as shown by the available data, life expectancy also rises in the period of economic recession. Is it possible that the crisis scenario, characterised by cuts in healthcare and social benefits, does not bear an impact on mortality? Some researchers suggest as much, as in the case of Tapia-Granados (2014), who even claimed that the crisis could yield beneficial effects on health and mortality. In Domínguez-Mujica's opinion (2013), however, it is still too early to assess the impact of the crisis on health and mortality and a number of years will have to elapse before appraising its influence. For their part, Castro *et al.* (2015)

5. In 2001, life expectancy was 79.7 years for the total population (76.3 for men and 83.1 for women); in 2008, it rose to 81.3 years (78.2 for men and 84.3 for women). Finally, in 2014, it stood at 83 years (80.2 for men and 85.7 for women)

6. Such as the €100-monthly benefit for working mothers with children under three years of age or the so-called "baby cheque", in other words, a single universal payment of €2,500 (Esping-Andersen, 2013)



note that, despite the continued rise in life expectancy in recent years, it could have improved much more in the absence of the crisis. Furthermore, the effect thereof is pointed out in the increase in the number of suicides, particularly among young people and young adults –ages with low mortality– and the erosion of disability-free life expectancy, two significant indicators that have deteriorated considerably in the most recent period.

As for fertility, the withdrawal of some family benefits and the rise in unemployment and job insecurity, declining wages, as well as the loss of families' purchasing power are factors that directly affect the decision to postpone having a child and, indirectly, are delaying processes such as emancipation or living with one's partner (Esping Andersen, 2013 and Castro *et al.*, 2015). In the latter paper, two key aspects are noteworthy in this regard: on the one hand, the greater effect of these impacts on young people, given the high rates of youth unemployment and the tremendous job instability consolidated among young people; on the other hand, generally speaking, they indicate that the effect of the crisis on fertility delays childbearing, although the onset of economic recovery is also usually accompanied by a recovery of natality. However, given

the lengthy duration of the current crisis, in this paper, the question is posed whether there will be actual time for the period of infertility to recover, particularly for couples in the more advanced stages of their childbearing years. The onset of the crisis ultimately meant the return to the decline in fertility as of 2008 which today stands at 1.3 children per woman, again among the lowest rates in the world.

Despite the contribution from natural increase described earlier, the main factor behind population change in Spain is the migration pattern. In 2001, Spain registered 1,968,781 births abroad. This figure rose to 6,044,528 births abroad in 2008, equivalent to a rise in excess of four million people in seven years, or the equivalent of tripling the number of residents in Spain born abroad. Economic growth and the employment opportunities offered by the Spanish labour market constitute the main reasons behind this explosive growth (Pumares *et al.*, 2006; Cebrián *et al.*, 2010).

The outbreak of the crisis and its dramatic effects on the labour market triggered a series of chain reactions. Firstly, it curbed the influx of new arrivals, as documented by Domingo and Recaño (2010), Domínguez-Mujica *et al.*

YEAR	CHILDREN BY WOMAN			INTERANNUAL CHANGE		
	Total	Spanish	Foreign	Total	Spanish	Foreign
2001	1.24	--	--			
2002	1.25	1.27	1.61	0.01		
2003	1.30	1.23	1.53	0.04	-0.04	-0.08
2004	1.32	1.27	1.56	0.02	0.04	0.03
2005	1.33	1.29	1.58	0.01	0.02	0.02
2006	1.36	1.30	1.68	0.04	0.01	0.10
2007	1.38	1.31	1.68	0.01	0.01	0.01
2008	1.44	1.36	1.83	0.07	0.05	0.14
2009	1.38	1.31	1.72	-0.07	-0.05	-0.11
2010	1.37	1.31	1.69	-0.01	0.00	-0.03
2011	1.34	1.28	1.66	-0.03	-0.03	-0.03
2012	1.32	1.27	1.75	-0.02	-0.02	0.09
2013	1.27	1.25	1.77	-0.05	-0.01	0.02
2014	1.32	1.21	1.86	0.04	-0.04	0.09

Table 2: Total Fertility Rate. Spain. 2001-2014

Fuente: www.ine.es



(2012) and Domingo and Sabater (2013). At the same time, the departure of former immigrants (or of their descendants) began who, in seeing labour market conditions worsen and unemployment benefit running dry, decided to embark on a new migratory process, either to their country of origin, or an alternative destination with better job prospects.⁷ Another of the factors influencing population behaviour is the increase in a growing number of Spaniards leaving Spain in pursuit of better job opportunities, either in European countries less plagued by the crisis or countries with emerging economies (Alba *et al.*, 2013). This group is difficult to quantify, because existing sources do not reliably document these new trends (Domingo *et al.*, 2014 and González-Ferrer, 2013).⁸

The debate revolving around this phenomenon is further complicated when this flow is related not only to the loss of Spain's young people, but when it is identified with brain drain, in other words, the emigration of the most highly trained or qualified people. In this regard, what is happening is not only a process of unwanted emigration, varying in intensity according to the source discussing the issue, but also a blatant loss of higher qualified and more competitive human capital. Whatever the case, the available data on immigration and international emigration (Table 3) illustrates this trend and, as a result, following a period in which it exercised the role of host country to immigration, Spain is resuming its traditional role as a country of emigration, with a negative balance between those entering and exiting the country.

The effect of dwindling immigration and rising emigration also bears a collateral impact on the population's structure. The curbing of the influx of immigrants of reproductive age and the emigration of young people further diminishes natural increase, weakening natality and heightening the ageing population, as it is young people who emigrate primarily (Valero, 2013). In short, over a few years, a whole series of transformations were noted that altered the population patterns prevailing in Spain until the outset of the crisis.

7. It should be remembered that among the groups most affected by the impact of the crisis are foreigners, with higher unemployment rates than those experienced by the autochthonous population (Vidal *et al.*, 2012; Cebrián *et al.*, 2010)

8. In fact, there is huge disagreement over quantifying the phenomenon, evident when comparing the reading of the works of González-Ferrer (2013) and González-Enríquez (2013). For some, the figure of this so-called "new Spanish emigration" or "expatriates" implies a major blow to the Spanish population (González-Ferrer, 2013); for others (Domingo *et al.*, 2013), its implication is negligible

YEAR	IMMIGRATION	EMIGRATION	NET MIGRATION
2008	13.0	6.3	6.8
2009	8.5	8.2	0.3
2010	7.7	8.7	-0.9
2011	7.9	8.8	-0.8
2012	6.5	9.5	-3.0
2013	6.0	11.4	-5.4
2014	6.6	8.8	-2.2

Table 3: International Migration rate (%). Spain. 2008-2014

Fuente: www.ine.es

4. Territory Matters: Vulnerable Spain versus Resilient Spain

The changes undergone by the Spanish population outlined in the previous section have undeniably reflected the effect of the crisis on population trends in Spain. However, this section calls for an in-depth geographical analysis, to determine subtleties and note the uneven impact of the shift in economic cycle on some municipalities, in order to verify the effects of the crisis from the demographic-territorial perspective, and contrast vulnerable territories with resilient areas. The various combinations of net migration⁹ and natural increases at municipal level explain the annual growth rates, an indicator that provides the basis for our analysis, on account of its compendious nature.

During the pre-crisis period (2001-2007), Spain presented a dual dynamic: areas grew demographically, albeit clearly at an uneven pace, while others showed population decline and depopulation, which translated into a net loss of population (Figure 2). However, the distinctive feature of this period is the noteworthy presence of areas demonstrating positive growth, as in the period 2001-2008, nothing less than 51% of Spanish municipalities recorded population growth, a higher percentage than that shown in previous periods.

Value added by the municipal population size (Table 4) shows that, in the period 2001-2008, only municipalities with less than 500 inhabitants recorded a negative growth. However, in the following period, we see how the group under 2,000 inhabitants experiences a loss of population, a situation which, paradoxically, also occurs in the larger cities. The other categories have modest growth, never exceeding 1% annually.



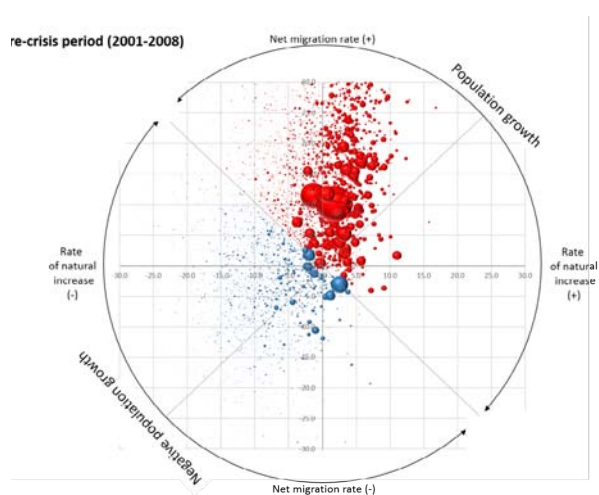


Figure 2. Scatterplot using Natural Increase and Net Migration (annual rates, ‰). Spanish municipalities, 2001-2007

Source: Compiled by authors based on INE: *Padrón Continuo*, 2001-2015 and *Movimiento Natural de la Población*, 2001-2014

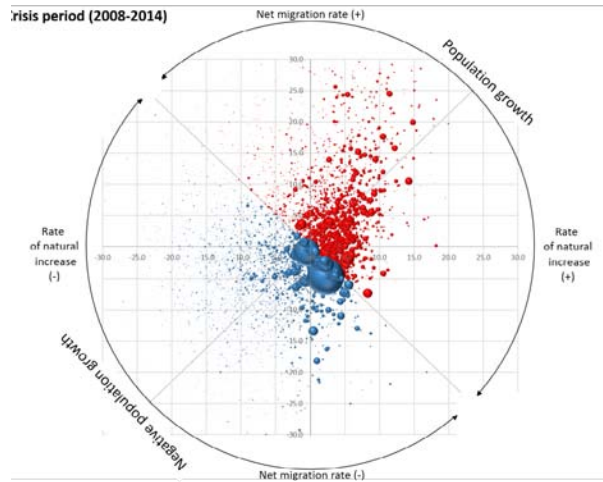


Figure 3. Scatterplot using Natural Increase and Net Migration (annual rates, ‰). Spanish municipalities, 2008-2013

Source: Compiled by authors based on INE: *Padrón Continuo*, 2001-2015 and *Movimiento Natural de la Población*, 2001-2014

MUNICIPAL DEMOGRAPHIC SIZE	Nº OF MUNICIPALITIES (a)	POPULATION (1 st January)			ANNUAL POPULATION GROWTH RATE (%)	
		2001	2008	2014	2001-2008	2008-2014
<500 habitantes	3,877	840,325	798,164	732,273	-0.74	-1.44
500-1,000 hab,	1,037	755,208	770,486	738,661	0.29	-0.70
1,000-2,000 hab,	917	1,290,665	1,345,409	1,302,915	0.59	-0.53
2,000-5,000 hab,	982	2,769,096	3,094,237	3,109,507	1.58	0.08
5,000-10,000 hab,	552	3,241,780	3,778,879	3,885,669	2.19	0.46
10,000-50,000 hab,	607	10,219,537	12,120,742	12,535,162	2.43	0.56
50,000-100,000 hab,	83	4,829,741	5,753,116	5,968,029	2.49	0.61
100,000-300,000	49	7,765,593	8,390,807	8,480,833	1.11	0.18
300,000-600,000	8	2,882,406	3,103,715	3,101,513	1.06	-0.01
600,000-1,200,000 (b)	3	2,060,108	2,173,088	2,149,158	0.76	-0.18
1,200,000 -2,000,000 (c)	1	1,505,325	1,615,908	1,602,386	1.01	-0.14
>2,000,000 (d)	1	2,957,058	3,213,271	3,165,235	1.19	-0.25
Total	8,117	41,116,842	46,157,822	46,771,341	1.65	0.22

(a) Padronal population at 1/1/2014 (b) Valencia, Sevilla and Zaragoza (c) Barcelona (d) Madrid

Table 4: Annual Population Growth rate by municipal demographic size (%)

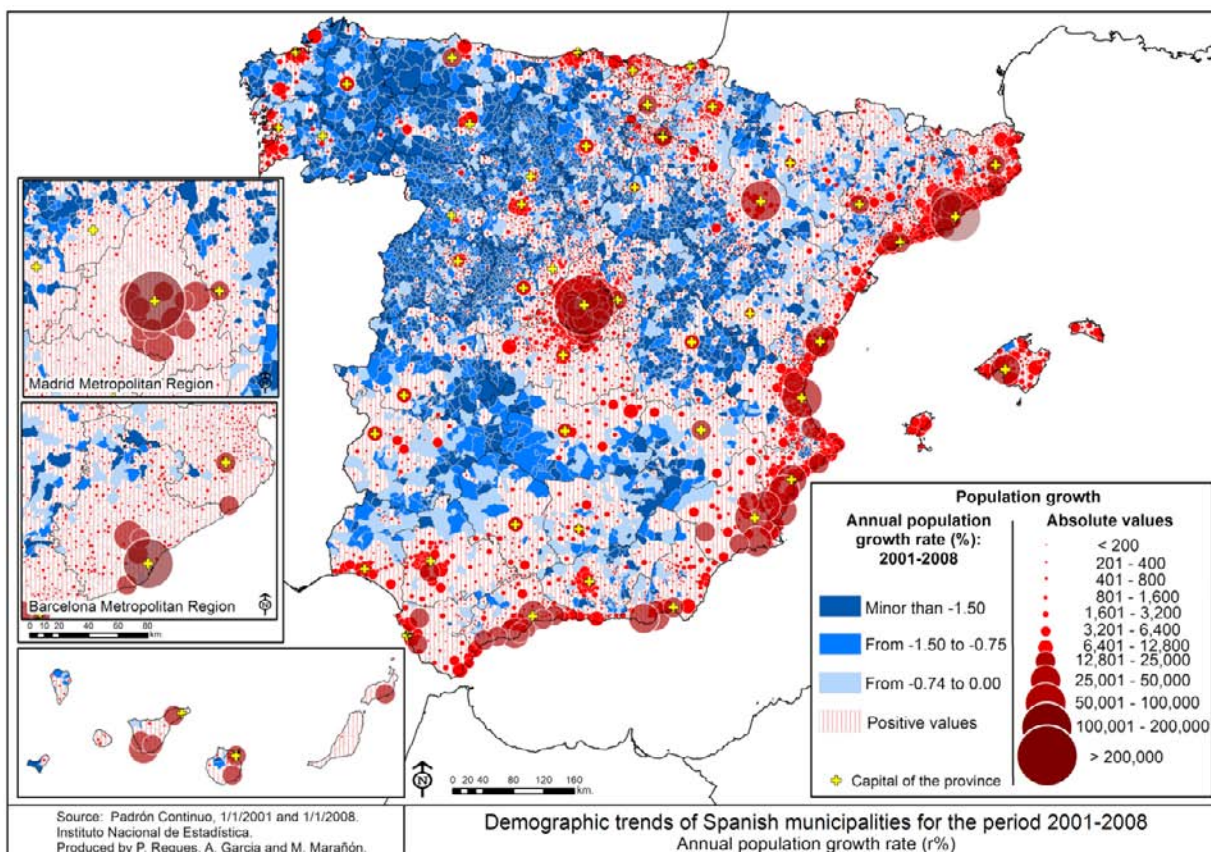
Source: Compiled by authors based on INE: *Padrón Continuo*, 2001-2015 and *Movimiento Natural de la Población*, 2001-2014

The comparison of Figures 2 and 3, like the aggregated analysis of the findings of Maps 1 and 2 and Cartograms 3 and 4, in statistical terms, stands testimony to demographic-territorial change experienced in the transition from one economic cycle to another.

Cartograms (Maps 3 and 4), which have to be understood more as a complement than as an

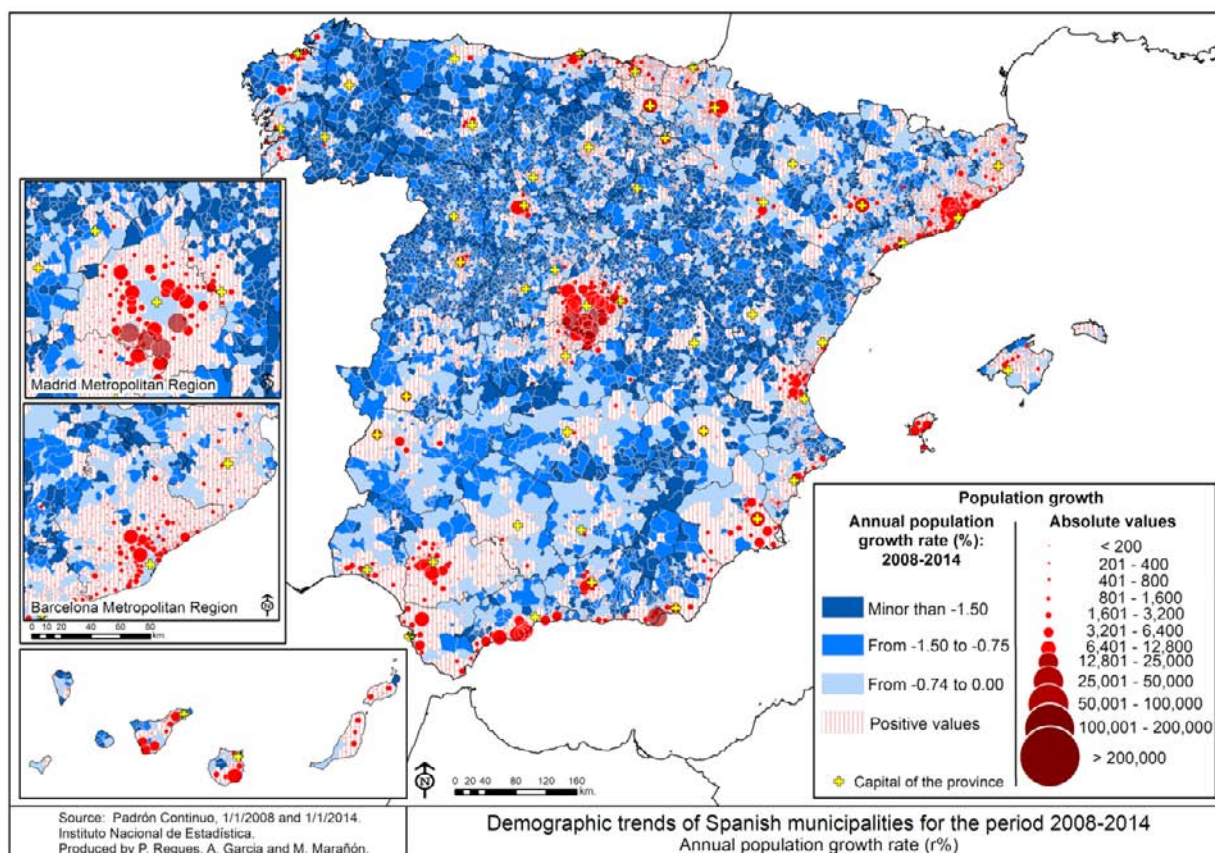
alternative to classic cartographic representations, reveal the same information as choropleth maps and proportional symbols (Maps 1 and 2) but these emphasize the volume of population growth or decline in each municipality, whose size is distorted by this factor. The maps show, again, deep contrasts, both in time and space, of the demographic dynamics of the Spanish municipalities before and after the crisis.





Map 1. Population Change trends of Spanish municipalities. 2001-2008

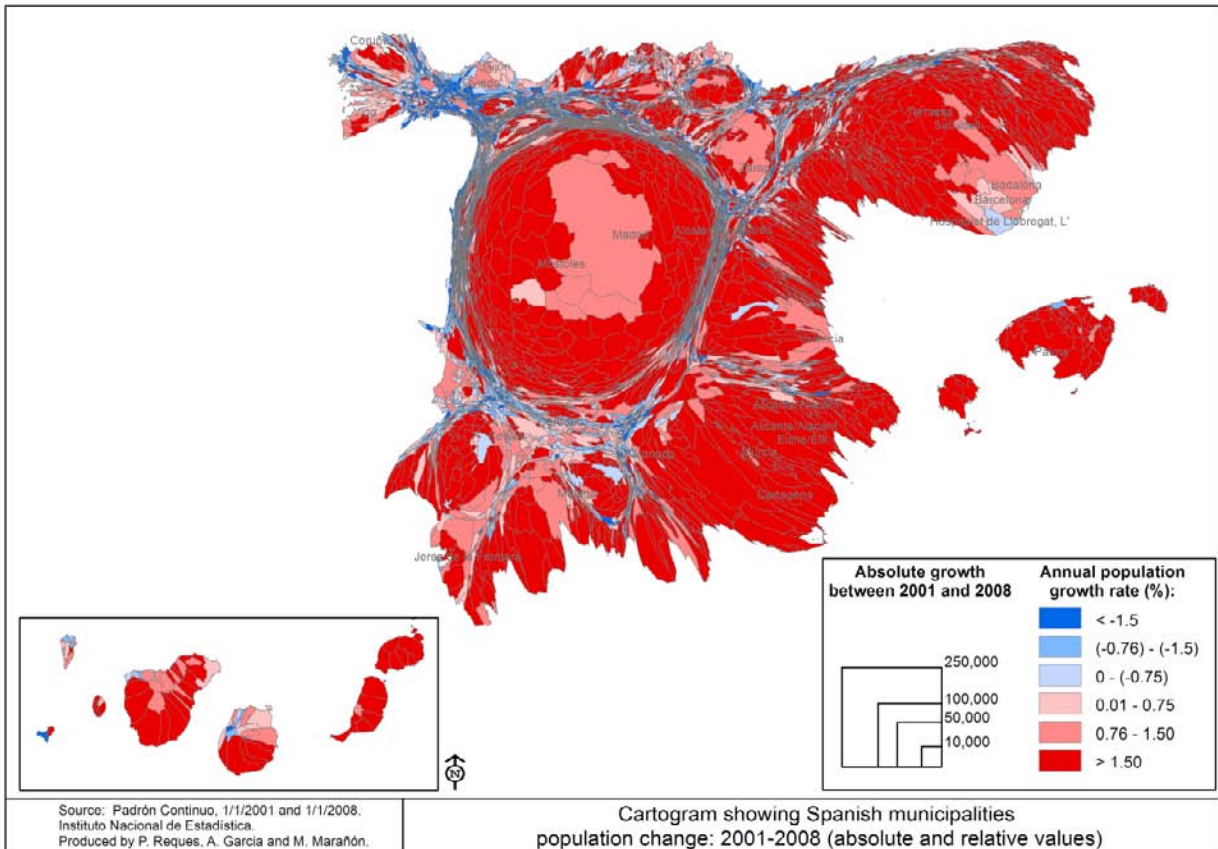
Source: Compiled by authors based on INE: *Padrón Continuo*, 1/1/2001 and 1/1/2008



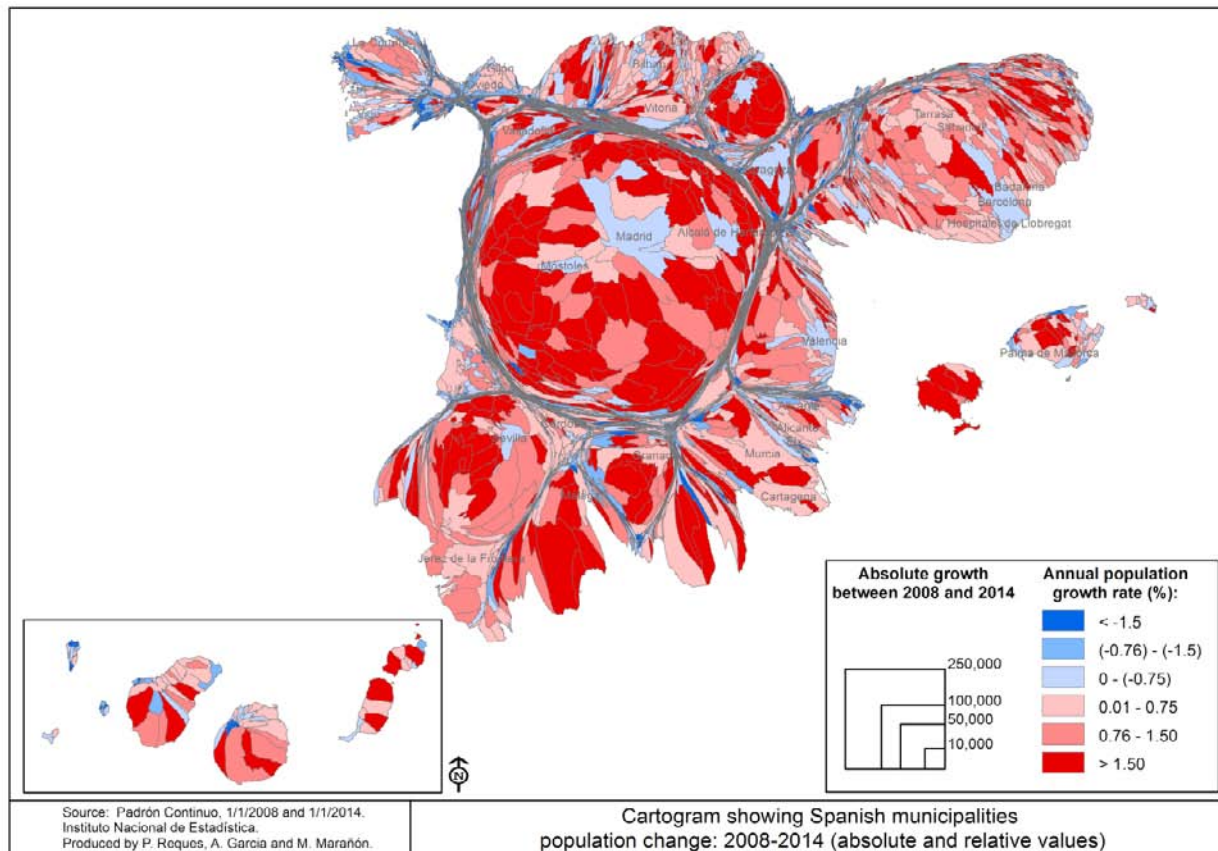
Map 2. Population Change trends of Spanish municipalities. 2008-2014

Source: Compiled by authors based on INE: *Padrón Continuo*, 1/1/2001 and 1/1/2008





Map 3. Cartogram or anamorphic map showing Spanish municipalities Population Change. 2001-2007 (absolute values)
 Source: Compiled by authors based on INE: *Padrón Continuo*, 1/1/2001 and 1/1/2008



Map 4. Cartogram or anamorphic map showing Spanish municipalities Population Change. 2008-2014 (absolute values)
 Source: Compiled by authors based on INE: *Padrón Continuo*, 1/1/2008 and 1/1/2014



Growth sign 2001-07	NUMBER OF MUNICIPALITIES			% MUNICIPALITIES		
	Growth rate sign 2008-2013			Growth rate sign 2008-2013		
	Negative	Positive (*)	Total	Negative	Positive (*)	Total
Negative	3,510	510	4,020	43.2	6.3	49.5
Positive (*)	1,997	2,089	4,086	24.6	25.7	50.3
No data (**)	--	--	11			0.1
Total	5,507	2,599	8,117	67.8	32.0	100.0

(*) 0 included. (**) Municipalities created between 2001 and 2014

Table 5: Number of municipalities by demographic trends before and after the onset of the economic crisis (Absolute and relatives numbers)

Source: Compiled by authors based on INE: *Padrón Continuo*, 2001, 2008 and 2014

Demographic losses that characterize the central municipalities of large metropolitan areas in the crisis period (2008-2014) are singularly remarkable. They show that Madrid lost 48,000 inhabitants, Valencia 21,000, Santa Cruz de Tenerife 16,000, Barcelona 13,000, Valladolid 12,000, Salamanca 8,000, Bilbao 7,000 and Santander 6,500, which are the most significant examples of decline. With them, small rural municipalities within Spain continue their process of depopulation, caused by negative natural and net migration rates.

Table 5 and 6 statistically summarise this process of change that is reflected territorially in Map 5.

The area encompassing dynamic Spain, meaning the one experiencing positive population growth, diminished considerably following the onset of the crisis. Only one quarter of Spanish municipalities are characterised as such during the two periods examined, making them the Spain that can be deemed *resilient*. Spaces showing positive growth in both periods are in line with the hubs of greater economic vibrancy in the country (Méndez *et al.*, 2015), although considerable disparities are appreciable in the most recent period, reinforcing the idea that the patterns differ at local level. From the viewpoint of demographic municipal size, there is major growth in central sections, from 5,000 to 600,000 inhabitants.

Also of note are the Mediterranean axis, from Girona to Huelva –albeit with significant discrepancies– the two archipelagos (the Balearic and Canary Islands), the Ebro Valley, the Basque Country, the eastern coast of Cantabria and the Ferrol-A Coruña-Pontevedra-Vigo-Tui axis in Galicia (although A Coruña, Vigo and Tui present negative growth in the second period and Ferrol in both). Added to these is the first ring of Madrid Metropolitan Area and Barcelona Metropolitan Region (whose central cities are characterised by population

loss) and the Guadalquivir Valley, with Seville and its metropolitan area at the head. In the recent past, these axes acted as centres of attraction for migration flows and international flows, which accounts for their population explosion (Dominguez-Mujica *et al.*, 2009). The capitals of inland provinces must be added to the aforementioned axes that, in many cases, became single “islands” of growth throughout the province as a whole, comprising an uneven number of municipalities that make up their sphere of influence, whose vibrancy spreads to others, or benefits from the population’s departure from the central capitals to the periphery. Almost all provincial capitals in Castilla-León together with Ourense and Lugo are fine examples of this type of process. As in the case of many of the medium-sized and large cities, a process of suburbanisation is noted, in which urban peripheries experience growth at the expense of population displacement from the central city for residential purposes (Susino and Duque, 2013). As a result of this residential mobility, mostly involving young couples of childbearing age or families with young children, the municipalities acting as population hosts are rejuvenated and witness a rise in their birth rate, reinforcing their natural growth and helping to consolidate them as areas of population increase. At a time when migration flows are declining –as is the case in recessionary Spain– having a population structure that reinforces natural increase becomes an undeniable asset. In short, it is also seen how, in addition to the traditional hubs of economic vibrancy, recent population growth is very much determined by residential mobility (Feria and Andújar, 2015) and, specifically, by the dynamics of suburbanisation in its various forms.

The temporal examination of demographic patterns points to the existence of a specific profile corresponding to those municipalities that, during the first period analysed, marked positive growth but have seen a shift in that trend to one of decline since the



Demographic Municipal size	NUMBER OF MUNICIPALITIES (a)					
	Negative both periods	From negative to positive	From positive to negative	Positive both periods	No data	Total
<500 inhabitants	2.281	413	810	372	1	3.877
500-1.000 hab.	476	35	290	232	4	1.037
1.000-2.000 hab.	383	31	257	245	1	917
2.000-5.000 hab.	251	16	304	407	4	982
5.000-10.000 hab.	72	7	150	322	1	552
10.000-50.000 hab.	36	7	146	418	0	607
50.000-100.000 hab.	4	0	22	57	0	83
100.000-300.000	5	1	13	30	0	49
300.000-600.000	1	0	1	6	0	8
600.000-1.200.000 (b)	1	0	2	0	0	3
1.200.000 -2.000.000 (c)	0	0	1	0	0	1
>2.000.000 (d)	0	0	1	0	0	1
Demographic Municipal size	% OF MUNICIPALITIES					
	Negative both periods	From negative to positive	From positive to negative	Positive both periods	No data	Total
<500 inhabitants	58,8	10,7	20,9	9,6	0,0	100,0
500-1.000 hab.	45,9	3,4	28,0	22,4	0,4	100,0
1.000-2.000 hab.	41,8	3,4	28,0	26,7	0,1	100,0
2.000-5.000 hab.	25,6	1,6	31,0	41,4	0,4	100,0
5.000-10.000 hab.	13,0	1,3	27,2	58,3	0,2	100,0
10.000-50.000 hab.	5,9	1,2	24,1	68,9	0,0	100,0
50.000-100.000 hab.	4,8	0,0	26,5	68,7	0,0	100,0
100.000-300.000	10,2	2,0	26,5	61,2	0,0	100,0
300.000-600.000	12,5	0,0	12,5	75,0	0,0	100,0
600.000-1.200.000 (b)	33,3	0,0	66,7	0,0	0,0	100,0
1.200.000 -2.000.000 (c)	0,0	0,0	100,0	0,0	0,0	100,0
>2.000.000 (d)	0,0	0,0	100,0	0,0	0,0	100,0

(a) Padrónal population at 1/1/2014 (b) Valencia, Sevilla and Zaragoza (c) Barcelona (d) Madrid

Table 6: Number of municipalities by demographic trends before and after the onset of the economic crisis by municipal demographic size (Absolute and relatives numbers)

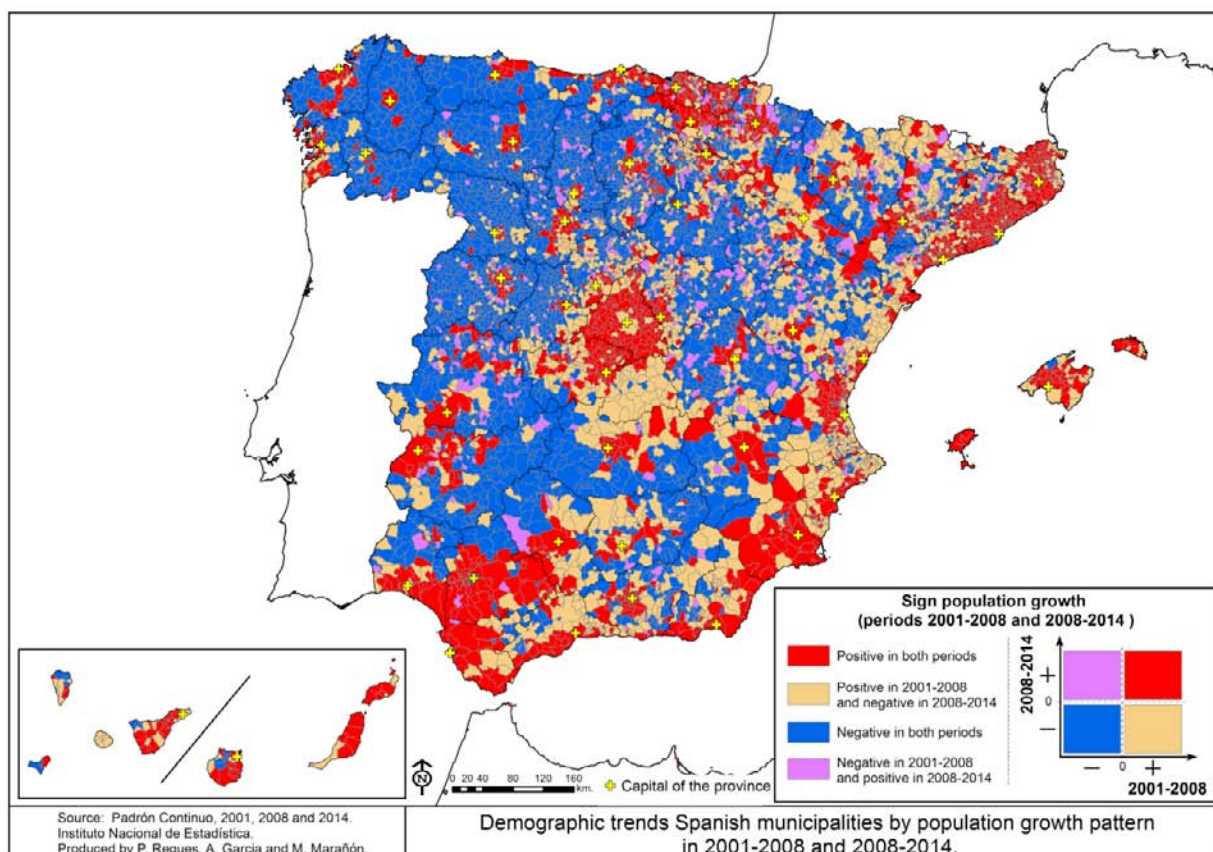
Source: Compiled by authors based on INE: *Padrón Continuo*, 2001, 2008 and 2014

advent of the crisis. This situation applies to no less than one quarter of Spanish municipalities that, moreover, meet quite specific territorial criteria. First, it has a noticeable presence in all categories of municipalities grouped by population size, a fact that points to their socioeconomic characteristics as the main reason for their change in behaviour. However, it is true that four of the five largest cities of Spain are included in this type, a sign of the vulnerability of their population trends in earlier stages.

Madrid and Barcelona, together with other major Spanish cities such as Valencia, Zaragoza and

Valladolid, as well as A Coruña, Santa Cruz de Tenerife, Pamplona, Burgos, Castellón de la Plana and Huelva are included in this pattern. The same fate has met the most mature cities in the Barcelona Metropolitan Area (l'Hospitalet de Llobregat and Esplugues de Llobregat, for example) and in Madrid, as in the case of Móstoles and Alcalá de Henares. Added to these cities are those that are not provincial capitals but are a noteworthy part of the urban system in their province, such as Vigo, Reus, Sagunto and Ponferrada, whose growth has been curtailed during the crisis period. From the demographic point of view, this behaviour is explained by the reduced entry of





Map 5: Spanish municipalities' trends by Population Change Patterns in 2001-2008 and 2008-2014

Source: Compiled by authors based on INE: *Padrón Continuo*, 1/1/2008 and 1/1/2014

foreign immigrants owing to the crisis, coupled with the sustained suburbanisation process that led to part of the population moving to the periphery of said cities. An in-depth analysis of the attached mapping reveals that its territorial impact is now much lower, despite the fact that the suburbanisation process is still taking place in the more recent period. In medium-sized cities, suburbanisation affects a lower number of municipalities, whereas in larger cities it is confined to the first metropolitan rings, with the areas furthest away from the central city showing population change. This scenario is highly tangible in Madrid's sphere of influence, whose expansion in the period of economic growth stretched beyond the borders of Madrid's neighbouring provinces, affecting the adjacent municipalities of Guadalajara, Ávila, Segovia and Toledo and even extending as far as Ciudad Real. In fact, now the opposite scenario is occurring to the one experienced in previous decades, when suburbanisation –both residential and related to economic activities– took place following similar territorial patterns.

This phenomenon is much less noticeable in the Barcelona Metropolitan Region, where the population loss as of 2008 has been felt less sharply. The existence of a polycentric urban system, with a network of more

mature cities (Roca *et al.*, 2011), explains the lower impact of population change in the case of Barcelona. The dwindling suburbanisation process affecting more remote municipalities is not solely noted in large cities, but those like Valladolid and Granada are experiencing similar processes. The conclusion is that more peripheral municipalities that had benefitted from urban expansion in previous periods are witnessing an end to their population growth in the light of the drop in residential mobility that is confined to nearer urban rings.

Other areas experiencing a shift in their population trends before and after the crisis are the coastal provinces that are clearly tourism-oriented in nature. Again, positive growth appears to occur in municipalities on the seafront, contrasted with decline in municipalities that are further inland. Andalusian provinces on the Mediterranean coast, such as Málaga and Almería, are excellent examples of how such a rupture occurs, but they are not the only ones where this dynamic is accentuated. The existence of continuums is again noted, corresponding to former areas of expansion of tourist municipalities on the coast that are now fading. However, an emphasis must be placed on the fact that the impact of the crisis is also felt in coastal municipalities with a longstanding tourist tradition, a situation that is



especially visible in Girona and Tarragona and, above all, on the Valencia coast. Thus, major municipalities in the tourism sector such as Benidorm, Torrevieja and Gandia present population loss in the second period analysed, revealing the severe impact of the economic crisis on tourism, both in the sector itself and in related construction projects (Cabrales *et al.*, 2009). The impact is especially tangible in Castellón de la Plana, a province that combines direct economic dependence on the tourism sector and on the construction industry, hit hard by the bursting of the housing bubble in Spain.

Finally, among the areas suffering from a shift in population pattern are some rural areas that had experienced a reversal of their trend in the past as a result of the new dynamics that emerged therein. Tourism development, both related to skiing and rural tourism in its different forms, had managed to turn their endemic decline into positive population growth. However, the crisis of consumption strongly affects those sectors that burgeoned in a period of economic boom and that are exceedingly dependent on the domestic market. It is thus seen how municipalities in the Lleida, Huesca and Girona Pyrenees or rural tourism municipalities in Navarre and Teruel also show a reversal in their demographic pattern with the advent of the crisis. Similarly, the development of competitive agriculture or quality production, as in the case of greenhouse agriculture or that related to the wine industry, is beginning to show uneven behaviour that breaks with a widespread pattern of growth in the previous period. This is occurring in La Rioja and in the county of Priorat in Tarragona, where population growth has given way to population decline.

Six per cent of Spanish municipalities are experiencing a different pattern, ranging from population loss to recording population growth. However, this often applies to sparsely populated municipalities whose territorial pattern cannot be clearly discerned.

Finally, a dynamic of regression has been identified that affects 43.2% of Spanish municipalities, which, despite the period of economic boom Spain enjoyed, fail to even stabilise their population. These municipalities maintained a negative balance in their population growth in the two periods observed, as a result of a structural component that has proven unfavourable to them for decades. Population decline marked inland areas -especially the less populated- in the north-western quadrant (Castilla y León, Asturias and inland Galicia), as well as the inland penplain in Extremadura and the Baetic mountains.

The overall balance of the identified patterns leads us to reflect on the existence of two models of vulnerability in Spain's current demographic landscape. On the one hand, the vulnerability noted in places traditionally suffering from depopulation, such as those listed previously. However, to this should be added the presence of a new vulnerability in municipalities affected by economic dynamics curtailed by the impact of the crisis. These municipalities are tackling the crisis "out of step", as they emerge from a recent past of growth and expansion. Therefore, their structures and planning in recent years were oriented toward managing a scenario of population and/or economic growth, which is dramatically disappearing in the throes of the crisis.

5. Conclusions

Since the mid-20th century, Spain has undergone sweeping territorial transformations. Until the mid-1970s, the rural-urban dichotomy explained the country's economic and social dynamics and, therefore, population dynamics too. From that point on, with the onset of industrial restructuring that followed the energy crisis in 1975, a process of differentiation between industrial areas began that restructured and reintroduced their competitiveness *vis-à-vis* industrial areas that did not manage to adapt to new economic scenarios. Furthermore, the strong commitment to rural development, favoured by the renewed role of rural areas and autonomous community aid or European programme grants, such as LEADER and PRODER, explains the so-called *Rural Renaissance*. This *renaissance*, though it does not affect all Spanish rural municipalities, explains the emergence of rural areas that regain economic vibrancy and, to a lesser extent, population growth. The emergence and consolidation of suburbanisation must be added to this, a phenomenon that manifests itself across a wide range of cities of different sizes, and which explains the residential and economic expansion of Spanish cities' peripheries. Thus, municipalities considered periurban rural territories located in areas of urban expansion record rapid population growth as they benefit from residential migration, whereas central cities or the more mature ones in metropolitan systems enter a phase of sluggish growth and even population loss. In this context, attempts to explain the population dynamics solely on the basis of rural-urban logic must be challenged, fostering much richer and more complex territorial dialogue.

The analysis undertaken in this paper has shown that Spain in expansion and Spain in crisis have given rise



to two models that are not only economic and social but also sharply contrasted in terms of demography and territory. Broken down geographically, the strong reduction in the presence of municipalities showing population growth is noted, which evolve from being more than half in the pre-crisis period to less than one third in the subsequent period. In fact, only one quarter of Spanish municipalities show a pattern of positive population growth, whatever the economic cycle observed, a situation that can be interpreted as a clear sign of resilience. The second characteristic is that, in this new period, resilience takes on a local dimension. Indeed, municipalities in which the production of material goods and innovation exist side by side, in which a commitment is made to diversifying and to improving productivity –whatever the sector, including the primary sector–, which enjoy greater accessibility as regards communications and transport infrastructure, which have a population with a higher socio-educational status, that are part of a more consolidated urban-metropolitan system and encourage the location therein of services for companies, hold greater importance and the effects of the crisis are less noticeable.

By contrast, the areas that, despite having high population potential, are burdened with high rates of unemployment and job insecurity, with population decline –firstly on account of rural emigration and secondly due to depopulation–, non-tourism mountain municipalities, those presenting greater problems of accessibility to high-capacity roads and high-speed trains, as well as the areas in which the tourist monoculture and where construction has been the lynchpin of their economy, have been far more severely affected and the demographic consequences have been much more adverse.

As regards vulnerability, it should be noted that two forms have been identified: one that is more traditional, affecting municipalities in an endemic situation of depopulation and structural economic deficiencies; and the other which has newly emerged, involving municipalities that, during the economic boom, experienced positive population growth but that, after the scourge of the crisis, entered a dynamic of population decline. It concerns the urban peripheries with less consolidated residential expansion, tourist municipalities on the coast that have recently expanded and, finally, rural areas whose economic dynamic in the midst of reinforcement is curtailed by the effects of the crisis.

The analysis of recent demographic history at municipal level gives us some food for thought to be borne

in mind. Firstly, the emergence of a new regional dichotomy that distinguishes regional relations in Spain, differentiating between resilient areas and vulnerable areas. On the other hand, the identification of resilient areas allows an assessment to be made of what characteristics or previous strategies account for their current vigour, even in periods of severe crisis like the current one. Finally, as to vulnerable areas, the new vulnerability tied to fragility must be set apart following the impact of the crisis as opposed to traditional vulnerability, regardless of the economic cycle.

The demographic-territorial future in Spain is not set in stone but the balance sheet of demographic behaviour at municipal level in periods of expansion and crisis undoubtedly presents subtleties that facilitate a greater understanding of the socio-demographic transformations of the Spanish population. These nuances are not observed when the scope of analysis uses a different means of breaking down the territory; hence the importance of the municipal perspective provided by this paper.

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Migrations and mobility abroad of Spaniards at a time of crisis. The state of the question

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Abstract

During the economic crisis in Spain, a significant migration of Spanish young adults who have not found a job or a job commensurate with their qualification has occurred. This fact is especially relevant among the young with a high level of training. Out-migration of these young people is analysed in this article, in the framework of globalization, the migration model in Southern Europe and international migration of skilled young people. Statistics and the results of an electronic survey with a snowball methodology, held in 2013 to 170 young people, allow us to characterize their socio-demographic profile. The internationalization of business, labour and higher education globalization, communication technologies, social networks, transnational patterns and deep disappointment at the inability of political regeneration in Spain have been the factors that allow us to interpret, besides the lack of work, this new stage of Spanish emigration.

Keywords: Spain; migration; young people; unemployment; qualification; globalization.

1. Introduction

As a consequence of the crisis and labour market maladjustments, migration patterns in Spain have grown in complexity: immigration and migration return flows coalesce with new emigration trends among young

Spaniards who are either unemployed or dissatisfied with their current job or career prospects. In greater numbers than in previous years, these young Spaniards move abroad in search of job opportunities, particularly if they are highly qualified. Our paper suggests that these young people's migration flow should be analysed as a pattern inherent in the process of globalization and southern Europe's migration model, which favours new relational balances between different geographical areas, blurring borders and contributing in turn to new forms of international connections on the basis of the major role played by information technologies and the consolidation of transnationalism.

In line with this hypothesis, our approach to emigration abroad, the object of this paper, attempts to place this process within the conceptual framework of globalization, of southern Europe's migration model and of the international migration flows of qualified young people. Additionally, our paper attempts to summarize the state of the question on the strength of the literature review undertaken while researching the paper. Finally, our third objective is the quantitative and qualitative interpretation of both primary and secondary data, which makes it possible to characterize this emigration flow. The paper is consequently divided into an initial section devoted to its conceptual framework, a second literature review section and a third descriptive section that sets forth the information gathered. The article concludes with a final discussion on what we do and don't know about this process.



2. A conceptual framework within which to interpret the recent emigration flow of young adult Spaniards

Globalization has given rise to situations of fast and complex transformations, and the recent emigration abroad by Spaniards during the years of economic crisis should be interpreted within the context of human mobility and global change. As pointed out by Castles (2002: 1144), “migration is clearly a systemic element in processes of globalization because globalization is not just an economic phenomenon: flows of capital, goods and services cannot take place without parallel flows of ideas, cultural products and people”.

In the words of Castells, “globalization generates a change in the spatial organization of the world from “a space of places” to a “space of flows” (1996: 6), in which human mobility plays an important role. On the other hand, the recent economic and financial crisis brought about by the contradictory evolution of post-Fordist capitalism has caused an intense economic recession in Greece, Italy, Spain and Portugal, among others, as from 2008. These countries, whose economies had been growing at varying rates throughout the first years of the 21st century, were all severely hit by the crisis which, among other consequences, caused unemployment rates to shoot up and delivered a blow to the job expectations of many workers, particularly among the young and, above all, the best qualified among them. As King *et al.* (2014:5) have stated, within the European Union “the crisis has had its most severe effect in the weaker peripheral countries, especially those on the southern periphery and this renewed vulnerability of the Southern Eurozone countries has become dramatically apparent since the 2008 financial crisis: across Portugal, Spain, Italy, Greece and Cyprus, growth has stagnated and unemployment, especially youth unemployment, has soared’. According to ILO figures (2015), between 2000 and 2014, youth unemployment rates rose by 11.7 percentage points in Spain, 12 percentage points in Portugal, 14.8 percentage points in Italy and 19.4 percentage points in Greece.

The cycle of economic expansion, up until 2007, was interpreted as one of the reasons for the remarkable migratory attraction these southern European countries exerted during the years of prosperity. At the turn of the century, the arrival of a considerable number of immigrants from both distant and neighbouring countries, linked or not by historic ties, individually or collectively, legally or illegally, modified migration patterns in southern

Europe, causing some researchers to claim that it was actually a distinct migration model. (King, 2000; Cavounidis, 2002; Ribas-Mateos, 2004; Sobotka, 2009; Arango *et al.*, 2009; King and Debono, 2013). This model is characterized by an intense historic emigration flow followed, subsequent to certain junctures, after the oil crisis and the collapse of Eastern Bloc communist regimes, by an intense immigration process.

The immigrating appeal of the years of expansion was the consequence of the extent of the informal economy in those countries and of the demand for workers in the secondary segment of their respective economies, characteristic of a dual labour market, which offers precarious employment niches (Arango, and Finotelli, 2009). Parallel to this process, the number of university students in southern Europe was increasing and its population was becoming better qualified.

Families, following what has been defined as southern Europe’s family model, invest their economic resources and focus their expectations on their descendants’ upward social mobility, “in a context characterized by weak family policies that force the families to be responsible for the well-being of their members’ (Ribas-Mateos, 2004: 1053). This situation also fostered a new attitude among the young, who have now come to regard mobility and new experiences more positively, as a sign, in fact, of a more cosmopolitan identity, which to a certain extent explains the fact that the subsequent migration propensity, in times of crisis, has been higher amongst those with top-class degrees and postgraduate qualifications. To this we should add a collective feeling of deep frustration with the conditions in the home country (Triandafyllidou and Gropas, 2014) and the rejection felt by these young adults towards political leaders and institutions, and towards the structure and practice of recommendations or family contacts as opposed to merit. (King *et al.*, 2014).

To these internal circumstances we should add the deep transformations that took place throughout those years within the context of globalization: the information technology revolution, the processes of “glocalization”, or, in other words, of connectivity between multiple locations at different socio-spatial levels, the awareness –either real or fictitious– of the disappearance of all barriers to mobility and to the process of internationalization of the economy. Likewise, notable changes were taking place in Europe itself. These years saw the gradual consolidation of the free movement of persons within the European Union (Schengen Agreement, Maastricht Treaty, The Convention implementing the Schengen Agreement



and the Treaty of Lisbon); a common higher education framework was further developed (European Higher Education Area) as well as university student exchange programmes (Erasmus, Leonardo da Vinci, etc.) which raised hopes that “migrating to learn might lead to learning to migrate”, Li *et al.* (1996), as the movement of students is an integral part of transnational migration systems, because the networks they forge often lay the tracks of future skilled labour circulation (Vertovec, 2002). There were additionally initiatives whose aim was to facilitate mobility, such as the European Job Mobility Portal (EURES) that encourages the flows of this kind of workers inside Europe (Labrianidis and Vogiatzis, 2013).

These are, among others, the factors that underlie the interpretation of the changes in migration patterns perceivable from 2008 onwards, so that “the return of emigration from the Southern EU periphery reflects the way that this new wave of highly qualified emigrants is but the latest stage in a coherent historical model of Southern European migrations” (King, 2014: 17). This phenomenon is evidently not new, it had been taking place over a long time, but it has sped up its pace and has acquired new connotations during this period of recession, underlining the fact that migration flows grow at times of social changes (Castles, 2008). In this case, it has defined a new profile of qualified migrants, that of young Southern European adults.

It should be pointed out that defining a highly skilled migrant has been a widely debated subject. According to Kōu *et al.* (2015: 1646), “many scholars advocate the distinction between skills-based (i.e., working experience) and qualifications-based (i.e., educational attainment) professional expertise (Koser and Salt 1997; Williams and Baláz 2005)”. However, in this case, a highly skilled migrant will be considered, without distinctions, one with a tertiary education or an equivalent specialized work experience (Iredale, 1999).

According to Tharenou (2015: 149) “the demand for skilled talented employees by global and multinational organizations for their foreign operations and by foreign countries for economic development continues to grow at a rapid pace (Vaiman *et al.*, 2012; Brookfield, 2014; Silvanto and Ryan, 2014). Thus, proportionately the increase in skilled migrants is greater than in migrants in general (Nifo and Vecchione, 2014). In addition, as indicated by Yeoh and Khoo (1998: 160), skilled international migration is likely to increase as Third World economies develop and the demand for international expertise expands. A good example of this is the growth in the figures of Italian (138%), Spanish (113%) and Portuguese (78%) professional migrants,

with work contracts for two years in Brazil, from 2009 to 2013 (Momo, 2014).

Other authors, in the specific case of Spain, point out that recent migrations to the USA are the result of the globalization of education and of the student and researcher exchange programmes, which have intensified the international flow of migrating professionals (Alcalde Campos *et al.*, 2014). There is also an extensive literature on the importance of the training of young adults in their host country language, or in a “lingua franca” such as English, since globalization gives a particular twist to the valorization of “language capital” (Canagarajah, 2013; Williams and Balaz, 2008; Chiswick and Miller, 2002, etc.). Migrants are attracted to particular countries in order to acquire English language capital, “but this opens up global employment prospects because of the prevalence of English as the language of international business and of the Internet” (Williams and Baláz, 2005: 445).

A final perspective on the migration of skilled labour regards its future consequences. The migration of highly educated professionals from the developing South to the developed North used to be perceived as causing “brain drain” in the 1960’s (Bhagwati 1976), it is now being treated as a win-win situation for both the developing and developed communities and redefined as “brain gain” (Kuznetsov, 2006). ILO, indeed, has recognized the “diaspora option”, the potentiality of highly skilled migrants to help their country of origin without returning home (Findlay and Cranston, 2015).

According to the Global Commission on International Migration (2005: 31), “in the current era, there is a need to capitalize upon the growth of human mobility by promoting the notion of “brain circulation””. The receiving countries gain from the accumulation of skilled labour which leads to increase in the level of productivity, boost in contributions to the welfare system, stimulation of innovation capacity and international dissemination of knowledge (Commander *et al.*, 2003, Kapur and McHale, 2005 and Salt, 2006 quoted by Kōu *et al.*, 2015: 1646). The professional expertise and networks of expatriates can be transformed into development of and investments in the home country (Stark *et al.*, 1997), even when they do not physically return. This interpretation has led some authors to talk of a “migration-development nexus”, in which migrants undertake the role of transnational development agents interacting with national states (Faist, 2008). It remains to be seen whether the recent emigration of young skilled Spaniards can be interpreted from this analytical perspective.



3. Cause for reflection

The departure abroad of young skilled Spaniards over the last few years has become a recurrent subject of political and social debate, particularly as general elections loom closer. The controversy generally rages over how many actually leave and where to, and how their departure should be interpreted in terms of the country's present and future. The Instituto Nacional de Estadística (National Statistics Institute) is the body responsible for compiling data corresponding to the Spanish Citizens Abroad Census (PERE). The PERE covers aspects such as composition by gender, large age groups, provinces and regions of origin and destinations by continents and countries. It also divides the Spanish residents abroad into three groups: those born in Spain, born in other countries but not

in the country of residence and born in the country of residence.

Over the last seven years Spanish emigration has grown by 48%, going from 1,471,691 to 2,183,387 migrants. During the same period, emigrants born in Spain have increased by 100,000 since 2009, reaching 733,387 in 2015 (figure 1).

Most Spanish emigrants have chosen certain countries in America or Europe as their main destinations, although other continents have also, to a lesser extent, seen their number of Spanish immigrants grow (figure 2).

From the point of view of age, according to INE calculations, over the last three years about 50,000 young Spaniards aged between 15 and 34 have left the country. But some researchers (González Enríquez and González Ferrer, 2012) and young emigrants' associations such as Marea Granate claim that the INE is understating its figures both for technical and political reasons (Marea Granate, 2015). They point out that the INE drafts its statistics (PERE) with the information supplied by Spanish consulates. It systematically ignores a second type of consular register, known as ERTA (Spaniards Temporarily Residing Abroad), and it tends to ignore the empirically established fact that not all of those who emigrate (natives, nationalized emigrants) report their departure to the municipal population census office and they do not register with the consular offices in their host country either, even if they do register with local

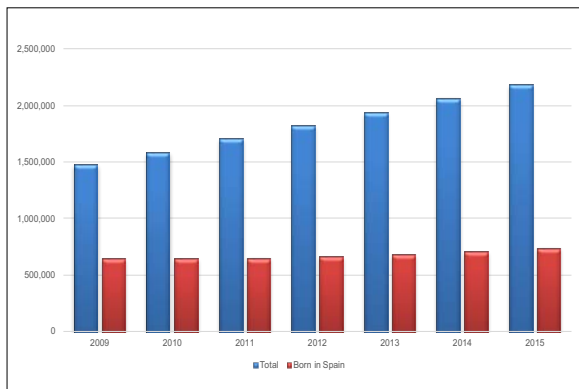


Figure 1: Emigrants born in Spain and total number of emigrants (2009-2015)

Source: INE. In-house compilation

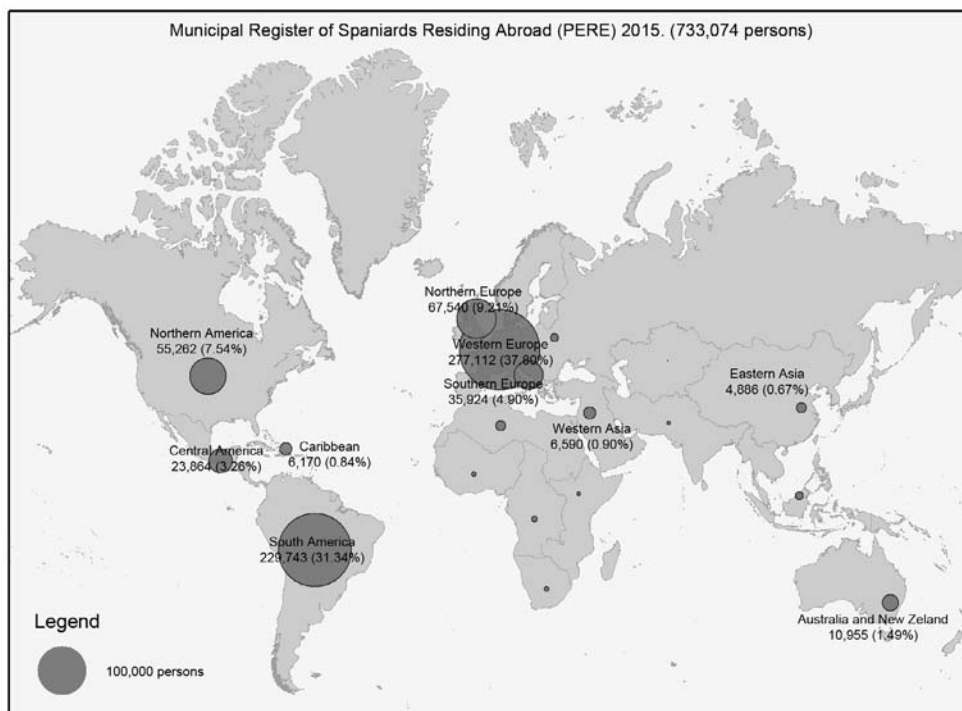


Figure 2: Spaniards residing abroad, by large geographical areas, 2015

Source: INE. Own elaboration



social security or population census offices. Some bodies, such as the Real Instituto Elcano (González Enríquez, 2015) undertook a survey in 2013, which demonstrated that no more than a third of the young Spaniards who had left the country since 2008 had been duly registered. Multiplying by three the INE's current figures, and deducting the number of returnees recorded so far, we would come to an approximate figure of 70,000-90,000 young people between the ages of 15 and 34.

Behind this mobility, however, there is a wide-ranging migration typology, as next to the migrant who leaves Spain with a working contract abroad there are also those who emigrate with the aim of trying their luck but who return after a few months if things do not go well. It is worth remembering that only those who have resided for over a year in another country are officially regarded as migrants, both according to the UN and as defined by European countries. Among migrants there are also interns who move abroad to either study or do research for long periods of time, employees transferred internationally by their companies, international aid workers, civil servants and military personnel, those exercising the right to family reunification and so on.

Despite the low level of accuracy of Spanish official statistics, Marea Granate has proven that the number of young Spaniards residing abroad has not ceased to increase during the economic crisis. They have recently undertaken a study based on local social security and population register data in the United Kingdom, the USA, Uruguay, Germany, Austria, Norway, Iceland, Denmark and Ireland. The study reveals a discrepancy of over 58,000 people between INE figures and their own (Marea Granate, 2015). The fact was also acknowledged by the Instituto de la Juventud (Youth Institute), under the Ministerio de Sanidad, Servicios Sociales e Igualdad (Ministry of Health, Social Policy and Equality), after having analysed the official data in each of the countries of destination and the characteristics and trends of the migration flows of the Spanish population during the years of the crisis (Navarrete Moreno, 2013). Thus, INE data together with the estimations that correct them lead us to the following conclusion: the emigration of Spaniards during the crisis cannot be termed as massive, but it is undeniable that there has been a growing tendency towards a greater number of departures and so, for the sake of clarity, official statistics should be revised and migration flows should be more rigorously measured.

4. Studies on the international migration of young Spanish adults

The first studies on the international migration of young Spanish adults and on the impact of the economic crisis on that process started to appear in 2011, the same year as the second economic recession started and when the change in the migration cycle became obvious. In 2012 Spain had a negative migration rate. The return of former immigrants has coincided with a greater flow of Spanish migrants abroad, as a result of which foundations, research institutes, public bodies and private institutions have mobilized to promote, finance and divulge research work on the "new emigration abroad".

Most reports and studies, such as those of the IOM (2012) make use of the statistical data of the European Commission, Eurostat, the World Bank, the OECD, the EURES network (the public employment services network of the countries in the European Economic Area of the European Commission), the International Labour Organization (ILO) and the *Observatorio de la Movilidad Laboral del Servicio Público de Empleo* (Labour Mobility Observatory of the Public Employment Service) for their primary observation sources. As to demographic data, the most frequently used sources to establish the stock of population living abroad were the Spanish Citizens Abroad Census (PERE) and the Electoral Census of Absent Residents (CERA). Likewise, both the Migration Statistics and the Residential Variation Statistics and its microfiche have been used to identify the characteristics and trends of Spanish migration flows abroad. In addition, the web portals for Spanish Citizens Abroad, the Ministry of Employment and Social Security and the Labour Force Survey were also used as sources.

Some researchers have sought data from the migrants' destination countries, such as the records of work permits granted to Spaniards or their registration with the local social security in each destination country. It should be borne in mind that Spaniards who habitually reside abroad do not always register with the Consular Office, which is responsible for the registration of the Spanish population living abroad. This may sometimes happen because work permits might not have been granted yet, or because a European Union country is involved, where work permits are not required. As a result, statistical information needs to be complemented with other types of sources, such as ad hoc surveys.



Most of these were closed-question surveys (either semi-structured or structured), although some have been complemented with open-ended questionnaires and also with focus groups and in-depth interviews such as those undertaken by Navarrete Moreno *et al.* (2013), one of the most complete works on this emigration flow. In some cases social networks have been made use of (Twitter, Facebook...) for the implementation of questionnaires, or the cooperation of consular offices has been sought, as in the case of the thorough research work undertaken by Aparicio Gómez (2014).

The first scientific conferences where this question was first tackled were held in 2011. However, it is only from 2013 on, both in general and in single-issue sessions that the question of the recent Spanish emigration abroad has been the subject of intense debate in numerous scientific conferences. Among others, the 7th and 8th Conferences on International Migrations (2013 and 2015), the 10th Conference of the Association of Historical Demography (2014), the CIDOB seminars (2012 and 2013), the 11th IMISCOE Annual Conference (2014), the 14th Congress on National Population (2014), the 11th Spanish Congress on Sociology (2013), the Regional Conferences of the International Geographical Union (Kyoto, Krakow and Moscow) (2013, 2014 and 2015), the Chemnitz Conference on "Migration and Crisis" (2015), and so on.

Numerous academic publications have tackled this issue, among them some by experts from renowned institutions, such as the works by González Henríquez, of the Real Instituto Elcano (2012 and 2014); the Immigration in Spain Yearbooks, of the CIDOB Foundation, those published by Aja *et al.* (2012) and Arango *et al.* (2013) or those undertaken by the research units of the OECD (2014), of the Bank of Spain (2014), of the Fundación Alternativas (2013), of the IESE Business School (2013), of the Fundación 1 de Mayo (2013), of the Centro Reina Sofía sobre Adolescencia y Juventud and the Fundación de Ayuda contra la Drogadicción (2013), and so on. Finally, some of the many articles published in scientific journals, such as those authored by Alaminos *et al.* (2010), Reher *et al.* (2011), Domingo *et al.* (2014), Izquierdo *et al.* (2014), Romero and Hidalgo-Capitán (2014), etc.

This general reflection has sporadically been mirrored in host countries, where some scholars have or are in the process of doing research on this migration flow, as has been the case with Rapado (2014) or Bygnes (2015).

5. Results of the current research work e-survey

Within this context of growing interest in the migration abroad of young skilled Spanish adults, we are submitting the main results of a study undertaken in 2013 by means of a virtual questionnaire implemented over 10 months, between March and December of that year.

The survey sample consisted of 170 young adults between the ages of 25 and 40, born in Spain and of Spanish nationality but residing abroad at the time. Snowball sampling was the method employed, with an initial random set of informants that made it possible to eventually survey young people residing in 37 different countries. The questionnaire, distributed by email, included both open and closed-ended questions.

The type of survey implemented is particularly suitable to situations where population size is not precisely established, and it is an efficient way of encouraging the participation of possible respondents. However, snowball sampling may be subject to bias given the procedure for the selection of respondents, which is based on previous contact with initial informants, and the fact that emigrants with an unsatisfactory experience in their host countries might feel more reluctant to participate.

The structure of the survey made it possible for us to undertake both a quantitative and a qualitative analysis of results. We tried, in particular, to reconstruct the respondents' discourse via the open-ended questions.

In line with INE records and those of the main host countries, the profile of those surveyed corresponds to men (55% of the sample), among whom those between the ages of 30 and 34 predominate. The average age of the women surveyed is slightly lower, and this slight difference might be due to the fact that motherhood tends to lessen any inclination to emigrate among women in their thirties or onwards.

From the point of view of education, most respondents have completed higher education studies (level 5), there being many engineers and architects among them. 71.2% of those surveyed stated that they were working as scientists, experts or technicians. The rest were working mainly as managers, administrators and middle-level experts or technicians. Thus, according to our survey, this is a migration flow of predominantly skilled young adults (30-34 years of age) which is



slightly male-biased (either because the crisis has had a greater impact on men in the labour market or because other socio-demographic factors might be playing a role).

Regarding their reasons to migrate, it should be taken into account that 83% of respondents migrated during the economic crisis, in other words, from 2008 onwards, though many did say that they had considered emigrating before then. Consequently, although the situation of the labour market in Spain has been the triggering factor of this migration, it has not been the only element involved, which sets this process apart from former Spanish migration flows.

46.1% of those surveyed stated that either unemployment or job insecurity led them to emigrate, whereas 51.5% mentioned other reasons. Not a few of the latter regarded moving abroad as another further stage in their process of education or training, or as a tool to acquire professional experience (36.7% of respondents). Many of those who mentioned such a motivation did in fact combine work and study in their host countries. In other cases, emigration is associated with the possibility of career advancement or job improvements. This is the case with expatriates transferred abroad by multinational companies or with young people who find better jobs abroad than those they had in Spain. 34.1% of respondents quoted better pay as the main reason why they had emigrated abroad.

Another element that underlies the answers given by many of the respondents is their perception of the lack of prospects in Spain. Their answers reveal a feeling that the authorities are not concerned with young people's job-finding difficulties, or that the measures which have actually been taken will drive them to a long-lasting situation of unemployment, job insecurity or low pay. Measures such as the labour market reform or the cuts in social spending confirm this impression. According to the respondents, the government's economic and labour market policies only favour large businesses and entail a loss of workers' rights. Respondents associate government policies with the political culture of a large part of the business sector, characterized, according to the respondents, by a lack of respect for workers, and with a deregulated labour market, two elements that are unlikely to change in the short term. Consequently, these young people have not only been driven to emigrate abroad by their failure to become integrated in the Spanish labour market, but also by their belief that this lack of integration has become a structural element that will not, as a result,

change in the future. Spain is no country for young people and, even less so, for the young and skilled. *"(I wish) business people wouldn't be so unscrupulous and they'd stop taking advantage of the situation the rest of society is in, drawing up abusive contracts when their companies are doing well, better, in fact, than before the crisis"* (Elba).

Consistent with this sense of a lack of prospects, another interrelated idea that emerges from the respondents' answers as a cause of their migration abroad is the Spaniards' scant political maturity and the existence of a corrupt political system that will hinder, at least in the medium term, the reversal of the situation. *"I would ask the political class to stop stealing; the only thing we want is for our taxes to be used to stimulate employment"* (Fernando, M.). The answers to the questionnaire suggest the respondents tend to believe that their fellow-citizens' indifference and lack of political culture has led to politics being identified with corruption. To this should be added a lack of trust in the electoral system, in the political parties that have governed the country over the last few years or in public institutions. This has all given rise to feelings of disaffection and dejection that have spurred their decision to depart. *"(I wish) they would put an end to this regime of corruption and cronyism most politicians engage in and that they would take note of how things are done in other more developed countries (Nordic countries). Of course, that is just a utopian idea and the system won't change if our own culture doesn't change, so, much to my regret, I do not expect the situation to improve in the near future"* (Juan, A.).

Another aspect of great interest in our research is the integration of young Spanish migrants in their host societies, which we should point out is an interurban migration process. Most of the young people involved lived originally in urban environments and they initially migrated to the main cities in their host countries. It should also be borne in mind that the destinations of this migration flow are many and dispersed. European Union member states are the most popular destinations, particularly the United Kingdom and Germany. In Latin America and the Caribbean migrants tend to choose Brazil, Ecuador, Mexico and Chile and in North America the USA. Outside the E.U., Switzerland is the country with the largest number of respondents. Thus, the integration of Spanish migrants displays notable differences depending on factors such as language difficulties, cultural idiosyncrasies, the different structures and regulations of the labour market, residence and work permit requirements in each country and the differences to be found in terms of family, fellow citizen and institutional networks. Since it is a personal



process, their degree of integration will also depend on the personal skill and attitude of individual migrants.

Three out of four migrants described their experience away from Spain as positive, especially as their working conditions abroad have improved. Most considered themselves to be better paid, although some of them stated that they have had to accept jobs for which they were overqualified or poorly paid. A similar percentage (78.2%) felt they were well integrated in their host societies. The elements that hinder integration are mostly a different language (Germany is the most representative case), the limitations experienced as foreigners in the labour market in some countries, the difficulties to find accommodation without having to resort to temporary shared lodgings, the legal and bureaucratic complications derived from their stay and access to adequate healthcare. Some respondents would on occasion complain about the lack of assistance by public bodies regarding these issues, although some of them have benefitted from official aid provided by the Spanish embassy or consulates and EURES. A third of those surveyed have turned to friends or family for help, particularly during the first few months after arriving in their country of destination, but the majority of respondents have received either very little or no help at all.

In spite of the above, some elements seem to suggest a high degree of integration. In this respect, according to their answers, those surveyed appear to lead intense social lives, especially with fellow Spaniards, colleagues and neighbours. It is common for them to participate in emigrant associations and to resort to them when in need of advice regarding different matters in their host country. Though smaller in number, there are some who have made friends among the native population of their country of destination. In any case, since it is a recent migration process involving young migrants, their marital status has tended to remain unchanged, and both the starting of new families and processes of family reunification have been rare. These things, though, might only be a matter of time.

Another aspect of great importance is the expectations of those surveyed. Most of them do not know how long they will stay away from Spain. Though they follow current affairs in Spain and keep in touch with family and friends thanks to communication technologies ("Skype emigrants"), 80% of them are not actively seeking work in Spain. Likewise, 77% have no plans for family reunification in their host countries. It could be said that those surveyed do not feel that there is a chance for them to return to Spain yet, but they have no plans either to settle in their countries of destination

for good. They are expectant. Nevertheless, in most cases their words reveal a wish to return. They believe that sooner or later they will return to Spain, though some of them are starting to lose hope given their negative perception of Spain's labour market and social and political reality. *"I am abroad because I have chosen it personally and professionally, the problem is that when I consider the possibility of returning to Spain I feel that I am unlikely to enjoy the same opportunities as I do abroad, even speaking four languages"* (Martin D.) *"It hurts me to think that my children will not grow up in Spain, but I am not going to bring them up in a country where healthcare and education are gradually coming to be regarded as a privilege rather than a right, where opportunities are for the few"* (Olmo).

In short, this is a migration process with a limited track record and a future filled with unknowns. In spite of this, some of its characteristics enable us to reflect on the real nature of this phenomenon.

6. Conclusions

This recent emigration flow at a time of crisis has posed a challenge for Spanish scholars. Much of the work done has made use of the statistical records available, but their limited character has driven researchers to seek complementary sources such as surveys, in-depth interviews or focus groups in order to characterize the migrants' profile and their respective experiences. The role played by information technologies has been fundamental for the gathering of primary data, as surveys and interviews have been held online. Since we are dealing with a recent and unfinished process, the analyses undertaken are not conclusive yet, as their immediacy has shortened historical perspective. In the future, research on this phenomenon will have to examine in greater depth aspects such as the conceptual framework of the study, progress beyond the stage of description and identify the different typologies that underlie these complex processes of emigration. It is likewise essential to make use of records in host countries, as well as to undertake comparative studies concerning emigration processes in more or less comparable countries, such as Greece, Portugal and Italy, from the point of view of the impact the crisis has had. Regional and local research could also contribute to broaden the geographical perspective on migration. It would consequently be ideal to be able to work with researchers from other countries, particularly with those from host countries. It would also be necessary to establish the long-term or temporary character of this



migration process and of the transnational links that it generates. It would be important as well to pay special attention to the influence exerted on this new mobility by social networks and movements online.

Despite the work that remains to be done, the research undertaken over the last few years and our own research project allow us to reflect on the need to further develop some conceptual aspects. In the first place, it is necessary to elucidate if we are facing a migration process caused by the economic crisis in Spain or whether it is derived from a maladjustment between labour requirements of the productive system in Spain and its education system of the last few decades. This is an issue raised by the high proportion of skilled workers among the migrants and by the fact that a number of respondents claim there are no jobs for them in the Spanish labour market, unless they take on jobs for which they would be overqualified or accept working conditions and pay below their expectations. Both factors, intrinsically related, are also present in other countries in southern Europe with which Spain has shared a similar migration transition, like Portugal, Italy and Greece. In all of them the internationalization of higher education and training has led to the departure of skilled migrants who fail to find suitable jobs in their national labour markets.

In second place, we should try and clarify whether this is a process linked to the economic crisis or to the creation of an international labour market. In other words, we should establish whether this is a process of emigration or of mobility. The fact that those who depart do not send remittances home, that many of them have found a job abroad while engaged in higher education or training, that they state that their motivation to work abroad is primarily to gain experience, or that their decision to move abroad is linked to their company's international business strategy, are all elements that reveal an underlying process of mobility under the internationalization of business and the globalization of both education and the labour market that has taken place over the last few years. In this sense, it is necessary to take into consideration the influence exerted by the development of communication technologies and transnational residential patterns. It is not by chance that many should describe those who depart abroad as Skype or e-migrants, or that young Spaniards should develop transnational habits under the European free movement of persons or the permeability of borders for the most skilled, driven by the global labour market.

Finally, we should also consider to what extent the departure of young people is linked to factors that are not strictly economic in character, in other words, to

what extent issues such as the deterioration of public life, as many of these young migrants perceive it, and the feeling that no political regeneration is possible might be elements contributing as powerfully as the lack of job opportunities to this migration flow. Many of them feel that they have been expelled from their country by a political class that ignores them and they often state that they do not expect to return to Spain because they do not perceive any changes in the short term, either in terms of economic policies or in the political system itself. It should be borne in mind that those who migrate abroad tend to display a strong sense of civic responsibility, and since they generally come from middle-class families they have never experienced situations of poverty or of extreme poverty.

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Innovation and new technologies for research and education in geography

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Abstract

Geographic Information Technologies (GIT) are continuing to revolutionise geographic research. This work reviews the output in the period 2006-2015. Spanish geographers have made use of these opportunities to produce new geographic information and develop new algorithms, analytical techniques and geographic models. Technology and innovation come together in geographic research, and although the role of geographers is not exclusive, they play an important part in advancing GIT. These technologies lead to increased collaboration between researchers in different branches of science.

The massive availability of data in digital format and their ease of access –in combination with the development of new technologies for visualisation– have multiplied the resources available to ensure geography is taught in an attractive way.

The challenges facing geographic research include the rise in multidisciplinary and internationalisation, increased participation by end users, and information transfer.

Keywords: geography; geographic information technologies; training; Spain.

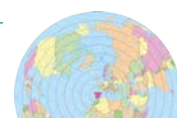
Introduction

There is no doubt that the new technologies encourage innovation in scientific research, and that this research in turn stimulates the further development of these same technologies. Given that the field of new technologies is very broad, the scope of this study will be limited to geographic information technologies (GIT). These are a highly differentiated set of

techniques, procedures and physical and logistical tools (software) based on the use and exploitation of data relating to a territory (Bosque, 2012:15). They generally include technologies for observing and obtaining data on a territory (by means of proximity, airborne and remote sensors and global positioning systems, GPS) and which facilitate the organisation and presentation of territorial data (mapping and new geographic visualisation tools –spatial data infrastructures (SDI) and geoportals), and others that offer tools for processing and analysing geographic data (Geographic Information Systems, GIS).

In spite of the academic debate arising in previous decades (Wright *et al.*, 1997), Chuvieco *et al.* (2005) conclude that GIT form part of the geographic traditions and the central core of geography. According to these authors, GIT are wholly connected with the four traditions defined by Harvey (1969) as being core to geographic research: morphometric analysis, cause-and-effect relations, temporal explanation and functional and ecological analysis. Morphometric analysis is the primary object of cartography, GPS and teledetection, while GIS and spatial analysis techniques facilitate the establishment of cause-and-effect relations. Teledetection provides continuous time series of geographic data that allow the detection of changes and the simulation of future and retrospective changes. Finally, the integration of spatial and time data in a GIS facilitates functional and ecological analysis.

The last decade has seen the emergence of what is known as neogeography, or volunteered geography (Bosque, 2015), in which a group of people, sometimes with little geographic and technological training, take part in compiling territorial data which is shared on the Internet.



The aim of this work is to examine the interaction between GIT and geographic research. We will also explore their relationship with the teaching of geography.

Advances in GIT in the last decade

Teledetection has developed significantly in the last decade. Martín *et al.* (2010) review the evolution and future trends of the main missions, and analyse the most notable features and applications of the new instruments for acquiring information, with particular emphasis on the advances in hyperspectral teledetection and LIDAR. These authors point out that the technological innovations of recent years have led to the development of new platforms and sensors with a wide array of features, and substantially increased the quantity and variety of data available. These ranges from data for use in studies at the local scale obtained from instruments with very high spatial resolutions (less than 1 m²), to those with low resolutions (from 1 to 5 km²) and a global scope, and also include others destined for studies of a regional nature with average resolutions (15 to 250 m²). This wide variety of products has made it possible to undertake multiscale studies on a range of environmental phenomena.

Technological innovation and the development of new methods has multiplied the geographic information available. In recent decades we have seen a revolution in systems for accessing geographic data. Directive 2007/2/EC of 14 March 2007, known as INSPIRE, regulates and incentivises the creation of spatial data infrastructures (SDI). This regulation has been transposed to our legal system through Law 14/2010 of 5 July (LISIGE) on infrastructures and geographic information services in Spain. In addition to the spatial data infrastructure in Spain (IDEE, <http://www.idee.es/>), there are another 13 themed SDI with a national scope –land registry, hydrographic basins, biodiversity, urbanism, social resources–, 17 with a regional scope, and many others with a district and local scope. Users therefore have a very comprehensive set of SDI available to aid their geographic research. Geographers are not only users of these infrastructures, but also

producers of new geographic information that is subsequently integrated in these platforms.

Virtual globes (VG) have interfaces through which they can integrate geographic data (González and de Lázaro, 2011). The National Atlas of Spain (ANE) can also be accessed via the Internet. A content search engine has been enabled (<http://www.ign.es/ane/bANE/bANE.htm>), and a new edition of the atlas is currently underway. SDI, VG and ANE, among other resources, facilitate the teaching of geography at all academic levels.

Geographers have always had –and continue to have– a key role in the teaching of GIT in Spain and Latin America, and hence in their use for geographic and multidisciplinary research. They have taught many generations of students who are today university professors, scientists and territorial managers specialising in a variety of academic disciplines, such as Geography, Environmental Science, Biology and Geology, all of which have one common denominator: the territory. The days when Spanish universities were only beginning to provide academic training in these technologies are long gone –in 1989 the University of Alcalá offered a master's degree in GIT as a permanent feature, and since then the offer has continued to grow. Today in 2015 there are 21 Spanish universities teaching master's and expert courses in GIT, in addition to doctoral programmes, some of which are clearly specialised in these technologies.

GIT in geographic research

A similar previous analysis by Martínez-Vega (2013) focused on the period 1990-2012. Now, and following the bibliometric analysis of Chuvieco *et al.* (2005), we have reviewed the articles published in two Spanish scientific journals on GIS and teledetection: *Geofocus* and *Revista de Teledetección*. In the last decade (2006-2015), the average participation of geographers was 40.93% in the first, and 16.39% in the second (Table 1). The participation of Spanish geographers in *Geofocus* has fallen 11.7%, and conversely has increased by

GIS AND TELEDETECTION JOURNALS	2000-2004			2006-2015		
	Total	Geographers	%	Total	Spanish geographers	%
<i>Geofocus</i>	19	10	52,63	171	70	40,93
<i>Revista de Teledetección</i>	85	10	11,76	183	30	16,39

Table 1. The presence of geographers in Spanish GIS and teledetection journals

Sources: Chuvieco *et al.*, 2005, *Geofocus* (www.geofocus.org/) and *Revista de Teledetección* (<http://www.aet.org.es/?q=revista>)



4.6% in the Revista de Teledetección since the period 2000-2004.

The data are not totally comparable, as we have selected only the articles published by Spanish geographers. Participation would have been higher if we had also considered the articles published by geographers of other nationalities. The decline in the contribution of Spanish geographers to *Geofocus* can be explained by the fact that this journal promotes the contributions of Latin American geographers and scientists from other disciplines, and indeed the last decade saw substantial participation by this latter group.

We have also examined the articles published between 2011 and 2015 in two Spanish geography journals: the bulletin of the Spanish Geographers' Association (AGE) and *Estudios Geográficos* (Table 2). The first

GEOGRAPHY JOURNALS	2011-2015		
	Total	GIT	%
Boletín de la AGE	261	35	13,41
Estudios Geográficos	110	28	25,45

Table 2. The presence of geographers in some Spanish geography journals

Sources: Bulletin of the AGE (<http://boletin.age-geografia.es/>) and *Estudios Geográficos* (<http://estudiosgeograficos.revistas.csic.es/index.php/estudiosgeograficos>)

of these is indexed in the SSCI. The second is the doyen of Spanish geographic journals and is indexed in SCOPUS, among other bibliographic bases.

We also consulted Science Direct to find articles published in other international journals in all scientific fields between 2006 and 2016 by authors who were professionally affiliated to a Geography department. 740 publications are listed as a result. With no claim to be exhaustive, we reviewed the first 200, and rejected articles published by non-Spanish geographers (Latin American and Portuguese). From among the results we made a small but varied selection of articles which use GIT or develop geostatistical and spatial models, including journals on geography, earth sciences and a number of other disciplines, in addition to journals with a technological orientation.

The themes covered cover the three areas of knowledge in geography: physical and human geography, and regional geographic analysis. We review them below.

In the field of Geomorphology, López-Martínez *et al.* (2012) produce detailed maps of periglacial forms

and processes in northern Antarctica with the help of fieldwork and by interpreting aerial photographs and satellite images. Hernández-Cordero *et al.* (2015) explore the relationship between vegetation dynamics and dune mobility in a coastal dune system using digital orthophotographs and spatial analysis in a GIS environment.

In the category of climate studies we highlight the review by García-Ruiz *et al.* (2011) of the relationships between climate variations, water resources and changes in land uses in the Mediterranean basin under a global climate change scenario. They analyse the seasonal and annual evolution of precipitation, potential evapotranspiration and the normalised difference vegetation index (NDVI) in the second half of the 20th century, and explain the changes predicted in the 21st century under different climate change models and land-use scenarios, and their consequences on the available water resources.

Other works estimate climate-related variables. Jiménez-Muñoz *et al.* (2010) calculate the land surface temperature (LST) using different algorithms in an operational method on a time series of Landsat thermal images. López García and Camarasa (2011) analyse the seasonal and ten-yearly sea surface temperature (SST) on a regional scale in the western Mediterranean basin using NOAA-AVHRR thermal images. Durá *et al.* (2014) validate the SST estimated from MODIS images on a local scale and compare them with *in situ* measurements at three different depths in a western Mediterranean coastal area.

We selected two works on the theme of oceanographic research. Ojeda *et al.* (2009) calculate a coastal vulnerability index (CVI) in a scenario of potential sea level rises taking the coast of Andalusia as the study area. They use a geo-database, a GIS for integrating the variables, and a 3D visor and web mapping for map-making and dissemination. Casal *et al.* (2011) apply visual analysis and unsupervised and supervised classification of SPOT-4 images to map turbid waters on the coasts of Galicia.

In the field of Hydrology, Colmenárez *et al.* (2013) estimate the speed of water in irregular non-metered riverbed sections based on digital elevation models (DEM) generated with LIDAR data and field measurements taken with GPS.

In the field of vegetation studies it is worth noting the work of García-Abad *et al.* (2010) who map the taxonomic composition of plants on a local-regional



scale in La Alcarria (central Iberian Peninsula). The flora analysed is inventoried in 1 km² UTM squares, and the spatial patterns of the taxa are detected using cluster analysis and multidimensional scaling. The Jaccard index is used to calculate the floristic similarity between cells.

There has recently been an increase in the number of works focusing on the estimation of biophysical variables using multiscale approaches and different algorithms. Durá *et al.* (2013) compare field measurements in a “dehesa” (wooded pasture) ecosystem fitted with flux measurement towers belonging to the international FLUXNET network, with a time series (2009-2011) of outputs from the MODIS sensor that measure the NDVI, the leaf area index (LAI) and the gross primary productivity (GPP). Fernández Arango *et al.* (2015) estimate the moisture content of herbaceous vegetation from hyperspectral images acquired from the CASI airborne sensor. They analyse the linear relations between three variables (canopy water content, CWC, fuel moisture content, FMC, and equivalent water thickness EWT), calculated from vegetation samples collected in the field, and a long series of spectral indices calculated on the images. Vlassova *et al.* (2014) assess different methods of calculating the LST from Landsat5-TM images. This variable is essential for assessing the water and carbon balance in fragile heterogeneous ecosystems such as Spanish “dehesas” (wooded pastures). They use three methods based on the radiative transfer equation.

The use of satellite images is common in agriculture. Aguilar *et al.* (2014) map the greenhouses in the province of Almería based on spectroscopic pairs from the WORLD VIEW 2 satellite, and apply object-based image analysis (OBIA) and DEM. Romero *et al.* (2013) estimate the LAI of an olive grove in relation to its water consumption using two techniques: a spatial extrapolation from QUICK BIRD images, and an interpolation using geo-statistical kriging-type models. Pérez Albert *et al.* (2010) propose a multi-criteria evaluation model (MCE) to select the most suitable agricultural soils for incorporating treated sludge from sewage plants. They use the logic scoring of preferences (LSP) technique in combination with GIS technology.

One of the themes that has given rise to the greatest number of publications is the mapping of land uses. As we indicated in the introduction, the multitemporal capacity of satellites has been used by scientists to monitor land cover, analyse its trends, explain the factors underlying the changes detected, and simulate future scenarios. This allows them to anticipate all the impacts that represent threats and mitigate them as

far as possible. As we are unable to mention all the contributions to this field by Spanish geographers in these pages, we will only discuss certain contributions that apply different methods and technologies.

Some works apply the traditional technique of overlaying maps in a GIS by means of cross tabulation. One of the most widely used sources is the CORINE-Land Cover (CLC) maps. Its interest derives from its applicability within the framework of territorial planning rather than in its methodological innovation. Hewitt and Escobar (2011) analyse land-use and land-cover changes (LUCC) in the area of the Regional Nature Reserve in the middle course of the Guadarrama River (Madrid) between 1990 and 2006. Gallardo and Martínez-Vega (2016) study LUCC in a longer series (1982-2006) at the regional scale in Madrid. Díaz-Pacheco and García-Palomares (2014) analyse urban LUCC in the same region between 2000 and 2009 on a more detailed scale.

Other studies apply additional complementary techniques to the detection of changes on the regional scale. Niclòs *et al.* (2010) propose a methodology for the periodic generation of land-use and land-cover maps. They use CLC as areas of ground-truth and make a supervised classification on images of the isotope parameter of the BRDF model (bidirectional reflectance distribution function) of the MCD43A1 output of MODIS. Jaraíz *et al.* (2012) use generalised linear models (GLM) on CLC data to identify the relations between independent variables and LUCC in a cross-border region between Spain and Portugal. Benavente and Botequilha-Leitao (2012) use principal components to select six landscape ecology metrics related with LUCC observed on CLC data in the most dynamic region of Portugal (Algarve) between 1985 and 2006. Díaz-Pacheco and Hewitt (2013) apply artificial neuronal networks (ANN) to model changes in the LUCC (2000-2009) in the Madrid region.

Based on the trends in the changes observed in the past, a number of geographers have also produced studies simulating urban and non-urban uses. Plata Rocha *et al.* (2010) apply MCE and GIS to simulate the optimal localisation of residential, industrial and commercial areas in the Madrid Region in 2010 based on real data from 1990, and in 2020 with real data from 2000. Barreira *et al.* (2012) propose an analysis of sensitivity to validate prospective models of simulation of urban growth in the Madrid Region based on cellular automata (CA).

Oñate-Valdivieso and Bosque (2010) analyse the LUCC observed in the Catamayo-Chira basin and their



explanatory variables. In addition, based on the trends in recent decades, they generate a simulation with logistical regression and ANN. Camacho Olmedo *et al.* (2015) compare techniques based on ANN and Markov matrices with CA to simulate future uses in the Segura basin, with particular attention to the quantity and the localisation of LUCC. Lastly, Gallardo *et al.* (2015) study the LUCC observed in the Madrid Region between 1990 and 2006 and the factors related with the occurrence of forest fires. They simulate three land-use scenarios in 2025 using logistical regression, and map the zones of interface between forest areas and other uses in order to estimate the future likelihood of forest fires in the region.

Articles on forest fires are of particular interest in the area of forestry research. On the national scale, Chuvieco *et al.* (2012) propose an integrated system for assessing the risk of forest fires in Spain with a spatial resolution of 1 km², using teledetection and GIS. They assess the risk by synthesising the risks of ignition and propagation. The risk of ignition is in turn the result of the synthesis of human risk (Vilar *et al.*, 2011; Rodrigues *et al.*, 2014a) combined with the risk of lightning strikes (Pacheco *et al.*, 2009), and the likelihood of ignition based on the moisture content of the living (Jurdao *et al.*, 2013) and dead vegetation. They also calculate the ecological (Martínez-Vega *et al.*, 2012) and socio-economic vulnerability (Román *et al.*, 2013) in €/km², considering the recovery time of the vegetation affected by the fire (Rodrigues *et al.*, 2014b). On the global scale, Chuvieco *et al.* (2013) integrate ecological and socio-economic factors to assess a territory's vulnerability to forest fires with a spatial resolution of 1°.

Geographers have also focused attention on mapping the burnt area using different spectral indexes on MODIS (Gómez and Martín, 2008) and MERIS images (Oliva and Chuvieco, 2013). Elsewhere, De Santis and Chuvieco (2008) estimate the severity of forest fires based on PROSPECT and GeoSail simulation models using SPOT-HR, Landsat TM, AWIFS, MERIS and MODIS images. Badia *et al.* (2011) estimate the probability of ignition in areas of the urban-forest interface (UFI) in two time periods: 1990-1999 and 2000-2009, using multivariate logistical regression, GIS and teledetection. Finally, Gómez *et al.* (2015) analyse the forest fires occurring in the Madrid Region from a multitemporal perspective with Landsat images and CLC data in order to characterise and compare the pattern of fires in different periods and its relation with land uses.

Other forestry issues concern the assessment of residual forestry biomass resources in the province of

Teruel using logistical regression techniques, Landsat and GIS images, taking as a reference the plots in the National Forestry Inventory and fieldwork (García Martín *et al.* 2006). García *et al.* (2009) make a planimetric adjustment with LIDAR data to estimate vegetation height in the Alto Tajo Nature Reserve. Martínez-Vega *et al.* (2016) assess forestry sustainability in Spain at the provincial scale integrating 20 indicators with the aid of GIS, CLC data and cluster analysis.

In relation to protected areas and conservation policies it is particularly worth noting the article by Martínez-Fernández *et al.* (2015), who analyse the LUCC occurring between 1987 and 2006 in Spain with CLC data, taking into account the biogeographic regions and distinguishing the protected areas designated at the national level, the areas integrated in Natura 2000, and the areas external to both. Pesquer *et al.* (2012) propose a methodology that integrates spatial interpolation techniques, multivariate linear and logistical regression models and ecological parameters in a GIS to automatically generate continuous maps of species distribution and abundance in the Doñana National Park. Gurrutxaga (2014) uses the CONEFOR program to analyse the forestry connectivity between the nodes in the Natura 2000 network in the Basque Country. He calculates a connectivity index by considering maps of resistance to the displacement of forest mammals and habitat availability.

Other works are related to habitats. Romero-Calcerrada and Luque (2006) assess the quality of the habitat of *Picoides tridactylus* in Finland, using the Weights-of-Evidence technique in a GIS. García Garrido *et al.* (2014) estimate the density of *Alectoris rufa* in the province of Toledo, taking into account the maximum entropy (MaxEnt) and data from conventional sampling to model its habitat.

In the sphere of urban geography, in addition to the changes in urban land uses and simulations of future scenarios mentioned above, a couple of articles are particularly interesting. Geographers and other specialists have taken part in the DESIREX 2008 campaign by the European Space Agency (ESA) (Sobrinho *et al.*, 2009) to study the effect of the heat island of Madrid. They measured parameters in the field and compared them with the data obtained from airborne and satellite sensors. Cañada *et al.* (2014) estimate the pollution levels in Barcelona and Santa Cruz de Tenerife with geostatistical, spatial integration (kriging) and deterministic (inverse distance weighting, IDW) techniques, and their relation with the sampling data.



In the sphere of transport, Condeço-Melhorado *et al.* (2011) assess the impact on regional accessibility of establishing tolls on Spanish roads using indicators, scenarios and GIS. With regard to the geography of tourism, there is an original work by García-Palomares *et al.* (2015) which identifies points of special interest to tourists in eight European cities through “photo-sharing” services on social networks and GIS.

There are many other contributions from geographers in the design of new algorithms and models to automate chains of processes and offer them using interoperable services. However, it is impossible to mention them all.

GIT in the teaching of geography

Traditional and digital maps have always had an important function as a resource in the teaching of geography. Today the availability in classrooms of computers, Internet connections and electronic blackboards, along with free access to diverse and massive geographic information through servers of aerial orthophotography, satellite images, SDI (Carbonell *et al.*, 2012), geo-portals and applications such as the VG (González and de Lázaro, 2011) and Google Earth (Luque, 2011) multiply the resources available to teachers and bring a new lease of life to the teaching of geography and the creation of new educational experiences.

One of the aims of the 2013-2016 National Cartographic Plan is to encourage the production of instruments and materials for education in geography. In the sphere of teledetection, we recommend the combined use in classrooms of videos (UNED, 2011; Universidad de Zaragoza, 2014), with a didactic guide to environmental applications (Martínez-Vega and Martín, 2010; Martínez-Vega *et al.*, 2015).

García González (2012) conceives the teacher as guiding the learning process, and as being responsible for setting the questions to be resolved by the students. Santos (2006) proposes the use of the e-learning methodology in the teaching of subjects such as GIS.

In summary, it is necessary to continue developing innovative teaching strategies in the area of GIT. Their use should not imply the discontinuation or replacement of other traditional teaching resources such as fieldwork (itineraries, sampling, on-site censuses, interviews and surveys), but should to serve to complement or integrate them.

New trends and future challenges

The trends in the field of GIT and geographic research will probably continue along the path of comparing methods and analytical techniques in order to understand their advantages and drawbacks in terms of their field of application, and also incorporate new models, algorithms and developments. The challenges for the future are similar to those facing other areas of knowledge:

- greater efforts towards multidisciplinary and the internationalisation of research
- broader and more dedicated involvement by the end users
- greater collaboration for the transfer of the data produced
- the transfer of scientific findings for decision-making by planners and managers, and for action by citizens

In the field of geography teaching there is a need to continue improving the technological infrastructures and equipment in classrooms in order to implement the GIT in an operational way, and to recycle the teaching staff by improving their technological skills, particularly in secondary and sixth-form education.

Conclusions

Geography continues to be a science with an international contribution to development and innovation in the field of GIT (Chuvienco *et al.*, 2005). A look at the role of geographers in GIT reveals that the gap between foreigners and Spaniards has narrowed in the last decade. There has been a substantial increase in publications by Spanish geographers in international and Spanish journals specialising in GIT, sensors and algorithms, and on themes relating to geography and a wide array of similar sciences.

There has also been a significant increase in multidisciplinary and international collaboration. 62% of the research works mentioned were undertaken by multidisciplinary groups, and 33% are the result of international collaboration. This is due to the enhanced integration of our geographers in international research projects, campaigns and actions, and to the collaboration with former doctoral students who now work in foreign universities and research centres.



Finally, although certain groups remain at the forefront, we are starting to see an increasing decentralisation in the selected research works with GIT. They have been produced by geographers working in 18 universities and research centres in 13 Spanish provinces. Naturally these results are conditioned by the fact they are not exhaustive and by the subjective nature of the selection of these research works, and should be taken merely as bellwethers of a new reality.

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New challenges for geographical education and research: The Digital School Atlas

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Abstract

Technological advances have revolutionised lecture halls and classrooms alike facilitating new ways of learning. The cloud can be very easily integrated in daily lessons and research. Active methodology improves spatial and digital competencies. In this context the School Digital Atlas (ADE) is created on the ESRI platform ArcGIS Online. It contributes to motivating students in Geography Sciences and skills, encouraging efficiency in quality open geodata management in order to improve learning results. ADE deals with the current secondary school Geography curriculum. Therefore it is transforming a descriptive character into GIS competencies so as to achieve critical and smart geospatial thinking, which are very necessary elements for the future work of 21st century citizens.

Keywords: school digital atlas; WebGIS; geodata; geographical education; geospatial thinking.

1. Introduction

Lectures and lessons have been completely turned around due to technological advances and transformations. This is improving and enriching the

way of learning with a natural use of the cloud in teaching and learning which in turn enhances active methodology.

New mapping tools allow for a deeper understanding by students when dealing with neogeography and other recent aspects which the syllabus reflects such as the crisis, globalization, sustainability as well as territorial and socioeconomic inequality in Spain. The Spanish contribution to the XXXIII UGI Congress has pointed out all these aspects as priority.

On the subject of the Atlas there have been some recent international initiatives for instance the World Geography Atlas, published as a pdf by the Mexico Institute of Geography (Autonomous National University, 2013)

Cartography transformations have not only emerged in the discourse of the language used but also in its adaptability, accessibility and compatibility (Bevington-Attardi and Rice, 2015). The new option of sharing data visualization which extends to an increased number of technological platforms and devices whose implementation in an information and communication society (Wolodtschenko, 2012) is ever increasing. Dynamic maps and big data representation are two



important challenges that need to be implemented in order to acquire space, time and theme related knowledge.

Within such a transformation framework the Digital School Atlas (ADE) emerges. It is an interactive atlas on the ArcGIS Online (AGOL) platform of geospatial ESRI technology. In the end the AGOL platform has been adopted for Atlas implementation based on its easy interaction with ArcGIS Desktop, which is a useful tool for making and improving content and for a final data visualization, so it integrates interactivity and usability.

Thus, ADE deals with an efficient approach to climate changes, urban processes, the crisis, globalization, sustainability and territorial and socioeconomic disparities among other topics on the secondary school curriculum. The tool could be seen as a challenge from an educational point of view on geography research at school. It is also possible to enhance interaction between university and secondary lessons during initial and in-service teacher training. These technologies enhance and contribute to acquiring competencies in professional development such as digital competencies, spatial thinking or teamwork. ADE is a WebGIS adapted to the school curriculum, to teacher training necessities found in the Secondary School Teaching Master's and to other spatial content of the Geography Degree.

ADE objectives will contribute to intrinsic motivation of students towards geographical science with efficient management of quality open geodata improving learning results and enhancing a true innovation in education. In order to achieve these objectives teachers and professors should improve their spatial thinking (Jo and Bednartz, 2014) by adding critical and smart geospatial thinking. This means an evaluation of geographical information reliability in order to set out smart questions that respond to real spatial problems using geographical information technologies.

Learning to learn through digital cartography navigation, the modification of maps and the creation of new maps will lead to the improvement of spatial and digital competencies through natural and necessary acquired knowledge of any 21st century citizen.

A further reflection on critical and smart geospatial thinking appropriateness and a brief approach towards digital atlases is available online outlining the advantage of interactivity of the ADE and its innovative character. We present ADE organization together with future work lines, at the end of the work come the conclusions.

2. Critical and smart geospatial thinking

Geospatial thinking enhances spatial thinking enriching one with a territorial vision of the real world with a digital vision (figure 1). If we consider the assessment of geodata sources used we can approach territorial problems with rigorously worked out solutions. This stage goes beyond spatial thinking giving an added value as well as turning it into critical geospatial thinking (Kim and Bednartz, 2013).

Spatial thinking is defined as "a collection of cognitive skills comprised of knowing concepts of space, using tools of representation and reasoning processes". (NCR, 2006). It integrates descriptive functions similar to those found on the Spanish Secondary school curriculum. Analytic and simulation tools are also essential for developing spatial intelligence, in Gardner terms.

Authors such as Lee and Bednartz (2009, 2012) connect spatial thinking to spatial visualization and orientation skills. They are based on visual incitement and manipulation (mental rotation, envisioning scenes from different viewpoints and digital territory models, among others) in order to get a better interpretation of patterns of entities of the territory framework (associations, relations, connections or hierarchies) understanding the order of elements and interpreting territory as learning results.

Thus, geographical information (GI) will be an essential element for dealing with spatial problems and linking digital dimensions of the territory to reality. GI will help to turn spatial analysis and problem solving into geospatial dimensions, which merge: a) the understanding of the context of the geographical problems, stating the Earth's surface and its representation on conventional or digital and interactive maps to be visualized on a computer;

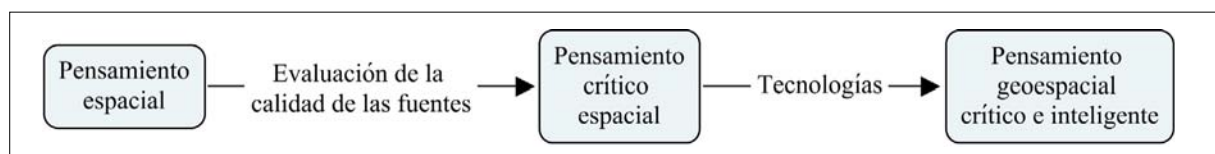


Figure 1. Spatial thinking in the 21st century

Source: Drawn up by Dr. Lázaro



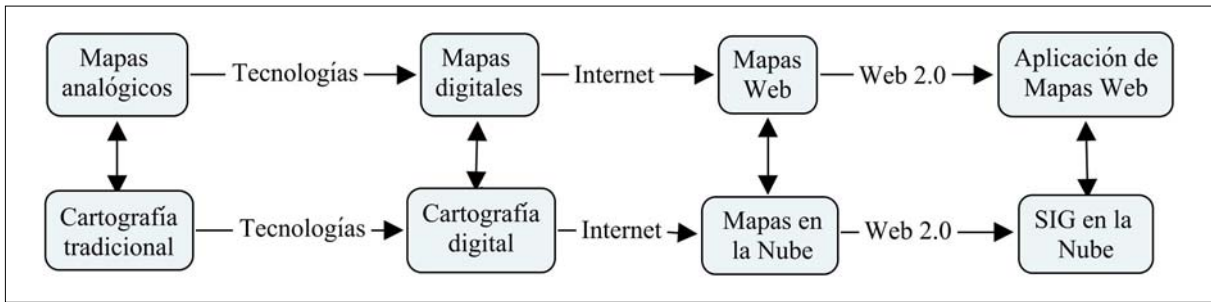


Figure 2. From an analog map to a Web mapping application with GIS functionalities

Source: Drawn up by M.L. de Lázaro

b) spatial relations in order to solve geographical problems (Huynn and Sharpe, 2013).

The next essential element for improving territorial knowledge is data reliability assessment, it leads to spatial and geospatial critical thinking (Kim and Bednarz, 2013). It brings us closer to an approach to real territorial knowledge and allows us to improve spatial reasoning and problems solving (Huynh, 2009). Data reliability assessment revalues an educational commitment towards a greater and more effective use of geoinformation in all educational classrooms and lectures (Buzo, 2015).

Open geodata, published by official institutions in charge of such, for instance the Spanish National Geographical Institute (IGN) or the Spanish National Institute of Statistics (INE), has been used to create ADE. This

provides a guarantee of data quality which gives a better understanding of Spanish spatial problems. Other international geodata provided by EUROSTAT, World Bank or International Monetary Fund, among others, allows European and World spatial problems to be addressed.

ADE contributes to the training of citizens to make decisions and solve spatial problems with a better understanding of the territory. So source assessment gives an added value to spatial thinking which turns into critical spatial thinking (Kim and Bednarz, 2013) and considering context and technology leads to critical geospatial thinking (figure 2). For this reason, Geographical Information Systems (GIS) is an essential tool for doing map navigation suitable to the needs of the problem we are facing. In spite of this, GIScience or the use of GIS in education does not have a unanimous position among teachers and students (table1) but

Author	Year	GIScience experience results
Abbott Albert y Golledge	2001 1999	There are not many differences between students using GIS and those who do not use GIS.
Kerski	2000	Better results and skills to encapsulate, identify and discover territorial elements.
Hagevik	2003	It develops visualization skills and spatial territorial thinking.
Patterson, Reeve & Page	2003	Can develop students' critical spatial thinking (many other authors agree: Wigglesworth, 2003; Liu and Zhu, 2008; Milson and Curtis, 2009).
National Research Council	2006	GIS had a clearly demonstrated potential as a support system for spatial thinking.
Demirci	2009	Teachers in Turkey have developed a favourable attitude towards GIS, although they are still seeking opportunities to use it in their geography lessons. However, the study indicates that they still need to overcome a number of obstacles ranging from lack of hardware and software to their lack of knowledge and skills on GIS.
Li et al.	2010	GIS and PBL develop analytical and evaluation skills of students.
Favier y Van der Schee	2012	Improve learning based on research projects, although teacher and student training is necessary to achieve learning tasks.
Kim y Bednarz	2013	Improve critical spatial thinking that curricula promote.
Buzo	2014	Students get actively involved in the learning process using technology, opening a different window to the world of knowledge and digital skills.
De Miguel	2014	Improve critical thinking, motivation and functionality of learning tools.

Table 1. A summary of research results of several teachers using GIScience at school

Source: M.L. de Lázaro et al. (2015) based on cited authors



nowadays the increase of technology in society is improving usability of GIS tools which are becoming more popular.

Spatial concepts such as scale, projection, geometry and topology can be learned by designing suitable activities using GIScience, in this case AGOL, a WebGIS platform on the cloud. ADE has been designed with these aims.

3. The use of a digital atlas as a tool to learn Geography

An atlas can be defined as a set of maps organized around a standard, objective or purpose. Jointly with the maps it contains tables, graphs, figures and texts (Brus, Vondrakova and Vozenilek, 2015). Thus spatial information is stored to be displayed and analyzed, usually as a book. Reyes *et al.* (Reyes, 2014; Reyes and Juhász, 2015) have widely discussed the relevance of using cartograms in school as a cartographic visualization system and their results claim to facilitate school content acquisition, as a complement to conventional thematic maps.

3.1. Electronic atlas

This concept expands the traditional idea of an atlas as a set of organized maps in digital format and sometimes also online. There are atlases in digital format that are not very different from an analogic book in paper such as the World Geography Atlas published as a pdf by the National Autonomous University of Mexico (UNAM, 2013) or the Spanish National Atlas (ANE) of the IGN. In 1986 the ANE edition initiated useful searching and processing of information tools which have been added. For example a clip tool that adds the source automatically after clipping the selected part of the map or the possibility of connecting and downloading geodata from data bases. This is made possible through siANWeb, an application for creating ANE maps.

However, importance of the concept of the interactive atlas is increasing, it is available on the cloud through cloud computing and allows one to interact: to activate and deactivate layers and it also has some GIS functionalities. It is not necessarily a map viewer service. Metadata explains the geoinformation of the atlas. This is the idea of Peterson (2013) and Hruby *et al.* (2015): the future of online cartography and the digital atlas online go through to cloud computing.

A digital atlas is a broader concept than a digital map as has more interactive possibilities: several layers can be activated and deactivated the same time (Hruby, Ressler and Wolodtschenko, 2015). In some cases new maps can be created from indications calculated on the fly, as it is the case of Hyperatlas which is the cartography tool of the European Observation Network for Territorial Development and Cohesion Programme (ESPON). It was originally used for analysis and showing politicians the territorial imbalance between members of the EU. It has been frequently used for pedagogic and didactic aims (Pigaki and Leininger-Frézal, 2014).

The same teaching purpose inspires the online Didactic Atlas of America, Spain and Portugal (IGN), similar to how a computer program is organized into four modules. The first three are more like a textbook of online geography (general content of the land in the solar system, physical geography, human geography and cartography), while the fourth is a compendium of national data from Latin American countries (De Miguel *et al.*, 2015).

Another teaching example is the Interactive Atlas of the World, created by the Research Group UCM-940 614 "Planning, Development and Culture" (Gago and others, 2012; Babinger and others, 2012) suitable for the teaching of the subject of World Geography in the Geography and Planning Degree.

Thus, mapping is increasingly integrated onto the cloud and it can provide solutions to the challenges that face geospatial sciences. The benefits of Geographic Information Technologies for school learning and geographical education are undeniable (Kerski, 2008) (Muñiz, Demirci and Van der Schee, 2015), and its relationship to the development of spatial thinking is very important (Bednarz, 2004). They are enriched by spatial citizenship (Gryl, Jekel and Donert, 2010) and spatial intelligence (De Miguel, 2015) while a suitable context is necessary in each case to facilitate their application.

3.2. Web maps and WebGIS

The maps served by a GIS are known as Web maps, and if they also have GIS functionality, they are called a WebSIG. Some of them may be integrated into a GIS application (figure 2).

Atlases are a more attractive and motivating than the textbook teaching resource, because of the dynamism and interactivity which encourage students. What



they do is allow students to combine different layers of geographic information in order to understand the complexity and interaction of the physical and human factors in the organization of the territory, as well as also linking to the map data, graphics, text, images and other multimedia documents.

The use of Web Maps (Slocum *et al.*, 2009) is increasingly widespread in learning geography, both during the process of creating and their subsequent use (De Lázaro, Izquierdo and González, 2016).

Another initiative that uses Web maps on a WebGIS is the digital atlas of the Austrian provinces or Vorarlberg Atlas, where you can view data as a thematic map and create maps that reflect emotional spaces. Students through their work on maps and statistics offered by the Vorarlberg Atlas developed a critical reflection on the data and improved their understanding of geographic methods. The results showed the absence of a single way for solving spatial problems (Dür, 2015). The same line of work was experimented by students doing a Teaching Master's working on the subject of Spanish agriculture (Buzo, De Miguel and De Lázaro, 2014).

Thus, an electronic or digital atlas is a good choice to offer Web maps and GIS functionality (WebSIG) without license overspending, and in fact, in the US all schools have had free access to AGOL platform for some years now. But it can be seen that not all teachers have the necessary skills to take advantage of this option. This explains the mentoring program promoted by ESRI, the enterprise owner of the AGOL platform.

The thematic information selection to include on the platform and the technical way of doing so is up to the discretion of those who use the tool. Direct downloads of data from other sources, the connection to the Spatial Data Infrastructure (SDI) services or the creation and integration of the data itself (Buzo, De Lázaro y Mínguez, 2014) are possible options in AGOL. Each outline one aspect of interest in relation to different forms of learning.

4. Digital Atlas School

ADE authors have been using these tools when creating collaborative maps for several years. They all work on different institutions. They have been integrating their students (De Lázaro, Izquierdo and González, 2016; De Miguel and Buzo, 2015; Buzo, De Miguel and

De Lázaro, 2014; Guallart and De Lázaro 2014; Buzo, De Lázaro and Mínguez 2014; De Lázaro and otros, 2015), who have not only been involved in the construction of maps, but also on the reflection and in the research of relevant data quality. Browsing through the elaborated mapping contents leads to a better understanding of the territory, improving learning outcomes that complement geographic data knowledge and memorization by students as well as the scientific work of geographers on discovery learning, based projects together with inquiry learning and simulation learning. Thus, in addition to promoting the acquisition of spatial thinking and social and civic competencies through geographic space, it is required of our students and their scientific vocations to demonstrate a geographical science that allows for a thorough knowledge of the territory in order to improve it.

The information obtained from the above cited sources can be displayed in the form of the Web Mapping Application or Web application, which is what has been done in the ADE. Its simple interface facilitates intuitive use by vertical displacement and gives the opportunity to interact with ArcGIS Desktop in order to continue creating and updating the created maps.

4.1. Objectives

The goals to be achieved by ADE can be specifically outlined as:

- Facilitating the integration of territorial firsthand knowledge of the Geography curriculum and integrate territorial aspects of the social sciences.
- Encouraging critical geospatial thinking, providing a tool for territorial analysis.
- Understanding the concepts and reflected contents on any map, rather than memorization. It invites browsing to reach the same learning outcomes proposed on the current curriculum.
- Leveraging open and quality geodata available on the portals maintained by the official bodies responsible for the same data.
- Promoting learning standards and evaluation criteria that are useful for learning throughout life centered reasoning and spatial, and acquiring digital skills.



- Learning how to properly integrate geolocation tools in pictures, maps and other geo-data to help gain a better understanding of the territory through its analysis and by drawing the right conclusions for actions to be taken.
- Forming a citizenship whose responsibility is to apply acquired knowledge. Study cases and school experiences will be proposed with this aim in mind.
- Serving as a laboratory instrument for geography education research in at least two parameters: geospatial thinking and geo-progressions (Solem *et al.*, 2014 and Bednarz *et al.*, 2013). These processes allow empirical verification of the possibility of renewal in the teaching of geography and improving the quality of learning.

4.2. Managing content

The ADE, which can be found at: <http://arcg.is/1Y04eFW>, is structured in five main themes which integrates the essence of the Spanish secondary level curriculum laws in Geography: LOGSE, 1992; LOCE, 2000; LOE, 2007 that the LOMCE splits into twelve in 2014, but are all included in the five thematic sections cited:

1. Physical Space
2. Population and urban spaces
3. Economy and Territory
4. Territory and territorial imbalances
5. School Experiences (maps and work done by students)

A section prior to all sections explain the “Instructions” where the main page has a video on AGOL, an

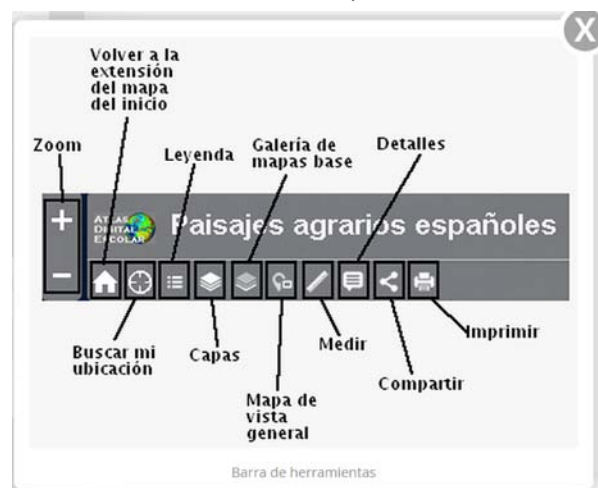
explanatory text on the atlas and index of the cited thematic sections.

On the second page functionality of ADE all six main elements are explained. They are:

1. The format of the Web map application, which occupies the main area of the screen and is not possible to delete or alter. The browser refresh will erase all the work done by students.
2. A popup window labelled “detalles” (details) offers information of interest to teachers: targeted students, on topics covered, enumerated layers and information presented on the map web. There are two available links: the first one, leads to what has been described as ArcLesson. It has examples of questions that can be directed at students to deepen their knowledge of issues presented; and a second link to the map that contains the built-in application (Web Map) for teachers or students registered to access the map information, activate the layer or create a new map from this ADE map.
3. The toolbar on the upper left, is an essential element for interaction on the map to activate and deactivate the layers that contain geographic information, visualize the legend or changing the base map or map background from the gallery which would allow new information to be added. Other tools allow sharing of the map, printing and measurements to be made (figure 3).
4. The searching box, symbolized by the magnifying glass instantly locates any geographical accident, municipality or region by just stating the name.
5. Finally, note that the graphic scale, which appears on the bottom left of the map.

Figure 3. Main elements of the Digital School Atlas (ADE)

Source: ADE (AGOL)



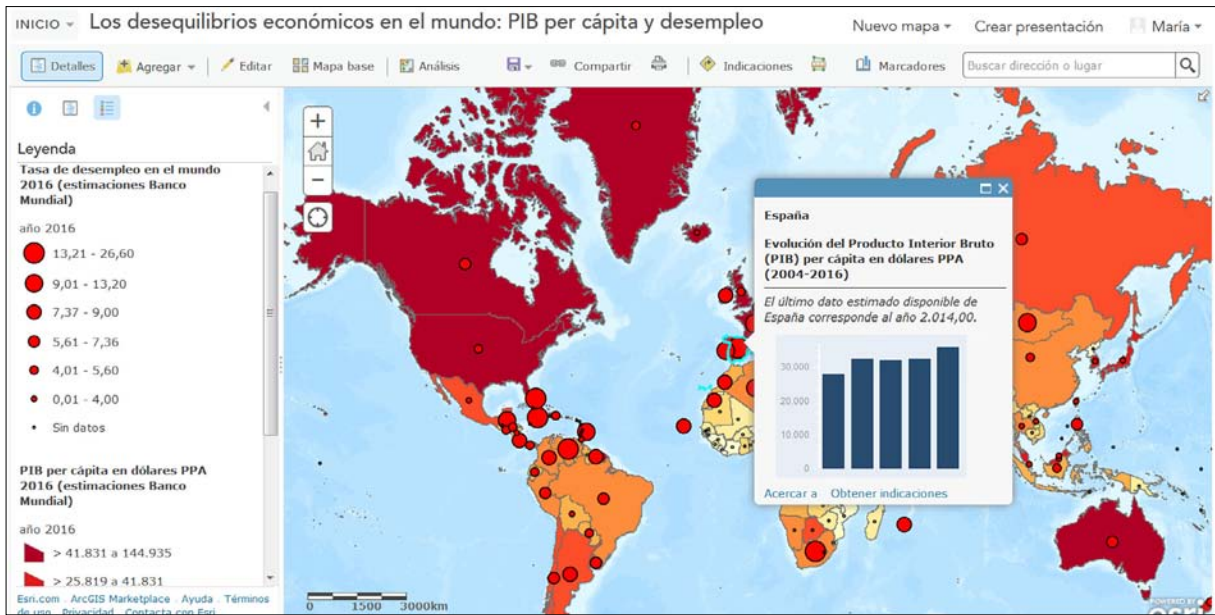


Figure 4. Graphs showing the economic and social imbalances in the world

Source: Web Application or Web mapping application, ADE (AGOL)

All ADE blocks are organized in the same way, the left column shows the list of topics and subtopics available on the map Web, and on the right column the properties and tools described in the toolbar are shown.

In some cases, graphics are integrated through pop-ups on the maps, as can be seen in figure 4 on socio-economic imbalances in the world. This is the web map which serves as the base of the Web map application (figure 5).

Another example is the map of agrarian landscapes consisting of a set of layers: climatic and population growth. Then, it leads to a reflection on the depopulation of some rural areas.

4.3. Its use in classrooms and lectures

Each Web map application has an ArcLesson which can be downloaded from the “Detalles” (detail) tool map with suggestions to be used in the classroom by teachers.

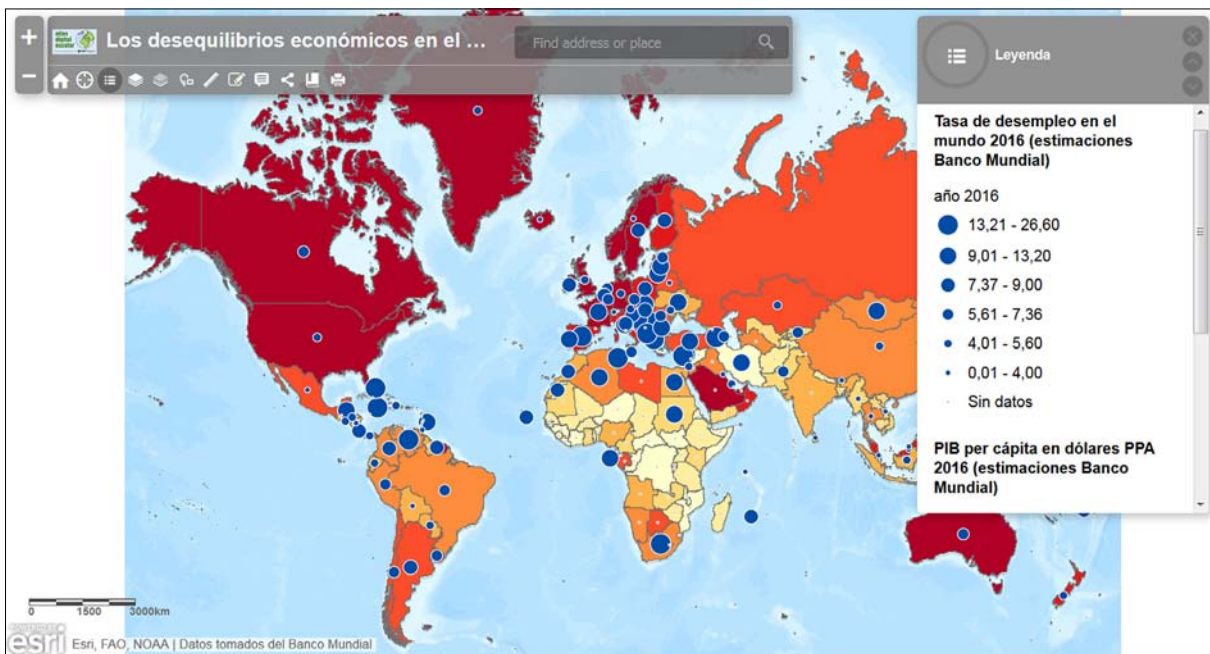


Figure 5. The economic imbalances in the world: unemployment and GDP per capita \$ PPP

Source: Web Application or Web mapping application, ADE (AGOL)



Figure 5 shows the ArcLesson of the European Union Web map application from the “Cuestionario propuesto” (proposed questionnaire) link (figure 6).

Maps allow personalized browsing or navigation and may set bookmarks to zoom in on the information level of detail to be shown. Certain scales can make some of the layers visible, as happens with political and administrative

bodies of the EU (figure 7 on UE organizations). The legends of other layers can also be displayed if they are activated, for instance, the capitals of each of the EU countries according to their size (figure 8) or the EU countries (in blue), EU candidate countries (black), EFTA countries (grey) and potential candidates (light grey). We can observe all the elements that have been pointing to these pages on the Web mapping application interface.

ORGANISMOS DE LA UNIÓN EUROPA

Trabaja las cuestiones siguientes:

1. ¿Elabora una tabla con las principales instituciones y organismos europeos, la ciudad en que se asientan, señalando aquellas capitales europeas que acogen más de una?
2. ¿Son las ciudades europeas de mayor población o las capitales de los principales Estados miembros de la UE las que acogen las instituciones comunitarias? ¿Cuál crees que es la razón para elegir la ubicación de las sedes europeas?
3. Elabora una tabla con los sistemas de gobierno de los países miembros de la UE.

Figure 6. ArcLesson from figure 7 map (European Union Organizations)

Source: ADE, AGOL

Este mapa se orienta al trabajo con alumnos de 12-18 años. En él se recogen diferentes características de la organización política y administrativa de la Unión Europea. Para ello se presentan las siguientes capas:

1. Instituciones y Organismos de la UE (sedes).
2. Capitales de los países miembros de la UE.
3. Países de la UE (28).
4. Países Asociados.
5. Sistema de gobierno de los países de la UE.

- Propuesta de cuestionario
- Enlace al mapa para utilizar sus capas, añadirle otras o quitar alguna

Figure 7. “Detalles” (details): explanation of the map, proposed questionnaire (ArcLesson) and link to the Web map on which the application is based

Source: ADE, AGOL

Nº de habitantes de la ciudad (salvo Londres, que es la aglomeración)

- > 3.501.870 a 8.256.400
- > 2.249.980 a 3.501.870
- > 1.246.780 a 2.249.980
- > 864.324 a 1.246.780
- > 649.853 a 864.324
- > 280.607 a 649.853
- 89.836 a 280.607

Figure 8. EU (blue), candidate countries (black), EFTA (grey) and potential candidates (light grey)

Source: Web Application or Web mapping application map, ADE (AGOL)

In short, the ADE is a tool that attractively invites learning Geography on the cloud in a different and innovative way based on clear reference maps on the AGOL platform and in the way that other layers of geographic information are added. Thus, autonomous students' work outside the classroom, supervised by the teacher and coordinated with the rest of the class group and collaborative work and networking, can be integrated, not only by flip teaching but also by discovery learning, collaborative and problem-based learning. Active methodology acquires a new dimension with this innovative tool (De Miguel, 2014) and opens new ways for research.

5. Conclusions

Geospatial technologies such as those used by the ADE, have come to schools (Baker *et al.*, 2015) and universities making it possible not only to generate knowledge but also to improve learning quality leading to acquisition of spatial and digital competencies versus rote and descriptive learning. We can say that this is a clear renewal of teaching techniques and methods in geography.

The ADE is an innovative material for curriculum objectives and a new resource that enhances and expands on the possibilities offered by print atlases for teaching and learning Geography in secondary education. Although scheme and organization may be similar, its digital nature allows great interaction among students as well as a process development of spatial learning by discovery. It also has functions of a GIS, and its layered organization allows students to understand the complexity of the elements involved in the organization of territory (physical, social, economic, political and cultural) resulting from their interaction. All this is made possible through a simple update of information at a very low cost.

Wide dissemination of ADE will take place in Spanish secondary schools, with the support of the Spanish and international leaders in geographical education, both cited throughout this work.

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On georeferencing old maps: online map libraries and open source GIS

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Abstract

Geographers have widely relied on old maps as didactic devices and as elements of synthesis in the historical analysis of given territories. However, the recent generalization of immediate access to this type of cartographic representation in digital repositories, and the popularization of geographic information technologies through open access tools have altered the traditional focus. The possibility of georeferencing old maps and interrelating them with other cartographies has opened up new roads for research. Acknowledging the methodological revolution encouraged by georeferencing online map libraries, the article proposes basic guidelines with which to georeference old maps in the most popular open source Geographic Information Systems (GIS): QGIS and gvSIG. The object is to reflect on the relevance of georeferencing as a useful tool to contextualize old maps and obtain better data from them, valorising cartographic heritage.

Keywords: old maps; georeference; online map libraries; Geographic Information Systems (GIS); open source.

1. Statement. Our fascination with old maps: going beyond color and image

Throughout time, maps, as a unique form of communication, have been one of human societies'

most powerful means of representing and expressing their territories' characteristics. As graphic images of the earth's surface, they reflect its evolution and transformations. They offer a spatial understanding of world historical events, while remaining linked to the passage of time, insofar as they connect space with what happened in history, and what human societies have done in that space (Brotton, 2014: 26). They are also important didactic tools, for they have contributed to popularize countless notions and information, so much so that some authors argue that maps have changed our perception of the earth (Harwood, 2008). Brotton offers a more nuanced argument, saying that it is not in maps' nature to change anything, but as individual and social means of expression, maps have provided, and been used to bolster arguments, proposals and interpretations of territories and human groups (Brotton, 2014:38).

From this perspective, a map is simply one way in which a space or event is regarded at a given moment, so that it constitutes a particular testimony.¹ With the passage of time, then, old maps become valuable historical documents, for they contain information of a bygone era. It is precisely when they are no longer present cartographies that they generate a sort of fascination, which is linked to human interest for the unknown, for discovering the "truth" of what the world

1. Indeed, as a mode of expression, maps can contain visions that are quite removed from reality. For analyses of falsehoods in maps, see Brodsky, 1994; Monmonnier, 1996; and Van den Heuvel, 2004



was like when we were not yet in it.² Far from being limited to scientists or specialists, old maps' attraction and interest is quite popular, as the successful general interest publications dedicated to maps demonstrates (Jennings, 2012; Garfield, 2013). Without a doubt, old maps attract us as graphic testimonies of the past, as graphic narratives of history.³

However, moving beyond this first impression, beyond the visual attraction that images and colour produce (San Antonio, Asenjo and Vellilla, 2008), maps invite onlookers to a more profound reading. Maps are not only regarded or appreciated: they can be read, for they contain a wealth of information that transforms them into testimonies and means of telling the history. Regarding his cartographic illustrations for *Le Monde Diplomatique*, Rekacewiz has written that maps are truly interesting when they can transmit to an audience a content that would otherwise remain invisible; when they make it possible for a reader to understand complex information that would otherwise be unintelligible, and always condensing a double dimension: space and time (Antoniou, Klanten and Ehmann, 2015: 4 and 94). It is this aspect of old maps as graphic transmitters of historical content, as fundamental elements of a place's cultural heritage, that this essay will address, and not just as snapshots of what that space looked like at a given moment.⁴

The field of geography has not overlooked this valuable aspect, for its practitioners have traditionally used old maps in studies of territories' evolution. However, the last few years have witnessed a broader valorisation of old maps, thanks in large part to their increased accessibility. A true revolution in the diffusion of

this cartography is in the making, and the forms of interpreting it have multiplied, opening up new roads of inquiry for geographic analysis. Analog documents in repositories of municipal buildings, libraries, archives or document centres have become available to the world's internet users in online map libraries to browse, study, use, and share. Many of these maps are being georeferenced –assigned a geographical location– with online tools, making it possible to establish direct comparisons with other maps. However, these online applications lack geometric precision and the capacity of carrying out other spatial analyses that Geographic Information Systems (GIS) offers. The generalization of the so-called open source (free) GIS has facilitated this analysis, encouraging new interpretations of the information contained in old maps from several points of view. Starting from the analysis of the revolution produced by georeferencing in online map libraries, this essay proposes basic guidelines to apply this technique to old maps in the two most popular open source GIS: QGIS and gvSIG. The object is to make manifest their capabilities for working with this cartography, and more specifically, to elaborate on the standards with which to georeference and analyse it.

2. The online map library revolution: old cartography made accessible and georeferenced through open collaboration

No more than two decades ago, only specialized searches granted access to an old map. Thus, it was usually researchers or collectors who located and studied them, and they did so almost exclusively in the archives and deposits that housed this sort of document in their original formats. This made old maps hard-to-access relics, which probably contributed to their aforementioned fascination. As early as fifteen years ago, Campbell theorized on what would happen to these old maps in the future digital age. He expressed a few doubts regarding their incorporation in the World Wide Web; the immense work that had to be done to make them accessible; and the technical and human difficulties that a generalized digitalization of these documents would entail. He even dared predict then, that in twenty years' time, users would still need to visit physical map libraries in order to work with these maps (Campbell, 2000: 492).

Today, with Campbell's deadline nearly upon us, many of the problems suggested by this author still exist, and the majority of the great map collections are not yet

2. I speak of old maps (ancient cartography) instead of historical maps (historical cartography), for I define the latter as those elaborated to reflect past characteristics, processes, or phenomena, following the reflection developed by Antonio Crespo in several of his works. For the purpose of this study, I regard primitive cartography (so-called early maps) as part of historical cartography. See Crespo, 2014: 4; Crespo and Fernández, 2011:405; and Iturriz, *et. al.*, 169
3. According to Ibáñez, the search for the perfect map has accompanied humanity throughout its history (Ibáñez, 2010). Jennings has argued that when a person enters a room in which there is a map hanging on a wall, he or she is incapable of looking away from it. Indeed, adds Jennings, maps fascinate nearly everybody, and for those who, like geographers, specialize in the analyses of territories as humanized spaces, the only thing that is better than a map, is an atlas (Jennings, 2012: 10 and 22)
4. I therefore subscribe the argument developed in the brilliant book *Mind the Map*, in its call to "keep the map in mind" as a valuable testimony; as a specific viewpoint of a human reality; as a (re) production that goes beyond the image; and as a social manifestation that can even be considered an artistic expression (Antoniou, Klanten and Ehmann, 2015: 2 and 27)



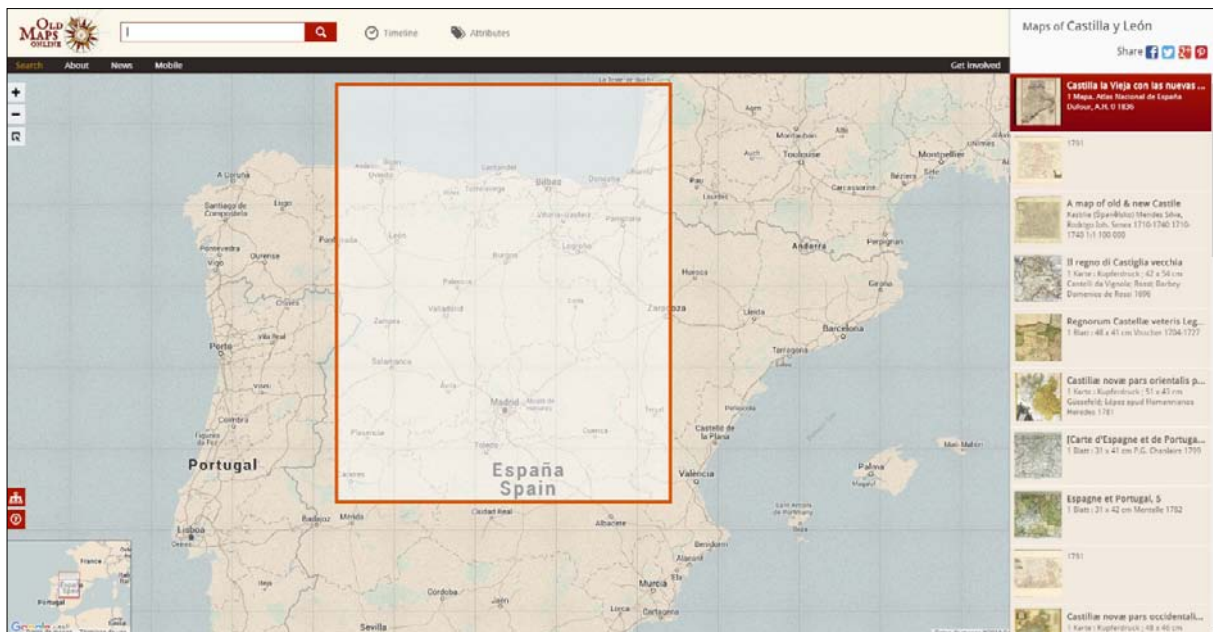


Figure 1: Old maps' geographic browser in www.oldmapsonline.org

online. However, online access to old maps has moved at an unprecedented speed, so much so that in the last few years online map libraries have been undergoing a true revolution. Already in 2008, Fleet pointed out that the web held great promise for old maps, well beyond that offered by paper, addressing the relevance of new geographic tools for the pooling and dissemination of cartographic heritage (Fleet, 2008: 257-258). Peterson has written recently that the internet has revolutionized the world of maps as much as the printing press revolutionized the world of books in its day. This author considers that there has been an increase of traffic of maps on the internet, their accessibility and exchange, and he believes that cloud source repositories are clearly the future in this field (Peterson, 2014: 1, 2 and 10). Indeed, the internet has profoundly transformed access to maps, and despite limitations in terms of the technical difficulties that non-specialists may still encounter in their use, or the underuse that is made in educational fields, it is evident that maps have been popularized and online cartography is today accessible for all (Osaci, Cocos, Cocos, 2014; Poplin, 2015: 359 and 360).

In fact, the map digitalization process that began in the decade of the 1990s has grown exponentially in the last few years. Initiatives undertaken across the world are countless, and it would be practically impossible to compile an exhaustive list of who has generated them from where. However, some of these initiatives are worth mentioning because of their scope and multiplier effect: the *David Rumsey* project, for instance, which placed its immense map collection in 2000 on the internet, constitutes such a benchmark. Starting with

an initial repository of 2,300 digitalized maps, even Rumsey had his doubts about the project, but the first few months of the website's life dispelled them. By then, the site had more than 10,000 visitors a day, and in three years, more than two million people had accessed the collection, including historians, geographers, cartographers, libraries, researchers, and members of the general public. It was clear that those interested in consulting old maps online came from a very broad spectrum (Sweetkind, 2000: 5; Rumsey, 2003: 5). Since then, the number of online map libraries has multiplied, with a similarly wide, popular appeal.⁵

Thus, the multiplying effect of these online map libraries means that the number of old maps online grows each day, and so do the visitors that seek access to them. As Southall and Pridall have pointed out, one can identify two types of online projects regarding old maps. On the one hand, there are those that deal with the digitalization of map collections. On the other, there are those that create search engines or portals that navigate the various online collections and that are committed to the idea of creating a sort of "Google for old maps" that is as thorough and complete as possible (Southall and Pridall, 2012: 74).

The complexity behind individual websites' maintenance has propitiated the logic of joint portals over that of

5. The IGCC map library is a good example of this: once it made its map library available online, in only two years (2007-2009) access to its webpage had multiplied by 2.5, so that it received more visits in a month than the physical map library received in a year (Montaner and Roset, 2010: 90)



Online map library	Institution/Collection	# of maps collection	# of maps online	Maps' dates
Old Maps Online http://www.oldmapsonline.org/	Univ. of Portsmouth and Klokkan Tech	381,625	381,625	15 th -20 th cent.
National Library of Scotland http://www.nls.uk/	National Library of Scotland	1,500,000	120,000	1560-1964
Perry Castañeda Library Map Collection http://www.lib.utexas.edu/maps/	University of Texas at Austin	250,000	70,000	18 th -20 th cent.
British Library http://www.bl.uk/maps/	British Library	4,500,000	58,093	10 th -20 th cent.
StaréMapy.cz http://www.staremazy.cz/	Moravská zemská knihovna	-	46,006	1400-today
The University of Chicago Library http://www.lib.uchicago.edu/e/collections/maps/	University of Chicago	470,000	38,908	18 th -20 th cent.
David Rumsey Map Collection http://www.davidrumsey.com/	Cartography Associates	63,041	38,336	1690-2010
Map Collection University Library Dresden http://www.slub-dresden.de/en/collections/maps/	University of Dresden	177,000	26,752	1574-today
New York Public Library http://maps.nypl.org/warper/	New York Public Library	32,000	21,039	1544-1980
National Library of Australia http://www.nla.gov.au/what-we-collect/maps	Australian Government	600,000	20,637	1493-today
Cartoteca Digital de Cataluña	IGCC	308,405	20,454	1482-today
Library of Congress Maps http://www.loc.gov/maps/collections/	US Government	5,500,000	19,130	1482-2000
University Library of Bern http://www.unibe.ch/	University of Bern	-	19,000	1500-1900

Table 1: Main online map libraries from across the world (according to number of online maps). October 2015

Source: Compiled by the author based on data found in the included map libraries' websites

individual collections.⁶ In the last few years, several national and international projects have been developed in Europe and the Americas to construct this sort of platform.⁷ One initiative stands out in its capacity to accumulate online map collections, allowing users to search through diverse online collections of old maps: the Old Maps Online portal. This project is the result of the collaboration between the Great Britain Historical GIS Project based on the University of Portsmouth and the Swiss company Klokkan Technologies in the generation of a platform to search through diverse online collections of old maps. Launched in February of

2012, the site already provides access to the old map libraries of 33 institutions and universities from across the globe, and is maintained for free by volunteers and employees of the cited Swiss firm (Southall and Pridal, 2012: 77; www.oldmapsonline.org/about).

As of today, Old Maps Online provides access to close to 400,000 online maps and has definitely become the foremost site for any investigation into old cartography, for it constitutes the major online access point to a network of the world's most important online map libraries. Table 1 includes the most relevant map libraries whose websites have gathered more than 20,000 online maps, and nine of the twelve here presented are integrated into the Old Maps Online portal (only the repositories from The Library of Congress, the National Library of Australia, and the University of Chicago are not yet indexed in Old Maps Online).

However, beyond this specific project and the others mentioned in the table, it is important to point out that countless other online libraries have between 1,000 and 20,000 old maps. Universities especially, including US-based institutions such as Berkeley, Harvard, Yale

6. As a matter of fact, in the last few years online maps are accessed via Virtual Map Rooms (VML), sites that integrate a browser that allows the user to locate a given map from among a multitude of online libraries, and also a series of tools that allow its contextualized visualization and analysis (Siabato, Bernabé and Fernández-Wytenbach, 2012: 316)

7. The European initiative Digmap, the French portal Cartomundi; the browser Maps of Australia; Spanish project CartoVirtual; IELAT's Cartoteca Histórica; the University of California's map browser called Alexandria, and UNESCO's World Digital Library, are good examples of this. Unfortunately, not all of them have been successful, and in fact, some have disappeared (Chias and Abad, 2008; Borbinha et. al., 2009; Fernández-Wytenbach and Bernabé Poveda, 2011a and 2011b)



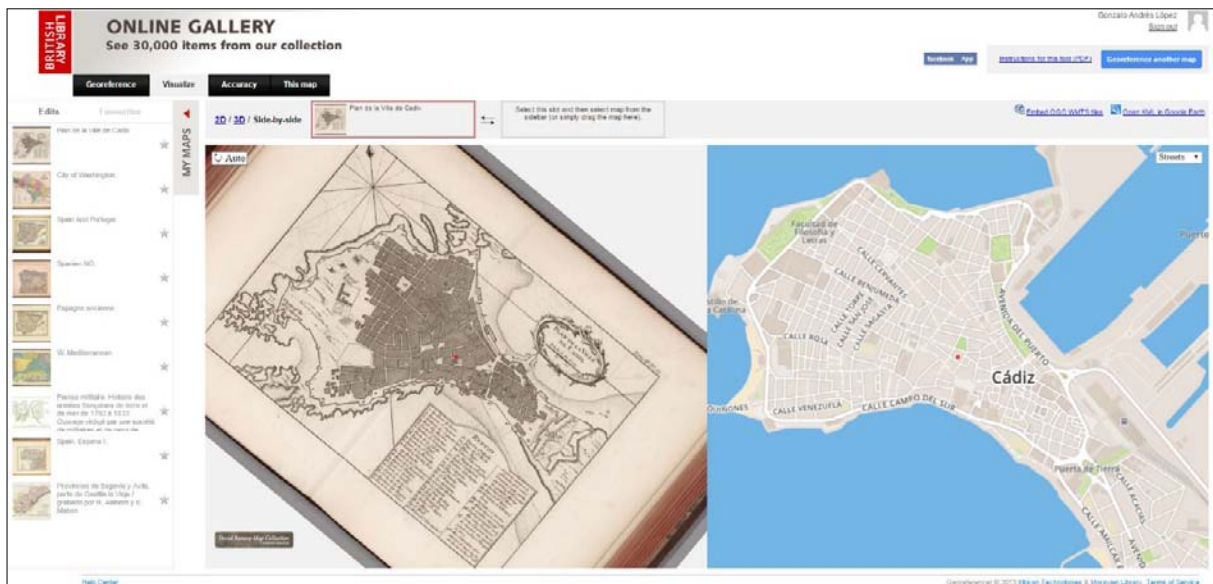


Figure 2: Georeferencing panel in the British Library website

and Stanford, and Europeans including Cambridge, Manchester and Utrecht, are contributing to increase the number of old maps available online. This effort is also aided by institutions such as Kartenportal, Broer Maps and Historic Cities, as well as by initiatives that facilitate access to and digitalization of archival materials more generally, and therefore include old maps.⁸ There are also several examples from Spain, among them the Instituto Geográfico Nacional (with 628 online maps) and the Biblioteca Digital Hispánica (6,870 maps).⁹ Spanish public universities, with nearly 330,000 maps in

their collections, are still in the process of putting them online, and various libraries and archives are interested in integrating their cartographic collections onto the internet (Blanco, 2010:4).¹⁰

However, and despite the increasing number of such initiatives, evidence shows that there is still a large number of funds to be digitized and placed online. The world's largest map collections (the *Library of Congress* and the *British Library*) have just started this process, and as we can see in Table 1, the number of online maps is quite small in relation to those that exist in the mentioned collections. The twelve map libraries included house a total of more than thirteen million maps, and only close to half a million of these are online: barely 4% of the total. The problems of digitizing these funds and maintaining web servers to house them are significant, but collaborative enterprises have solved most of the technical difficulties and labour costs, although there is still much work to be done (Southall, 2013: 5; Southall and Pridal, 2012: 80).

Georeferencing provides one of the clearest examples of this collaborative tendency, for a good number of these old map websites include online tools to situate maps geographically and project them adequately, with their coordinates. This process uses crowdsourcing, in which georeferencing is carried out directly online by the webpage's users, moved only by the desire to increase general access to this cartographic heritage (Fleet, Kowal, Pridal, 2012: 7).

8. The cited examples can be consulted at: University of Berkeley: <http://www.lib.berkeley.edu/EART/>; University of Harvard: <http://hcl.harvard.edu/libraries/maps/>; University of Stanford: <https://searchworks.stanford.edu/>; University of Yale: <http://www.library.yale.edu/MapColl/index.html>; University of Cambridge: <http://www.lib.cam.ac.uk/collections/departments/maps/collections>; University of Utrecht: <http://bc.library.uu.nl/>; University of Manchester: <http://www.library.manchester.ac.uk/search-resources/guide-to-special-collections/map-collection/>; Kartenportal: <http://www.kartenportal.ch/>; Broer Maps: <http://broermapsonline.org/site/>; and Historic Cities: <http://historic-cities.huji.ac.il/>. There have also been projects that link documentation centres online through gateways that facilitate access, which include old maps and cartographic resources: at the European level, see APEnet (now APEX), which manages the Archive Portal of Europe (<http://www.archivesportaleurope.net/>) and Europeana (<http://www.europeana.eu/portal/>). In Spain, the Portal de Archivos Españoles (PARES) maintained by the Ministerio de Educación y Cultura, grants access to hundreds of thousands of online documents, including the maps of the Colección Digital de Mapas, Planos y Dibujos del Archivo General de Simancas, which has all of its 5,005 registries online (Sainz, 2013 and Sainz and Manso, 2014). See also Hispania, the Spanish portal of Europeana (<http://hispana.mcu.es/es/inicio/inicio.cmd>)

9. To consult a list of Spanish map libraries, see the directory developed by IBERCARTO, at <http://www.bne.es/es/Colecciones/GeografiaMapas/>. For IGN's online map collection, go to <http://www.ign.es/fondoscartograficos/>. For the Biblioteca Digital Hispánica's collection, visit <http://www.bne.es/es/Catalogos/BibliotecaDigitalHispanica/Inicio/>

10. Regarding the Spanish public universities' map libraries, see Blanco 2006 and 2010



Map Library	Institution/Collection	# of maps online	Maps that can be georeferenced	# of maps already georeferenced	Maps' dates
StaréMapy.cz http://www.staremapy.cz/	Moravská zemská knihovna	46,006	46,006	31,480	1400-today
British Library http://www.bl.uk/maps/	British Library	58,093	58,093	17,782	1 st -20 th centuries
New York Public Library http://maps.nypl.org/warper/	New York Public Library	21,039	21,039	6,349	1544-1980
Map Collection University Library Dresden (SLUB) http://www.slub-dresden.de/en/collections/maps/	University of Dresden	26,752	26,752	5,600	1574-today
David Rumsey Map Collection http://www.davidrumsey.com/	Cartography Associates	63,041	38,336	4,824	1690-2010
Cartoteca Digital de Cataluña http://cartotecadigital.icc.cat/	Instituto Cartográfico y Geológico de Cataluña	20,454	1,855	1,855	1482 -today
National Library of Scotland http://www.nls.uk/	National Library of Scotland	120,000	817	673	1560-1964

Table 2: Some of the most important online map libraries according to the number of georeferenced maps. October 2015

Source: Compiled by the author based on data found in the included map libraries' websites

Accordingly, two aspects usually characterize old map websites: first, they base map location on geographic search procedures, integrating tools that allow users to "find old maps through maps" (MapRankSearch) (Oehrli, et. al., 2011:7-8). Second, with the same object, they give great relevance to georeferencing, so that all maps are geo-located, and browsers and indexers use terrain as the central axis to organize the maps (Fleet and Pridal, 2012:252-254). These tools can "map the maps", placing old cartographies in geographic coordinates, allowing them to be visualized on a present map (Heald and Kowal, 2015).¹¹

The process of georeferencing maps online is quite simple and intuitive for users. They simply have to find the same place on both maps, set a number of control points on them, and the program will calculate the old map's geographic position. Various authors have detailed the benefits and results of georeferencing, but it is worth mentioning a few. Thanks to the locating coordinates, users can make geographic searches in

old maps; interfaces are more user-friendly; integrated into present maps, the data contained in old maps can be compared to the present terrain –providing new historical sources in the context of digital humanities– and finally, the diffusion of cartographic heritage is modernized (Fleet, Kowal, Pridal, 2012: 1 and 2).

The collaborative initiatives that have been carried out have had surprising results. In the *British Library*, 750 maps were georeferenced in only 5 days, while 999 maps were georeferenced in the IGCC in only 24 days (Ramos and Roset, 2012: 6 and 8). Table 2 shows the state of georeferenced maps in the main libraries that have participated in these projects. We can see that nearly 70,000 old maps have been georeferenced in these online repositories. Although this is a significant amount, it is still small, for it is less than 20% of the total of these collections' online maps. In such a context, the Czech site *StareMapy.cz*'s more than 31,000 georeferenced maps stand out, nearly doubling the next most significant institutional website: that of the *British Library*, with nearly 18,000 georeferenced maps.¹²

Aside from the quantity of georeferenced maps, and without any incursion into the uncertainties inherent to these kinds of projects –which have been addressed by various of the authors cited in this text– it is worth

11. Much has been written during the last five years on this phenomenon, for georeferencing has become one of the most relevant elements of the online map library revolution. Almost all projects are based on two tools: MapWarper (2009), developed by Tim Waters who based his work on MapRectifier (2006); and Georeferencer (2008), developed by Klokán Technologies as part of a collaborative pilot project with Brno's Moravian Library (Fleet, Kowal, Pridal, 2012: 6; Kowal and Pridal, 2012: 277-278). MapWarper has been successfully applied in the New York Public Library's map collection, as well as in those of Harvard and Stanford. Many of the online map libraries that are gathered in Old Maps Online use georeferencing. See Fleet, Kowal, Pridal, 2012

12. *StareMapy.cz* is a repository that houses initiatives from various Czech institutions



addressing the true value of online georeferencing of old maps beyond the mere improvement in their contextualization. For, despite some interesting exceptions that are developing historical GIS, most of these applications do not allow for the association of historical topics to the old map, nor do they integrate tools for the posterior measurement or analysis of georeferenced maps.¹³ The revolution that this process in online map libraries has unquestionably facilitated access to these maps, but if one wants to obtain data beyond mere positioning, integrating the variables shown in the map to carry out a spatial analysis, a second step becomes necessary. We must use GIS tools that allow measurements, surfacing, the integration of aspects of the old map in our present cartographies, or even the vectorization of elements that are most relevant or significant for our specific work. This is currently possible thanks to the popularization of open source GIS, which have become very useful and interesting tools to work with old maps, georeference them, and analyse their contents.

3. Georeferencing old maps in open source GIS: QGIS and gvSIG. Methodological and analytical guidelines

Open source GIS are conquering the geographic information market in many fields, and their use has become quite generalized. The early 1980s saw the first initiatives to develop software of this kind (GRASS-ILWIS), but it was not until the decade of the 2000s when most projects bore fruit, including those that are addressed in this text (QGIS, 2002; and gvSIG, 2003). Many programs of this sort have appeared in the last twenty years (Mapwindow, Udig, Open Jump, Kosmo...), all of them with advanced functions for the visualization, edition, and analysis of geographic information, and all of them free of cost (Steiniger and Bocher, 2009:1355-1356)¹⁴.

All this has multiplied the possibilities of working with old maps, for all of these tools make it possible to carry

out two processes: on the one hand, the georeferencing of old maps through the establishment of control points and assigning coordinates; and on the other, the spatial analysis of a map's content using various tools. Most online map libraries allow users to export their collections' maps, so that they can georeference and analyse them through their chosen GIS program. Let us look at the main aspect of both processes, using as examples old urban maps. Urban cartography is a good choice because most of the old maps that have already been georeferenced in online map libraries do not correspond to cities. Moreover, maps of urban areas can be worked with more precision; there is an ample selection from the period after the 1830s –that is, the context of industrialization and urbanization– that allows for the identification and analysis of cities' elements, buildings, spaces, and structures with more geometric precision.

Georeferencing is accomplished by assigning a series of control points to the image of the old map to establish its correspondence in a coordinates system that locates such points and projects the old map superimposed upon a current map. The methodology and logistical aspects of the process have been amply analysed in more technical papers, but we cannot analyse georeferencing without at the very least addressing a few basic elements. A person interested in georeferencing an old map must first take into account the original map's representation or projection system. Maps that were drawn without using a modern projection system, such as the oldest or so-called "early maps", cannot be georeferenced. Second, they must select adequate control points, particularly significant landmarks that are easily identifiable and that have varied the least in terms of historical change, in order to ensure a better assimilation into a current map. Third, in order to do this, it is important to know the scale and graphic resolution of the old map. The scale is fundamental in determining the location of the selected control points in the reference map, and the higher the digital file's resolution –ideally, above 200 dpi– the more precisely will this location be. Fourth, they must determine which spatial or coordinate reference system they will use, pursuant to the old map's location and the reference base with which they will work. The type of coordinate transformation that will be applied over the old map's raster image –polynomial, affine, or conformal transformations, depending on the degree of translation in the x and y axes; rotation; the scale's radius and/or the distortion necessary to represent it– and the resampling method (closest neighbour, bilinear interpolation, or cubic convolution), are necessary so that the program reassigns the pixel colour composition (Roggero and Soleti, 2015;

13. There are diverse platforms that use historical cartography and associating thematic data to it using browsers and applications. One of the most interesting is the project entitled Addressing History. See Macdonald and Osborne, 2013 and <http://addressinghistory.edina.ac.uk/>. Regarding the use of GIS in historical analyses, see Gregory (2002) and Crespo Solana (2013)

14. Open Source GIS have significantly generalized access to working with multi-layered geographic data. For more on this phenomenon, its extension, the diverse software available, and its applications, see Steiniger and Bocher (2009) and <http://freegis.org/>



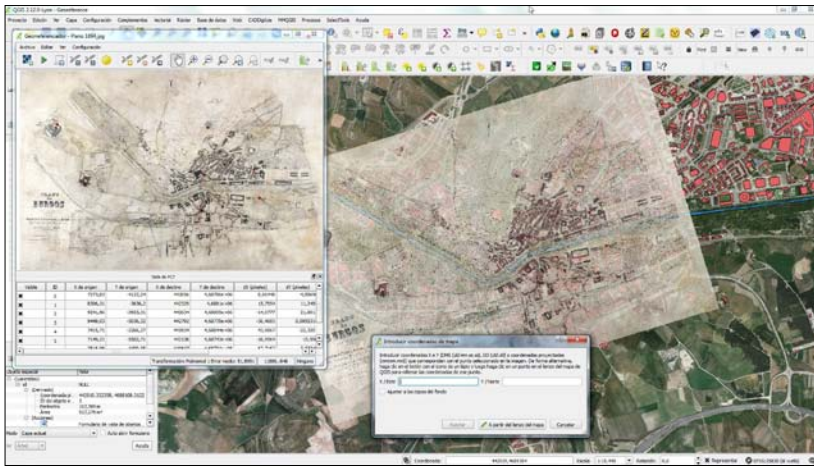
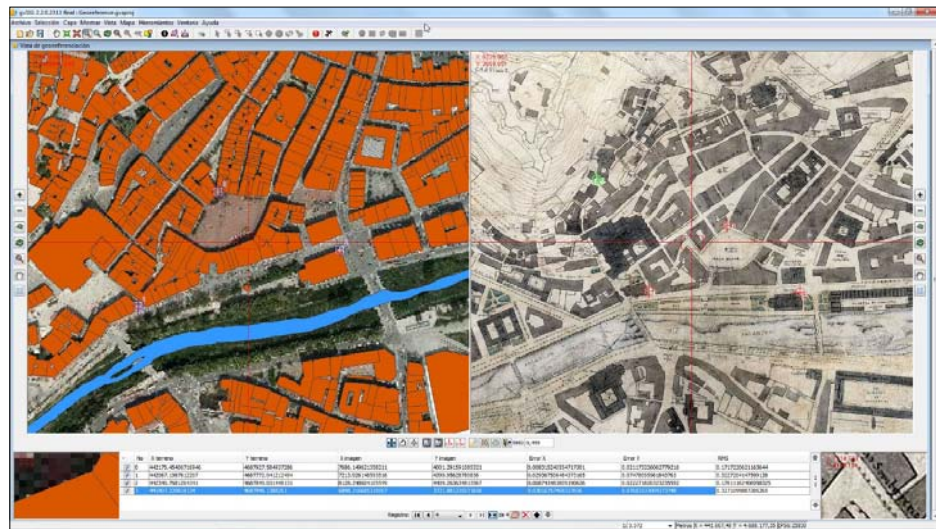


Figure 3: Georeferencing panel in QGIS 2.12 Lyon

Figure 4: Georeferentiation panel in gvSIG 2.2.



Hackeloeer *et al.*, 2014; Crespo Sanz, 2013; Dávila and Camacho, 2012; Roset and Ramos, 2011).

Taking all these elements into account, if we have a high-resolution digital file of an old map drawn with a geometric projection system, that refers to a territory that is relevant to our research, all we have to do is use one of the abovementioned open-source GIS to georeference it. In our case, we will use two of the most complete georeferencing desktop applications: QGIS and gvSIG.¹⁵ Both of them have intuitive interfaces that allow users to assign control points with relative ease. GvSIG allows for the visualization of two parallel windows: the one on the right showing the old map,

and the one on the left, the reference map. QGIS' georeferencing tool opens a floating window over the main window if one selects the option of having the program assign coordinates to the control points on the reference map –but the user can manually specify the coordinates of said points from data provided by QGIS or any other online platform.

The process of georeferencing an old urban map is similar in both GIS. First, it is necessary to choose and open the map that will serve as the reference base. Either a vector file or raster image with coordinates from the user's own database can be used, or one loaded through WMS (Web Map Service), WFS (Web Feature Service) or WCS (Web Coverage Service), any of which can be accessed in QGIS or gvSIG. Second, once the reference map is selected, open it before proceeding to open the georeferencer –whether in QGIS or gvSIG– and indicate which raster file is to be georeferenced. Then, the parameters are selected that will be used to implement the transformation of coordinates and resampling method, indicating the name and location of the output raster file, once it has been georeferenced.

15. Gary Sheman began developing Quantum GIS in 2002, and in 2007 the Open Source Geospatial Foundation (OSGeo), which released QGIS' first version in early 2009, took it up as an incubator project. It is now administered by the QGIS development team. See OSGeo's 2007 Annual Report in http://wiki.osgeo.org/wiki/Annual_Report_2007_Compiled#OSGeo_in_2007. GvSIG was originally developed for the government of the Spanish autonomous region of Valencia –hence its acronym, for SIG is Spanish for GIS and Gv stands for Generalitat Valenciana– by an association that has continued with this and other projects. It is also part of OSGeo. See its website at <http://www.gvsig.com/>



Once all the necessary parameters have been established, reference points are assigned. As we have indicated, the best are landmarks that have varied as little as possible (historic buildings, traditional public spaces, places that exist in the present in as similar a condition as they are represented in the old map), and assign the points with as much precision as possible (with the adequate scale level). The number of necessary control points depends on the antiquity of the map and its projection. Roset and Ramos argue that maps older than 1850 need more than 100 control points to be adequately georeferenced; 25 to 100 points are needed for maps drawn between 1850 and 1900; and for maps drawn between 1900 and 1980, 15 points can be enough. Maps drawn after 1980 can simply use the four corners of the map as coordinates (Roset and Ramos, 2011: 3).

Once the points are assigned, gvSIG offers the opportunity of testing the georeference and visualizing its deviation, controlling the correspondence's root-mean-square error (RMS) produced by the point assignment. If it is acceptable, the process can be run to display the correctly placed raster map. In QGIS, it is also possible to execute the georeferencing and keep the georeferencer open, checking these parameters. Once the process is carried out, save the control points with their corresponding coordinate pairs by exporting them into tabular form text files, for later use as new point assignments. Once georeferencing has finished, the old map can be visualized in its context and analysis

begun. This enables identification of diverse changes and continuities in given urban spaces, and through the vectorization of some of the old map's elements, measurements can also be taken, relevant historical landmarks identified—in conclusion, address whatever elements are relevant to the analysis.

Figure 5 shows the application of this technique in the conversion of a disappeared building into a vector, identifying its geometry, measuring its surface and perimeter (1,053 m²; 174 m), and integrating it into the present cartography. In allowing for the identification of old buildings, this is very useful in concrete urban planning projects; in interventions that require archaeological excavations; and in any urban intervention that would benefit from understanding the previous structures and uses in a given space. This technique also allows us to identify, locate, surface, and determine the presence of old water courses that are presently channelled; their relation with present or disappeared buildings; and the presence of water in diverse spaces. It also makes it possible to identify and visualize old land parcelations in the context of their creation, vectorising each plot, and thus facilitates interventions that might encounter conflicts in this regard. We can also appreciate the situation, dimensions and composition of specific urban structures such as bullrings, markets, public buildings, etc.; reflect on the role, location, and demolition process of the old city walls, or on the construction of new boulevards, river channels, streets, buildings, etc. Thus, the spatial



Figure 5: Conversion of a disappeared old building into a vector. Geometrical identification, measurement of surfaces, and integration into present cartography



value that specific institutions, buildings or activities have had in each moment in history can be determined.

An example is best provided graphically. Figure 6 shows, already vectorised and analysed, urban military barracks, as well as an old bullring, before its demolition, in the context of an urbanized plain area

occupied by rivers in their original state, before they were channelled. Figure 7 below represents the tracing in the old map of a historical city wall, and we have compared the new alignment produced by the modern buildings constructed over the path that surrounded the city walls after their demolition. In this same map, we can also identify the singularity of the main river's

Figure 6: Analysis of the location, dimensions, and surfaces of military quarters, bullrings, and pluvial channels in an old 1928 map

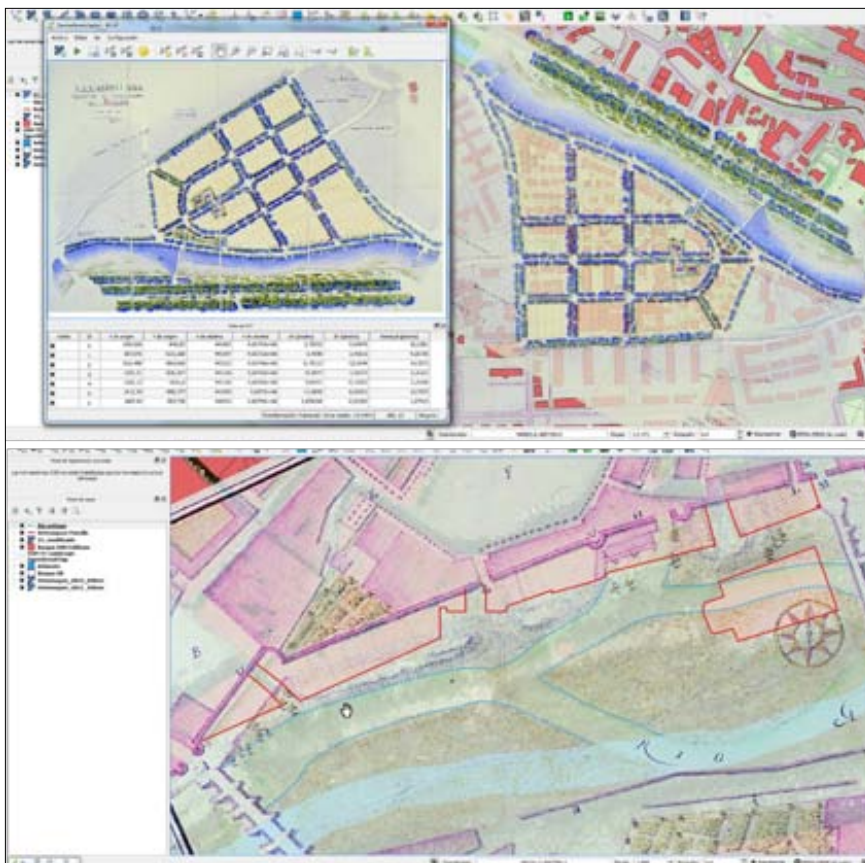
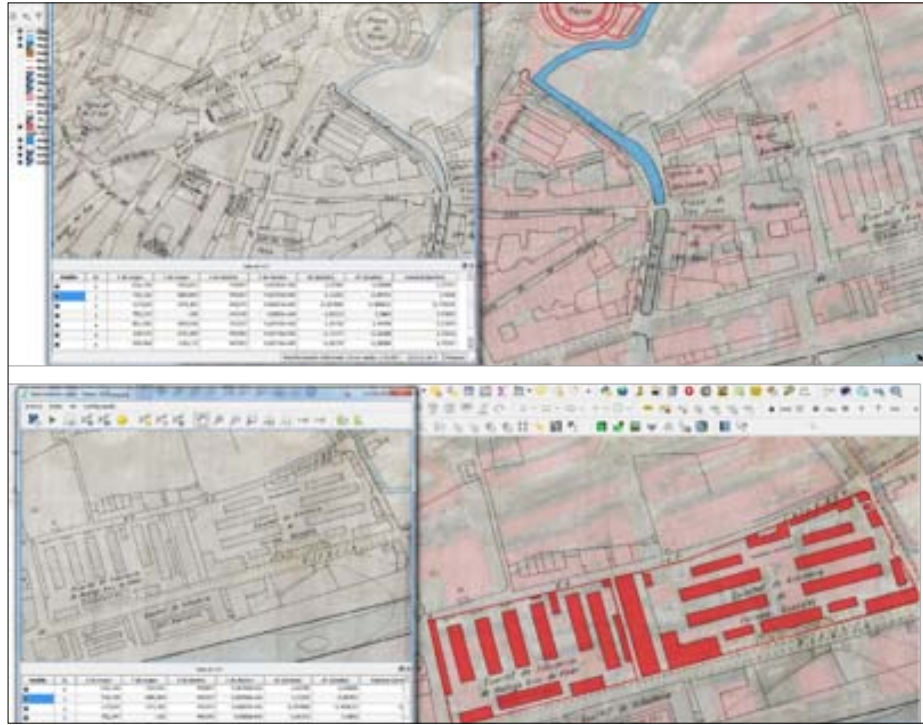


Figure 7: Analysis of the location, dimensions, and surfaces of an old land parcelling for homes in Garden City (1923). Vector and analysis of an old curtain wall (new buildings and changes in the river's course) on a 1737 urban map



variation through time and the historical presence of water under some of the present buildings. A 1923 parcelling of Garden City, with the distinctiveness of its trace and the precise measurements and location of each of the original plots, is also contextualized, making it possible to compare their evolution with the present cadastral record.

4. Conclusion: georeferencing and the valorisation of old cartographic heritage

We have addressed different examples that evidence the value of georeferenced old cartography as relevant analytical sources. The usefulness of open-source GIS in the generation of georeferenced maps is evident, and the cases shown illustrate some of the applications that can be used in urban studies. In this field, georeferencing is becoming a relevant tool to valorise the global and local old cartographic heritage. Such heritage is formed by the content of those maps that have been bequeathed to us, with their diverse geographic information and themes, which can no longer serve the purpose for which it was created, but which can contribute significant data. Indeed, they are relevant in historical analyses of any sort, as well as in the analyses of intervention procedures and policies for present territories, as the above examples of city maps show.

The revolution of online map libraries seen today is popularizing access to and use of this type of cartography, and is notably increasing its contextualization through georeferencing initiatives. It is still necessary to increase online capacity of sharing of old maps, as well as their georeferencing through collaborative participation. So far, it is already possible to work with the old maps currently available, using the open-source GIS that we have discussed. GvSIG and especially QGIS have the capacity to process and contextualize these maps, which allows us to have completely virtualized urban spaces that reflect what they were like in the past. The applications described can produce a double-sided result: on the one hand, they favour the preservation and conservation of this type of cartography, guaranteeing its permanence into the future and consolidating its identification as heritage and as a valuable legacy. On the other hand, they make it possible for researchers from various fields as well as policymakers to approach the study of any given city with more knowledge. This will prevent urban interventions that act upon a city as if it was a tabula rasa, in which past human presence left no imprint.

When georeferenced correctly, old cartography can serve to contextualize urban projects, and definitely, to plan and project cities that are in accordance with their identities and their pasts.

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Trends and challenges in urban planning and land management. The perspective of Spanish geographers (2005-2015)

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Abstract

Decades of burgeoning construction, with its concomitant speculation and corruption, have taken a heavy toll on Spain, to the point that its excesses have been felt throughout the country, although metropolitan and tourist areas have fared worst. The impact it has caused on the land and environment have been particularly devastating in the most sensitive zones and protected spaces, where reckless urban planning has been pursued more aggressively. It so happens that the challenges posed by such a situation have coincided with a serious financial crisis which calls the urban and territorial model into question and, therefore, amplifying the difficulties faced in various types of planning actions. The only possible response is to apply the principles of sustainability and governance to both the regeneration of consolidated urban fabric and the search for solutions to the imbalances that arose from the widespread practice of irresponsible urban and territorial planning.

Keywords: the spread urban model in Spain; sustainable urban planning; urban governance; territorial governance; spanish geographers.

1. Introduction

The Spanish contribution to the 31st International Geography Congress, held in Tunisia in 2008, included a look at urban planning in Spain when the country was still not aware of the full extent of the effects of almost a decade of property speculation linked to poorly thought out urban expansion (Valenzuela and Salom, 2008: 3-13). Since then, the scenario has made a complete turnaround and, this time, the

Spanish Committee of the IGU is asking us to focus on assessing a reality that is fundamentally problematic, and to find solutions to the challenges now facing our spatial planning model.

A veritable challenge is posed, then as now, by the mere attempt to condense into a few pages the scientific output (in this case, from Spanish geographers only) related to this topic, which synthesises one of the concerns shared by many other scientific and professional groups interested in compiling a bibliography as a basis for this discussion. In other words, it has not been possible to include an exhaustive list of references to fill these pages, for which we apologise to our colleagues whose contributions have been left out, since their inclusion would have meant an exponential increase in the compilation of the bibliography, which could not be done in the time available or the space allotted to this text.¹

The ten years included in this text could well be described as atypical, since its early years include the longest, most excessive *building bubble* of any in Spain since the 1980s, while the rest of the period was overshadowed by the devastation of the financial crisis and the social unrest triggered by high unemployment rates. The worst part is that there is still no strong sign of a definite end to the crisis. If any part of the country

1. The material used to draft this text has mostly come from contributions made by Spanish geographers to domestic and international geographical congresses held from 2005-2015, from conferences organized by the Urban Geography group at AGE (Association of Spanish Geographers) during the same period, and from other events organised by geographers and Spanish geographical journals, especially those most widely read by geographers



has felt the brunt of its effects, it is the cities, especially the large cities and metropolises. Therefore, it is not surprising that geographers have focused very close attention on an urban model, like the one in Spain, which displays an accumulation of poor living conditions due to urban practices that were more concerned with grand urban marketing projects, based on a production-based conception of urban spaces. We shall try to place the contributions from Spanish geographers for the period within this framework².

2. A decade of transition between the *building boom* and the financial crisis

2.1. The balance sheet from the *prodigious decade* for residential construction

The aftermath in Spanish cities of the so-called *prodigious decade* in the property market has interested certain geographers, as well as many other academics and professionals, much like how the topic of unbridled urban sprawl, which has had such dire effects on the land and environment, has also generated similar interest.

The property speculation unleashed during the boom years (1997-2007) has been included in the Spanish geographical bibliography in varying degrees: geographical areas and cities, particularly the large ones (in Madrid and outlying provinces), and the tourist zones in the Mediterranean. Eugenio Burriel (Burriel, 2008) provided the first overview for the whole of Spain and coined the expression *prodigious decade* to refer to the period. Focused on Catalonia, X. Delclós and A. Gutiérrez introduced the concept of *over-production of housing*, seen especially in zone two of the metropolitan area of Barcelona, particularly in tourist areas and second homes (Delclós and Gutiérrez, 2014; Gutiérrez and Delclós, 2015:283-306). Beyond other cases and situations that may have been affected by this, it is worth noting the dire effects that such unbridled growth in the property sector could have had on many other areas of life in Spain (economic, territorial, environmental, social and political). An overview can be found in the comprehensive work by J. Romero (2010:17-46), although it concentrates more on the territorial model resulting from the *building*

bubble, especially on a local scale, since he states that “there have been as many territorial dynamics as municipalities, and the public and private actors in each place have been the driving force in the process and its associated ills” (Romero, 2010:26)³.

There were highly complex and varied factors leading to the spectacular growth of housing in Spain during the period and to the huge increase in the land occupied by the residential sector: higher incomes, improved transport, a change in housing preferences, and low interest rates are just a few. It is obvious that a policy promoting property ownership, rather than renting, inflated the *bubble*, in addition to a flawed assessment of the land value in the final price of the dwelling that helped to overheat the property market in Spain. The last reason is the basis for the rationale of municipal urban policy during the period, which only the crisis in the sector, and not the urban planning policies of the different autonomous regions, was able to detect and reverse (Burriel, 2009).

2.2. An urban model that promotes speculation and starts urban sprawl

It was not by chance that widespread growth in housing started in 1997, when Law 7/1997, 14 April, was passed. It lifted limits on land and professional associations, and declared all Spanish territory fit for development with very few restrictions. Thanks to this, one third of urban areas in all of Spanish history were built in two decades (Romero, 2010: 26). This long period of uncontrolled development, which was curtailed after 2007 by the current Building Code, has been the subject of a great deal of writing by geographers on a national (Romero, 2009; González Pérez, 2007; Rullán, 2012), regional, and local level. Looked on with complacency, or at least tolerance, from regional councils, the strongholds of authority over urban planning within the current model in Spain, large numbers of municipalities were bent on rezoning land for property development. This sometimes doubled or tripled the previous housing stock, without forgetting other formulas where buildings were constructed on rural land due to lax regulations or without any legal basis whatsoever. These processes were particularly prevalent in the tourist areas on the Spanish coast (Albert and Rullán, 2007; Del Romero, 2007; Martín García, 2010) but also in metropolitan

2. For this reason, the text does not cite references from authors who are not geographers, whatever their interest and originality, except in exceptional cases

3. Romero corroborates this in the text by citing several building projects in the bubble era that took their names from other urban or tourist municipalities, such as Marbella (Malaga), Torrevieja (Alicante) and Seseña (Madrid)



areas (Vinuesa and Martín, 2013). Transport infrastructure and proliferation of car ownership in modern society are factors aiding the spread and fragmentation of outlying suburbs (Gutiérrez Puebla and García Palomares, 2005:333-336)

2.3. The excesses of the urban sprawl model

The eloquent expression *urbanizing tsunami* coined by F. Gaja (2008) refers to the growth of mass development and construction in Spain during the decade straddling the 20th and 21st centuries. This subject has been approached from a variety of viewpoints: its features and peculiarities compared to other models, its origin, its socio-economic and environmental effects, its impact on heritage, as well as possible initiatives and policies to tackle the problem and reduce its effects on society, the economy, and the landscape. This is the view that the Association of Spanish Geographers put forth in a presentation at the 12th Congress of Spanish Geographers (Alicante 2011) and the 12th Symposium of the Work Group on Urban Geography (Madrid, 2014), the latter under the meaningful title of “Unfinished territories, broken societies”. However, urban sprawl was widely discussed in the other symposiums of the Urban Geography Group during the decade (2006, 2008, 2010 and 2012).

Faced with the impossibility of correctly summarising the extensive list of contributions from the Alicante Congress, we direct readers to the highly reliable paper/report made by our colleague Onofre Rullán (Rullán, 2012: 165-209). Some of the highlights include contributions on widespread development on the coastline of the Costa del Sol (Almeida and Cortés: 15-28), and Cantabria (Delgado Viñas, 2011: 203-2015), also on the coast and interior of the province of Alicante (Martí and Nolasco, 2011; Amat Montesinos, 2011:29-40). The common denominator here is the lack of alignment and coordination between the spatial planning instruments in the respective regions, making it hard to manage, let alone control, the rapid rate of housing development both on the coast and in protected natural areas. Good examples of this last aspect can be found in the autonomous region of Cantabria (Delgado Viñas, 2011:209-2012). Communications on the uncontrolled growth of artificial surfaces in metropolitan areas were equally strongly present at the AGE congress. These included papers on: the areas of peripheral growth in Valencia with increases in the amount of built-up surfaces at the expense of agricultural land earmarked for urban, industrial, tertiary and public services (Boira, 2011: 79-90), or residential suburbanisation

undergone by the metropolitan zone of Seville (Foronda, 2011:253-265) and Valladolid (Molinero and Baraja, 2011:457-459), which end up evolving towards counter-urbanisation initiatives in urban-rural transition areas, such as those analysed in the province of Malaga (Galacho, 2011: 305-307) and Aragon (Lardiés *et al.*, 2011:355-366). The expansion of suburbs has even reached medium-sized cities in very rural regions like Castilla La Mancha (Cebrián, 2007: 221-2040).

Such a wide range of situations becomes even clearer when we drill down to the functions that drive the urban sprawl model. These can be seen in examples taken from experiences that have been analysed by geographers.

2.3.1. Residential expansion in metropolitan and tourist areas

The residential function is where the legacy left by urban sprawl on the reality of Spanish urban development in the last decade is most visible. Sometimes it concerns large residential developments of collective housing on the outskirts of large cities. A favourite case with several geographers is the PAU (Urban Action Plan) model widely found in Madrid (Brandis, 2006, 2010). Compared to this compact residential model built in orthogonal blocks, the genuine sprawl comes from single-family housing projects, of wildly varying density, that have been the subject of several articles over this decade (Artigues and Rullán, 2007; Molini and Salgado, 2010). There are many studies on the metropolitan area of Madrid, with the common denominator being the consolidation of suburbanisation processes before, during, and after the *building bubble*, although this does not exclude its coexistence with the compact habitat (Azcarate *et al.*, 2010: 115-126). Even when considering that the larger sprawling outskirts are linked to improved transport infrastructure and widespread car ownership, making the situation clearly similar to American suburbs, differences can be found in the process of decentralisation of companies and facilities, as well as new centres developing in the peripheries (Gutiérrez Puebla and García Palomares, 2005:333-335; Méndez and Rodríguez, 2007). It is striking that low-density residential developments are increasingly overtaking compact ones and covering more territory, and that this is happening even when the population in the entire metropolitan area is in decline (García Palomares and Gutiérrez Puebla, 2007: 65). The fact remains that, when analysing the fabric of suburban single-family homes in Madrid with detailed cadastral information, profound differences can be seen



in its evolution, morphology and functionality (Santos Preciado and García Lázaro, 2012:178). Similar intense growth in suburban housing is also found in medium-sized cities, such as Valladolid, with heavy overspill beyond the municipal boundaries that stretches into the surrounding towns (Cordero, 2007: 101-118).

Peripheral sprawl comparable to suburbanisation, morphologically at least, has occurred in coastal tourist areas, most obviously in the Mediterranean. In the province of Alicante, the systematic use of all available land to build tourist accommodations has been the norm, to the point that coastal municipal districts have been saturated. This has encouraged new tourist-residential developments to move inland and has affected pre-coastal towns that are farther and farther away from the sea front (Ponce and Ramos, 2007: 399-403). An expansionary mechanism in the tourism-residential model towards inland areas has arisen in the province of Malaga and other regions with a large tourist industry, such as the Balearic Islands, Canary Islands and Catalonia, driven by an alliance between property developers and the local administrations who use the often misleading argument that this will greatly benefit the local economies (Navarro Jurado, 2007:375-379). The model of low density developments, intrinsically linked to tourism accommodation on the coast and inland, is creating residential sprawl and totally lacking any facilities except those for sport and leisure, with golf courses being particularly prevalent. The model in question has strong similarities with the gated communities widely found in high-class, outlying residential zones. These resort-type developments found a very fertile breeding ground during the building bubble, enabling their construction in coastal provinces where tourism would later arrive. Examples include Castellon, Almeria and Murcia, with the latter being a paradigm for the rise and fall of this type of tourism-residential settlement (Valenzuela, 2007: 277-282)⁴.

2.3.2. Out-of-town shopping centres

Similar to the relationship described above is the one between suburban residential developments and shopping centres. It is a challenge for researchers to

4. The golf resorts, popular for many years in the English-speaking world and found on the Costa del Sol since the 1960s, became the must-have tourist accommodation during the decade of 1997-2007. The bursting of the bubble caused a crash among real estate developers, whose core business consisted more of speculation rather than commercial enterprise; *Polaris World*, a dozen resorts in the province of Murcia, clearly illustrates the case, and the *ruins* of some of their complexes stand as proof

find the causal relationship between the two, but it is obvious that the residential and commercial functions have complemented each other ever since towns came into being. This is especially true when the latest shopping malls have included other types of consumerism (leisure, catering) and other functions, with a large part of daily social contact taking place there. Therefore, when wondering whether shopping centres appeared together with housing from the start or if this happened later, it seems logical to assume that they unavoidably complement each other, bearing in mind that suburban residential areas bring with them an intrinsic lack of public services. Cases studied in Madrid seem to prove this (Diaz Pacheco and Hewitt, 2010:240-244). While we should not forget the relationship between new commercial structures and well-established areas of the city, such as historic centres and suburban developments; as pointed out by Vahí and Feria, it is obvious that in the outlying, unconsolidated metropolitan areas, these *new commercial formats* have more influence on construction, transformation, and urban development. Therefore, according to those authors and referring to the metropolitan areas in Andalusia, these zones contain the highest number of new commercial structures, and they were also the most innovative and sophisticated (Vahí and Feria, 2007:44-50). If we extend the viewpoint further to include all shopping centres, it is evident that their influence on cities stretches far beyond their relationship with their surroundings, since they affect the urban commercial fabric as a whole, as well as certain structural aspects of the city (transport infrastructure) and even the decision-making mechanisms used by public authorities and social actors (Miramontes, 2012:204-205).

2.3.3. Logistics and transport as an instrument for urban sprawl

The intimate relationship between urban sprawl in the country and transport infrastructure, regardless of the urban functions that are affected (residential, industrial, commercial, and logistical), has already been mentioned in this text. Two points of view can be gleaned from the available literature: one deals with infrastructure (motorways, railways, airports), and the other tackles economic activity making it possible to move goods and products to the benefit of everyone, i.e. logistics. A subject that deserves special attention from geographers during the period discussed in this paper is our most advanced type of railway infrastructure- the high speed rail (HSR, which is referred to as AVE or AVF in Spain) Particularly important are the writings of the group of



geographers from the University of Lleida, especially Carmen Bellet and her co-workers. An overview of the integration of high speed rail in cities during the 21st century focuses on how it complements other infrastructure mega-projects (ports, airports, motorways, etc.). This is very different from the physical integration of stations into the urban fabric, where two situations may arise: the railway model adapts its logistics to the pre-existing urban model, or, on the contrary, the railway model imposes its own logic, which means there is a dichotomy between stations already integrated into the city (as in Seville, Cordoba and Madrid), and those in suburban areas or outside of the city, with Guadalajara being a prime example (Bellet y Gutiérrez, 2011:257, 271). At the same time, this does not prevent the high speed rail from stimulating *intermittent metropolisation of the land* if it is accepted that new processes of urban sprawl tend to prize connectivity over proximity. In such a case, high speed lines would help spread metropolitan expansion selectively, as shown when comparing Segovia to Madrid, and Lleida to Barcelona (Bellet: 2010). 377,381). The role of airports in urban sprawl processes during the last decade is more controversial. It is evident that those located in busy urban and tourist areas tend to reinforce urban sprawl through the combined effect of the rail facilities and activities linked to these. The urban-territorial role of small regional airports, usually located inland away from tourist zones and metropolitan areas, is very different. In the latter, despite the vast investment made by public administrations supported by EU funds, traffic data cast doubts on their future viability. Paradoxically, in the article by A. Gámir and D. Ramos (2011: 94-95), the future of this group of airports is closely tied to “the articulation of an intermodal system that physically integrates airports and high speed rail stations, which would demand close collaboration between air and rail companies”.

Good accessibility to advanced transport infrastructures is a determining factor in logistics, as important as, or even more important than proximity to large consumer hubs, which by definition are heavily developed urban areas. Both circumstances can be found in the metropolitan area of Madrid, which makes it the pinnacle of logistics in Spain. It is not by chance that in the heat of the economic prosperity coinciding with the building bubble, there was huge growth in the provision of specialised spaces for logistics, which strengthened suburbanisation and economic decentralisation in Madrid and the rest of the conurbations in Spain. The demand for land for these activities reinforces the suburban and periurban nature of logistics platforms and the incorporation of formerly agricultural land into the development, with

the sole condition of there being a good connection to communications channels. This is borne out in Madrid, where the *logistical arc* is organised around the angle formed by the A2 (Zaragoza) and A4 (Andalusia) motorways (Del Río y Rodríguez, 2012:289). However, there are an increasing number of logistics operations that spill out of the metropolitan area and function on supraregional, national and international scales, as large companies like Inditex or Amazon are already doing. A response to this seems to be logistics activities like PLAZA in Zaragoza and ZAL (Logistical Activities Zone) in Oviedo in Asturias (Fernández Noguerol, 2013: 59-73) and the Integrated Centre for Goods in Valladolid (CENTROLID) (Calderón, 2013: 116-120).

2.3.4. Major services related to suburban or periurban locations

The infrastructures and public or private services that accompany the inhabitants in the suburban areas contribute to the spread of large urban-regional structures by promoting the development of the city and mobility within these large conurbations. Apart from the shopping centres and logistics platforms, discussed elsewhere in this text, hospital, university, research, sports and leisure infrastructure deserve mention. Most of these exist due to the urban dynamics of the last few decades, but also due to voluntary rezoning policies for the outskirts that had sprung up beforehand and had brought with them a serious lack of public services and quality of life. Taken as whole, they reflect the transfer of centrality to the metropolitan outskirts, freeing them from the endemic dependency on central urban areas and providing a better balance of urban structures (Vahí, Rodríguez and Hurtado, 2015:10-23). An example of the transformations and improvements that occurred in certain suburban cities in the southwestern metropolitan area of Madrid are the cases of Getafe and Leganés. The decision to locate the Carlos III University there highlights the restructuring and regeneration potential these kinds of infrastructures can have, in contrast to the type of expansion that took place during the *housing bubble* period (Morales y Constenla, 2012:217)

2.3.5. Territorial and environmental impact of urban sprawl

A recurring viewpoint in the writings of Spanish geographers during the decade and one which complements the previous approaches is the negative impact that urban sprawl has had on several aspects of



the land (natural, environmental, rural and landscape), but also on the image of the city.

The invasion of development (fragmented or concentrated) in rural areas, which has normally been driven by some type of tourism, has severely distorted the agricultural economy both in deeply rural areas and those in transition from rural to urban. Although this process has been going on for decades, the novelty in the latest chapter stems from the wide availability of rural land for building in the heat of permissiveness and deregulatory urban legislation at the end of the 1990s, as well as from contagion by *construction fever* that spread through municipalities as a formula to absorb the endemic budget deficit of town councils. The spread of residential zones thus became the main threat to modernisation and even to maintaining agriculture, especially in places next to large cities and tourist areas, such as in Axarquía on the Costa del Sol (Ocaña and Gómex, 2008: 70-71; Galacho, 2011: 303-305). Even more serious is the threat that urban sprawl poses to conservation and the integrity of natural spaces, especially those that are protected. Carmen Delgado has demonstrated this in several articles, where she has exposed the aggression by these *savage developments* on protected areas despite comprehensive plans and regulations created by the competent administrations over many years (Delgado Viñas, 2012: 179-187). However, these regulations, have not managed to dissuade building on the outskirts where, according to the author, there has been a true *assault* (Delgado Viñas, 2008). Residential and leisure developments have been approved in their interiors, with appalling examples in Cantabria and elsewhere, but fortunately, they have been mostly reversed by judicial decisions (Delgado Viñas, 2011: 208-211). Something similar occurred on the Galician coast where coastal protection agencies have been relegated to the background, pushed out by the profits from property developments. These are not large construction projects like those in the Mediterranean, “but a provision of second homes, hotels and rural accommodation, scattered and occupying a small surface area, having an irreversible effect on a valuable natural space and detrimental to the landscape” (Lois and Piñera, 2012: 245).

Another telling example of developments in sensitive areas has resulted in *regional projects* set up by the Castilla y León Council as an instrument for direct intervention in the area with an emphasis on construction. These are projects scattered throughout the region for tourism, environmental or technological purposes, with the most controversial being the

Environment City in Soria (2003), which was presented as essential to the development of the province.

Although the project had been questioned even before it began for environmental reasons, its Achilles heel was its *exceptional* nature which eventually led to it being declared illegal. However, this declaration did not prevent highly sensitive areas from being disturbed (Manero and Bachiller, 2014: 9/13).

The greatest exponent of the impact of urban sprawl is “the archipelago of scattered and isolated developments, uniform in their urban design and use, which have arisen in new speculation scenarios” as brilliantly described by I. Concheiro (2014:6/11). This is simply the result of how important the construction and tourism sectors became in a context of liberal management of the housing market. So far there has been no real reconsideration of the building model that has led to this situation (Concheiro, 2014:9/11), a model which, incidentally, caused a financial and property crash, as shown by the collapse of many companies that sprang up during the bubble.

A significant by-product of the situation described above is the construction sector had to change its business model towards refurbishing, rather than new construction. In any case, the huge stock of housing inherited from the bubble stage is slow to be absorbed by either the market or effective social housing measures (Valenzuela, 2013: 313-316)⁵. But, important questions remain. What can be done with the large amounts of rezoned or developable land that has not been built up? And, what can be done with the large number of unfinished infrastructure projects? There is a significant amount of unused building potential left over from the *bubble*, mostly planned for housing that is still having an impact on the region⁶. The media has widely discussed the fact that scattered throughout Spain there is the huge expanse of vacant developed spaces thanks to the irresponsible urban expansionist policies applied by innumerable municipalities and aided, or at the very least permitted, by regional urban planning managers during the *bubble*. The shameful spectacle of these *urbanised deserts* can be found in virtually all autonomous regions, although the most striking cases are in the coastal tourist spots and metropolitan areas. The province of Alicante is a good example of a tourist

5. The weighting calculations of unsold new-build stock in 2011 vary from 680,000 by the Ministry of Public Works to an estimated 2.3 million from experts

6. Burriel (2013:121) assessed the stock of residential land in Spain which could vary between 250,000 and 290,000 ha.



zone where authorities have documented and charted “4,708 ha of unfinished residential sites, on which 100,000 houses could have been built” (Amat, 2015:18). The *Henares corridor*⁷ in Madrid and Dos Hermanas in Seville are other outstanding cases. However, the outskirts of medium cities and even small provincial capitals in the two Castiles, Extremadura and Andalusia are equally guilty of what could be called urban excess considering their size (Burriel, 2014: 122-129). A notable example of zoned and developed land is provided by Avila (population 50,008 in 2011), where between 1998 and 2004, 22 of 40 sub-plans in the general plan were developed, creating developable land for 11,253 dwellings (Calderón, 2013:87-91)⁸

3. Trends and challenges in urban planning in the current context of crisis in the financial and urban model

The Spanish urban reality in the period discussed in this article has not been able to recover from the threefold crisis - economic, property and financial - that broke out around 2007. The downturn put a stop to the period of massive housing expansion, where the *brick economy* reigned supreme, urban planning was at the mercy of property interests, and local finances depended on construction density and rezoning. The impact of this on the environment and landscape is clearly visible all over the Spanish urban landscape in fenced off, unfinished or abandoned districts. In this context, it is worth looking at some of the trends and challenges facing geographers who study the city and urbanization in Spain, but they will also need to provide ideas in the search for solutions to such a complex situation.

3.1. A metropolitan model tending to poly-centrism

At the top of the urban system in Spain, the metropolitan areas are showing clear signs that they are moving towards a greater poly-centrism, even in those cases that, until very recently, have been fiercely mono-centrist, such as Madrid. Contributions to this trend can

be found in three very different regions: Galicia, Madrid and the Community of Valencia. In practice, Galicia functions as an urban region organised around several centres (La Coruna, Vigo, Pontevedra and Santiago), most of them on the coast and all fighting to become the leader, since there are no cooperation policies in place to counteract competition among them. Therefore, the challenge for cities in Galicia is to explore opportunities and rely on their strengths to achieve cohesion, by encouraging cooperation and networking (Alcalde and Expósito, 2012:272-273).

Valencia is a very different case since it went from nuclear city to metropolitan area thanks to a suburbanisation process which overspilled the central limits of the city a long time ago. At the same time, it functionally engulfed several municipalities in the immediate vicinity. The appearance of subcentres outside the functional metropolitan area with relative job self-sufficiency means that the urban-regional area is less dependent on the central city, and that it is moving from a polarised and dependent system of suburbanisation to a *metropolitan city* or *city of cities* (Ponce, 2013: 165-166). Madrid is more complicated because of its metropolitan status and the area it occupies. A wider variety of indicators must be taken into account (jobs, demographic, residential), and suitable techniques must be found to identify the sub-areas and hubs of growth. Criteria must also be established to set up the boundaries needed to govern the whole. An additional element to consider is the fact that the metropolitan region thus defined encroaches on five provinces belonging to the autonomous regions adjacent to Madrid (Ávila, Segovia, Cuenca, Guadalajara and Toledo) (Solís, 2008: 133,138,159). From subsequent analyses, it can be concluded that the urban area of Madrid is changing towards a poly-centric model, characterised by several centres of varying size and importance and belonging to the six central provinces of Spain operating in a network (Solís, Ureña, Ruiz Apeláñez, 2012:14/23). Regardless of the organizational boundaries put in place, it is highly improbable that a formula can be found to delimit authority over planning, but this is even more difficult when it comes to managing daily problems in such a widespread and complex region tending to poly-centrism.

3.2. Challenges in the new urban planning

After the financial crisis there has evidently been a need to change the parameters supporting the growth of urban sprawl. Beginning halfway through the first decade of

7. The *ghost town* of Valdeluz in the surroundings of Guadalajara and built in the fervour of the first HSR station to Barcelona is a paradigm for these *urbanised deserts*

8. The 2007 crisis left 2.3 million m² of developable land with space for 11,500 dwellings, of which only 1,080 were, finished (Calderón, 2013:90)



the 21st century Spanish geographers begin moving from mere criticism of the expansionary model to offering possible inspiring ideas on the massive changes needed to deal with intervention in cities and regions.

3.2.1. Inter-institutional cooperation and coordination

Since the local and/or regional interests have completely taken over urban and regional planning in Spain, coordination and cooperation among institutions is consequently very weak, on one hand due to institutions being divided into four levels and, on the other, from the “absence of a culture of cooperation, seen especially in public policies relating to territorial cohesion” (Romero, 2005:64). Additionally, the distribution of responsibilities when drafting the planning instruments has left their approval and application in the hands of autonomous regions and city councils, respectively, and little attention is paid to the reality outside their limits.

However, the complex regional and urban reality imposes its own comprehensive view of the processes on the existing instruments and policies, but this rarely fits well to the political and administrative limits. Without this overall perspective, integrated management will be impracticable in spaces that have specific problems, such as the coasts and mountains, but also in metropolitan and even local, sub-regional and inter-regional areas. Furthermore, in order to discuss, establish and implement policies to deal with the problems strongly affecting the city and region (environment, economic development, etc.) a clear understanding is needed of which levels of the administration are able to resolve them. Many community development initiatives that promote vertical and horizontal cooperation on a local scale have obtained results below expectations due to poor coordination (Romero, 2005:71-81)

Of the regions with a strong urban footprint, it is vital for metropolitan areas to have a government based on the principles of inter-institutional coordination and cooperation between public and private bodies. Spain's experience shows that these principles clash with the lack of an adequate legal framework, or if some framework exists, it impedes the application of the above mentioned principles (as in the *comarcas* of Catalonia and Aragon). Furthermore, planning instruments are extremely inflexible due to the primacy of the municipality as a privileged area, unless a local metropolitan entity is created which is responsible for spatial planning, planning growth and managing

services. The reticence of municipal autonomy zealots when implementing these supra-municipal entities is well-known, even more so when, in the inner metropolitan area, a large city dominates the whole economically and demographically, as is the case with Zaragoza (Bielza de Ory and Gorriá, 2010: 21/22). It must be admitted, however, that a lack of stable mechanisms and organisations for cooperation and coordination among municipalities is the common denominator, even when they form part of the same metropolitan structure. The situation becomes more complex when a metropolitan area is shared by municipalities belonging to several autonomous regions, as in the case of Madrid (Fernández Muñoz, 2008: 106). It seems that this fact and other difficulties inherent in approving a metropolitan plan were not an obstacle when creating the Metropolitan Territorial Plan of Barcelona in 2010, although the process required more than five years before a political and administrative agreement and the process of participation and consultation was achieved “that would enable the highest level possible of social approval to be reached” (Nel-lo, 2011:4/15). Perhaps this experience cannot be easily exported, and therefore the more realistic action is to opt for gentler ways of cooperation, such as associations or consortia, which in the end avoid establishing a true regional government. Therefore, the answer must come from outside the regional planning instruments, which would mean taking another look at the innovative application of strategic plans or imaginative forms of contract and consensus. In any case, it would be imperative to review the current regulatory framework, including decision making authority and financing (Romero, 2005:74-75).

3.2.2. Public participation

Even when it is highly efficient, collaboration between public and private entities is not sufficient as a planning tool if the general public is not allowed to participate. In fact, some authorities do not believe that this is positive for the city's development in that “it hinders the effectiveness achieved by collaboration between the public sector and the financial agents of the city” (Casellas, 2007:11/20). Despite such institutional and psychological difficulties, there are excellent examples of how contributions from the city's human capital are able to complement the public sector's activities⁹. With its successes

9. This occurred in Barcelona in 2005 when public participation managed to preserve the Can Ricart factory within the 22@Barcelona project of Poblenou (Casellas, 2007:12-13/20)



and failures, there is really no alternative to public participation as a way for society to become involved in making decisions on policies, plans and actions that concern it, which in our case is spatial and urban planning. However, this pretension in practice has been far from encouraging. The fact is that there is no lack of legal instruments to support this, including the latest government Building Code (Law 8/2007, 28 May) and various regional regulations that attempt to guarantee both the right to participation as well as to information and transparency in urban planning procedures (Fernández Muñoz, 2008: 98-106). If the experience of public participation did not see its finest hour during the building boom years, cessation of construction during the crisis has not afforded many opportunities for it to start again.

In spite of the slightly pessimistic view that could be inferred from the above, the subject of participation has become essential in today's world and is of great value in improving the city and for planning in particular, to the extent that dialogue should be made the customary way to manage the city, and it should lead to fostering civic awareness. At least, this is the opinion of Horacio Capel (2010: 2-3/4), who inspired the idea behind the 11th International Geocritical Symposium on "Planning and urban development based on dialogue and participation"¹⁰.

3.2.3. Urban regeneration, a commitment to consolidated cities in the face of sprawl

The bursting of the building bubble and the shock of the financial crisis affected all sectors of the property market during 1997-2007, characterised by a rapidly rising number of properties for sale and precarious living conditions for several social groups (Valenzuela. 2013:295-297). At the same time, it forced a rethinking of the strongly expansionary urban planning promoted by local administrations, property developers and banks, and another look at the value of compact cities, limiting growth to land for development and cutting off speculation at the roots. Thus, tertiarization has recently been reactivated in central areas, aided by office spaces that were able to resist the decentralising trends, but especially by the new three-pronged tertiary sector consisting of commerce, culture, and catering. These typical mass consumer items have brought fresh opportunities

and have breathed new life into urban centres by making use of *containers* that are unused or lacking in alternatives that justify their maintenance, such as old industrial, railway, or commercial structures, as well as centrally located buildings that were formerly used in the service sector or housed institutions (Sanabria, de la Torre and Gumiel, 2007:560-562). This opens the way for *urban recycling*, ideal for refurbishing run-down areas that are no longer habitable. Doubtless, some of these will prompt urban regeneration, which since the 1980s has been driven in other countries and in Spain by the construction of outstanding, large architectural complexes, usually for cultural use. The risk is that they will become *super projects* which, without correct governance, can trigger dense construction and gentrification (Vila Vázquez, 2012: 252-254). This would include older, mature tourist destinations, whose survival depends on redevelopment projects, such as the one proposed with dubious success in the playa de Palma de Mallorca in the Balearic Islands (González, 2012: 142-146).

The European Union URBANA initiative (2007-2013), as well as comprehensive local and urban development projects receiving structural funds from the EU, have helped with urban regeneration in Spain in the last few years. Another interesting perspective on typological and functional renovation processes in the consolidated urban areas is provided by urban stakeholders and the positions they have taken regarding the redevelopment of certain run-down residential zones or unique elements of the city. A good example of urban regeneration of residential areas is the integral plan for districts in Catalonia, promoted by the *Llei de Barris* of 2004 (Roquer *et al.*, 2013: 303-304). As for singular projects and those concerning heritage sites in historical areas, stakeholders' opinions are usually fairly contradictory, making them irrelevant in practice, as was the case in Toledo and Cuenca (Aparicio, 2013:17-18). On the opposite end of the spectrum are cases where stakeholders exercised a strong influence throughout controversial processes and negotiations on operations in the historic centre of Cáceres and Badajoz to reoccupy them and redefine their functions (Barrado, García Baltodano and Porras, 2013:78-85)¹¹.

10. Published in full in Scripta Nova. Revista Electrónica de Geografía y Ciencias Sociales, vol. IV, nº 331 (1), 1st August 2010. Available at: <http://www.ub.es/geocrit/sn/sn-331/sn-331-1.htm>

11. Under the title "Policies and actions for urban regeneration and reactivation. A critical analysis of recent experiences in Spain" *Polígonos. Revista de Geografía* published a monographic edition (nº 23) with a collection of articles from the 6th Urban research Symposium (July 2013) linked to the Spanish cities in the autonomous era research project. *Processes, problems and policies (1978-2012)" (URBSPAIN)*



3.2.4. The challenge of urban sustainability

From the viewpoint of Spanish geographers, sustainability, particularly in its ecological and environmental dimension, is one of the main ideas marking the new analytical and proactive approaches to urban planning. A decidedly ambitious approach to the ecological functions of open urban spaces was undertaken by geographers from Seville, José M^a Feria and Jesús Santiago (2009), based on the premise that “natural processes take place in open spaces that are significant for the environmental quality of cities to which they serve as a support, while at the same time they are a fundamental structural element in the integration of the urban fabric with the natural and rural surroundings” (Feria and Santiago, 2010:1/29). An important part of this text is given to a review of the bibliography of ecology in urban and metropolitan spaces and of its components, as well as various planning experiences drafted in several urban planning documents on Andalusian cities and metropolitan areas. They reach the conclusion, currently shared by geographers and other physical urban environment scientists, that “physical planning as an instrument for intervening in the region is the best tool available to create the new understanding of the function of ecological processes in the urban environment, basically by creating plans for open spaces”. In short, the natural processes in a city must be reconsidered (Feria and Santiago, 2010:24-25/29), including the prevention of risks (particularly fires) which can affect areas where forests come into contact with built-up zones (urban and forest interfaces) (Galiana, 2012:2006-2007)¹².

Following the course marked out by the eminent ecologist González Bernáldez, the ecological dimension of the territory translated into landscape units has been successful and must always be taken into account in spatial planning. In fact, there are many examples of this in the general urban plans of several cities and metropolitan areas in Andalusia that were drawn up during the transition from the 20th to 21st century, from which it would be reasonable to conclude that the landscape is now a fully consolidated component of territorial policies (Delgado Bujalance, 2009:112-122). Perhaps this statement may seem overly optimistic, but examples

can be cited, although there are no regulations clearly committed to dealing with the ecology of green spaces in the city beyond their status as an amenity. A more telling case is this change in approach to green urban areas from the point of view of urban planning found in the Green Ring of Vitoria, the European Green Capital in 2012. The main objective of the operation was to preserve the periurban natural areas and integrate them into the urban structure, with the aim of recovering biodiversity, without forgetting other social functions of green spaces: relaxation, recreation, environmental awareness, and education of the public (Aguado, Barrutia y Echebarria, 2013:402-403).

In any case, integrating the bioclimatic component into urban planning and generally incorporating sustainable environmental solutions into planning instruments and urban design are still far from being achieved beyond the establishment of sectorial regulations and special plans, environmental assessments or Agenda 21 plans (Caballero, 2007:488-491). However, even if Spain cannot be said to have achieved full implementation of a sustainable development framework, it must be admitted that advances have been made in the past two decades towards slow but sure creation of an urban scenario tending toward sustainability, although, in truth, this has been more well-intentioned than effective, as shown in the White Book on Sustainability in Urban Planning in Spain (2010). Apart from having adapted Community directives on urban environment to Spanish legislation, some steps have been taken to set up criteria and objectives to make building more sustainable cities in Spain viable in practice. Important among these is the implementation of a network of networks for sustainable development in 2005, joined by a good number of regional and provincial councils and over 2,000 municipalities, in addition to other types of networks (climate, biodiversity, etc.). On an intraurban scale, a highly valid contribution to sustainability over the last two decades has been the experience of the *ecodistricts*, now quite common in medium (Sarriguren in Pamplona) and large cities (Valdespartera in Zaragoza). This is the case even in Barcelona and Madrid, although the results are definitely mixed (Valenzuela, 2009: 430-432). Here it is worth mentioning the experience of using good practice as a vehicle to move toward sustainability in cities, promoted by the United Nations Habitat Programme for Human Settlements from its 2nd Assembly in Istanbul in 2006. From the Spanish experiences gathered from the first eight competitions organised up to 2012, it can be seen that from the 100 selected as good and best practices relating

12. An interesting initiative for integrating the landscape into the territorial actions of public administrations is the Landscape and Territory Study Centre, created in 2005 by agreement of the Public Works and Transport Council of the Regional Council of Andalusia with public universities in Andalusia



specifically to cities, more than half (54.6%) deal with the environment (Valenzuela, 2012:121-124)¹³.

4. Trends and challenges of land management in a context of financial crisis

4.1. The new territorial culture, the driving force behind land management

The only possible way to recover from the disastrous results of three decades of scattered developments and the disorderly and predatory occupation of land of all types (urban, coastal, inland, rural, etc.) is by beginning to accept the *new territorial culture*¹⁴ (Mata, 2007). Its roots lie in the European Territorial Strategy of 1999 and the Lisbon Strategy (2000), which foster a new way of understanding and governing the territory that would consist, in the words of J. Romero, of placing “land management at the centre of the debate as a strategic policy objective” (Romero, 2010: 42). This entails far-reaching changes in the way of designing and assessing policies affecting it, based on fresh proposals such as the transition towards a new production process, sustainable management, public consultation and participation, among other innovations. These are all strands in an ambitious project that has been gaining strength among Spanish geographers since the mid-2000s. An example of this is the monograph published by the Association of Spanish Geographers (edition nº 46, 2008), coordinated by J. Farinós and J. Romero, who had just finished working as the coordinating team for the ESPON 2.3.2 project, the inspiration behind the monograph¹⁵ (Farinós and Romero, 2008: 5). It was not, however, an easy task to implement land management practice in Spain, as the country lagged far behind in matters of coordination and vertical and horizontal cooperation, apart from the fact that a strong culture of reaching agreements and collaboration does not exist, which has posed the largest obstacle to government efficiency at the different government levels (Farinós, 2008: 25).

13. The object of the programme overall is to promote effective policies and strategies for the sustainable development of human settlements via transmitting information and knowledge on experiences and proven solutions, which should adapt to criteria and modalities previously decided at sittings of the national committees.

14. The Manifesto for a New Spatial Culture was sent out in 2006, with strong backing from the academics and professionals among Spanish geographers.

15. The ESPON (European Spatial Planning Observation Network) project is a Community research programme to compile and compare data on spatial development and cohesion trends in Europe.

4.2. The new horizon of spatial planning from the viewpoint of governance

Some of the contributions mentioned previously when dealing with urban planning also apply to territorial planning. From the start, spatial planning is linked to a wide range of policies on several scales (local, regional, national, and european), with varying content (planning, development, urban planning, housing, infrastructure, etc.), and involving very different public and private actors. It must also be emphasised that territorial governance involves a new way of operating for the actors and administrations concerned when drafting and implementing policies affecting the territory. At this point, both the horizontal and vertical cooperation and coordination among the parties concerned seems to be indispensable if the goal is to reach comprehensive and cross-sectorial planning for the region.

We should take this opportunity to remember the numerous contributions made by geographers over the period covered by this article, although obviously not all of them can be mentioned here. A recurring theme has been the methods implemented with varying success in the administrative districts to go beyond municipal limits when applying public policies to boost cooperation. Several autonomous regions have set up administrative districts, in some cases endowed with wide authority over spatial planning (Aragon, Catalonia and Castilla y León) (Rodríguez, Menéndez and Cadenas, 2005: 179-183). A consortium is the most frequently used instrument used by autonomous regions to manage basic services (solid waste, water, waste water, etc.) and to implement spatial development policies (183-193), without forgetting other innovative methods of cooperation among municipalities aimed at promoting participation by social partners in the discussion, management and drafting of territorial strategies (193-197).

The association of municipalities, or *mancomunidades*, which have a long history in Spain, are the dominant force within inter-municipal associations, basically due to a flexible process of constitution and the option to add new objectives, which explains their strong presence in autonomous regions, especially in the larger ones with scattered towns such as Castilla y León and Castilla La Mancha. One of their most important assets is their versatility, which explains why they host such a wide range of cooperation instruments (Riera *et al.*, 2005: 157-162).

Furthermore, the use of spatial planning could well afford a golden opportunity to demonstrate that it is an effective



cooperation strategy, or at least, that is how it is seen in the copious legislation drawn up by autonomous regions since the 1980s. If it has not lived up to expectations, it is because of a lack of a true political and administrative culture of territorial cooperation and coordination. Therefore, “the degree of consolidation of spatial planning in the next few years will be both a symptom and a consequence that this new form of governance is in operation” (Feria, Rubio and Santiago, 2005:115). These authors reached this conclusion following a detailed analysis of the regulation framework for spatial planning in Spain and the application of its instruments on a regional and subregional scale in August 2004 (Feria, Rubio and Santiago, 2005:89-105). In the larger regions with more widespread municipalities there is a greater need for cooperation in territorial governance, which makes them the best place to assess the suitability of spatial planning as a cooperation strategy. This can be seen in Castilla y León, where the *mancomunidades* and the supramunicipal groups created to implement development projects requested by the European Union have been quite effective. Conversely, the spatial planning instruments have been shown to be less effective for governance, except for Spatial Planning for Natural Resources (PORN) (Martín, Hortelano and Plaza, 2007:552-553 and 571). When the urban sprawl started, there was hardly any coordination and cooperation when forming public policies on a regional and subregional scale, and the application of both principles, far from being the rule, was the exception in Spain. This is borne out by writings on many other examples taken from regional experiences and compiled in the *Territorial governance in Spain* part of the publications from the Interuniversity Institute of Local Development at the University of Valencia (Romero and Farinós, 2006).

Despite the scepticism caused by the above findings, there is reason to continue believing, following F. Manero, that public participation must be “the cornerstone on which to build approaches to governance and integrated, sustainable spatial planning”, sharing the view that in this way a global social project is being created (Manero, 2010:47, 50-51). Along the same line, Manero still thinks that “it is not unreasonable to give spatial planning, intervention in urban development, and territorial development a central position in the institutional debate and that it should be fostered and encouraged within society”. This idea connects with the proposal for a *multi-agent territorial pact* capable of combining efforts and resources to reach shared and complementary objectives (Manero, 2013: 59-60). This opinion is emphasised by Romero and Farinós when they state that “good territorial governance, in addition to resting

on principles of coordination and cooperation, requires a strong society”, and continues by referring to empirical examples where participative democracy has been applied on a local and metropolitan scale (especially in local agendas), as well as to participation in spatial, landscape, and environmental planning and evaluation. According to these authors, the real guarantors of good territorial governance, which are inseparable from democratic governance versus the temptation to deregulate, are “more civil society and more Government” (Romero and Farinós, 2011:314-315).

4.3. Governance in supramunicipal and metropolitan areas

The rate of modern urban growth gives rise to complex regional structures, which are often seen as dysfunctional and not able to meet the demands of the public with regard to integrated economic development, environmental sustainability, or integration. In fact, municipal autonomy is frequently an obstacle to achieving this, which has sparked interest in strengthening cooperation and supramunicipal management mechanisms. The role of metropolitan areas, subject to regulations from the state as well as regional standards and which in principle should have fulfilled this mission, has not been suitably implemented. More than standards and regulations, what is lacking is “the metropolitan territorial culture; the idea that cities and their suburbs must accept that the capabilities linked to governance of polynuclear urban spaces can play a role in their integration” (Manero, 2010:1/18, 9-14/18). Perhaps it is worth delving further into these premises in order to reach a consensus among the actors who must design the type of actions that fall within the concept of governance. R. de Miguel comes to this conclusion on realising that the level of regional government responsible for supramunicipal spatial planning in Spain has been unable to find a solution to metropolitan organisation. He attributes this to the continued existence of a deep-rooted tradition of local autonomy and municipalism, and tentatively puts forward the idea that “metropolitan governance in Spain in the 21st century will not be possible without direct participation of city councils making up large cities” (De Miguel, 2008:371-372). Although taking for granted that problems and disputes over land will take place on a local scale, it is just as certain that administrative limits (local, regional and even national) are usually exceeded, which leads to a search for the ideal administrative level on which to tackle the most effective solution. This does not mean that, in order to do so, “the current regulation framework must be



reviewed, new levels of government created and more sectoral regulations specific to metropolitan areas enabled (finance, environmental, etc.); what is really relevant is that the people holding the power to draft and apply policies and actions affecting the territory accept and implement the global perspective needed for spatial planning” (Valenzuela, 2010: 124).

Other proposals go further, aimed at improving governance of the current metropolises suffering from low representation and a democratic deficit, which would be solved through a threefold perspective: inter-administration cooperation, participative democracy, and cooperation between public and private bodies. By accepting this situation, “each metropolitan area could and should generate its own model by adapting general models to the characteristics and specific needs of its surroundings” (Precedo, Míguez and Orosa, 2012: 281).

4.4. Intermediate levels of the settlement system, an asset to territorial governance and the quality of life.

This embraces a wide range of settlements that could be used to counteract large urban concentrations and, at the same time, implement formulas of governance to provide services and create other opportunities in rural areas. This refers to semi-urban nuclei (villages) and medium and intermediate towns, whose role in organising their territory has undergone considerable diversification and reinforcement.

The presence of semi-urban nuclei as structuring elements for the surrounding rural environment has provided particularly striking results in regions on the Cantabrian coast, where they have been able to counter the emergence of strong forces aimed at creating metropolises, especially in Vizcaya and Asturias. In Asturias, the land outside the *ciudad astur*, the name given by some authors (Rodríguez, 2009:54) to designate the asturian metropolitan area (AMA) consisting of Oviedo, Gijón and Avilés, villages are seen as one of the fundamental pieces in the future of spatial planning in the region and key to ensuring the dynamism of the surrounding area. Therefore, villages go beyond their traditional function of providing services to rural areas to become elements that structure the territory and act as a communication channel with the metropolitan body of the region (Rodríguez, Menéndez and Fernández, 2013: 52-55)

Medium cities are usually associated with an image of quality of life and balanced development, which has

been the focus of public policies aimed at promoting deconcentration. Whether planned or not, medium cities have played an intermediary role in spreading regional development between large regional cities and the rural surroundings. The same has occurred with medium cities in Andalusia “which have entered a growth dynamic that has changed them from being highly agricultural or industrial, as the case may be, to service-based economies” (Rodríguez and Sánchez, 2012:80). The way in which these levels of urban development and transformation have been obtained is no trivial matter. Local policies may have been chosen based on large, flagship projects involving public and private actors, but from a business standpoint, and boosted by powerful marketing campaigns. This happened in cases like Avilés and Ponferrada with rather disappointing results, as demonstrated by J. Somoza (2013). In contrast, cities such as Pontevedra have opted for a change at a different pace, where “human development and people’s quality of life comprise the main objectives to be achieved, with city planning taking into account the public interest”. In short, according to this author, in the next few years many councils of medium cities will have decided upon one of the transformation models. They will decide between being competitive or they will opt for healthier cities committed to the environment and sustainability (Somoza, 2013:56-64).

Strategic planning has also taken a local turn; although from the mid-2000s there are many examples of supramunicipal plans, initially, most of the supramunicipal strategic plans were decidedly urban or metropolitan in character. However, areas with districts of villages around small and medium cities have gradually predominated, providing them with a more rural atmosphere. These formulas of relationship and cooperation among municipalities have been the greatest test bed for European Union policies (Farinós *et al.*, 2005:119-123,145-146). Furthermore, suitable location of services and facilities is a guarantee for one of the basic principles of spatial planning, which is the balanced and sustainable development of the region; hence, the strengthening of the regional urban network and rural centres is the chosen method for achieving such objectives throughout the region, which includes the marginal spaces often found in large areas of the interior of Spain. This is the case with Castilla y León, where urgent and significant steps must be taken to achieve the desired goal of a balanced mix of services and facilities, based on its network of rural centres. This not only ensures territorial cohesion, but is also a key factor in attracting investment in a productive capacity (Bachiller and Molina, 2014: 95-100).



5. Conclusions

It has been no easy task to write this paper, based on laboriously compiling and selecting articles, collecting quotes and linking the content into a coherent text. I trust that I have made the right choice and that colleagues reading these words will obtain a clear, if not complete, picture of Spanish geographers' views on the complex issue presented here. I would like to stress the important role played by bibliographical materials from congresses, symposiums, seminars and other geographical events, which tend to better reflect the current urban and territorial reality. They provide a good opportunity to compare methodological innovations and provide responses to socio-spatial conflicts. Participation in these forums is, therefore, a way to enhance our professional activity and it gives geographers' an opportunity for greater social involvement.

As for the content of this contribution, the most important thing to emphasise is the complicated urban and territorial aftermath of the excessive urban sprawl spurred on by the *building bubble*. This is visible in very different sections of the city and region: an unfinished residential fabric, with its vacant urban developments, a spatial layout that is especially chaotic in the case of certain functions and facilities (commerce, logistics, etc.) and, above all, some appalling effects on the region and environment. Urban planning and territorial governance bodies thus face enormous challenges when making decisions that take into account social demands and the new *territorial culture*, which urges action that is diametrically opposed to the events of the last two decades. It will not be easy. There are some hopeful signs, but they will only become reality if the principles of sustainability and governance are applied to all of the interventions in property developments, planning, and regional development (coordination and cooperation among administrations, participative democracy, and cooperation between public and private entities in particular). Lastly, the role that all levels of the urban system must play in the application of this approach must be highlighted. From the large metropolises to the semi-urban centres, they must all act as pivots and structuring elements to promote territorial balance.

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City lights. The urbanisation process in Spain as shown by night-time images of the Earth (1992-2012)

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Abstract

The Spanish urban system has experienced significant transformations over the last two decades in both its articulation and extension, as well as in the morphology of its consolidated areas. The sources of information on land use, although increasingly precise and exhaustive, present some limitations when it comes to identifying and quantifying this development, most particularly because their data are sporadic. In this context, the advances in the availability, precision, territorial coverage and repetition of night-time satellite photographs allow them to be used to identify the evolution of transformed land. Based on the hypothesis that there is a direct relationship between light emissions and the level of urbanisation, this study identifies the development of the Spanish urban system between 1992 and 2012, as well as evaluating the suitability of the source used for this purpose.

Keywords: urbanisation; spanish urban system; energy; night satellite images.

1. Introduction

In spite of its relatively belated development, the Spanish urbanisation process has experienced rapid and decisive changes over the last decades. In 1960 –by which time a substantial majority of the population in many European countries was urban– more than half the inhabitants of Spain were still living in places with fewer than

20,000 inhabitants. Notwithstanding, the urban development in the following thirty years was extraordinary, providing Spanish cities with their fastest growth ever, to such an extent that by 1995 two out of every three Spaniards were living in cities (Nel-lo, 1997).

Since then the Spanish urban system has undergone notable transformations in both its articulation and extension, as well as in the morphology of each of its component parts. Iberian cities have become more interdependent and more closely connected to the worldwide urban network; metropolitanisation processes have intensified, leading to every urban area expanding its outreach; urbanisation has become more spatially dispersed and there has been a widespread move towards greater functional and social specialisation. These changes, which are closely related to the manifestations of how Spanish society has evolved in recent decades, provide significant opportunities but also pose major challenges, not the least of which is measuring and analysing the extent of these urban transformations.

This study seeks to contribute to this crucial task of quantification and interpretation. It aims to provide data and reflections on the development of the urbanisation process in Spain in the years bridging the 20th and 21st centuries by using a relatively new source of information: the annual series of night-time satellite images of the Earth. As we shall see, this source of information is not without its problems and therefore particular attention must be paid to methodological



issues. The study's contribution is thus twofold: on the one hand, it provides data on the evolution of the urbanisation process; on the other hand, it discusses the potential and limitations of this particular data source.

The starting point and hypothesis under discussion states, firstly, that it is possible to establish a direct relationship between the brightness detected by night-time satellite images and the level of urbanisation; secondly, that the quantification of a surface area via its levels of urban lighting provides interesting possibilities for studying the artificialisation of land and the efficiency of its use, as well as the relationship between urban dynamics and environmental parameters, including energy consumption and the fragmentation of spaces of natural interest.

Apart from this introduction, the study comprises five sections: the first indicates some of the main background information regarding the evolution of the urbanisation process in Spain from the mid-20th century on; there follows a presentation of the source of information used to analyse the period from 1992 to 2012; the third section explains the method applied to the treatment of this source and discusses its usefulness; the fourth shows the results of this analysis with respect to the areas of urban land and the speed of their occupation in the urban areas of the Spanish provincial capitals; finally, some brief conclusions bring the work to a close.¹

2. Characteristics and recent evolution of the Spanish urban system

The Spanish urban system has a number of specific characteristics (Reher, 1994; Nel-lo, 2004). Firstly, it is distinguished by a marked bicephalism, resulting from the presence of two powerful metropolitan regions: Madrid and Barcelona. Along with Lisbon, these urban regions represent the leaders of the Iberian urban system and are among the 10 most populated urban areas in Europe. It has repeatedly been pointed out

1. The present study contains part of the results of the project City Lights. The evolution of the urbanisation process in Spain as shown by night-time images of the Earth (1992-2012), undertaken by the Research Group for Energy, Territory and Society of the Universitat Autònoma de Barcelona, led by Oriol Nel-lo. For the 2014-2016 period, the project benefits from financing from the programme Challenges of the National Research Plan of the Ministry of Economics and Competitiveness

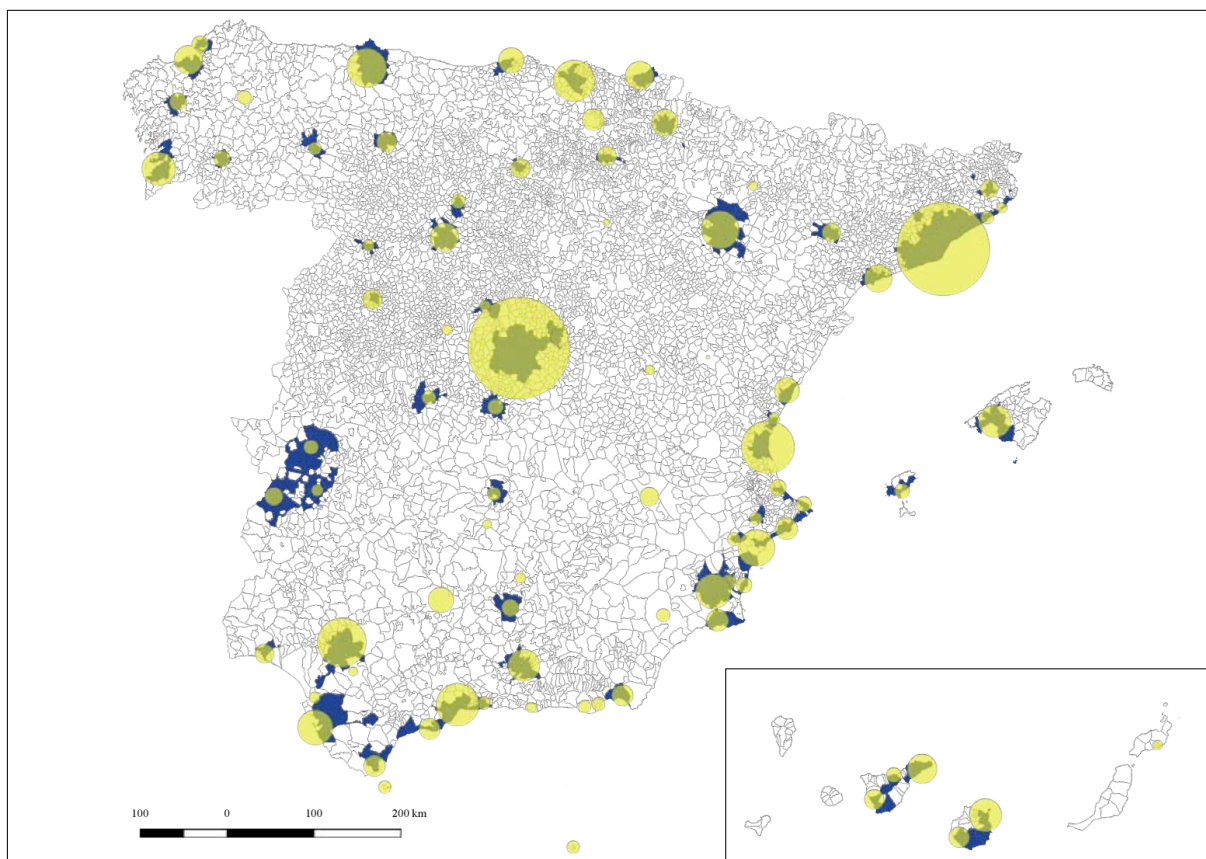
that this situation strongly refutes the adjustment of the Spanish urban system with the rank-size rule so often used in the analysis of urban networks.

In addition to these two main metropolises, there are six metropolitan areas with a population approaching, or exceeding, one million: Valencia, Bilbao, Seville, Málaga, Zaragoza, the central area in Asturias (Oviedo-Gijón-Avilés) and the constellation of cities in Galicia (ACoruña-Santiago de Compostela-Vigo-Pontevedra), which is closely interrelated with the urban system of northern Portugal. It should be noted that most of these heavily populated urban areas are located in coastal provinces, showing that the second distinguishing feature of the Spanish urban system is undoubtedly the population shift toward coastal settlement. The main exception to this pattern is, of course, the metropolis of Madrid, located exactly in the centre of the peninsula, over which it exerts a great attraction, enhanced by the markedly radial layout of the earthbound communication networks (railways and roads).

The third defining characteristic of the Spanish urban system is the speed and decisiveness of the transformations it has undergone in the last fifty years. We have already mentioned the relatively late start of the mass urbanisation process compared to other European countries, as it was delayed by historical circumstances until the end of the 1950s. Since then, however, the transformations have been very noteworthy and extremely fast. They occurred in three successive phases:

- An initial phase, dating from around 1959 to 1975, particularly characterised by a striking concentration of people and activities in the main cities, due to large-scale inter-regional migration. This was mostly related to economic modernisation, which entailed profound changes in the labour market and a massive move away from agricultural work towards industry and services.
- A second phase (1975-1996) in which the population growth of the main metropolitan areas stagnated. At the same time, there emerged a strong trend towards expansion, as well as decentralisation and dispersion of activities and population over their respective areas. Thus, the evolution of urban structure during this period is largely linked to the existence of intra-metropolitan migration related to the housing market.
- Finally, the last phase, which began around 1996, largely corresponds to the period studied





Map 1. Population of the main Spanish urban areas, 2013

Source: in house, on the basis of data from the Spanish Instituto Nacional de Estadística: *Padrón continuo* (continuous census) Urban areas according to Aguado (2013)

herein. The renewed economic and demographic growth seen up until 2008 brought both increases in population in the urban centres –particularly as a result of international migration related to the labour demand– and a continuation of the processes of metropolitan expansion and dispersion, primarily the consequence of intra-metropolitan migration dominated by the local population and linked to the evolution of the housing market.

The period on which we are focusing our analysis of the Spanish urban system are the two decades between 1992 and 2012, which mostly correspond to the above-mentioned third phase of the urbanisation process. These two decades, crucial to Spain's urban evolution, present two clearly differentiated and contrasting stages: the period between 1996 and 2007, distinguished by rapid economic growth and intense urban development (Burriel, 2008), and the subsequent financial crisis, which began in 2008 and which, combined with a steep increase in unemployment and social inequality, has triggered a striking reduction in the rate of urban growth (Albertos & Sánchez, (coords.), 2014; Méndez, Abad & Echaves, 2015).

The demographic effects of the transformations in this period are shown in Map 1. As we can see, there is a continuing primacy of the large metropolitan areas, Madrid (6,047,108 inhabitants in 2013) and Barcelona (5,042,757)², which struggled to adapt their economic and social base, as well as their infrastructural capacities, to the territorial redimensioning forced upon them by increasing globalisation in this period. At the same time, the two metropolitan regions have managed to halt, and even partially reverse, the relocation process that was shifting a large part of their population and activities from their centres to their peripheries. Apart from Madrid and Barcelona, a dozen metropolitan areas with a population of between 500,000 and 1,500,000 inhabitants also showed considerable growth in this period; these include the aforementioned Valencia, Seville, Málaga and Zaragoza, but also Asturias, Alicante-Elche, Bahía de Cádiz, Murcia, Vigo-Pontevedra, Las Palmas de Gran Canaria, Palma de Mallorca and Granada. Only Bilbao, Spain's sixth largest metropolitan area with almost a million inhabitants, has experienced a net loss in population.

2. Populations as specified in the *Atlas Digital de las Urban areas de España*



It should be noted that, in contrast with previous decades, this growth in urban areas did not occur mainly at the expense of rural areas. As we have seen, the growth in the main urban areas was largely due to their capacity to absorb and channel most of the flow of foreign immigrants and the economic growth Spain enjoyed from the late 1990s to 2008. Transport and communications infrastructures, the high concentration of businesses operating on a worldwide scale and the configuration of a social base open to the requirements of a globalised system has enabled them to remain not only at the top of the Spanish urban system, but also given them a pre-eminent position on the European level.

Beside growth in absolute terms, the recent evolution of Spanish cities and metropolitan areas is mainly distinguished by changes in their morphology. Thus, in a process which tends to be reproduced with logical variations in every urban area, the dense construction patterns (blocks of multi-family housing) that dominated the development of almost every Spanish city over the course of the 20th century began to coexist with, and even give way to, less dense residential models and greater territorial dispersion. The increase in accessibility played an instrumental role in this transformation, as the population took advantage of improvements in the road network and in public transport services to set up home away from urban conglomerations. Furthermore, the decentralisation process in large cities and the dispersion of urbanisation over their surrounding territory not only affected housing but also impinged on industrial activities and many services. It was only at the end of the period, when urban land started to become scarce in many municipalities, that high-density and compactness came to the fore once again.

Growth and extension are, therefore, the two main distinguishing traits of the evolution of the Spanish urban system in recent years. These two characteristics obviously had a major territorial impact as they entailed the development of land for housing, infrastructures and economic activities at an unprecedented pace. The magnitude of this phenomenon will be analysed in the following sections.

3. Analysis of the urbanisation process as shown by night-time images

One of the main challenges currently facing Spanish geography is precisely the quantification and analysis of

these processes of urban evolution. However, the lack of exhaustive, comparable and up-to-date information makes this task singularly difficult. It is true that there are various sources of information regarding land development, especially the Information System for Land Development in Spain (SIOSE) of the National Plan for Observation of the Territory. On the European level, there is also the LANDSAT system, which has given rise to some interesting approximations of changes in land development in various regions (Zornoza, 2013; Carrero, 2013). Nevertheless, although these resources do allow us to draw some interesting conclusions, they present serious problems when it comes to comparing urban land surface in different areas and, more particularly, comparing their evolution.

In this context, the emergence of new sources of information provides an opportunity to overcome these limitations. More specifically, the constant improvements in the quality, frequency and dissemination of aerial and satellite photographs offer analytical possibilities that were inconceivable only a few years ago. It is therefore to be hoped that the extremely interesting results obtained from these sources with respect to light pollution (Sutton & Elvidge, 2015) and even calculations of electricity consumption (Sánchez de Miguel *et al.*, 2014) will be complemented by others relating to the analysis of land development and different types of urban fabric.

Accordingly, the night-time satellite images that have been published every year since 1992 by the National Oceanic Atmospheric Administration (NOAA) constitute a highly valuable body of information. These images form part of the remote urban detection items derived from satellite sensors capable of registering the artificial light resulting from human activities.

The images, which cover the entire longitude of the Earth in the latitudes between -65° and 75° , are available in georeferenced files made up of raster information bands with a pixel resolution of 30 arc seconds, i.e., between 750 x 750 metres and 1,000 x 1,000 metres, depending on the latitude.

The information associated with each pixel contains the lights of cities and towns, as well as other places with sustained lighting. The value of the data is a whole number ranging from 0 to 63, with 0 the value of maximum darkness and 63 that of maximum brightness. The treatment carried out on this mass of satellite images includes areas affected by burning gas but excludes other relatively ephemeral events like forest fires.





Figure 1. Field of study and stable lights in 1992

Source: in house, on the basis of the *Defense Meteorological Satellite Program*

In short, the spatial range covered (practically all the inhabited areas of the planet), the high level of territorial detail (750 x 750 metres), the wide range of brightness applied (63 values), the long time period covered (20 years) and the frequency of the recordings (every year) all mean that the source we have used is an extremely valuable resource for the comparative analysis of urban areas all around the world. Nevertheless, it should be noted that some of its features could limit its explanatory capacity.

Firstly, the images do not maintain any single reference to a time or day for each year or each geographical area. In other words, they are a collection of images corresponding to a single year but the different areas covered might have been photographed at varying times and on varying days. This obviously reduces the capacity to compare both periods and areas as variations in light emissions may be the result of differences in time or seasons. This limitation is easily understandable in this case, however, because a

collection of images covering the entire planet cannot in a practical sense offer an overall picture of a cloudless sky at the same time on the same day over a period of twenty years.

Secondly, the images mainly reflect the light emitted by street lamps. However, measures implemented in many places to not only encourage energy saving and efficiency but also control atmospheric light emissions may have caused reductions in brightness in some areas. These reductions, although welcome, contradict the premise assumed in this research that the greater the brightness, the higher the level of urbanisation.

Finally, it must be pointed out that over the course of the 21 years with access to night-time satellite images no less than six NOAA satellites have been put into orbit, and for a period of 12 years two satellites have been present simultaneously. For the purposes of this analysis, in those cases where more than one image from a single year has been available for download, we have used the most recent one. The change of satellites does represent an added complication; however, as the fact that none of them had a calibration system on board creates differences in the brightness values. Although various authors (Elvidge *et al.*, 2014) have proposed formulas for correcting this shortcoming, for the purposes of the present study, applying intercalibration formulas would not have provided any consistent improvement in our analysis with respect to the research objectives. This is mainly because they alter the entire range of values, including the minimums and maximums for each year (with the former sometimes even becoming negative), which rules out any comparisons based on a specific brightness level applied to several years.

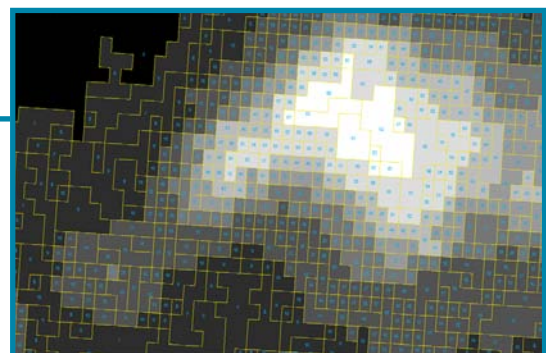
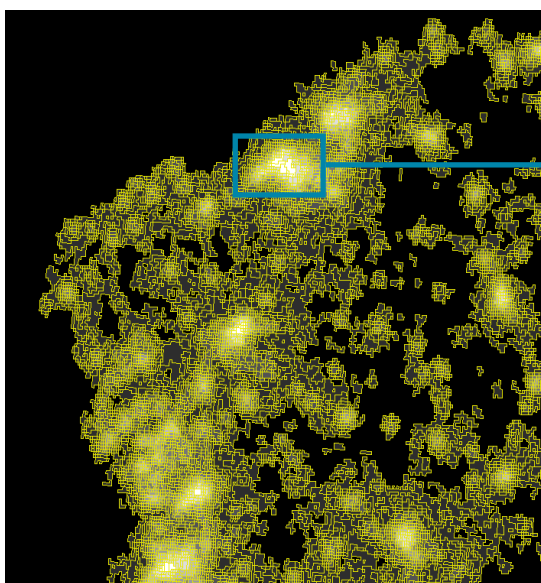


Figure 2. Detail of the image based on a file in vectorial format

Source: in house, on the basis of the *Defense Meteorological Satellite Program*



Despite these limitations, the importance of the phenomenon under analysis, the territorial range of the images, their recurrence over time, the relatively innovative nature of the methodology and the possibilities of comparisons between very distant areas all render the use of satellite images particularly attractive for analysing the urban reality of Spain.

4. Methodological considerations for the calculation of the evolution of land development

The use of night-time satellite images to analyse the evolution of the Spanish urban system provides extremely interesting results, but a specific analytical methodology had to be designed before the results obtained could be presented. The main steps of this methodology are described below.

4.1. Scope of analysis

The study's scope of analysis in the present work is the entire territory of Spain. As the main objective was to identify the extension of Spain's urban areas and their process of territorial expansion in recent years, the first step was to select the urban areas that would be analysed.

Accordingly, the analysis began by identifying the topographical centroid of each provincial capital in peninsular Spain, as well as Palma de Mallorca (i.e., leaving aside the capitals on the Canary Islands and the African cities of Ceuta and Melilla). The centroids were selected by using the coordinates of the *Atlas Nacional de España* (Instituto Geográfico Nacional). Next, five concentric circles with a radius of 5, 10, 15, 25 and 50 kilometres were superimposed on these centroids; the areas corresponding to these circles were the fields that were eventually analysed.

There were two reasons for choosing provincial capitals and rejecting other selection criteria, such as a minimum threshold of municipal population. Firstly, the concentration of various cities of, for example, 50,000 inhabitants resulted in repeated overlapping of the areas around them, and, secondly, because of the well-balanced distribution of the Spanish provincial capitals.³ Thus, although some medium-sized cities do

lie beyond our field of analysis, the major cities and all the agglomerations and conurbations are included in one or other of the circles that were drawn.

4.2. Determining the level of urban brightness

As mentioned above, the main hypothesis underlying the methodology is the possibility of establishing a direct relationship between light emissions detected by satellite images and the level of urbanisation (understood here as the artificialisation of land via the introduction of constructed artefacts). However, the identification of the extension of various urban and metropolitan areas on the basis of night-time images presupposes the establishment of a minimum brightness level. In other words, using the satellite images' various values of brightness (which, as we have seen, range from 0 to 63) as a starting point, a minimum threshold that can be considered "urban brightness" had to be decided upon. To establish this threshold the images of light emissions were compared with the topographic bases, aerial photographs and land developments of a specific known urban area. This comparison made it possible to establish the threshold of brightness corresponding to actual urban land developments, which could subsequently be extrapolated to other areas.

Accordingly, we analysed the metropolitan region of Barcelona, an area with reliable, up-to-date land development information. In order to proceed, the NOAA images of light emissions corresponding to 2010 were superimposed onto the *Land Cover Map* of the Centre de Recerca Ecològica i Aplicacions Forestals (CREAF) for 2009. The map identifies 279,448 polygons for the metropolitan region of Barcelona and labels each of them according to 411 categories. For the purposes of this research only 51 categories were considered, which correspond to artificial compound types and thus include all residential, industrial and tertiary land, in addition to infrastructures and facilities. Those related to agricultural land, forests, water, etc. were ignored. This reduced the total number of polygons to 108,539.

Having completed this operation, we went on to calculate the level of land development derived from the land cover map for each pixel or group of pixels from the layer of night-time satellite images presenting an identical intensity of light. This land

3. The provincial division was established in Spain in 1833 closely following the French departmental model (Burgueño, 1996). One of its main features is to cover the Spanish territory with a fairly

homogeneous administrative grid, adapted to the existing urban centres. Hence it provides a reasonably good basis for the analysis of urban development over the entire territory of the State



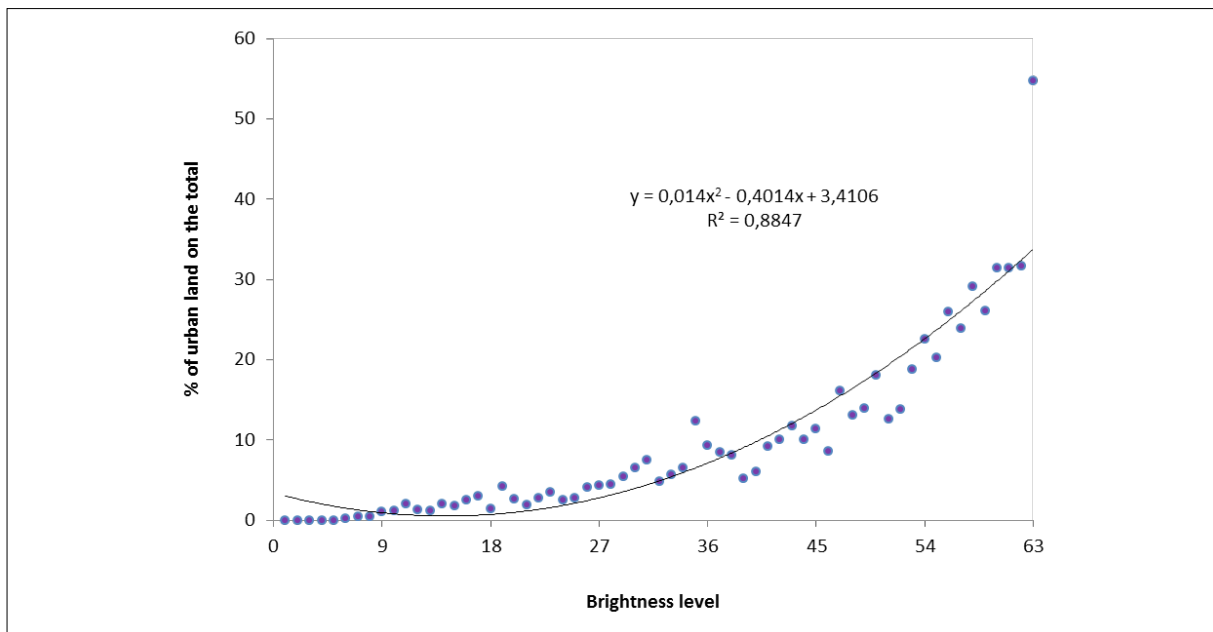


Figure 3. Relationship between brightness levels and land development in the territory of the metropolitan region of Barcelona, 2010

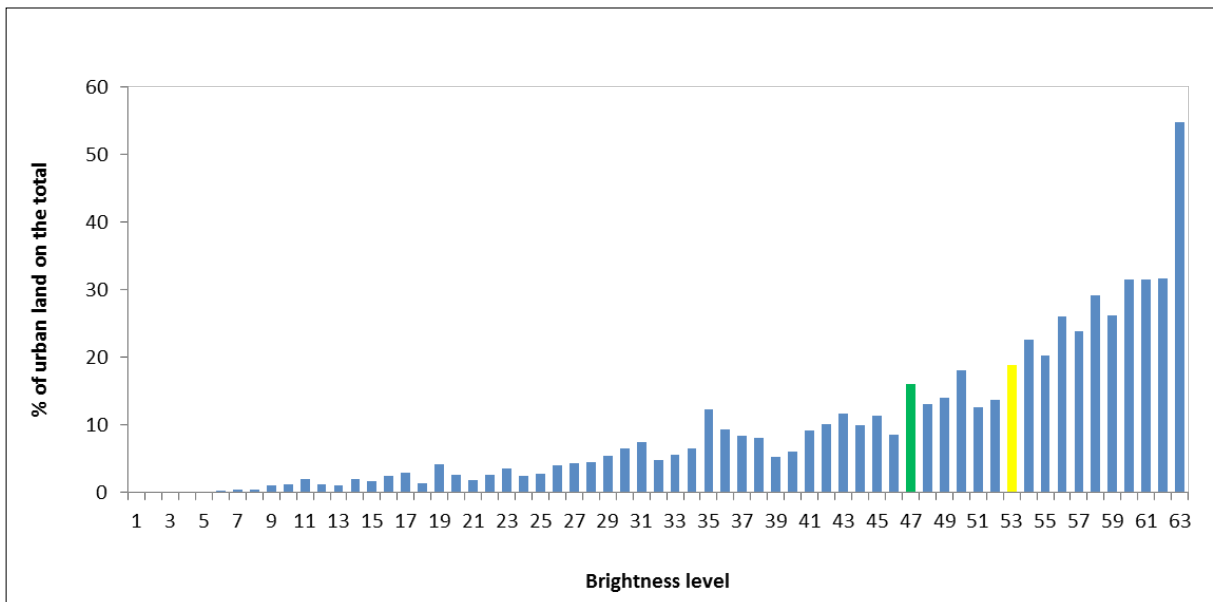


Figure 4. Relationship between the brightness level and land development in the territory of the metropolitan region of Barcelona, 2010

development can theoretically range from 0% in areas with no urban land to 100%. In reality, however, after grouping together the pixels, the maximum urban use was merely 54.79% for the large group of pixels corresponding to the central area, which covers, among others, the municipality of Barcelona and its surroundings⁴. Figure 3 demonstrates the clearly

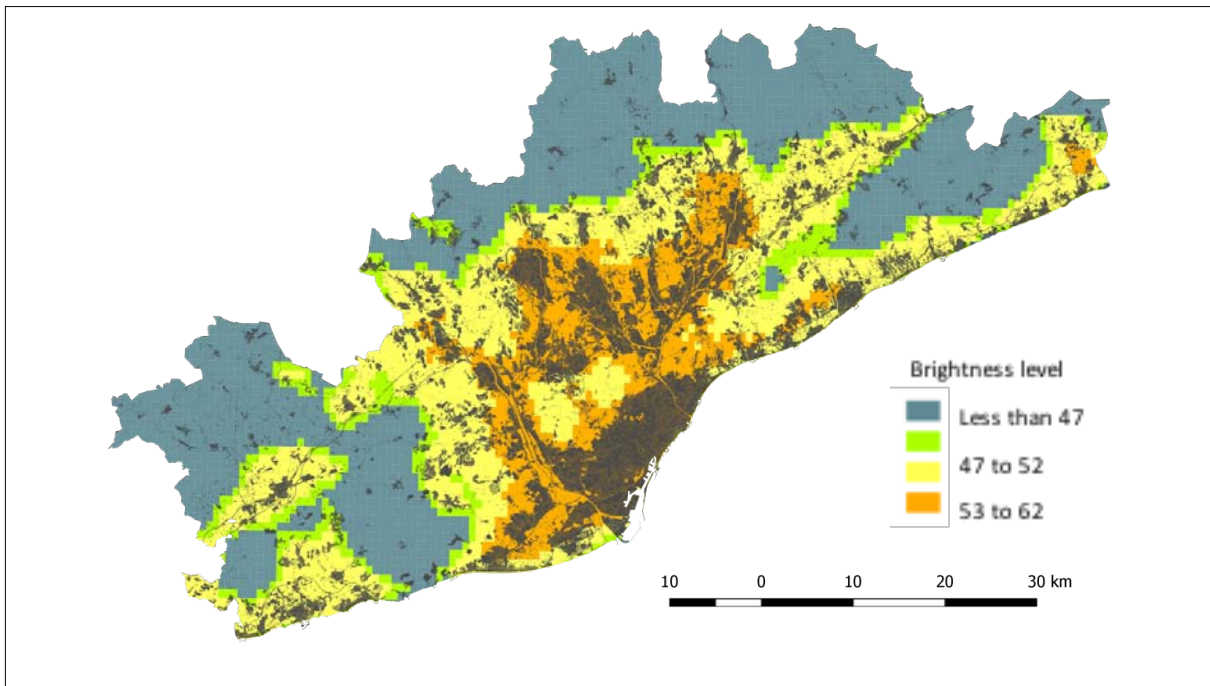
positive and exponential relationship existing between the level of land development and the brightness level of the corresponding pixels.

The correlation confirms the premise that a higher level of urbanisation corresponds to greater brightness but it does not, in itself, make it possible to establish a limit or threshold of “urban brightness”. In order to tackle this issue, the values represented in the form of a point graph (Figure 3) have been used to make a bar graph (Figure 4).

This graph demonstrates how the territories corresponding to the maximum brightness level

4. This apparently contradictory maximum level of urbanisation is due to the fact that, although an area may be 100% urbanised, the great brightness that it emits “pollutes” neighbouring areas with a lower degree of urbanisation, which will then be grouped under the same pixel of light intensity





Map 2. Brightness level of urban land in the metropolitan region of Barcelona, 2010

Source: In house

(63) present not only a high level of urbanisation (the above-mentioned 54.73%) but also a marked difference from the areas immediately below them in terms of light emission.

However, a considerable proportion of urban land lies outside the area with maximum brightness (as the orange area in Map 2 clearly shows). Furthermore, our empirical knowledge of the reality of the metropolitan region of Barcelona, based on variables such as everyday mobility, indicates the existence of an area with a high degree of functional relationships, notably wider than that delineated by brightness level 63. In order to encompass this area it is therefore necessary to establish the “urban threshold” at a brightness level lower than the maximum.

In this respect, Figure 4 also allows us to observe how, despite an evident upward trend, the relationship between brightness and the level of urbanisation is not constant, as some pixels with lower brightness levels have a higher proportion of urban land. Thus, there are two inflection points that could be deemed “thresholds”. The first, and most restrictive, corresponds to brightness level 53 and is shown in yellow on Map 2. This point corresponds to an urbanisation of 18.8% of the pixel or group of pixels’ surface and is the first in a series of cases where the urbanisation values are always higher. The second, at brightness level 47, constitutes a larger area on the map (shown in green), and is

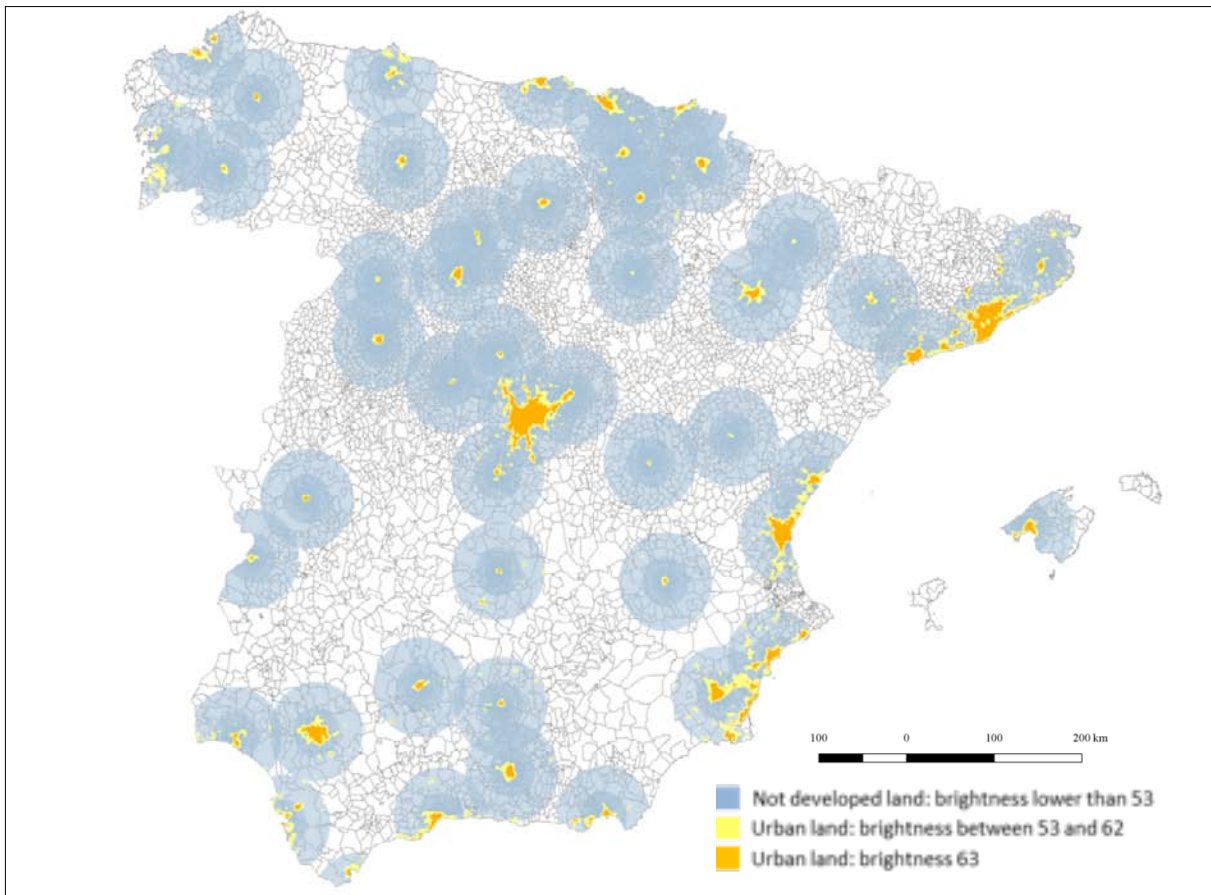
the first in a series of points whose values never fall below 13%. Establishing the value 47 as the threshold of the delineated area would encompass 92.26% of the urban land in the metropolitan region of Barcelona, whereas the value 53 would include 87.36%. Even so, below brightness level 53 the increases in urban land for every new pixel value are always lower than the increases in total land. In other words, the consideration of areas with a lower brightness level incorporates more urban land, but in a much lower proportion than the incorporation of undeveloped land.

On the basis of this analysis, we opted for brightness value 53 as it better reflects the existence of areas that have been effectively urbanised. Thus, this was the threshold applied to the remaining areas examined in order to measure the surface of their respective urban land and thereby calculate, by aggregation, the extension of urbanisation in the Spanish territory as a whole.

5. Calculation of the urbanisation process in Spain (1992-2012) as shown by night-time satellite images

Using the selection criterion described above – i.e., a brightness level equal to or greater than 53 as equivalent





Map 3. Urban land within a radius of 50 km around the Spanish provincial capitals, 2012

Source: In house

to an area that is mostly urban Map 3 shows the extension and form of the urbanisation within a radius of 50 kilometres around the Spanish provincial capitals.

As can be seen, in practically every case the central parts of the areas present maximum brightness levels (63). These areas are surrounded by lower brightness that is nonetheless representative of urban fabric (corresponding to a brightness levels between 53 and 62).

The surface area of each of these urbanised spaces, their distribution in concentric rings around the provincial capitals and their evolution over the

course of the last twenty years will be analysed in the following sections.

5.1. Urban land and its distribution around the urban nuclei

An analysis of the urban land falling within a radius of 50 kilometres around the Spanish provincial capitals in 2012 shows substantial differences as regards the physical extent of urbanisation.

Thus, as we can see in Figure 5, Spain's main metropolitan areas have a greater extension of urban

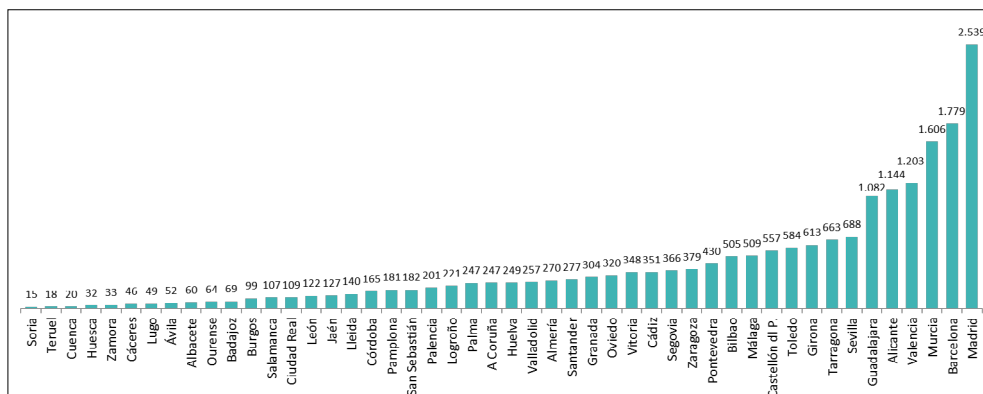


Figure 5. Surface area of urban land within a radius of 50 km around Spanish provincial capitals, 2012 (km²)



land: Madrid (2,539 km², Barcelona (1,779 km²) and Valencia (1,203 km²), as well as Seville (688 km²), Málaga (509 km²) and Bilbao (505 km²).

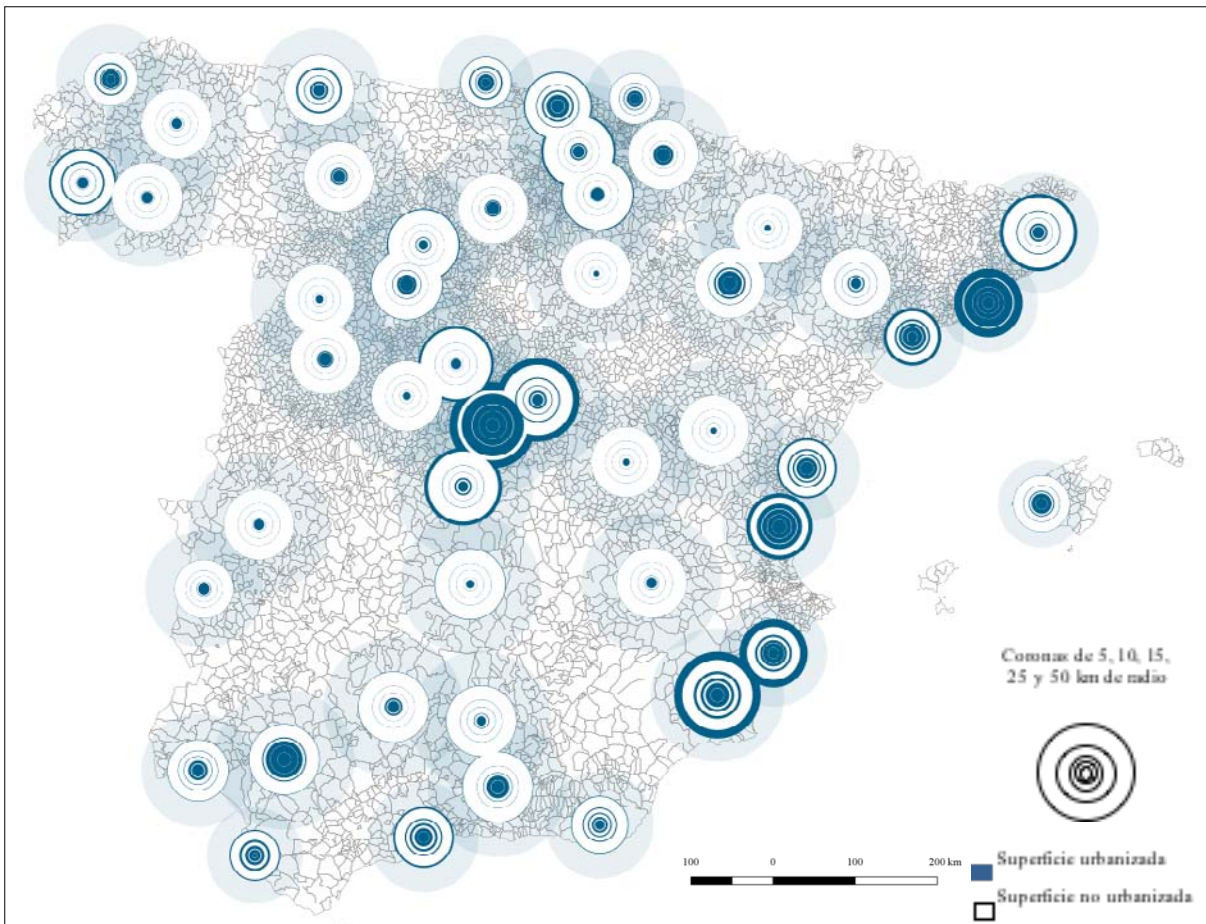
Nevertheless, other smaller capitals with the same, or sometimes even greater surface area of urban land, such as Murcia, Alicante and Guadalajara, present an extension of land with an urban brightness level far greater than that corresponding to its economic and demographic weight. The difference may be firstly explained by variations in land use efficiency, as some areas have needed to develop more land than others in order to obtain similar growth in population and activity.

These differences may also have other explanations, however. In this respect, it should be pointed out that the surface areas represented correspond, as mentioned above, to the urban areas within a radius of 50 kilometres around each provincial capital, which does not necessarily cover urban development originating in a single urban focal point. This can be clearly seen in Map 4, which shows the proportion of urban land in each of the five rings, revealing that, although in many cases there is an evident continuity in urbanisation

going outwards from the centre of the provincial capitals (in the first three rings in Seville, in all five in Barcelona, in only the first in most of the Castilian capitals), in many others the outer radius tends to include urban nuclei that are clearly distinct and separate, or even more closely related to other provincial capitals.

Such is the case in cities like Guadalajara (which includes Alcalá de Henares and Torrejón de Ardoz in its outer rings, as well as the centre of Madrid itself), Toledo, Segovia, Castellón de la Plana (which includes Sagunto) and Girona (not only affected by coastal nuclei but also by significant medium-size cities inland). These cases therefore produce a certain oversizing of the urban area, as they also include part of a neighbouring area as developed land.

In other cases, despite the discontinuity observed, the fifth ring can indeed be considered part of the specific metropolitan reality. This is true of Tarragona and Valencia and its catchment area, as well as situations where the discontinuities between the various rings are due to the existence of a linearly structured metropolitan reality (generally following a coastline),



Map 4. Surface area of urban land within a radius of 50 km around the Spanish provincial capitals, by metropolitan rings 2012 (km²)

Source: In house



leaving large areas of free land in the intermediate rings but nevertheless clearly belonging to the same urban area. This is the case with Málaga, running from Nerja to Marbella.

The picture becomes more complex in the cases of Alicante (which is affected by the thriving urban system made up of cities like Altea, Benidorm, Ibi, Elda and Elche), Murcia (also encompassing Elche, as well as other urban nuclei such as Orihuela, Torrevieja and Cartagena within a radius of 50 kilometres) and even Cádiz (running from Sanlúcar de Barrameda to Barbate via Jerez de la Frontera). In these instances it is more difficult to distinguish whether the area around the provincial capital constitutes a metropolitan region or merely a multi-centred urban system.

Sometimes this phenomenon can be seen in the fourth ring, as in Oviedo, which is affected by the proximity of Gijón. And in some even more complicated cases it occurs in both the fourth and fifth rings, such as in the aforementioned Cádiz and also in Pontevedra, which takes in cities such as Vigo (fourth ring) and Santiago de Compostela (fifth).

Beyond any limitation regarding the interpretation of the uni-centre or multi-centre nature of metropolitan urbanisation –a subject which has been exhaustively debated in conceptual terms– the analysis of the surface area is still totally valid for the quantification of urban land using concentric rings around Spanish provincial capitals. In all, this amounts to 16,249.22 km², i.e. 5.9% of the territory included in the 50 kilometres surrounding their respective centroids and 3.3% of the overall surface area of peninsular Spain and the Balearic islands.

5.2. The extension of urbanisation

Having defined the question of the urban surface areas of the provincial capitals in the year 2012, it is time to analyse their evolution over the two previous decades, bearing in mind that these years partly correspond, as noted above, to one of the periods of fastest and most decisive urban growth in Spain. This question can be approached from the viewpoint of the evolution of the urban surface area and urban morphology.

Urban surface area

The availability of satellite images dating back to 1992 allows us to observe the evolution of urbanisation over the course of 20 years running between 1992 and 2012. The results obtained demonstrate that, in the analysed areas as a whole, urban land (brightness value of 53 or more) multiplied by 2.3 between 1992 and 2012, rising from 6,992 km² to the 16,249 km² mentioned above.

All areas saw an increase in the surface area of urban land in the two decades studied. This occurred to widely varying degrees, however, ranging from 50% (Barcelona) to a multiplication by three, four or even more (this is particularly true of the Galician capitals, but also of some medium-size Castilian ones). In absolute terms, Madrid is the capital that presented the greatest increase in urban extension but the Mediterranean coastline, especially between Castellón and Murcia, achieved values which, added together, far exceed those of the Spanish capital (Figure 6).

The results obtained from the interpretation of brightness are therefore consistent with the known

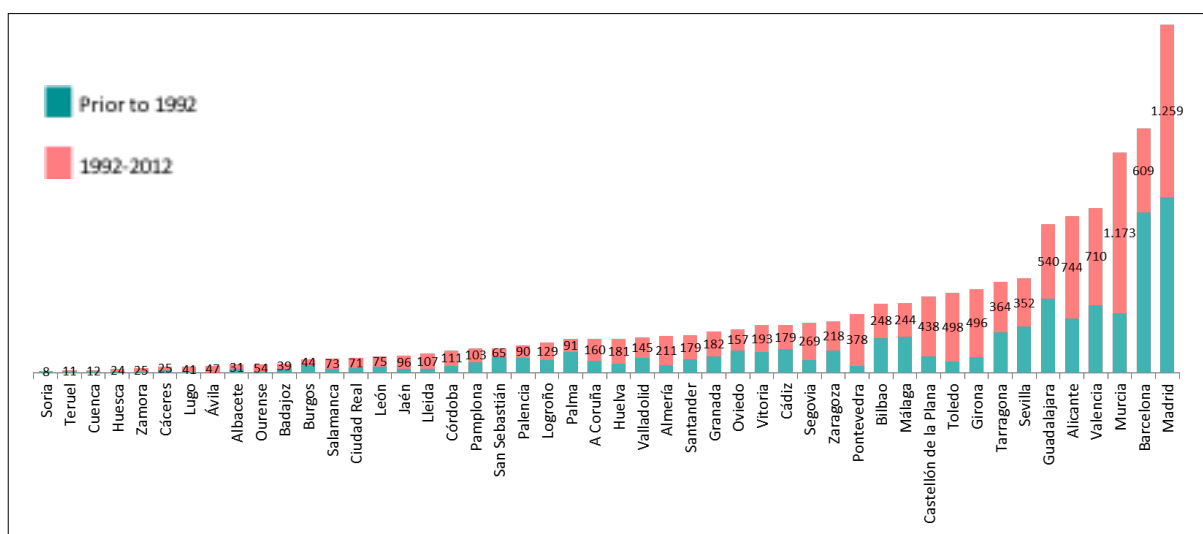


Figure 6. Urban land within a radius of 50 km around the Spanish provincial capitals, 1992 and 2012 (km²)



evolution of the Spanish urban system, which has experienced a strong process of growth and extension in recent years. In fact, in some cases the figures obtained from our interpretation are much higher than those produced by other sources. A comparison with data from direct sources of identification of land development such as CORINE and SIOSE shows that, between 1987 and 2006 (a period of even greater urban dynamism than our own, as it includes the economic boom underway in 1986 but does not cover the stagnation that began in 2008), artificial surface areas in Spain increased by 51.8% (Aguado, 2013), a figure that is clearly high but well below the one obtained from the brightness values. It is true, however, that the method we adopted (the evaluation of growth around provincial capitals) does favour those territories that are most dynamic from the urban viewpoint, and this could partly explain the discrepancies with sources that take into account the territory as a whole.

These divergences could also be due to the aforementioned limitations, i.e. the approach used in this research both on the technical level (lack of calibration of satellites) and with respect to the method used to capture the images (lack of equivalence of time, day, week or season). Nevertheless, they can also be explained by the form of urban growth, since, as described at the outset, in recent years there has been a proliferation of patterns of land development based on dispersion and low density. This being so, and taking into account the dispersion of light, the newly occupied areas would tend to multiply the surface area covered by a high level of brightness, as the halos from various adjoining nuclei superimpose themselves over most of their areas, while those emanating from dispersed nuclei complement each other and therefore expand the covered surface area.

Accordingly, we would not have an indicator of the exact total number of hectares that have been developed but a much more real figure of the territorial spaces endowed with urban characteristics by the current pattern of the urbanisation process. These spaces, which include areas that have been transformed but also varied and numerous interstitial spaces, are hard to quantify via an analysis of land coverage or, even less so, of planning use or urban land legislation, but they do represent the authentic urban and metropolitan environments. Thus, the coverage of its surface area as seen in night-time images would be a more reliable reflection of the urban reality.

Urban Morphology

The analysis of the forms that this urbanisation process has taken in Spanish cities reveals at least five different identifiable patterns.

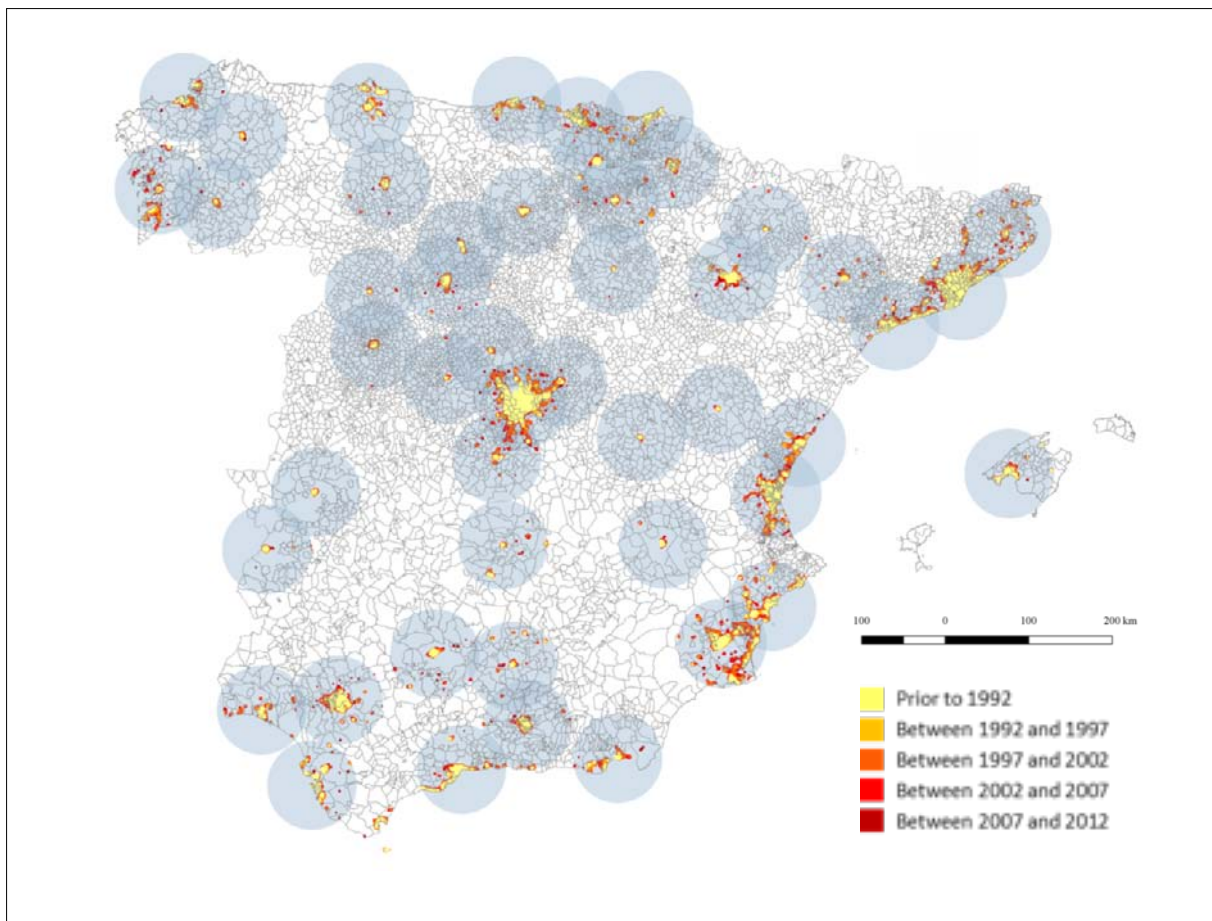
Firstly, there is the pattern of the growth processes for Spain's two large metropolises, Madrid and Barcelona. These two metropolitan areas, although similar in surface area and population, have nevertheless presented strikingly different patterns of land development. The evolution of Madrid would fit the concept of metropolitan "explosion", as its growth in the last twenty years has doubled (98.5%), with its urban land conforming to a tentacular structure. In contrast, Barcelona's growth has been more moderate and has been confined to an "extension" (52.1%) of its urbanisation. Both orographic characteristics and policy developments may explain this divergent evolution.

A similar process, although obviously on a smaller scale, can be seen in most of Spain's major cities. Thus, Zaragoza, Valladolid, Seville, Granada, Palma de Mallorca and the cities on the Cantabrian coast, despite making only modest contributions to the total of Spanish urban growth, have doubled or even tripled their transformed surface area between 1992 and 2012. Furthermore, this growth is echoed within the existing nuclei, tending to reinforce these cities' articulatory function within the Spanish urban system.

In addition to these processes that strengthen urban nuclei, the urbanisation process fostered two further dynamics of a radically different nature. On the one hand, there is urbanisation of the coastline, which is clearly visible on the coasts of Levante and Andalusia. The concentration of new urban developments in these areas in a narrow strip along the coast is by no means a recent phenomenon and should be interpreted as a continuation of the processes of coastal settlement which, as noted in our introduction, is one of the salient characteristics of the urbanisation process in Spain. However, the distinguishing feature of this current urbanisation is its tendency to gobble up coastal areas: transformed land now stretches out linearly and virtually without interruption along many sections of the Mediterranean coastline, mimicking the processes previously observed on the Catalanian coastline.

On the other hand, urban "archipelagos" have also emerged in areas such as Murcia, Pontevedra, Córdoba, Jaén, Girona and Logroño. In these cases, continuous transformation, whether linear or resulting from the extension of urban nuclei parallel to the coast,





Map 5. Evolution of land development within a radius of 50 km around the Spanish provincial capitals. 1992, 1997, 2002, 2007 and 2012

Source: In house

has been substituted by a proliferation of several relatively small urban areas.

Finally, in contrast with these four expansive dynamics, there has been a notable restraint on growth in many of the interior cities. A large number of the Castilian capitals, as well as many of those in Extremadura and Aragon, have presented urban growth which may be substantial but makes little or no contribution to the total increase in Spanish urban land: the urban land transformed between 1992 and 2012 around the cities of Soria, Teruel, Cuenca, Huesca, Cáceres, Zamora, Albacete, Badajoz, Burgos, Ávila, Ciudad Real, Salamanca, León and Palencia amounts to a mere 5% of the total (5.01%) and does not therefore seem to indicate any increase in the weight of these capitals in terms of Spanish urban land as a whole (Map 5).

6. Conclusions

The analysis of the urbanisation process in Spain between 1992 and 2012 via night-time images of the Earth provides valuable results, both as regards the

urbanisation process itself and the suitability of the source used for this analysis.

As far as the latter point is concerned, night-time satellite images have distinct advantages for small-scale analysis: the high level of detail derived from reference to minimum territorial units of 750 by 750 metres, the coverage of virtually all the inhabited planet and the capacity to compare different territories and times provided by an annual series dating back two decades are features beyond the reach of any of the other sources currently available for land use and coverage.

Nevertheless, such an analysis requires a methodology that circumvents the substantial failings and limitations that make it difficult to not only interpret the urban phenomenon at any given moment but also make comparisons over time. Thus, factors such as the spread of halos of light beyond the physical limits of their source of emission, the lack of calibration of the origin of the images and disparities in the dates and times when they were taken hinder a fully exact analysis of the urban reality in question, at least on a large scale.



Despite these limitations, the application of this methodology to the Spanish urban system produced at least two valuable results. Firstly, the confirmation of a notable increase in the extension of urban land that other sources of direct or indirect observation (from aerial photography to land regulation) had already posited, albeit without reaching any exhaustive or homogeneous quantification through details updated every year. Thus, according to night-time brightness, the urban land located within the fifty kilometres around the 48 provincial capitals considered in this analysis increased by 132.4% between 1992 and 2012.

Secondly, this methodology allowed for the identification of various patterns of urbanisation that coexist in the Spanish urban system: from the explosion and restraint displayed by the metropolitan regions of Madrid and Barcelona, respectively, to the continuous growth of many of the large cities; from the urbanisation of numerous stretches of the coastline to the discontinuous growth around many other capitals and the marked restraint of cities in the interior of the peninsula. All these phenomena have not only been identified but also quantified on the assumed basis of a correspondence between urbanisation and a specific threshold of brightness.

In this respect, the level of brightness suggests that the surface of land transformed for urban uses has been much greater than the one identified by using other sources, such as aerial photography or planning regulations. This may be interpreted not as a limitation of the data used but rather as their chief strength: the night-time images present a greater capacity to explain new patterns of urban development that cannot now be quantified solely on the basis of direct land coverage. The patterns of land development based on dispersion and low density that have proliferated in Spanish urban areas during the period analysed have led to an increase in the number of urban centres emitting light. Consequently, the spread of the light produced in these dispersed nuclei tends to multiply the surface area covered by a high level of brightness, which thus proves far bigger than the physically occupied area. It is surely the case that, rather than urban land in the strictest sense, the whole of this “enlightened” territory, with its various coverages and uses, may come close to representing the true scope of urban relationships from the viewpoint of everyday use.

Therefore, in the long run images of night-time brightness could turn out to better explain the urban phenomenon than those sources that only consider

direct land coverage: they may enable us to identify the everyday extension of a city, comprising its urban areas and the infrastructures linking them, as well as the interstitial spaces which, conditioned as they are by the uses and coverages around them, should also be considered part of the city.

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Border and governance in Andalucía (Spain), Algarve, Alentejo (Portugal) Euroregion *

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Abstract

The policy of European Territorial Cooperation (ETC) proposes integrated and inclusive development, especially for those spaces configured around national borders. This involves a complex process for the development of border areas between Spain and Portugal.

In this context, the policies of transboundary cooperation in the Algarve-Alentejo-Andalucía Euroregion (AAA) have economically benefited their political structures, but they have not affected how they are governed or the "true" border area: the *Raya ibérica*. The advances have been insufficient to reverse demographic decline and weaknesses in their productive capacity, thus perpetuating the peripheral location of the inner *Raya*. The same applies to a large part of the Spanish-Portuguese border.

The AAA Euroregion has created such a broad cooperation framework that the deactivation of the border is diluting the role of the local sphere in European Territorial Cooperation, where it would be preferable to have greater involvement of local entities.

Keywords: euroregion; Algarve; Alentejo; Andalusia; border; *Raya ibérica*.

1. Introduction

The current European Union system recognizes Euroregions as a territorial sphere of regions formed by two or more countries, whose objective is the promotion of cross-border cooperation. Their objectives and funds attempt to iron out economic, social, population and governance differences in these territories.

In this context, the creation of a Euroregion between Alentejo, Algarve and Andalusia aims to strengthen European cohesion. Indeed, on 5 May 2010 the President of the Junta de Andalucía and the presidents of the Portuguese Comisiones de Coordinación y Desarrollo Regional de Algarve y Alentejo signed an agreement in Faro to constitute a tripartite Euroregion for cooperation in cross-border projects of common interest. The President of the Junta de Andalucía explained that Algarve, Andalusia and Alentejo share a peripheral location at the European level and so "it is preferable to establish a joint strategy of action to make sure that the European institutions understand that special support is needed to correct this situation, now that our countries no longer are beneficiaries of the cohesion policy" (Europa Press, 2010). The three territories of this new space share a section of the Spanish-Portuguese border, the oldest and largest in



the European Union, and have a total population that exceeds nine million inhabitants.

However, this European Territorial Cooperation cohesion policy, which pursues integrated and inclusive development for the majority of the local communities with direct borderlines, is generating contradictions as the deactivation of the border has not been able to ease their socio-economic problems, and in some cases it has even led to a decline in “resources”, since the Raya’s population had forged a peculiar economy around the border.

Thus, there are serious doubts about the cooperation between such disparate territories, from a social, economic and demographic point of view, or when considering their political autonomy, especially in the current financial and budgetary crisis.

The territorial development policies have identified, without great difficulty, the major threats to the future of the border area of the AAA Euroregion: depopulation, governance and territorial disruption. However, as we shall see later, not all have been treated with equal importance in terms of planning, especially the demographic problem which besets the border territories of much of the Portuguese-Spanish border.

As a starting hypothesis we believe that the policies of trans-border cooperation in this Euroregion have benefited the political structures of the Algarve, Alentejo and Andalucía, but have not had an impact on how

they are governed or on the border areas, which have increased their degree of territorial marginality and they are still suffering depopulation.

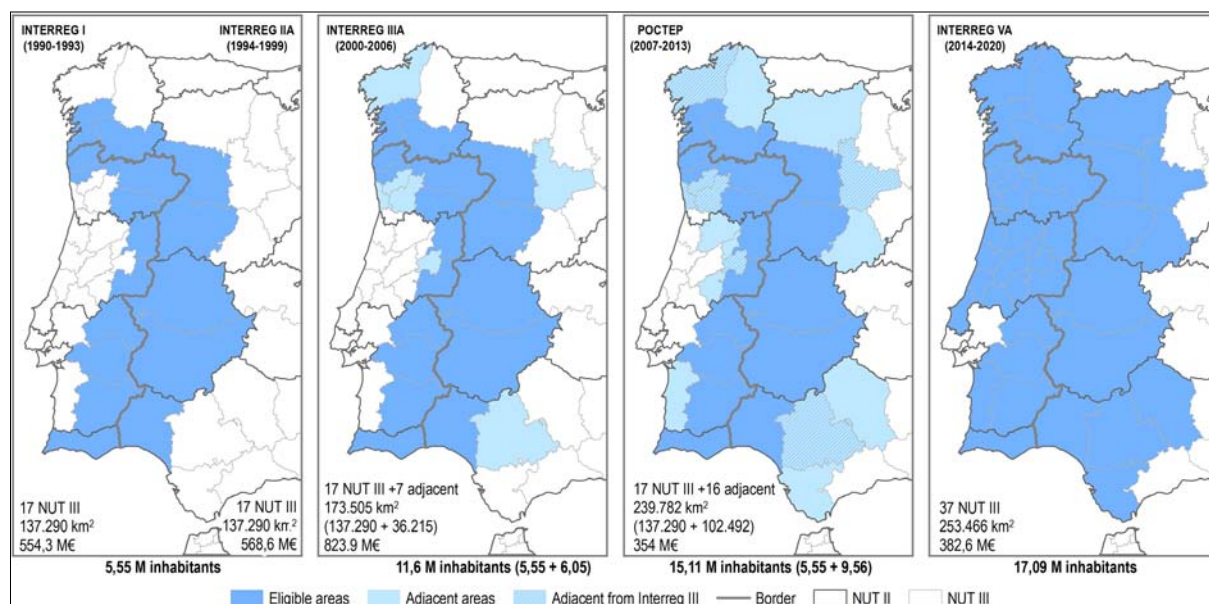
Therefore, the aim of this contribution is to understand and evaluate the effects of European Union cross-border cooperation programs in terms of this AAA Euroregion, at the regional level and in the border areas.

2. Alentejo-Algarve-Andalucía (AAA) Euroregion

The border between Spain and Portugal stretches for 1,234 km. The Spain-Portugal Cross-border Cooperation space (programming period 2014-2020) comprises 37 NUTS 3 regions belonging to both countries, after various expansions of its scope of intervention.

The cooperation space now covers a surface of 253,466 km², which means that Spanish-Portuguese cross-border cooperation represents 5.64 % of the surface area of the European Union and includes more than 17 million people (3.36 % of the EU-28).

This cooperation space is mostly a rural area, with more than 50% of the population living in towns with fewer than 10,000 inhabitants. Only after the cooperation space was enlarged by the successive INTERREG (and POCTEP) schemes were mid-size and large cities included. (map 1)



Map 1. Evolution of the space for cross-border cooperation between Spain and Portugal INTERREG I to INTERREG VA

Source: InfoRegio, 2015; INE-P, 2015; INE, 2015



The lack of a strong system of cities along the “real” border hinders the process of development. In the area nearest to the border only Badajoz can be considered a city of significant size, with about 150,000 inhabitants (municipality). After Badajoz, only the *concelho*¹ of Castelo Branco exceeds 50,000 inhabitants, and only two other cities are above 25,000 (Chaves and Bragança). Except for Badajoz, we must move quite a long way from the border to find cities that exceed 100,000 inhabitants (Ourense, Salamanca and Huelva), and Vigo is the only city with approximately 300,000 inhabitants. We must turn to what, until 2014, were considered “adjacent” spaces (POCTEP 2007-2013) in order to find large urban and metropolitan areas (Sevilla, Bahía de Cádiz, Cávado-Ave, Grande Porto, etc.). They are, however, geographically distant from the border, so one might wonder if their inhabitants and economies have even really experienced the construction, consolidation or deactivation process of the border.

In this way, globalisation, which has led to the restructuring of production systems and has intensified competition between organisations and companies, has worked against the border regions, to such an extent that these regions can be described as “losing territories”, marginal areas where development strategies have failed. This is the case with almost all of the Iberian Raya.

These conditions significantly hinder their development and economic progress. Greater efforts are thus needed to contribute to the process of convergence, and also to eliminate and dismantle the border effect that prevents and impedes the evolution of economic, social, environmental and territorial progress.

The Andalucía, Algarve, Alentejo Euroregion includes more than 9.5 million inhabitants, about 17% of the peninsular population. However, as expected, this Euroregion

Territories	Population*	Surface (km ²)	Density (inhab/km ²)	% Peninsula
Alentejo**	733,370	31,551	23.24	1.29
Algarve	441,468	5,412	81.57	0.78
Andalucía	8,388,875	87,868	95.47	14.75
Euroregión AAA	9,563,713	124,831	76.61	16.81
ESPAÑA	46,507,760	504,645	92.16	81.76
PORTUGAL	10,374,822	92,201	112.52	18.24
TOTAL	56,882,582	596,846	95.31	100.00

* Data obtained from Padron 2014 (Spain) and the Série Estimativas Provisórias da População Residente 2014 (Portugal).
 ** Scope of the region defined in the new Official Administrative Letter of Portugal 2013 (CAOP2013), which now includes the entire district of Portalegre, as well as the south of the Santarém; in addition to that of Beja, Evora and the southern part of the district of Setubal.

Table 1. Scope of the AAA Euroregion

Source: INE-P, 2015; INE, 2012

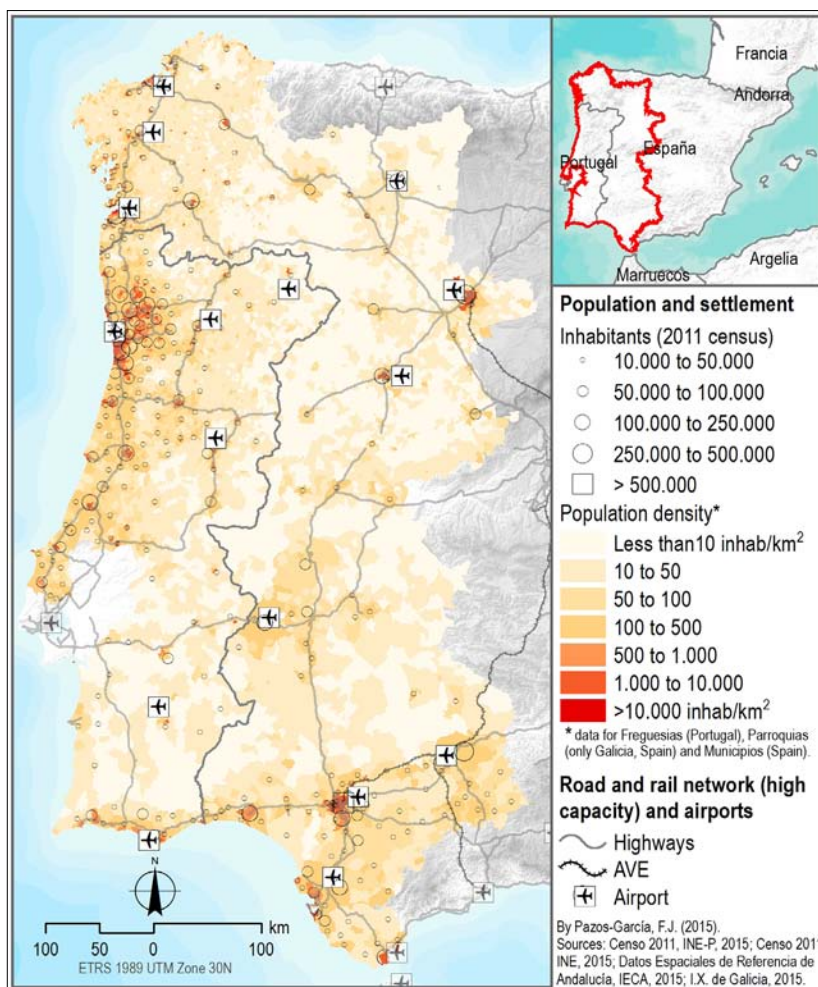
The border territories and regions of Spain and Portugal have lower development and economic levels compared to other territories, heightened by the “border effect”. Historically, border areas have been remote and isolated from the large urban centres of their States’ economic and political activity. In addition, their peripheral location has led to a lower infrastructure endowment over centuries in relation to economically central regions. Consequently, these regions are predominantly rural and have a low population density.

presents strong regional imbalances. In this sense, Andalucía alone represents 87.7% of the AAA Euroregion while Alentejo and Algarve amount to only 7.67% and 4.62% of the Euroregion, respectively. In terms of surface area, Andalucía accounts for 87,268 km², Alentejo 27,276 km² and Algarve 5,412 km². In total, the region covers about 125,000 km²; it is larger than Portugal and has a population similar to the Portuguese continental population (which was 9,869,783 inhabitants in the *Série Estimativa* of INE-P in 2014).

The AAA Euroregion was created as a late attempt to “control and gain access to European funding for cross-border development” in a very broad and barely operational space (Felicidades, 2011). It is a Euroregion that has had to face new changes in European cross-border development policies, since at present the

1. For these examples, we have taken data at the level of *concelho* (Portugal) and municipality (Spain), although if we stick to the Eurostat Local Administrative Unit 2 level (*Local Administrative Unit* or LAU-2) then we would have to compare freguesia and municipality, as in Spain the LAU-1 level has not been defined. However this presents difficulties given the much greater degree of disaggregation of the Portuguese population entities





Map 2. Population* of the INTERREG V area (2014-2020)

*Level LAU-1 data (only in Portugal) and LAU-2 (Spain), except for Galicia, where the density data are at the Parroquia level

European Groupings for Territorial Cooperation (EGTC)² are considered more important and have greater powers.

3. Governance and territorial structures in the Portuguese-Spanish border: the AAA Euroregion

Structures and territorial divisions, although considered to be equivalent on paper, are indeed different on either

side of the border. The Portuguese regions were made to coincide with the Spanish autonomous communities, but their territories are tightly controlled and managed by Lisbon, unlike the Spanish regional state, where autonomous communities have vast powers. Therefore, for example, the powers of the Junta de Andalucía are by far greater than those of the Portuguese CCDR.

On the contrary, at the municipal level, the Portuguese *concelhos* are larger and have a greater degree of financial and political autonomy (*autarquias locais*) than Spanish municipalities, which are heavily dependent on the regional, provincial and autonomous authorities.

Furthermore, compared to Spanish municipalities, the territorial organisation of Portuguese municipalities contains numerous population centres and municipal subdivisions known as *freguesias*, which have been assigned a specific territory to manage. The *freguesias* do not correspond to the Spanish commune, since the latter has neither a municipality to manage nor a real political and administrative structure. The difference is so significant that in the LAU-2 level of the EU (formerly called NUTS-5) the territorial equivalence established by both States is Municipality-*Freguesia* (LAU-2 level).

² The main objective of the European Groupings for Territorial Cooperation (EGTC) is to strengthen the economic, social and territorial cohesion in their geographical scope. They emerged after the publication of European Parliament and Council Regulation (EC) N° 1082/2006 of 5 July 2006 on a European grouping of territorial cooperation (EGTC) (later amended by European Parliament and Council Regulation (EU) N° 1302/2013 of 17 December 2013 as regards the clarification, simplification and improvement of the establishment and functioning of such groupings). In addition to being entities for cross-border cooperation, they are also entities entitled by European regulations on transnational and interregional cooperation to cooperate with third Member States. Their members can be both regional and local authorities, such as bodies governed by public law and the Member States themselves (they must include at least two EU Member States)



Actually, the powers of Portuguese *concelhos* would be in an intermediate state between Spanish provinces and Spanish municipalities. For the purposes of the EU and its statistical and administrative body (Eurostat and NUTS), as they have not defined the LAU-1 level in the Spanish case, the formal equivalence was established as NUTS-3 (Spain)–LAU-1 (Portugal); i.e. Province-Municipality. Portuguese districts are also not comparable, as they are basically judicial, and Spanish provinces have greater powers.

On the Spanish side, except for Galicia, no examples could be found like the *concelho* of Mértola, whose large municipality covers 1,293 km², with 7 *freguesias* (one fewer than before the *Lei 11A/2013, de reorganização administrativa do território das freguesias*) and about 28 populated areas, although with a total population of only 6,681 inhabitants. However, there are also other *concelhos* that are very small and similar to the normal dimensions of Spanish municipalities.

Given this asymmetry in the territorial structures on both sides of the border and in a transnational context, the EU has been developing a process to eliminate the internal borders for years. In the name of integration, and under its principles and policies of cohesion and cooperation, different strategies, entities and cross-border cooperation projects have been developed along the borders (table 2) in an attempt to “erase” the wounds that have defined national spaces for

decades or centuries. The fact is that after almost 30 years of cross-border cooperation, under the umbrella of European policies and funds, Spain and Portugal have implemented numerous institutions of shared relationship and governance, but they never really got off the ground, at least to the levels and standards that we can find in other Central European border spaces.

In spite of the progress achieved regarding the “elimination of EU internal borders”, the physical, social, economic and demographic reality is more complex and slower than the political or administrative reality, and the change is not easy. This situation is especially evident along the more rural borders, as in Spain and Portugal, where the path towards development and integration is slower than in Central Europe.

In this cross-border context, relying on local and regional governments is not only necessary, but logical. There are many spaces on a local scale that have strong ties from a historical, social, economic and functional point of view even though they are located in a border area and also in two different national realities. These are spaces that need and complement each other (labour force, transportation, health services...) in areas where borders are not barriers but bridges that improve opportunities for cooperation in a context of border elimination or permeabilisation and cross-border cooperation. However, as a result of funds from the EU, the development of regulations, and a certain

EGTC	Formed	Galicia-North of Portugal, Duero-Douro, ZAP-NET, Eurocidade Chaves-Verín, Faja Pirítica Ibérica
	In process	León-Bragança, Interpal-Medio Tejo
Euroregions or similar	Comunidad de Trabajo de la Euroregión Alentejo-Centro-Extremadura (EUROACE). Alentejo-Algarve-Andalusia Euroregion. Macroregion of Southwest Europe (RESOE).	
Associations or similar	Eixo Atlântico of the North-western Iberian Peninsula. Cross-Border Association of Municipalities of Galicia and Northern Portugal. Iberian Association of Municipalities Bordering the Duero River. Asociación do Vale do Miño Transfronteirizo (Diputación de Pontevedra y Comunidade Intermunicipal do Vale do Minho). Iberian network of cross-border bodies of cooperation.	
Municipalities or similar	Eurocidade Tui-Valença do Minho and Eurociudades del Guadiana (Ayamonte-Vila Real de Santo António-Castro Marim) and Badajoz-Elvas.	
From Universities	Centro de Estudos Eurorrexionais (Universidade Trás-os-Montes Alto Douro, Universidade de A Coruña, Universidade de Santiago de Compostela, Universidade de Vigo, Universidade do Minho and Universidade do Porto). Conference of the Rectors of the European Southwest (CRUSOE NETWORK, with eight universities from Castilla-León, the three Galician universities, three in Portugal and four polytechnic centres led by the Institute of Bragança). Centro de Estudos Ibéricos (Universidade de Coimbra, Universidad de Salamanca and Câmara Municipal de Guarda).	

Table 2. New territorial structures for the governance of the Portugal-Spain border

Sources: Ministry of Public Administrations (2015)



centuries-old natural tendency of the border societies to cooperate, the processes of cooperation and local empowerment have been intense from the beginning, although the speed of change is not comparable to that of Central European borders. In fact, in the meagre societies along the Raya, it has become almost their only chance for development (Vassi and Salas-Olmedo, 2014:43-44).

Despite problems arising from its cross-border nature, only the most dynamic border territory and the one with the most consistent demographics (North coast, between Galicia and Northern Portugal) has had the critical mass, both demographically and socio-economically, to be able to absorb and even eliminate the “border effect” at levels comparable to Central Europe, where they have come to produce true cohesive “border regions”.

Overall, it is well known that in order for European territorial development policies to be successful, the elimination of borders cannot be confined to the physical, administrative or political structure, but rather requires the full communion of both Member States at the national, local and regional levels. Only with good governance and an approach to the border communities will success be complete. The EU itself is aware of this multiscale approach, and the European Spatial Development Perspective (ESDP) states that “Integrated spatial development policy at EU scale must, therefore, combine the policy options for development of certain areas in such a way that national borders and other administrative hurdles no longer represent barriers to development. The ESDP provides the framework for integrated application of the policy options. Its application is not the responsibility of one authority but of a wide range of spatial development (land use, regional planning, urban planning) and sectoral planning authorities” (CE, 1999:38).

The ESDP leaves the door open to multiple tools and levels of collaboration to avoid conflicts of jurisdiction. This depends on the States and it is they who must decide which tool to apply to achieve the objectives and what the proper political-administrative scale is in each case. It is perhaps symptomatic that the ESDP does not expressly mention the term “governance”, which appears only implicitly: “(7) Spatial development issues in the EU can, in future, only be resolved through co-operation between different governmental and administrative levels. In the wake of European integration, closer relations at all levels are developing: between the regions themselves and between the regions and the national and European authorities.

Cities and regions are becoming more dependent, both on global trends and decisions at the Community level. European integration could benefit spatial development by encouraging the participation of cities and regions” (CE, 1999:7).

Inspired by these ESDP principles and by their own objectives for cross-border cooperation, regions on both sides of the border began creating proposals for common strategic plans.

In this context, and in the case of our space, the AAA Euroregion, in 2012 the Plan of Action for Cross-border Cooperation (PACTA, 2012) was adopted. This Strategic Plan at an interregional level seemed to ignore the main weakness of the Raya: the lack of population. This is not trivial, as not spelling out the problem meant leaving out one of the key factors for taking action, which is essential for carrying out any of its proposals. Especially prominent among these are the proposals that depend on socio-economic activities or local empowerment, which must necessarily be carried out by the residents in the area and not by their administrations (whose plans and projects end up being unviable because the scarce and aging population does not participate).

The strategic planning that has been implemented seeks to coordinate actions and decision-making regarding management plans on both sides of the border. However, an obstacle still remains: economic infrastructures have exercised centrifugal forces on the border and they are located far from the border region: the ports of Huelva, Faro and Portimão, railways that only reach the Raya on the Portuguese side, the airports of Faro and Sevilla, roads that exclude much of the border area, and hydraulic infrastructures, such as the Alqueva or Chanza dams, that do not equally benefit all parts of the territory. Thus, in the Management Plan for the Territory of Andalucía (POTA), in the Territorial Regional Management Plan of the Algarve and in the Territorial Management Plan of the Alentejo there is a lack of territorial coherence for this border area (Hildenbrand Scheid, 2010), which is further complicated by very unequal sectoral and urban policies.

This is due to the fact that the large urban centres of power and decision-making are located outside of the border region. For example, the two most important cities in the Southern region, Huelva and Faro, are somewhat distant from the border and are not large enough demographically to form a powerful urban system. Therefore the most influential cities have ultimately been Seville (more than 140 km away from



Document and scope	Status
Management Plan for the Territory of Andalucía (POTA)	Approved
Regional Management Plan for the Territory of Alentejo	Approved
Regional Management Plan for the Territory of Algarve	Approved
Subregional Management Plan for Sierra de Aracena	Currently under development
Subregional Management Plan for the Territory of the West Coast of Huelva	Approved
Subregional Management Plan for the Territory of Western Andévalo	Currently under study
Plano Diretor Municipal (PDM) of Vila Real de Santo Antonio, Castro Marim, Alcoutim, Mértola, Serpa, Moura and Barrancos	Approved or under review
PGOUs of Ayamonte, S. Silvestre de Guzmán, Sanlúcar de Guadiana, El Granado, El Almendro, Puebla de Guzmán, Paymogo, Sta. Bárbara de Casa, Rosal de la Frontera, Aroche and Encinasola	Approved or under review

Table 3. Reference framework for instruments of urban and territorial planning

Source: International Forum for the development of Bajo Guadiana. Office of the President, Junta de Andalucía. 2015

the border) and Lisbon (about 220 km from Extremadura and 240 km from Andalucía).

In addition, at the local level there is a lack of reference to the border system and the essential documents for territorial management at the local level are different. In Portugal management is done via the “Plano Diretor Municipal”, aimed at “establishing rules for the occupation, use and transformation of the municipal territory and defining the general urban management rules needed to implement the Plano and PMD, and which are applicable to the entire municipality’s territory”. In Spain, on the other hand, we have the General Urban Development Plan (PGOU), essentially an urban instrument subject to territorial planning at the sub-regional level. (table 3)

4. The process of disabling the border in the AAA Euroregion

The progressive dismantling of the borders after the integration of Spain and Portugal into the European Union in 1986 and the advent of the Single Market in 1993 initiated a new phase for the Iberian Raya and for other territories in the EU, supported by the metadiscourse of cooperation and the rapprochement of border communities. To this end, the generous EU structural funds (ERDF, EAFRD) are used within the framework of Community programmes and initiatives (INTERREG, LEADER), with mixed results in the border areas.

The dismantling of the border led to the disappearance of the Customs duties. Consequently, the comparative

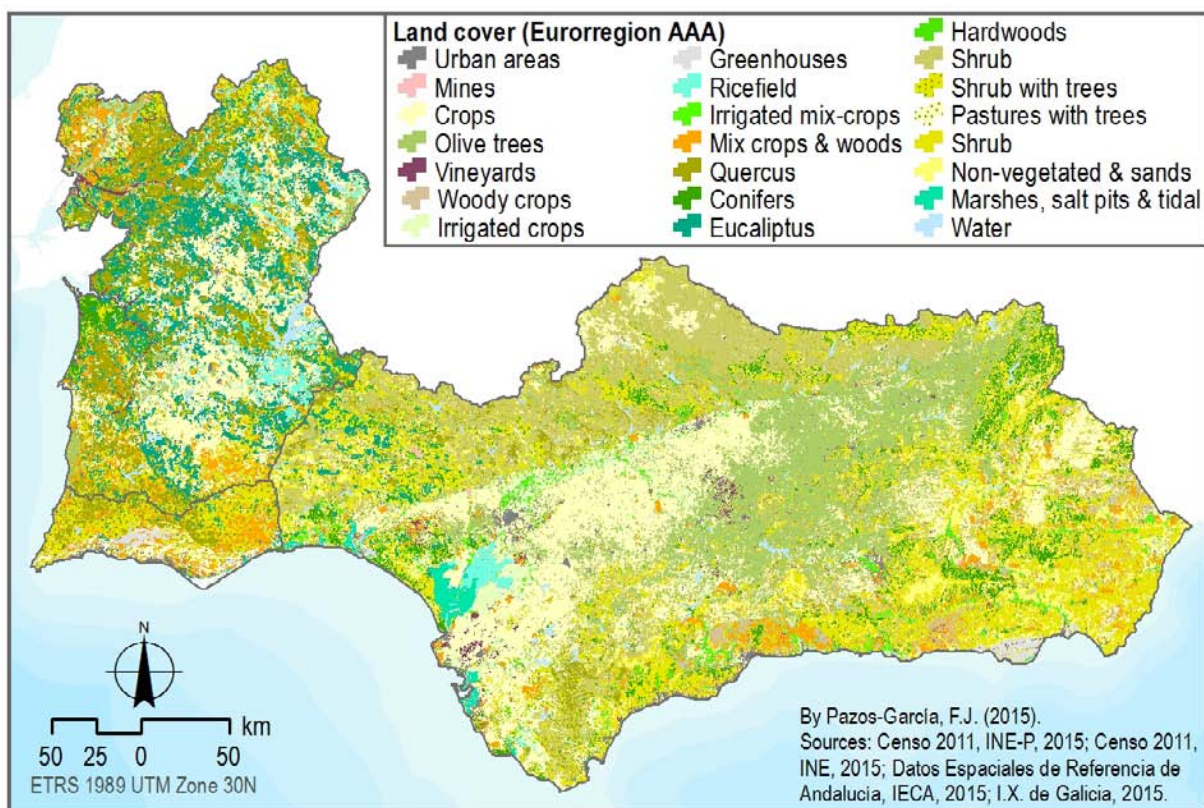
advantages of border trading activity, which had reached a certain equilibrium due to many centuries of adaptations, gradually broke down. The official view of the European Union proposed measures to revive the declining border spaces. To do so, a number of programs were proposed as ways to mitigate the adverse effects on competitiveness caused by the elimination of the border and the clash of territories with different productive structures. Identitarily, formal relations were sought, but they forgot about the informal, illicit, and even underground relations, which were more effective and had a greater impact than official relations.

In principle, this new political-administrative context is a positive step forward for the integration of the border territories. However, in the case of the Portuguese-Andalusian border the territorial and demographic characteristics do not favour a process that requires local forces to be reconfigured to fit into a political-administrative situation that is very different from the centuries-old system to which they were well adapted. This assertion is confirmed in the analysis of their physical, economic and demographic environment.

4.1. The border in the AAA Euroregion

The Raya, which makes up the Portuguese-Andalusian border and extends for 190 kilometres, consists of the districts of Algarve, Baixo Alentejo and the province of Huelva. It is adjacent to 18 municipalities, of which seven are Portuguese and 11 Spanish. It covers 6,606 km² and has 100,409 inhabitants (Census of 2014 and *Série Estimativa de População* 2014).





Map 3. Land uses within the AAA Euroregion

This Spanish-Portuguese border, like many others, historically used natural elements as points of reference. The Raya was drawn with reference to rivers and streams, except in a small Northern portion where the Contienda conflict introduced other variables related to an ancient settlement that used a communal organisation of the space (ANTUNES, 2008). In reality, the official boundaries of the Spanish-Portuguese border were not definitively drawn until 1926 (League of Nations, 1928; Medina, 2006; Márquez, 2012).

In general, the Raya and its surrounding territory can be considered to be an empty space, with a population density of 15.2 inhabitants per km², compared to 112.5 in Portugal, 92.2 in Spain or 95.5 in Andalucía (INE and INE-P, 2014). The municipalities in this area presented an urban system that was weakened by significant migration and decades of underdevelopment. At present, there is a clear dichotomy between the interior and the coast, driven, perhaps, by a natural environment which, given the current economic situation, determines human activities.

Geologically, it has a very old hypsography from the Palaeozoic era and a significant part of the area belongs to the Iberian pyrite strip. As a result, the soils in the border area are poor and have a high slate content, except on the coast where sands, clays and saline soils

(wetlands) predominate. This landform predetermines the uses of the soil (map 3).

Anyone travelling the border from South to North will notice the pronounced differences in the landscape. From South to North the border is 112 kilometres long if you draw a straight line; however, it winds back and forth for a total of about 190 kilometres. The first 50 are navigable from the mouth of the Guadiana River to the confluence of the Guadiana and Chanza rivers.

The Guadiana River, which is the artery that defines the navigable border, has offered an opportunity for trading at some points in history. In a territorial context which hindered land travel, especially East-West travel, this river was a significant means of connection. The port of Pomarão in Portugal and the port of La Laja in Spain provided the export of minerals until the middle of the 20th century.

Along the non-navigable part of the border that meanders through some 139 kilometres of territory, from Pomarão to Encinasola, the landscape is more extensive and lonely. Poor soils and a declining population make it difficult to stimulate farming along the Raya. From an environmental point of view, this inner border includes rich meadow and forest ecosystems which have made it a good area for hunting, from time immemorial.



In more recent decades the southernmost coastal area has been transformed by large tourism projects and irrigated agriculture. Traditional fishing activity is still carried out in some harbour towns, such as Ayamonte, Isla Cristina and Olhão.

In short, two geo-economic areas can be clearly differentiated, the coastline and the interior. In the first, tourism, fishing, farming and services drive a booming and growing population, while the interior can barely maintain basic activities and its shrinking population, which faces serious problems of survival.

4.2. The demographic problem in the Portuguese-Andalusian Raya

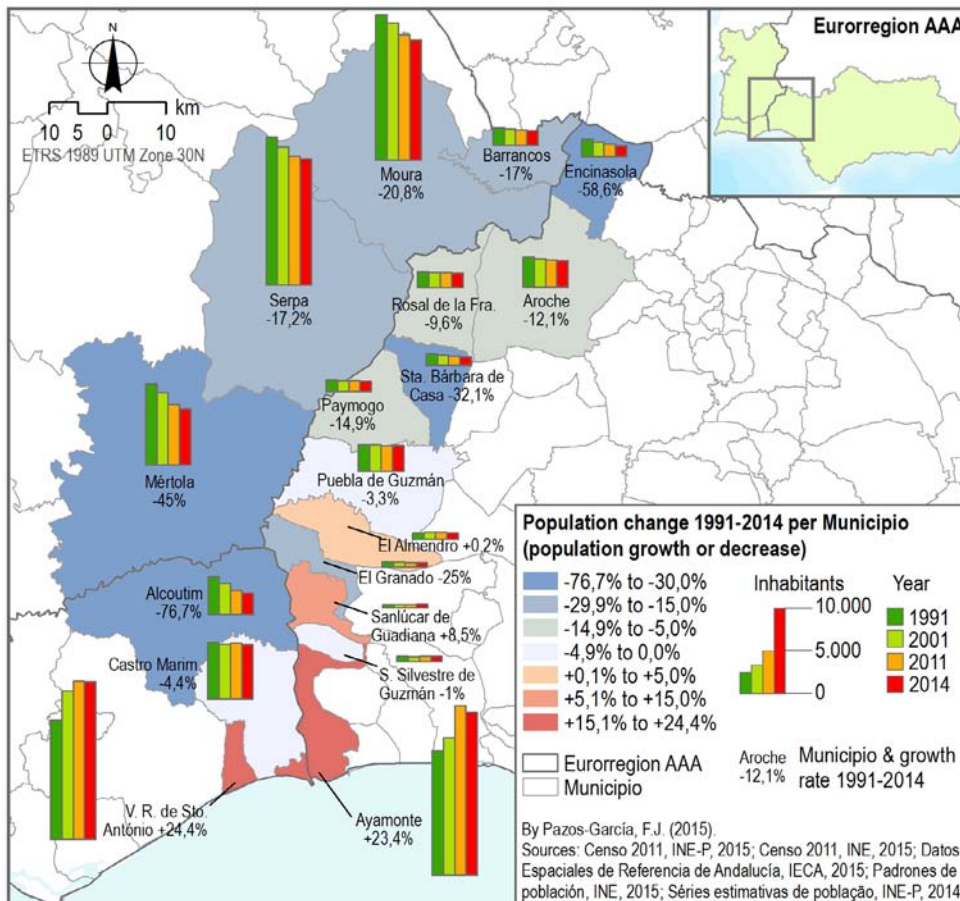
Long ago, Alfred Sauvy (1944) pointed out that the most important thing on this planet is people and that demography always takes revenge against those who ignore its problems. From this perspective the territory along the Raya, with the exception of the aforementioned coastal area, is a space in demographic decline. In the last forty years, the settlement and population of the Raya have experienced a significant decline in populated areas and in terms of people. Thus, in 1970 the 18

Portuguese-Andalusian municipalities in the area had 123,875 inhabitants, while in 2014 there were only 100,409, a decrease of close to 19%.

This percentage hides extreme differences because the two most populated municipalities, Vila Real de Santo António and Ayamonte, which are both located on the dynamic coastal border, have had sustained population growth that conceals a true demographic catastrophe (maps 4 and 5). Of the rest of the municipalities that make up the Raya, only Castro Marim and Rosal de la Frontera had demographic decreases close to the average. In extreme cases such as Encinasola and Alcoutim, the population in 2014 is barely 35% of what it was in the 1970s.

Understandably, in places like Alcoutim and Encinasola this devastation makes it difficult for businesses and services to be minimally profitable and some of them have had to close down. In this same context, population densities have dropped to the point that some of these spaces are nearly unoccupied.

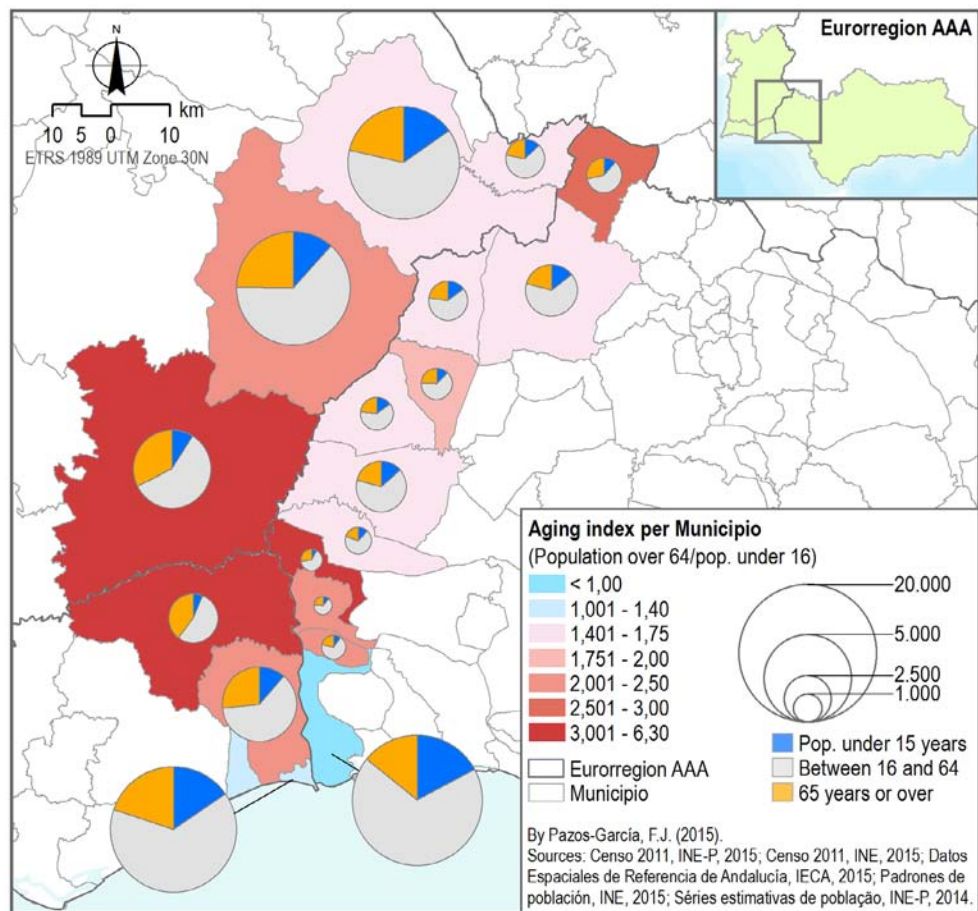
Generally speaking, widespread demographic decline has been caused by rural depopulation, especially the wave that took place a few decades ago due to the



Map 4. Population growth for 1991-2014 in the municipalities of the Portugal-Huelva border



Map 5. Population distribution by age in the municipalities of the Portugal-Huelva border



lack of economic and social prospects. This is now even more evident with the decline in the birth rate and an aging population, the two most serious and pressing problems in the Raya, and which no territorial development policy has ever dealt with.

Currently, the demographic dynamics and low population densities restrict the appeal of this territory, its capacity to compete and any chances of convergence with the regional, national and European space, especially in the interior border, away from the coast. To the north of the Ayamonte-Castro Marim axis, the scarcity of the population calls into doubt the future of these lands.

In short, the Portuguese-Andalusian border is a very old territory (map 5), where the relative presence of the elderly far exceeds the averages in Spain, Portugal or Andalusia. If left unaddressed, these weak demographic structures cannot give rise to initiatives for the development of the Raya. This can be seen, for example, in Sanlúcar de Guadiana, where the elderly population, aged 65 and above, represents 21% of the total, or in neighbouring Alcoutim, where it goes as high 44%. Meanwhile, the population of children aged 0 to 14 years has dropped to an alarming 9% and 8%, respectively.

4.3. The mixed results of the deactivation of the border in the AAA Euroregion

In this context, it was no surprise that the inhabitants of the Raya and the surrounding areas believed that a proposed highway that would not end at the border and would connect the interior spaces of both countries was a threat to the survival of local communities. They felt that the two areas that would be most negatively affected by the project were Ayamonte and Vila Real de Santo Antonio, because their cafés and restaurants would no longer receive the waves of people waiting to take the ferry that connected the banks of the Guadiana River. "In the mid-80s this traffic exceeded 1.3 million inhabitants and 150,000 vehicles annually, thus giving both towns a powerful commercial function" (Jurado, 1995; 191) and making them the centre of gravity in the immediate area.

Initially it was thought that the bridge over the Guadiana River would erode commercial activity. However, highway access points to Ayamonte, Vila Real, Castro Marim, Monte Gordo or Altura were built and tourism has increased, as well as other ways of visiting the Raya. It fostered a greater presence of Spanish and Portuguese citizens who seek eno-gastronomic and environmental knowledge of the "other side", or for



investment, business and commercial opportunities (Antunes Simões, 2008: 7 and Corrales Romero, 2006). In fact, it was the imminent construction of this important bridge that drew attention to new tourism resorts on the west coast of Huelva (Islantilla and Isla Canela, mainly).

Although this situation has had a positive impact on the southern region, this was not the case for the inner Raya. It can be said that the cross-border territorial policies have not adequately met the expectations of the Raya territories.

5. Conclusions

The delineation of the boundaries between Spain and Portugal throughout history created conflicting and complementary territorial dialectics between the States and local communities. In the case of the Portuguese-Andalusian border, as in others, the separation, insecurities and battles between the States forced local communities to create a more permeable Raya, full of encounters and possibilities for trading and smuggling. In the words of Eusebio Medina (2006:719) it was the territory “of the mixed game preserves and promiscuous dust, of the magical and festive border, of understanding and implicit alliances, the border of everyday life”, but also the peripheral and marginal space of the territorial construction of Portugal and Spain, where the basic territorial structure of the States faded away most of the time.

After the incorporation of Spain and Portugal to the European Union in 1986, the dismantling of the border led to a period of deactivation, and which has led the Autonomous Community of Andalusia and the regions of the Algarve and Alentejo to launch attempts at cooperation, studies and, most significantly, the distribution of European funds.

The construction of three international bridges over the Guadiana and Chanza rivers, and some other bridges along the Spanish-Portuguese border become the most significant symbols of this new historic stage. However, the bridges connect to large and high-capacity roads that connect medium or large cities, which the border territory lacks.

There are many studies of the area that deal with the environment, tourism and sustainable development. They are written in offices in the regional capitals, which are very far away from the Raya's real problems. Cooperation and links between states, communities and border regions have increased, but these potential

benefits are not reflected to the same extent in the actual Iberian Raya territory.

The AAA Euroregion may be a useful framework of reference for cross-border cooperation, but the actions and interventions should have an impact on a smaller scale, closer to the Raya, and should not dilute scarce community funds and beneficial effects over such a broad Euroregion, in which the majority of its citizens and productive fabric are not in close contact with the problems of the border.

Given the demographic weakness and the frailty of the urban system along the Portuguese-Andalusian border, its deactivation in a period of crisis is magnifying the effects of marginalisation in areas with lower demographic and economic dynamism. This situation requires new policy approaches in order to promote comprehensive development. These approaches must take into account the interconnectedness, the need for demographic momentum and the governance of communities along the Raya.

Although the dismantling of the border made good progress in the past 25 years (thanks to the combined push provided by community funded investment and capitalisation processes and programmes and the cooperative effort launched by the Public Administrations), progress has been insufficient to reverse productive deactivation and overcome the peripheral location of the inner Portuguese-Andalusian Raya, and almost the entire Iberian Raya.

We believe that results would have been very different if the following circumstances had been prevented:

Development has been designed as a top-down approach, as central and autonomic powers manage the bulk of the resources coming from the European Union.

Globalization policies have been chosen instead of glocalization policies and this has favoured the system of cities consolidated at the regional and national levels. Thus, Faro, Huelva and, to a greater extent, Sevilla and Lisbon are the large cities that end up getting the bridges and roads, to the detriment of the border.

The demographic problem of border territories has been concealed with futile discourse surrounding the environmental paradigm, tourism and sustainable development. The lack of men and women in these empty and aging lands is the real problem for the territories along the Raya and other rural territories on the Iberian Peninsula.



Unfortunately, three major threats to its future can be identified along the Raya: disparate governance; meagre demography and development policies that extend over a vast area and dilute their effects on the real border.

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